PROPOSED ESKOM NUCLEAR POWER STATION
AND ASSOCIATED INFRASTRUCTURE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA: 12/12/20/944)

COMMENTS ON
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

(Volume 51 RDEIR IRR 04 August 2011)

Issues have been received from the following stakeholders:

No	Name	Organisation
1	Antony & Mary Yoell	Interested and Affected Parties
2	Richard Lorton	Interested and Affected Party
3	Dawid A Reynders	Interested and Affected Party
4	Eric Mair	African Alternative Technologies
5	Sally Andrew and Bowen Boshier	Interested and Affected Parties

NO	DATE	NAME & ORGANISATION		
1	08 August 2011 Email	Antony and Mary Yoell Interested and Affected Parties	Many thanks for forwarding the Minutes of the last Public Meeting held in St Francis Bay in May. We note from the minutes that you are planning to re-look at the access route to the Thyspunt site. We were extremely concerned to hear at the meeting that the R330 from Humansdorp is the preferred routing and that no up-grade or widening of the road was considered necessary. We are sure that in view of the recent collapse of the main road over the Sand River, your Roads specialist will be reviewing his opinion that this road would not require any up-grade for extra heavy transport! As you are no doubt aware, this is the second wash away of the R330 - the first being in 2007. We do understand that there has been an assurance that no heavy vehicles will be allowed to use the road during peak times. However, this road is a busy road for business vehicles, delivery trucks, school buses and residents of St Francis Bay, Cape St Francis and Oyster Bay at all times during the day. It will become totally impossible if this road becomes jammed with hundreds of heavy construction vehicles. The proposed route will pass two schools, an extensive residential area	Your comments are noted. The Transportation Specialist Study has been revised and will be made available for public comment and review as part of the Revised Draft EIR Version 2. The revised specialist study acknowledges that the Thyspunt site requires significant transport infrastructure upgrades. The R330 is now proposed to be used for light vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operational phases for staff access, light vehicle traffic, heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity. Bypass roads to the East and West of Humansdorp are also now proposed to be constructed to reduce the traffic impact on central Humansdorp.

NO	DATE	NAME & ORGANISATION		
			bordering the R330 and the noise and disruption to the local community will be considerable. It will also become an extremely dangerous road as drivers will become frustrated sitting behind queues of slow moving construction vehicles. May we urge you to please look at an alternative route to this for access to the Thyspunt site as the impact on all residents of St Francis Bay, Sea Vista and Cape St Francis will be very high?	
2	02 August 2011 Email	Richard Lorton Interested and Affected Party	I feel that the selection of the sites is flawed. The selection criteria seems to solely be based on sites that ESKOM bought and owned many years ago when environmental and social considerations were not high on the agenda i.e. they are "previous regime" selections. The general public needs to be convinced that there are no other environmentally and socially more acceptable sites regardless if these have to be purchased or subjected to expropriation procedures. The draft report is not convincing in this respect. In fact the report emphasises the environmental	Thank you for your comments. A difficulty in terms of the identification of potential sites for the location of a Nuclear Power Station is that demand for electricity in South Africa varies spatially (geographic) and temporally (with time) and areas of high electricity demand (such as the Eastern Cape) are not correlated with current power generation centres in South Africa. The Nuclear Site Investigation Programme (NSIP) therefore aimed at identifying the most suitable sites for location of Nuclear Power Stations in South Africa (within the context of the statement above) and included a wide range of specialist studies, such as engineering, social science, geology, ecology and town planning. The primary objective was to identify sites along the coastline of South Africa, suitable for the construction and operation of future Nuclear Power Stations. Thus although the choice of the original five and later three sites are based on the NSIP study undertaken by independent consultants during the 1980s, the outcome of the NSIP is still applicable to the complexities described above.

NO	DATE	NAME & ORGANISATION		
			sensitivity of the sites.	It cannot however reasonably be expected from the Environmental Impact Assessment (EIA) process to duplicate the work of the NSIP, as the EIA process is seen as an Integrated Environmental Management tool used to assess the specific significance of the impact of the proposed development of the Nuclear-1 Power Station on the Duynefontein, Bantamsklip and Thyspunt sites. Please refer to chapter 5 of this EIR for further information on the sites assessed as part of the EIA process.
3	02 August 2011 Email	Dawid A Reynders Interested and Affected Party	Impak van kern- en nie-kernafval *(Impact from nuclear and non-nuclear waste)* From reading the above paragraph I would like to request further information about how the storage of radioactive material actually takes place. In research I have done, it appears that there is no real determined way yet to permanently dispose of nuclear waste, since even the containers that the waste is stored in will corrode over time and leak the radioactive material into the environment. There are no long term studies to prove safety in this case. We are planning to build seven new nuclear power stations, without proper tested and proven knowledge of how to dispose of materials that could	Thank you for your comments. It is acknowledged that the issues of radioactive waste management is important and integral to debate surrounding nuclear energy and as stated in Section 3.17 of the Revised Draft EIR Version 2, the only alternative currently available in South Africa is long-term storage of the spent fuel in the nuclear power station. Provision is made to store compacted waste on site for up to three years, but normally, waste will be removed to Vaalputs every year. The concept for the disposal of solid waste at Vaalputs consists of near surface trenches using metal containers for low-level waste and concrete containers for intermediate level waste. The long-term safety of the facility, which complies with international best practices for the disposal of low and intermediate level waste, has been demonstrated for a national inventory of radioactive waste. The inventory derived for this purpose, included waste of the proposed Nuclear-1 Nuclear Power Station. Vaalputs therefore has more than enough capacity to dispose of the solid waste estimated to be generated by the Nuclear-1 Nuclear Power Station (refer to the Management of Radiological Waste Report which forms part of the revised EIR Version 2 (Appendix E29) Which will be made available for public review.

NO	DATE	NAME & ORGANISATION		
			threaten our environment and life in South Africa.	Please note that a Radioactive Waste Management Institute has recently been legislated. One of the functions of this institute is to identify a repository for high level waste in South Africa. Highly radioactive waste are emplaced in stainless steel containers/ canisters which are corrosion resistant and their design lives are approximately 40-50 years. Thereafter direct disposal or reprocessing can be considered. Geotechnical direct disposal facilities are being implemented in Finland and Sweden
4	02 August 2011 Email	Eric Mair African Alternative Technologies	Just to make sure you have this message loud and clear. There is no need to expose ourselves to any of the risks involved in nuclear power. Renewable sources of energy are available, more than we will probably ever need, and we have the technology to convert those resources into usable power. Please do the sensible thing and advise your client he should rethink his nuclear strategy.	Thank comments and concerns are noted. There are indeed many technologies (including alternative/renewable energy sources) which could be employed to generate energy to meet South Africa's current and future energy demand. The choice of technologies and the weighting to be given to each in terms of addressing South Africa's energy requirements however does not fall within the ambit of this Environmental Impact Assessment (EIA) to address. It falls within the ambit of strategic government initiatives such as the Integrated Resources Plan 2010 (IRP 2010). It should therefore be noted that as determined in the IRP 2010 nuclear and renewable technology are both an important component of South Africa's future energy mix. No single source of power can however provide in South Africa's need for an additional 20 000 MW of additional capacity by 2020 and a mixture of sources, including wind power and nuclear power, has been recommended in the approved IRP 2010. The assessment of nuclear safety risks lastly are outside the scope of the EIA process and will be considered in the National Nuclear Regulator's licensing process. Please refer in this regard to the Co-operative Governance Agreement included in Appendix B4 of the Revised Draft EIR.

NO	DATE	NAME & ORGANISATION		
5	02 August 2011 Email	Sally Andrew and Bowen Boshier Interested and Affected Parties	All our objections still stand. None of our concerns (outlined in previous correspondence) have been adequately addressed	Your comment is noted. All correspondence received from yourselves during this EIA process and responses thereto have been and will be included in the documentation submitted to the Competent Authority for their review and decision.

Yours faithfully

For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

14 February 2014

Our Ref: J27035/ J31314

Your Ref: Email received 05 August 2011

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Dear Professor Ellery

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Your submission dated 05 August 2011 has reference. As such please find comment from Dr. Werner Illenberger (comment 1 – 31) and the Nuclear-1 EIA and Technical Teams attached.

Introductory Comment:

Comment on the Addendum to Dune Geomorphology Impact Assessment: Debris flows in the Sand River and potential for flood damage to the R330

Submission made by Fred Ellery, Department of Environmental Science, Rhodes University.

Introduction

I have yet again been presented with material that I find dismissive of issues that I have previously raised with Dr Illenberger. I will cover these here and in a report that accompanies this submission.

Introductory Comment:

Dr Illenberger thanks Prof Ellery for his contribution to this EIA but unfortunately still finds that Prof Ellery's submissions raise few scientifically valid issues.

Comment 1:

Study approach

The complete lack of field work as a part of this investigation is unsatisfactory. The specialist has not engaged in a way to reflect new knowledge on the role of water in structuring the dunefield. This has meant that his ability to explain events such as those that have happened over the weeks in July 2011 leading to destruction of the road bridge on the R330 across the Sand River is limited.

Response 1:

Dr Illenberger questions the validity of Prof Ellery's assumption that not much fieldwork was undertaken. For information:

Dr Illenberger undertook four field visits subsequent to the events that happened over the weeks in July 2011. He also procured a very valuable and extensive collection of aerial photographs taken by

Mr Don McGillivray of Afri-Coast Engineers on 9 July, two days after the destruction of the Sand River culvert.

Dr Illenberger performed additional investigation, such as grain size analyses and macro photographs.

Dr Illenberger procured aerial photographs taken 24 March 2011 of the whole area from Oyster Bay to the mouth of the Kromme River to Cape St Francis, taken at a resolution of 200 mm, as well as Lidar elevation data for the same area, accurate to 100 mm. The above were procured from Eskom, which commissioned the work.

Dr Illenberger also has very extensive experience and knowledge of the area gained over 27 years, including traversing the entire length of the Oyster Bay dunefield, numerous other forays into various parts of this dunefield, including exploration of the Sand River after flood events. Hundreds of field trips were undertaken.

Dr Illenberger additionally draws on the extensive experience and knowledge of his colleagues gained over the past 30 years, as detailed in the Geomorphology and Addendum Reports. He has been communicating with Mr. Frank Silberbauer, who has considerable experience and knowledge of the Sand River gained over many years. Considering that dune-sand dam breach events like the one that caused the destruction of the Sand River culvert on 5 July 2011 has happened previously in the recent history of the area, e.g. in 1992 and 1998 (Addendum Report, page 15) all this experience and knowledge is directly applicable to the events that happened in July 2011.

Prof Ellery, in an e-mail of 17 October 2010, stated "[Dr Illenberger] has an infinitely larger data set than we could ever collect".

It can be safely concluded that Dr Illenberger has sufficient information available to provide a robust analysis and interpretation of the events of July 2011.

Comment 2:

It has also meant that his views are entirely favourable in respect of the planned development, notwithstanding threats to infrastructure posed by natural processes.

The implication of the use of the study approach used here is that the dunefield is fully understood or can be understood entirely using remote sensing and interviews with local residents.

For a problem of the magnitude being examined here, nothing could be further from the truth. As a field scientist I am of the view that there is no substitute for field investigation, particularly during periods of contrasting climatic and environmental conditions in an unstable and dynamic environment such as this.

Response 2:

Please refer to Response 1. It is clear from this response that Dr Illenberger has undertaken more than sufficient field investigations of the Oyster Bay mobile dune field over many years, and also drawn on local knowledge and extensive data in the form of detailed aerial photographs and topographical maps. His assessment is not based only remote sensing or interviews. His views on dune dynamics and the implications for the development of Nuclear-1 are based on objective evidence.

Comment 3:

To illustrate this, I wish to capture the differences in perspective with respect to the structure and function of the dunefield between myself and Dr Illenberger. The critical issue in my view relates to the role of water in sediment transport in the eastern third of the Oyster Bay Dunefield. Dr Illenberger claims that the role of water in sediment transport has been adequately covered in the original Dune Geomorphology Specialist Report, which I have read repeatedly in respect of this issue. All the material on the role of water in sediment dynamics is provided in Table 1.

Table 1: Reference in Dr Illenberger's "Dune geomorphology specialist report" concerning the role of water on sediment dynamics.

Page/s	Para/s	Line/s	Text
17	3	1-3	Full quote: "The eastern third quarter of the dunefield is drained by the Sand River, which flows episodically during periods of high rainfall; floods transport appreciable volumes of sand into the Kromme estuary" End of quote. I am not sure what is meant by the "eastern third quarter" and assume it is an editorial error.
26	3	1-11	Reference is made to the eastern third of the Oyster Bay dunefield being drained by the "fairly permanent Sand River" and the suggestion is made that the "steeper slope of the eastern sector helps the Sand River keep its channel open because river flow is fast, and hence has strong erosional power." The material then goes on to suggest that "The smaller dunes in the eastern sector will also make it easy for the river to keep its channel open, as less dune sand needs to be eroded and carried downstream by the river". Remarkably, the author then says that "Surface flow only occurs after high rainfall events; the river responds rapidly to such events". Nevertheless, nothing more is said in this paragraph about the interaction of surface flow and sediment transport.

This (14 lines of text) is the sum total of what is said about the role of surface water in respect of the sediment dynamics of the Oyster Bay Dunefield. There is no reference to possible damage to infrastructure by surface water flow. I find that this is inadequate consideration of the relevant issues, particularly in the light of events in the dunefield over the period 7 to 26 July 2011.

There is no reference whatsoever in the report to:

- Flood deposits along the Sand River;
- Flood events and damage to infrastructure over the past decade or 2; and
- The likelihood or possibility of flood damage to infrastructure.

These are serious omissions because they relate directly to risk associated with the development and the infrastructure supporting it, and therefore cannot be overlooked.

Response 3:

Dr Illenberger would gladly correct the editorial error in "The eastern third quarter of the dunefield is drained by the Sand River". The below paragraph corrects the error and provides further explanation:

> "The eastern half of the dunefield that is currently still active (i.e. excluding the portion that has been artificially stabilized – the portion east of the R330) is drained by the Sand River, which flows episodically during periods of high rainfall; floods transport appreciable volumes of sand to the Kromme estuary. About half of the catchment of the Sand River is farmland to the north of the dunefield."

Furthermore, the Sand River, its floods and its effects on infrastructure are dealt with extensively in other parts of the Geomorphology Report as well as the Addendum Report (The Risk of Debris Flow, Appendix E30 of the Revised Draft EIR). It would appear that Prof Ellery has overlooked or ignored these parts of the text, which is puzzling, considering that the content of Dr Ellery's submission concerns the issues addressed in the Addendum Report. See also Response 1.

Comment 4:

The view of the role of surface water in sediment transport of Dr Illenberger is interesting and conflicts strongly with my own. His view is spelled out very clearly in the Dune Geomorphology Specialist

Report as follows (page 26 paragraph 3), and explains his lack of due consideration of the role of surface water in sediment transport in the eastern part of the dunefield.

I quote: "The steeper slope of the eastern sector helps the Sand River keep its channel open because river flow is fast, and hence has strong erosional power. The smaller dunes in the eastern sector will also make it easy for the river to keep its channel open, as less dune sand needs to be eroded and carried downstream by the river."

This view is of a passive and rather insignificant river that simply responds to prevailing conditions that are structured by wind. It is a river that can keep the channel open because of the steeper slope on the dunefield (the river is helped in keeping its channel open).

Furthermore, luckily for the channel, the wind-blown dunes are smaller, so that there is not so much sediment for the river to move. Therefore, the little Sand River keeps an open channel.

To reiterate, the view here is of the Sand River being shaped by wind-blown dunes. The river is passive:

The steeper slope allows the river to keep its channel open, (my emphasis) and because dunes are smaller the river is more easily enabled to keep its channel open (again my emphasis).

Response 4:

The sentence "The steeper slope of the eastern sector . . ." quoted by Prof Ellery was used to compare the influence on dunefield dynamics of the Penny Sands River in the western sector (where the slope is lower and dunes are higher) with that of the Sand River in the eastern sector (Dune Geomorphology Specialist Report, page 27). The quote in Comment 4 was taken out of context and thus does not provide an accurate reflection of the meaning in Dr Illenberger's report.

See also Response 5.

Dr Illenberger finds it regrettable that Prof Ellery had not communicated with him regarding the precise meaning of his text, rather than making assumptions. This would have eliminated Prof Ellery's apparent mis-interpretations, and made for much more meaningful and valuable constructive interaction in the EIA process. Dr Illenberger has always readily corresponded with Prof Ellery via e-mail and telephone.

Comment 5:

My view of the Sand River is quite the opposite. The Sand River is the very reason that the eastern part of the dunefield has a steep slope – it is the primary reason for the present structure of the eastern part of the dunefield.

It is not a meek river, but comes down in flood periodically, with devastating consequences. Developers should bear in mind the unpredictable and destructive nature of the Sand River because when it flows high, it is powerful and can be destructive, with devastating consequences for infrastructure!

I have been saying all along that one needs to have a much greater focus in the Dune Geomorphology Specialist Report on the role of the Sand River in respect of its episodic discharge and capacity to transport large quantities of sediment during floods. It occasionally results in debris flows.

My view is that it is more important to focus on the behaviour of this stream than on the work of wind, because this river is the key agent of sediment transfer in the eastern part of the dunefield.

Response 5:

The Dune Geomorphology Assessment (Appendix E2 of the Revised Draft EIR) has never claimed that the Sand River is a meek and mild river. The Sand River, its floods and its effects on infrastructure

are dealt with extensively in the Addendum Report, which report is not referred to by Prof Ellery and therefore does not appear to have been perused by Prof. Ellery.

Also, when considering the Cape Recife headland bypass dunefield, whose dimensions, geomorphologic setting, upwind and downwind slopes and dune dynamics are virtually identical to the Oyster Bay Dunefield (except that there is no river involved in moving sand downslope in the eastern sector of the former dunefield), it is clear that wind can be the major sand-transporting agent in such a setting.

There are many other examples of headland-bypass dunefields where wind is the prime agent that blows sand downslope over headlands. Sand dunes with large slip-faces that are only formed by wind-blown sand occur throughout the eastern sector of the Oyster Bay Dunefield. The sand dune that totally blocked the Sand River in 1992 (Addendum Report, Figures 5.3, 5.4 and 5.5) was formed by wind. This clearly shows that wind is a significant agent moving sand downslope in the eastern sector of the dunefield.

To expand on Dr Illenberger's reports:

It is clear from historic photographs of 1942, 1961 and 1969 that the advancing tip of the Oyster Bay Dunefield was wind-driven, and substantial volumes of sand were moved. At the same time, the Sand River was carrying appreciable volumes of sand eroded from dunes, and depositing it in the Kromme Estuary. Thus the morphodynamics of the dunefield involve both wind-blown and water-borne sand.

Wind-blown sand movement immediately upwind of the R330 was stopped by drift fences built from the 1960's onwards. Appreciable volumes of sand were trapped in this way. The current situation is that the Sand River is the only natural agent transporting sand out of the eastern end of the dunefield, and sand mining is the other significant agent removing sand from the eastern end of the dunefield.

Comment 6:

Once again, I wish to re-iterate what it is that is being said. East of the crest of the dunefield the landscape is fundamentally shaped by fluvial processes:

- Streams control the slope on the land surface and are the main agents structuring the landscape.
- This is achieved by flooding and transport of sediment by water
- It happens intermittently and is episodic
- It may have dire consequences for humans interacting with this landscape, including engineered structured built with the best intentions.

Response 6:

It is clear from Dr Burkinshaw's PhD thesis that wind is the prime agent *shaping the dunefield*, and the significant contribution of the Sand River to the dunefield morphodynamics is clearly identified in her thesis and subsequent work (see Geomorphology and Addendum Reports).

Also see Response 5.

Dr Illenberger clearly states in the conclusions of the Addendum report that "Road engineers should check what flood recurrence interval the culvert [where the R330 crosses the Sand River] can handle, and improvements should be made if necessary".

Comment 7:

The differences in my view of the dunefield and that of Dr Illenberger are profound in respect of what they mean for development and risks thereof.

This is readily illustrated by recent events in St Francis Bay where the road bridge on the R330 was washed away. Dr Illenberger might think that these are caused primarily by human actions; I think

they are a natural process and have happened before modern humans occupied and transformed the land.

Indeed, they are aggravated by human activities, and what we see today is a consequence of natural processes AND the cumulative effects of human activities. These factors provide good reasons to be cautious in considering future developments.

Response 7:

Dr Illenberger concurs that human activities have had a significant and cumulative impact on natural processes in the dunefield and surrounding area. The consequences of this are dealt with in the Addendum Report.

Also see Response 6.

Comment 8:

Debris flows
It is useful to clarify terms used in this discussion. I have used the Penguin Dictionary of Physical geography for much of the material provided here (Whittow 2000).

Definitions:

Dr Illenberger in his Addendum Report provides a good picture of what debris flows are. They are rapid flows of solid debris that are a consequence of unconsolidated sediment being liquefied and therefore moving rapidly downslope. This definition is consistent with the definition of debris flows provided by Dr Illenberger.

They:

- typically occur in environments with steep slopes;
- require a large supply of unconsolidated sediments;
- require a large volume of water; and
- typically occur in areas where unconsolidated sediment is poorly vegetated or un-vegetated.

All of these conditions are met within the Oyster Bay Dunefield.

Response 8:

In comment 8 Prof Ellery has ignored other crucial features of debris flows that are not present in the Oyster Bay Dunefield, as proven in the Addendum Report. Prof Ellery seems to have missed the point that the deposits are DEFINITELY NOT debris flow deposits, as proved conclusively in the Addendum Report.

Comment 9:

A further term that may be useful to define is slope failure, which is a general term relating to the downward movement of a large amount of slope material. There are several types of slope failure, of which two are of interest here – a flow and a slide. A flow is a slope failure that takes place in the presence of a large amount of water in the form of a mudflow or a debris flow. A slide is a rapid movement of slope material in the absence of a large amount of water (Figure 1).

Figure 1: A series of slides (indicated by 4 sets of arrows along the slope) where slope material has moved downwards without water acting as the medium causing slope failure.

Response 9:

Dr Illenberger cannot comment on Prof Ellery's photo and description of supposed slope failure without having visited the site, apart from observing that it can be seen in the photograph that the Sand River eroded into the base of the deposit during the recent floods, which would have caused slope instability, and it is quite possible that the sandy slope had a high water content during the time of the floods.

Comment 10:

Interpretation of the occurrence of debris flows in the Oyster Bay Dunefield:

In conjunction with the photographic evidence I have of what I and others identified as debris flow deposits (including initially Dr Peter Illgner), I have provided in an attached report compelling evidence of the circumstances leading to debris flows in the Sand River, and there is little doubt in my own mind that debris flows happen intermittently in the Oyster Bay Headland Bypass Dunefield.

We might invite a neutral specialist to judge our differences, but I do not think this is necessary because debris flows and floods are the main threats to infrastructure to be used to access the proposed power plant.

Response 12:

Prof Ellery seems to have missed crucial conditions necessary for a debris flow:

The eastern sector of the Oyster Bay Dunefield slopes eastward with a slope of 1:85 (1.2% or 0.67°). A slope of AT LEAST 15º is required to initiate a debris flow. Thus there must have been a substantial steep hill of sandy sediment upgradient, i.e. west, of the supposed debris flow deposits, in the dunefield, to form a debris flow of any size. There is no evidence that such a hill existed. Dr Illenberger invites Prof Ellery to provide evidence of such a hill.

Debris flows can continue flowing on shallow slopes, at least 1º, until friction dissipates their inertia. Considering that the slope of the dunefield is 0.67°, it is impossible for a debris flow to move down the dunefield. Also, Prof Ellery seems to imply that debris flows can initiate on the slope of the dunefield, which is clearly totally impossible.

Also see Response 11.

Comment 11:

It is useful to examine the language used by the specialist in this report. On page 8 (paragraph 3) he says that "The opinion of the above specialists is that the supposed debris flow deposits are river flood deposits ... ...sediments portrayed in Figures 2.2, 2.3 & 2.4 were probably deposited by a flood event of the Sand River like the one illustrated in Figure 2.7." The language used involves language typically used by scientists who "hedge" in their descriptions of their findings.

Response 11:

Firstly, again Prof Ellery seems to have missed the point that there is no evidence to indicate that the deposits are debris flow deposits, as proved in the Addendum Report.

Secondly, Prof Ellery initially only supplied a vague locality map for the supposed debris flow deposits. He has now supplied GPS co-ordinates in his report that was submitted on 5 August 2011. Dr Illenberger has since visited this site. The deposits here are material that was dumped by a bulldozer when Lionel Donnelly built a dam to the south of the deposits in the 1990's (Frank Silberbauer, pers. comm., November 2011). Frank Silberbauer has compiled a document describing the history and layout of the dam. He has prepared a document entitled "Sandriver Middle Reaches
General Geological and Environmental Observations, Compiled by Frank Silberbauer, Infinity Consulting, November 2011."

Upstream of Lionel Donnelly's dam there are some overbank deposits formed by the Sand River when it is in flood. Dr Illenberger will provide supporting evidence in the report he is preparing that covers the 2011 flood events.

Comment 12:

However, in the very next sentence (starts the next paragraph); Dr Illenberger concludes that "there are no debris flows or debris flow deposits in the Sand River." He goes on to be quite categorical about environmental conditions in the Cape St Francis area with respect to the occurrence of debris flows and the threats that may be posed by such to the Thyspunt site. I feel that in addition to providing strong direct (photographic) evidence of debris flow deposits, I am able to provide strong circumstantial evidence for their occurrence in the landscape, and therefore the claim that there are no debris flow deposits must be questioned.

Response 12:

See Response 11.

Comment 13:

Quicksands and liquefaction of sand:

I did not raise this as an issue, but I can testify that there are quicksands in the Oyster Bay Dunefield – I have experienced them first hand.

Response 13:

The relevance of this statement is unclear. The Addendum Report provides photographic and other evidence of quicksands in the Oyster Bay Dunefield. Dr Illenberger has on many occasions experienced them first hand.

Comment 14:

The November 2007 flood that damaged the R330: Material in the Addendum about the damage caused by the November 2007 flood needs to be reconsidered in the light of events in the study area in July 2011.

Response 14:

Dr Illenberger will provide detailed analysis of these events in the report he is preparing that covers the 2011 flood events.

Comment 15:

While this material describes and explains events in November 2007, it fails to recognise that events like this:

- can and will happen naturally
- are aggravated by human interventions in the landscape
- are highly likely in the future precisely because of cumulative impacts of human activities already present in the landscape
- may occur in the landscape in places other than where it happened in November 2007.

Response 15:

See Response 14.

Comment 16:

It is irresponsible to think that events like this will not happen again – they will happen with increasing frequency as developers and the Local Authority continue to develop and allow development respectively that is so at odds with natural processes.

A moratorium should be placed on development in order to improve our understanding of the natural environment so that development becomes more sustainable. Currently, the natural environment is treated as though there are no natural thresholds that exist, and the cumulative impacts of human activities in a soft environment like this will increasingly lead to natural disasters precisely because the system is pushed beyond natural thresholds.

Response 16:

Your opinion in this regard is noted.

Comment 17:

There are several general issues that need to be commented on.

Firstly, one cannot consider micro-catchments as isolated features in the way that Dr Illenberger has done because the groundwater beneath these systems is interconnected and erosion by surface water is a feature of the landscape that is very easy to overlook. The sediments, even when vegetated, are able to erode – as illustrated in the accompanying report where erosion (albeit facilitated by artificial breaching in this case) can take place naturally across a large dune. Furthermore, a gully has eroded from the south into the dunefield along what seems a natural course.

Response 17:

Dr Illenberger clearly described interconnected groundwater in the Oyster Bay Dunefield in the Geomorphology Report. Dr Illenberger does not see why erosion by surface water is a feature of the landscape that can be very easily overlooked. It is well known that a sand ridge (that is highly permeable) cannot be used to make a dam wall. That is why dam walls must be impermeable.

Comment 18:

Secondly, the removal of alien vegetation as a factor contributing to increased groundwater levels and therefore flood risk is very unlikely. Alien plants are unlikely to materially affect groundwater in a way that makes an appreciable difference given the rainfall over the period prior to the flood event. Alien

plants have a far bigger effect on base flows than peak flows, and given the amount of rainfall prior to the flood, their role in reducing or mitigating the flood is unlikely to be measurable.

I am not sure what the point is of going into detail on the localised nature of rainfall that gave rise to the flood damage – the area contains many wetlands and the water table is naturally high. There was a lot of rain.

Response 18:

The November 2007 event was a very unusual event. That is why Dr Illenberger investigated it in detail. Dr Illenberger will take Prof Ellery's comments into account in his report on the 2011 flood events.

Comment 19:

Thirdly, the question as to the likelihood of another flood of this magnitude is important. Dr Illenberger simply does not acknowledge the fact that further events like this will happen precisely because of a combination of natural processes AND cumulative human impacts. The issue about cumulative effects of already existing developments makes this issue even harder to deal with because existing developments will argue that they have rights to do what is necessary to protect their investment. All of this exacerbates an already delicate situation.

Ironically, another flood of this magnitude has happened less than 3 years following the November 2007 event, and caused considerable damage to the R330 – albeit at another location. This illustrates the susceptibility of this system to large episodic events, and therefore the difficulty in catering for them in developments.

Response 19:

Dr Illenberger has been gathering substantial information regarding the 2011 flood events and similar events that have occurred within recorded history. These are presented in the report on the 2011 flood events.

Comment 20:

Fourthly, the recommendation of placing a cut-off drain along the western boundary of the St Francis Links Golf Course is the kind of recommendation that will lead to the solution of 1 problem and the creation of others.

One cannot willy-nilly divert water from one location to another in this landscape without creating problems elsewhere! The diversion of water from the St Francis Links northwards contributed to the recent series of disasters on the Sand River where it is crossed by the R330.

These sorts of suggestions are alarming and reflect a lack of understanding of the cybernetic nature of the system – it is an integrated system with feedbacks such that interference in one part of the system has consequences for other parts of the system.

Response 20:

Dr Illenberger agrees with most of the sentiment expressed here. However the cybernetic nature of the system is understood to a fair extent.

Comment 21:

I have similar feelings about pipes, side drains and box culverts to take care of the existing and other roads – but what are the consequences for the St Francis Bay Golf Course – or does it matter? The impact of diverting water and focussing it locally at low points in the landscape increases "stream power" and therefore has consequences (see my main report).

Response 21:

Dr Illenberger agrees with the sentiment expressed here. However, it should be pointed out that improvements suggested by engineers for the St Francis Bay Golf Course have ameliorated the situation.

Comment 22:

Finally, it seems that improvements to infrastructure are reactive rather than proactive because of the diffuse nature of water in this system – it is a large interconnected groundwater system that interacts with a soft landscape. Unexpected things are likely to happen.

Response 22:

Dr Illenberger agrees with the sentiment expressed here. However, he wishes to point out that many of the advances in human technology are experiential.

Comment 23:

Potential for flood damage where the R330 crosses the Sand River:

The suggestions made by Dr Illenberger regarding mitigation along the R330 in order to prevent damage to the road bridge across the Sand River are as follows:

- Repair wing walls on either side of the culvert
- Check what flood recurrence intervals the culvert beneath the road can withstand and make improvements if necessary
- Check the culvert regularly to ensure that it is not blocked by sand
- Check the culvert during floods and remove any debris caught across the culvert.

These recommendations are unlikely to have increased the likelihood of survival of the bridge during flooding in July 2011 because erosion of the toe of the box culverts is what did the damage. My main contention is that the reason for this damage to the bridge is the presence of a box culvert beneath the road. Dr Illenberger's choice of action is to strengthen or reinforce the box culvert.

Response 23:

Dr Illenberger also recommends in the Addendum Report that "Road engineers should check what flood recurrence interval the culvert can handle, and improvements should be made if necessary".

Comment 24:

Nevertheless, my main concern is that the material presented here is not in the least precautionary. I find this material on risks to existing infrastructure linked to flooding along the Sand River rather gung-ho and favourable towards technical solutions and development. The sentiment is that "engineers can sort it out" and that engineers can do the work necessary to prevent failure. My contention is that they need to be guided by the environmental specialist about the sorts of hazardous things that might happen, so that engineering can be designed to meet the necessary specifications. Dr Illenberger simply does not deal with hazards in the system in sufficient detail and therefore engineers are likely to be poorly informed. In particular, the specialist completely underestimates the role of water in shaping this landscape, and ignores the likelihood that it might damage property and infrastructure.

Response 24:

The fact is that the R330's crossing of the Sand River is an existing piece of infrastructure that is essential for St. Francis's connection to the outside world, and therefore needs to be maintained. How else, besides on solid engineering principles, does Prof. Elllery suggest should the bridge be designed and constructed? As indicated in previous responses, the role of water in shaping the dune field has been considered and there is no objective evidence to indicate that water is the primary agent

responsible for the formation of the dune field. Please see Responses 5, 21, 22 and 23, which deal in detail with this issue.

Comment 25:

Conclusion:
Once again I find myself worried by the extent to which the specialist has ignored clear signs in the field of the role of surface water in the eastern part of the Oyster Bay Headland Bypass Dunefield, and further dismissed very useful information provided to him.

Response 25:

See Response 5.

Dr Illenberger presumes that the "very useful information provided to him" that Prof Ellery refers to is the information provided by Prof Ellery in his report. However, most of this information is not new.

Comment 26:

He has not been mindful of the precautionary principle and has consistently aligned his report in favour of development and by suggesting that engineering solutions are possible. Engineering solutions are only possible provided that the risks to infrastructure have been adequately pointed out. Developers should want the very best advice from specialists, with caution spelled out where it is appropriate. The current material indicates that the Oyster Bay Headland Bypass Dunefield is sufficiently well understood for the EIA and that there is nothing new that needs to be added. To dismiss material such as that presented to him throughout the process of acting as a specialist is negligent.

Response 26:

Dr Illenberger fully agrees with the precautionary principle. Dr Illenberger will always accept new information and undertake new investigations to help understand the Oyster Bay Dunefield better, from all sources, not only the "very useful information provided to him" apparently by Prof Ellery. See also Response 25.

It is worth noting that in an e-mail of 30 August 2011, Prof Ellery says

> "I had an intimate hand in all of the data collected for Lauren's[1] thesis, but cannot get my hands on it. I have tried for close to a year to get data from Lauren, but she simply will not give me anything."

This is after Prof Ellery and other I&APs protested that Dr Illenberger did not refer to the studies and data of the "Rhodes Group", in spite of Dr Illenberger trying numerous times to communicate and arrange a field trip with Prof Ellery (exact details are given in the Dune Geomorphology and Addendum reports), and Prof Ellery reneging on his undertaking at the focus group meeting of 29 July 2011 to arrange correspondence with Lauren Elkington for purposes of incorporating her findings in Dr Illenberger's reports.

Obviously it is not possible to incorporate Lauren Elkington's data in the investigations being undertaken for this EIA if her data is not made available.

Comment 27:

A further concern is that given the failure to deal with the part of the system that has been best studied by the specialist and his peers, and which (as far as I know) is best well known to the author of the specialist report, his analysis on the geomorphology of the stable dunefield in the vicinity of the power plant itself cannot be trusted either. This is an area that I do not know well, but (once again) which I would approach with the precautionary principle uppermost in my mind.

[1] With reference to Lauren Elkington

Response 27:

This statement is rather vague, and mostly seems to be an attempt to discredit the work of Dr Illenberger and his peers without having presented objective evidence that Dr Illenberger's work is factually poorly motivated.

Comment 28:

Nowhere in the Dune Geomorphology Specialist Report has the topography been carefully examined, particularly in respect of the southward slope of the dunefield towards the coast and its variability.

Response 28:

Dr Illenberger disagrees with this statement. Please refer to Response 1 regarding detailed topographical data that Dr Illenberger consulted in the preparation of his assessments.

Comment 29:

The likelihood of large engineering works reactivating the dunefield surrounding the power plant has not been considered at all. It may be argued that this will be managed by sound engineering principles, but there is a lot that can happen over a short space of time between excavating the site and full construction of the facility.

Response 29:

There are many of examples of house-building, commercial developments and engineering works reactivating dunefields, and it has never proved impossible to manage wind-blown sand with sound specialist and engineering principles, as stipulated in the Geomorphology Report.

Comment 30:

Other issues relate to the impact of the retaining wall at the interface of the nuclear facility with the dunefield (the specialist term for this structure escapes me) have on groundwater?

Response 30:

The term used in the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR) is a "cutoff wall". The cutoff wall is proposed to be placed around the perimeter of the excavation for the nuclear island (as shown in Figure 4.7B of the above-mentioned report) and would therefore be situated outside the Oyster Bay mobile dune field. The primary purpose of the cutoff wall would be to prevent drawdown of the groundwater table during excavation from impacting on the Langefonteinvlei wetland, which is situated to the northeast of the recommended power station position.

Comment 31:

How will groundwater be managed in order to ensure that surface flow of water is prevented?

Response 31:

The meaning of the comment is unclear. Surface flow cannot be prevented and will be directed around the excavation of the power station. The cutoff wall will serve to prevent the pumping out of groundwater that occurs inside the nuclear island's excavation from impacting on wetlands such as Langefonteinvlei, which is situated upstream of the recommended power station position. The Freshwater Ecology Assessment requires that the cutoff wall would need to be one of the first construction-phase activities, to reduce the extent of groundwater draw-down during construction.

Comment 32:

If surface flow of water occurs due to a damming effect of the retaining wall, how will this be managed?

Response 32:

Surface flow will be directed around the power station excavation in accordance with the recommended mitigation measures stipulated in the Hydrological Assessment (Appendix E6 of the Revised Draft EIR). Recommendations for handling stormwater flows at the Thyspunt site are discussed in detail in this report.

Comment 33:

Little attention has been paid to these matters, and there is very little precaution advised with respect development of this kind in a soft landscape.

Response 33:

Your comment is noted. As indicated by Dr Illenberger's detailed responses above, your opinion in this regard is contested.

Yours faithfully

For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 05 August 2011

Email: janda@ecocreate.co.za

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Dear Ms Macdonald

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Current Chair Koeberg Public Safety Information Forum

Human Health Risk Impact Report Appendix E24

PLEASE NOTE: Whilst "Site Safety Reports" prepared as part of the authorisation process for nuclear licensing have been included as appendices in this draft EIA Report (Appendices E24, E26 and E27), radiological issues will not be assessed in detail Since this is the mandate of the NNR.

> *Footnote [7] The Emergency Response (Appendix E26) and Site Access Control Report (Appendix E27) and Human Health Risk Assessment (Appendix E24), which have been prepared on a high level,, are appended to this EIR for information only. Further details on these reports will be prepared as part of the NNR nuclear licensing process, as their findings will be evaluated by the NNR."*

Conclusion, we should not have entertained this submission. The EIA do not deal with researching medical health applied techniques and tools.

I will consider a few of the major flaws of this report below:

Comment 1:

ICRP model inadequacies

The following was part of the response from Arcus Gibb (ref J27035) to my last submission:

"The report is based on a dose assessment, with qualitative interpretation of health risk. This is in line with the regulatory requirements as set out by the National Nuclear Regulator on safety standards and regulatory practices (R388) which is based on the accepted international system of radiation protection to ensure that public and the environment are not at risk from the effects of ionising radiation. Regulatory limits set by the National Nuclear Regulator are in line with ***recommendations from the International Commission of Radiological Protection (ICRP).*** *The ICRP is an advisory body that offers its recommendations to regulators and advisory agencies..."*

The ICRP risk model has been shown to be outdated.

As per the recent edition of the European Committee on Radiation Risk's report for 2010, the ex scientific secretary of the ICRP and editor of its reports, stated that the ICRP risk model could not be employed to predict or explain the health effects of exposures to human populations. This was because the uncertainties for internal exposures were too great.

Response 1:

The European Committee on Radiation Risk (ECRR) is an organisation with no formal links to official bodies, described as "self-styled" by the UK Health Protection Agency (HPA). The HPA reviewed the ECRR report.
(http://www.hpa.org.uk/Publications/Radiation/NPRBArchive/NRPBResponseStatements/nrpbResponseStatement303/).

The HPA is an independent UK organisation that was set up by the government in 2003 "*to protect the public from threats to their health from infectious diseases and environmental hazards. The Agency combines public health and scientific knowledge, research and emergency planning within one organisation – and works at international, national, regional and local levels. It also supports and advises other organisations that play a part in protecting health*".

According to the HPA, the weight of evidence and considerations of biological plausibility argue against ECRR's views that ICRP's risk assessment methodology seriously underestimates risks from internal emitters. HPA strongly referred to ECRR's proposed methodology as arbitrary, without having a sound scientific basis. HPA pointed out many misrepresentations of ICRP, misunderstandings, inconsistencies and unsubstantiated claims in the ECRR report. According to the HPA, the report compares poorly with the detailed justification and referencing of published data characteristic of ICRP reports.

Dr Mike Thorne, internationally recognised scientist and specialist in radiological risk assessment reviewed the ECRR document (J Radiol Prot 32 (2012) 369–372). Dr Thorne concluded: " *—in my opinion, it is poor science from cover-to-cover and should not be taken seriously in any deliberations on radiological protection policy and standards*".

Current understanding of effects of exposure to radioactivity radiological risks is based on extensive interpretation of large volumes of epidemiology and laboratory studies by internationally recognised scientists over many years. The ECRR report does not provide a basis for changing radiological protection standards.

Comment 2:

The Linear No Threshold model is used by the ICRP to predict radiation damage. However this model does not take into account the bystander effects demonstrated with regards to low level radiation.

Response 2:

Bystander effects are not new. As referenced in EU (2009)[1], there is extensive literature on clastogenic factors and other "compounds" that stimulate or modify responses in cells that were not damaged. The relevance of bystander effects to carcinogenic risk has not been determined and acknowledgement of this effect does not "*prove the inaccuracy*" of the current linear-no-threshold hypothesis that is used in radiation protection practice. Research in this field is continuing and findings are interesting. However, these are not sufficient to support a new and completely different paradigm of radiological risk assessment. It must be acknowledged that there is a large volume of radiobiological and epidemiological evidence that is in line with the classical paradigm.

Comment 3:

Research on "non-(DNA)-targeted" radiation effects prove the inaccuracy of a simplistic linear relationship[i ii] especially at low doses.

[1] EU. 2009. Radiation Protection No 151. EU Scientific Seminar 2005. Alpha Emitters: Reliability of Assessment of Risk for Radiation Protection. Proceedings of a scientific seminar held in Luxembourg on 21 November 2005. Working Party on Research Implications on Health and Safety Standards of the Article 31 Group of experts. Director-General for Energy and Transport, Directorate H – Nuclear Energy. Unit H.4 – Radiation Protection. European Commission.

These effects include radiation-induced bystander effects (Morgan, 2003a; Morgan, 2003b), genomic instability (Wright, 1998; Wright, 2000), adaptive response (Wolff, 1998) and low dose hyper-radio sensitivity (HRS) (Joiner, et al., 2001).[iii] Radiation-induced bystander effect (RIBE), which was found in the 1990s, challenged the conventional dogma that no effects were expected in the cell population that had not been exposed to radiation. With the RIBE, the irradiated cells could secrete some signal factor(s) to affect the nearby non-irradiated cells or cells that had received the transferred conditioned medium, and then to induce DSBs, mutation and cell death etc. in the non-irradiated cells.[iv]

An essential feature of "non-targeted" effects is that they do not require a direct nuclear exposure by irradiation to be expressed and they are particularly significant at low doses.

Response 3:

See response to comment 2.

Comment 4:

In 2003, the European Committee on Radiation Risk (ECRR) produced a report that directly challenged the 1991 ICRP recommendations. The ECRR, which arose from criticisms of the ICRP dose model at a European Parliament workshop, used over 500 professional references to support its conclusions, most of them after 1991. The ICRP model is lacking, states the ECRR report, because of recent discoveries in biology, genetics, and cancer research suggesting the ICRP model of cellular DNA is not a good basis for risk analysis. Thus, the maximum permissible dose to the public should be no more than 0.1 millisievert (mSv), rather than the ICRP "safe" dose of 100 mSv.

Response 4:

See response to comment 1.

Comment 5:

The elevated risk to foetus and infant is important to note. The U.S. Environmental Protection Agency draft paper EPA/630/R-03/003 from 2003 concludes that harm from radiation exposure is considerably higher in young persons than in adults (children age 2-16 have three times the risk, while children under age 2 have ten times the risk). This paper officially acknowledges that use of risk models based on "average" humans minimizes risk to those who are especially vulnerable.

Response 5:

The comment reflects a fair conclusion arising from the referenced USEPA document. However, it is trusted that the commentator also noted the remedy for the problem of sensitive of vulnerable receptors, as explained in the referenced USEPA document; namely, the adjustment of relevant risk factors to reflect the perceived increased risk. It might have been easier to explain the specific application of the adjustment to the case of radiation risks, if the EIA assessment had progressed to the calculation of cancer risks, in stead of being terminated at the dose calculation level. It should suffice to say that the referenced USEPA document specifically mentions, with regard to radiation cancer risks, that age-specific relative risk coefficients were developed (***Section 2.4. IONIZING RADIATION*** in that document). Specifically, ***Section 3.2.3. Ionizing radiation*** in that document states:

"*The report developed mortality risk coefficients using several models that took into account age and gender dependence of dosimetry, radiogenic risk, and competing causes of death as well as transporting of risks across populations. … For most of the sites in the table* (Table 11 in the document)*, the risk coefficients are higher in the earlier age groups; liver, bone, skin, and kidney coefficients are age-independent and only esophageal cancer coefficients increase with increasing age. … Similar to the information from the UNSCEAR (2000) Annex, most sites show greater risks in the younger ages than the older ages."*

It is therefore fair to conclude that the vulnerability of younger receptors was recognized, and is reflected in higher risk coefficients in the earlier age groups. While the EIA does not address risk in

terms of cancer risk, a similar principle is at work in the calculation of the total effective dose for regulatory purposes. It is known that *"the dose to organs of the body from external radiation increases with decreasing body size. This effect is more pronounced at low photon energy, and for organs located near the middle of the body, which are shielded by overlying tissues"*[2]. This is reflected in higher dose coefficients for younger age groups, found also in updated guidance documents (e.g. United States Nuclear Regulatory Commission (2007), **Radiological Toolbox**. Version. 2.0.0. Eckerman, K.F and Sjoreen, A.L. [Internet]. Available from <http://www.nrc.gov/about-nrc/regulatory/research/radiological-toolbox.html> [Accessed January to December 2010]. Dose coefficients (also referred to as dose conversion factors) are used to relate radionuclide uptake to the dose of ionizing energy in the tissues of the body. Total effective dose calculations are required by the NNR.

Comment 6:

Since 1956, when Dr. Alice Stewart demonstrated that prenatal pelvic X-rays yielding a dose as low as 10-20 mSv significantly raised the risk of cancer deaths by age ten, the risk radiation poses to the foetus and infant has been a focus of research.. In the most recent document the ICRP stated that below 100 milligrays, lethal effects to the foetus are "infrequent" (100 mGy equals 100 mSv). The following are among the more recent studies to identify radiation risks to the foetus and infant (other than childhood cancer):

-The October 23, 1999 Lancet published research showing that every additional 100 mSv of radiation exposure to external ionizing radiation before conception added a 25% risk of a child being stillborn.

Response 6:

The context of this comment must be clarified. The publication in Lancet refers to heritable genetic changes affecting the risk of stillbirth and neonatal death following preconception radiation treatment. The study investigated the risk of stillbirth and neonatal death among the offspring of men and women who had survived childhood cancer. Radiation technology was applied in the treatment of cancer and patients were subjected to high radiation doses.

The authors of the study concluded that careful management of pregnancies is warranted in women given high doses of pelvic irradiation before puberty. The outcome of the study cannot be related to environmental levels of radioactivity that are within the dose limits and dose constraints stipulated by the NNR.

Comment 7:

An article in the January 2004 British Medical Journal documented that males irradiated for cutaneous haemangioma under 18 months had a progressively lower attendance rate in high school, documenting lower rates even at doses of under 20 mSv.

Response 7:

The researchers analysed cognitive function in a large population based cohort of men at the time of military enlistment who had received low dose ionising radiation for cutaneous haemangioma before age 18 months. The average estimated absorbed dose to the brain in the study was 52 mSV (median 20 mSV, range 0-to-2800 mSV) and the largest contribution came from irradiation of haemangiomas in the head region.

The purpose of the study has not been to assess effects of public exposure to low environmental levels of radioactivity, but to assess effects of radiation treatment on infants, in particular effects that radiation treatment may have on the development of the human brain. The authors concluded on the basis of their findings that the risk and benefits of computed tomography scans (which involve

[2] United States Environmental Protection Agency (1993), External Exposure to Radionuclides in Air, Water and Soil. Federal Guidance Report 12. Washington, DC.

radiation) in minor head trauma need re-evaluating. This interpretation is very specific and cannot be related to radioactivity at environmental levels below dose limits and dose constraints.

Comment 8:

The April 28, 2004 Journal of the American Medical Association presented a study associating risk of low weight births with prenatal dental radiography at a dose of over 0.4 mGy (0.4 mSv).

Response 8:

The study did show an association with X-ray exposure, but this should not be mistaken to be a definite cause-and-effect conclusion. The study was designed as a retrospective, population-based case-control study. Case-control studies cannot prove cause and effect; they can be used only to demonstrate associations. The authors raised the possibility that radiation-induced thyroid dysfunction might play a role in causing the low weight births. However, alternative explanations have not been ruled out. For example, it has been noted that women who need radiographs during pregnancy may have serious dental disease and already may be at risk of having a low-birth-weight baby because of the disease (Reported by Mark Berthold, senior editor, ADA News). Overall, the study is interesting but it has no bearing on exposure to radioactivity at levels below population dose limits and dose constraints.

Comment 9:

In 1991, U.S. public health officials had not admitted that fallout from 1945-1963 atmospheric nuclear weapons tests caused any harm. However, the release of a 1997 report by the National Cancer Institute estimated that Iodine-131 from tests – still considered low dose exposure - caused between 11,000 and 212,000 Americans to develop thyroid cancer. No acknowledgement of this landmark research study was made by ICRP.

Response 9:

The association of thyroid cancer with exposure the iodine-131 has been known long before the publication of the National Cancer Institute in 1999. ICRP deals with exposure to I-131 separate from the other radionuclides, with emphasis on assessment of exposure through milk.

The well-documented Windscale accident in October 1957, which was a plutonium production factory, resulted in release of iodine-131. This led to the establishment of a widespread milk monitoring programme and of the development of radiological criteria for the protection of the population in the UK. Herbert John Dunster, a leader in the development of radiological protection philosophy, played an important role in the decisions that were required following the Windscale accident. He became an ICRP Committee member in 1959 and played a prominent role in the development of ICRP publications.

Without distracting from the value of the study of the National Cancer Institute, it must be pointed out that the ICRP was not ignorant about I-131 and its association with cancer, as inferred by Comment 9.

Comment 10:

In 2000, the U.S. Department of Energy released a report summarizing many research studies, and concluding that workers at American nuclear weapons plants suffer from disproportionately high rates of various cancers. Congress subsequently passed a law entitling affected workers to compensation. Again, the ICRP made no note of this important development and its implications for radiation safety standards.

Response 10:

Refer to Response 9. The ICRP set standards for occupational exposure to radionuclides long before the US DOE publication in 2000. The issue of cancer in nuclear weapons plants is not relevant to the evaluation of a nuclear power station.

Comment 11:

The series of assumptions that radiation exposure carries no risk that were later reversed by empirical research – for pelvic X-rays to pregnant women, atomic bomb test fallout, and occupational exposures in nuclear weapons plants – suggests strongly that the ICRP re-evaluate health risks of low-dose exposures, and lower the current limits.

This evidence shows that the ICRP model is outdated and is not necessarily protective of human health.

If there is an image of the ICRP as comprising a balanced medical and scientific team free from government involvement and political pressures, this is a myth.

Response 11:

This comment suggests that the ICRP is an incompetent institution that is unaware of events and developments in the nuclear industry. It also infers that the ICRP is dishonest and unethical. See also responses to earlier comments that had the intention of discrediting the ICRP. This kind of derogatory discourse is not constructive.

Comment 12:

A complete list of the members responsible for the ICRP Document #2 [1959] (see Appendix 1), Standard Setting for Internal Radiation Doses, indicates quite clearly that they were chosen with respect to their employment by their respective governments. They were all involved in the research and development of nuclear energy and/or national regulatory agencies. They do not represent public health concerns or interests and they cannot be said to have maintained structural independence from governmental influence. Many members were also involved in their nation's nuclear weapon development and testing programs.

Membership in ICRP is by recommendation of present members of the ICRP, subject to approval by the Executive Committee of the International Congress of Radiology (ICR).

Response 12:

See Response 11.

Comment 13:

Mutagenicity

The Precautionary Principle states that if consequences of an action are unknown but have potential for negative consequences, it is better to avoid that action.

In the health field, this belief has existed since the **Hippocratic principle of "first do no harm"** of over 2,000 years ago.

The nuclear industry goes against this basically ethical principle.
Page 5 states: "Ionising radiation has sufficient energy to change the structure of molecules, including DNA, within the cells of the human body. Although there are repair mechanisms, it is possible to damage the genetic code permanently by means of ionising radiation, resulting in faulty genetic information. Faulty genetic information may result in cell death, or the cell may survive and divide, transferring the faulty genetic information to the next cell lineage. Faulty genetic information may result in abnormal cell function, manifesting as harmful effects in the organism. However, the evidence is

that only a very small fraction of such changes would be expected to result in cancer or other health effects.

There are two types of cells in the human body – somatic cells and germ cells (spermatozoa and ova) in the reproductive system. Tissues with particular specialised functions are referred to as organs. Cells, tissues and organs are maintained through regulated processes of cell division. The division, structure and functioning of cells are controlled by DNA in the nucleus of the cell. The DNA in cells carry the blueprint of the cell structure and function, and this information is commonly referred to as the genetic code. During cell division, the genetic code is transferred from one lineage of cells to the next with remarkable fidelity. "

To analyse the excerpt from the EIR above:

*i) " the evidence is that ...would be expected to result in cance*r."

The "evidence " alluded to here, is not enough.

The issue of calculating/ estimating cancer rates due to radioactive releases from nuclear plants due to routine emissions, from an incident or an accident, is fraught with difficulty and inaccuracies.

Response 13:

The description of the precautionary principle in the comment is not in line with the intention of the concept. The 1992 Rio Declaration on Environment and Development states that:

"*The precautionary principle should be invoked when:*

- *there is good reason to believe that harmful effects may occur to human, animal or plant health or to the environment; and*
- *the level of scientific uncertainty about the consequences or likelihood of the risk is such that the best available scientific advice cannot assess the risk with sufficient confidence to inform decision-making."*

The United Kingdom Interdepartmental Liaison Group on Risk Assessment (UK-ILGRA) placed the following limitations on application of the precautionary principle:

- "*The precautionary principle should be distinguished from other drivers that require caution such as society's view on the extent of protection afforded to children or others considered to be vulnerable, or the wish to ensure that conventional risk assessment techniques deliberately over rather than under-estimate risk."*
- *"Action in response to the precautionary principle should accord with the principles of good regulation, i.e. be proportionate, consistent, targeted, transparent and accountable."*
- *"Applying the precautionary principle is essentially a matter of making assumptions about consequences and likelihoods to establish credible scenarios, and then using standard procedures of risk assessment and management to inform decisions on how to address the hazard or threat."*
- *"Decision-making should bring together all relevant social, political, economic, and ethical factors in selecting an appropriate risk management option."*
- *"Invoking the precautionary principle shifts the burden of proof in demonstrating presence of risk or degree of safety towards the hazard creator. The presumption should be that the hazard creator should provide, as a minimum, the information needed for decision-making."*
- *"Decisions reached by invoking and applying the precautionary principle should be actively reviewed, and revisited when further information that reduces uncertainty becomes available."*

The precautionary principle is thus applied out of context in the comment. *The statement that "(T)he issue of calculating/ estimating cancer rates due to radioactive releases from nuclear plants due to*

routine emissions, from an incident or an accident, is fraught with difficulty and inaccuracies" is typical of the bullets in the limitations in applying the precautionary principle placed by UK-ILGRA.

The Hippocratic Principle of "first do no harm" is also interpreted out of context. It refers strictly to the doctor/patient relationship. From the Hippocratic writing Epidemics[3]:

"The physician must be able to tell the antecedents, know the present, and foretell the future - must mediate these things, and have two special objects in view with regard to disease, namely, ***to do good or to do no harm.*** *The art consists in three things - the disease, the patient, and the physician. The physician is the servant of the art, and the patient must combat the disease along with the physician."*

Comment 14:

Whilst it is scientifically proven that ionising radiation causes DNA double strand breaks and deletions, the result of this genetic damage varies tremendously depending on where it occurs, how rapidly the cell is dividing, extent of the damage and cellular radio-sensitivity.

Response 14:

This is regarded as a general statement that does not require a response.

Comment 15:

The range of deleterious results are enormous and range in severity from mild endocrine, vascular , immune system disorders to cancers and death. Any genetic anomaly is possible.

The actual number of deaths in the mid to long term from these mutations is impossible to record or attribute with any certainty as related to exposure to a specific release of radioactivity - from an accident or an incident at a nuclear plant or from routine emissions.

Response 15:

Health risks depend on the level of exposure (dose). The hazards of radiological exposure are recognised, but if exposures are very low, as in the case of a power station operating within the regulatory limits, risks would be in the *de minimus* range. It must also be remembered that there are many natural sources of radioactivity and mere exposure to these sources does not mean that there would be health risks. This is analogous to many natural sources of chemicals in the environment.

Comment 16:

What is also impossible to ascertain is the exact extent of radiation contamination. The picture shown in Figure 3.1 of air dispersion at Thyspunt would obviously only apply for a short period.

Response 16:
The air dispersion isopleths actually depict annual averaged concentrations, which are relevant for assessment of chronic exposures.

Comment 17:

We have seen with dispersion models from Fukushima how 'hotspots 'of high concentration of radiation have emerged at large distances to the site. The dispersion is not necessarily highest closest to the plant with gradually diminishing effects. Particularly as the released isotopes are dangerous for decades, unusual and unpredictable dispersion is inevitable.

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[3] Gill N S, online. Is "First Do No Harm" From The Hippocratic Oath? Myth Vs Fact. http://ancienthistory.about.com/od/warfareconflictarmor/u/Heroes.htm.

Response 17:

Atmospheric dispersion depends on such factors as topography and meteorology, which are accounted for in the mathematical models. The comment refers to the nuclear accident at Fukushima, which is not relevant to this EIR that deals with normal operation and anticipated operational occurrences.

18 Jan 2012 (NucNet) News reported; About 30 workers at the Fukushima-Daiichi nuclear power plant in Japan received between 100 millisieverts (mSv) and 250 mSv of radiation exposure, which would have increased their chances of cancer by about one percent to 2.5 percent, a parliamentary committee in the UK was told. Her Majesty's chief inspector of nuclear installations, Mike Weightman, told the House of Commons Energy and Climate Change Committee that in terms of the workers, "there don't appear to be any acute radiation effects".

He said 30 of them have had "a significant dose", but it is not in the sense of an immediate life-threatening dose. In a declared nuclear emergency, the recommended limit is 100 mSv. The International Commission on Radiation Protection is mandated to sanction a maximum accumulated dose of 250 mSv in extraordinary circumstances. Mr Weightman said public evacuation was well-organised and exposure countermeasures for the public have been "effective so far", and there will be a longer-term health monitoring programme."

Comment 18:

With regard to death rates from nuclear accidents, it is interesting to note the following:

In1959 an agreement was passed between the World Health Organisation and the IAEA giving the IAEA a veto right over WHO pronouncements as regarding nuclear power. It also requires that any investigation into the health effects of nuclear radiation by the WHO be first agreed to by the IAEA. The mandate and objective of the IAEA is to promote atomic energy. Of course WHO findings which do not align themselves with the IAEA's mandate would not be supported.

Response 18:

There is a large volume of independent peer reviewed research documents and views of credible organisations and individuals that are within broad consensus about the scientific understanding of the science. It is preposterous to believe that the entire nuclear industry and nuclear science across the world is controlled in an unethical way by the IAEA. The conspiracy theory is unconvincing.

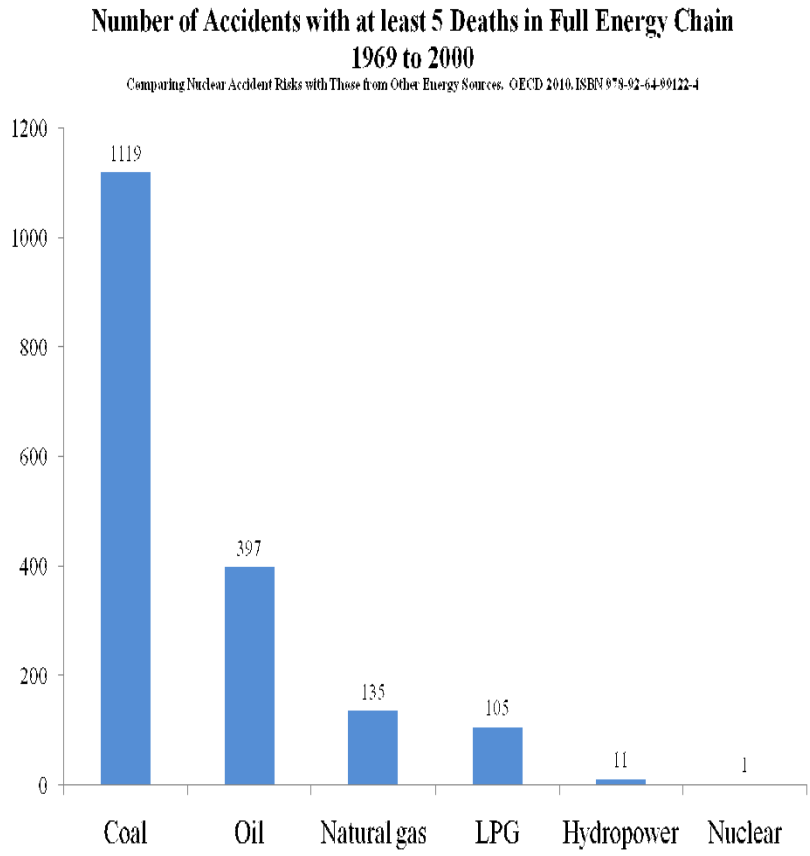
Comment 19:

The fact that there are such massive discrepancies in estimations regarding deaths due to the Chernobyl accident proves the point that estimations are impossible. Even using the exact formulae used by the WHO to extrapolate their 4000 deaths the Union of Concerned Scientists found a very different figure of 34 000.

Response 19:

Cannot comment without reviewing the methodologies followed respectively by WHO and UCS. Nevertheless, this EIR does not deal with nuclear accidents.

However, can one use the graph below to counter argue the statement? Or will this become a ping pong game where various research materials are countered against each other?



Comment 20:

ii) *" only a very small fraction of such changes would be expected to result in cancer or other health effects."*
In the above excerpt, it states that though the cell's DNA structure has been damaged and altered, this does not mean that cancer or health effects arise in every case.

This assumes that genetic mutations are acceptable provided they do not result in dramatic health effects.

I would like to see a consensus from the general public to show that they agree with this point.

Response 20:
The comment refers to scientific fact saying exactly what is underlined in the comment above. The interpretation that "*genetic mutations are acceptable provided they do not result in dramatic health effects*" is that of the person who made the comment and not that of the authors of the EIR.

Comment 21:

Especially when the implications as stated, are fully understood:
"The DNA in cells carry the blueprint of the cell structure and function, and this information is commonly referred to as the genetic code. During cell division, the genetic code is transferred from one lineage of cells to the next with remarkable fidelity."

Only 10% of genetic damage is visible in the first generation. It becomes more apparent in later generations.

Response 21:

Generally, it is understood that effects may not show up until future generations, but to attach a percentage to effects in the first generation is questionable.

Comment 22:

iii) "However, there is no direct evidence of increased risk of non-cancer diseases at doses below about 100 millisieverts (mSv)."

This is deceptively stated. There is a lot of evidence showing that non-cancer diseases are **likely** to arise as a result of low-dose radiation. There is simply no direct evidence that they are the only causal factor.

Response 22:

If causality is not demonstrated, clearly there is no direct evidence. It is not a deceptive statement.

If this point has to be argued for identified health effects, specific toxicological and/or epidemiological evidence must be produced to support one of the following relationships:

- Causal relationship
- Likely to be a causal relationship
- Suggestive of a causal relationship
- Inadequate to infer a causal relationship
- Suggestive of no causal relationship

The comment offered a generalised statement without scientific support for the relationships listed above.

Comment 23:

The Independent Advisory Group on Ionising Radiation in the UK produced a document in October 2010[v] showing the following results amongst others:

1. Radiation predisposes to the formation of an inflammatory, thrombotic plaque phenotype in arteries.
2. A radiation-induced persistent decrease in capillary density is associated with focal loss of alkaline phosphatase.
3. Many of the underlying contributory mechanisms associated with the development of circulatory disease, particularly atherosclerosis, are also associated with radiation exposure.
3. Vessel occlusion can occur many years after irradiation, and the precise mechanisms of this are not fully known etc.

Response 23:

The comment does not refer to the radiological doses in the study. The study was conducted on patients that received radiotherapy at high and very high doses. On the lower-dose side, survivors of the atomic bomb in Japan were studied. Even in these cases the doses on the lower end were in the order of hundreds of mSV, which is much higher than the regulatory dose limits.

The study is interesting and appears to have been well conducted, but it is of no relevance to the EIR under discussion.

Comment 24:

There have been numerous studies showing that DNA mutation and cellular damage results in both cancer and a variety of non cancerous diseases.

Response 24:

This statement must be made in context with exposure. These effects are not measured at low exposure doses. Keep in mind that there are background levels of radioactivity everywhere, which do not translate into numerous cases of these effects.

Comment 25:

However working backwards (so to speak) it is virtually impossible to isolate radiation as the only causal factor of the disease in question.

The report acknowledges this and states:

Insights from mechanistic experimental studies might eventually provide the required weight of evidence of causality at low radiation doses. (pt 4 pg 87)

The fact that it cannot be isolated as the only cause, providing direct evidence, does not mean that it is innocent of harm.

Response 25:

Refer to response 22.

Comment 26:

3. Assumption of compliance with NNR dose limits

Page 20 states: *"For purposes of the EIA, it is assumed that quantified radiological doses through all pathways and routes of exposure at any of the sites with a proposed new nuclear power station will be within the NNR dose limits and dose constraints for public exposure."*

There are two assumptions here.
Firstly the assumption that the NNR dose limits are protective and secondly that these limits will be adhered to.

This report calls for the EIR to be passed **on the assumption** that NNR levels will be held **on the assumption** that these levels are safe. These assumptions need to be tested and to be found acceptable before this EIR would be valid. One cannot assume that the claims of reactor manufacturers or claims of current operators and proponents of the industry, are accurate. This necessitates a study done outside of the confines of the NNR, Eskom, NECSA environment.

Response 26:

The dose limits and dose constraints are supported by credible scientific data and are accepted to be protective of human health.

The reactor manufacturers will have to comply with the dose limits and dose constraints of the NNR. It is not helpful and without basis to distrust the NNR, Eskom and NECSA.

Comment 27:

No independent, peer-reviewed or publicly available studies have been done around our existing nuclear power station to assess health impacts and all data regarding radioactive emissions from Koeberg are from ESKOMS internal laboratory (ESL).

It certainly seems to me to be extraordinary that we are claiming the safety of nuclear power without any decent, publicly available, peer reviewed, independent study of our existing plant to prove to the public that this is in fact so.

Response 27:

The internal Laboratory data is scrutinised by the NNR of which their mandate explicitly is to protect persons, property and the environment against radioactive emissions form nuclear power plants. Hence, Koeberg is complying with the NNR regulatory requirements and has been doing so for over 20 years.

Comment 28:

Understanding also that these emissions are sometimes unavoidable and often unintentional, there is little basis for the assumption that plants will in fact comply with NNR emission levels set.

Response 28:

Eskom**/** SSR Specialist to input See response 27. If the vendor designs do not comply with the NNR requirements, the plant cannot be build

Comment 29:

The fact that all data regarding the plant arises from Eskom's internal Environmental laboratory cannot be tolerated.

I pose the question as to whether ESKOM management would allow a report to be published by an internal division implicating ESKOM as a major offender?

An example of a discrepancy noted with regard to data is shown below.

The original report from 2002 as signed off by the national nuclear regulator shows that in 2001, the amount of Caesium 137 emitted was 4.49E+10.

This is 4 490 000 000Bq Cs 137.

		TABLE II(a): IODINE-131 IN GASEOUS EFFLUENT FROM KNPS 1984-1992								
	1984	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	
Sr-90	0	0	0	0	0	0	0	0	0	
I-131	7.39E+07	1.27E+08	3.17E+08	6.66E+08	2.62E+09	2.05E+09	6.32E+08	2.13E+09	9.17E+08	
Cs-137	0	0	0	0	0	0	0	0		
		TABLE II(b): IODINE-131 IN GASEOUS EFFLUENT FROM KNPS 1993-2002								
	1993	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Sr-90	0	0	0	0	0	0	0	0	0	3.02E+05
I-131	5.61E+08	4.41E+08	5.29E+08	2.29E+08	2.69E+08	7.48E+07	1.91E+08	2.80E+08	1.03E+09	5.27E+08
Cs-137	1.28E+06	1.94E+07	0	0	0	1.42E+06	6.40E+05	1.40E+06	4.49E+10	3.54E+06

In the EIRs report Appendix 10 Air quality Assessment I would like to draw your attention to the table 8.12 on page 202 where measured emissions of radionuclides from Koeberg Nuclear Power station are shown. In the year 2001, the amount of all radionuclides coincides with the amounts above for every year except for 2001 the amount for Caesium 137 as emitted is shown as 4E+04. This is 40 000Bq.

This is an exceptionally significant discrepancy and indicates that either Eskom or ESL cannot be trusted with regard to accurate record keeping.

Response 29:

Your comments are noted however as responded to Mr. Mike Kantey in IRR 37 which was attached in Appendix D8 of the Revised Draft EIR Version 1 the figures in the Air Quality Report correspond to

the emission values provided by Eskom (Enviromental Survey Laboratory Report for 2001 Eskom Reference K-16696-E Appendix A). The original list of radionuclide emissions provided by Eskom agrees with all other values. It is possible that the table given above mistakenly refers to the liquid effluent for Cs 137 which is 1.26x1010.

Comment 30:

Nuclear power emissions to take note of are the fission products Strontium 90, Caesium 137 and Iodine 131. When internally ingested these isotopes are absorbed by the body for eg Sr90 is a calcium analogue so is deposited in bone from which it is able to irradiate sensitive hematopoeic (blood forming) tissue at close proximity resulting in the development of leukemia. Sr 90 is not found naturally and its only source is nuclear fission processes.

The most recent ESL report states that activity of Caesium and Strontium have been consistently found in sewerage sludge from Melkbos and Westfleur Sewerage works and in terrestrial and marine samples.

It notes that the detection of activation product in both kelp and seawater collected from Springfontein in November coincides with outage 118. Outage 118 refers to the refuelling incident which resulted in the internal contamination of 90-odd workers at Koeberg. This is a direct example of the fact that when there is too much fission product created (accidentally in this case) it must be released which it is into sea and air.

It states that Sr 90 analysis will be completed by mid 2011 and that thus excludes Sr 90 (possibly the most important readings from a health perspective) from the report.

We have yet to see the figures for Sr 90 from the latest ESL report.

Response 30:

Let us be specific to issues related to this particular EIA. We request that you submit this commentary to the Koeberg Public Safety Forums. As you know, these meetings normally take place four times per year. The Koeberg Visitors Centre is also open Mon-Thus from 07:30.- 16:30 and Fri : 07:30 – 13:00.The contact number is 021 550 4667 during office hours….

Comment 31:

4. Emissions and accidents.

Page 24 states : "Furthermore, should components or materials fail, or should human errors lead to consequences that may have adverse effects on human health and the environment, several layers of backup systems and other controls are automatically introduced to stop the propagation of the IE or to mitigate its consequences. In addition to regulatory dose constraints and dose limits set to protect human health, the NNR also applies the ALARA principle, thereby assuring by a large margin of safety that radiological doses to members of the community would be in the de minimis lifetime risk range.

Furthermore, should radiological doses approach the de manifestis level of risk, the NNR would intervene by taking regulatory action to reduce the risk. There are thus several layers of mitigation to protect human health against the consequences of radiological exposure.

This contradicts the previous assumption that "*For purposes of the EIA, it is assumed that quantified radiological doses through all pathways and routes of exposure at any of the sites with a proposed new nuclear power station will be within the NNR dose limits and dose constraints for public exposure."*

The first excerpt demonstrates the undeniable fact that accidents can happen**.** What this in effect is saying is that emissions will be within the NNR limits except when they aren't.

This is simply not acceptable.

This report makes a mockery of an authentic EIR process. Arcus Gibb and its consultants have not sought to accurately present all data, both positive and negative in a truly unbiased environmental assessment demonstrating the true impact of a new nuclear plant. I would like to state that this EIR and indeed this specific report relating to Human Health, with its heavy reliance on nuclear industry literature and lack of acknowledgment of the latest medical research with regard to exposure to ionising radiation, is fundamentally flawed.

Response 31:

Your comments are noted. The author is reminded that GIBB as independent Environmental Impact Assessment Practitioner responds to its mandate of independency by working within the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement in order to present the Competent Authority with all relevant information which is in its mandate to do. Therefore as indicated repeatedly in public forums and in EIA documentation the issues of radiological safety are within the mandate of the NNR.

Furthermore, it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement within an EIA process. We must, therefore, conduct the EIA based on their legal mandates and their co-operative governance agreement.

In this regard you are also referred to the then DEAT's approval of the Scoping Report, dated 19 November 2008, where the following is stated:

> 2.21 All radiological issues raised during the EIA process, which are not comprehensively addressed, must be explicitly referred to the NNR to be addressed as part of their process.

This response by the DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process.

Thus in terms of its Assessment of the radiological emissions during emergency events and the readiness of the relevant role players to deal with such events is clearly within the ambit of the NNR owing to its legal mandate in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). As with many different forms of development, construction is dependent on authorisations from a number of different legal entities, including local, provincial and national authorities. Construction of such developments is reliant on all these authorisations being obtained from entities with vastly different legal mandates. Reporting requirements to satisfy all these authorisations vary hugely, and it cannot reasonably be expected that information relevant to all these authorisations should be contained in an EIR.

Comment 32

Management of radioactive waste Appendix E29

I will deal briefly here with some of the more obvious flaws:

pg 49 Disposal of Spent Fuel

The National Radioactive Waste Management Policy and Strategy (see Section 2.2) clearly suggests that a long-term management strategy for spent fuel in South Africa has not been agreed upon. Internationally, several counties are in the process of formulating and developing long-term management solutions for their spent fuel. The preferred solution is geological disposal, mainly for its passive safety features, multiple safety functions in terms of natural and engineered barriers,

containment of the waste and excellent ability to isolate the waste from the biosphere and humans over the long term.

i) It is unacceptable that an EIR might be passed where " *a long-term management strategy for spent fuel in South Africa has not been agreed upon"*

Surely a prerequisite for the passing of an EIA would be that there would be an acceptable strategy for the disposal of waste.

In fact the only way to 'solve' the thorny issue of high level waste disposal is to remove it from the public domain and from the EIA process. The only way to do this is to form a separate 'body' which would be responsible for matters regarding high level waste and ensure that this body is adequately protected from public scrutiny. To do this one requires complex legislation in the way of laws and bylaws setting limits and regulatory procedures which would be enforced by another nuclear industry affiliated body, thus releasing it from standard forms of scrutiny.

And thus we now have a National Radioactive Waste Disposal Institute. The clumsy management of this issue is unethical and unacceptable.

ii) Any "*multiple safety functions in terms of natural and engineered barriers"* would merely retard the integration of this waste into the earth which is ultimately inevitable, as there is no known containment vessel which can be manufactured and can possibly remain intact for thousands of years.

iii) On page 14 the report state that the government should investigate the best long term options for disposing of spent fuel, including
1) reprocessing, conditioning and recycling;
2) geological disposal and
3)"transmutation"

On 'transmutation' the author himself says that this is unproven and rather unlikely, so one wonders why it has been included, if not in desperation to provide some form of alternative.

Rudimentary research into reprocessing shows it to be very unsatisfactory also - la Hague in France has been found to be extremely costly and far from solving the nuclear waste problem has amplified it, with discharges from this plant significantly more than dry or wet storage would have been over this period.

We know the difficulties with regard to geological disposal with reference to the experiences of various countries, even though the report refers to several national programs that are I quote "within a decade" of operating a geological repository for HLW and spent fuel, notably Finland, Sweden, and the USA. There was talk that a geological repository would be available in the next decade in a report by the IAEA a decade ago.

Since the beginning of the nuclear industry in the 1940's there have been promises of a plan for high level waste. And yet globally this remains the Achilles heel of the industry and a problem which has not yet found a suitable answer.

There remain globally no adequate long term solutions or disposal sites.

iv) I quote "*The National Radioactive Waste Management Policy and Strategy recognises that the storage of spent fuel is not sustainable indefinitely.*

Government should thus ensure that investigations are conducted within set timeframes to consider the various options for safe management of spent fuel and high-level radioactive waste in South Africa."

Even though this is an issue which has not yet found a satisfactory solution anywhere in the world, the author is optimistic that South Africa will come up with a solution for the spent fuel within a "set timeframe".

CONCLUSIONS

I hold that this EIA is illegal and unethical without adequate analysis of solutions regarding the issue of high level waste.

Failure to assess all potential impacts of nuclear waste violates National Environmental Management act. It also violates EIA Regulations, read together with PAJA 6(2) (b)

Response 32:

Your comments regarding the assessment of the impacts of radioactive waste disposal are noted.

I - iv Please refer to Response 31 in terms of the separation between the EIA process and the NNR licensing process where the then DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process.

Your comments on the National Radioactive Waste Disposal Institute are noted. However, the above-mentioned specialist study and the EIR are based on on-site storage (as currently applied at Koeberg Nuclear Power Station), as this is the currently applied storage mechanisms for high level waste (HLW). The impacts of on-site storage of HLW may indeed be regarding as significant if no mitigation is applied. However, the on-site storage of HLW is subject to very strict controls that are monitored by the NNR. After the application of these mitigation measures, and based on the experience with the application of these measures at the Koeberg Nuclear Power Station (where long-term storage of HLW has not resulted in health impacts), the impacts of this activity are assessed to be of low significance.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

Appendix 1

RESPONSIBLE FOR ICRP DOCUMENT #2 (1959) ON STANDARD FORINTERNAL DOSES OF IONIZING RADIATION:

L. BUGNARD: 1956: Member, Conseil Scientifique du Commissariat a la Energy Atomique, France 1956 -1965; Vice-President, Comite de Biologie Commissariat a l'Energie Atomique. 1956 - 1965: Member Scientific and Technical Committee EURATOM.

L.S. TAYLOR: 1948 - 1961: Organized and headed the Biophysics Section in the Division of Biology and Medicine of the U.S. Atomic Energy Commission during above ground nuclear bomb testing (1946 -1963). He was trained as a physicist.

W. BINKS: 1953 - 1963: Secretary of the U.K. Medical Research Council Committee on Protection against Ionizing Radiations. He was trained as a physicist.

J.C. JACOBSEN: 1956 - 1958: Research Director, Atomic Energy Research Station, Risoe, Denmark. 1958 -1969: Consultant to Danish Atomic Energy Agency. He was trained as a physicist.

E.A. WATKINSON: 1959: Principal Medical Officer,University of Toronto; also Department of Environmental Health and Special Projects, Health and Welfare, Canada. He was a physician.

R.G. JAEGER: 1950 - 1962: Chairperson Committee III Protection against Xrays and electrons up to energies 3 MeV and beta and gamma from sealed sources; 1960: International Atomic Energy Agency. He was a West German physicist.

W.V. MAYNEORD: 1947 - 1962: U.K. Medical Research Council committee on Medical and Biological Applications

G. FAILLA: 1946 - 1960: Consultant to U.S. National Council on Radiation Protection and Measurements. Physicist, Director of the radiological research laboratory at Columbia University (died 1961).

R.M. SIEVERT: 1941: Professor of Radiophysics, Karolinska Institute, Stockholm; Co-founder of International Xray and Radium Protection Committee (1928) and of ICRP (1950); Swedish delegate to UNSCEAR 1960. He was trained as a physicist.

H. HOLTHUSEN: 1937 - 1960: Physicist, Member of International Commission on Radiation Units; 1960: Member of West German Atomic Energy Commission.

K.Z. MORGAN: 1934 - 1943: Member of the Research Staff, Atomic Bomb Project, University of Chicago; 1953- 1959: Chairperson of committee II (Internal Doses) of ICRP - Responsible for ICRP Document #2; 1943 - 1972: Director of Health Physics Division, Oak Ridge National Nuclear Laboratory, U.S. Atomic Energy Agency. He was a physicist.

R.S. STONE: 1952 - 1960: Project Director for Health, U.S. Atomic Bomb testing; Member of the Executive Committee of the U.S. National Commission on Radiological Protection. He was trained as a radiologist.

[v] Lehnert, B.E., Goodwin, E.H. Cancer Res. (1997), 57, 2164-71.

[v] Wei Han and K. N. Yu Ionizing Radiation, DNA Double Strand Break and Mutation Advances in Genetics Research. Volume 4 City University of Hong Kong, Hong Kong (2010) Nova Science Publishers, Inc.

[v] Oleg V. Belyakov, Heli Mononen and Marjo Perälä; Radiation Effects Studies of Non-Targeted Effects of Ionising Radiation STUK - Radiation and Nuclear Safety Authority, Helsinki, Finland

[v] Wei Han and K. N. Yu Ionizing Radiation, DNA Double Strand Break and Mutation Advances in Genetics Research. Volume 4 City University of Hong Kong, Hong Kong (2010) Nova Science Publishers, Inc.

[v] Jacob P, Rühm W, Walsh L, Blettner M, Hammer G, Zeeb H., Is cancer risk of radiation workers larger than expected? Occup Environ Med. 2009 Dec;66(12):789-96. Epub 2009 Jun 30. Hemholtz Zentrum München, Institute of Radiation Protection, D-85764 Neuherberg, Germany.

[v] Professor T J McMillan, Professor M R Bennett, Professor B A Bridges, Professor J Hendry, Professor B Jones, Dr C Kanthou, Dr M P Little, Dr A Taylor, Dr I Tzoulaki Circulatory Disease Risk Report of the independent Advisory Group on Ionising Radiation, Health Protection Agency UK, 2010

05 August 2015

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Your Ref: Email received 03 August 2011

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Dear Ms Dittke

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

This letter is in response to the Revised Draft EIR for the proposed Nuclear-1 Power Station (NPS). There are a number of concerns with the DEIR which I would like to raise:

First, the EIAR fails to consider the economic impacts that the construction of the NPS will have on broader South Africa (rather than the economic impacts on the local communities that was submitted by the EAP).

Response 1:

Your comment is noted. Although the Environmental Impact Assessment for the Nuclear-1 Power Station is a site-specific assessment tool the Economic Report (Appendix E17 of the Revised Draft EIR Version 1 – Section 3.3) prepared by Conningarth Economists and Imani Development (SA) (Pty) Ltd nevertheless conducts a macroeconomic equilibrium analysis in order to quantify the macroeconomic impact associated with the possible construction and operation of the Nuclear-1 Power Station.

The report acknowledges that, as the nuclear power station is such a large capital investment (equivalent to that of six times the capital investment in Gautrain), the economic ripple effects will go far beyond its direct boundaries. We refer the author to section 3.3 of the report for an expanded discussion.

Comment 2:

Second, the EIAR fails to assess worst-case scenario impacts, a particularly important point in light of what has happened at Fukushima.

Response 2:

Thank you for your comment. It is acknowledged that the incident at Fukushima as a result of this natural disaster has highlighted many important safety factors in terms of the future of nuclear energy and is indeed a stark reminder of the unpredictability of the natural environment. However it is also well known that South Africa is located on a vastly more stable tectonic environment than Japan, which is situated close to a major subduction zone within the Pacific Ocean.

Nevertheless, the Revised Draft EIR Version 2 will include an analysis of “Beyond Design Basis Accident” scenarios like Fukushima to assess the implications for Nuclear-1. This assessment will consider the differences in technology between Fukushima Daiichi, which is based on a late 1960’s design, and the Generation III nuclear power generation technology to be used for Nuclear-1. Based

on the newer nuclear technology, the probability and consequence of meltdown incidents, such as happened at Fukushima, is greatly reduced, if not eliminated, if the same events were to take place at a Generation III nuclear power station.

Comment 3:

Third, it does not consider the impacts and costs of waste and its disposal, and additionally, there is no long term solution for the waste.

Response 3:

Your comment is noted. The nature and impacts of construction waste is discussed and assessed in Chapters 3, 5, 9 and 10 of the Revised Draft EIR Version 1 and in its associated Specialist Studies (Appendix E). The nature and impact of radiological waste is described and assessed in Chapters 3, 9 and 10 of the Revised Draft EIR Version 1 and in the Radiological Waste Assessment (Appendix E29)

It is acknowledged that the issues of radioactive waste management is important and integral to debate surrounding nuclear energy and as stated the current global practice is long-term storage of the spent fuel at the nuclear power station. However please note that a Radioactive Waste Management Institute has been legislated by the Department of Energy and one of the functions of this institute will be to identify a repository for high level waste in South Africa.

In the interim, Eskom will follow the internationally accepted practice of permanent on-site storage of High-Level Waste, following practices that allow for the safe storage of such waste on site.

Comment 4:

Fourth, it does not adequately assess project alternatives (such as renewable energy) and a no-go option.

Response 4:

GIBB confirms that it is a legal requirement in terms of the National Environmental Management Act to assess feasible alternatives, which is defined to mean *different means of meeting the general purpose and requirements of the activity* – in the case of this EIA, the activity is the construction and operation of a nuclear power station to provide base load electricity generation at either the Duynefontein, Bantamsklip or Thyspunt sites. As such Chapters 5, 9 and 10 of the Revised Draft EIR Version 1 discusses alternatives, which include:

- Location of the power station;
- Nuclear plant types;
- Layout of the nuclear plant;
- Fresh water supply and utilisation of abstracted groundwater;
- Management of brine;
- Intake of sea water;
- Outlet of water and chemical effluent;
- Management of spoil material;
- Access to the proposed sites; and
- The no-development alternative.

The choice of technologies, described in Chapter 5 of the Revised Draft EIR Version 1 and the implications of alternative technologies such as wind generation to address South Africa's energy requirements is provided for information but does not fall within the ambit of this Environmental Impact Assessment (EIA). It falls within the ambit of strategic government initiatives such as the Integrated Resources Plan 2010. The IRP was subject to an extensive public participation process. Carrying out such a debate during the EIA process would be duplication.

This EIA and Application for Environmental Authorisation is not a strategic assessment of South Africa's energy requirements and the future energy mix proposed to address these requirements or an

investigation into the pros and cons of the use of nuclear power versus renewable / alternative energy. It is a tool used to assess the possible positive or negative impact that the proposed project may have on a specific receiving environment, which in this case are the Duynefontein, Bantamsklip and Thyspunt sites.

Comment 5:

Fifth, there is no final project design, making any assessment of the actual impacts impossible.

Response 5:

Your comment is noted. We assume that you are referring to design detail in terms of the reactor type/manufacturer to be used as you have not defined the lack of design detail in your statement above.

It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known and the environmental impacts can be predicted or deduced from these inputs and outputs with reasonable certainty, it is not necessary to know the brand name of the technology and makes the assessment of impacts very possible.

As has been done in other issues and response reports, it may be appropriate to explain the envelope of criteria in colloquial terms, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel type, fuel efficiency, catalytic convertor performance, type of tyres and wheels, fuel tank size, effective range, CO2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBD. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would not qualify. Similarly, if a vendor proposes a power station design that fails to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration.

Assuming that an authorisation is granted by the DEA, a power station design that deviates significantly from that specified in the Consistent Dataset in the Nuclear-1 EIR (Appendix C of the Revised Draft EIR) would render the design incapable of meeting the requirements of the EIR and the authorisation. Hence such a non-confirming design could not be considered for construction.

Comment 6:

In light of these concerns, I suggest that these revisions be added to the report so that decision-makers have all the relevant information to make their decision.

Response 6:

Your comments have been noted and revision to the report will be made only where deemed necessary. Your comments will however be added to the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision making.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

PROPOSED ESKOM NUCLEAR POWER STATION
AND ASSOCIATED INFRASTRUCTURE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA: 12/12/20/944)

COMMENTS ON
DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

(Volume 55 RDEIR IRR 10 August 2011)

Issues have been received from the following stakeholders:

No	Name	Organisation
1	Banie Engelbrecht	Interested and Affected Party
2	A Glaser	Interested and Affected Party
3	Angie Curtis	Interested and Affected Party
4	Briaan Smit	City and Area Planner, Matzikama Municipality
5	Candice Pelser	Interested and Affected Party
6	Chris Pretorius and Janli Maartens	Interested and Affected Parties
7	Leonie Mervis	Interested and Affected Party
8	Fiona Ross	Associate Professor – Department Social Anthropology - UCT
9	Fiona Hinds	Interested and Affected Party
10	Catherine and Hugh Corder	Interested and Affected Party
11	Jenna da Silva Pinto	Interested and Affected Party
12	Jill Mackay	Interested and Affected Party
13	Liezl Coetzee	Interested and Affected Party
14	Margaret Carol Mervis	Interested and Affected Party
15	Margaret Carol Mervis	Interested and Affected Party
16	Mark Attwood	Interested and Affected Party
17	Rob McLeod	Interested and Affected Party
18	Rod Tritton	Interested and Affected Party
19	V Govindsamy	Interested and Affected Party
20	Stephen Syrett	Interested and Affected Party
21	Dr Susanne Godhart	Interested and Affected Party
22	Chris Liepold	Interested and Affected Party
23	Anka Esterhuizen	Interested and Affected Party
24	Tristen Taylor	Interested and Affected Party
25	Dr David Fig	Honorary Research Associate, Environmental Evaluation Unit, Department of Environmental and Geographical Sciences, University of Cape Town Chairperson of the Biowatch Trust Independent environmental policy researcher

26	Daniel Hutchinson	Rebelsrus Trust Member
27	Harris Johnson	Interested and Affected Party
28	Francois Bekker	Interested and Affected Party
29	Amanda Jephson and Charl Laubscher	Interested and Affected Parties
30	Chris Barratt	St Francis Kromme Trust

NO	DATE	NAME & ORGANISATION		
1	04 August 2011 Email	Banie Engelbrecht Interested and Affected Party	My interest is in the characteristics / features of the external infrastructures outside the Nuclear Station. That embodies employees (permanent / temporary / top structure) with reference to their residence, habitation, roads, schools, retail, trade, industrial, hospitals and so forth. This is my forte. It is a fact that first you need the above infrastructures then the main plan of action and constructions can follow. Whoever the contractor will be, will have to consider these facts. We are ready with a presentation of vacant land next to Humansdorp and the study of the environment.	The location and exact nature of the external infrastructure has not yet been determined. Once a decision is made on a location of the nuclear power station (assuming a positive authorisation is issued), the planning for the external infrastructure will be undertaken. At this stage, Eskom has held conceptual discussions with the applicable local authorities to determine the availability of appropriate land for employee villages, etc, but has not initiated detailed planning. The consistent dataset (Appendix C of the Revised Draft EIR Version 1) contains conceptual information on the facilities that will be required for the conventional nuclear power station.
2	07 August 2011 Email	A Glaser Interested and Affected Party	I am against the building of new nuclear plants at Thyspunt, Bantamsklip or Koeberg	Your comment is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
3	07 August 2011	Angela Curtis Interested and Affected Party	I am opposed to the flawed EIR being accepted. I am in support of the KAA submission.	Your comment and support for the Koeberg Alert Alliances' (KAA) submission is noted. Your comment will be addressed inthe Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
4	07 August 2011 Email	Briaan Smit City and Area Planner Matzikama Municipality	A land use application needs to be lodge with the Matzikama Municipality for land use approval before any construction may take place.	Your comment is noted. Land use applications are one of the more than 30 different authorisations that will be required for the proposed nuclear power station. Eskom is pursuing the environmental application first as it is a key authorisation. Should environmental authorisation be

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			Matzikama Municipality reserves the right for future comment.	granted, Eskom will apply for other authorisations.
5	07 August 2011 Email	Candice Pelser Interested and Affected Party	I do not believe that the DEIR has sufficiently assessed the full impact of the proposed Nuclear-1. My specific concerns are well represented in the comments and questions submitted by the following organisations; • Project 90 by 2030 • The Legal Resources Centre • Koeberg Alert Alliance • Earthlife Africa. Please note my input as such.	Your comment is noted. The responses to the comment from the various organisations listed by yourself will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
6	08 August 2011 Email	Chris Pretorius and Janli Maartens Interested and Affected Parties	We, my wife, Janli Maartens and myself, Chris Pretorius, of Wolvengat, close to the proposed Bantamsklip site. Wish to object in the strongest to the proposed NUCLEAR development of this and any site in South Africa. When the rest of the developed and developing world has put a hold on developing any further nuclear power station, and are actually phasing those nuclear power stations that they have out, you want to develope (sic) them. Are we, SOUTH AFRICA, just to become the dumping ground for the "developed"	Your comment and objection to the Bantamsklip site is noted. It is not factually correct to state that the rest of the "developed and developing world has put a hold on developing any further nuclear power …" The German government has taken a decision to phase out nuclear power. However, other European countries such as France and the United Kingdom are continuing to develop nuclear power as a key source of electricity. Several nuclear power stations are in the process of being constructed across the world, including in China, the United Kingdom and Finland.

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			worlds technology seeing as their own countries no longer want it and well they the developers still just want to make more money out their technology which is outdated!! and dangerous to us humans, the fauna and flora and the wellbeing of our generations to come!! We have the most amazing country with the most amazing natural resources for alternative energy sources, yet you still want to contaminate it with unsightly nuclear power stations, you want to contaminate our air, our sea life, need I carry on. The basic bottom line is as follows; we object to you, ESKOM, developing the proposed NUCLEAR sites on the grounds that you are going to infringe on our basic human rights, and constitutional rights. And those of everyone who would be in the general area of the proposed sites. Regards, but with heavy concerns.	
7	05 August 2011 Email	Leonie Mervis Interested and Affected Party	I am against the building of a new nuclear power station at Thyspunt, Bantamsklip or Koeberg. I wish to fully endorse the Koeberg Alert Alliance (KAA) submission to the Nuclear-1 draft 2 EIR.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
8	06 August 2011	Fiona Ross	I learn with concern about the proposed	Your comment is noted.

NO	DATE	NAME & ORGANISATION		
	Email	Associate Professor – Department Social Anthropology – UCT	nuclear site at Thyspunt. The area is important from a heritage point of view and the history and archaeology must be protected. Heritage and archaeological experts have identified the significance of the site and have strongly recommended that the site is unsuitable. It is unclear why these recommendations have not been followed.	We take note of your objection. However, recent additional monitoring of archaeological sites at Thyspunt (undertaken during the 2nd half of 2011 and therefore did not reflect in the Revised Draft EIR Version1 of 2011, but is included in the Revised Draft EIR Version 2) indicate that there are very few archaeological sites within the proposed footprint of the power station and that these sites are of poor quality compared to the concentration of well-preserved archaeological sites along the coastline. The revised Heritage Impact Assessment (which will be provided to all I&APs for comment) concludes that "*it is possible to position the proposed nuclear power station in such a way that physical impacts to heritage sites of an archaeological nature can be minimised. Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available."* Some on-site storage (a small museum) may be necessary.
9	08 August 2011 Email	Fiona Hinds Interested and Affected Party	I am opposed to the flawed EIR being accepted and I support the Koeberg Alert Alliance (KAA) submission.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
10	07 August 2011 Email	Catherine and Hugh Corder Interested and Affected Parties	We Catherine and Hugh Corder object to the establishment of a nuclear power facility at Thyspunt on heritage grounds.	Your comment is noted. The Heritage Impact Assessment (Appendix E) has assessed the potential impacts on heritage resources at all three alternative sites, including Thyspunt. We take note of your objection. However, recent additional monitoring of archaeological sites at Thyspunt

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				(undertaken during the 2nd half of 2011 and therefore not yet reflected in the Revised Draft EIR of 2011) indicate that there are very few archaeological sites within the proposed footprint of the power station and that these sites are of poor quality compared to the concentration of well-preserved archaeological sites along the coastline. Therefore, the revised Heritage Impact Assessment (which will be provided to all I&APs for comment) concludes that "*it is possible to position the proposed nuclear power station in such a way that physical impacts to heritage sites of an archaeological nature can be minimised. Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available."* Some on-site storage (a small museum) may be necessary.
11	07 August 2011 Email	Jenna da Silva Pinto Interested and Affected Party	I am absolutely against the building of a new nuclear plant at Thyspunt, Bantamsklip or Koeberg. It is hard to understand why, whilst the rest of the world rethinks nuclear (some even cancelling their nuclear programmes), this country continues to forge ahead with little regard for the communities and future generations involved. Several critical issues have been raised by the Koeberg Alert Alliance (KAA) and I would like to endorse their submission.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
12	07 August 2011 Email	Jill Mackay Interested and Affected Party	I oppose acceptance of this EIR on the basis that it is flawed and therefore support the submission by the Koeberg	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed

NO	DATE	NAME & ORGANISATION		
			Alert Alliance (KAA).	before the Competent Authority for decision-making.
13	07 August 2011 Email	Liezl Coetzee Interested and Affected Party	This is to note that I support the Koeberg Action Aliance's (KAA) submission concerning the incomplete nature of the Nuclear-1 EIR.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
14	05 August 2011 Email	Margaret Carol Mervis Interested and Affected Party	I am totally against the building of a new nuclear plant at Thuyspunt, Bantamsklip or Koeberg. We should all learn from the Japanese nuclear disaster. We have no right to expose future generations to the dangers and long term effects of such projects!	The design of the Fukushima Daiichi nuclear power station dates from the late 1960s and did not incorporate the substantial lessons in nuclear power station design that have been learnt in the decades since its construction. An analysis of the events leading to the Fukushima Daiichi incident will be included in the next revision of the EIR, which will be provided for public comment. One of the major differences between the design of the Fukushima Daiichi power station and later power stations in terms of spent fuel storage is that the Fukushima design includes the spent fuel pool in the containment structure, whereas in later designs (e.g. at Koeberg Nuclear Power Station), the spent fuel pool is separate from the containment structure and contamination in the containment structure does not impact access to, and operation of, spent fuel cooling systems. Several other major differences in nuclear power station design and operation have been implemented in the decades since Fukushima was built, including passive cooling. There are inherent dangers in nuclear technology (as with many other forms of technology) but if these are responsibly managed the risk to the public is negligible. The release of radioactivity from the Fukushima Daiichi plant is a regrettable incident that could have been avoided with proper planning. Unfortunately planning for

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				the Fukushima Daiichi plant in terms of catering for tsunami events was poor, in that a very low tsunami was assumed than should be the case for a country like Japan, which is prone to frequent earthquakes of high magnitude. In contrast, emergency planning for the Koeberg Nuclear Power Station assumed a tsunami of 4 m, even though no tsunami has ever been recorded on the West Coast, and in spite of the fact that Southern Africa is seismically more stable than Japan. In addition to planning for a tsunami, planning for the Koeberg Nuclear Power Station assumes that a tsunami may coincide with a spring tide and major storm surges (a so-called meteo-tsunami event), and thus the terrace for the Power Station is built at a height of 8 m above sea level. Backup generators to supply power to the cooling systems has also been placed at heights of 12 m above sea level, besides the backup power that can be supplied from two gas-fired peaking power stations in proximity to the Power Station. Similar planning is in place for Nuclear-1, in that a combined tsunami and an exceptional storm surge has been assumed in deciding on the height of the nuclear island and the location of backup power supplies. Whilst the Fukushima Daiichi incident is without a doubt a tragic event, as it could have led to loss of life, some perspective is also required on this event. The tsunami was responsible for the loss of approximately 20 000 lives, the evacuation of approximately 450 000 people and the complete destruction of several coastal towns. On the other hand, not a single death or serious injury due to the radiation release from the power station has been recorded to date. This is not mentioned to minimise the significance of the nuclear incident, but to provide some perspective regarding the public perception of what is regarded as a significant risk. In the wake of the

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				Fukushima incident, very critical attention has been focused on the nuclear power station. However, the everyday risk of living in vulnerable low-lying coastal areas prone to flooding seems to be tacitly accepted or at least not treated with nearly the same level of concern.
15	06 August 2011 Email	Margaret Carol Mervis Interested and Affected Party	I fully endorse the Koeberg Alert Alliance (KAA) submission to the Nuclear-1 draft 2 EIR. I am totally against the building of a new nuclear plant at Thyspunt, Bantamsklip or Koeberg.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
16	10 August 2011 Email	Mark Attwood Interested and Affected Party	Please can I add my voice to the many who oppose the building of a new nuclear plant in SA. I am firmly against building of a new nuclear plant at Thyspunt, Bantamsklip or Koeberg and am opposed to this flawed EIR being accepted and hence support the KAA submission. Nuclear is a short-sighted and selfish way to generate power. The legacy it will leave for future generations is too ghastly to contemplate. We should be focussing our energy build firmly on sustainable sources of solar and wind.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making. Your comment on development of renewable energy source is noted. It is not within the mandate of this EIA process to compare the costs and benefits of nuclear generation technology to renewable forms of electricity generation, since the EIA process is, by its very nature, a project-specific tool that focuses on a particular form of technology. Please refer to chapter 5 for a strategic discussion on form of power generation. However, government is pursuing renewable technologies in parallel to nuclear generation. It is to be noted that the Integrated Resource Plan (government's strategy for security of energy supply over the next two decades) requires a balanced mix of generation technologies, including 9 600 MW of nuclear and 18 700 MW of renewables. The purpose of nuclear generation is to provide reliable base-load power, which most of the renewable technologies are not capable of providing on

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				the same scale. It is also pointed out in the Revised Draft EIR that a mixture of generation technologies is required in order to meet South Africa's future energy needs and that SA cannot place reliance on only a single form of technology or a limited number of technologies. Although the relative contribution of renewable technologies must increase over time, it is not a simple matter of replacing non-renewable technologies with renewable technologies.
17	06 August 2011 Email	Rob McLeod Interested and Affected Party	I wish to state that I am the opposed to this flawed and incomplete Nuclear-1 Environmental Impact Report being accepted. I hence not only support the Koeberg Alert Alliance (KAA) submission but press for this process to cease being bulldozed and demand that the public be better informed and consulted.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
18	07 August 2011 Email	Rod Tritton Interested and Affected Party	Please let it be known that I know I speak for many people too busy and too apathetic to say for themselves when I say that I strongly believe that this EIR is flawed and unacceptable on a number of bases. I ardently support the Koeberg Alert Alliance (KAA) submission which quite plainly exposes a number of fatal flaws in this EIR, and I know that I speak for many people who cannot afford the time to be inundated by your thousands of pages of reports and caught up in the process, when they simply do not want anything	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.

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			nuclear in South Africa at all. Nuclear power is foolish and should be abolished, especially after the Japanese disaster. Nuclear power is patently unacceptable on many fronts, the expense being just one fatal flaw of nuclear power. The people who support nuclear are carelessly infecting the planet. Do you have plans to leave, or are you happy to infect your children with nuclear radiation? Wake up and let's stop this madness while we still can.	
19	07 August 2011 Email	V Govindsamy Interested and Affected Party	I am against the building of a new nuclear plant at Thuyspunt, Bantamsklip or Koeberg and am opposed to the flawed EIR being accepted and hence support the KAA submission.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
20	07 August 2011 Email	Stephen Syrett Interested and Affected Party	I am opposed to this flawed EIR being accepted and hence support the KAA submission.	Your comment and support for the KAA submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
21	02 August 2011 Email	Dr Susanne Godehart Interested and Affected Party	I support the submission of Earthlife Africa against the EIA for Nuclear 1.	Your comment and support for the Earthlife Africa submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
22	06 August 2011	Chris Liepold Interested and	Good day, I am writing on behalf of Chris G Liepold 21 Grosvenor Road Cape St	

NO	DATE	NAME & ORGANISATION		
	Email (sent by Tamara Manton)	Affected Party	Francis 6312 His objections are as follows; 1. Otters habitat is threatened. 2. Khoisan/Stranlopers (sic) fish traps and historical heritage needs to be protected.	1. Your objection is noted. The recommended positon of the power station on the Thyspunt site takes into consideration the various sensitive features of the site, such as freshwater resources. The recommended footprint avoids open water sources. 2. The origin of the fish traps in the Thyspunt cannot without a doubt be traced back to Khoisan peoples who occupied the Thyspunt site. An analysis of the origin of these traps is included in the Heritage Impact Assessment – HIA (Appendix E22 of the Revised Draft EIR). The HIA reports as follows: "*Hine (2007) has re-examined the issue and found compelling historical evidence that most of the tidal fish traps existing today were built by colonial farmers in the 19th century and maintained by their descendants well in to the 20th century. What remains unknown is whether the tradition of tidal fish traps has historical continuity back to pre-colonial times. At present, the balance of evidence suggests this is not the case.*" We take note of concern for the historical heritage. However, recent additional monitoring of archaeological sites at Thyspunt (undertaken during the 2nd half of 2011 and therefore not yet reflected in the Revised Draft EIR of 2011) indicate that there are very few archaeological sites within the proposed footprint of the power station and that these sites are of poor quality compared to the concentration of well-preserved archaeological sites along the coastline.

NO	DATE	NAME & ORGANISATION		
				The revised Heritage Impact Assessment (which will be provided to all I&APs for comment) concludes that "*it is possible to position the proposed nuclear power station in such a way that physical impacts to heritage sites of an archaeological nature can be minimised. Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available."* Some on-site storage (a small museum) may be necessary.
			3. Tourism will be negatively affected (Garden Route is world famous).	3. Your comment regarding tourism is noted. The concern on the impact on tourism is well-recorded in the Tourism Impact Assessment (Appendix E22 of the Revised Draft EIR). This study found that although tourism in the St. Francis region could be negatively affected during construction, there would most likely be not negative net impact on tourism over the long-term. This is consistent with the tourism experience near Koeberg Nuclear Power Station, where tourism products operate within sight of an operational nuclear power station. In contrast, should Nuclear-1 be constructed at Thyspunt, it would not be visible from St. Francis.
			4. Emissions from plant with the prevailing South Westerly wind.	4. Emission from the plant were modelled in detail in the Air Quality Assessment (Appendix E10 of the Revised Draft EIR) and found to be far below the level that would raise concern from a health perspective.
			5. 3km evacuation zone is implausible.	5. Your comment is noted. Please note the EPZ proposed is as per the EUR standards. The NR will however determine the final EPZ radii during the
			6. How can our community's	

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			constitutional right to live without threat be taken away?	NNR licensing process. 6. Whilst it is true that there are (managed and well-controlled) risks associated with nuclear power generation, there are many other common risks (that have a far greater potential to lead to fatalities or serious and debilitating injuries) that the public is happy to accept on a daily basis. Such common risks include travelling in vehicles (more than 16,000 South African's killed on our roads each year – this does not count the number of serious injuries and incidents of paralysis) and common household chemicals like chlorine that can be used to make explosives but over which there is no control. In spite of the comparatively low risk of sickness or death from nuclear incidents (bearing in mind that there has been not a single fatality recorded from the release of radioactivity from Fukushima Daiichi but more than 20 000 combined deaths and missing persons recorded as a result of the tsunami), there remains a perception that nuclear technology results in an inherently greater risk of death or injury than other forms of commonplace risks. In spite of 20 000 deaths from the tsunami, there does not seem to be an equal perception of risk associated with living in coastal cities, living in areas prone to earthquakes or other commonplace risks that people have come to take for granted. Whilst there are numerous calls for nuclear technology to be avoided as a result of its risks, there does not seem to be a corresponding demand for other technologies (that carry far higher risks) to be avoided.
23	07 August 2011 Email	Anka Esterhuizen Interested and Affected Party	I have no additional comments, and stand by my original reasons for opposing the Nuclear Plant envisaged for Bantamsklip.	Your comment is noted. The location of Nuclear-1 in either the Eastern or

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			The only other thing I want to add is: I strongly believe, that renewable sources of energy, proven successful throughout the world need to be explored for the use of the immediate, and surrounding inhabitants of the South Western Cape. We have no aluminium smelting here, or other activities that require huge amounts of electricity. So, the area that has these industrial loads should look for energy closer to home. I request that you keep me on your files as an Interested & Affected Party, and would like to be kept in the loop.	Western Cape is meant to address the electricity deficit in both these regions, where electricity demand exceeds electricity supply. The sources of demand include a range of activities, including household, retail and industrial. On average Eskom needs an increase of 13% in power generation per year and an additional 3% from independent power producers to meet electricity supply needs. It is uneconomical and risky to import the majority of the region's electricity from the coal-fired power stations on the Mpumalanga Highveld, and the electricity production from the Koeberg Nuclear Power Station is already fully utilised in the Western Cape. Eskom's power planning for the Western Cape already takes into account the additional generation capacity from other sources such as pumped storage in the Western Cape. Additional generation capacity is still required even after such sources are considered. Whilst renewable energy sources are also being developed in the Western Cape, this does not negate the need for a reliable large scale base-load generation alternative in this region.
24	07 August 2011 Email	Tristen Taylor Earthlife Africa	Please note that the South African Municipal Workers` Union (SAMWU) has signed onto the Earthlife Africa Jhb submission to the Revised Draft EIA for Nuclear 1 (submitted to Arcus GIBB on the 5/8/2011).	Your comment and support for the Earthlife Africa submission is noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
25	01 August 2011 Email	Dr David Fig Honary (sic) Research Associate, Environmental Evaluation Unit, Department of Environmental and	In view of my support for the submissions mentioned below, please attach my name to the submissions of the following organisations in regard to the Revised Draft EIR for Nuclear-1 1.Earthlife Africa Johannesburg/Legal	Your comment and support for the Earthlife Africa and SA Faith Communities submissions are noted. Your comment will be addressed in the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.

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		Geographical Sciences, University of Cape Town Chairperson of the Biowatch Trust Independent environmental policy researcher	Resources Centre. 2. Southern Africa Faith Communities' Environmental Institute.	
26	06 August 2011 Email	Daniel Hutchinson Rebelsrus Trust Member	The EIR does not mention the impact on the stone age "fish kraals' at Thyspunt. These "fish kraals" are an example of "living heritage": Given the right combination of weather and tidal conditions, fish still get trapped in these incredible structures built by early hunter-gatherer communities. Any change to water temperature or salinity would cause these unique structure to stop "working", cutting off this glimpse into the pre-colonial past.	The origin of the fish traps in the Thyspunt cannot without a doubt be traced back to Khoisan peoples who occupied the Thyspunt site. An analysis of the origin of these traps is included in the Heritage Impact Assessment – HIA (Appendix E22 of the Revised Draft EIR). The HIA reportsd as follows: "*Hine (2007) has re-examined the issue and found compelling historical evidence that most of the tidal fish traps existing today were built by colonial farmers in the 19th century and maintained by their descendants well in to the 20th century. What remains unknown is whether the tradition of tidal fish traps has historical continuity back to pre-colonial times. At present, the balance of evidence suggests this is not the case.*" GIBB has conferred with Dr Tammy Robinson (*pers. com.* 09 November 2012) the Marine Specialist on the Nuclear-1 team and she has confirmed that the rise in temperature and salinity will not affect the fish kraals in the vicinity of the Thyspunt site.
27	07 July 2011 Email	Harris Johnson Interested and Affected Party	Please tell me are you producing nuclear weapon? I want to understand your email or is this Auto respond?	Email reply on 22 August 2011: The GIBB Nuclear-1 Public Participation Office acknowledge receipt of your email hereunder dated 07 July 2011 and confirm that this Public Participation office deals with Nuclear-1 Revised Draft EIR (DEA Ref No:

NO	DATE	NAME & ORGANISATION		
				12/12/20/944) for a proposed Nuclear Power Station.
28	02 August 2011 Email	Francois Bekker Interested and Affected Party	On previous occasions I have requested information about the Milnerton geo-technical fault line that the current Nuclear reactor is built upon. You did not provide any information to us! What would be the result of a similar strength earthquake happens in the region of the current plant? We have a farm adjacent to Koeberg Nature reserve and would like to know urgently what the exclusion zones, or planned exclusion zones are, as it would severely affect what we could do on the land, and it would also affect the price of the land. I do not approve of the current processes your (sic) are following as you do not consult with adjacent landowners whose land prices could be severely affected if another plant is built nearby the current Nuclear plant. What is the expected lifespan of the current plant? Please provide the requested information	The Koeberg Nuclear Power Station (KNPS) is not built on a fault. The following extract from the Seismic Risk Assessment (Appendix E4 of the Revised Draft EIR Version 1) deals with the postulated Milnerton Fault. "*Dames and Moore (1976) concluded that enough circumstantial evidence exists to postulate the presence of a northwest striking fault offshore of Duynefontein but that it does not come closer than 8 km to the site. It is however possible that such a postulated fault could pass anywhere between 7 and 10 km offshore of Duynefontein (the inferred Melkbos Ridge Fault passes 7.5 km from the Koeberg Nuclear Power Station). No new research has been performed to con firm or refute the presence of the postulated fault or its point of closest approach to the site. The inference that the event happened closer to Milnerton than to Duynefontein is based on the reported damage to the farmhouse at Jan Biesjes Kraal*." Should you have any scientifically validated peer-reviewed information to challenge these findings, GIBB would welcome the opportunity to consider this. The Koeberg Nuclear Power Station has been designed to withstand a peak ground acceleration of 0.3g, which is equivalent to an earthquake of magnitude 7 on the Richter Scale (directly below Koeberg). The sizes of the planned Emergency Planning Zones (EPZs) for Nuclear-1 are documented in Chapter 3 of the

NO	DATE	NAME & ORGANISATION		
			on an urgent basis, and I would like to discuss the matter with the head of GIBB or Eskom. I do not approve of the extension of the plant at Koeberg, as we would be affected by it.	Revised Draft EIR. These zones are much smaller than the current EPZs for the Koeberg Nuclear Power Station. Therefore, should Nuclear-1 be established at Duynefontein, Nuclear-1 would have no impact on land use. Accordingly, based on the potential presence of an offshore fault and the seismic events that have taken place in the Western Cape, the Koeberg Nuclear Power Station has been built on an "aseismic raft", and all the components and plant systems that are important to nuclear safety have been designed to these seismic specifications so that they will be able to perform their expected functions during and after an earthquake. The expected life span of the Koeberg Nuclear Power Station is 40 years (i.e. it is expected to shut down by 2024), unless upgrading takes place to extend its life-span. Lastly the Nuclear-1 Stakeholder Register contains the contact details of in excess of 4 000 registered Interested and Affected parties including adjacent landowners. These contact details have been used to inform the public (via letter and e-mail) about the EIA process and the availability of documents for review. The team furthermore utilises public meetings, advertisements and the GIBB and Eskom websites to further communicate updates and information regarding the project to all concerned parties.

NO	DATE	NAME & ORGANISATION		
29	03 August 2011 Email	Amanda Jephson and Charl Laubscher Interested and Affected Parties	Support Earthlife JNB Submission.	Your comment is noted. Your comment will be added to the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making.
30	08 August 2011 Email	Chris Barratt St Francis Kromme Trust	**Eskom Environmental Impact Assessment (DEA Ref. No.: 12/12/20/944) for a Proposed Nuclear Power Station and Associated Infrastructure - Revised Draft Environmental Impact Assessment Report** We refer to the above and would advise as follows 1. We are participating members of the Thyspunt Alliance and as such wish you to note that we fully support their submission. 2. You have not responded to items raise by this organisation's representatives (at various public meeting - but not limited to these meetings). 3. We believe that the final rating criteria, as well as your conclusions, are totally biased in favour of the developer and as mentioned previously reserve our rights. We await hearing from you and to receiving the revised documentation as	Your comment and support for the Thyspunt Alliance submission is noted. Your comment will be added to the Revised Draft EIR Version 2 and Final EIR which will be placed before the Competent Authority for decision-making. Our previous responses to your organisation's comments remain valid. We have responded in detail to the issue of the rating system in the response to the Thyspunt Alliance (Issues and Response Report 64 – your submission dated 08 August 2012).

NO	DATE	NAME & ORGANISATION		
			advised by your representatives.	

Yours faithfully

For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 04 August 2011

Tshwane

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Dear Frances Becker

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

NOISE

I live within earshot of the Kromme river bridge. I want a proper study of the effects of increased truck traffic on the bridge.

I hear the traffic as I wake up each morning, and to say that 900 trucks a day will not impact the sound levels to the residents is LUDICROUS. We have not had an opportunity to meet the "expert" from Cape Town who must not know the wind directions.

There are laws governing noise levels - and I am sure that insufficient work has been done in this impact study.

Should the traffic continue at night - all of us will have disrupted sleep. The houses have thatched roofs and the shacks have no insulation whatsoever. 10 years is a long time to have disrupted sleep.

Response 1:

Your comment is noted.

Since the release of the Revised Draft EIR, the Traffic Impact Assessment (TIA) has been substantially revised so that the bulk of construction traffic will avoid Humansdorp and St. Francis (with the exception of less extra heavy loads that will have to use the Eastern Access Road to the Nuclear-1 site over the 9 year construction period). The revised TIA recommends the construction of a new interchange on the N2 to the west of Humansdorp that will bring construction traffic to the site via the Oyster Bay road and the Western Access Road to the Nuclear-1 site. The revised TIA recommended that only personnel traffic (buses and passenger vehicles) should use the R330.

Comment 2:

DUNE FIELD

After the recent slurry floods and disaster I find it incredible that Eskom continues with their plans to build in an active Dune Field.

After discussing the situation with expert Japie Buckle (please let me know if you have not spoken to him - but you surely must have) he says that the mechanisms that create slurry floods are poorly understood.

You may be able to build a nuclear plant but you may find it buried or your access severely limited. Ultimately St Francis will have more such incidents as the coast becomes wetter due to climate change. Over 100,000 cubic meters of sand have been displaced in this one incident.

How will you position Pylons in the middle of such an active dune field?

What is the cost of doing this by helicopter?

Response 2:

Your comment is noted.

It is not proposed to construct the power station within the Oyster Bay Mobile Dune Field. As indicated by the recommended power station footprint in the Revised Draft EIR Version 1, the power station is proposed to be placed well to the south of the mobile dune field.

Mr Japie Buckle represented the SA National Biodiversity Institute (SANBI) and the Working for Wetlands project at a Nuclear-1 key stakeholder meeting held on 12 April 2010. He is also included on the Nuclear-1 EIA stakeholder database as a registered Interested and Affected party and has therefore been privy to all communication to I&APs throughout the history of the project.

With regards to the so-called slurry floods, an extensive study of the mechanisms that give rise to debris flows was undertaken for the Revised Draft EIR Version 1 (See Appendix E30 of the Revised Draft EIR version 1). The conclusion of this study is that there is no evidence of debris flows having occurred at or close to the site and that the conditions that would enable debris flow to take place (e.g. very steep slopes) do not occur at the Thyspunt site.

It has been proposed, to minimise the impact on the dunes that helicopters are used as far as possible to place the pylons.

Comment 3:

ROUTE to SITE

The proposed route of heavy traffic is dangerous and will destroy the community.

As the recent washing away of the bridge indicated - there is one road in and one road out - and when that is disrupted it is disastrous. The residents will have their lives severely disrupted with the amount of traffic.

I live on the R330 and will be stuck trying to get in and out of my property. As it is, I have to wait in the mornings for an opening in the traffic. The recent disruption showed how much commerce and traffic goes between Humansdorp and St Francis. It will be slowed to a crawl.

The traffic studies saying it will not disrupt the town are inaccurate.

Response 3:

Your comment is noted. Please refer to Response 1 above.

Comment 4:

ATTITUDES TO RESIDENTS

That lawmakers regard St Francis as an elitist community is clear - however anyone standing at the bridge and watching who crossed over to go to work in the community and how many deliveries are made on a daily basis would know that the "elitists" are much fewer in number than ordinary citizens - and that they provide an enormous number of jobs. Kouga municipality will lose far more jobs than it will gain. And those will dwindle as people choose not to stay - what with a nuclear power plant, wind farms and flooding. It is already less attractive to buyers.

I am a business owner that relies on retirees and tourists for my business - I have never once been consulted about the power plant and its possible effect on my business. None of my twelve workers who live in the area are interested in the nuclear plant and feel that their voice is not being heard.

Response 4:

Your comment is noted.

The proposed position of the power station is approximately 11 km from St. Francis and would not be visible from St, Francis. The experience of the operation of the Koeberg Nuclear Power Station (KNPS) shows that communities, including tourism developments, suffer no long-term negative effect on tourism due to proximity from a power station. There are, for instance, high-income golf estate developments that have been developed within sight of the KNPS in the recent past and several guest houses and organic wine farming initiatives operate within sight of the KNPS.

The Tourism Impact Assessment (Appendix E22 of the Revised Draft EIR) predicts that there may be some loss of nature-based tourism but that due to the increased business tourism to the region, the net impact on tourism around the St. Francis region will be zero. This effect is also borne out by the experience at the KNPS and the current construction of other Eskom power stations.

Your comment regarding Nuclear-1 EIA not having solicited your individual comment is noted. It is not the purpose, neither is it possible for every individual landowner or resident in a particular geographical location to be consulted individually. The EIA public participation process makes use of a range of different techniques to solicit comments from I&APs, including press adverts, site notices, public and key focus group meetings, availability of hardcopy reports for review and availability of documents for review on the internet. You have the choice, as interested and affected party, to make use of the channels of communication that the EIA team has provided to you. Whilst it is a principle of the public participation process to consult was widely as possible, it is unfortunately not possible to consult every interested and affected party individually.

Comment 5:

SAFETY PLANS

I have not yet heard any evacuation plans that satisfy me. It would be more honest to say that you choose to live in the area at your own risk. I think that people who wish to re-locate should be compensated for their loss of security. We could all be so easily trapped in St Francis - as the recent incident illustrated.

Response 5:

Your comment is noted.

The evacuation plan for Nuclear-1 has not yet been formulated. The development and approval of evacuation plans is within the ambit of the National Nuclear Regulator Act (NNRA), 1999 (Act No. 47

of 1999), once a technology has been determined a extensive nuclear licensing process will be initiated, this process will include an extensive emergency plan and the public will be engaged.

Comment 6:

IN CLOSING

I have found the entire EIA process to be flawed in that it has been like banging our heads against a brick wall to get answers out of ESKOM. We have been treated poorly and the process has been BIASED. Crucial answers are never forthcoming. It appears that warnings about the environment have not been heeded.

WHY is ESKOM going to build in a unique potential WORLD HERITAGE SITE??

WHY is THYSPUNT the best site when it is clearly the most environmentally sensitive and unstable?

ESKOM will easily be able to divest itself of it's holdings in St Francis by creating a world class unique environmental center that would receive world acclaim and tourism income. The purchase is not in vain and could lead to significant positive effects.

I thank you for taking my points into consideration and seriously considering them and giving us proper answers.

Response 6:

Your comment is noted.

Please note that the Thyspunt site is not a World Heritage site. It is an opinion expressed by the heritage specialist that the Thyspunt site may qualify for listing as a World Heritage Site. Whilst this is a noteworthy conclusion, the site currently has no World Heritage Status and it would need to be nominated by South Africa and accepted by UNESCO prior to such status being applied under South Africa's World Heritage Convention Act, 1999 (Act No. 49 of 1999). Only one nomination can be made per year per country. It cannot be deduced that the expression of the heritage specialist's opinion in this regard necessarily implies that UNESCO would share the opinion that the Thyspunt site is of universal value to humankind.

There are indeed sensitive elements on the Thyspunt site (as there are on the other two alternative sites). However, given the recommended positioning of the power station in the least sensitive portion of the site, the potential environmental impacts of Nuclear-1 on this site are not regarded as fatal flaws for the site. Please refer to chapter 9 for more detailed information.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Dear Mr Becker

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

Introduction
This document has been prepared by the Koeberg Action Alliance (KAA) in response to the invitation for public participation and comment on the Environmental Impact Assessment for Eskom's proposed Nuclear-1 project.

KAA is a civil society grouping of South African citizens with deep reservations about the use of Nuclear Energy in South Africa.

We are particularly concerned with the actual and potential risks;

- to the health of citizens,
- to the environment,
- related to Nuclear Waste, and,
- to the economy.

KAA is therefore particularly keen to see that the EIA for the Nuclear-1 project is as accurate and complete as possible. We have therefore brought together a team of experts in various fields to examine to volunteer their time to analyse some aspects of the draft report. Of particular interest was the scientific accuracy of the studies, and whether the draft report is objective, or shows bias towards the applicant.

Last year we assessed the first Draft EIR for Nuclear-1 and found that it was incomplete, biassed and erroneous. We identified 36 specific and detailed corrective actions that would have to be performed in order for the EIA to be acceptable. We have now analysed the newly revised EIR in terms of those same issues, and have used the same 13 section headings as before. For details of the required corrective actions please refer to out previous submission. In this report they are simply paraphrased under the title of 'what we asked for'.

Response 1:

Please refer to Appendix E37 of the Revised Draft EIR Version 2 for the Peer Review reports on the Specialist studies conducted. The Peer Reviews found the specialist studies to be objective and adequate for this EIA

Comment 2:

1 Biased treatment of matters related to radioactivity

What we asked for:
The entire report including specialist reports needs to be rewritten in a fair, objective and neutral manner. Issues relating to radiation need to be dealt with consistently and in appropriate detail.

What we got:
There is little change and no significant improvement to the amount of bias in most of the specialist reports. We still have the situation where potential radioactive leaks have been cherry picked and included in the study only when the results are considered acceptable and excluded where they would be unfavourable to the development.

For example:

1. The air quality reports still excludes abnormal accident scenarios with the excuse that they are beyond the scope of the project.

2. The marine ecology also still excludes abnormal accident scenarios using the excuse that major radiation leaks are just too improbable to consider further because Koeberg has never had a significant radiation leak.

3. The consequences of an accident occurring during the highly dangerous and unavoidable exercise of transporting spent fuel is still just ignored, with the excuse that this issue is not site-specific and somehow that is considered reason enough to exclude it from the EIA.

4. The groundwater report remains the only report to consider a major radiation leak, and we submit that reason why this case is included is because they show that the result of the leak is insignificant, however their result is erroneous.

The faulty groundwater modeling is dealt with later, in section 4. The other three excuses need to be dealt with in some detail as they are used, with slight variations, repeatedly throughout the report and in the responses to comments from the public.

Excuse number 1: Catastrophic incidents need not be included in the EIA.

The excuse that catastrophic accident scenarios are beyond the scope of this project is no longer valid, despite the agreement between the DEA and the NNR.

Radiological issues and catastrophic events have been discussed at formal public meetings, in the IRRs and in some of the specialist reports and in the EIR. Much of the information presented has been biased and incorrect. The only acceptable way forward now is for the EIA to include a thorough assessment of the consequences and possibilities of various incidents leading to radiation emissions in a consistent, objective and neutral manner, taking into account the recent experiences in Japan.

Excuse number 2: If it hasn't happened at Koeberg it can't happen anywhere.

It seems a bit trite to point it out but it needs to be done: just because we have not seen a major radiation incident at Koeberg does not mean it's impossible for major radiation leaks to occur at Koeberg in the future. Koeberg provides a sample size of one, and also has not reached the end of its life time.

Excuse number 3: Only site specific factors are relevant.

The excuse that non-site-specific issues can be excluded from the EIA is flawed. If a radiation leak occurs, the site and surrounds will be affected. So of course such incidents should be covered in an environmental impact assessment.

On the whole, looking at the bias in favour of the development, the EIR is now even worse than it was before.

Although Eskom has claimed that a Fukushima type accident cannot occur at Koeberg, we note that the reactors designs are both from the 1960's/1970s and originate from the same design i.e. Fessenhein. It is not scientifically defensible to state that a large scale accident could not occur, and to use this as a reason for not investigating the possible impacts of such an accident.

The original reports have not been fixed. They remain as biased as before. Some of the new reports are clearly biased. E26 Emergency Response is particularly bad.

In this report we are told:

The Duynefontein Site includes the existing Koeberg Nuclear Power Station, therefore the emergency response infrastructure and systems are in place.

They might be in place and they might even be adequate but we cannot make this assessment if we don't have access to the Koeberg emergency plan. We have attempted to obtain the relevant documentation from Eskom, even reverting to a formal PAIA which was refused (ref. PAIA 10125).

A little further there is another attempt to avoid doing an emergency preparedness analysis:

The outcomes of the Safety Analyses, done prior to commissioning as part of the Safety Analysis Report has to confirm that the current infrastructure would be adequate to cope with the demands of the additional and proposed Nuclear-1 Power Station.

Whatever tasks may be required as part of some other process does not diminish the responsibility of Eskom or Gibb to fulfill the requirements of the EIA. The analysis of the readiness for dealing with emergencies cannot be classified as a nuclear radiation issue covered by the agreement between the NNR and the DEA.

A major part of the emergency response assessment must be to consider the infrastructure available to assist in the case of an emergency. Just one example: In Japan's recent disaster 104 massive fire-engines with powerful pumps and hoses on long extension booms of the type used for putting out fires in skyscrapers were sent out from Tokyo to assist in cooling the damaged reactors. What capacity do we have here for that type of task?

There is some confusion between probability and consequence in the EIR. Enhanced safety can only affect the probability of a nuclear disaster, not the consequences.

It might be unlikely, but it is not impossible that Nuclear-1 could experience a total loss of cooling and suffer a meltdown and a breach of the reactor vessel and a major explosion and then release into the air and spill onto the ground vast quantities of radioactive matter. Possible scenarios that could cause this included an earthquake, a Tsunami, repeated shelling from an artillery gun, a commando style raid by terrorists, a series of operator errors compounded by a series of equipment failures and other scenarios that nobody has thought of yet. Regardless of how unlikely, it is possible.

The purpose of an emergency response assessment is to assess how prepared we are for a nuclear disaster.
It appears to us that this document was authored with the intention of enabling Eskom to minimise its responsibility to prepare for emergencies.

It is totally unacceptable that sheltering, evacuation and iodine prophylaxis are to be excluded from the emergency plans.

If a disaster occurs it no longer matters how enhanced the safety features of the damaged plant was thought to be. What would matter most would be to get people away from danger. And the distance that they would have to be evacuated to would depend on where the radioactive matter is and not on where it used to be or how safely it was contained when it was contained.

The EUR requirements amount to no more than an attempt by NPS suppliers and operators to reduce their costs and avoid their responsibilities via a proposal for reduced safety standards. No democracy

would accept these industries proposed 'standards' and they do not form part of the national regulations in any European country. Referring to them as European and as a 'standard' as though they are accepted by the governments and people of Western Europe is simply misleading, and an indication of bias in favour of the applicant.

FEMA in the USA requires that evacuation plans be made for a 50 mile (80 km) radius around nuclear plants. During the recent nuclear disaster in the Japan the American government advised its citizens to get at least 50 miles away from Fukushima. We see no reason why South Africans should accept a lesser standard. We are all more or less equally susceptible to getting cancer from radiation.

One of the most serious problems with this revision of the EIR is in the responses to questions and comments from the public, the IRR's. On reading these documents it is clear that they have been written by someone who is highly motivated to defend the development.

Status: Worse – additional evidence of bias

Response 2:

Air quality report:
Emergency planning is outside the scope of the EIA process and forms part of the NNR's nuclear licensing process.

Marine ecology report:
Emergency planning is outside the scope of the EIA process and forms part of the NNR's nuclear licensing process.

Transfer of spent fuel:
The proposed project does not involve transfer of spent fuel, since it is proposed that spent fuel will be stored on site until such time as a long-term repository for spent fuel is developed in South Africa.

Groundwater report: Radiation leak:
Your claim that the finding of insignificant impact is erroneous is unsubstantiated and can therefore not be considered.

A major radiation leak was not considered in the groundwater (Geohydrology) report. The two scenarios related to contamination that were considered were 1) incorporation of tritium into the groundwater from air dispersion releases related to normal reactor operations and 2) on-site (reactor footprint area) contamination by an unspecified liquid contaminant. These scenarios were run regardless of the outcomes and not because they show that the result of the leak is insignificant (a claim that is bordering on slanderous). The result may seem erroneous to the reader if the scenario modeled is not understood, as would seem to be the case here.

Groundwater modelling
Your claim of "faulty" groundwater modelling is responded to below.

Probability and consequence of potential impacts:
Your statement of confusion between probability and consequence in the EIR refers. It is incorrect to state that mitigation can only affect the probability but not the consequence of an impact. While there are mitigations measures that are geared towards minimising the consequence after an event has occurred without reducing the probability of occurrence of an event, other mitigation measures are designed to address the probability of occurrence of and event. Thus, if the probability of an event occurring is reduced, there is a chance that the consequence may also be reduced but it does not follow that reducing probability will lead to reduction in consequence.

Your assumption that all nuclear emergency situations necessarily have the same consequence is not reasonable. A small scale release of radioactivity that exceeds legal limits, but which holds no risk to health or to food chains cannot be regarded to have the same consequence as a large-scale release that potentially affects the health of a large number of people. Thus to suggest that all unplanned releases of radioactivity necessarily have the same consequence is simplistic.

Emergency response (Appendix E26 of the Revised Draft EIR Version 1):

Access to Koeberg Emergency Plan and consideration of infrastructure required

EUR requirements:
The basis for adopting the EUR by Eskom is that the EUR aims at ensuring that the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their designs studied and endorsed by the relevant regulatory bodies. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and the environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundaries allow for minimal restrictions around the site, while also providing for safer designs.

Application of EUR and comparable FEMA Emergency Planning Zones
Nuclear specialist to respond

"Catastrophic incidents need not be included in the EIA"
Your statement that the agreement between the DEA and the NNR is no longer classified as a radiological issue and that catastrophic scenarios are therefore required to be included in the EIA is note substantiated. The DEA / NNR agreement clearly spells out the roles of each of the respective authorisation processes and furthermore states that issues of a radiological nature that cannot be resolved within the EIA process must be referred to the NNR for consideration. GIBB, as the Environmental Assessment Practitioner, cannot ignore the requirements of this agreement as it constitutes a valid co-operative governance agreement in terms of the National Environmental Management Act, 1998.

"If it hasn't happened at Koeberg it can't happen anywhere"
Your comment is noted and as with any other form of power generation project or indeed any form of development, lack of an incident in the past does not guarantee that an incident would never occur. Hence as result of the aftermath of the Fukushima nuclear accident Eskom established an External Event Review Team (EERT) at Koeberg (located in its Duynefontein site) with the view of analyzing and understanding what happened in Japan and to come up with improvements that can be made at its Koeberg Nuclear Power Stations to mitigate against a Fukushima type criticality event.

"Only site specific factors are relevant"
Inasmuch as the KNPS uses Pressurised Water Reactor (PWR) technology, it is instructive to refer to the environmental impacts that have been experienced at Koeberg, and it is indeed required by the DEA to refer to the KNPS environmental experience in order to predict the potential environmental impacts of Nuclear-1. However, your comment is focused on the potential for a disaster occurring at Koeberg, which is beyond the scope of the Nuclear-1 EIA, since this EIA process focuses on the proposed Nuclear-1 power station.

Nevertheless, some response is required with regards to your comparison of the KNPS and Fukushima Daiichi. It is not factually correct to state that the designs of the Fukushima Daiichi plant and the KNPS are directly comparable. The KNPS has a Pressurised Water Reactor (PWR) design and the Fukushima Daiichi plant has Boiling Water Reactor (BWR) design.
The primary reason for the Fukushima Daiichi accident was that the pumps that operated the cooling system, as well as power supply to these pumps (offsite power and backup generators that provided power to the pumps) were incapacitated or destroyed by the tsunami. Resultantly, cooling water could no longer be pumped into the reactor.

The following measures are in place at the KNPS to prevent an occurrence similar to Fukushima, even though no tsunami has ever been recorded on the Western Cape coastline:

- The original design of Koeberg provided protection against earthquakes and tsunamis and loss of off-site power supplies.

- The two nuclear reactors at the KNPS are constructed on an “aseismic” raft, and all the components and plant systems that are important to nuclear safety have been designed to these seismic specifications so that they will be able to perform their expected functions during and after an earthquake.
- A 4 m tsunami (as a result of an earthquake in the South Atlantic) was considered in determining the Koeberg terrace height. This was considered to coincide with a maximum spring tide and a major storm surge and maximum wave set-up and run up, leading to a water level of 7 m above mean sea level. The Koeberg terrace height is at the 8 m level above mean sea level.
- During normal operation, each unit at Koeberg is supplied from two 400 kV lines connected to the national grid. The station also has supply from a 132 kV line connected to the national grid.
- If there is a problem with the normal 400 kV and 132 kV supply, the Acacia open cycle gas turbine power station (far inland) supplies electricity to Koeberg through a dedicated 132 kV line.
- Koeberg has two emergency diesel generators of 5MW each for each unit respectively to provide backup power supply. A fifth emergency diesel generator that can be switched between either of the two units is also installed. These five diesel generators are all located on the Koeberg terrace at 8 m above mean sea level.
- Two smaller (1 MW) diesel generators are installed, one for each unit, and are independent of the emergency diesel generators and physically located in a different place (at a higher elevation [14 m] above mean sea level). They will provide power to the batteries and hence the instrumentation & control systems, and will ensure the integrity of the reactor coolant pump seals – thus enabling the fuel to be cooled through natural convection if all other systems fail.
- There are a further two portable generators on site that could also provide emergency power supplies.

None of these additional measures were available at Fukushima Daiichi to provide power to the power station’s cooling system. The emergency diesel generators at Fukushima Daiichi were based on an assumption of only a 5 m tsunami, which is inappropriate for a country characterised by frequent earthquakes.

Comment 3:

Confusion about time-scales

What we asked for:

Several impacts were incorrectly classified as "short term", when in fact they should have been classified as "medium" and "long term".

What we got:

The time periods have been redefined. The minimum category is now 9 years or less rather than 3 years or less.

This fixes one class of problem: A few impacts that will endure for more than three years but less than nine years that were previously incorrectly rated as short term can now correctly remain in the minimum duration category.

However it has introduced two new fatal errors into the project.

The first fatal consequence of this changing of the time intervals has, like so many aspects of this report, been done incompletely. In table 7-16 the old definitions remain. So now the time intervals are ambiguously defined, and hence many of the rating scores are invalid.

The second fatal consequence is that this causes a watering down of the significance rating of impacts. Serious impacts that last between four and nine years will now ALL be downgraded from medium to low and from high to medium. Processes and ratings methods accepted during the

scoping phase have thus been manipulated to favour the development. This moving of the goal-posts in a way which favours the applicant is one example of a widespread bias in this EIR.

It is now almost impossible to for anything to be rated as significant in this scoring system and almost any activity would be acceptable.

An outrageous hypothetical example:

We demonstrate this by sketching an extreme scenario. The first atom bombs were only expected to have 40 to 50 percent chance of working. Would the DEA allow a trial detonation of one of these atomic bombs in the Kruger National Park? Obviously not, yet according to the rules used for this EIA they would have to allow it to proceed.

We will now proceed to do a detailed analysis of using the Kruger National Park as a test site for atomic bombs using the rules of this EIA. What are the impacts? We consider the following two hypothetical impacts:

Impact A)
At the central blast zone in a crater of about half a kilometre across, all life would be obliterated and the ground so thoroughly contaminated by radiation that it would, like Chernobyl, remain un-inhabitable for about a thousand years.

Impact B)
The radiation over much of the rest of the Kruger Park within 10 km radius would be so severe that nobody would be allowed to enter the area for 15 years.

Now let's do the scoring.

Impact A - 45% Possibility of a total permanent nuclear obliteration of a 500m wide crater in Kruger Park

Criteria	**Rating**	**Reason**
Nature	Negative	
Intensity	High	Natural process will permanently cease. Definition in Table 7-16
Extent	Low	Affects only the development footprint. Definition in Table 7-16
Duration	High	1000 years
Impact on irreplaceable resources	Low	It's only a few hectares of bushveld, which is considerably less than the coastal fynbos.
Consequence	Medium	This particular combination (High Intensity, Low Extent, High Duration, Low Impact) is not specified in Chapter 7, but we can work out the scoring by looking at other impacts that have the same combination, for example in Table4-7 of the Geohydrological report.
Probability	Low	Less than 50 % likely that an impact will occur. Definition in Table 7-16.
Significance	Low to medium	Medium consequence and low probability. Definition in Table 7-16

We repeat this exercise with Impact B.

Impact B - 45% Possibility of 15 years of dangerous radiation over 30 000 ha of Kruger Park Criteria Rating Reason

Criteria	Rating	Reason
Nature	Negative	
Intensity	Medium	Using the definition and terminology from Table 7-16 we note that the environment will be affected as individual animals will die. Tourists will still be able to visit the rest of the park, and so cultural and social processes will continue albeit in a modified way.
Extent	Medium	From Table 7-16. Local Extent (limited to the site and its immediate surroundings, including the surrounding towns and settlements within a 10 km radius)
Duration	Medium	15 years is now considered medium term. (Page 7-34) Impact on irreplaceable resources
impact on irreplaceable resources	Low	The wildlife that dies can readily be replaced.
Consequence	Medium	Intensity is medium and at least two of the other criteria are rated medium
Probability	Low	Less than 50 % likely that an impact will occur. Definition in Table 7-16
Significance	Low to medium	Medium consequence and low probability. Definition in Table 7-16

On page 7-35 this significance rating is defined as below the level required to influence the decision to proceed with the proposed project. How remarkable! This new scoring system is clearly unacceptable.

What these examples show is that just a couple of low scores can completely outbalance very, very serious issues.

In all rating categories the severity of impacts that score high-impact are extreme. For example the impact has to reach beyond 10 km before it can score high in the extent category and so an impact that covers 30 thousand hectares will only get rated as medium-impact. For the scoring to be balanced then impacts that score low-impact should be almost trivial, but this is not the case. In the probability category, for example, an up to 50% chance of an event occurring is rated as low-impact. A 49% chance of something bad happening cannot be considered a low risk in anyone's mind. .

How long is long term?

Why is there an upper limit to what is considered long term? Is it there so the EIA can avoid complying with the requirements with respect to the long term storage of spent fuel?

The conditional acceptance of the Scoping report from the DEAT of 2008 contains:
"2.11 The long term storage of high level nuclear waste must be addressed in the EIR"

During the Milnerton meeting it was asked what the meaning of long term in this sentence was. The consultant initially replied that the question should be addressed to DEAT (who were not present).

Under pressure from the public, the question was answered again that the consultants understood long term meant the life time of the plant plus 10 years, which may come to about 50 to 70 years.

In the field of nuclear waste handling long term is generally considered to mean thousands of years. The consultants appear to have not been diligent in engaging with specialists familiar with the field of long term nuclear waste and hence have failed to authoritatively address point 2.11

Status: Still fatally flawed – in addition the consultants appear insufficiently informed to fulfil the TOR

Response 3:

Time scales

Your comments regarding the definition of impact assessment criteria are noted. Your summary of the assessment criteria for duration is incorrect. As stated in Table 7-16 of the Revised Draft EIR Version 1, duration has the following categories, compared to the initial categories in the Draft EIR of 2010:

Revised Draft EIR Version 1		**Draft EIR**	
Low	0-3 years	Short-term	0-5 years
Medium	4-8 years	Medium-term	6-10 years
High	Longer than 9 years	Long-term	More than 10 years
		Permanent	Permanent

As with all the other criteria, the number of categories per criterion was reduced to three to make the method easier to apply by the specialists and therefore more consistent. A change in the Revised Draft EIR Version 1 is that the duration of the categories has been made shorter. Thus, the category of highest duration now includes any impact of nine years or longer and effectively any impact that commenced at the start of construction and extends into the operational phase of the power station (based on a construction phase of nine years) is regarded to have a high duration.

Your following statement refers: “Serious impacts that last between four and nine years will now ALL be downgraded from medium to low and from high to medium”. This is not correct, since impacts lasting between 4 and 9 years will be considered to have a medium duration. Any impact lasting nine years or longer is considered to have a high (long-term) duration.

Your example of the detonation of an atomic bomb over the Kruger National Park is inappropriate and GIBB will not enter into a detailed debate on the merits of assessing such a hypothetical impact. Your application of the impact criteria is not consistent with how these were applied in the Nuclear-1 Revised Draft EIR Version 1. Your application of probability is incorrect.

There is no upper limit to what is considered long-term. As indicated above, there is only a lower limit of 9 years. All impacts lasting longer than 9 years are considered to be long-term.

With regarding to the long-term storage of radioactive waste, that is the function of the National Radioactive Waste Disposal Institute that has been established by Parliament under Act 53 of 2008. It is the policy of the DoE to establish a central interim spent fuel store (under the NRWDI) for South Africa by 2025. Therefore spent fuel would be shipped to this store from the power station on its closure.

Comment 4:

3 Undetermined risk of earthquakes

What we asked for:

We found several problems in the seismic risk analysis and noted that it was far from complete.

What we got:

Your responses to our comments do not resolve any of our concerns.

Your Response (8)

Reference to " experience in the seismic hazard assessment and seismic design of other nuclear reactor sites in regions characterised by levels of seismicity, and thus expected levels of seismic hazard, comparable to or higher than those encountered in South Africa, such as California and Japan" do not fill one with confidence at all. If anything, the tragic recent experience of Japan, and especially of Fukushima, proves that international regulatory benchmarks, even those of countries with the greatest experienced in relation to earthquake and tsunami risks, are entirely inadequate to guarantee fail-safe reactor design.

The fact that "the investigators acknowledge the limitations inherent to the data and methodology employed so far and the Seismic and Geological Hazard Impact Assessment reports are quite clear about the fact that not all the questions regarding the geological environment have been resolved" amounts to an admission that the job required has not been done satisfactorily. The precautionary principle would suggest that such an admission of an insufficient understanding of the long-term seismic hazards and risks, especially but not only at the Duynefontein site, disqualifies the sites from being suitable for the construction of NPSs, especially in a post-Fukushima world. The repeated assurance that "there is therefore a need for additional work to reduce remaining uncertainties" is entirely unacceptable – either the necessary work has been done and can be considered as part of the EIA, or it has not been done (as is the case here) and is therefore irrelevant to the current EIA.

A postponement of necessary research "due to financial constraints" is not an acceptable excuse for cutting short a comprehensive seismic risk assessment which is crucial in determining the long-term safety of the proposed NPS. Promises of proper studies to be completed or "redone using a different methodology" at some time in the future are simply not good enough. No "informed conclusions" can be drawn from an incomplete study. As it stands, the incomplete and flawed nature of the seismic risk assessment are grounds to disqualify the proposed site as suitable at least until such time as the necessary new and additional research has been completed. It is simply not true that "informed preliminary conclusions" of any real value can be drawn "regarding the suitability of the sites for the development of a NPS" in the absence of a complete set of data.

Your Response (9)

Admission is made that "no new Seismological Risk Assessment was completed since 2007" and again reference is made to "financial restraints" necessitating a postponement of necessary studies. This should not be an excuse for something as important as seismic risk assessment. An EIA for a proposed NPS that does not include state-of-the-art seismic risk assessment is simply not acceptable after Fukushima.

On a more fundamental level, the assumption, made repeatedly in the responses, that "design and appropriate engineering mitigation" will necessarily result in a NPS that is able to withstand any earthquake risks provided good seismic data is available has quite demonstrably been proven fatally misguided and erroneous in the case of recent events in Japan.

Your Response (10)

Once again reference is made to data that is not internationally acceptable and work still to be done ("the future PSHA for Duynefontein…"). Until such work has been concluded, no valid conclusions can be drawn. Referring to studies to be completed or carried out at some stage in the future are not acceptable for consideration in an EIA. Similar references to expected future work are made in most of the other responses.

Your Response (12)

The reference to "successful operation of nuclear power reactors in regions with generally higher levels of seismicity and thus higher seismic hazard levels, such as California and Japan" is unfortunate, ironic and rather tragic in the light of the recent disaster experienced in Japan – a tragedy that has led the country to re-assess its involvement with nuclear power and has prompted its Prime Minister to call for the technology to be phased out in Japan.

Your Response (18)

You state that “the Seismic and Geological Hazard Impact Assessment reports are quite clear about the fact that not all the questions have been resolved and that there is a need for additional work before the green light can be given for the development of a NPS at any of these sites”. Yet the draft EIA report itself states that “based on current knowledge, the three localities under review are considered suitable locations for standard export NPS’s”. These are two blatantly inconsistent statements. The draft EIA report clearly draws a conclusion that is the direct opposite of what the

Seismic and Geological Hazard Impact Assessment reports are “quite clear” about.

Grade:

Status: Specialist report still fatally flawed

Response 4:

Please note that the seismic assessment (Appendix E4) conducted concluded that all three sites were seismically suitable to construct a nuclear power station. Furthermore, please note that a detailed site safety case will have to be presented to the NNR as part of the nuclear license application.

Comment 5:

4 Faulty groundwater modelling

What we asked for:

Geophysical surveys. The team of experts needs to be extended. Geophysicists should be brought in to perform field surveys to locate fractures and more accurately determine the boundaries of the various geological layers.

What we got:

Although we have been assured that a geophysics survey was performed to locate the boundaries of the aquifers no Geophysics report has been made available. It still appears that there may exist underground fractures that could dramatically influence the pattern of underground water movement.

Status: Specialist report still incomplete

Geophysical surveys can be important aids to determining aquifer boundaries. However, they are indirect methods, eg resistivity, electromagnetic and magnetic, and ground-truthing in the form of drilling is needed to calibrate geophysical results. Many boreholes have been drilled at the Duynefontein site over the years, for the KNPS, PBMR and Nuclear-1. It is the author’s position that there is sufficient information on the site to adequately portray and conceptualised aquifers. Geophysics is not going to pick up each and every fracture anyway and underground water movement is towards the coast. There is no existing groundwater abstraction from the fractured aquifer that could change this; all current abstraction is from the primary Atlantis Aquifer, which is one of the most intensely studied aquifers in the country. Additional geophysical work will not significantly improve or change the geohydrology EIR.

What we asked for:

Better determination of aquifer properties.

What we got:
The geo-hydrologist claim that they cannot get better accuracy of these parameters, that it is normal in their work for data input values to vary by an order of magnitude, and that the numerical modelling results are to be seen as no more than a rough qualitative guide and not a quantitative assessment.
Had it been stated in the report that the parameters derived were 100% accurate this could also have been criticized, and rightly so, for being too optimistc given the fact that most geohydrological parameters are derived via indirect methods. This uncertainty is not a flaw in the study/report; it is an inherent issue with groundwater studies worldwide.

This explanation appears to be in direct conflict with their statement that they have a high degree of confidence in their results. But then, as we have pointed out elsewhere, the confidence rating of high medium and low has not been properly defined. So the high confidence doesn't mean anything.
I confirm the high confidence level in the results documented in terms of the broad conclusions reached, eg aquifer definition, groundwater flow directions, groundwater level fluctuations, dewatering, fate of contaminants. However, I have a low confidence in being able to state, for example, that the transmissivity of an aquifer is 12 m^2/day as against 20 m^2/day, or 150 m^2/day as against 200 m^2/day; that its storage is 0.001 as against 0.0001 or that recharge is 15% of MAP as against 20%. These are all uncertainties that any competent geohydrologist will acknowledge. The degree of convergence of modeled groundwater levels with measured groundwater levels gives the geohydrologist confidence in his /her estimations of hydraulic parameters. The calibration of 98% achieved with the Duynefontein flow model is thus an indication that it is highly unlikely that the hydraulic parameters calculated/used in this EIR are erroneous.
The implication of this is that there cannot be any hard statements regarding groundwater flow. All we are left with is a qualitative and subjective opinion of an expert who appears to be biassed in favour of the development.
It is possible to make a “hard statement” that groundwater flow direction is towards the sea and I reiterate that here.

What we certainly do not have is a guarantee that crucially important aquifers will not be irredeemably contaminated in the event of a radiation leak.
A radiation leak from the reactor footprint in the form of say radioactive liquids would not contaminate important aquifers such as the Atlantis Aquifer. However, I do not think it is the duty of the EIA specialists to provide guarantees.
This must be seen as a fatal impact that should terminate the project. Over the next 100 years while nuclear contaminated water will be stored on the site, South Africa will become critically short of water. All accessible aquifers will become crucial irreplaceable resources, even if they are considered to be poor quality by current standards. Even quite brackish water is likely to be used in future as it is much easier and cheaper to filter salts out of poor quality borehole water than it is to desalinate sea water.
However, seawater is a constant source and not subject to limitations related to environmental constraints and seawater desalination is the only viable long-term sustainable option for future large-scale water supply to end-users such as the City of Cape Town.

Status: Specialist report still incomplete

What we asked for:

The use of better software.

What we got:

The response was an argument that MODFLOW is popular and has been used on American nuclear projects.

MODFLOW is popular mainly because it is old, cheap and open source. Correct for older versions but not for up-to-date versions with latest features. For example, SRK has recently purchased the PMWIN8 version of MODFLOW for US$1 190.

MODFLOW has also been used in many academic radionuclide contamination studies, but the reason for this is that the source code is readily available for researchers to modify and extend in order to test pioneering mathematical algorithms. In particular this relates to studies of the very complicated retardation processes that radionuclides are subject to once released into the groundwater systems.
For each of the three sites there was as an attempt to simulate the potential nuclear contamination resulting from a hypothetical incident in which the entire is initially 100 % contaminated right down to the bedrock, (the Scenario 6 numerical models).Yes but the hypothetical contaminant was not specified as being a radionuclide or radioactive. On p50 it is clearly stated that ”contamination type is not specified for this hypothetical scenario” This is a reasonable modelling scenario that would demonstrate some of the consequences of catastrophic incidents that are well beyond design base incidents, such as what might arise from a rapid leak of the water from the spent fuel cooling pond or the escape of supplementary cooling water used in attempts to contain a partial meltdown.

While we accept that MODFLOW is adequate for some of the uses to which it has been put in this study, such as to obtain a qualitative idea about the likely consequences of dewatering during construction, it is in regard to the nuclear contamination scenarios the modeling study is truly appalling and is quite simply wrong. We did **not** model nuclear contamination apart from air dispersion of tritium (a conservative radionuclide that does not react once it is incorporated into groundwater) emissions from normal plant operation. It is clearly stated that air emissions and fracture flow scenarios for contamination are excluded. The respondent has misread the report.

It is just not adequate to use a simple mass transport model to estimate the flow of radioactive contaminants where nuclear reactions with substrate material, adsorbtion into the substrate, radioactive decay and thermal effects also have to be modeled in order to get reasonable results. For this type of problem it is possible, but not easy, to obtain numerical results of determinable accuracy. See for example the work of Ewing, Yuan and Li in the SIAM Journal on Numerical Analysis. As per the previous response, it is not stated in the report that we had modeled a radioactive contaminant.

In response to our previous comments we have been told that the geohydrologists were simply attempting to obtain a qualitative rather than quantitative result. However their quantitative numerical results are too far out to be usable for any kind of interpretation. Simple qualitative comparison with other major nuclear contamination incidents is proof enough of the inaccuracy of their results. The contamination of the groundwater at Fukushima and Chernobyl are several orders of magnitude bigger than this prediction. Any attempt to simulate a Chernobyl-type scenario, (which was in any case less severe that a 100% footprint contamination down to the bedrock) should yield a Chernobyl-type result, where a huge contaminated wedge is gradually moving towards Kiev, 130 km away, where it is expected to linger for 300 years. A Chernobyl-type scenario is different to what was modelled in the EIR and the Chernobyl site is an inland site whereas the Duynefontein site is on the coast. The latter gives rise to a totally different flow path situation and receptor. At a site such as Duynefontein (and Thyspunt and Bantamsklip), the only possible receptor from an on-site reactor (assuming the footprint is located where depicted in the EIR) leakage, e.g. of radioactive water as described by the respondent above, is the coast/ocean because the site is situated at the end of the groundwater flow path. It is not possible to get a “Chernobyl-type result”. It is also not clear from the information provided above if the “huge contaminated wedge” is purely the result of on-site contamination or includes air dispersion of radionuclides and subsequent incorporation into the groundwater. However, it can be deduced that the red line shown on the map below must include air dispersion. If it was the same scenario as depicted in the EIR, there would be preferential migration of the contamination along the groundwater flow path instead of the semi-equidistant development of the contamination zone around the site, with expansion in the direction(s) of the prevailing winds.

The red line in the diagram below marks the dangerously contaminated zone around Chernobyl. The white rectangle superimposed near the bottom left corner is page 52 of the Geohydrological Assessment, reproduced so the map is at the same scale as the main image.

The small red dot in that rectangle is the predicted contamination zone.

(http://www.facebook.com/photo.php?fbid=410162273652&set=o.405140235598&type=1&theater)

This illustration shows that major radiation leaks can be considerably more serious than what is presented in the geo-hydrology report. Agreed, for inland sites and with a Chernobyl-type accident. The Chernobyl contamination zone and the Duynefontein contamination zone are for two different types of sites and occurrences and just because the former is much larger does not make the predicted smaller area for the latter incorrect.

We note further that the report states that "specific contamination type unspecified at this stage". The NNR requirements call for a full source term analysis. So apart from being incorrect by several orders of magnitude, this study is also very far from being complete.

Status: Specialist report incomplete

What we asked for:

Numerical expertise.

The numerical modelling must be redone from scratch, and it must be performed and reviewed by appropriately skilled mathematicians.

What we got:
The team are still includes many earth scientists and no mathematical scientists. Incorrect; Dr Ingrid Dennis, who carried out the numerical modeling, has a BSc in Mathematics and Applied Mathematics. This was pointed out in the previous submission.

Even though some of them have spend many years using simple finite difference programs to assist in interpreting groundwater flow that does not mean that they have sufficient knowledge of the mathematical theory that is required for the nuclear contamination scenarios.

But even the simpler modelling of basic the groundwater flow problem has not been done properly. Apart from all the spacial and time discretisation checks and parameter sensitivity checks that were apparently performed, but not included in the report, there is still something fundamentally wrong with the basic model.

Consider the scenarios concerning the impact of the increase in sea water level on the groundwater system. While the actual consequences of a rise in sea level might not present any significant threat to a power station, the modeling of this scenario is clearly wrong, which indicates that there is something wrong with the modelling in general.

The modeling results are that the effect of an 80cm rise in sea level will cause a 50cm maximum rise in the water table. But this must be wrong. If the sea level rises then the height of the land surface above see level will be reduced. The average gradient of the water moving through the ground from where it lands as rain to where it eventually flows into the sea is therefore less. If the gradient is less, so the groundwater must flow more slowly. If the same amount of water flows more slowly (the rainfall is the same), it takes longer to get to the sea and hence at any given time there is more water moving through the ground in the zone between ground surface level and see level. This means that the water table must rise by more than the rise in sea level, but they've got it as less. Intuitively the effect of a sea level change will be diminished further inland and far enough away from the coast the effect should be negligible. But close to the coast the water table must rise by more than the rise in sea level, and this is not seen anywhere in the results of the modeling.

Status: Specialist report still fatally flawed

Response 5:

This is not a fatal flaw. The increase in sea level was input into GIS and a “new’ coastline derived at the site. This was then input as the new 0 m level western boundary of the model. The resulting groundwater level was simulated and gave an average 0.55 m rise across the site. This was used to provide an indicative increase in groundwater levels and the effect this might have on inflows/dewatering for the reactor excavation. As stated earlier in the EIR, modeling is not an exact science. However, a calibration level of 98% was achieved which indicates that the model is reproducing actual measured groundwater levels to a very high degree of accuracy, which gives assurance and a high level of confidence for the predictions derived for the various scenarios.

Comment 6:

5 Incomplete economic risk assessment

What we asked for:

The economic impact assessment must be repeated. All of the costs that will occur over the entire duration of the project must be included. In the cases of uncertain events a probability of occurrence and associated costs must be estimated. The report must be objective and neutral.

What we got:

Although the economic impact assessment has had a few minor changes it remains just as incomplete and biased as before. Costs associated with uncertain events are still ignored and instead we have been told that it is impossible to quantify the economic costs of such events. But you cannot just ignore something because it is uncertain. Few environmental impacts are ever 100% certain. Estimating unknown costs for events that may never happen is an everyday practice in the insurance industry.

The main purpose of the EIA is to provide information to the DEA to enable them to make a decision on whether or not they should allow the project to proceed at all. The choice between the three sites is a secondary issue. Their decision boils down to a cost versus benefit analysis, and for them to be able to do this they need all costs to be considered, including the uncertain costs of uncertain events. Uncertain events need to be analysed in terms of their cost consequences and probability of occurrence.

We have been told that all of the costs that we identified as missing from the report are included in the costs of the NPS. But the EPRI report that the data is based upon does not included all external costs. In the recent revision of the IRP the cost of nuclear power has been increased by 40% above the EPRI values. The Fukushima incident and the subsequent collapse of the Nuclear Renaissance mean that this cost needs to be increased yet further still.

The economic impact assessment report remains biased.

It still includes a pro-nuclear argument by quoting from a British government white paper (a fairly old report produced for a previous British government). Just about every democratic country now intends to cut back on nuclear power. In the next revision of the economic impact assessment report must be updated with a new quote that is more representative of international opinion on the costs, benefits and risks of nuclear power.

There is a section on the chances of a Chernobyl-type incident occurring that is more propaganda than fact.

It claims that Nuclear-1 would have a containment structure that would be able to "keep the radiation inside the plant in the event of such an accident." That's complete nonsense. No containment structure would be able to to keep theradiation inside the plant in the event of a hydrogen explosion of the type that occurred at Chernobyl. Typically containment domes can withstand a maximum internal pressure of less than 10 bar (145psi). (see http://en.wikipedia.org/wiki/Containment_building)

Bicycle pumps can produce more pressure than that.
(http://en.wikipedia.org/wiki/Bicycle_pump)

The photo below shows the damaged Chernobyl power station a few days after the explosions.
(http://en.wikipedia.org/wiki/File:Chernobyl_Disaster.jpg)

Do our economic's specialist really believe that this kind of damage was caused by an explosion that generated less pressure than a bicycle pump?

The report correctly identifies operator error as one of the primary causes of the Chernobyl accident, but then states that in South Africa safety measures are strictly adhered to and operator errors won't occur. But this is not necessarily true.

For example, a radiation alarm at Koeberg was once ignored for two days.

The report that is inappropriately dismissive of the concerns of the people in Jeffreys Bay who oppose the development.

The section on the results of a Nuclear Disaster gives no estimates of the actual costs of serious incidents, but instead repeatedly emphasises that such events are unlikely.

What is required is an ordinary hazard analysis written in plain language. The report must simply define scenarios corresponding to events ranging from 1 to 7 on the INES scale and estimate the range of probabilities of incidents occurring and estimate the associated costs. Without this, we are not able to participate in an informed and meaningful way with the EIA process.

Status: Specialist report still incomplete

Response 6:

Your comments are note. Please find a response from the Economic Specialist below:

The author of the document criticises the specialist for using a report produced for a previous British Government. Our work was undertaken at a time when the British report represented the most comprehensive independent report available. The fact that it was produced for a previous British Government is not relevant.

It is necessary to take into consideration the exact purpose (scope of work) of the economic evaluation. We were asked to evaluate and compare the three sites (Thyspunt, Koeberg and Bantamsklip), in terms of economic suitability and possible impacts. We were never asked to compare nuclear electricity generation with other forms of electricity generation. The Economic Study is part of an Environmental Impact Assessment for the proposed Nuclear Power Station.

That is what we set out to accomplish: compare the three sites in terms of economic parameters, which includes a risk assessment. The approach was, however, aimed at identifying risk factors that differentiate the three sites from one another. If a too-low risk evaluation technique was used, it would make very little difference to the final outcome as this was applied at each of the three sites. We have confidence in our approach and techniques. To state that the economic evaluation is pro-nuclear or biased is just not true as we have already stated that we were not comparing different electricity generation options, but three different proposed sites.

With regard to Fukushima: it is true that some governments have abandoned their nuclear power programmes but equally true that others are proceeding with expansion. In our opinion, there was an irrational response worldwide to the Fukushima incident. While a recent commission has found that the Japanese regulatory system was weak and that it needs to be improved, the fact remains that the incident was caused by a tsunami. Japan built nuclear power stations on a fault line and a coast susceptible to tsunamis. South Africa will not build its nuclear power stations on fault lines or on coasts susceptible to tsunamis, and it has already reviewed its regulatory system. Moreover, after a longish period since the Fukushima incident no proof has been presented of anybody dying of radiation contamination, while thousands of people died because of the natural disaster.

We stand by our assessment that serious incidents in South Africa are unlikely, and we would reiterate that the architecture and technology of nuclear power stations have changed significantly since the Soviets built Chernobyl and that the safety factors incorporated in new nuclear power stations render the occurrence of a Chernobyl-type disaster extremely unlikely to say the least. Thus, the improbability of such incidents occurring in South Africa makes a scale assessment purely academic and not worthwhile.

Comment 7:

6 Inadequate Agriculture Specialist Report

We note some changes in the executive summary of this report. The phrase 'short term' has been prefixed to the phrase 'negative impact' both times it occurs. This is indicative of bias, and an attempt to de-emphasise the negative impacts. It is also questionable to categorise the construction phase as short term, since this is defined as < 9 years. From experiences at other nuclear plants, time and cost overruns are likely (c.f. the IRP 2010 adding 40% to the quoted cost of nuclear power to cater for overruns). This means that the construction phase may well last more than 10 years, and hence categorising these impacts as short term is not only misleading but also inaccurate.

What we asked for: (33)

Section 5.1 be modified to address the TOR w.r.t. the operational phase.

What we got:

You responded:

"*The operational impacts of a accidental reactor incident on crop production and livestock are accordingly discussed in section 3.3 and 3.4 of the report respectively. All the impacts in Table 5-1 are related to the operational phase.*"

Table 5-1 appeared to us to deal with dust pollution, which relates to the construction phase. We are therefore further confused by your response.

Section 3.3 and 3.4 only deal with an accidental large scale release.
We note that the issue of releases during normal operation, such as releases of tritiated steam and condensate, and the possibility of accumulation in terrain features or bio-accumulation and the resulting effect on agriculture (e.g. dairy farming) is not dealt with, except for the single sentence that has been added in the second draft, which reads: "*Under normal operating conditions there is no effect on livestock or other agricultural produce.*" No justification or reference is provided for this statement, which is unacceptable in a scientific report.

What we asked for: (34)
That the economic impacts of the need for measures such as "the stock would need to be slaughtered or moved outside the danger area." be quantified.

What we got:

You replied:

"*given that the probability of an incident happening is very low, the discussion, assessment and "carry through" of impacts must be seen in this context.*"

This appears to be saying that there is no need to evaluate the impact of such a procedure. In order for us to participate in an informed manner, we once again demand that the possible measures described in this report are evaluated for their economic impact.

What we asked for: (34)

That Chapter 9 fairly presents the possible negative impacts

What we got:

The table 9-51 in Chapter 9 of the EIR still contains only three categories: dust pollution, labour and market conditions.

As before this ignores the possible agricultural impacts (such as loss of export markets) in the case of an incident resulting in a radiation leak. The recent experiences in Japan should be used as the basis for a study, particularly the economic impact on the dairy and beef industries with respect to export markets. It is indicative of bias on the part of the consultants to accept the applicants word that the selected design will be 'inherently safe' without investigation, and hence avoid analysis of the possible impacts of a large scale accident.

What we asked for:

That the agricultural report be redone by someone with expertise in amongst other things, the long term effects of the release of radionuclides on agriculture.

What we got:

This specialist report has not been redone. The fact that Wikipedia is quoted as a source for this report further indicates that it still lacks scientific rigour.

Status: Specialist report still biased and incomplete.

Response 7:

Your comments are noted.

The phrase short term is used as the negative impacts identified it can be mitigated against (e.g. tarring of road) and does not relate to the length of the construction phase.

33: "Under normal operating conditions there is no effect on livestock or other agricultural produce."

Under normal operating conditions and given the release specifications we understand there to be no negative impact to agriculture. Obviously if there is an accidental release then this is no longer valid. However we confirm that emergency planning falls outside the scope of the EIA process and forms part of the NNR's nuclear licensing process.

The DEA / NNR agreement clearly spells out the roles of each of the respective authorisation processes and furthermore states that issues of a radiological nature that cannot be resolved within the EIA process must be referred to the NNR for consideration. GIBB, as the Environmental Assessment Practitioner, cannot ignore the requirements of this agreement as it constitutes a valid co-operative governance agreement in terms of the National Environmental Management Act, 1998.

34: Evaluation of Possible Measures for their Economic Impact

We are referring to the 3km emergency zone only

34: Analysis of Impacts of Large Scale Incident

Please refer to our response under "33" above

34: The Use of Wikipedia as an Information Source

We are not sure where the reference to Wikipedia is found but agree that this should not be used as a reference unless it is referencing a credible source

Comment 8:

7 Flawed marine biology assessment.

What we asked for:

A more complete analysis of the impacts of this project on the maritime environment must be performed.

What we got:

The report still excludes any analysis of radiation emissions. This is concerning when compared to the agricultural specialist report, which states in section 3.5

"*All the sites are located on the coast in close proximity to the sea. Therefore in the event that there is a contaminated spillage and a subsequent seepage into the ground water, this will not affect the ground water used by farmers as they are inland of the sites.*" which seems to imply that such contaminated groundwater would move towards the sea.

The conclusion that unintentional release of radiation emissions are of low consequence and low significance because of the design of the cooling system is not valid. To prove that our argument is correct we need only note that there are actual cases where unintentional release of radiation emissions into the ocean has occurred.

The report recently made available to us titled "The Provision of Groundwater Monitoring Boreholes (Construction Groundwater Monitoring) for the PBMR Demonstration Power Plant Project" shows that radiation has indeed leaked from Koeberg NPS.

This is a list of nuclear plants in the USA where radiation has leaked into the groundwater:

- Braidwood, Byron, Dresden and Quad Cities in Illinois;
- Indian Point and Fitzpatrick in New York;
- Yankee Rowe and Pilgrim in Massachusetts;
- Three Mile Island and Peach Bottom in Pennsylvania;
- Callaway in Missouri
- Catawba in South Carolina
- Oyster Creek in New Jersey
- Hatch in Georgia
- Palo Verde In Arizona
- Perry in Ohio
- Page 14
- Palisades in Michigan
- Point Beach in Wisconsin
- Salem in Delaware
- San Onofre in California
- Seabrook in New Hampshire
- Shearon Harris in North Carolina
- Watts Bar in Tennessee
- Wolf Creek in Kansas
- Connecticut Yankee in Connecticut
- Vermont Yankee in Vermont

Just like Koeberg and Nuclear-1, these facilities also all have cooling systems designed to minimise the risk of unintentional release of radiation emissions. In some of these cases the amounts have been small, but it still serves to remind us that leaks still do occur, despite the fact that cooling systems are designed to prevent this possibility. And of course much bigger leaks have occurred at Chernobyl and Fukushima.

Spent fuel pools, which don't even have cooling water systems, have also been the origin of unintentional release of radiation emissions into the oceans.

In addition to ignoring radiation, the Marine Biology report contains many other areas of concern.

We draw your attention to the following:

- The envisaged 'once-through' reactor resign would affect a very large volume of sea water annually.
- The high importance of marine based eco-tourism in the environs of Bantamsklip and Thyspunt.
- The fact that whales were specifically mentioned in the conditional acceptance of the Scoping Report of 19/11/2008 [clause 2.34.1].

In our opinion there is clear evidence that the marine specialist employed by Arcus Gibb to do the marine ecology study:

- does not have expertise in the field of whales or other marine mammals and
- has failed to fulfil the terms of reference

- overreaches his field of expertise and
- is biased towards a positive result for the applicant.
- In addition, the report has not undergone a professional peer review, and we have not found a review either attached to the specialist report, or elsewhere on the website.

The evidence is as follows (drawn from the specialist report unless otherwise indicated):

1. The author states "We acknowledge that we are not specialists in the field of marine mammals" on page 7 of his response to the Dyer Island Conservation Trust (DICT) submission. On page 16, The "Southern right whales" are given the name "*Balaena glacialis*". This appears to be a mixture of the genus name *Balena* (the bowhead whale) and the species name of the Northern Right Whale, *glacialis*. The author appears to be unaware of the species name of the Right Whales found along our coast which is *Eubalaema australis.*

2. The author frequently references his own work which was done as consulting work for the applicant.

3. On page 32, the terms accident, incident and event are used in a way which clearly indicates the author and the reviewer(s) are not familiar with the INES definition of terms relating to nuclear power stations.

4. The well known alternative to once-through seawater of using cooling towers is neither evaluated nor mentioned.

5. The author in their response to the DICT submission states that monitoring of toxicity of marine organisms is not considered useful, and gives the reason as "the great expense and time commitment required to determine toxicity levels" is not justified. This is not only unscientific, but also appears to indicate the specialist is considering the financial interests of the applicant above impacts on the environment.

We refer you to section 81(1) of the EIA Regulations, which, since inaccuracies have been identified for you, will apply should this specialist report be submitted to the competent authority in its present form. In addition, we submit that this author is in violation of the code of ethics for Environmental Assessment Practitioners (clause 6.2.11) and as such should be excluded from submitting a specialist report for this EIR, and a formal complaint lodged.

Status: Specialist report fatally flawed due to lack of expertise and rigor.

Response 8:

Your comments are noted. Please find the response from the Marine Specialist below:

Radiation

The report has not ignored radiation, but referred that to the appropriate experts. As stated on page 25 of the report "In South Africa the National Nuclear Regulator (NNR) controls radiation emissions released into the environment. As such the proposed plant will be legally required to meet the NNR's dose limits prior to approval." All radiation issues fall under the jurisdiction of the NNR and as such it is not appropriate for the issue to be considered further in our report.

About the Marine Specialists Employed by GIBB

Note that our mandate is to report in Marine Ecological impacts – not specifically those on whales or any other specific taxonomic group. We have a combined experience of 45 years in the field of marine biology (indeed Prof Griffiths has been professor and director of one of the country's leading marine research institutes for over 25 years!). This, plus the fact that we are the only researchers in the country who have hands-on experience in monitoring the marine impacts of an operational nuclear power plant; places us in a an ideal position to appropriately comment on and review the literature regarding such impacts. We have thus certainly not overreached our field of expertise, indeed we are

probably the best placed researchers in the country to do this study (and were first choice candidates to be invited to do so). In an effort to ensure that our assessment is correct the Dr Simon Elwen, a prominent marine mammal expert, has been asked to contribute to the sections of the report dealing with marine mammals. There is no evidence that we have not fulfilled our terms of reference. We are also in no way biased to the applicant, as detailed further below.

Peer Review of Marine Report

This report was reviewed by Emeritus Professor George Branch. If this review has not been made available to the public it is through no fault of ours. In addition, input has been provided by other specialist researchers (for example extensive input by the Squid Working Group) to strengthen those sections of the report, the section dealing with marine mammals will be further reviewed by Dr Simon Elwen.

Southern Right Whale

The species name Balaena glacialis is a synonym to the name Eubalaena australis (note not Eubalaema australis as stated above). This name has been used in South Africa until quite recently. The use of the name on page 16 was a formating error for which we apologise. Please note the correct name is used throughout the rest of the report. Note also that no consutant reporting on an entire discipline (marine biology, botany, freshwater biology, terrestrial fauna, etc) could ever claim to be an expert on each and every of the thousands of species within those systems. Our role is rather to collate and report on such information, as gathered and published by a host of other experts.

Referencing of Work

The work referred to (i.e. the marine monitoring at Koeberg Nuclear Power Station) is very important as it offers vital information from the only comparable development on our coast. We would be severely negligent not to include it.

INES Requirements

There is no requirement that we use the definitions of the INES.

Use of Cooling Towers

This is a design issue and not one relating to marine ecological impact.

Monitoring Toxicity of Marine Organisms

In the reply to the DICT we said: “A monitoring programme considering toxicity in marine organisms during the construction phase is not considered a useful exercise. This is due to the fact that that toxicity levels for chemicals which might be co-released with the brine have not been determined in South Africa (or in many cases they have not been determined at all). Without this basic information monitoring would only be able track levels of chemicals within chosen organisms and attempt to correlate this to changes in the density of these species (without showing causality). The large natural variability known to occur within sandy and rocky shore communities would further complicate interpretation of any such results. Considering the very limited area which is predicted to be affected by the brine and the temporary nature of the impact, the great expense and time commitment required to determine toxicity levels prior to monitoring does not appear to be justified.”

We are by no means partial to the applicant. We have offered our scientific opinion with regards to the value of monitoring toxicity levels. Note also that this highly selective criticism seems to ignore that a whole last section of our report is dedicated to recommended additional monitoring and evaluations programmes that we suggest are done (including those on marine mammals). This clearly demonstrates that we have recommended extensive follow up where it is needed, only not where it is not useful.

Section 81 (1)

It is ridiculous to claim we are in violation of section 81(1) of the EIA regulations or any ethical code. Prof Griffiths is a leading academic in the field of marine biology, has been the Director of the Marine Biology Research Centre at the University of Cape Town for more than 25 years, and is probably South Africa's leading expert on marine biodiversity (and how this is impacted by human activities); while Dr Robinson has seven years post-doctoral experience in the field, specifically including the monitoring of marine impacts of a nuclear power station. We have applied all this knowledge, and that of other contributing experts, in producing the most accurate report possible. The fact that the report has been reviewed and supported by internationally recognised marine biologist Emeritus Professor George Branch reaffirms that our report is an appropriate assessment of the proposed development. In an effort to further ensure that our assessment of potential impacts on marine mammals is enhanced, Dr Simon Elwen has been asked to contribute to the sections of the report dealing with marine mammals.

Comment 9:

8 Sabotage and terrorism trivialised

What we asked for:

We pointed out that on 11 April 2010 a gathering of 47 world leaders including President Zuma attested that they believe that terrorist gaining access to nuclear material is "the single biggest threat" that the world faces right now. Various sabotage and terrorism scenarios must be detailed and all of the associated impacts must be analysed.

What we got:

The response that we received is not relevant to our comment.

In the EIA report potential terrorist acts are still considered to be only "perceived risks" and not "real risks". And because terrorism is seen as only "perceived" and not "real" they suggest as a "mitigation measure" that Eskom undertakes a propaganda exercise, what they call a "reliable flow of relevant and correct information" in the form of "an aggressive community-oriented and comprehensive public information campaign." It is not adequate to address terrorism by claiming that it is not a valid concern and by launching a marketing campaign with the message that terrorism is not a real risk. The recent event in Norway and the completely unexpected act of terrorism there reinforces the fact that we need to consider these risks as real. Therefore, this EIR must examine the possible impacts of these possible worst case scenarios which must be accepted as real possibilities by the consultants.

We still insist that various sabotage and terrorism scenarios must be detailed and all of the associated impacts must be analysed.

Status: As before, EIR fails to deal with these scenarios.

Response 9:

Your comment is noted. GIBB stands by its previous response in this regard.

As part of the requirements planning for the proposed nuclear power station, a complete safety analysis, which includes the possibility of events such as terrorist attacks, must be undertaken by the National Intelligence Agency in terms of the National Key Point Act 1980 (Act No. 102 of 1980), since all power stations are regarded as National Key Points. An EIA process will not duplicate a safety assessment that will in any event be undertaken through another avenue.

Furthermore, the purpose of an EIA process is to predict the potential impact of the development on the environment and not vice versa i.e. the potential impact of possible terrorist attacks on the proposed development.

Comment 10:

9 Dodging the health regulations

What we asked for:

The Human Health Risk Assessment deliberately misquotes the NNR regulations in an attempt to provide a less complete analysis than what the law requires. Misrepresenting the requirements is fraud and evidence of bias. We called for the consultants to be replaced. We pointed out that the analysis must include due consideration of a full and representative range of postulated risk events, including low probability catastrophic incidents, whether of natural origin or human induced. And in order to perform the required calculations on potential impacts on human health, more input data will be required from other specialist studies than what is currently in the reports.

What we got:

In your response to our observation that in the Human Health Risk Assessment there was a misrepresentation of the legal requirements you claim that "The amended paragraph referred to provides a more complete description of operational states". This is not true. The effect of amendments is to imply that nothing beyond design base accidents needs to be considered. In fact the legal requirements are that all potential incidents must be considered.

We believe that this was a deliberate attempt by the authors to distort the requirement of the EIA process and we submit that they did this because they are biassed in favour of the development. We insist that those individuals should be removed from the project and replaced with a new team of neutral unbiased medical experts.

You state further that "One must keep in mind that the study deals with an assessment of the suitability of a site to accommodate a nuclear power station, not the assessment of the inherent safety of a nuclear reactor." This warrants some unpacking.

Your use of the phrase 'inherent safety of a nuclear reactor' indicates a strong personal bias in this matter. The safety of the NPS is disputed. But even if we ignored the fact that the stated probabilities associated with various incidents are disputed and if instead we all agreed on the same set of number to describe the probabilities of various incidents occurring, it still remains a subjective opinion on what qualifies as 'inherently safe'. There is not a number associated with 'inherently'. We also note the consultants were employed by Eskom to do an EIA for the PBMR (Pebble Bed), and in that documentation there is reference to the PBMR design as 'inherently safe', presumably as compared to other designs at the time such as PWR reactors. For this EIR, the consultants now refer to a PWR design as 'inherently safe'. This is contradictory, and also shows a bias on the part of the consultants, who apparently accept the applicants word that any design they put forward is 'inherently safe'.

A better, more neutral, expression of your statement above could be:

"One must keep in mind that an EIA deals with the suitability of a site to accommodate a development and not of the safety issues relating to the development"

In this form we can understand what you are trying to say, but the opinion expressed is still not correct. You seem to imply that the study must answer the question "How will the development be affected by the characteristics of the site" rather than "How would the environment be effected by the development". However it is more important for the EIA to answer the second question. The EIA must therefore include an analysis of all potential health risks associated with the development.

Later you state that
"The report is based on a qualitative interpretation of regulatory requirements ",

and further

"These ... satisfy the requirements of a qualitative interpretation of regulatory requirements ".

We question this "qualitative interpretation" of the law. The law must be complied with fully, and in this context it quite simply means that ALL possible hazards are within scope.

A full analysis must be performed. Several other reports will have to be extended to provide the required information regarding the dispersal of radionuclides through the groundwater, the air and the ocean.

Status: Incomplete - health issues still not addressed.

Response 10:

We have responded to these issues in a previous review. There appears to be a misunderstanding about the purpose of the EIA and what is required by the NNR.

The assessment of radiological dose in the EIA report was conducted as a qualitative assessment, considering that the Site Safety Report will present all the detail that is required by the NNR. This decision was reached on the basis of deliberations and agreement between regulatory authorities. The EIA report cannot produce more than what has been presented. There is nothing that can be added to this.

The study deals with the suitability of the sites for nuclear power stations and the studies are thus site-specific. Aspects that may influence the suitability of a site may be the meteorological conditions, proximity of sensitive receptors, seismic issues, etc.

The issue of “abnormal accident scenarios” is dealt with in design specifications of a reactor, including for example various levels of precaution (defence-in-depth), safety interlocks etc. Complex and thorough procedures of analysis of the entire safety case are followed. These considerations are not site-specific and do not belong in the assessment of the suitability of a site, which is what the EIA report is about.

It is untrue that there is even the slightest possibility that the siting of a nuclear power station will not fully comply with all the acts and regulations of South Africa. Such unfounded accusations do not contribute to constructive debate.

Comment 11:

10 Wishy-washy methodology

What we asked for:

Better definitions of the rating categories.

What we got:

In the response from Gibb states that the assessment criteria "adheres to acceptable international and national guidelines and practices" and anyway had been approved by the DEA. Please provide a reference to what guidelines or in fact any other reputable study where the word 'probable' is used to mean LESS than 50% probability.

We note that only three categories is not enough, especially not for something like a nuclear project where some impacts have very extreme ratings, since this obfuscates the issue by placing incidents of very different probabilities into the same category.

There still remains a problem that the confidence category is undefined, and hence meaningless. Even qualitative estimates of probability need to be based on a numerical definition.

We also note the lack of any validation process of the weighting system used to combine the impacts. This weighting system was concocted by the consultants while they had some data already in hand.

This is a clear weakness in terms of objectivity, and should have made the need for an objective validation of the weighting system clear.

Status: Fatally flawed methodology

Response 11:

Numerical definition / quantification is still based on judgement. Even if numerical values are assigned, it still remains up to the judgement of the applicable specialist or the Environmental Assessment Practitioner to assign a particular value. It is therefore questioned what additional value a quantified approach would provide, as it is in effect no different to the current rating system, which is also based on professional judgement.

The rating system in the Draft EIR, which preceded the Revised Draft EIR Version 1 Version 1, had more than three categories and it was found that this resulted in the specialist team not understanding the rating system and applying it incorrectly. This was indicated by the independent peer review of the EIA process as an issue that needed to be addressed and accordingly, the rating categories were simplified and made more consistent.

Your opinion regarding the "validation" of the rating system is noted. There is no process for validation of impact assessment methodologies. Every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts includes a number of criteria that are applied almost universally in EIAs. These criteria typically include nature, extent, duration, intensity, consequence (seriousness), reversibility, probability and significance.

Although there is general agreement about type of criteria to be included in assessment and there are local and international guidelines on this, there is no single method that is applied universally. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria for the project under consideration, bearing in mind any requirements that the environmental authority might in this regard. Some EAPs apply only some of the above criteria, others apply all or even more than the ones mentioned above, and in different combinations. Some EIA practitioners apply quantified rating systems, some apply only qualitative assessments and some use a combination of the two. The criteria applied for the Nuclear-1 EIA are a result of GIBB's experience with EIAs over a number of years and have been developed based on this experience.

Comment 12:

11 Wishful thinking on NPS design and safety

What we asked for:

A choice of the actual NPS and full particulars of its design must be fully defined before the current stage of the EIA process, including the public participation process, can be completed. If more than one design is still being considered then all candidate NPS designs must be fully specified.

Crudely specifying a generic class of PWR is far too imprecise to allow the EIA process to proceed further.

What we got:

The same technology envelope and the same flawed argument remains with the same incorrect analogy to American examples, that as we pointed out last time actually support our position that the actual choice of NPS must be made at this stage of the approval process.

Grade: No change

What we asked for:
Catastrophic incidents cannot be considered to be too improbably to occur and must be included in ALL sections of the EIA that deal with potential impacts of the development on the biophysical, social and economic environments.

What we got:

Much of the EIA is a pointless exercise. You start by assuming the NPS will always adhere to some safe standard with only minimal amounts of radiation being released. Then you analyse the impacts, and obviously the impacts turn out to be minimal because the safe standard was designed to be safe with minimal radiation being released. But there is a basic fundamental logic flaw here. You cannot be 100% sure that the NPS will always adhere to the chosen standard and only release minimal amounts of radiation. Even enhanced safety processes with multiple levels of redundancy and passive gravity driven shut down and cooling mechanisms can still be damaged or bypassed or they can simply fail.

You must consider all types of incidents from 1 to 7 on the INES scale.

Status: Fatal flaw – missing design of the reactor and associated infrastructure.

Response 12:

Your opinion in this regard is noted. Our previous response remains valid.

Comment 13:

12 Unacceptable risks to unique ecosystems

What we asked for:

All three sites are too valuable to be developed. This is clearly the impression of the vast majority of natural scientists who are familiar with these areas. The EIA must be rewritten to reflect their views more accurately.

What we got:

No significant change.

Status: EIR does not reflect opinion of the majority of scientists with experience around the sites.

Response 13:

Thank you for your comment. Local knowledge is invaluable to EIA processes. Please rest assured that all comments raised and information submitted has been considered within this EIA.

Comment 14:

13 Inadequate consideration of alternative options

What we asked for:

Throughout this EIA the all of the existing descriptions of alternative options to how the land could be used and to how the equivalent power could be generated must be replaced with more thorough, objective and factually accurate analyses.

What we got:

The consideration of alternatives in the EIR is still incorrect and incomplete.

Nuclear costs

The EPRI estimated prices shown for nuclear power in the EIR and in the first IRP in 2010 are way too low. They were increased by 40% for the updated IRP, and that was assuming a learning cost reduction based on a global roll-out of several hundred new reactors. The Fukushima meltdowns and subsequent collapse of the Nuclear Renaissance means that steady upward price trend of nuclear power over the past few decades is certain to continue to rise at the same rate or an even higher rate for the next few decades. Nuclear fuel price must be based on actual data from Koeberg. Load factor estimates could be based on actual data from Koeberg (about 69%) or derived from more sophisticated modeling. It is certainly not correct to use the 93% value provided by EPRI. Apart from scheduled and unscheduled downtime for maintenance there will be times when power supply will exceed demand and the NPS will run at reduced output because its maximum capacity is not required and not because it cannot produce maximum power. Wind and solar will be part of any future energy mix. Because they use no fuel they will always be dispatched before any fuel based power source. And because their output is variable the shortfall to be provided by fuel based power stations will be more variable in the future than what it is now. Load factor should be between 60% and 70%

Lifetimes

The postulated 60 year lifetime of a new NPS is disputed. Although it may be possible it is probably only likely with significant refurbishment and considerable expense in the last few decades. A detailed analysis of historical data from similar projects should be performed to obtain an estimate of likely lifetime and refurbishment costs. A reasonable result would be something like 40 years of trouble-free operation followed by an additional expense of about 20% of the initial cost to extend the life to the full 60 years.

The EIR states that the lifetime for solar power (and its not clear if this means photovoltaic or CSP) is only 30 years, and for wind 20 years. For CSP that has been accurate for existing pilot projects. Commercial CSP power stations are likely to have a very similar lifetime to any other thermal power station, including nuclear. In the case of wind and photovoltaic systems the manufactures guarantee period is generally 20 to 30 years. Thereafter photovoltaic panels might produce up to 20 percent less power than when they were new but they will not need to be replaced. Likewise wind turbines will probably need some significant refurbishment after 2 or 3 decades but one can expect that they could be put back into service for another few decades.

Photovoltaic

In section 4.5.2 Technological Alternatives of the Economic Impact Assessment report a reference is made to a 125MW 9 hours storage system. Nothing like this exists, and so this calls into question the expertise of the specialist who wrote this report.

Photovoltaic solar power is going through one of the most extraordinary technological revolutions of our time. Computer memory is the only technology to experience the same phenomenal rate of growth, increase in performance, decrease in price and dramatic future trend projections. Photovoltaic is going to be the most dramatic game changer in the energy field, and yet the Gibb appointed expert cannot even spell the word properly ('Photo Voltaic') and does not differentiate it from Concentrated Solar Power. This section must be repeated by an engineer with qualifications and up to date experience in renewable energy.

The cost estimates of photovoltaic systems used in the EIR is out by orders of magnitude. The given price per watt for a 125 MW solar farm is 5 to 10 times the hardware store retail prices of domestic portable 100 watt panels. See www.solarbuzz.com for photovoltaic costs. They provide a consulting service and they should be able to provide pricing data for large systems based on real world experience and independent analysis of price trends.

In a “historic crossover,” the costs of solar photovoltaic systems cheaper a cheaper option than Nuclear power in 2010.

Source: Prof J Blackburn, Economics Dept, Duke University, USA.

http://www.ncwarn.org/wp-content/uploads/2010/07/NCW-SolarReport_final1.pdf

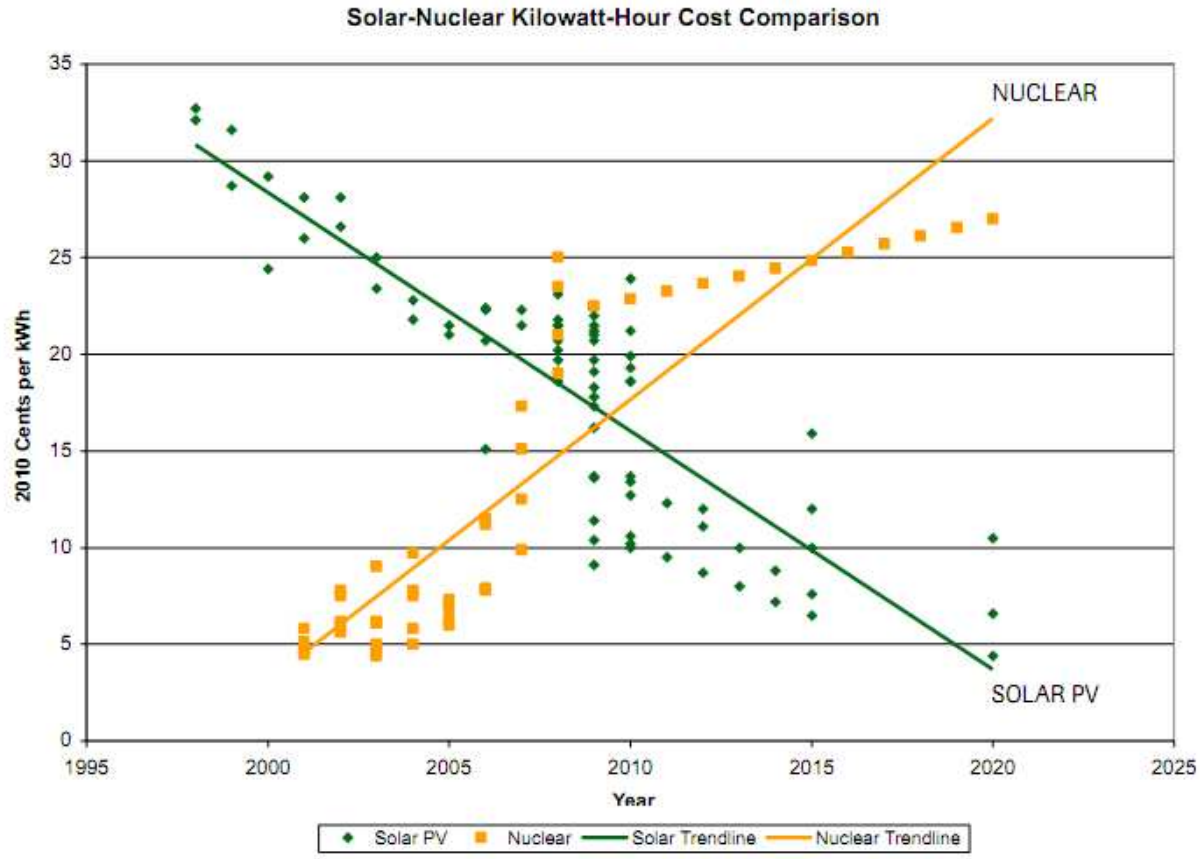


Figure 1: The Historic Crossover – Solar photovoltaic costs are falling as new nuclear costs are rising.[1]

There are a number of other special considerations regarding PV. They will largely be privately owned, thereby removing the funding problem from Eskom and the state. They use no water. They do need inverters which can add to the expense. They will often be producing power close to where it is being consumed and hence reduce transmission infrastructure costs. There will have to be some planning for load balancing on cloudy days, but only a small fraction of the country is covered by clouds at any one time. The details for all of these issues are probably beyond the scope of this project. They should be acknowledged as issues that need to be taken into account, but they do not change the basic fact that PV is going to play a big role.

How solar power can displace base load

Currently, heavy users of electricity are encouraged to use energy dring the low demand period at night. The same mechanisms could be used to encourage energy use during sunlight hours, when solar PV plants would be producing electricity. Concentrated Solar plants would collect energy and have sufficient storage to provide for the early evening peak. This would have the effect of reducing the need for power stations which run 24x7, such as nuclear power plants. This alternative approach must be investigated and presented in this EIR, as per 2.14 of the conditional acceptance of the scoping report.

Concentrated Solar Power

A first CSP project in South Africa is likely to be expensive, about 168% more expensive than coal according to reports from within Eskom. The same report predicts that CSP will be comparable to coal within 20 years.

http://www.engineeringnews.co.za/article/eskoms-concentrated-solar-power-ambition-2010-06-18

The A.T. Kearney global management consulting firm predicts that it will be a profitable business within 10 years. So if CSP is not already cheaper than nuclear, it almost certainly will be within the time frame that it would take to build a new nuclear plant.

http://www.estelasolar.eu/fileadmin/ESTELAdocs/documents/Cost_Roadmap/2010-06-29_-_Press_Release_ATKESTELA_-_ENG.pdf

Although there are several sites around the world where CSP has been implemented and operated successfully, it cannot yet be considered a stable or mature technology. There does still remain a risk of cost and construction overruns. Given the record of recent NPS projects the two technologies are probably about equal in this regard. CSP with fairly modest amounts of storage is a good solution to meeting the evening peak. Heat gathered during 8 hours of sunshine can be used to generate power for 4 hours in the evening. The same steam turbine and generator can be driven by fossil fuel to provide peaking power to cope with the early morning demand. Plants built now using this approach will be cost effective at current prices for meeting this requirement, but more than that, later when the technology matures and becomes cheaper they can be extended with more heat gathering and more storage to provide longer dispatchable power source. They would then be able to provide a backup for the variability of wind turbines and hence enable more renewable energy to displace coal and nuclear base load generators.

Wind

Wind power is discussed in the EIR, but mostly in the form of little anti-wind anecdotes, such as how Spain once had power shortages, all the negative impacts on birds and bats, and some vastly exaggerated nonsense about how much space is required and how impacts on transport networks will be substantial and so on. Nothing positive is said about wind at all. The EIR should provide accurate objective information for decision makers, and hence not just repeat one sided views supplied by the applicant.

The EIA states that technologies for wind energy have not developed beyond the level of small-scale plants. This is patently false and yet another example of the bias of the economics specialists. In the last few years more wind power was installed than any other power source.

Several countries produce more than 20% of their power from wind. Germany gets more power from wind than what Japan gets from nuclear.

We have pointed this error out in our previous submission and yet it has remained in the report.

Gibb must consult wind energy experts to provide information on the wind potential of South Africa.

The South African Wind Energy Association (SAWEA) has proposed that we should aim to have 20% of South Africa's electrical energy generated by wind by 2025. They estimate that this would require turbines capable of producing a maximum of 30GW and they predict that these could be distributed so that at any time they would produce at least 7GW. This is all backed with engineering data and calculations. Moreover, private funding is available and contractors are ready.

The bottom line is that when the calculations are done correctly and accurately and without bias, wind comes out cheaper than nuclear power.

The official US government data confirms this: http://www.eia.gov/oiaf/aeo/electricity_generation.html as does the finding of the revised IRP 2010.

Since the consultants compare nuclear power to coal power in the EIR, it appears that they share our view that comparison to alternate form of power generation should be included in the EIR. It is therefore unacceptable that this comparison is limited to coal vs nuclear, and there is an international trend of both of these technologies being replaced by renewable sources of energy.

Distributed power

Climate data shows that the major sites suitable for wind turbines stretch along a band parallel to the entire South African coast from Namibia to Mozambique, and another band runs along the escarpment from Lesotho to Swaziland. This covers a range of climate zones.

If wind turbines are distributed throughout this area the variability of the combined total wind power output will be much less than if fewer wind turbines are concentrated in a few places. More importantly the output and the variability in the output can be estimated and predicted with statistically determinable accuracy.

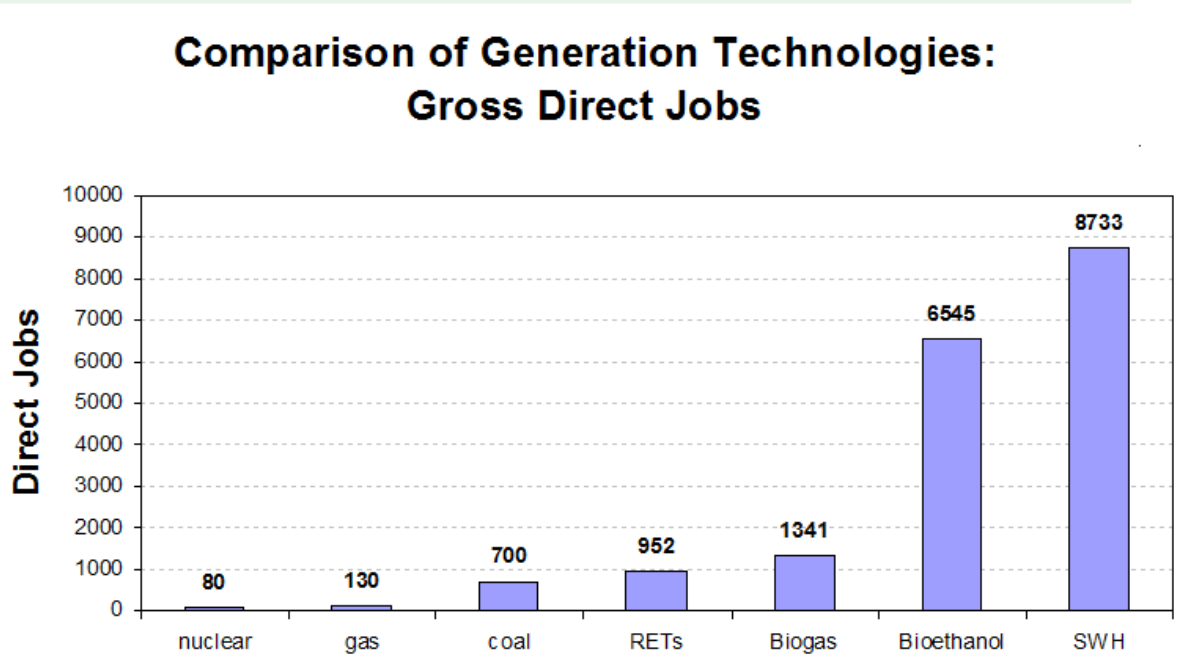
Scenarios like what happened in Spain in September 2010 can be effectively designed out.

You are correct in your statement that the option to use wind power to provide stable, dependable base load supply to the grid is challenging and that wind power does need to be supplemented by more dependable generating sources. However it can be done. The challenge is one of planning and design. And the solution will turn out to be cheaper than pursuing nuclear power. And if it was not biassed the EIA would show this.

It is only the variability of wind power that needs to be backed up with another source, not the entire capacity. Let's suppose that we follow the SAWEA plan and install 30GW nameplate capacity of wind power distributed so that the average output is 7.5GW and the 95% range in output is predicted to be from 7GW to 8GW then the backup power required is 1GW and not 30GW. Because we could predict several days in advance what the actual output is likely to be the backup source could be an existing older base load coal power station, being slowly and continuously being ramped up and down and producing an average of 500MW and a maximum of 1GW. By the time these older coal power stations need to be retired, either because they are too old or because because of CO2 concerns, they can be replaced with purpose build CSP generators which will by then be cost effective.

Jobs

In South Africa job creation is one of our nation's most important goals. Renewable energy technologies will create many more jobs than nuclear. As shown in the graph below, investment in SWH (Solar, Wind and Hydro) will create more than one hundred times as many jobs as the same investment in Nuclear power.



Source: "Employment potential of renewable energy in South Africa", SECCP 2003, Agma Energy 2003

Imports
If South Africa were to embark on a nuclear path then vast sum of money would leave the country, probably to France or America. It would be much better for our society to the develop the local renewable energy industry by spending the money here. The EIR must be extended to include references such as the above, and either refute or confirm this information.

Carbon trading
You have not responded to our request to include a consideration of the potential for capital inflows from carbon trading schemes.

Scope
It is not clear to us what Gibb of the DEA consider to be included within the scope of this EIR regarding the extent to which alternative sources of power need to be considered.

The quotes below seem to imply that alternative power sources do need to be considered.

DEAT approval of Final Scoping Report
2.37.1 This study must address the cost implications of the proposed NPS in relation to other electricity generating activities.

2.14 Power generation alternatives
2.14.1 The SR is deficient in presenting the suite of policies which led government, the National Energy Regulator and Eskom to submit an application for a proposed conventional pressurized water reactor (PWR). The screening of alternative to arrive at the conclusion that PWR is the preferred option is poorly motivated and hence undermines the well communicated need and desirability of the proposed project. This must be addressed in the EIR.

Gibb response to DEAT PoS.

Power generation and technology alternatives were discussed in the Scoping Report, where relevant these technologies will be discussed further in the EIR.

The Gibb response to our previous comment asking that the EIR be corrected regarding alternatives had this to say:

The revised Economic Impact Assessment, included in the Revised Draft EIR, includes a brief assessment of the relative financial costs of other generation options. However, this is given for information purposes, since the intention of this project-specific EIA process is not to assess different generation options. This EIA is specifically for nuclear power station providing base load. Please refer to a more detailed assessment in the Draft Integrated Resource Plan recently released for public comment by the Department of Energy.

Whatever the Department of Energy does or does not do has no legal consequences to Eskom's obligations to perform a full EIA for its proposed projects.

In general terms it is a requirement for EIA's to consider alternatives, both alternative uses of the land and alternative means to achieving the same functional or economic goal. Eskom cannot choose to consider only a "nuclear power station providing base load" without including in the EIA a proper consideration of alternative schemes that would meet the same need as a "nuclear power station providing base load".

What is indisputable is that wind and solar have been discussed in the EIR, in the specialist reports, at the public meetings and in the responses to comments from the public. The law requires that the EIA must be objective and factually correct. Yet much of the information given about alternative power generating options has been incorrect and biased. The EIR must be updated to correct these shortcomings.

The correct and unbiased conclusions regarding alternative power generating options that should be included in the EIA is that all of the electrical energy demand that would be fulfilled by developing nuclear power plants can be satisfied by an alternative solution based almost entirely on renewable energy, and this alternative solution would be:

- Cheaper
- create more jobs
- keep more capital within the country

Status: Fatal flaw – coal is the only only alternative discussed in any detail

Response 14:

Your opinion regarding the ecological value of the sites is noted. This opinion contrasts with the documented assessments of the specialists, all of whom agreed that there are no fatal flaws at any of alternative sites and that the sites can be developed, provided that the recommended mitigation measures are adhered to, particularly with regards to the positioning of the proposed power station on the site. The sites contain sensitive areas, but these areas can be avoided by judicious placement of the power stations on the sites.

The Revised Draft EIR Version 1 accurately reflects the opinions of the specialists. The specialists' assessments of the impacts are reflected verbatim in the Revised Draft EIR Version 1, although they have been condenses in the EIR to reflect their key findings.

Comment 15:

Issues regarding non-compliant process

It is the duty of the consultants to take minutes of the public meetings, to provide an accurate record, and to provide information in response to reasonable requests.

Slow and inefficient response to requests for information

1. During the Milnerton public meeting on 25 May 2011, Peter Becker quoted the response from the consultants to the KAAs previous submission, which reads in reference to Koeberg "Local groundwater close to the reactors shows somewhat elevated tritium levels..."

2. The request was made that the source of this information was made available as part of the EIR documents. This was agreed to by the consultants

3. The minutes were produced which misquoted the question as relating to strontium (instead of tritium). The response was therefore not relevant to the question.

4. After further contact with the consultants a report was sent to us which purportedly contained the requested information on 6 July 2011. It was not searchable (it was scanned) and so it was necessary to read the entire report to discover that it did not mention tritium

5. After further discussion with the consultants, a document was sent to us on 21 July 2011, which contained the requested information

6. 8 weeks is a significant portion of the submission period, and so waiting this long for information, as well as the time required to engage in this drawn out process, impacts on our ability to engage in an informed and meaningful way

7. The web site containing all the EIR documentation was rearranged in July 2011, and the specialist reports are no longer accessible via existing bookmarks, links, and also not accessible from the main Arcus Gibb Home page. This obstructed the process of obtaining information w.r.t. the second draft of the EIR.

Lack of diligence on the part of the consultants

1. As of 2 August 2011, the minutes of the Milnerton meeting were still not available on the Arcus Gibb website, with the deadline for submissions 5 days away. In some cases, the responses to questions raised at this meeting would influence or inform our submissions, and we therefore found the time between this information being made available and the deadline for our submissions, hampered our ability to engage in informed and meaningful participation in this process

2. Those from the Southern Suburbs and elsewhere who were not able to be physically present at Milnerton, have thus not (as of 2 August) been able to peruse the minutes and engage in the process

3. The microphone used for the public at the Milnerton meeting was faulty and there was not a backup on hand.

4. The process of transcribing the minutes was not done with due diligence, leading to long delays (see above) in providing information to IAPs.

Refusal to hold public meeting

1. After the release of the first draft of the EIR, three meetings were held near Cape Town. By far the most attended the Southern Suburbs meeting. Possibly due to concerns about the possible effects of a radiation leaks which would the winter North Wester would spread over the Southern Suburbs, there was a large turnout by a well informed public. There were many hard questions put to the consultants and vigorous debate. [cf the minutes].

2. As a result of the public participation process, many specialist reports were substantively changed, and in some cases new reports were written. After the release of the second draft, the Southern Suburbs was omitted from the schedule of public meetings. Many individuals and organisations requested that a meeting was arranged there, but this was refused by the consultants.

3. Milnerton is some distance from the Southern Suburbs, and the meeting was arranged for 6pm, which is when that route is clogged with rush hour traffic, which resulted in many interested parties not having the opportunity to engage with the consultants and applicant re issues arising from the second draft.

4. The consultant explained this by saying since Thuyspunt was the preferred site, that people in Cape Town are less affected than after the first draft, hence on meeting instead of three was appropriate. Since Milnerton was closest to the Koeberg site (where the new plant was not going to be built), it was most appropriate to have a single public meeting closest to that site. Apart from not making sense, this has the effect of reassuring Cape Townians that Koeberg will not be the selected site, and that the site decision has been made, whereas this is a decision for the competent authority.

5. By refusing to arrange a public meeting in the area that was previously most successful in terms of public engagement and participation, the consultants have not been diligent in pursuing meaningful and informed public participation.

In short, there is evidence that the consultants are biased towards the applicant, and in some cases have employed specialists who are similarly biased and also not competent in the fields they attempt to cover.

<u>Conclusion</u>
None of the issues that we have previously highlighted have been addressed adequately. In addition, while analyzing the second draft of some of the specialists' reports, we have identified further fatal flaws in the EIA process and this second draft of the EIR.

The EIR is still incomplete, biased and erroneous and it needs to be reworked, and once again submitted to a public participation process. If it is submitted in its current form to the competent authority, this in our view will be an offence in terms of section 81(1) of the EIA Regulations.

Contributors to this submission include:
Robert Isted M.Sc. Eng (Cape Town)
Peter Becker B.Sc (Cape Town), B.Sc. Hons (UNISA)
Andreas Spath M.Sc. (Cape Town), PhD Geology (Cape Town)

Response 15:

The Revised Draft EIR Version 1 makes no claims regarding the life spans of alternative forms of power generation technology. Should you be able to provide a reference to the section in the Revised Draft EIR Version 1 where such claims are made, GIBB can consider this comment.

All the alternative technologies mentioned in Section 4.5.2 of the Economic Impact Assessment (Appendix E17 of the Revised Draft EIR Version 1) are based on reference EPRI report[1], which was commissioned for the Integrated Resource Plan IRP). The specific technology referred to is parabolic trough with a central receiver. Please refer to the EPRI report, which available on the IRP website, in this regard.

Your comments regarding the merits of other forms of renewable power generation are noted. It is acknowledged that other forms of power generation have merit, but it is not the intention of this EIA process to assess the relative merits of these technologies vs. nuclear generation.

EIA is, by its very nature, a project-specific process. We thus reiterate our response that the environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a specific power station on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa's electricity needs. This is especially the case in the instance of the Nuclear-1 application, where the government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades.

Yours faithfully
for GIBB (Pty) Ltd

Nuclear-1 EIA Manager

[1] EPRI. 2010. *Power Generation Technology Data for Integrated Resource Plan of South Africa.* EPRI, Palo Alto, California. 23p.

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

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Dear Ms Galimberti

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

REVIEW COMMENT ON HERITAGE IMPACT ASSESSMENT

Mr Tim Hart
Dated: October 2010, Received: May 2011

Environmental Impact Assessment for the Proposed Nuclear Power Station ('Nuclear 1') and Associated Infrastructure

Mr Tim Hart
Dated: March 2011, Received: May 2011

Archaeology and Heritage Mitigation Study for a Proposed Nuclear Power Station At Thyspunt, Eastern Cape, South Africa

Dr John Almond
Dated: July 2008, Received: January 2010

Palaeontological Desktop Study for Bantamsklip (W. Cape) and Thyspunt (E. Cape) Reactor Sites

Comment 1:

INTRODUCTION

The Integrated Energy Resources Plan, gazetted by the Department of Energy on the 6th of May 2011, makes provision for an additional 9 600 MW of energy for South Africa in 2030 from nuclear production. Currently about 1800MW of South African energy is produced by the Koeberg Nuclear Power Station, in the Western Cape, about 40km north of Cape Town.

The initial investigative studies for potential sites to establish new Nuclear Power Stations were done during the 1980s. The original study researched the South African coastline, excluding the previous homelands. The outcome of the study identified five sites, two in the Northern Cape, two in the Western Cape and one in the Eastern Cape. Of the five sites, the two in the Northern Cape were scoped out at the end of the Scoping phase of the EIA process.

Arcus Gibb was appointed by Eskom to undertake the Environmental Impact Assessment process for the Nuclear Power Station 1 project (NPS1) and associated infrastructure on the three remaining sites. At the same time, two different environmental companies, Coastal and Environmental Services and Sivest, were engaged to undertake the Environmental Impact Assessment process for two of the necessary power lines in the Eastern Cape, namely the 132kV and the two 400kV distribution lines.

A first Draft Environmental Impact Assessment report for the Nuclear Power Station was compiled by Arcus GIBB and released for public comment in March 2010. Heritage Western Cape (HWC) approved both sites at Bantamsklip and Duynefontein stating that: *1.The recommendations in the HIA were accepted; 2. Total destruction of the archaeological sites could not be permitted and HWC will insist on large scale excavations that will generate very large samples; 3. Provision for long term storage of the material must be made on site as part of the cost of the project; 4. A mitigation workshop must be held to establish the feasibility of the work proposed in order to structure a proper business plan for mitigation of the archaeological and palaeontological resources (HWC Record Of Decision dated 12 January 2010).*

SAHRA commented on Thyspunt, the site proposed in the Eastern Cape, and advised that the development should not proceed at the identified location. This was communicated through the Review Comment submitted to Arcus GIBB on the 30th June 2010. The main reason advanced by SAHRA was that 145 archaeologically sensitive sites were identified in the proposed area. These sites, of diverse heritage significance, represent a unique case on the South African archaeological scenario for concentration, distribution and time span.

After consultation with relevant stakeholders and interested and affected parties, Arcus GIBB, revised the EIA report, and this included both new specialists' studies and an amendment of existing specialist reports.

SAHRA received the revised Heritage Impact Assessment in May 2011 along with a mitigation plan for the Thyspunt site.

Considering all specialists' reports and all areas of sensitivity, Arcus GIBB identified a portion of land of about 175ha (Fig. 1) within Eskom property (about 1600ha) which could be feasible for the construction of the nuclear power plant and associated infrastructure.

Infrastructure associated with the NPS1 will include turbine halls, spent fuel and nuclear fuel storage facilities, waste handling and storage facilities; waste water treatment works, intake and outfall structures into the ocean, desalinisation plant, transmission and distribution lines, access roads, high voltage yard (HV yard), a temporary coffer dam in the ocean for construction, a temporary spoil pipeline into the ocean for construction and laydown areas (from Revised Draft Environmental Impact Assessment Report for the Eskom Nuclear Power Station and Associated Infrastructure (Nuclear-1), Chapter 3).

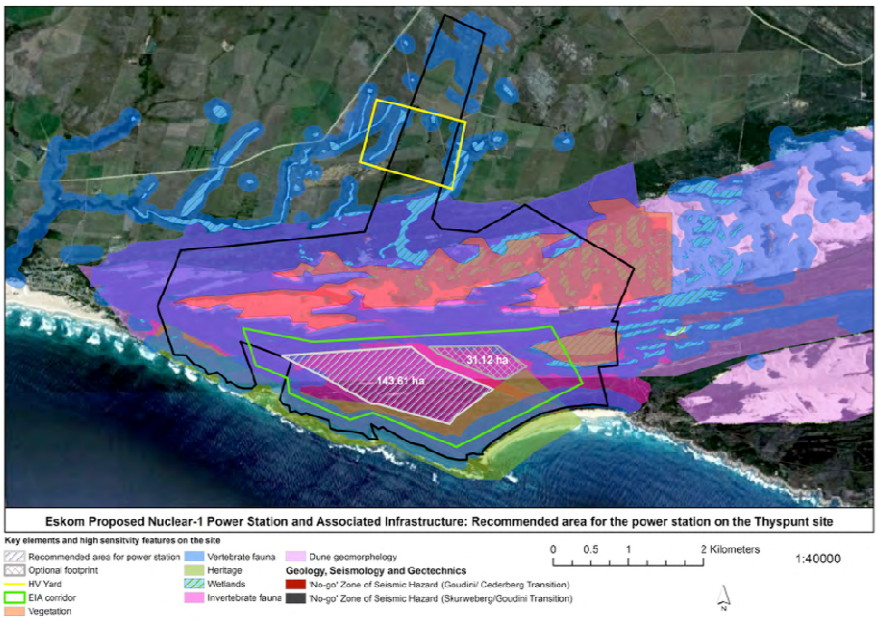

Fig. 1. Proposed position for the NPS 1 (Arcus Gibb, Environmental Impact Assessment Report (Revised Draft Environmental Impact Assessment Report for the Eskom Nuclear Power Station and Associated Infrastructure (Nuclear-1)).

DISCUSSION

The assessment carried out for the Nuclear Power Station 1 is one of the few systematic studies of the Eastern Cape coastline. Previous research in the area include Dr Binneman's 1996 PhD thesis (Symbolic construction of communities during the Holocene Later Stone Age in the Southern Cape year), and work carried out over the years by the Albany Museum and few other scholars (Deacon, H.J., 1995; Cairns, 1975 amongst others). Even before these studies were undertaken, in 1946 Goodwin, in his publication *The loom of prehistory*, stated that *"the southern Cape, from Port Elizabeth to Swellendam, is by far the most important archaeological area in Southern Africa …here South Africa has evidence of value to the world of prehistory and it is essential that it should be protected so far as it is humanly possible" (Goodwin 1946:105-106; 116).*

The Archaeological Impact Assessment for the Thyspunt area was conducted by the Archaeology Contracts Office (ACO) of the University of Cape Town. The specialist indicated that ground vegetation cover was extremely dense limiting visibility and allowing less than 20% of the study area to be effectively surveyed. Despite this, approximately 145 archaeological sites were identified. The range of the identified heritage resources is summarized as follows by the specialist:

- Middle Stone Age scatters on almost all exposed palaeosoles within the active dune system.
- Numerous well preserved Later Stone Age shell middens within 300-400m of the coastline and in the dunes about 2km inland.
- Six well preserved fish traps.
- Three ship wrecks known to have occurred in Thysbaai during the 19th century.
- The St. Andrews Shack, still in used by the school and with living heritage value.
- Natural wilderness qualities of the area.

In addition, the specialist indicated the significance of the area in the following:

- The area is characterised by a large volume of well preserved shell middens, which are highly significant in terms of Later Stone Age pre-colonial archaeology, especially as representing Khoe-San heritage.
- The Early and Middle Stone Age material identified on the fossil dunes is potentially important in scientific terms, especially if it is preserved in an *in-situ* context on palaeosoles buried under shifting dunes, and associated with fossil bone.
- The cultural landscape significance of the place relates mainly to its superb natural heritage, pre-colonial heritage, setting and contribution to the wilderness qualities of the region.

From a Palaeontological perspective a desktop study was conducted by Dr. John Almond in 2008 and SAHRA commented on it in the Review Comment of June 2010. No revision of this study was undertaken for the revised Environmental Impact Assessment.

The specialist indicated that the palaeontological sensitivity for the Thyspunt NPS is moderate to low. According to the Desktop Study, the Thyspunt NPS overlies the striking contact between the Goudini (NE) and Skurweberg (SW) Formations of the Nardouw Subgroup (upper Table Mountain Group) with relatively low palaeontological significance.

The highly sensitive Cederberg Formation, also belonging to the Table Mountain Group, underlies the coastal plain to the east. Dr Almond and other scholars have previously identified in it post-glacial biota of invertebrates and primitive jawless fish showing soft tissue preservation. Mantling the TMG is the Late Caenozoic Algoa Group, part of which was eroded away during previous interglacials when sea level was higher than at present, however, evidence of it in the form of different formations is still recorded in sections of the Thyspunt area earmarked for development. These formations are the Alexandria and the Nanaga Formations, both located above 18m amsl, underlain the interior coastal plain. While the Alexandria Formation is highly fossiliferous, the palaeontology of the Nanaga Formation is considered sparse. Horizons from the Emian or last interglacial period were located thanks to boreholes studies about 2m amsl and 200m inland. These are attributed to the Salnova Formation of the Algoa Group, a fossiliferous formation, *characterized by rich fossil fauna of shelly invertebrates* ("Swartkops Fauna") *that are of considerable palaeontological and palaeoenenvironenmental interest*. The unconsolidated surface sand at Thyspunt is formed by the Schelm Hoek Formation of low palaeontological significance.

In view of all the above, and the results of the Archaeological Impact Assessment (Hart, January 2010) and the Heritage Impact Assessment (Hart, October 2010), SAHRA highlighted the following issues:

a. Thyspunt is a sensitive terrain in terms of heritage resources as evidenced by the presence of many heritage sites at varying intensity and significance from the mid-late Pleistocene to the abundant Holocene occupation. According to the specialist report, because of this abundance of heritage resources, the NPS will likely result in a very high heritage casualty rate.

b. The HIA identified 145 sites during the initial survey, while a further 30 sites were identified by different surveys undertaken for associated project activities.

c. Worth noting is that the author states that the total number of archaeological sites could be ten times higher than what he identified during the survey both because of the dynamic of the shifting dune system and because of the thick vegetation cover that hampered survey in some instances. In most road cuttings the exposed profile revealed deep (50-60cm) deposits, mostly of shell middens.

d. Archaeological sites were identified along the exposed areas both north and south of the proposed location of the NPS1, further increasing the probability of identifying archaeological sites in the central vegetated area. However, the presence or absence of sites in this section will only be clarified once the results of the ongoing test excavations are known.

e. The character of the site will be irrevocably changed with the presence of both the nuclear power station and its ancillary infrastructure.

f. In terms of Maritime and Underwater Cultural Heritage, potential impact may occur on wrecks in the vicinity of the outlet and inlet pipes. This is because the warmer water from the plant would stimulate growth of plant life which in turn attracts sea life, including wood borers such as worms. This increase in temperature and marine life would result in wrecks within the area decaying faster than they would normally do in colder water.

g. Occurrence and distribution of fish traps in the project area were not adequately addressed in the current HIA.

h. Unique post-glacial biota of invertebrates and primitive jawless fish showing soft tissue preservation in the sensitive unit of the Late Ordovician Cederberg Formation will require extensive mitigation.

The proposed NPS1 project and its associated development activities therefore have high potential impact on this rich and unique heritage landscape (Fig. 2). The proposed Thyspunt site is considered as a complete and holistic cultural landscape with a uniquely long evidence of the history of the country.

Fig. 2. Map of all known sites in this section of the Eastern Cape shoreline, which includes the area earmarked for the proposed Nuclear Power Station 1.

Response 1:

Your comments are noted and responses are provided as per your numbering above for ease of reference.

a. to d.

A sensitivity analysis of each of the alternative nuclear power station sites was undertaken, based on the findings of the relevant specialists and their identification of sensitive areas on the sites. These sensitive areas have been overlapped to produce a composite sensitivity map and hence indicate an area that would affect the least sensitive features on the sites. In the instance of heritage, the greatest concentration of sensitive sites (in terms of number, variety of ages and condition) occur along the western coastline of the Thyspunt site, within 200m from the coastline. There is also a lesser concentration of archaeological sites along the eastern coastline and then a more widely distributed collection of archaeological sites in the mobile dunes on the northern portion of the site. The recommended position for a power station at Thyspunt, given these findings, was roughly in the centre of the site, in the vegetated dunes.

As indicated by your comments, there was uncertainty about the occurrence of additional archaeological sites within this central area of vegetated dunes. However, in the time since the Revised Draft EIR was released for public comment, the ACO has conducted additional test excavations at the Thyspunt site (under authority of SAHRA through a permit for test excavation). The finding of these test excavations is as follows (from the Revised Heritage Impact Assessment, which considers the test excavation results):

"*The potential for destruction of Late Stone Age middens will be particularly acute with respect to areas within 300 m of the coast and very much less acute further inland in the vegetated dune areas. The location of the facility will be a key factor in determining the extent to which impacts will occur. Any facilities placed within 200 m of the rocky shoreline or crossing the rocky shoreline will result in impacts. However, if a site were to be selected adjacent to Thysbaai beach, or within the vegetated dunes as proposed, the degree of impact will be greatly reduced as Late Stone Age middens tend to be more common adjacent to rocky shores, and in areas where there are surface water sources.*"

e. It is agreed that the sense of place will be changed. Although other forms of impact can be mitigated, there is little mitigation that can be applied to mitigate the change in the sense of place due to the presence of a large structure such as a nuclear power station. The mitigation measures recommended in the EIR therefore focus on ensuring that there are sufficient benefits to the project to offset the potential negative impacts of the power station e.g. proper curation of the archaeological artefacts through a purpose-designed on-site curation and educational facility and the creation of a larger conservation area around the power station (including sensitive ecosystems outside the land currently owned by Eskom).

f. As indicated in the Revised Draft EIR (Version 1) and in its Consistent Dataset (Annexure C), the cooling water will be chlorinated to prevent the growth of plants that could clog the cooling water inlet and outlet pipes. Furthermore, due to the offshore release of the warmed cooling, water, release at or near the sea bottom and the design of the outlet release points, warmed cooling water will be dissipated very quickly. For instance, the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR) concludes that if a nearshore outfall is used at Thyspunt a mean increase of 3ºC near the seabed will be limited to an area of roughly 0.2 km² (2 ha) around the outlets of a 4,000 MW plant and an area of 0.7 km² will experience a maximum increase of 3ºC or more at any time.Section 2.2.2. of the Heritage Impact Assessment (Appendix E20 of the Revised Draft EIR) is entirely devoted to a discussion on fish traps while the site inventory in the report appendices contains co-ordinates of fish traps. The fish traps at both Thyspunt and BantamsKlip lie effectively outside the development envelope, which commences 200m from the high water mark. The likelihood of any impacts on the fish traps is very unlikely indeed and it was therefore not considered necessary to discuss the fish traps in further detail.

The palaeontological report states with respect to the highly fossilifierous formations: "These formations are the Alexandria and the Nanaga Formations, both located above 18m amsl, underlain the interior coastal plain." The recommended site for Nuclear-1 lies on sands that are mainly deeper

than 18 m amsl and not on the interior coastal plain. The formation spoken of lies at a higher elevation and is a feature of the inland coastal plain. Indications are that the Thyspunt site will not encroach on this formation. However the presence of fossil material cannot be ruled out until the ground surface is opened and bedrock is penetrated. Fossil shell deposits relating to the Eemian transgression are possible. However, it is likely that this material is well represented at numerous locations along the south coast. Mitigation, if necessary, is feasible and could be implemented as bulk sampling during excavation. As a general rule successful exposure and mitigation of palaeontological material can take the direction of a positive impact as deeply buried material which under normal circumstances is very seldom exposed, finds its way to the surface, thus making a contribution to science. It must be noted that trial excavations found no evidence of old marine deposits at depths of up to 2 m below surface within the recommended development area, although these could occur at deeper elevations.

Comment 2:

CONCLUSION AND RECOMMENDATIONS

1. In line with the provisions of sections 38(3) & (4) of the National Heritage Resources Act SAHRA considered the revised heritage impact assessment and is of the view that the development may not proceed at the current location based on what is stated in this document, along with the following reasons:

   a. Thyspunt is a sensitive terrain in terms of heritage resources as indicated by the 145 sites identified during this HIA process and additional sites recorded during other surveys.

   b. Thyspunt is considered a cultural landscape based on the cumulative significance of the sites which *are illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal* (Unesco Operational Guidelines for the Implementation of the World Heritage Convention from 2005).

2. For the reasons outlined in this review comment, mitigation is not considered an option by SAHRA.

3. SAHRA observes that no alternatives, which would have probably been feasible in terms of heritage resources, were considered in proximity of the proposed Thyspunt site.

Response 2:

1. and 2.

Your comment is noted. As indicated in Response 1, the recommended position of the power station is such that the greatest concentration of archaeological sites on the Eskom property will not be directly affected by the power station. The largest concentration of sites is within 200 m of the coast, which will be left undeveloped. The central portion of the site within the vegetated dunes has been found, through test excavations that were permitted by SAHRA, to be free of significant heritage sites. SAHRA is therefore requested to study the findings of the test excavations before making a decision in this regard, as SAHRA does not yet have all relevant information in its possession. A revised heritage Impact Assessment, which includes the findings of the test excavations, will be provided for SAHRA's comments together with the next revision of the EIR.

3. SAHRA's attention is drawn to Response 1, where it is pointed out that sensitivity analysis of the sites was performed and that the recommended position of the power station is in the area with the lowest heritage sensitivity.

Comment 3:

In the event that the consenting authority is inclined to permit the development to proceed at the current location, despite SAHRA's objection to this, SAHRA must be consulted and afforded the opportunity to provide input and guidance on how the impact on heritage resources may be minimised.

Response 3:

Your comment is noted. In terms of the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998), in terms of which the Department of Environmental Affairs is mandated to make its environmental authorisation decision, this Department is required to consult with other government bodies (including SAHRA) who have any form of jurisdiction or interest over the matters concerned.

Yours faithfully

For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

Tshwane

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05 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Dear Ms Andrews

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

FOREWORD:

We act for Earthlife Africa, Johannesburg. We enclose here our client's submission to the Revised Draft Environmental Impact Report ("Revised Draft EIAR") for the proposed Nuclear-1 Power Station (NPS). This submission is supported by:

Alternative Information and Development Centre,
Greenpeace Africa,
Christopher Wylde
Hermanus Ratepayers Association
Save Bantamsklip Campaign
Zwartkops Conservancy
South Durban Community Environmental Alliance
Pelindaba Working Group
CANE Northern Regions: Gauteng, NW Province, Mpumulanga, NP and Free State.
St Francis Bay Residents Association
Friends of St Francis Nature Areas (FOSTER)
Gamtkwa KhoiSan Council
First Indigenous Nation - Eastern Cape (FINEC)
Women's Energy and Climate Change Forum
Timberwatch
Mrs. Cheron Kraak
Earthlife Africa Cape Town
Dr Caeleen McNaughton-Pascoe
Supertubes Surfing Foundation
St Francis Kromme Trust
Renee Royal,
Dr. A.E. Marshall
David Fig, and Earthlife Africa eThekwini.

A further list of supporting organisations, if any, will be forwarded to you in the course of the next few days.

This submission will evaluate the Revised DEIR against the legal requirements for such reports. ***It is submitted that the Revised Draft EIR fails to place relevant considerations before the decision maker as is required by the Promotion of Administrative Justice Act No 3 of 2000 (PAJA) and violates several substantive provisions of the National Environmental Management Act No 107 of 1998 (NEMA) and the regulations passed thereunder (EIA Regulations).***

Comment 1:

1. Legal Context

1.1 Promotion of Administrative Justice Act 3 of 2000:

S 6(2): "A court or tribunal has the power to judicially review an administrative action if:

(b) a mandatory and material procedure or condition prescribed by an empowering provision was not complied with; . . .

(e) the action was taken –

(iii) because irrelevant considerations were taken into account and relevant ones were not considered.

Response 1:

Your comment is noted.

Comment 2:

1.2 The Constitution of the Republic of South Africa Act 108 of 1996:

S 24: Everyone has the right –

(a) to an environment that is not harmful to their health of well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

(i) prevent pollution and ecological degradation;

(ii) promote conservation; and

(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

S 195(1): Public administration must be governed by the democratic values and principles enshrined in the Constitution, including the following principles:

(b) Efficient, economic and effective use of resources must be promoted.

Response 2:

Your comment is noted.

Comment 3:

1.3 National Environmental Management Act (NEMA) and the Environmental Impact Assessment (EIA) Regulations:

Relevant provisions of these statutes will be referenced where applicable in the submission.

Response 3:

Your comment is noted.

Comment 4:

2. Failure to assess socio-economic impacts of the proposed project violates NEMA and the EIA Regulations, read together with PAJA 6(2) (b).

The preamble and principles laid out in section 2 of NEMA recognises that sustainable development requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations. It

further states that ecologically sustainable development must be secured while at the same time promoting justifiable economic and social development.

Section 23 of NEMA is more specific in that it requires the actual and potential impacts on the environment, socio-economic conditions, and cultural heritage to be taken into account in environmental management. Regulations 31(2)(d) of the EIA Regulations state that the manner in which the social, economic and cultural aspects of the environment may be affected by the proposed activity must be taken into account.

Added to this section 2(4)(b) of NEMA states that environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. The best practicable environmental option is defined in section 1 of NEMA as the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term.

Regulation 17 of the EIA Regulations states that guidelines must be taken into account where they have relevance to the proposed activity. For this purpose guidelines for the Western Cape have been drafted that determine how economists are to be involved in the EIA process.[1] The guidelines are very clear on what should be contained in an economic report. The guidelines state that the basic function of economic specialist input is to assist in the determination of whether a project will enhance the net social welfare. This involves considering the efficiency, equity and sustainability of the project. Input from an economic specialist is especially required if there is a chance that economic impacts are likely to influence the decision of whether or not a project is desirable. The guidelines further state that macro-economic risks need to be taken into account. In fact they clearly state that where the size of the project is such that it could influence relative prices then further analysis is required to identify and assess potential risks. The guidelines go on to state that the report also needs to take into account the vulnerability of the groups impacted on. Part of the assessment should include a consideration of who benefits and who loses from the impacts associated with the project.

It is submitted that the legal context set out above mandates that the EIAR consider the economic impacts that the construction of the NPS will have on broader South Africa, rather than a focused report detailing the economic impacts on the local communities as was submitted by the EAP. Accordingly, the previous submission by Earthlife Africa[2] detailed the concerns with the Draft EIAR as follows:

a. the impact on the price of electricity of the expenditure of R120bn on a NPS and how this will affect consumers, particularly the poor;
b. the impact on household income and the taxpayer;
c. the economic impact of a catastrophic incident on adjacent communities;
d. the economic impact on all phases of the NPS's life including decommissioning which could be of the same order as commissioning;
e. an indication of the costs and benefits to assess the socio-economic impacts of the project;
f. the economic impacts of a major or serious accident;
g. waste storage costs (current and cumulative).

It is submitted that the failure to assess these impacts results in the infringement of the environmental rights set out in both the Constitution and NEMA. Our client is concerned that the costs involved in the construction and operation of the NPS will be passed on to electricity consumers, the majority of whom are from disadvantaged backgrounds, and that these costs will be intergenerational (which is problematic given that future generations will not have benefitted from the generation of electricity from the NPS).[3] Both the Constitution and NEMA make specific mention of the right to have the environment protected for the benefit of both present and future generations and that development should be sustainable. It is submitted that the assessment of the above socio economic impacts as

[1] Van Zyl, H.W., de Wit, M.P. & Leiman, A. 2005. *Guideline for involving economists in EIA processes: Edition 1.* CSIR Report No ENV-S-C 2005 053 G. Republic of South Africa, Provincial Government of Western Cape, Department of Environmental Affairs & Development Planning, Cape Town. These guidelines are relevant to the extent that the NPS will be built in the Western Cape.
[2] Submission by Earthlife Africa to the Director of the Department of Environmental Affairs on the Draft Environmental Impact Assessment Report. Dated 29 June 2010.
[3] NEMA s 1 (definition of "sustainable development").

well as the assessment of cumulative economic impacts[4] is required in order to ensure that these constitutional imperatives are complied with.

In spite of the legal framework which clearly mandates that these (macro-economic) impacts must be assessed, and in spite of the concerns having been voiced by various I&APs including Earthlife, these impacts have not been considered in the EIAR. Not only have these concerns been ignored in the revised drafts, but they were ignored in spite of the fact that the scoping report was accepted by DEAT subject to the condition that the economic study was required to address the cost implications of the proposed NPS in relation to other electricity generating activities[5] and in spite of the fact that the Plan of Study reiterated this by including the following criteria for the economic impact analysis:

> *"Impacts on poor (low income households), other households, fiscal impacts, balance of payment impacts and social impacts, cost implications of the proposed NPS in relation to other electricity generation activities as indicated in the long term mitigation strategy document".*[6]

The economic report itself acknowledges that *the NPS is such a large capital investment (equivalent to that of six times the capital investment in Gautrain) that the economic ripple effects will go far beyond its direct boundaries*.[7] However, the response to Earthlife's comments shifts the responsibility of assessing the impact of increased electricity prices to the National Energy Regulator of South Africa ("NERSA"), and avoids the legislative requirement of assessing alternative forms of electricity generation, by stating that it is the purpose of the Integrated Resource Plan[8] ("IRP") to decide the relative contribution of various generation options to South Africa's overall electricity mix. What this response fails to acknowledge is that neither NERSA's electricity price increase process, nor the IRP constitute an equivalent mechanism for assessing the economic impacts of the project in the manner which the law suggests. Further, neither of these processes consider all the economic impacts that must be considered in the EIA, nor do they consider potential or cumulative economic impacts. It is submitted that it is a mistake to conflate these (NERSA and IRP) processes with the environmental impact assessment process and it is further submitted that doing so circumvents the requirements of NEMA.

In addition to the concerns canvassed in earlier submissions, it is submitted that it is not possible for the applicant to come into compliance with the EIA requirements for assessing the economic impacts of the project at this stage because of lack of certainty as to the specific type of plant, its design and safety mitigation features. Different types of nuclear power plants, and their safety mitigation features will generate different consequences in a major accident which will in turn result in different economic impacts. The monetary value of such economic impacts will also be different for different sites, based on issues such as population densities and the nature of the surrounding economy. Factors which may determine the range of impacts include:

a. fuel storage options including alternatives,
b. waste facilities and disposal methods,
c. number of containment hulls,
d. whether a core catcher is necessary (such technology is dependent on the type of design),
e. the emergency zones that need to be determined,
f. the source term,
g. possible cost overruns,
h. labour, expertise and material required etc.
i. the nature of the adjacent economy, and population densities e.g. types of agriculture undertaken
j. the extent of emergency zones

It is submitted that the cost of insurance against such impacts should be included as part of the economic impact assessment, given that it may be significant. Insurance against the consequences of nuclear accidents is usually excluded from household insurance. It is understood that the actual level of financial security and the manner in which it must be provided must be determined under the provisions of the National Nuclear Regulator Act No 47 of 1999. However, it is submitted the actual determination of the financial security is not equivalent to the assessment of the economic impact

[4] EIA Regulations 2010, regulation 22(i) (i).
[5] Letter from DEAT to Arcus Gibb dated 19/11/2008.
[6] Page 27, Plan of Study.
[7] Page 40, Economic Report, Revised DEIR APP E17 Economic Report.
[8] Government Gazette, No 34263, Vol 551, 6 May 2011.

thereof. The failure to assess this impact constitutes a failure to properly comply with statutory requirements.

A final socio economic concern is the fact that the report fails to consider the impact on land use planning in the greater Cape Town metropolitan area of locating a further nuclear plant at Duynefontein, which is to the north of Cape Town. The city has a rapidly increasing demand for housing and is landlocked by mountains and ocean, placing pressure for development on the zone to the north of the city where Koeberg is situated. A further nuclear plant at this site will in all likelihood limit development in the area for a further 100 years. The socio economic impact of such a development, which may be significant, has not been considered in the EIA.

As a result it is submitted that the report does not place all relevant socio economic information that could materially influence the decision maker before it and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[9]

Response 4:

Focus of the economic impact assessment
It is not factually correct, as you have stated that the economic impact assessment focuses on the economic impacts on local communities. The macro-economic assessment focuses on the potential economic impacts to the provincial economies, not only on potential local impacts.

Claim of infringement of environmental rights
Your claims that the Nuclear-1 project would result in infringement of environmental rights of the Constitution and NEMA refer. Your concern is that these costs are inter-generational, and you claim that future generations will not have benefitted from the generation of electricity from Nuclear-1. In view of the fact (as reasoned in Chapter 4 of the Revised Draft EIR) that the 4,000 MW of electricity to be generated by Nuclear-1 is meant to contribute to the 40,000 MW of new generation capacity required by 2025, which is meant to address both the growth in electricity demand and to replace existing ageing coal-fired power stations, it is difficult to understand your conclusion that future generations would derive no benefit from electricity to be generated by Nuclear-1. Nuclear-1 would contribute significantly (approximately 10%) to the development of this new generating capacity, and thereby provide increased security of supply to all electricity consumers in South Africa.

Your footnote 4 (with reference to the assessment of cumulative impacts) refers. There is no Regulation 22(i) (i) in the 2010 EIA regulations. Regulation 22(1) of Government Notice No. R 543 of 2010) refers to the content of Basic Assessment Reports.

Costs of nuclear generation in relation to other forms of electricity generation
The cost of nuclear electricity generation in relation to other forms of electricity generation is addressed in Section 5.3.3 of the Revised Draft EIR. This refers to costs as reflected in a study by the International Energy Agency as well as a study by the EPRI, undertaken specifically for the Integrated Resource Plan, and therefore reflecting the South African context. This, and other international studies, indicate that the Levelised Cost of Electricity (LCOE) of nuclear generation (the costs over the entire life cycle of generation) are comparable with other forms of generation, including coal and renewables.

Costs of electricity are approved by the National Electricity Regulator of South Africa (NERSA). Affordability of electricity to the poor is taken into consideration in setting of costs for consumers.

Your claim regarding the “legislative requirement of assessing alternative forms of generation” refers. We contend that it is not a legislative requirement, since EIA as a tool of environmental management is, by its very nature, a project-specific and location-specific tool that is not equipped to deal with strategic issues such as the choice between different forms of electricity generating technology.

The environmental application for Nuclear-1 is for a single nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a specific power station on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa’s electricity

[9] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

needs. This is especially the case in the instance of the Nuclear-1 application, where the government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades. The EIA process, which is a project-specific environmental management tool, does not have any mandate to revisit the strategic analysis of power generation alternatives that was completed in the IRP.

In view of the project-specific nature of EIA, although economic impacts have to be (and have been) addressed in the Nuclear-1 EIA process, it is not a requirement for the Nuclear-1 EIA to assess the economic impacts of nuclear generation vs. other forms of electricity generation to come to a conclusion on which of the wide range of electricity generation technologies is preferred. Such an assessment would amount to a Strategic Environmental Assessment, which would require inputs in terms of the complete life-cycle environmental impacts of the various technologies alternatives. Furthermore, as illustrated in Section 5.3.2 of the Revised Draft EIR, the spatial requirements for different forms of technology can vary widely – for 4,000 MW of wind-generated electricity, an area between around 270,000 and 350,000 ha would be required. This would mean that site selection (already a contentious issue with a single site for a nuclear power station) would become virtually impossible. Such a large area would require potentially thousands of landowners to consent, apart from consent from interested and affected parties. Based on experience with recent EIAs for wind farms near St. Francis, similarly vociferous opposition could also be expected for renewable energy projects[10].

Lack of design clarity and the claim that impacts cannot be predicted and that different designs will result in different levels of impacts in case of a major incident, resulting in different levels of economic impact.

It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known and the environmental impacts can be predicted or deduced from these inputs and outputs with reasonable certainty, it is not necessary to know the brand name of the technology.

As has been done in other issues and response reports, it may be appropriate to explain the envelope of criteria in colloquial terms, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel type, fuel efficiency, catalytic convertor performance, type of tyres and wheels, fuel tank size, effective range, CO_2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBD. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would not qualify. Similarly, if a vendor proposes a power station design that fails to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration.

Assuming that an authorisation is granted by the DEA, a power station design that deviates significantly from that specified in the Consistent Dataset in the Nuclear-1 EIR (Appendix C of the Revised Draft EIR) would render the design incapable of meeting the requirements of the EIR and the authorisation. Hence such a non-confirming design could not be considered for construction.

Impact on Nuclear-1 at Duynefontein on Cape Town's land use planning

The proposed Nuclear-1 power station will have smaller emergency planning zones (EPZs) than the KNPS. This assumption is supported by statements by the NNR. For instance, in a presentation to the Parliamentary Select Committee on Economic Development on 1 June 2010, the Chief Executive Officer of the NNR stated the following: "*One major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, which is the zone within which evacuation of the public has to be catered for, would in all likelihood be reduced from 16 km in the case of Koeberg, to a much smaller radius which could fall within the property owned by the holder* …".

[10] Wind farms in the St. Francis area have been heavily opposed, in spite of assertions by Nuclear-1 interested and affected parties during the Nuclear-1 public participation process that St. Francis Bay stakeholders would welcome renewable energy projects.

An assessment of the implications of Nuclear-1 for planning purposes was furthermore undertaken and included in the Revised Draft EIR Version 2 (Appendix 34). The impact on land use is

	Duynefontein
Direct impact on land use E.g. the impact of the nuclear site as well as the emergency planning zones on urban expansion.	• The proposed development will have an impact on future development of the region in terms of. land that can be utilised for future development. Areas around the site will need to be protected, densities may need to be lower than if the development was not there and infrastructure upgrades will be required, especially roads.
Indirect impact on land use	• The influx of approximately 2000 people, as projected when the site is fully operational, will not have a dramatic impact on services and facilities (indirect land uses) required to sustain them as will be the case with the Bantamsklip and Thyspunt sites. This only take into account the increase in population and not the impact of on existing policies as result of the existing Koeberg Power Station.
Compatibility with local planning instruments and policies	• The Nuclear 1 facility is not specifically mentioned in the Municipal SDF, but existing surrounding land uses are compatible with proposed land use. • There are some conflicts with future land use as the site is located within the growth path of the city. If the proposed development is implemented, this will have an impact on the future growth of the city i.t.o. urban form (densities allowed, etc.) and the existing risk management/ evacuation model. • There are legislative processes in place that will require the submission of an application to the Municipality to obtain the rights for the proposed land use.
Impact in case of emergency	• There is existing urban development around the proposed site that will be impacted upon, especially to the south and east of the site, which will be affected.

	• The site is located adjacent to an existing operational nuclear power plant.

Lack of Insurance against nuclear accidents
In terms of the National Nuclear Regulatory Act, the operator of a nuclear facility is obliged to provide insurance. The amount that is stipulated by the NNR is R3 billion. The NNR is however currently reviewing the amount of insurance that the nuclear power operator has to provide.

Comment 5:

3. Failure to assess worst-case scenario impacts violates NEMA and the EIA Regulations, read together with PAJA 6(2) (b).

EIA Regulation 31(2) (l) states that an environmental assessment report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[11] "Significant impact" is defined in the Regulations as "an impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[12] Under this definition, "significant impact" includes a catastrophic, worst-case scenario impact.

In addition, NEMA's repeated focus on minimisation, prevention, and mitigation of environmental degradation[13] mandates an assessment of the impacts of a severe accident because such an assessment will lead to better prevention and mitigation measures. The need to carefully consider catastrophe scenarios is particularly apparent in light of the recent Fukushima nuclear disaster. The plant, operated by Tokyo Electric Power Co. (TEPCO), was protected by a seawall 5.7 meters high but unprepared for the 14 meter waves that actually hit the plant after the earthquake. TEPCO's disaster projection scenarios for the plant had not considered the possibility of higher waves.[14]

The Revised DEIR fails to assess worst-case impacts. With regard to natural disasters, the EIR merely states the obvious, that an earthquake or flood may have a major negative impact on a nuclear power plant, rather than assessing the impacts that the nuclear power plant would have on the surrounding environment in the event of an earthquake or flood.[15] The emergency response report explicitly states, "The approach of this specialist report is different to the other specialist reports, in the sense that *it has not identified and assessed impacts*."[16] With regard to health impacts, the EIR merely estimates the *probability* of accidents caused by external forces ("Category C events") without assessing the *impacts* of such accidents, contrary to Regulation 31.

The response to this issue when raised at the Final Draft Environmental Impact Report stage was that severe accidents "fall firmly within the ambit of the NNR licensing process."[17] Such reliance, however, is misplaced as an NNR license cannot function as the equivalent of an environmental authorisation under NEMA 24L. NNR authorisation establishes safety standards under normal operating conditions;[18] it does not meet the requirements of NEMA 24(4) (a) to measure environmental *impacts*.

It is further submitted that not only does the Revised DEIR bypass the statutory requirement to assess all identified potentially significant impacts, which includes a worst-case analysis, it is actually impossible for the applicant to assess the impacts of a catastrophe in the absence of a final design.

[11] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).
[12] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.
[13] NEMA s 2(4)(a)(i)–(iii), (vii), s 23(2)(a)–(b), s 24(1), (4)(b)(ii), (4A).
[14] *TEPCO details tsunami damage: Waves that hit Fukushima plant exceeded firm's worst-case projections*, Yomiuri Shimbun (Apr. 11, 2011), available at http://www.yomiuri.co.jp/dy/national/T110410003477.htm.
[15] Revised DEIR APP E4 Seismic Risk Assessment 4.1.1(a), (f); 4.1.2(a), (f); 4.1.3(a), (f); Revised DEIR APP E16 Oceanographic Assessment at 3.1.3, 3.2.3, 3.3.3, 4.1.5, 4.2.7.
[16] Revised DEIR, Chapter 9, Environmental Impact Analysis, Emergency Response, at 9.23 (emphasis added).
[17] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 16.
[18] *See* National Nuclear Regulator Act Regulations, No. R. 388 (2006) s 3–5; National Nuclear Regulator Act 47 of 1999, ch 1 (definition of "action").

Eskom purports to base its assessments on a generic nuclear power station design,[19] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[20] including Generation III reactors. But different systems will have different accident consequences. As stated above, in other words, a nuclear meltdown is not just a nuclear meltdown – rather, the specific effects of an accident will vary widely depending on factors such as the type of fuel used, the burnup rate of the fuel, and the safety mechanisms installed, all of which depend on the final design of the plant. Basing an assessment on "highest possible values" is not sufficient because the difference in impacts is not merely a matter of degree but also of quality and composition. Moreover, it is currently not possible to make generalisations about Generation III reactors as they are just beginning to enter the market and do not yet have a proven track record.[21]

Response 5:

Your comments are noted.

Assessment of the radiological emissions during emergency events and the readiness of the relevant role players to deal with such events is clearly within the ambit of the NNR owing to its legal mandate in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). As with many different forms of development, construction is dependent on authorisations by a number of different legal entities, including local, provincial and national authorities. Construction of such developments is reliant on all these authorisations being obtained from entities with vastly different legal mandates. Reporting requirements to satisfy all these authorisations vary hugely, and it cannot reasonably be expected that information relevant to all these authorisations should be contained in the EIR.

As indicated repeatedly in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement, which governs the consideration of radiological issues in EIA processes and the interaction between the DEA and the NNR in terms of their respective mandates for environmental and radiological safety (See Appendix B4 of the Revised Draft EIR). The agreement clearly stipulates that issues of radiological safety and emergency planning are within the mandate of the NNR. Furthermore, it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement. We must, therefore, conduct the EIA based on their mandates and their agreement.

In this regard you are also referred to the then DEAT's approval of the Scoping Report, dated 19 November 2008, where the following is stated:

> 2.21 All radiological issues raised during the EIA process, which are not comprehensively addressed, must be explicitly referred to the NNR to be addressed as part of their process.

This response by the DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process.

Nevertheless an assessment of radiological impacts **(Appendix E32)** has now been included in the Revised Draft EIR Version 2. The purpose of this assessment will be to quantify and assess the environmental (health) impacts of normal operational process and "Design Basis Accidents" (DBAs) for Nuclear-1. This assessment will also assess whether the series of external events that happened in Japan in March 2011 could reasonably be expected to cause impacts similar to those of the Fukushima Daiichi nuclear accident to a Generation III nuclear power station constructed at any of the alternative sites considered for Nuclear-1.

[19] *Id.*

[20] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[21] *See* Advanced Nuclear Power Reactors, World Nuclear Association (June 2011), at http://www.world-nuclear.org/info/inf08.html [last accessed 28 July 2011] (discussing various types of Generation III reactors, only one of which is currently operating while others are still undergoing development, design certification, or construction).

It is to be noted that the impacts of potential rise in sea levels and meteo-tsunami events have been taken into consideration in the coastal engineering reports (Appendix E16 of the Revised Draft EIR). It is for this reason that the proposed platform height of the nuclear island is proposed to be 10 to 12 m above sea level.

Your statement of the reason for the Fukushima Daiichi incident is indeed correct. Insufficient planning was done for tsunami events and assumptions were not appropriate for a region subject to frequent earthquakes. Studies of external hazardous events that could affect the nuclear power station will be contained in the Site Safety Reports, which will be submitted to the National Nuclear Regulator as part of an application to site a nuclear installation at any of the three sites. Such studies will take into consideration lessons learned from historic accidents including the Fukushima accident and no nuclear installation will be sited in areas where it can be proven that such cannot be mitigated. An assessment of the events leading to the Fukushima Daiichi incident and the impact of this event on nuclear safety for future nuclear power stations and Nuclear-1 will be included in the next revision of the EIR.

Your statement is noted that the NNR license cannot serve as an equivalent of an authorisation under NEMA section 24L. It is to be noted that it has never been the intention of the DEA and the NNR to issues an integrated authorisation in terms of Section 24L(1)(b). As indicated by the co-operative governance agreement, these authorisations remain separate and issues that are not dealt with in the EIA process need to be referred to the NNR for consideration.

Your claim that the NNR regulations (Government Notice No. R 388 of 2006) only establishes safety standards for normal operating conditions, refers. This claim is inconsistent with the content of the said regulations. For instance, Regulation 3(8) of this notice requires planning for accident management and emergency planning, emergency preparedness and emergency response. Your claim is supported by a footnote referring to the definition of "action" under the NNR Act (Act No. 47 of 1999). Under Section 1(i) of the Act, in terms of which "action" is defined as follows:

"(a) the use, possession, production, storage, enrichment, processing, reprocessing, conveying or disposal of or causing to be conveyed, radioactive material;
(b) any action, the performance of which may result in persons accumulating a radiation dose resulting from exposure to ionizing radiation; or
(c) any other action involving radioactive material."

Given the fact that "action" is defined to include any action resulting in the accumulation of a radiation dose due to exposure to radiation, and the fact that the Regulations under the Act explicitly provide for emergency (i.e. non-normal operating conditions), your conclusion of the NNR Act only providing for normal operating conditions is contested. It is clear that the definition of "action" applies to any instance of radiation exposure, since no restriction applies with respect to normal or abnormal operating conditions.

Furthermore, Section 3.3 of GN R 388 of 2006 requires that: "*Measures to control the risk of nuclear damage to individuals must be determined on the basis of a prior safety assessment, which is suitable and sufficient to identify all significant radiation hazards and to evaluate the nature and expected magnitude of the associated risks …*". In terms of this requirement, it is clear that a form of assessment of the radiological risks is required. Even though the methodologies employed in such a risk assessment may not be identical to those used in environmental impact assessment, this risk assessment is specific to the nature of the radiological risks and is therefore complementary to the environmental assessment that is required by the NEMA.

Comment 6:

4. Failure to assess all potential impacts of nuclear waste violates NEMA and the EIA Regulations, read together with PAJA 6(2) (b).

EIA Regulation 31(2) (l) states that the report must include "an assessment of each identified potentially significant impact, including cumulative impacts, the nature of the impact, the extent and duration of the impact, the probability of an impact occurring, the degree to which the impact can be reversed, the degree to which the impact may cause irreplaceable loss of resources, and the degree to which the impact can be mitigated."[22] "Significant impact" is defined in the Regulations as "an

[22] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(l).

impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment."[23] Radioactive waste is certainly a "significant impact" under a common sense reading of the definition, and it has been identified as such by numerous public participants,[24] the DEA,[25] and the applicant itself.[26]

The applicant has failed to adequately assess the impacts of generating radioactive waste. First, the EIR does not assess the cumulative impacts of generating radioactive waste, in violation of EIA Regulation 31(2) (l). The impacts of the waste to be generated by Nuclear-1 must be analysed in light of the waste already generated by Koeberg Nuclear Power Station and in addition to other existing environmental stresses in the proposed sites.

Second, the EIR does not adequately analyse the nature, extent, duration, and probability of waste impacts and the degree to which they may cause irreversible damage. The EIR merely classifies each identified potential impact (such as water contamination) as "low," "medium," or "high," without any explanation as to the content of those labels and how it arrived at those conclusions. Such an "impact assessment" is meaningless and results in an incomplete EIR.

Third, the EIR does not assess the economic consequences of long-term waste disposal and storage. Economic impacts are probably the most far-reaching potential impacts of waste management, as the consequences of waste extend to future generations and radioactive emissions can continue to thousands of years,[27] and the costs of constructing high level waste facilities are exorbitant. The proposed Yucca Mountain high level waste repository in the U.S. was estimated in 2006 to cost $23 billion, a 342% increase over the original estimate in 1984 (accounting for inflation).[28] The costs of permanent high level waste disposal is an extremely significant impact of nuclear waste; failure to mention such huge-scale impacts violates EIA Regulation 31(2)'s requirement that an EIR contain all information necessary for the authority to make a decision and PAJA's requirement that all relevant information be presented to the decision maker (sic).

Fourth, and most alarmingly, the EIR has failed to identify the overheating of spent fuel rods as a potential impact of storing high level nuclear waste. The EIR proposes to store high level waste temporarily in spent fuel pools on-site.[29] These spent fuel pools pose grave safety risks because in the event of an accident, the rods could overheat, releasing radioactive gases and potentially causing a meltdown.[30] Overcrowding in spent fuel pools also poses risks as the pools become hotter and more radioactive.[31] The risk of overheating pools is particularly salient and urgent in light of the Fukushima nuclear disaster, in which a spent fuel pool overheated at Reactor No. 4 after cooling systems were knocked out by the earthquake and tsunami.[32] Indeed, the head of Areva's North American unit, Jacques Besnainou, stated, "One of the things we're discovering in Fukushima is leaving used fuel in a spent fuel pool may not be a very wise decision."[33] Overcrowding is also a present danger, as the spent fuel rods at Koeberg have been re-racked to extend their operating

[23] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1.

[24] Revised DEIR App D8 Combined IRR Volumes Final at 157–186.

[25] Letter from Ms. Joanne Yawitch, Deputy Director General of Environmental Quality and Protection, DEA, to Mr. Tim Liversage, Arcus Gibb (Nov. 19, 2008) (laying out conditions under which the scoping report was to be accepted, which included assessment of nuclear waste).

[26] Revised DEIR, Chapter 9, Impact Analysis 9.29 and APP E29.

[27] *See* Revised DEIR, APP E29 Waste Assessment 5.2.2;

[28] *See* Marvin Resnikoff et. al., *The Hazards of Generation III Reactor Fuel Wastes: Implications for Transportation and Long Term Management of Canada's Used Nuclear Fuel*, GREENPEACE CANADA 35 (May 2010), *available at* http://www.greenpeace.org/canada/Global/canada/report/2010/5/nuclear/GP_REACTOR_FUEL_REPORT_MAY2010.pdf.

[29] Revised DEIR APP E29 Waste Assessment 5.5.2.

[30] *See* Union of Concerned Scientists, Nuclear Power, Safer Storage of Spent Nuclear Fuel, at http://www.ucsusa.org/nuclear_power/nuclear_power_risk/safety/safer-storage-of-spent-fuel.html (last accessed 8 July 2011).

[31] Robert Alvarez, *Spent Nuclear Fuel Pools in the U.S: Reducing the Deadly Risks of Storage, Institute for Policy Studies* (May 2011), available at http://www.ips-dc.org/reports/spent_nuclear_fuel_pools_in_the_us_reducing_the_deadly_risks_of_storage [last accessed 21 July 2011].

[32] *E.g.*, Hiroko Tabuchi et al, "Spent Fuel Hampers Efforts at Japanese Nuclear Plant," N.Y. Times (March 23, 2011) at A14.

[33] *Update 2 –Areva Sees U.S. Nuclear Waste Recycling Planning by '15*, REUTERS AFRICA (June 6, 2011).

capacity.[34]

The response to this issue when raised at the Final Draft Environmental Impact Report stage was, "The impacts of handling and storage of radioactive waste is a matter that is firmly within the ambit of the NNR and the newly established National Radioactive Waste Disposal Institute."[35] However, the EIA Regulations clearly list the "construction of facilities or infrastructure for . . . the **storage and disposal of nuclear fuels**" as an activity requiring an EIA[36] and thus also within the ambit of NEMA. The response goes on merely to repeat that no solution has been found for long-term storage of high level waste and that it will be stored indefinitely onsite, unresponsive to any of the issues above.

It is further submitted that just as it is impossible for the applicant to assess socio-economic and worst-case impacts in the absence of a final design,[37] it is also impossible to assess waste impacts in the absence of one. The impacts of radioactive waste will vary depending on the composition of the waste, which depends on the type of fuel used and burnup rate, which in turn depend on the reactor design. The cursory categorisation of potential waste impacts (such as contamination of water) as "low," "medium," or "high," without any explanation as to how it may affect the environment, public health, and agriculture, is unlawful but also unsurprising given that the composition of the waste is unknown.

Response 6:

Cumulative impacts of nuclear waste

The Revised Draft EIR indicates that both Low-Level Waste (LLW) and Intermediate-Level Waste (ILW) would be disposed at the Vaalputs nuclear waste disposal site and that there is more than sufficient capacity to accept these wastes from a power station of the capacity of Nuclear-1. Thus, from a cumulative impact perspective, there would be no cumulative implications for Nuclear-1.

In terms of the storage of on-site storage of High-Level Waste (HLW), the physical separation of the Nuclear-1 power station from Koeberg Nuclear Power Station (KNPS) and the secure design of the storage facilities would ensure that there is no cumulative radiological impact. Cumulative impact is determined by the effective radiological dose to the environment, not by the number of power stations.

The current public dose limit (1 mSv per annum) is a legal limit applied internationally for the protection of human health from exposure to ionizing radiation. This is regulated in South Africa by Regulation 388 of April 2006. Also included in this Regulation is the concept of a dose constraint. Internationally the dose constraint (not a limit) varies between 0.1 and 0.3 mSv per annum. In South Africa it is 0.25 mSv per annum, although the dose constraint could be changed to a higher constraint as part of negotiations between the operator and NNR, at least in principle. Its application is such that a constraint of say 0.25 would be imposed on the KNPS, with a constraint of 0.25 for the next nuclear power station, and 0.25 for the next. In this way in principle up to four nuclear power stations in the area can be established, each with a constraint of 0.25, but the limit of all contributors will still be below 1 mSv per annum. Thus the effective cumulative radiological impact would remain the same as for the KNPS.

Furthermore, effective radiation as a result of the cumulative storage of greater volumes of spent fuel in spent fuel pools does not increase. The water in the spent fuel pool acts as a shield, even though the inventory of spent fuel elements increases the effective dose does not increase. There are effective controls to ensure that the radiation dose stays within the limits. Therefore environmental radiation levels do not increase as greater volumes of spent fuel are stored on site.

Assessment of nuclear waste impacts

The Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR) goes to some length to describe the built-in controls that are applied to mitigate the impacts of nuclear waste, including the ways in which LLW is contained in sealed metal drums, the encapsulation of ILW in concrete drums and the wet and dry storage mechanisms for spent fuel (High-level Waste). Given these controls, it is reasonable to come to the conclusion that the environmental impacts of the management of these wastes will be limited.

[34] Nuclear Waste, NECSA, at http://www.necsa.co.za/Necsa/Nuclear-Technology/Nuclear-Waste-442.aspx [last accessed 21 July 2011].
[35] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 8.
[36] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Listing Notice 2, Appendix 1.
[37] See discussion *supra* p. 4.

The meanings of the various impact assessment criteria are explained in Chapter 7 of the Revised Draft EIR.

Economic consequences of nuclear waste management
Section 3.2.1.3.5 of the Economic Impact Assessment indicates the costs associated with the transport of waste from the proposed alternative Nuclear-1 sites to the Vaalputs nuclear waste disposal site.

Economic consequences and burden on future generations
As explained by Eskom during public participation meetings for the Nuclear-1 EIA, the cost of high-level waste storage on site is considered to form part of the operational costs of the power station.

Your comment regarding the consequences of nuclear waste management extending to future generations refers. It is indeed true that nuclear waste endures and has to be managed by future generations. However, intergenerational impacts are not unique to nuclear waste and are intrinsic to all forms of waste disposal. All forms of waste disposal, including general waste disposal, is in fact a form of long-term storage. The waste never disappears, it is simply stored indefinitely. Even conventional waste sites are characterised by long-term environmental issues such as methane production and leachate management, which need to be managed by future generations. Thus, inter-generational impacts are not unique to nuclear projects and the fact that intergenerational impacts are involved in nuclear generation does not imply that other forms of generation are free of these impacts or that they provide a risk-free alternative to nuclear. In conclusion, the fact that nuclear electricity generation can result in inter-generational impacts is not an effective argument for nuclear generation to be prohibited, as it would imply that many other commonplace human endeavours (all of which produce waste and therefore also impose burdens on future generations) also need to be rejected.

A more important consideration than whether intergenerational impacts are caused is whether these impacts can be responsibly managed. International and South African experience with management of nuclear waste suggests that it can be responsibly managed without long-term detrimental effects. It is interesting to note that commonplace open sources of radioactivity such as gold mine dumps around Johannesburg are generally accepted as a part of the landscape but that radioactivity contained within purpose-designed shielded structures and disposal of nuclear waste in properly designed containers in a purpose-designed facility at Vaalputs is questioned.

Overheating of spent fuel rods
It is an international practice that the spent fuel from the reactor core is in the spent fuel pool filled with water for periods up to 15 to 20 years or up to full capacity of the spent fuel racks before it is transferred into the metal or concrete casks. Spent fuel pools are designed to internationally accepted standards to ensure safety of public, workers and environment, and in line with the principle of defence-in-depth, they have multiple redundant protective barriers to ensure that failure of one barrier does not result in undue radiation exposure of the public. They are operated by trained personnel according to approved procedures. In an unlikely event of an incident, safety analysis studies prove that no member of the public, workers or environment will be exposed to undue risk (which is more than what is internationally accepted).

Parameters that are critical to nuclear safety are monitored on a regular basis and the safety functions are also tested regularly. Some of the critical parameters that are monitored include boron concentration, the temperature and the water levels of the spent fuel pools.

Ability to assess waste impacts in the absence of a detailed design
The forms of nuclear waste that are generated, its potential impacts on human health and the environment and mitigation and management measures to control and avoid such impacts are well known and are not dependent on a detailed design. As such, the Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR) provides a sufficient assessment of the impacts on nuclear waste generation and management.

Comment 7:

5. **Failure to adequately assess project alternatives and a no-go option violates NEMA and the EIA Regulations, read together with PAJA 6(2)(b), and places false information in front of the decision maker** (sic) **in violation of PAJA 6(2)(e)(iii).**

Regulation 31 of the EIA Regulations requires an assessment and comparison of potential alternatives

to the proposed activity.[38] "Alternatives" is defined in the Regulations as "different means of meeting the general purpose and requirements of the activity, which may include alternatives to the type of activity to be undertaken and the option of not implementing the activity."[39] NEMA s 24 also requires every application for an environmental authorisation to include an investigation of alternatives to the activity, including the option of not implementing the activity.[40] The duty of the applicant is to submit "all information necessary for the competent authority to consider the application and reach a decision,"[41] and the duty of the decision maker (sic) is to then choose the "best practicable environmental option,"[42] the one that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term."[43]

Guidelines from the U.S. Nuclear Regulatory Commission (NRC) prove helpful in interpreting what it means to assess alternatives and the option of not implementing the activity (no-go option). NRC guidance calls for investigating alternatives to meet the energy demand that do not require building new capacity, such as purchasing from another utility or initiating energy conservation measures that would avoid the need for the plant.[44] It also calls for consideration of several other energy sources, including wind, geothermal, hydropower, and solar, even if they are considered non-competitive options.[45]

The Revised DEIR has not adequately assessed project alternatives and the no-go option. The EIR simply lists some energy sources in a table,[46] without any analysis of their impacts or the significance of those impacts, and cites the lack of base load capacity as justification for not evaluating other energy sources. Missing from Eskom's analysis is an investigation of ways to meet energy demand without generating new capacity or ways to generate the shortfall from other sources. In other words a true comparison of the various alternatives. With regard to the no-go option, the EIR simply states that the no-go alternative is not a feasible or realistic alternative,[47] despite the fact that the government included a no-nuclear scenario in the IRP2 that is cost-effective and provides security of supply.[48]

The report's conclusions about project alternatives and the no-go option not only violate substantive requirements to assess them under NEMA and the EIA Regulations but are also inaccurate. The finalised Integrated Resource Plan (IRP2) included no-nuclear scenarios that are cost-effective and provide security of supply.[49] Thus, the IRP2 shows that base load is not an issue in pursuing a nuclear-free energy plan. In addition, the IRP2 stated that after taking into account the fact that new energy technology costs would decrease over time and that nuclear would be 40% more expensive that originally projected, the cost-optimal output from the model did not include nuclear at all.[50] Thus, not only is a no-nuclear scenario feasible and secure, it is actually the most cost-effective option.

The applicant has not only failed to assess project alternatives and a no-go option, but has inaccurately concluded that alternatives and a no-go option are simply not viable. In addition to violating substantive provisions of NEMA and the EIA Regulations, the applicant here has put irrelevant information in front of the decision maker (sic) in violation of PAJA 6(2)(e)(iii), and any decision taken on the basis of such information will be unlawful.

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[38] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2(g), (i).
[39] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 1, s 1, subsec 1.
[40] NEMA s 24(4)(b)(i).
[41] EIA Regulations 2010, GNR 543 GG 33306 of 18 June 2010, Chapter 3, s 31, subsec 2.
[42] NEMA s 2(4)(b).
[43] NEMA s 1 (definition of "best practicable environmental option").
[44] *See* Environmental Protection Agency, Office of Enforcement and Compliance, EPA Publication 315-X-08-001, § 309 Reviewers Guidance for New Nuclear Power Plant Environmental Impact Statements (Sept. 2008) at 14.1.1, 14.1.2, available at http://epa.gov/compliance/resources/policies/nepa/309-reviewers-guidance-for-new-nuclear-power-plant-EISs-pg.pdf (last accessed 18 June 2011).
[45] *Id.*
[46] Revised DEIR, Chapter 5, Project Alternatives, 5.3.1 Nuclear Generation Alternatives.
[47] Revised DEIR, Chapter 9, Impact Analysis, 9.33.12.
[48] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.
[49] Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at p. 18, 6.9.1, 6.9.4 ("If new renewable generation capacities should fail to reach their forecast performance in terms of full-load hours, this will increase total costs. It will, however, not affect other dimensions like security of supply, since solar PV is completely backed up with conventional, dispatchable generation and wind power is backed up to a large extent."); *id.* at p. 39, B.30.
[50] *See* Integrated Resource Plan for Electricity 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–39, paras. B.23, B.25, B.27, B.30.

Further, the report suggests that Eskom has usurped the role of the decision maker (sic), deciding for itself which option is best and that the no-go option is not a viable one. Removing options from consideration also precludes the decision maker (sic) from choosing the best practicable environmental option as required by NEMA.

When this issue was raised at the Final Draft Environmental Impact Report stage, applicant asserted that the IRP2, which chose to commit to 9600MW of nuclear, obviates any need to investigate alternative forms of power generation and the no-go option in the EIR because it has already established the optimal energy mix.[51] However, such rigid adherence to policy in making an administrative decision fetters the decision maker's (sic) discretion in violation of PAJA. While policies in keeping with the empowering legislation may be used to assist decision making (sic), they may not inevitably determine the outcome of the decision, lest they "preclude the person exercising the discretion from bringing his mind to bear in a real sense on the particular circumstances of each and every individual case coming up for decision."[52]

The IRP2 includes feasible no-nuclear scenarios[53] that are cost effective and provide security of supply, showing that the decision to pursue nuclear energy is not an inevitability but a policy decision. The applicant, however, falsely asserts that the no-go option is not viable and attempts to hide behind policy (the IRP2) to bypass the statutory requirements of NEMA.

Response 7:

Your comments are noted.

We reiterate our response that the environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a specific power station on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa's electricity needs. This is especially the case in the instance of the Nuclear-1 application, where the government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades. The conclusion of the IRP process, as you have stated, is that nuclear technology must form a part of the mix generation technologies. The EIA process, which is a project-specific environmental management tool, does not have any mandate to revisit the strategic analysis of power generation alternatives that was completed in the IRP.

It is indeed true that the IRP II included a scenario excluding nuclear generation, since several different alternatives of different generation mixes were considered. However, the fact the "no-nuclear" options was considered does not imply that this scenario is the most feasible or desirable alternative. It was simply one of a number of scenarios considered. The recommended option of the three considered in the IRP was to commit to a fleet of nuclear power stations. As indicated in the IRP, "*This should provide acceptable assurance of security of supply in the event of a peak oil-type increase in fuel prices and ensure that sufficient dispatchable base-load capacity is constructed to meet demand in peak hours each year*". Therefore, the IRP's conclusion, in the interests of security of supply, is that a no-nuclear scenario is not desirable.

The EIA process, which is a project-specific environmental management tool, does not have a mandate, neither is it equipped to revisit the strategic analysis of power generation alternatives that was completed in the IRP.

It must also be borne in mind that Nuclear-1 will generate a maximum of 4,000 MW of the 40,000 MW of new generating capacity that needs to be developed by 2025 and that the Integrated Resource Plan (IRP) II identifies the need for 9,600 MW of nuclear generation, whilst requiring the development of 18,000 MW of renewable energy. Thus, the development of nuclear generation is not being undertaken to the detriment or to the exclusion of renewable electricity generation.

[51] Revised DEIR, APP IRR 45a Long Submission ELA Final, at 19–20.
[52] *Richardson v Administrator, Transvaal* 1957 (1) SA 521 (T) at 530.
[53] Integrated Resource Plan for Electricty 2010–2030, GNR 400 GG 34263 of 6 May 2011, at 38–45.

Lastly, to expect the Environmental Assessment Practitioner to undertake a detailed analysis of the environmental merits of various electricity generation technologies would require not only the overturning of the administrative decision that the DEA has taken to approve the Nuclear-1 Scoping Report (and the alternatives that were proposed to be assessed), but would also require a full life-cycle assessment of the various generation alternatives – something which an EIA as a project-specific environmental management tool is not equipped to do.

Comment 8:

6. General failure to place relevant considerations in front of the decision maker violates PAJA 6(2)(e)(iii).

Failures to assess socio-economic impacts, worst-case scenario impacts, waste impacts, a no-go option, and project alternatives, in addition to violating substantive provisions of NEMA and the EIA Regulations, also amount to withholding relevant information from the decision maker (sic) in violation of PAJA 6(2)(e)(iii).

Because of NEMA's repeated emphasis on the integrated nature of environmental management, the socio-economic impacts of the NPS (most notably the impact on electricity prices and the economic fallout from a disaster) is relevant information that must be brought before a decision maker (sic). Because NEMA places such a high premium on minimisation of impacts and investigation of mitigation, a worst-case scenario analysis is also clearly relevant information, as it will bring to light the full extent of potential impacts and all possible safety measures.[54] Because of NEMA's life cycle and intergenerational provisions, waste impacts are also relevant. Assessment of project alternatives and a no-go option are relevant because NEMA and the EIA Regulations have specified them as such.[55] Any approval made without such information will be one in which relevant factors were not considered.

Response 8:

Your comments relating to the preceding points are noted. Our responses to these issues are included in Responses 1 to 7.

Comment 9:

7. Approving the NPS in the absence of a long-term solution to the problem of high level nuclear waste is unlawful.

This EIR acknowledges that no long term solution currently exists for the disposal of high level nuclear waste.[56] Storage of high level waste in spent fuel pools, which the applicant proposes to do, is only an interim solution[57] and one whose safety has been questioned in the aftermath of the Fukushima disaster. The Waste Assessment makes no projection of the costs of this interim storage or any mention of research and development that will be invested in finding a solution.

Approving such a project will violate NEMA's life cycle[58] and intergenerational provisions.[59] Without knowing the project's full life cycle consequences or the costs of long-term waste storage, the decision maker (sic) will be unable to determine whether the applicant is able to bear responsibility for the project throughout its life cycle (because it is unknown) and whether the project will pose an undue burden on future generations.

Approval will also violate international standards, which state that no "undue burden" be placed on future generations[60] and every country should have a national policy and strategy in place for the management of radioactive waste.[61] While the Revised DEIR refers to the National Radioactive Management Policy and Strategy of 2005 and the National Radioactive Waste Disposal Institute Act of

[54] *See supra* Section (b)(ii) at p. 13–15 & n. 30.
[55] NEMA s 24(b)(ii); EIA Regulation 31(g), 1 (definition of "alternatives").
[56] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6; Revised DEIR APP E29 Waste Assessment, 2.2.10.
[57] National Radioactive Waste Management Policy and Strategy (2005) at 13.1.
[58] NEMA s 2(4)(e).
[59] NEMA s 1 (definition of "sustainable development").
[60] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 4, Principles for Establishing a Policy and Strategy, at 8 (2009).
[61] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 1, Introduction, at 3 (2009).

2008, such policies do not meet international best practice as they do not identify the ultimate disposal end point for high level waste.[62] The National Radioactive Management Policy and Strategy does not identify an ultimate disposal end point, merely stating that "Government shall ensure that investigations are conducted within set timeframes to consider the various options for safe management of used fuel and high level radioactive wastes in South Africa."[63] The National Radioactive Waste Disposal Institute Act also does not provide a long-term solution; its purpose is limited to establishing an agency to manage radioactive waste,[64] which the Revised DEIR acknowledges has not yet been formally constituted.[65]

Response 9:

Your comments are noted.

Internationally, with a few exceptions such as the emerging development of geological storage, long-term storage of spent fuel on the site of the nuclear power station is accepted as a safe practice and is bound by strict controls that prevent radiation from escaping into the environment. This practice has been shown to be safe in the more than 20 years of operation of the KNPS. Your opinion that failure to identify an alternative long-term disposal solution is unlawful would imply that all international experience with the on-site storage of storage of spent fuel is also illegal.

Your comment on the questions that have arisen around interim storage of spent fuel in fuel pools on site after the Fukushima Daiichi incident refers. One of the major differences between the design of the Fukushima Daiichi power station and later power stations in terms of spent fuel storage is that the Fukushima design includes the spent fuel pool in the containment structure, whereas in later designs (e.g. at Koeberg Nuclear Power Station), the spent fuel pool is separate from the containment structure and contamination in the containment structure does not impact access to, and operation of, spent fuel cooling systems. Several other major differences in nuclear power station design and operation have been implemented in the decades since Fukushima was built and the lessons from Fukushima are being incorporated into new nuclear power station designs.

Your comment regarding life-cycle and inter-generational impacts refers. Please refer to our Response 6 in this respect. We repeat that the purpose of a EIA process is not to investigate the full life-cycle impacts of the proposed project. Nevertheless, it is untrue to say that the life cycle impacts of nuclear electricity generation are unknown, since nuclear electricity generation has been practiced for several decades both South African and there is extensive international experience of the management of long-term on-site storage of high level waste.

Your comments regarding the National Radioactive Management Policy and Strategy of 2005 and the National Radioactive Waste Disposal Institute Act of 2008 are noted.

The absence of the identification of a final destination for High-Level Waste (HLW) refers. You seem to infer no HLW should be produced until such time as a long-term strategy is in place, in spite of the fact that long-term storage on site is regarded to be a safe method of long-term storage. A parallel can be drawn with strategies for the disposal of other forms of waste. Prior to 2011, with the publication of South Africa's National Waste Management Strategy, no formal national strategy was in place to provide for responsible waste management. Currently, several of the larger general and hazardous waste disposal sites are reaching the end of their operational lives, and no guaranteed solution has yet been found for their expansion or for the creation of new disposal sites, although it is assumed that solutions to these problems have to be found in future. As indicated in Response 6, management of these wastes is just as unsustainable as the management of nuclear waste, in that the waste never disappears – it is simply stored indefinitely. In spite of the vacuum in waste management strategy prior to 2011, there was never a suggestion that South Africa should simply suspend the generation of general or hazardous waste until this strategy was in place. However, as far as nuclear waste is concerned, you have insisted that a final solution needs to be found before society can accept the risks associated with the storage of this waste. This is in spite of proven safe storage mechanisms that exist for long-term on-site storage of nuclear waste.

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[62] International Atomic Energy Agency, *Policies and Strategies for Radioactive Waste Management*, Chapter 11, Strategy Formulation and Implementation, at 41 (2009) ("If long term storage is considered within the strategy, the ultimate intended disposal end point should nevertheless be indicated.").

[63] Radioactive Waste Management Policy and Strategy for the Republic of South Africa, Department of Minerals and Energy, at 13.1 (2005).

[64] National Radioactive Waste Disposal Institute Act 53 of 2008.

[65] Revised DEIR, Chapter 9, Impact Analysis, 9.29.6.

Comment 10:

8. Approving the NPS in the absence of a final project design is unlawful.

Eskom has chosen to conduct an EIA before settling on a plant type and admits that "detailed descriptions of the proposed plant are not available."[66] Thus, it has decided to assess a generic nuclear power station design for the EIA process,[67] using an "envelope" of data that includes the "highest possible values for various aspects for a range of different nuclear technology vendors,"[68] including Generation III reactors.

While the EIA regulations do not explicitly require a project design as part of the application,[69] one is necessary in order to meaningfully fulfill (sic) its requirements. Without one, it is impossible to specifically and accurately assess the impacts the development will have on the surrounding environment. Absence of a final design precludes a proper impact assessment of not only socio-economic, worst-case, and waste impacts but of all impacts. Mitigation and safety measures, in turn, are also vague and based on inadequate information. Further, a meaningful choice cannot be made between the three proposed sites on the basis of such scanty information.

The pointlessness of conducting an EIA without first deciding on a project design is evident from the superficial treatment given to potential impacts and mitigation measures throughout the Revised DEIR.[70] Even where proposed measures are more detailed, such as the emergency planning zones (EPZs),[71] without a final design it is unclear how such measures were determined and whether they are justifiable. An EIR of such scanty analysis amounts to a failure to assess impacts and investigate mitigation measures as required by the EIA Regulations and NEMA.

In addition, such an inadequate EIR will constitute a grand failure to place relevant factors in front of the decisionmaker (sic). If the regulator does not get specific, meaningful analysis on the potential impacts of the NPS in each proposed site, he or she will be unable to choose the right site or proper levels of mitigation. Any authorisation based on this EIR will be an unlawful one, as none of the factors identified as relevant under NEMA and the EIA Regulations have been properly assessed. Insofar as the lack of a project design precludes adequate assessment of impacts and mitigation measures, conducting an EIA before choosing a design is premature.

Response 10:

Your opinion is noted.

It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known, it is not necessary to know the brand name of the technology. In similar vein, the Nuclear-1 application is based on a number of different designs from different potential vendors. Thus, whilst it is true that the specific vendor and design for Nuclear-1 has not been identified, the Nuclear-1 Consistent Dataset (Appendix

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[66] Revised DEIR, Chapter 3, Project Description 3.5.

[67] *Id.*

[68] Revised DEIR, Chapter 9, Impact Analysis, Assumptions 9.2.2.

[69] Compare UK regulations, which require environmental statements to contain "a description of the development comprising information on the site, ***design***, and size of the development." Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, Regulation 2(1) (definition of "environmental statement") & Schedule 4, Part II (1) (emphasis added).

[70] *See, e.g.*, Revised DEIR, Chapter 9, Impact Analysis, Impacts on Flora and Ecosystem Functioning, Duynefontein, 9.10.1(a) ("the primary dunes ***may*** be impacted, ***depending on what coastal setback is created***") (emphasis added); Revised DEIR, APP E29, Waste Assessment, 8.2, 8.3, 8.4, Table 8-1 (superficial assessment of the impacts of radioactive waste, without any explanation as to how it came to its conclusions); Revised DEIR, Chapter 9, Impact Analysis, Impacts of Nuclear and non-nuclear waste, Mitigation 9.29.7 ("high level waste management system must be designed to safely manage and hold all high level waste and spent fuel"); Revised DEIR, Chapter 9, Impact Analysis, Impacts on Terrestrial Vertebrate Fauna, Mitigation, 9.13.5 ("reduce number of roads and tracks and place them carefully").

[71] Eskom has proposed emergency planning zones of 800m and 3km, based on little more than an assertion that Generation III nuclear reactors possess enhanced safety features despite the fact that they are just beginning to enter the market and do not yet have a proven track record. *See* Revised DEIR Chapter 9, Impact Analysis, Limitations 9.2.1 & Emergency Response 9.23.

C of the Revised Draft EIR) identifies the inputs and outputs of the proposed power station from a "basket" of commercially available Generation III nuclear power stations.

It may be appropriate to explain the envelope of criteria in colloquial terms, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel efficiency, type of tyres and wheels, fuel tank size, CO_2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBS. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would not qualify. Similarly, if a vendor proposes a power station design that fails to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration.

Furthermore, nuclear power generation technology has been in use for several decades, and more specifically with respect to the proposed Nuclear-1 power station, Pressurised Water Reactors (PWRs) are in common use internationally and the experience with the operation of the KNPS is available in South Africa. Nuclear-1 EIA specialists have referred to the KNPS experience, including information from the monitoring of its environmental impacts that has been collected in the more than two decades of its operation. With reference to these examples, it is certainly possible on a generic level to predict the impacts of a nuclear power station and on a project-specific level to predict the environmental impacts of a proposed nuclear power station with an output of 4,000 MW.

Your statement that it is impossible to make a meaningful choice between the three proposed sites based on the available information refers. The choice between sites is dictated to a greater extent by the characteristics and sensitivity of the sites than by the specifics of the nuclear technology. Detailed assessments of the site conditions have been undertaken and therefore it is certainly possible to determine the environmental sensitivity of the different sites and to identify specific areas within each site that are suitable or unsuitable for construction of a nuclear power station.

Comment 11:

9. The Thyspunt site is not a viable one for the Nuclear-1 project.

The Revised DEIR identifies Thyspunt as the preferred site for Nuclear-1,[72] despite the fact that the Heritage Impact Assessment concluded that Thyspunt has exceptional archaeologic, palaeontologic, and wilderness value[73] and presents excessive difficulties for mitigation[74] and that the South African Heritage Resource Agency has uncategorically recommended that Thyspunt is not a suitable site for development.[75] Dr. Binnerman, an archaeological expert states that, "The archaeology of the coastal zone (5 km inland from the coast) is well-known and has been investigated in some detail by the author in the past. Heritage practitioners also conducted surveys along the adjacent coast for the proposed ESKOM Nuclear Power Station at Thyspunt. These studies indicate that the coastal zone from the Klasies River in the west to the Krom River in the east is one of the richest and most important archaeological cultural landscapes in South Africa."[76]

The Heritage Assessment repeatedly emphasizes the impossibility of constructing Nuclear-1 without extensive, irreversable (sic) impacts on heritage at Thyspunt.[77] Yet the EIA largely ignores this, recommending that Thyspunt be the preferred site. Despite the Heritage Assessment's unequivocal warnings that mitigation at Thyspunt is highly infeasible,[78] the Revised DEIR has included a "Heritage Mitigation Study" proposing a trial excavation in the Thyspunt site. The Heritage Assessment states that the archaeological preference is to preserve conservation *in-situ*, yet the EIA suggests a parallel system of construction of the nuclear station and excavation instead.[79]

As the projects stands currently, it may not go forward before Eskom has carried out its own proposed trial excavation to explore unknown aspects of the Thyspunt site to determine if there is an area where

[72] Revised DEIR, Executive Summary.
[73] Revised DEIR, APP E20, Heritage Impact Assessment 4.3.
[74] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).
[75] Revised DEIR, APP E20, Heritage Mitigation Study, Introduction 1.
[76] Dr. Johan Binnerman, An Archaeological Desktop Study for the Construction of the Proposed Tsitsikamma Community Wind Energy Facility, Kouga Local Municipality, Humansdorp District, Eastern Cape Province (March 2011).
[77] Revised DEIR, APP E20, Heritage Impact Assessment 3.1.1; 3.2.9; 3.2.10; 5.1.3.
[78] Revised DEIR, APP E20, Heritage Impact Assessment 4.3; 5.1.3; 5.2.2 (c).
[79] Revised DEIR, APP E20, Heritage Impact Assessment 5.1.2; Heritage Mitigation Study 1.1.1.

the development footprint will result in fewer impacts. However, the suitability of Thyspunt as a site for Nuclear-1 will not change whether something is found in the trial excavation or not because the value of Thyspunt lies in both its cultural heritage and high biodiversity – even if the NPS is built in an area of relatively fewer archaeological sites, it will still destroy the landscape and wilderness qualities of the area.[80] Further, cultural heritage as understood under the NHRA is not limited to artifacts and other physical vestiges of human society; rather, it is a holistic concept, encompassing all the relationships that existed within a certain geographical area.[81] As the HIA states, "The landscape, together with the archaeological sites it contains may be viewed as a single holistic entity, which retains the spatial patterning of human use of the landscape in a largely intact natural coastal environment that has not changed significantly since prehistoric times."[82] Thus, any approval of the project will be an unlawful administrative decision in violation of the National Heritage Resources Act s 5, NEMA s 2(4)(a)(iii) and PAJA s 6(2)(e)(iii) & (h).

A project approval at Thyspunt would also violate international law. Given that the Thyspunt site qualifies as a "cultural landscape" under the UNESCO World Heritage Convention, the state now has an obligation, under Article 4 of the treaty, to ensure "the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 to the utmost of its own resources and, where appropriate, with any international assistance and co-operation, in particular, financial, artistic, scientific and technical, which it may be able to obtain." Article 5 also require each State party to "take the appropriate legal, scientific, technical, administrative and financial measures necessary for the identification, protection, conservation, presentation and rehabilitation of this heritage."

In addition to violating several statutes, pursuing the Thyspunt site also presents practical difficulties. The rich palaeontological and archaeological record at Thyspunt would require a large-scale scientific dig over the period of decades, far longer than during the proposed construction of the nuclear power station. A similar scope would be Klassies Rivers Mouth, which has been under continuous archaeological examination since 1960.[83]

Response 11:

At the time of the release of the Revised Draft EIR and the Heritage Impact Assessment (Appendix E20 of the Revised Draft EIR) for comment there was uncertainty about the occurrence of additional archaeological sites within this central area of vegetated dunes. However, in the time since the Revised Draft EIR was released for public comment, the additional test excavations have been conducted at the Thyspunt site. These excavations were done under authority of SAHRA through a permit for test excavation. The finding of these test excavations is as follows (from the Revised Heritage Impact Assessment, which considers the test excavation results and which will be released for public comment with the next revision of the EIR):

"*The potential for destruction of Late Stone Age middens will be particularly acute with respect to areas within 300 m of the coast and very much less acute further inland in the vegetated dune areas. The location of the facility will be a key factor in determining the extent to which impacts will occur. Any facilities placed within 200 m of the rocky shoreline or crossing the rocky shoreline will result in impacts. However, if a site were to be selected adjacent to Thysbaai beach, or within the vegetated dunes as proposed, the degree of impact will be greatly reduced as Late Stone Age middens tend to be more common adjacent to rocky shores, and in areas where there are surface water sources."* This study found that archaeological sites are concentrated close to sources of fresh water, which occur at the Thyspunt site along the coast (coastal seeps), in the mobile dune corridor in the northern portion of the site (inter-dune wetlands) and in the eastern portion of the site. The central vegetated dune portion of the site where power station has been recommended to be placed also happens to be the area where the least other environmentally sensitive features occur.

As indicated by the above quotation, the recommended position of the Nuclear-1 power station is within the vegetated dunes, which avoids the concentrations of archaeological sites in the coastal corridors. It is indeed a well-documented principle that archaeological material should, where possible,

[80] *See* Revised DEIR, APP 20, Heritage Impact Assessment 3.2.9, 3.2.10.
[81] *See* National Heritage Resources Act s 1 (definition of "living heritage"), s 3(2).
[82] Revised DEIR, APP 20, Heritage Impact Assessment 2.3.2(c).
[83] See Archaeology Case Studies, Klasies River Caves, Association of Southern African Professional Archaeologists, at http://www.asapa.org.za/index.php/archeaology/case_studies/about_archaeology_klasies_river_caves/ [last accessed 27 July 2011].

be conserved in situ. The findings of the test excavations confirm that the vast majority of the archaeological sites on the Thyspunt site can be conserved in-situ and that a small minority would need to be excavated.

The comments from the South African Heritage Resource Agency (SAHRA regarding the suitability of the Thyspunt site for Nuclear-1 are noted, however additional test excavations at Thyspunt that were approved by the South African Heritage Resource Agency and conducted in 2011 (after the release of the Revised Draft EIR Version 1), have confirmed that the heritage sites in the recommended footprint of the power station at Thyspunt are few in number and of low quality. This implies that direct impacts on heritage resources can be mitigated. It is important to note that no formal application has yet been lodged with SAHRA for the excavation of the site and that any statement by SAHRA in this respect is therefore premature, since not all the facts in respect of an archaeological excavation permit have been placed at SAHRA's disposal.

Your statement that development at the Thyspunt site would violate international law refers. It is an opinion expressed by the heritage specialist that this site may qualify for listing as a World Heritage Site. Whilst this is a noteworthy conclusion, the site currently has no World Heritage Status and it would need to be nominated by South Africa and accepted by UNESCO prior to such status being applied under South Africa's World Heritage Convention Act, 1999 (Act No. 49 of 1999). Thus there is no current question of violation of any international law. It cannot be deduced that the expression of the heritage specialist's opinion in this regard necessarily implies that UNESCO would share the opinion that the Thyspunt site is of universal value to humankind. An opinion about violation of international law is therefore premature.

Your opinion about the practical difficulties of mitigating the heritage impact at Thyspunt refers. In this regard it must be pointed out that the revised conclusion of the Heritage Impact Assessment (HIA), based on the trial excavations undertaken during 2011, is different from the conclusions of the HIA that was included in the Revised Draft EIR.

The revised conclusions are: "*Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available. Some on site storage (a small museum) may be necessary*."

This contrasts with the previous conclusion: "*Mitigation without excessive impacts is going to be technically difficult to achieve due to the character of the site and difficulties with respect to accessibility*".

Comment 12:

Conclusion

It is submitted that the failure to properly assess the impacts referred to above create a real risk that if the project is authorized it will infringing (sic) the environmental rights of both present and future generations. Further, the revised draft environmental impact assessment report does not place all relevant information that could materially influence the decision maker before it, and therefore a decision to authorise the construction of a nuclear power station based on this report would be open to legal challenge.[84]

Response 12:

Your comment is noted. Our comprehensive responses to each of the factors that contribute to your opinion are contained in the responses above.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 Team

[84] Section 6(2)(e)(iii) of PAJA Act No 3 of 2000.

05 August 2015

Our Ref: J27035/ J31314

Your Ref: CP Cullinan/lk/S59-001
Email received 08 August 2011

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Dear Thyspunt Alliance and its members, Mr Cullinan and Ms Kleynhans

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Please find our comments in terms of your submission below.

General

Submitted on behalf of:
The Thyspunt Alliance and its members

Prepared by:
Cormac Cullinan and Lia Kleynhans
Cullinan & Associates Inc

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

DEA	Department of Environment
DEIAR	Draft Environmental Impact Assessment Report
DSR	Draft Scoping Report
EAP	Environmental Assessment Practitioner (i.e. Arcus Gibb)
EIA	Environmental Impact Assessment
EIA Regulations	The NEMA Environmental Impact Assessment regulations, 2006 (GNR.385 of 21 April 2006)
EPZ	Emergency Planning Zone
Eskom	Eskom Holdings Limited (the Applicant for the environmental authorisation)
EUR	European Utility Requirements
HLW	High-Level (Radioactive) Waste
I&APs	Interested and Affected Parties
IRP2	Integrated Resource Plan 2
NEMA	National Environmental Management Act, 107 of 1998
NNR	National Nuclear Regulator
NNRA	National Nuclear Regulator Act 47 of 1999
NPP	Nuclear Power Plant
NSIP	Nuclear Site Investigation Program

Nuclear-1	The proposed nuclear power plant of up to 4000MW (megawatts)
PAZ	Pro-active Action Zone
PGA	Peak Ground Acceleration
PoS	Plan of Study for EIA
PWR	Pressurised Water Reactor
SECCP	Sustainable Energy and Climate Change Project of Earthlife Africa
SSHAC	Senior Seismic Hazard Advisory Committee
Thyspunt Response Executive Summary	Executive Summary of the Thyspunt Alliance Response to the Nuclear-1 Draft EIAR
UPZ	Urgent Protective Zone

TABLE OF CONTENTS

Comment 1:

1. INTRODUCTION

1. We represent the Thyspunt Alliance and its member organisations ("our client"). The comments submitted in this memorandum are in respect of the Revised Draft Environmental Impact Assessment Report ("revised DEIAR") and are submitted on behalf of the Thyspunt Alliance as a whole (and each of its members), each of which are interested and affected parties ("I&APs") in the environmental impact assessment ("EIA") process.
2. The comments in this memorandum must be read with:
   2.1. the more detailed comments on the revised DEIAR prepared by members of the Thyspunt Alliance which are attached as **Annex A**;
   2.2. the comments submitted on behalf of the Thyspunt Alliance and its members in respect of the draft Environmental Impact Assessment Report ("DEIAR") on 30 June 2010 which are still applicable; and
   2.3. the comments on the revised DEIAR submitted by Earthlife Africa and Greenpeace in response to the revised DEIAR, which are endorsed by the Thyspunt Alliance and its member organisations.

Response 1:

We take note of your comments.

Comment 2:

3. In preparing this response to the revised DEIAR we have taken account of the letter dated 30 June 2011 from Arcus Gibb, the environmental impact assessment practitioner in this matter ("EAP") to us which responds to the comments which we submitted on behalf of our client in respect of the first DEIAR. We have not responded in this document to each of the EAP's responses in that letter, but the absence of a response to any points made by the EAP should not be interpreted as a concession on our part that we accept the correctness of the response. On the contrary, unless otherwise indicated, the absence of a specific response to the EAP's comments indicates that we are of the opinion that our original arguments are still valid despite the response from the EAP.

Response 2:

We take note of your comments.

Comment 3:

4. This memorandum focuses on discussing new information and additional issues that were not dealt with in our previous comments on the first DEIAR. Additional studies undertaken on behalf of our client in respect of the proposed nuclear power station and associated infrastructure are attached to this memorandum. For ease of reference we have adopted the same format in this document as in our previous comments of 30 June 2010.

Response 3:

We take note of your comments.

Comment 4:

2. OVERVIEW OF COMMENTS ON REVISED DEIAR

5. The EAP has responded to the comments which we submitted in respect of the first DEIAR in a letter to us dated 20 March 2011 and by making minor revisions made to the original DEIAR. As appears from the more detailed comments set out below, neither we nor our client consider that the EAP has responded adequately to our previous comments. In our view, it would be unlawful for the Department of Environmental Affairs ("DEA") as the competent authority to grant an authorisation for the construction of a nuclear power plant ("NPP") on the Thyspunt site on the basis of the revised DEIAR.

Response 4:

We take note of your comments.

Comment 5:

6. The revised DEAIR continues to suffer from a number of defects, including:
   6.1. material gaps in the information required by decision-maker to make a properly informed decision;
   6.2. a failure to comply adequately or at all with mandatory legal requirements, including the requirements to assess the "no-go" option; to identify and assess feasible alternatives, and to identify and assess the potential environmental and socio-economic impacts of each alternative; and
   6.3. the application of inaccurate and misleading methods of evaluating the significance of the impacts identified and of comparing the relative methods of the three possible sites which produces the absurd result that the Thyspunt site has been identified as the preferred option despite the fact that the expert reports clearly indicate that it is the least suitable site from both an environmental and a heritage perspective.

Response 5:

We take note of your comments. Kindly substantiate your comments with respect to what you claim to be material gaps in information required by decision makers.

Kindly substantiate your comments with regards to legal requirements that you claim have not been assessed. The no-go alternative is not considered a feasible and reasonable alternative in this instance, given the current backlog in the construction of new electricity generation capacity and the requirement for an additional 40,000 MW of generation capacity by 2025. A mixture of generation options will be required, as indicated by the Integrated Resource Plan, and no single generation technology will be sufficient to cater for the expected increase in demand in its own. The Department of Environmental Affairs, the decision-making authority for this application, has accepted the reasonable and feasible alternatives that were identified for further assessment at the end of the Scoping Phase. All relevant environmental and social impacts has been assessed in detail in relevant specialist reports in Appendix E of the Revised Draft EIR.

The methodology for assessment of the impacts and for evaluation of the sites has been employed is transparent and has explained in Chapter 10 of the EIR. Each of the three alternative sites have different levels of impact significance related to different aspects of the environment. From a heritage perspective, the revised heritage impact assessment, which was completed after extensive supplementary fieldwork in 2011, confirmed that the level of impact in the proposed footprint of the power station at Thyspunt is very low. Given the concentration of heritage sites along the coastline and the very low incidence of such in the inland portion, the heritage impact of the proposed power station at Thyspunt will be lower than either Duynefontein or Bantamsklip. From a biophysical perspective, there are sensitive ecosystems on the larger Thyspunt property, but the proposed

power station has been positioned on site in such a way as to avoid these sensitive systems. Two of the most sensitive systems on the Thyspunt site are the mobile dunes (including the wetlands found within the dunes) and the wetlands, particularly the Langefontein wetland. The headland dune system has been avoided by placing the power station to the south of it and the Langefontein wetland has also been avoided. Wetland and groundwater modelling has confirmed that the water table that feeds the majority of the Langefontein wetland is not geo-hydrologically connected with the water table where the power station is to be built. This confirms that mitigation measures proposed to prevent drawdown of the water table in the Langefontein wetland during construction are feasible.

Comment 6:

3. MANDATES

3.1 Standard of care and precautionary approach

7. In our comments submitted in respect of the DEIAR (paragraphs 18-22), we indicated that the DEA must apply a high standard of care and adopt a strong precautionary approach when awarding environmental authorisations for NPPs. We asserted that this high standard has not been achieved in this EIA process. In its response letter to us dated 20 March 2011 the EAP stated that this conclusion was unfounded and unsubstantiated.
8. On the contrary, the comments which we submitted in respect of the DEIAR clearly substantiate that conclusion, for example by pointing to the gaps in information, the errors and inadequacies in various expert reports, the shortcomings in the public participation process etc.

Response 6:

Please refer to our response above regarding substantiation of your claims of inadequacies in reporting and gaps in information. The independent peer review of the EIR and the EIA process (Appendix H of the Revised Draft EIR) found no fatal flaws in the public participation process.

Comment 7:

3.2 Mandate of National Nuclear regulator

9. In its response letter to us dated 20 March 2011 the EAP responded to our comments submitted in respect of the DEIAR in relation to the relative mandates of the DEA and National Nuclear Regulator ("NNR") (see paragraphs 23 to 25 of our comments) by stating that the consideration of radiological issues will be assessed when Eskom applies for a licence from the NNR and that this application process could not be commenced until such a time as the design of the plant is confirmed.
10. We reiterate our view that the NEMA and the regulations made under it require that the environmental and socio-economic impacts of the radioactive emission, both operational and in emergencies, must be assessed as part of the EIA process.
11. The above statement by the EAP supports our view that information about the design of the NPP and the site layout is necessary in order to assess the potential environmental and socio-economic impacts of radioactive emissions. The fact that that information is not currently available merely indicates that the EIA process was commenced prematurely.
12. In our opinion the EAP's statement that it believes that the revised DEIAR provides information of the possible impacts in respect of the storage and handling of radioactive waste, emergency incidents and seismic reports in sufficient detail for the decision-maker to decide the matter lawfully[1] is a statement of misplaced optimism rather than of fact.

[1] Page 8.

Response 7:

We take note of your comments. As indicated in the EIR, the assessment of the impacts of the proposed power station is based on a Consistent Dataset (Appendix C of the Revised Draft EIR), which represents a worst case scenario of potential inputs and outputs from a Generation III nuclear power station operating under normal conditions. This dataset has been based on the commercially available nuclear power station designs currently available.

Information about radiological emissions under normal operating conditions is provided in the EIR and the environmental impacts of these emissions is assessed. Assessment of the radiological emissions during emergency events and the readiness of the relevant role players to deal with such events is, however, clearly within the ambit of the NNR owing to its legal mandate in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). As with many different forms of development, construction is dependent on authorisations by a number of different legal entities, including local, provincial and national authorities. Construction of such developments is reliant on all these authorisations being obtained from entities with vastly different legal mandates. Reporting requirements to satisfy all these authorisations vary hugely, and it cannot reasonably be expected that information relevant to all these authorisations should be contained in the EIR.

That being said an assessment of radiological impacts (**Appendix E32**) has now been included in this Revised Draft EIR Version 2. The purpose of this assessment will be to quantify and assess the environmental (health) impacts of normal operational process and "Design Basis Accidents" (DBAs) for Nuclear-1. This assessment will also assess whether the series of external events that happened in Japan in March 2011 could reasonably be expected to cause impacts similar to those of the Fukushima Daiichi nuclear accident to a Generation III nuclear power station constructed at any of the alternative sites considered for Nuclear-1.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

This is a statement of the requirements upon which such processes are based - until such time as a licence application is made the specifically licence requirements cannot be established

Comment 8:

4. LEGAL REQUIREMENTS FOR EIA PROCESS

13. We reiterate our comments submitted in respect of the original DEIAR (paragraphs 26 to 28).
14. The EAP is required to conduct an EIA process that results in an EIAR for submission to the competent authority which contains the information required by law and which the competent authority requires to make a properly informed decision as to whether or not to authorise some or all of the listed activities for which an environmental authorisation is required, and if so, to select the alternative which the competent authority considers to be the best practicable environmental option ("BPEO") the terms and conditions which the environmental authorisation must be subject to. In making these decisions the competent authority must consider each of the alternatives and their impacts with reference to section 24 of the Constitution, the principles set out in section 2 of the National Environmental Management Act 107 of 1998 ("the NEMA"), the general objectives of integrated environmental management in section 23 of the NEMA, and the factors set out in section 24O of the NEMA.
15. The EAP stated in its letter to us dated 20 March 2011 that "one of the functions of the EIA process is to balance the rights and responsibilities of different parties."[2]
16. This is incorrect and the EAP's misunderstanding of the purpose of the EIA process has coloured the revised DEIAR. In attempting to strike a balance between the rights and responsibilities of different stakeholders in the process (e.g. between the interests of electricity

[2] Page 95.

consumers throughout South Africa versus the rights and interests of our clients) the EAP is usurping the role of the competent authority. It is not for the EAP to determine the balances to be struck - the EAP is required to present the facts objectively and independently so that the competent authority is able to make the decision that it is required by law to do. In fact even the competent authority is not required to balance the rights and responsibilities of different parties – it is required to consider the comments of the different parties and then to make the decision on the environmental and related socio-economic grounds as outlined above.

Response 8:

We take note of your comments. One of the fundamental purposes of an EIA process is to determine the costs and benefits of a development proposal. These costs and benefits are not distributed equally across society and thus, the Nuclear-1 EIA process has considered how these impacts are distributed amongst the various groups of society. In a complex project such as this, where many different stakeholders have an interest, and where national interests need to be weighed against local interests, it is particularly necessary to consider how the positive and negative impacts are distributed.

In this regard, we refer you to Section 31(2) of the EIA Regulations (Government Notice No. R 543 of 2010). Subsection (n) indicates what contents are required in an EIR, including the following: "*a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation*". In reaching such a "*reasoned opinion"*, it is incumbent upon the Environmental Assessment Practitioner to analyse not only the nature of the impacts, but also their distribution in society. Ignoring the distribution of costs and benefits would not provide the decision-makers with all relevant information required to make an informed decision.

With regards to the consideration of the societal distribution of costs and benefits, guidance on reporting requirements for EIRs (based on a review of international best practice) is provided in Document 15 in the Integrated Environmental Management Guideline Series[3]. Section 5.3 of this document (*Best Practice Requirements)* refers to a number of reviews of EIA reporting systems world-wide[4], all of which recommend that an EIR must include the following (emphasis in bold type inserted by GIBB):

- With regards to Assessment and Evaluation of Impacts and Risks of Project and Alternative: Potentially significant impacts and risks for each alternative, before and after mitigation or optimisation, to cover (amongst others):
  - "The distribution of impacts, **namely who would stand to gain and who to lose from the proposed activity**, and whether the distribution of impacts was fair …";
- With regards to Evaluation of Alternatives and Trade-offs:
  - "Implications of the proposed activity and alternatives should be systematically compared to enable the most appropriate option to be determined";
  - "An explicit basis for choice of the most appropriate alternative should be established";
  - " … the **distribution of significant impacts among affected parties** and associated equity and environmental justice implications"; and
  - "Trade-offs should be clarified."

[3] **Department of Environmental Affairs and Tourism.** 2004. *Environmental Impact Reporting, Integrated Environmental Management, Information Series 15*. Department of Environmental Affairs and Tourism (DEAT). Pretoria.

[4] **De Villiers Brownlie Associates**. 2000 (unpublished). *Draft Review Guidelines for Environmental Impact Assessment in the Cape Metropolitan Area*. Prepared for the then Cape Metropolitan Council, in association with Arcus Gibb (Pty) Ltd, the Environmental Evaluation Unit of the University of Cape Town and Sue Lane & Associates.
Institute of Environmental Management and Assessment. 2001. *European Commission Review Criteria*. http://www.iema.net/ceam/reviewcrit.pdf
European Commission. 2001. *Guidance on EIA-EIS Review, Appendix A: Environmental Information Requirements.* Set out in Annex IV of Directive 97/11/EC. Luxembourg.

- With regards to Overall evaluation of alternatives and of the implications of the proposed activity:
  - o "The implications of the proposed activity and alternatives should be systematically compared to enable the most appropriate option to be determined. **As far as possible, the trade-offs should be clarified** and an explicit basis for choice established".

Clearly, based on these international benchmarks, it is regarded as best practice for the distribution of costs and benefits to be dealt with in an EIR.

Comment 9:

5. PREMATURE COMMENCEMENT OF EIA PROCESS

5.1 Decision-making sequence

17. In comments submitted in respect of the DEIAR, it is pointed out that the commencing of the EIA process prematurely distorts the decision-making process, potentially resulting in poor decision-making (see paragraphs 29-32 of comments in respect of the DEIAR). We confirm our position and assert that the EAP has not adequately addressed our comments in the revised DEIAR.

5.2 Failure to Identify Proposed Nuclear Technology and the design of the proposed development prior to Commencement of EIA

18. The revised DEIAR does not contain any specific information regarding the nature or design of the PWR that the applicant proposes to build and this glaring omission is justified in the executive summary of the revised DEIAR by the statement that:

    "A nuclear power station of standard Generation III design is favoured by Eskom due to its operational simplicity and rugged design, availability, reduced possibility of core melting accidents, minimal effect on the environment, optimal fuel use and minimal waste output. Detailed descriptions of the proposed nuclear plant are not available, as the preferred supplier has not been selected."

19. The EAP reiterates[5] that "the envelope of criteria is used which is based on the specifications of all possible PWR III Generation vendors or represents a conservative set of criteria that provides "the worst case scenario" in terms of the footprint of the proposed site".
20. In this regard we refer to the comments submitted by Greenpeace at 5.2. which highlight the fact that: there is no such thing as a standard Generation III design for a NPP.

Response 9:

Indeed there is no standard Generation III design for a nuclear power station, as each vendor's design differs. However, the Consistent Dataset has been created from a "basket" of the available Generation III nuclear power station designs currently available.

Comment 10:

5.3 The "envelope approach"

21. As previously discussed, Eskom is applying for an environmental authorisation for an "envelope" which will enable it to build any NPP that has biophysical impacts that fall within the ranges used to define the "envelope". In our view, this process is not authorised by law. Indeed the adoption by Eskom and its EAP of the "envelope approach" is an attempt to circumvent the legal requirement to consider alternatives, including technological alternatives.
22. As indicated in our comments in relation to the first DEIAR, the applicant (i.e. Eskom) must identify the technology which it wishes to use and provide sufficient information about it and about the proposed design of the NPP to enable a proper identification and assessment of the risks to be made. If Eskom wishes to consider several alternative forms of technology, it should propose each of these as an alternative and identify and assess the impacts of each.

[5] Page 3.

23. The absence of information about the nature, design and layout of the proposed NPP prevents the assessment of specific impacts and means that both the impacts and the corresponding mitigation measures cannot be identified with any degree of certainty or precision as is reflected by the vague and general nature of the impact assessments in the DEIAR. Unless this information is known before the EIA is conducted it is not possible to determine:
    - the specific risks posed to human health and the environment;
    - the emergency response measures which would be required to be put in place and the potential impacts of an emergency event, for example involving the release of radiation;
    - the amount of insurance that would be required to cover the risk;
    - the potential liability of Eskom and of the State (which should be insured against); and
    - the socio-economic implications of the risk through enhanced insurance costs to be borne by Eskom and also by residents in the area (household insurance invariably excludes radiation risk).
24. An EIA process is designed to identify and assess the environmental, heritage and socio-economic impacts of various alternatives and to put the necessary information before the competent authority to enable it to make an informed decision, firstly about whether or not the project should be allowed to proceed at all (which involves an evaluation of the project against the "no-go" option) and secondly, if the project is to be authorised, to select and authorise the alternative that the competent authority considers to be the best practicable environmental option. The "envelope" approach means that the competent authority is prevented from exercising its statutory mandate to identify the best alternative since no technological, design or layout alternatives have been identified and assessed. In other words, the DEA is faced with the choice of either approving or rejecting a single "envelope".
25. The effect of this is that a wide range of considerations which are material to the decision to be made by the competent authority cannot be taken into account in making its decision. Information that is material to identifying and assessing the environmental, heritage and socio-economic impacts of the proposed NPP, such as the precise nature of the PWR technology to be adopted, the design of the plant and ancillary structures, and the plant layout, is not in the revised DEIAR. This means that if the competent authority were to grant an environmental authorisation for an "envelope" it could well be authorising the construction of an NPP which it would not have authorised had it known the full facts. The absence of such crucial information will also prevent the competent authority from identifying the BPEO which is determined by an holistic determination of the interaction of many factors, including technology, plant design, and layout, in the context of a specific site. Consequently if this information is not placed before the competent authority, it will not be in a position to make a properly informed decision and must refuse the application.
26. Authorising an "envelope" without knowing the details of the actual design, layout, etc. of the range of NPPs that are notionally contained within that envelope, would in our view be unlawful. In colloquial terms authorising an envelope would amount to "buying a pig in a poke" (i.e. purchasing something which you have not yet seen). This adage reminds us of the foolishness of such a course of action.

Response 10:

We take note of your comments. Please refer to Response 9 above. As indicated in the EIA process, the envelope of criteria provides a set of specifications to which the proposed nuclear power station must conform.

Since you have used a colloquial adage to illustrate your opinion, it may be appropriate to explain the envelope of criteria in colloquial terms as well, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel efficiency, type of tyres and wheels, fuel tank size, CO_2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBS. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would

not qualify. Similarly, if a vendor proposes a power station design that fails to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration.

Comment 11:

6. SOCIO-ECONOMIC IMPACT AND ELECTRICITY PRICES

27. Our client has submitted a response to the Social Impact Assessment Report as part of the revised DEIAR. The response is attached to these submissions as part of **Annex A.**
28. Comments submitted in respect of the first DEIAR highlighted the need to adequately address the socio-economic impacts of the proposed development, as the costs of financing the development of Nuclear-1 will be recovered via electricity prices.[6] The Social Impact Assessment did not consider any possible future non-nuclear developments taking place at any of the sites. Therefore no comparative analysis is available.
29. The Social Impact Report only considers the social impacts at the construction and operational phase. Little or no consideration is given to the possible socio-economic impacts of a NPP in relation to electricity prices in the revised DEIAR. We refer to our comments in respect of the DEIAR (paragraphs 50-53) in this regard.

Response 11:

Electricity prices are regulated by the National Energy Regulator in terms of the National Energy Regulator Act, 2004 (Act No. 40 of 2004). It is outside the DEA's decision-making mandate under the National Environmental Management Act, 1998 (Act No. 107 of 1998) to make decisions related to electricity prices.

Comment 12:

7. DECISION-MAKING BY NNR

30. We refer to our comments in respect of the DEIAR (paragraphs 53 to 63) in this regard. We further refer to the response to our comments from the EAP. It is indicated that the "neither the EIA process or the NNR process will dictate the specific technology or plant." This is contrary the purpose of the EIA process, as the technology or design of an NPP may have different environmental and socio-economic impacts that must be assessed in the EIA process. We refer to our comments in 5.2 above.

Response 12:

It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known, it is not necessary to know the brand name of the technology.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

Correct - what is important is to envelop the potential impacts - in addition the EIA cannot predetermine nor prejudice the conditions which may be subsequently emanate from any RoD or other independent process in this regard

Comment 13:

[6] See Annex A page 13 at paragraphs 50 to 53.

8. CONSIDERATION OF ALTERNATIVES

8.1 Dismissal of renewable energy alternatives

31. As highlighted in the comments submitted on behalf of Earthlife Africa, regulation 31(g) of the EIA Regulations requires an assessment to be conducted in respect of alternatives to the proposed activity and "alternatives" may include alternatives to "the type of activity being undertaken." Further, section 24(4) of NEMA reiterates the obligation to consider alternatives and a "no-go option" to the proposed activity.7 In response to the comments submitted in respect of the DEIAR and the question of alternatives, the EAP responded by stating that "the application for environmental authorisation relates specifically to a Nuclear Power Station on three specific sites… it does not aim to establish the energy mix to be implemented in South Africa… as it falls within the ambit of the…IRP and IRP 2010 processes."
32. This assertion does not adequately reflect the obligation set out in section 24(4) of NEMA or Regulation 31(g). Further, regulation 31(f) provides that the need and desirability of the proposed activity must be considered. The need and desirability of building a nuclear power station cannot be adequately evaluated if an assessment of alternative technologies (particularly renewable energy sources) is not undertaken. As highlighted in paragraph 25 of the comments to the DEIAR, the identification of the best practicable environmental option, including the no-go option, may only be assessed if alternative technologies are adequately considered and proper studies are undertaken to determine an appropriate energy mix for South Africa.
33. Since we submitted comments on the first DEIAR the Integrated Resource Plan for Electricity 2010 ("IRP II") has been adopted. The IRP II examines a range of scenarios for meeting South Africa's energy requirements and considers various policy options. It indicates that the Department of Energy has adopted the policy option of committing to "a full nuclear fleet of 9600 MW" (paragraph 4.4) but also states that:

    > "The scenarios indicated that the future capacity requirement could, in theory, be met without nuclear, but that this would increase the risk to security of supply (from a dispatch point of view and being subject to future fuel uncertainty)."

34. The fact that the IRP II contains a scenario in which no new nuclear power stations are constructed (i.e. that it would be viable to meet South Africa's energy needs without using nuclear power) confirms the validity of our previous comments that renewable energy generation should have been evaluated as an alternative to constructing Nuclear 1. As highlighted in our comments on the first DEIAR in paragraph 73, studies have shown that renewable energy technologies may provide a credible alternative to nuclear power in respect of base-load capabilities and should be investigated. This is reiterated in the comments submitted by Greenpeace in respect of the revised DEIAR (see page 11 of Greenpeace submission).
35. The revised DEIAR states that:

    > "South Africa does not have sufficient quantities of indigenous natural gas and does not have the large rivers required for base load hydro-electric power stations".8"
    >
    > "Only certain electricity generation technologies are presently commercially available, although not necessarily financially viable in South Africa, based largely on the availability of resources (fuel) and geographical constraints."9

36. Renewable energy is dismissed on the basis that it does not provide guaranteed base load capacity. However it is misleading to say that "base load technologies" are required where in fact there are many ways of meeting base load demand, including by using renewable energy sources.

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[7] Section 24(4)(b) - Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment must include, with respect to every application for an environmental authorisation and where applicable— (i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity.

[8] Chapter 4 at 4.2.2

[9] Chapter 5 at page 8.

37. The revised DEIAR has addressed comments received in respect of the DEIAR indicating a lack of consideration of wind-generated power as an alternative to nuclear-generated power. The revised DEIAR considers the potential environmental impacts of the infrastructure and associated infrastructure for the operation of wind turbines.
38. We reiterate our comment submitted in respect of the DEIAR at paragraph 73. Alternative energy options, particularly renewable energy technologies, are viable and credible and discounting alternative technologies without adequate evaluation is contrary to the obligations set out in NEMA and the EIA Regulations.

Response 13:

We reiterate our response that the environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a technology(coal, gas, wind) on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa's electricity needs. This is especially the case in the instance of the Nuclear-1 application, where the government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades. The conclusion of the IRP process, as you have stated, is that nuclear technology must form a part of the mix generation technologies.

We refer to your statement that "… *the identification of the best practicable environmental option, including the no-go option, may only be assessed if alternative technologies are adequately considered and proper studies are undertaken to determine an appropriate energy mix for South Africa.*". Such a study to determine the appropriate energy mix has indeed been undertaken in the IRP. The EIA process, which is a project-specific environmental management tool, does not have any mandate to revisit the strategic analysis of power generation alternatives that was completed in the IRP.

It is indeed true that the IRP II included a scenario excluding nuclear generation, since several different alternatives of different generation mixes were considered. However, the fact the "no-nuclear" options was considered does not imply that this scenario is the most feasible or desirable alternative. It was simply one of a number of scenarios considered. The recommended option of the three considered in the IRP was to commit to a fleet of nuclear power stations. As indicated in the IRP, "*This should provide acceptable assurance of security of supply in the event of a peak oil-type increase in fuel prices and ensure that sufficient dispatchable base-load capacity is constructed to meet demand in peak hours each year*". Therefore, the IRP's conclusion, in the interests of security of supply, is that a no-nuclear scenario is not desirable.

Comment 14:

8.2 Comparative costs of technologies

39. The comparative costs of power generation alternatives have been considered in the revised DEIAR. The comparison is however limited to coal-powered plants and nuclear energy plants, with the conclusion that:
    "the study suggests that no single electricity generating technology can be expected to be the cheapest in all situations. The preferred generating technology will depend on a number of key parameters and the specific circumstances of each project."

40. The comparative costs are inadequately addressed in the report. As highlighted in the comments submitted by the LRC on behalf of Earthlife Africa, "the EIR simply lists some energy sources in a table, without any analysis of their impacts or the significance of those impacts". The IRP II provides for cost effective scenarios which exclude nuclear power with the assertion that security supply can be guaranteed without nuclear power.

41. The revised DEIAR fails to consider the promotion of energy efficiency programmes, which is a cost effective and viable measure to provide electricity security.

Response 14:

We take note of your comments regarding the comparative costs of electricity generation technologies.

It is not factually correct, as indicated in your Comment 14, that the comparison of costs was limited to coal-fired and nuclear power stations. Both of the studies referred to in the Revised Draft EIR compare a wide number of electricity generation technologies, including coal-fired, nuclear, wind and gas. For instance, Figures 5.5 and 5.6 in the Revised Draft EIR, which were obtained from the study by the International Energy Agency (IEA) and the OECD Nuclear Energy Agency (NEA), provide levelised cost of electricity (LCOE) for nuclear, coal, gas and onshore wind power generation. The Electric Power Research Institute (EPRI) report referred to in the Revised Draft EIR provides data on renewable resource technologies (e.g. wind, solar thermal, solar photovoltaic and biomass), fossil fuel technologies and nuclear technologies. Since these studies are international peer reviewed studies, it is not the intention of the EIA to interrogate their findings. The EIA process cannot revisit the conclusions of these studies.

Your following statement refers: "*The IRP II provides for cost effective scenarios which exclude nuclear power with the assertion that security supply* (sic) *can be guaranteed without nuclear power*." This statement is not factually correct. As indicated in Response 14, the IRP (Summary, page 6) concludes that a nuclear fleet of 9.6 GW is necessary to account for the uncertainties associated with the costs of renewables and fuels. The IRP conclusion, in Section 8, is "*A commitment to the construction of the nuclear fleet is made based on government policy and reduced risk exposure to future fuel and renewable costs*".

Comment 15:

8.3 Dismissal of the "no-go" option

42. The revised DEIAR does not assess the no-go option but simply dismisses it as being illogical and unfeasible. Simply stating that the no-go option is "not feasible" amounts to a statement rather than an adequate reason for not considering it. In any event, the no-go option is not required to be feasible, it must be assessed so that the competent authority has the necessary information about what is likely to occur if the application for an environmental authorisation is refused. This has not been done.
43. In response to the "no-nuclear" option, the revised DEIAR states that if the proposed development of an NPP in South Africa is not approved, that Eskom would in all likelihood apply to develop more coal-fired power stations. In our view this statement is misleading, particularly in light of the need to achieve carbon emission reductions (which means that coal-fired power stations are unlikely to be authorised as the BPEO), the fact that the government is providing incentives to renewable energy generators (e.g. through the REFIT programme) and that the IRP II has recognised that it would be viable to meet South Africa's energy needs without using nuclear power. In other words, if the proposed Nuclear 1 power station were not built at Thyspunt or the other two sites proposed, the most "no-go option" is that the additional electricity generation capacity would be fulfilled by independent renewable energy power producers.

Response 15:

As indicated in our Response 13 above, and as stated elsewhere, the environmental application for Nuclear-1 is for a single nuclear power station. Within the ambit of this project-specific EIA, and given the commitment in the IRP to a fleet of nuclear power stations, as well as the conclusions of the Nuclear-1 Scoping Report that the no-go alternative is not feasible (which report has been accepted by the DEA), it is not considered reasonable to once again review the no-go alternative in this EIA process. Renewable technologies are not able to provide base load requirements. Existing

coal fired power stations will come to the end of life in approximately the next 15 years and will need to be replaced by other base load technologies. The lowest carbon options would be preferable for South Africa. South Africa would therefore have to consider the various technologies including nuclear, coal and potential gas in South Africa and a limited contribution of imported hydro. It is therefore not correct to state that independent renewable energy power producers will meet the demand and the requirement of quality of supply.

Comment 16:

9. DEFICIENCIES IN PUBLIC PARTICIPATION PROCESS

44. We refer to our comments in respect of the DEIAR (paragraphs 74 and 75).
45. One of the new studies in the revised DEIAR is a Heritage Mitigation study. In the introduction to the study the following statement is made:
"We have however conducted significant amount of consultation with respect to mitigation of archaeological sites."
46. Our client finds it unacceptable that none of the specialist or affected parties in the Eastern Cape was invited to this discussion and therefore contest the significance of the consultation.

Response 16:

The Nuclear-1 EIA process has included numerous opportunities for input into the EIA process. Specialist studies, including the Heritage Impact Assessment, were included in the documentation that has been provided for review of interested and affected parties (I&APs). In addition, meetings with specific heritage role players (e.g. individuals and groups claiming to represent the Gamtkwa First Nation) were convened at their request. Refer, for example, to the minutes of the meeting with the Gamtkwa Council on 27 August 2010.

In response to the requests by groups such as the Thyspunt Alliance to interact directly with the EIA specialists after the Draft EIR was provided for I&AP comment, a specialist workshop was convened in St. Francis on 25 May 2010. The Thyspunt Alliance made significant inputs into the agenda for the workshop and the list of specialists that were requested to attend this workshop. However, the Heritage Specialist was not requested to attend this workshop.

An additional request for another Focus Group Meeting with selected specialists (including the Heritage Specialist) was received during the comment period for the Revised Draft EIR Version 1 and you will be consulted in terms of the scheduling on the meeting.

Furthermore, your quote above from the Heritage Impact Assessment is related specifically to "*mitigation of archaeological sites*" and should be understood in that context. The specific consultations mentioned were therefore of a technical nature and focused organisations and individuals involved professionally in the management of archaeological sites.

SAHRA as the regulator and possessing specialist knowledge have closely monitored the the activities and processes related to the heritage studies including site visits while the excavations were on going.

Comment 17:

10. FAILURE TO ASSESS NUCLEAR SAFETY ISSUES AND RISK OF SEVERE ACCIDENTS

47. We refer to our comments submitted with regard to the DEIAR in this respect (paragraphs 76-77). In response to comments submitted in respect of the DEIAR, the EAP refers to an agreement between the DEA and the NNR indicating that the DEA would not decide on the acceptability of radiological safety issues ("severe accidents") and that this issue is within the

ambit of the NNR licensing application.[10] Radiological safety issues and the risk of severe accidents affect the environment as well as humans and have not been adequately assessed.

Response 17:

We take note of your comment. In this regard, please refer to Response 7 above. As indicated repeatedly in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement, which governs the consideration of radiological issues in EIA processes and the interaction between the DEA and the NNR in terms of their respective mandates for environmental and radiological safety (See Appendix B4 of the Revised Draft EIR). The agreement clearly stipulates that issues of radiological safety are within the mandate of the NNR. Furthermore, it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement. We must, therefore, conduct the EIA based on their mandates and their agreement.

In this regard you are also referred to the then DEAT's approval of the Scoping Report, dated 19 November 2008, where the following is stated:

> 2.21 All radiological issues raised during the EIA process, which are not comprehensively addressed, must be explicitly referred to the NNR to be addressed as part of their process.

This response by the DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process.

Please refer to Response 7 as well.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

The is a correct statement of the regulatory situation - there is no failure to assess safety and accidents they are part of an overall set of processes of which this EIA forms a component part

Comment 18:

10.1 Emergency and disaster management planning

48. According to the revised DEIAR, the final and detailed emergency plan for each site will be approved by the NNR based on detailed plant-specific safety assessments that must provide final justification for the technical basis of a site's emergency plan.
49. The EIA has been conducted on the assumption that Generation III technology will be used and that the European Utility Requirements (the "EUR") for light water reactors ("LWR") nuclear power plants are appropriate. The revised DEIAR states that:

    "it is assumed that the NNR will accept Eskom's proposal, adopted from the European Utility Requirements (EUR) for new reactor designs, for emergency planning zones (EPZs) of 800 m and 3 km for the Proactive Action Zone (PAZ) and the Urgent Protective Zone (UPZ), respectively. Should this not be the case, a re-assessment of the impacts in relevant specialist studies and in the EIR may need to be undertaken. The proposed **PAZ** of 800 m around the proposed power station places limitations on the degree to which the power station footprint can be moved around on the site to adapt to the site's environmental sensitivities. The power station may not be any closer than 800 m from a public road."

[10] See Annex B at page 25 "Response (76-77)".

50. The revised DEIAR states that Eskom has developed a document demonstrating that the proposed nuclear power stations can be built without the need for off-site short–term emergency interventions in line with the EUR requirement.[11] These interventions include sheltering, evacuation or iodine prophylaxis. The EUR provides there is no or minimal need for these emergency interventions beyond 800 meters from the reactor and that any delayed action such as the temporary transfer of people will not be required beyond 3 kilometres from the reactor. Further, the document indicates that no long-term action involving permanent (i.e. longer than one year) resettlement of the public will be required at any distance beyond 800 meters from the reactor.
51. The revised DEIAR concludes that:
    "All three sites are acceptable for emergency planning considerations because of the EUR approach to emergency planning followed by Eskom.[12]"
52. In our view the EUR are an unacceptable basis on which to base the EIA, particularly given the legal requirement to adopt a precautionary approach. The EUR requirements are the product of a joint exercise by 12 companies or organisations in Europe all of which are involved in nuclear power generation. These requirements are completely inadequate and have not been endorsed by the International Atomic Energy Agency or by any government nuclear regulator. The EUR are much less onerous than the requirements usually imposed by government regulators. For example the equivalent zones applied:
    52.1. by the NNR in relation to Koeberg, are 5 kilometres from the reactor for the PAZ and a 16 kilometres for the UPZ; and
    52.2. by United States Nuclear Regulatory Commission are 10 miles and 50 miles (instead of 800 metres and 3 kms).

Response 18:

As stated in the Revised Draft EIR, it is an assumption that the NNR will accept the EUR's EPZ recommendations during the nuclear licensing process. Initial indications provided by the NNR are that it is likely that the EPZ will be reduced. For instance, in a presentation to the Parliamentary Select Committee on Economic Development on 1 June 2010, the Cief Executive Officer of the NNR stated the following: "*One major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, which is the zone within which evacuation of the public has to be catered for, would in all likelihood be reduced from 16 km in the case of Koeberg, to a much smaller radius which could fall within the property owned by the holder* …".

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

What is stated is correct and the specific requirements will be confirmed as part of the NNR licensing process

Comment 19:

53. Furthermore, the fact that there is only one Generation III nuclear reactor operating means that there is no generally accepted international good practice in relation to safety precautions for Generation III nuclear reactors.

Response 19:

These designs will be reviewed to ensure that it has taken cognissance of the basic nuclear power plant design objectives and the recent events related to Fukushima.

In addition all Generation III designs that will be considered have multiple independent power supplies (diesel generator supplied) and Eskom has indicated that it will be installing a gas turbine

[11] Chapter 9 at 9.23.2.
[12] Chapter 9 at 9.23.3.

plant to provide a further diverse electrical supply. These alternative power systems will be shown to meet the NNR public safety requirement

Comment 20:

54. As a result of the nuclear incident in Fukushima, villages 45km from the site were found to be highly contaminated which resulted in these villages being evacuated at a later stage.[13] With the potentially severe environmental impact a nuclear incident can have on the environment, an adequate emergency plan indicating what tools will be adopted to mitigate the potentially severe environmental harm; the true impact of the development cannot be assessed. The NEMA requires the adoption of a precautionary approach to decision-making. Where the potential environmental harm resulting from an emergency incident may be significant, a detailed emergency plan indicating how this harm to the environment and human health will be mitigated is essential to the decision-making process.

Response 20:

We take note of your comments. However, as indicated in Response 7 and 17 above, aspects of nuclear safety are not within the ambit of the EIA process and development and approval of an emergency plan must take place within the ambit of the NNR's nuclear licensing process.

Comment 21:

55. The Emergency Response Impact Assessment in the revised DEIAR merely sets out a high level description of the emergency plan. The report indicates that a Safety Analysis Report (SAR) will be developed by Eskom prior to a licence being issued by the NNR.

Response 21:

We take note of your comment. Please refer to Response 20.

Comment 22:

56. The Emergency Response Impact Assessment highlights the two requirements for nuclear emergencies. These include infrastructure considerations and functional (response) considerations. An emergency response plan may well require the construction of additional site-specific infrastructure (e.g. new roads to be used for evacuation purposes may be required at Thyspunt but not at other sites). Without an adequate assessment of the emergency response procedures to be adopted, the potential environmental impact of additional roads and infrastructure cannot be assessed and considered. These considerations are particularly significant in considering the cumulative impacts of a development. The additional costs associated with the safety measures that must be put in place have also not been considered in the revised DEIAR.

Response 22:

No additional roads will be required for evacuation purposes. The current road proposals for Thyspunt (one eastern and one western access road) are sufficient for evacuation purposes.

As indicated with regards to the upgrading of other forms of infrastructure such as sewage, Eskom will be responsible for agreeing with local authorities on the apportionment of financial responsibility to upgrade emergency infrastructure.

[13] Greenpeace Africa submission on Nuclear-1 Revised Draft EIA Report – August 2011 at 6.2 page 21.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

The position is stated that no additional roads will be required and this is part of the evacuation planning basis. It is agreed that infrastructure development is a multi agency issue

Comment 23:

57. The revised DEIAR should have contained the following information to enable a proper identification and assessment of the socio-economic and environmental impacts of responding to emergencies at each site:
    57.1. a site-specific emergency plan which identifies the additional infrastructure that will be required for emergency responses purposes and an assessment of the consequential environment and socio-economic impacts (these will be different for each site and consequently may affect the selection of the BPEO); and
    57.2. the mitigation measures to be adopted in emergency situations at each site.
58. The failure to assess the implications of emergencies (e.g. major disasters) amounts to a failure to comply with the legislative requirement to assess each identified and potentially significant impact. The socio-economic impacts as well as the environmental impacts of any significant emergency incident (e.g. release of radioactive materials) would be very significant indeed.

Response 23:

We take note of your comment. Please refer to Response 20.

Comment 24:

11. FAILURE TO IDENTIFY AND ASSESS ALTERNATIVES FOR HANDLING, STORAGE AND DISPOSAL OF HIGH-LEVEL RADIOACTIVE MATERIALS

59. The revised DEIAR states that:
    "The potential environmental impacts identified and assessed include all potential types of radioactive wastes expected to be generated by the proposed Nuclear-1 Nuclear Power Station. The assessment results indicate that with the implementation of appropriate mitigation measures all potential impacts are low."
60. The specialist report on Waste Assessment states that radioactive waste management:
    "comprises all the administrative and operational activities involved in the handling, pre-treatment, treatment, conditioning, transport, storage and disposal of radioactive waste. Conditioning of waste typically includes immobilisation and packaging of waste, treatment includes volume reduction and activity removal, while pre-treatment refers to activities such as collection, segregation, chemical adjustment and decontamination."
61. However the Waste Assessment fails to highlight the cost implications of radioactive waste management or, as highlighted by the LRC, the cost of research and development for finding alternative solutions for storing radioactive waste, to which a solution needs to be found.
62. At present, South Africa does not have an authorised facility for the disposal of high-level radioactive waste. Thus, the only current and feasible alternative is for Eskom to store high-level radioactive waste in spent fuel pools on the Nuclear-1 nuclear island, as is the case at Koeberg. The Fukushima incident in Japan has drawn attention to the danger of keeping spent nuclear fuel rods in pools on the site (as is proposed in this case) and of the inherent risks of nuclear power. For example in Fukushima the event which precipitated the emergency incidents lay beyond the parameters of the risk assessment assumptions which had considered a tsunami wave of approximately 5 meters high but had not considered the possibility of a tsunami wave of approximately 14 meters (which is what occurred). This means that the proposed Nuclear-1 facility must be designed in such a way that such long-term storage within the nuclear island building is possible.
63. The potential impacts and hazards associated with the transportation of low and intermediate radioactive waste have not been adequately considered in the Waste Assessment. It is

apparent that low and intermediate radioactive waste will be transported to and disposed of at the Vaalputs Waste Disposal Site. The future power station will be required to obtain a written authorization in accordance with the NNR Regulations for the transportation of the waste, which will be done at a future point in time. It is clear that a route for the transportation of the waste has not been established. The potential impacts of the transportation of this waste have not been adequately considered in the EIA process, particularly as the risks associated with transportation will be difficult to contain and, depending on the route along which the waste is transported, the socio-economic and environmental impacts must be assessed.

64. In this EIA, inadequate attention has been given to the potential impacts of emergency incidents on the basis that this will be dealt with by the NNR during the process of deciding whether or not to grant a nuclear licence for the operation of the site. However, this ignores the fact that an EIAR must identify and evaluate all potential risks, including emergency incidents.
65. The DEIAR must indicate how the long-term storage of nuclear waste will be dealt with in order to assess the ecological, financial and socio-economic impacts of proposed NPP. As will be appreciated, the enormous cost of storing radioactive waste indefinitely will have a major impact on the cost of the project and will impose a burden on future generations.

Response 24:

The cost implications of radioactive waste management were assessed in the Economic Assessment (Appendix E 17 of the Revised Draft EIR). See Section 3.2.1.3.5 of this report.

Internationally, in situations where there is no long-term storage facility for the disposal of high level radioactive waste, it is an acceptable practice to store high level waste on the site of the nuclear power station. Storage within nuclear island and danger of keeping spent fuel on site - Eskom to respond. The spent fuel pools are designed to have no leakage (they are normally stainless steel lined reinforced concrete design – also see fukushima comment

Impacts of waste transport
Your following statement refers: “It is clear that a route for the transportation of the waste has not been established”. This is not factually correct. Please refer to the Transport Impact Assessment (Appendix E 25 of the Revised Draft EIR), which contains illustrations of the proposed transport routes to Vaalputs. Low Level Waste and Intermediate Level Waste will be transported in sealed drums (metal drums and concrete drums, respectively) that prevent the escape of radiation into the environment. This is an internationally acceptable practice that will be undertaken in terms of the conditions of the National Nuclear Regulator and the IAEA Regulations for the Safe Transport of Radioactive Material, In terms of the Regulations, the transport process is subject to radiation protection, emergency response, quality assurance and compliance assurance programmes. Such waste transport to Vaalputs has continued to take place from Koeberg Nuclear Power Station successfully for several decades.

We take note of your comments regarding emergency incidents. However, as indicated in Response 7 and 17 above, aspects of nuclear safety are not within the ambit of the EIA process and development and approval of an emergency plan must take place within the ambit of the NNR’s nuclear licensing process.

The nuclear waste assessment (Appendix E29 of the Revised Draft EIR) indicates how long-term storage of waste is proposed to be managed, both at Vaalputs Nuclear Waste Site and at the power station site. Eskom makes financial provision for the long-term storage of high level waste on the power station site in the power station’s operation budget.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

The IAEA transport regulations are well established and form the basis for international transport of all radioactive materials including medical and industrial isotopes and nuclear fuel cycle components of which the former account for by far the majority of transport operations globally

Comment 25:

66. In our comments submitted in respect of the DEIAR, we indicated that a "precautionary approach" should be applied by the DEA when considering the storage, transportation and handling of hazardous waste (see paragraphs 78 and 79), particularly in light of the fact that the Waste Assessment highlights the lack of an authorized facility for the disposal of high level waste in South Africa.[14] In response to these comments, the EAP stated that the impacts of handling and storage of radioactive waste falls firmly in the ambit of the NNR, based on a co-operative governance agreement between the (then) DEAT and the NNR signed in 2007. We refer to comments in our submission in respect of the DEIAR (paragraphs 7-12) that the mandates of the DEA and the NNR are clear and by agreeing to allow material impacts to be considered by the NNR, the DEA has abdicated its responsibility to consider material impacts (as legally required) in the EIA process.
67. The revised DEIAR includes numerous assumptions in respect of the study, including an assumption that "in terms of the Constitution…and the NEMA, it is assumed that the DEA is responsible for assessing the potential impacts of the power station on the environment. It is further assumed that in recognition of the dual but distinct responsibility with respect to the assessment of radiation hazards, the DEA, is the lead authority on environmental matters and the NNR is the decision-making authority with respect to radiological issues." The potential environmental and socio-economic impacts of radiation hazards are both evident and of critical concern in the EIA process. Actual and potential environmental impacts must be considered in the EIA process, including cumulative impacts. Regulation 31(1)(l) requires "an assessment of each identified potentially significant impact" which includes "cumulative impacts.[15]" A "significant impact" includes "an impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.[16]" The potential and actual radiation hazards are significant and will affect the assessment of cumulative impacts at each of the proposed sites, and will affect the assessment of the no-go option.

Response 25:

We take note of your comment. In this regard, please refer to Response 7 and 17 above.

We reiterate that it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either the DEA or the NNR, or to question the validity of their co-operative agreement. We must, therefore, conduct the EIA based on their existing mandates and their agreement.

Comment 26:

68. Further, we draw attention to aspects of procedural fairness, where the public participation processes under the NNRA are narrower than those prescribed in NEMA and the EIA Regulations for the EIA process. The potential impacts associated with transporting, handling and storing radioactive waste (and in particular high level waste) are critical, particularly in light of nuclear and radioactive safety and are of great public concern (see paragraphs 60 and 63.2 of the Draft EIA comments).

Response 26:

We take note of your comments regarding the differences in the public participation approaches required under NEMA and the NNRA. However, all public participation processes under the control

[15] Regulation 31(l)(i).
[16] Regulation 1.

of organs of state are bound by the requirements of the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000).

Comment 27:

12. INCOMPLETE INFORMATION

69. Numerous uncertainties in the DEIAR have not been addressed in the revised version and significant important information has still not be provided. This includes information in relation to:
    69.1. detailed designs, cross sections or layouts of new planned access roads, sea tunnels, pumping tunnels, the open Cycle Gas Turbine, and desalination plants or waste water works;
    69.2. whether or not mixed oxide fuels will be used (the use of mixed oxide fuels changes the safety parameters and accordingly the potential risk of harm and extent of the impact);
    69.3. possible "source terms" (i.e. how long the fuel will remain in the reactor which affects how radioactive it becomes) which is relevant to assessing the potential risks and impacts of operating the reactor.

Response 27:

As indicated in the EIR, the assessment of the impacts of the proposed nuclear power station are based on the Consistent Dataset, which combines the inputs and outputs of a number of commercially available Generation III power station designs.

Layouts of the access roads, particularly for the Thyspunt site, are illustrated in the Revised Draft EIR and the nature of these roads is specified. Diameters of intake and outlet tunnels, as well as the number of these tunnels, are specified. The approach in the EIA process has been to allow the relevant specialists (e.g. the marine specialist with regards to the tunnels) to specify the maximum allowable dimensions and numbers of the tunnels. The impacts of the brine disposal from the desalination plant (based on predicted concentrations and volumes, in turn based on the expected volumes of drinking and construction water that would be required) have been assessed in the marine assessment and have been found to be insignificant.

Furthermore, sensitivity maps provided by the range of relevant specialists have been overlaid for each site and the preferred footprint for the power station has been defined to exclude areas of high sensitivity on the sites. The EIA team defined this preferred footprint independently of the spatial requirement that Eskom has specified it would require. In most cases, the environmentally preferred footprint is smaller than the area required by Eskom. Eskom will be bound by the preferred footprint, should authorisation be granted, and will have to place all necessary infrastructure within this footprint, thus avoiding sensitive areas. Should all necessary infrastructures not fit within this footprint, some of the infrastructure such as administrative buildings may have to be placed off-site.

Design details can only be assessed when the vendor design is known and during the NNR licensing process which allows for public hearings to consider public concerns such as those raised in this comment

Comment 28:

13. RELIANCE IS PLACED ON INCORRECT, UNVERIFIED AND IRRELEVANT INFORMATION

70. In this regard we reiterate our comments in respect of the first DEIAR and to the comments in **Annex A** and reiterate our view that information in the revised DEIAR is insufficient to justify the selection of the Thyspunt site as the BPEO.

Response 28:

We take note of your comment and refer you to our responses above.

Comment 29:

14. SPECIALIST STUDIES INADEQUATE

71. In this regard we reiterate our comments in respect of the first DEIAR (paragraphs 83 and 84) and to the comments in **Annex A**.
72. In responding to those comments the EAP rejected our client's assertion that potential debris flows at the site posed a risk and stated "after detailed investigations, it was found that no evidence of this having occurred at or close to the site, of the conditions that would enable debris flow to take place." (p 27)
73. A specialist report of Ellery and Elkington which are attached to these comments indicating the EAP and its specialists are incorrect.

Response 29:

Dr. Werner Illenberger and GIBB as the EAP have responded to the matter of debris flows in a number of correspondences with yourselves and other Interested and Affected Parties and Stakeholders. As you have raised no substantively new issues in this submission we refer you to said correspondence. However please take note that all information received have been captured and will be included in the final submission to the DEA for decision making.

Comment 30:

15. FLAWED METHODOLOGY

15.1 Methodology for the assessment of impacts

74. Our client has made detailed comments in relation to the methodology adopted for the assessment of impacts. These are attached as part of **Annex A** to these submissions.

15.2 Characterising the NPP as beneficial to conservation and heritage

75. In their letter response to us the EAP argue that Eskom is already engaged in active conservation at all of the sites but simultaneously argues that if the NPP is not built at Thyspunt, the site will continue to deteriorate due to the spread of alien invasive plants. The short point is that Eskom must comply with its legal obligations to eradicate alien invasive plants regardless of whether or not a power station is built.
76. The logic of the specialists appears to be that the only viable way of conserving areas of flora and fauna is to allow a major industrial installation to be built within them and then to exclude people from the remainder. In considering the impacts on terrestrial vertebrate fauna the revised DEIAR states that.

    "highly significant potential conservation offsets are possible at Thyspunt if the undeveloped land is declared a nature reserve and managed as such."[17]

    In considering the impacts on terrestrial invertebrate faun it is stated that;

    "Thyspunt…would benefit substantially from getting formal protected status. Thus the proposed project would have a potential net positive impact on invertebrate communities at…Thyspunt.[18]"
77. A similar conclusion is drawn in the Heritage Assessment report. This is a reductionist approach which fails to take account of the impact of large industrial undertakings on the landscape and in this case the significant risk which the NPP poses not only to human safety but also to other aspects of the environment.

[17] Executive Summary at page 13.
[18] Executive Summary at page 13.

78. The logic of this approach suggests that the most effective conservation strategy would be to promote the establishment of large industrial facilities which pose such a significant and inherent risk that exclusion zones must be maintained around them, in the most ecological sensitive and conservation worthy areas of the country. This is clearly absurd. The construction of an NPP in an area of very high biodiversity and heritage significance is unwise, unjustifiable and detrimental to the cultural and natural heritage of South Africa. To argue the contrary, as the revised DEIAR does, is irrational and misleading.

Response 30:

Eskom is currently already engaging in an active alien eradication programme on the Thyspunt site, irrespective of whether or not it is developed as a power station site.

As indicated in the revised Draft EIR, a maximum area of approximately 280 ha is required for the power station. Thus, only a small portion of the site will be developed. The land currently owned by Eskom at Thyspunt is 1638 ha. Thus, if 280 ha is used for development, it would leave approximately 83% of the site undeveloped. At Duynefontein, where the Eskom owned property is 2849 ha, even a larger proportion of the site is undeveloped and dedicated to nature conservation. Indeed the indiscriminate development of industrial zones would be a threat to ecological systems. However, every EIA process must examine the merits of the particular project, which is this instance do not involve indiscriminate development across the entire site. Development of the nuclear power station is proposed to be focused on a specific concentrated footprint, which has been defined for its low environmental sensitivity, leaving more than 80% of the property free for conservation. In the absence of any significant efforts to establish conservation areas along the affected stretch of coastline (with the exception of the Rebelrus conservancy) and the vigorous alien vegetation encroachment throughout the St. Francis region, the possibility of the development of a *de facto* nature reserve is indeed considered to be a significant offset benefit for conservation.

Comment 31:

15.3 Methodology use to compare the three sites

79. The weighting system adopted for assessing the impacts of the NPP at the three sites has been altered in the revised DEIAR however remains inaccurate and its application unclear.
80. The methodology used by the EAP to compare the three sites is self-evidently defective because it result in the conclusion that the Thyspunt site is the best alternative (i.e. the BPEO) despite the fact that:
    80.1. the environmental impacts of constructing an NPP there will be significantly more severe than at the other two sites; and
    80.2. the potential impacts on cultural heritage at the Thyspunt site are immitigable resulting in a fatal flaw.
81. Numerous conclusions throughout the revised DEIAR indicate the potentially severe environmental harm at the Thyspunt site and numerous specialist reports indicate that the environmental impacts at the Thyspunt site will be significant, even with the adoption of mitigation measures. The executive summary of the revised DEIAR highlights the following points, among others.
    81.1. The potential impact of the development on flora at the Thyspunt site is significant and "Thyspunt has by far the greatest diversity of vegetation communities, including extensive and highly sensitive wetlands… Thyspunt will experience the highest level of impacts.[19]" The above impacts are likely to result in profound degradation of a system that presently exists as a relatively un-impacted mosaic of terrestrial and wetland habitats, with high levels of interconnectivity and high overall biodiversity value, to which the wetland systems make a significant contribution. The potential cumulative impacts of the proposed development of a single nuclear power station at the Thyspunt site without implementation of mitigation measures has been assessed to be of high negative significance.

[19] Executive Summary at page 12.

81.2. The impact of the development on wetlands is deemed the most significant at the Thyspunt site. The executive summary states:

> "without mitigation, the development could result in profound degradation of relatively unimpacted wetlands systems….The onus is on Eskom to ensure that mitigation measures are put in place to meet the requirements to protect the wetlands and extend the conserved area of wetlands…."

81.3. "Thyspunt has in all probability the highest butterfly diversity and conservation value of the alternative sites. This together with a high ant diversity and the *Onchyophoran* species indicate that Thyspunt has significant conservation value. Thyspunt is therefore considered to be more sensitive to development than Duynefontein, and only marginally lower than Bantamsklip. If development is pursued at Thyspunt, further monitoring of faunal communities and mapping of vegetation habitats would be required.[20]"

81.4. The Geo-hydrology assessment indicates that the overall sensitivity at Thyspunt is low to medium, but in Wetland areas the sensitivity is high, unlike the two alternative sites where the sensitivity is low.[21]

82. The revised DEIAR indicates that the Thyspunt site is the preferred site on the basis of environmental and technical factors, a statement which is contradicted by the statement that the Thyspunt site is more sensitive from a biophysical and heritage perspective than the other two proposed sites.[22]

Response 31:

From a biophysical perspective, there are sensitive ecosystems on the larger Thyspunt property, but the proposed power station has been positioned on the site in such a way as to avoid these sensitive systems. The specialist studies have assessed the impacts as if a worst case scenario impact would occur, i.e. as if the most sensitive elements of the site would be affected. However, the most sensitive elements of the Thyspunt site, namely the mobile dune system and the wetlands (particularly the Langefontein wetland) have been avoided. Furthermore, wetland and groundwater modelling has confirmed that the water table that feeds the majority of the Langefontein wetland is not geo-hydrologically connected with the water table where the power station is to be built. This confirms that mitigation measures proposed to prevent drawdown of the water table in the Langefontein wetland during construction are feasible.

Your quotation above regarding the significance of wetland impacts refers. Please note that that the quote refers specifically to unmitigated impacts. However, the proposed placement of the power station and associated infrastructure outside of the wetland zones avoids these impacts. Furthermore, the wetland specialist report supports development, provided that mitigation (including the acquisition and effective conservation of threatened wetlands currently not owned by Eskom) is applied. Eskom has consistently indicated its willingness to implement these measures and has already embarked upon the acquisition of such properties.

With regard to invertebrate biodiversity, the proposed monitoring programmes have been initiated.

Your reference to the findings in the geo-hydrological assessment refers. Again, it must be emphasised that none of the sensitive wetland areas will be disturbed.

Comment 32:

15.4 Process review of Draft EIA

83. The EAP responded to criticisms of the EIA process by appointing two other EAPs to undertake a review of the EIA process (this did not involve reviewing the specialist reports).
84. While we agree with certain conclusions of the reviewers, in our opinion the reasoning used to support the main conclusions is irrational, for the reasons set out below.

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[20] Executive Summary at page 13.
[21] Executive Summary at page 10.
[22] Executive summary at page 6.

85. The reviewers state that if the potential impacts of undertaking the proposed activities at a particular site are found to be intolerable, the site should be regarded as being fatally flawed and should in fact be disqualified from any further consideration as a possible site for the power station. (pages 18 and 19). The reviewers also stated:

> "there is no provision in the impact ranking for an impact greater than "high" – hence "high" must include the most unacceptable case. In these terms, and given the multiple impacts identified as being of high significance for all 3 sites (see table 2) it would not be unreasonable to expect that all three sites would be disqualified. Contrary to this, all the specialists agreed that there were no fatal flaws in any of the three sites. This again suggests that the impact significance has been exaggerated in the EIA."

86. The ranking of impacts as "high" is based on the specialist reports which the reviewers did not review. It is clear from many of the specialist reports (some of which, in our client's view, understate the impacts) that there are sound reasons for ranking many of the impacts at Thyspunt as "high". Therefore logically, unless it can be established that the specialists were incorrect (which the reviewers do not do) the fact that the impacts on the environment and on cultural heritage at Thyspunt are high and cannot be significantly mitigated should mean that the Thyspunt site has fatal flaws and should be excluded from consideration. (This follows the argument advanced by the reviewers which is referred to above.)
87. The heritage studies and specialist studies as well as the additional studies undertaken on behalf of our client, confirm that not only are the impacts of building an NPP there high, but in some cases they have been underestimated in the specialist reports contained in the revised DEIR. In fact the Thyspunt site is a classic example of a site that should be excluded from consideration as the site of any major industrial development, let alone an NPP. The South African Heritage Resources Agency ("SAHRA") has indicated that no development should take place there; having been identified as a critical biodiversity area, and constructing an NPP there would have severe environmental impacts on both terrestrial and marine ecosystems (which are currently poorly understood).
88. However instead of reaching the logical conclusion that the Thyspunt site should be excluded from further consideration, the reviewers start with the conclusion in the DEIAR that none of the sites have fatal flaws and work backwards to conclude that the only way in which such a conclusion could be valid despite the number of high impacts identified, is if the impacts were exaggerated. Without demonstrating any flaws in the specialist reports (which they did not review) the reviewers conclude that there has been a general exaggeration of the significance of the impacts (the factual basis for this conclusion is not apparent).
89. The reviews compound this error by reasoning that if all of the sites are potentially suitable from an environmental perspective because the DEIAR says that none of them suffer from fatal flaws, then it is legitimate to identify the preferred option primarily on the basis of the relative ease and cost of connecting the proposed NPP to the grid.
90. The relative ease and cost of connectivity to the grid is primarily relevant to determining whether or not it is feasible to develop an NPP on the site. The applicant (Eskom) has indicated that it is reasonable and feasible to build an NPP at any of the 3 sites. Once that determination has been made the relative ease and cost of connectivity to the grid should only have a marginal and indirect impact on the decision-making process (i.e. they are only relevant insofar as they affect the environmental and socio-economic impacts of the proposed listed activities). These so-called "technical" issues cannot be used as a basis for overruling environmental considerations. Any weighting system which allocates a preferred site based on a disproportionately high weighting to ease of connectivity to the grid and the supposed benefits to the Eastern Cape economy where the site has also been identified as having the greatest environmental and heritage impacts, is clearly fatally flawed and misleading.
91. Furthermore, it is doubtful whether the competent authority is entitled to take account of issues such as ease of connectivity to the grid and the cost of constructing the NPP except to the extent to which these factors are shown to have socio-economic or environmental impacts. In this case these factors are given such a high weighting that they become decisive in selecting Thyspunt as the preferred option and therefore the BPEO.
92. The specialist reports and the stance adopted by SAHRA make it clear that the Thyspunt site should be excluded from further consideration. The fact that the scoring system is weighted in

a manner that transforms a site that should have fallen out of consideration completely, into the preferred option, is an indication of the deficiencies in the weighting system.

93. Furthermore, the fact that the revised DEIAR rates a site that is clearly unsuitable for environmental, heritage and geomorphological reasons as the preferred option creates a strong perception of bias (as recognised by the reviewers). The reviewers suggested that this perception be corrected by including a credible explanation for this in the revised DEIAR. This has not been done and accordingly the perception of bias remains.
94. In our view, it would be unlawful for a competent authority to authorise the selection of the Thyspunt site as the best practicable environmental option because the facts simply cannot sustain such a conclusion and consequently any such decision based on the revised DEIAR could be set aside by a court as being irrational.

Response 32:

In response to the reviewers' comments on the Draft EIR, the criteria for rating of impact significance were accordingly changed to provide a more realistic assessment of impact significance and to prevent a situation where, as stated above, impacts are rated as high, in spite of the specialists not identifying any fatal flaws. The concern behind the statement of the reviewers was that the specialists tend to rate impacts unnecessarily high, as a precaution. For instance, specialists would assume that the most sensitive elements of the site would be destroyed, without having regard to the fact that the proposed development footprint would avoid such sensitive elements.

The criteria for assessment of impact significance were accordingly amended in consultation with the specialists to ensure their agreement with the meaning and application of the criteria. One of the outcomes of the revision of impact criteria was a change from only three significance categories (low, medium and high) to five categories. Thus, if an impact is still found to be of high significance with mitigation after application of the new criteria, there is a greater possibility that it could be regarded as a fatal flaw. After application of these revised criteria, there are very few impacts that remain high after mitigation (one each at Duynefontein and Thyspunt and two at Bantamsklip).

With reference to the heritage impacts, extensive field surveys were conducted during 2011 to confirm the occurrence of heritage features within the proposed footprint of the power station. These studies confirmed, as suspected, that the sensitivity of these features is low. This confirms that the heritage impacts at Thyspunt can be mitigated. Eskom has, throughout the EIA process, committed itself to implementing an extensive heritage mitigation programme .

Your reference to the identification of Thyspunt as a critical biodiversity area refers. Kindly provide a substantiation of this statement, as no such identification is known to the EIA team.

The transmission integration factors are indeed relevant, as they play a critical role in the site selection decision. Seismic factors, which are also technical factors, equally play a critical role in the site selection decision. Contrary to your statement that technical factors "overrule" environmental factors, they have been considered together and do not result in the elimination of environmental factors as decision-making criteria. Since no "clear-cut" preferred site emerged from the analysis of the environmental impacts, an analysis of all relevant factors, including technical factors, was considered appropriate to identify the recommended site. With regard to the perception of bias, all assumptions employed in the site selection recommendation were clearly articulated in the Revised Draft EIR. The reasons for the allocation of particular values to decision factors, as well as the weighting of these factors, were explained in a transparent manner. We take note of your view regarding the decision of the competent authority.

Comment 33:

16. HERITAGE RESOURCES AT THE THYSPUNT SITE

95. The Heritage Assessment report included in the revised DEIAR as well as the revised DEIAR indicate that the impacts of a NPP on human cultural heritage and landscape will be the most significant at the Thyspunt site where archaeological and paleontological heritage is diverse and prolific. The Thyspunt site is therefore deemed the least preferred site from a heritage perspective, however this is ignored in the revised DEIAR, as the Thyspunt site remains Eskom's preferred site. Indications are clear that mitigation is going to be technically difficult to achieve due to the character of the site, difficulties with respect to accessibility and will be extremely lengthy and costly.[23] The Heritage Assessment considers the no-go alternative and its impacts on the various sites from a heritage perspective. The specialist takes the view that the *status quo* would be maintained until such a time as alternative land uses are adopted. The specialist states that:

> "Eskom has indicated that land will be sold if it cannot be used for power station development. Should any of the sites be used for property development, it is likely that heritage impacts in terms of archaeology and landscape will be severe. While the development of a nuclear power station on any of the proposed sites will result in substantive impacts, the conservation of landscapes within of the owner-controlled zone as well as possible biodiversity offsets will be advantageous for heritage conservation in the long term."

96. These conclusions are absurd in respect of the current EIA process. Even if Eskom were to sell the site any future property development would not be authorised without an EIA and heritage assessment and in view of the extraordinary value of the area as a cultural landscape, there is no reason to believe that developments that have a severe impact on archaeology or the landscape would be permitted. The potential impact of property development in the long term (as a potential future land use) cannot be used to justify the destruction of the heritage value of the land in the short term as a result of the construction of a NPP.
97. A Heritage Mitigation Study has been complied as part of the revised DEIAR even though the South African Heritage Resources Agency (the "SAHRA") has indicated that it does not support the development of a NPP at Thyspunt due to the significant heritage value of the site.[24] In addition, the heritage impact of the proposed NPP at the Thyspunt site cannot be accurately determined for the following reasons:
    - the design parameters of the NPP will have a significant effect on the severity of the impacts on heritage sites at Thyspunt;[25]
    - the true cultural value of the site can only be determined once trial excavations at the site are undertaken;[26] and
    - without a clear understanding of the potential and actual impacts on heritage sites, mitigation criteria and a mitigation strategy cannot be established or determined.[27]
98. The SAHRA do not support mitigation through excavation as has been proposed in the revised DEIAR, as this approach is unfeasible and not in the interest of overall heritage conservation. Section 35(4) of the National Heritage Resources Act, 25 of 1999 (the "NHRA") declares that no person may damage, destroy or excavate any archaeological or paleontological site without a permit issued from the competent heritage authority. Therefore excavation work at the Thyspunt site cannot be undertaken without the necessary approval. When exercising any power or performing any function in terms of the NHRA, including granting a permit for excavation, the competent heritage authority must consider the following principle:

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[23] Heritage Assessment at 4.3.
[24] Heritage Mitigation Study at 1.
[25] Heritage Mitigation Study at 3.1.
[26] Heritage Mitigation Study at 3.1.
[27] Heritage Mitigation Study at 3.1.

> "Heritage resources have lasting value in their own right and provide evidence of the origins of South African society and as they are valuable, finite, non-renewable and irreplaceable they must be carefully managed to ensure their survival."[28]

99. The Heritage Assessment Report indicates that wilderness qualities of the Thyspunt site are exceptional and substantially contribute to the "character of the region and the contiguity of the strong cultural landscape qualities of the place."[29]
100. Based on the above, the competent heritage authority cannot grant a permit for the excavation of the Thyspunt heritage sites without complying with the general obligations and principles set out the NHRA. In doing so the competent heritage authority would be acting unlawfully.
101. The Mitigation Study indicates that the SAHRA has the option of declaring the Thyspunt cultural landscape a National Heritage Site, resulting in the SAHRA having the power to dictate the future of proposed activity in the area.

Response 33:

Your views regarding the alternative forms of land use not being authorised are noted. However, unfortunately recent history of residential and golf estate developments in the St. Francis region contradict your statement. Even though these developments have been subjected to EIA processes, development of these sites has caused extensive destruction of heritage resources, without sufficient mitigation having been undertaken. There is, therefore, reason to believe that other developments having a severe impact would be permitted. It must be borne in mind that developments are not always planned on a large scale. Small developments that individually have insignificant impacts can eventually have highly significant impacts when their cumulative impact is considered. This is especially the case with the development of urban areas, especially along the coastline.

It is in recognition of such potential cumulative impacts of individual development decisions and in view of recent development history around St. Francis that all biophysical specialists as well as the heritage impact assessment specialist consider the conservation of the majority of the Thyspunt site through the development of the power station to be of benefit for conservation.

Your quotations from the heritage impact assessment refer. It is stating the obvious that the design parameters of a development will affect the severity of the impacts. It does not necessarily imply that the impacts are severe. Through positioning of the power station footprint in the area of lowest heritage sensitivity (at least 200m from the coast where the majority of the archaeological sites are located), impacts on the most valuable heritage resources have been avoided. The passage quoted from indicates uncertainty about the nature of all the heritage impacts and the necessity for trial excavations to increase the degree of certainty. Such trial excavations have been undertaken during 2011 and the results confirmed a very low incidence of heritage sites within the recommended power station footprint, which is situated in the vegetated dunes. The archaeologist's deduction is that the location of archaeological sites corresponds strongly with sources of fresh water. Archaeological sites are concentrated in the mobile dunes (where there are permanent polls in the dune slacks) and close to wetlands and fountains along the coastline, the eastern portion of the site and outside the site towards the St. Francis Links golf course. With this improved knowledge, the heritage specialist is now in a much better position to define a heritage mitigation strategy. His conclusion is that impacts on archaeological sites can be minimised, provided that the power station is located within the vegetated dunes, at least 200m from the coastline (as is indeed the case with the recommended power station footprint).

Heritage mitigation through excavation is indeed not normally supported, as in situ conservation of heritage resources is always preferred. However, as indicated above, trial excavations indicate that

[28] National Heritage Resources Act, 25 of 1999 at section 5(1)(a).
[29] Heritage Assessment Report at 6 (page 78)

minimal excavation will be required as long as the power station is positioned on the vegetated dunes.

Comment 34:

17. APPREHENSION OF BIAS

102. The socio-economic impact report has only considered the benefits of remunerating workers at the NPP but still fails to address the potential impact on consumers and taxpayers associated with funding the construction and decommissioning of the NPP.
103. In the response to our Draft EIAR submissions, it was indicated that the recommendation of Thyspunt as the preferred site "is based on a number of factors, including technical factors, a number of social and biophysical factors, and cost." Although factors such as technical specifications and cost are relevant in the EIA process, section 2 of the NEMA requires that environmental management must pursue the best practicable environmental option which is the option that "provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society in the long term as well as in the short term."[30]
104. It is clear from the specialist reports, firstly that the Thyspunt site is wholly unsuitable for a major industrial development and should have been excluded from consideration because of the existence of high impacts that cannot satisfactorily be mitigated. Secondly, even if Thyspunt were not excluded from consideration, the fact that the environmental and heritage impacts of constructing an NPP at Thyspunt are substantially more severe than at either of the other two sites means that it cannot possibly be the best practicable environmental option. The fact that Thyspunt is Eskom's preferred site and the methodology applied by the EAP to compare the three sites results in Thyspunt being recommended as the BPEO creates suspicion that the EAP is not fully independent and we reconfirm our comments submitted in respect of the DEIAR (paragraphs 90 and 91).
105. In this regard it is worth noting that in the recent case of *S v Frylinck and another* an environmental assessment practitioner (EAP) was convicted in terms of regulation 81(1)(a) of the Environmental Impact Assessment Regulations, 2006, for providing incorrect and misleading information in a basic assessment report. A failure to place all relevant information before a decision maker may result an EAP being convicted of a crime in his or her personal capacity.

Response 34:

We take note of your comments.

It is agreed that the Best Practical Environmental Options principle in NEMA must apply to decision-making. The aim of impact assessment is precisely the judge whether the costs are acceptable to society. In making this judgement, consideration must be given not only to the direct costs to those that will be disadvantaged, but also the costs and benefits to society as a whole, as well as whether the costs can be mitigated. As indicated in the Revised Draft EIR, there are no fatal flaws at any of the sites, and the impacts can be mitigated. For a strategically important project such as this, which is designed to ensure South Africa's security of electricity supply, it would be difficult to argue that the mitigable costs of the project outweigh the benefits to society at large.

Our assertion that the impacts cannot be successfully mitigated is not supported by the findings of the specialist studies. Arguably the most significant impacts at Thyspunt are heritage impacts and wetland impacts. Specialist studies of both these disciplines have confirmed that impacts on wetlands and heritage resources can be mitigated.

[30] NEMA definitions section 1

Comment 35:

18. CONCLUSIONS

106. The EAP has dismissed and failed to address substantively almost all the comments which we submitted in relation to the first DEAIR and accordingly the revised DEIAR is also defective and in our view, could not form the basis for a decision to authorise the construction of an NPP at Thyspunt.
107. The defects in the revised DEIAR include:
    107.1. material gaps in the information required by the decision-maker to make a properly informed decision;
    107.2. a failure to comply adequately or at all with mandatory legal requirements, including the requirements to assess the "no-go" option; to identify and assess reasonable and feasible alternatives, and to identify and assess the potential environmental and socio-economic impacts of each alternative; and
    107.3. the application of inaccurate and misleading methods of evaluating the significance of the impacts identified and of comparing the relative methods of the three possible sites which produces the absurd result that the Thyspunt site has been identified as the preferred option despite the fact that the expert reports clearly indicate that it is the least suitable site from both an environmental and a heritage perspective.

Response 35:

We take note of your opinions and refer you to our responses above, which respond in detail to your contentions.

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

GIBB
ENGINEERING & SCIENCE

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 08 August 2011

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Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE **NUCLEAR 1**

RESPONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT

APPENDIX E 26, SECTION 1.1 **EMERGENCY PLANNING SPECIALIST REPORT**

Response compiled by H.Thorpe, and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

1. The Achilles heel of the Thyspunt site

Eskom has been aware for years that emergency and disaster management planning are serious issues affecting the viability of the Thyspunt site. This goes back to the Nuclear Siting Investigation Programme of the early nineties and the resultant Kouga Coast Sub-Regional Structure Plan of 1998, both of which recognized that population expansion in the area threatened the viability of the site in terms of emergency planning requirements. What were not acknowledged at that time were the additional complications of wind speed & direction and the single escape route for five communities along ten kilometers of coastline. In combination these make disaster management planning a pipe dream for this area.

Eskom's method of getting around this hurdle is to change the rules, and lobby for more relaxed emergency planning requirements, which would eliminate the embarrassment of the vulnerability of the Greater St Francis community.

Response 1:

The sizes of the proposed emergency planning zones for Nuclear-1 are in line with current international emergency planning for Generation III nuclear power stations per EUR requirements.

Initial indications provided by the NNR are that it is likely that the EPZ will be reduced for newer generation plants, and possibly even for Koeberg Nuclear Power Station. For instance, in a presentation to the Parliamentary Select Committee on Economic Development on 1 June 2010, the Chief Executive Officer of the NNR stated the following: "*One major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, which is the zone within which evacuation of the public has to be catered for, would in all likelihood be reduced*

from 16 km in the case of Koeberg, to a much smaller radius which could fall within the property owned by the holder …".

RESPONSE FROM THE INDEPENDENT NUCLEAR SPECIALIST
What is stated is correct and the specific requirements will be confirmed as part of the NNR licensing process.

Comment 2:

2. The Fukushima factor

It will be some time before the full details of the Fukushima disaster will be made public. The nuclear lobby will argue that this was a different technology from the modern PWR technology being proposed; that it was forty years old; and that the tsunami which hit it was far in excess of anything that had been anticipated.

However, at this stage, certain conclusions can be drawn. Briefly, these are that nuclear power generation remains a potentially hazardous activity; that nuclear contamination can be catastrophic, threatening life and health, and potentially rendering large tracts of land unfit for human habitation for decades, if not centuries to come; that, despite full knowledge of the tsunami risk, and the extensive safety engineering design incorporated by one of the most advanced engineering countries in the world, the system failed; that risk assessment in this case was too optimistic; that the accident was caused by failure of the defence-in-depth cooling system; that far greater transparency is required; and that there is a case for a complete review of the safety assumptions being used by the nuclear industry, as has been called for by most advanced countries.

A moratorium should be placed on all nuclear developments until the final outcome of the Fukushima disaster is known; lessons learnt from this disaster have been fully assessed; and plant design and safety features have been modified to accommodate these new insights.

In particular Fukushima has emphasized that there is no place for fragmented, superficial, inaccurate, incomplete or politically pre-determined impact assessments for such plants.

Response 2:

We take note of your comments.It was reported in the News on18 Jan 2012 (NucNet) that; "About 30 workers at the Fukushima-Daiichi nuclear power plant in Japan received between 100 millisieverts (mSv) and 250 mSv of radiation exposure, which would have increased their chances of cancer by about 1% to 2.5 %, a parliamentary committee in the UK was told. Her Majesty's chief inspector of nuclear installations, Mike Weightman, told the House of Commons Energy and Climate Change Committee that in terms of the workers, "there don't appear to be any acute radiation effects".

He said 30 of them have had "a significant dose", but it is not in the sense of an immediate life-threatening dose. In a declared nuclear emergency, the recommended limit is 100 mSv. The International Commission on Radiation Protection is mandated to sanction a maximum accumulated dose of 250 mSv in extraordinary circumstances. Mr Weightman said public evacuation was well-organised and exposure countermeasures for the public have been "effective so far", and there will be a longer-term health monitoring programme."

The safety of the KNPS has recently been reviewed based on the events of Fukishima by the NNR . These checks included beyond design basis seismic ground motion and flooding as the initiating events. The evaluation by the NNR on the safety assessment done by Eskom concluded that KNPS

is able to withstand these events. It should also be noted that every two years the NNR tests preparedness of the various organisations involved in the Koeberg emergency plan

Furthermore several reports on the Fukushima accident have been circulated into the international nuclear community. This has allowed for proper investigations to be performed on existing plants, e.g. Koeberg. In this regard, responses to WANO and the regulatory bodies have been made, clearly indicating the areas of strength as well those requiring some gaps to be closed. The Nuclear-1 work in this regard will consider the accident causes and will ensure that these are addressed by the final plant design.

Lastly please see the Beyond Design Accident Report attached as Appendix E33 to the Revised Draft EIR Version 2.

COMMENT FORM THE INDEPENDENT NUCLEAR SPECIALIST.
Agreed - in addition both the initiating event scenarios, frequency and reactor design will **all** be different making direct comparisons potentially misleading - however lessons learned from the Fukushima event have been applied by the industry in order to identify reasonably practicable design modification in the beyond design basis region assessment of which will form part of the safety case assessment and licencing process by the NNR.

Comment 3:

3. Generation III nuclear power plants

   It is repeatedly stated in the Draft EIR that Eskom favours the use of "Generation III" technology. This despite the fact that government some two years ago stated that this was unaffordable, and took over negotiations for the selection of the specific technology to be used. To this day this has still not been announced. The Emergency Planning Objectives in Appendix E26 take it for granted that Generation III will be used, and that EUR requirements will apply.

   Definitions of Generation III technology can be found in Ch 3 "Project Description section 3.5, and Appendix E26, based on a document (NSIP-01344) prepared by Eskom on a framework for demonstrating that a proposed nuclear installation can be built in South Africa without the need for off-site short-term emergency interventions like sheltering, evacuation or iodine prophylaxis, in line with the European Utility Requirements (EUR) for a Light Water Reactor (LWR) Nuclear Power Plants. These documents prescribe that modern nuclear power plants should have no or minimal need for emergency interventions (e.g. evacuation) beyond 800m from the reactor, and provide a set of criteria that a reactor must meet in order to demonstrate that it can be built without such emergency planning requirements.

Response 3:

The EIA is conducted based on a set of enveloping parameters for the proposed nuclear power station. These enveloping parameters cater for the designs of modern nuclear power stations that are available in the world\ today referred to as Generation III reactors. Apart from approving IRP2010 which includes 9600MW of nuclear, Government has not as yet officially stated when the procurement process will commence.

Comment 4:

4. EUR Requirements

   The EUR requirements can be summarized as follows:

- Minimal emergency protection action beyond 800m from the reactor during early releases from the reactor containment;
- No delayed action, such as temporary transfer of people at any time beyond approximately 3km from the reactor;
- No long-term action involving permanent (longer than 1 year) resettlement of the public at any distance beyond 800m from the reactor;
- Restriction on the consumption of foodstuffs and crops should be limited in terms of timescale and ground area, in order to limit the economic impact.
- IIt will be noted that this proposal derives from the European Utility Requirements, and not from either the International Atomic Energy Agency, or from any National Nuclear Regulator.
- The EUR regulations are the product of a joint exercise by twelve companies or organizations in Europe, all of which are involved in nuclear power generation. The prime motivation has to be promotion of the nuclear power industry, rather than protection of people and property. This is the responsibility of nuclear regulators, none of whom world-wide have recognized EURs for regulatory purposes.
- It will also be noted that nowhere in these regulations is it suggested that nuclear power generation has become inherently safe. It is accepted that some intervention may be required within the 800m zone; that people living within 3 kilometres of the plant may need to be evacuated; that it might be necessary to resettle people living outside the 800m zone, but not for more than a year; and that the economic implications of restricting consumption of foodstuff and crops should be taken into account.
- Obvious questions arising from this are the scientific basis for selecting 800m and 3 kilometres as the limits for emergency planning, and whether there is any conceivable event which could lead to the need for active intervention over a wider area, for example if the cooling system were to fail as at Fukushima.
- It is difficult to avoid the conclusion that this is a pure marketing exercise, to make it easier for utilities to obtain authorization to operate NPSs, and that the most optimistic attitude is taken towards risk and public safety.
- It is hardly surprising that to our knowledge, no Nuclear Regulator has endorsed these requirements.
- These requirements are in marked contrast to those imposed by the United States Nuclear Regulatory Commission, which are summarized in a Fact Sheet on Emergency Planning and Preparedness, released in March 2002, and reviewed & updated on 4 February, 2011.

Response 4:

The EUR aims at ensuring that the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs.

RESPONSE FROM THE INDEPENDENT NUCLEAR SPECIALIST
Ultimately the emergency planning assumptions and plan basis will form part of the safety case to be considered by the NNR as part of the licensing process as such applicant's basis is being established however this must be independently verified as part of that process.

Comment 5:

5. United States Nuclear Regulatory Commission Requirements

The fact sheet lists details of the available documentation.

It recognizes the need for "reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency." Following the Three Mile Island accident, emergency planning was added to the "defence-in-depth" safety philosophy.

The "defence-in-depth" philosophy requires high quality in the design, construction & operation of nuclear plants to reduce the likelihood of malfunctions; recognizes that equipment can fail and operators can make errors, therefore requiring safety systems to reduce the chances that malfunctions will lead to accidents that release fission products from the fuel; and recognizes that, in spite of these precautions, serious fuel damage may happen, therefore requiring containment structures and other safety features to prevent the release of fission products off-site.

Despite all of this, the NRC demands that, in the "unlikely" event of a release of radioactive materials to the environment, there is reasonable assurance that actions can be taken to protect the population around nuclear power plants.

With this in mind, the following emergency planning is required, and remains so to this day:

"For planning purposes, the Commission has defined a plume exposure pathway emergency planning zone (EPZ) consisting of an area about 10 miles (16km) in radius and an ingestion pathway EPZ about 50 miles (80km) in radius around each nuclear power plant. EPZ size and configuration may vary in relation to local emergency response needs and capabilities as affected by such conditions as demography, topography, land characteristics, access routes etc"

These requirements are pretty well identical to those currently used for the so-called "Koeberg model", which Eskom is now seeking to abandon. There is nothing in the US regulations to indicate that safety margins have increased to such an extent that EPZs can virtually be disposed of.

Response 5:

Emergency Plan radii are defined by source terms that the plants are designed for, together with the potential accident scenarios modelled. Over the plant life several modifications are made to the plant, taking into account various experiences and risk study outputs. These allow for the reduction of public risk and may also inform the reduction of Emergency Plan radii. The new plant designs have taken into account the lessons learnt from the Operating Experience of plants in operation. These improvements have been incorporated on designs, and will also be reviewed by the NNR for soundness.

COMMENT FROM THE INDEPENDENT NUCLEAR SPECIALIST.

It is correct that accident prevention incorporating defence in depth is the fundamental safety objective of any reactor design as demonstrated in the plant safety case - notwithstanding this regulators require that emergency plans based largely on procedural arrangements be put in place - as designs improve as required by the first objective inevitably and as a direct consequence of these improvements the risks are likely to reduce with a consequential reduction in the degree of emergy planning provisions - this must all be demonstrated via the safety case as part of the licensing process.

Comment 6:

6. Contradictions

   In a written response, dated 20 March, 2011, to submissions to the first Draft EIR by the St Francis Kromme Trust, the Environmental Assessment Practitioner, Jaana Maria Ball of Arcus Gibb, made the following comment (p.10, response 5):

   "US regulations represent an important benchmark since there are at present no specific South African regulations regarding the licensing of nuclear power plant sites. Eskom therefore follows the regulations of the United States Nuclear Regulatory Commission (US NRC) which is considered to be the most stringent and detailed (and tested) set of regulations in the world. Also, by following US NRC regulations Eskom will also comply to IAEA regulations (which represent the second of the two sets of internationally accepted regulations used for the siting of nuclear power stations)".

   It would be difficult to imagine a greater contrast between the EUR and the US NRC requirements. It is clear that Eskom is seeking to run with the hares and hunt with the hounds. While US requirements suit them, they are happy to conform, but when they do not, they seek other solutions, and present them as if they are internationally accepted criteria.

Response 6:

Best practices are employed where there is lack of clear guidance. This is not cherry-picking practices that suit Eskom. The best practices allow for incorporation of elements of importance in the analyses. It must also be noted that Eskom's choice of the best practices is not the end of the process. These practices are adopted, and then adapted for local conditions and the NNR has the ultimate authority to review and accept/reject the final proposal for the analyses performed.

Comment 7:

7. Demand

   In the context of the recent events at Fukushima, and of the conservative position being taken by the US NRC, which is supposed to be our benchmark, we demand that any proposal to move away from the US regulations, especially towards criteria which have been developed by the nuclear industry itself, be rejected out of hand.

   The Thyspunt Alliance demands that this submission be included as a formal response to the second Draft EIR, and that the issues raised be addressed in full, not only by the EAP, but also by the Department of Environmental Affairs and the National Nuclear Regulator.

Response 7:

We take note of your demand for the Department of Environmental Affairs and the National Nuclear Regulator to respond to these issues. However, please note that the EIA regulations, under which

the public participation process for Nuclear-1 is being managed, it is the responsibility of the Environmental Assessment Practitioner to respond to comments by interested and affected parties. Such comments must be submitted to the environmental decision-making authority for consideration, but such authorities are not required to respond to such issues, besides applying their minds to the issues and responses and making a decision based on their evaluation thereof.

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

05 August 2015

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Our Ref: J27035/ J31314

Your Ref: Email received 08 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

THYSPUNT ALLIANCE NUCLEAR 1

REPSONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT

THE COOLING SYSTEM CIRCULATING WATER CIRCUIT

CHAPTER 3, SECTION 3.6.1 & APPENDIX E 16, SECTION 1.3.1

Response compiled by H. Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

1. **The Fukushima Factor**

   The Fukushima accident has highlighted the critical importance of the cooling system for all current forms of nuclear reactor, including Pressurized Water Reactors. Failure of the cooling system at Fukushima has led to tragic devastation of surrounding land, resulting in the possibly permanent evacuation of large numbers of people, with massive disruption in normal life, huge economic losses and trauma to those involved. This is an environmental & social disaster of major proportions

   In the case of Fukushima, the primary cause was the tsunami, which exceeded all expectations. This may not appear to be a major consideration at Thyspunt, although it does raise the question as to whether risk assessment has been too lenient in general. Be that as it may, the accident has emphasized the importance of this component of the project. Unless it can be demonstrated that the cooling system is guaranteed to function flawlessly for the entire life of the plant, any NPS must be regarded as a flawed undertaking.

   Questions

   1. Is it accepted that the Fukushima accident was caused by failure of the cooling system?
   2. Are modern PWRs susceptible to the same risk?
   3. What would happen to a modern PWR in the event of failure of the cooling system?
   4. Can it be shown beyond all reasonable doubt that the containment building would contain any conceivable radiation arising from failure of the cooling system?

5. Can it be accepted that flawless functioning of the cooling system has to be guaranteed for the lifetime of the plant?

Response 1:

1. All nuclear power stations have backup systems to drive the cooling system. The primary reason for the Fukushima Daiichi accident was that the pumps that operated the cooling system, as well all power supply to these pumps (offsite power and backup generators that provided power to the pumps) were incapacitated by the Tsunami. Resultantly, cooling water could no longer be pumped into the reactor (for a more detailed discussion please see Appendix 32 and 33 of the Revised Draft EIR Version 2).
2. The Fukushima Daiichi reactors were all Generation II reactors and were not designed for passive cooling of the core as a means of preventing overheating if all electrical power is lost. Generation III reactors are significantly safer than the units involved in the Fukushima Daiichi disaster. Rather than relying on engineered safeguards requiring electrical power, Generation III designs make use of mechanical systems to ensure continued cooling and require no electrical power. For instance, some of these systems make use of gravity to drains water from a tank into the reactor. Thus, the possibility of a similar outcome to the Fukushima accident due to loss of power to the cooling system is eliminated in a Generation III nuclear power station (for a more detailed discussion please see Appendix 32 and 33 of the Revised Draft EIR Version 2).
3. As indicated in 2 above, the passive cooling system would ensure safe cooling of the reactor after shutdown.
4. Nuclear power plants are licensed in accordance with strict licensing criteria stipulated by the South African National Nuclear Regulator (NNR). These criteria align with international standards such as those issued by the US NRC and the IAEA. The design and licensing of the containment structure will be in accordance with these criteria through the NNR.
5. Continued functioning of the cooling system is necessary for any thermal power plant, whether the power generated by nuclear reaction or by the burning of coal. Should the cooling system fail, a Generation III power station is designed to shut down safely whilst the passive cooling system continues to operate.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

Agreed - in addition both the initiating event scenarios, frequency and reactor design will all be different making direct comparisons potentially misleading - however lessons learned from the Fukushima event have been applied by the industry in order to identify reasonably practicable design modification in the beyond design basis region assessment of which will form part of the safety case assessment and licensing process by the NNR.

Comment 2:

2. **Defence in depth**

Much is made in Eskom's publicity of the concept of defence in depth. This, of course, failed at Fukushima. Eskom's proposal for the intake of cooling water is described in section 3.11.1 of the Project description (Ch 3)

3.11.1 Intake tunnels
An undersea intake tunnel will draw cooling water from the sea into the cooling water intake basin adjacent to the cooling water pump houses. No detailed design for the intake tunnel(s) has been done, but the design will comply with the requirements of the relevant specialist recommendations, so as to minimise the impact on marine ecosystems and sediment

movement. The following basic principles will, however, apply. The construction of the intake tunnel(s) will involve sinking of a shaft on land to a depth of approximately 65 m below mean sea level. At this point the tunnel will be driven seawards underneath the seabed. The tunnels will be lined with precast or in-situ poured concrete. At the other end of the tunnel, a tower extending approximately 5 m to 10 m above the sea bed floor will be constructed to connect the intake structure and the tunnel.

Fixed dredging may need to be installed at the base of this tower. The length of the tunnel from the onshore access shaft will be approximately 1 km to 2 km **and the depth of water in which the intake structure will be constructed is limited to 30 m.**

"A more detailed description is given in section 1.3.1.3 on pages 4 – 5 of App E 16 Oceanographic Study"

Questions

1. It is not clear how many tunnels are proposed. If it is to be only one, with one tower above the sea bed, can this legitimately be described as "defence in depth"?
2. What would happen if a blockage were to occur at the tunnel entrance?
3. Would Eskom be able to guarantee that this would not occur during the lifetime of the plant?
4. If not, would Eskom accept that this is a fatal flaw in the whole design concept?
5. In view of the evidence of major seismic activity across the globe, including a recent tremor at Plettenberg Bay, will any allowance be made for possible earth movement, and what impact could this have on concrete pipelines?

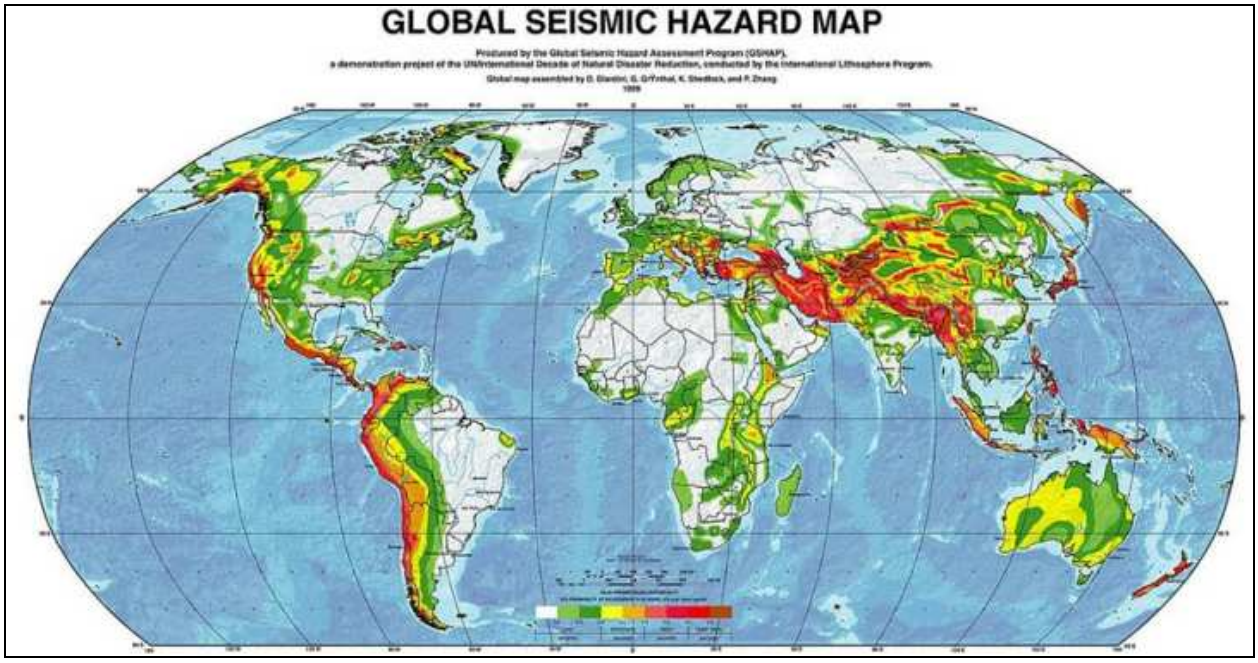
Response 2:

1. As indicated in the Consistent Dataset (Appendix of the Revised Draft EIR), there will be either one or two tunnels with a diameter of 5 to 10 m each.
2. It is highly unlikely that any object in the sea would be large enough to cause a complete blockage of the intake. The intake will be designed to prevent the update of sediment from the seafloor and will have screens to prevent the intake of large marine organisms such as kelp, fish and jellyfish. Smaller organisms will have no impact on the operation of the system. This type of system has been in use at Koeberg Nuclear Power Station and at countless other nuclear power stations around the world without incident.
3. The possibility of a complete blockage of the cooling water intake tunnel, given the precautions indicated above, is negligible. It should also be noted that the sea will not represent the ultimate heat sink and alternate cooling systems will be provided to remove heat from safety systems in the event of a blockage to the CW intake. The alternate cooling systems will be sized to safely remove the residual heat generated and will be designed to survive beyond design basis hazards. Nuclear safety demands the use of diverse, redundant and independent safety systems.
4. The operation of similar cooling systems across the world has never resulted in any incident. Thus it is not regarded as a fatal flaw.
5. Of the three alternative sites, Thyspunt was found to present the lowest seismic risk. The earth tremor that was felt in the in Southern Cape on 14 May 2011 measured 4.3 on the Richter Scale. This is far below the design threshold at which a nuclear power station would be damaged. A nuclear power station designed for peak ground acceleration of 0.3g can withstand an earthquake of approximately 7 on the Richter Scalein the near field. In this respect, it must be remembered that the Richter Scale is a logarithmic scale, This implies that an earthquake with a magnitude of 7 is 1000 times more intense than one measuring 4 on the Richter Scale.

South Africa is seismically relatively stable, compared especially to Japan, which is situated on a major seismic subduction zone, where continental plates collide. The figure below illustrates the relatively low seismic risk is South Africa, compared to high risk zones such as the western coastlines of South America and North America, the Asia-Pacific Rim, most of South-Central Asia and the Middle East.

The worldwide, large seismic events referred to correspond to tectonic movements at plate boundaries. No such plate boundaries exist in South Africa.
As the design basis seismic event for the Nuclear power plant represents one of the major load cases to be considered, seismic movement will be considered in all safety related structures. It should be noted that seismic movement corresponds to vibratory ground motion.

Lined tunnels and buried pipelines will accommodate seismic displacements along their length. As they are below ground structures they are not subject to the amplification effects experienced by buildings and as such are relatively robust against earthquakes.



Comment 3:

3. **Detailed design**

It is disturbing to note the acknowledgement in the section quoted that the detailed design for the intake tunnels has still not been done.

Questions

1. Will this detailed design be done prior to an application to the DEA for an ROD, or to the NNR for a license? If not, why not?
2. Does such an installation not require a separate EIA?
3. Will the tender specifications include flawless functioning and seismic protection?

4. What will happen if the consultants engaged to do the detailed design are unable to guarantee flawless functioning throughout the life of the plant?
5. How will “defence in depth” be possible on this design?
6. What are the cost estimates for this structure? Have these costs been included in the economic assessment on the relative costs of the three sites? (See attached Appendix on costing by Dr Mike Roberts)

Response 3:

1. The detailed design for the intake tunnels will not be done for EIA process. However, detailed designs are required for the NNR process. The current conceptual designs for the intake tunnels were regarded as sufficient to assess the environmental impacts, based on the marine specialist team’s experience with monitoring of marine impacts at Koeberg Nuclear Power Station.
2. There is a large number of listed activities that have been applied for in the Nuclear-1 EIA, of which the intake tunnels is one. No separate EIA is required. Many EIAs for large scale infrastructure include a number of different listed activities.
3. Eskom will develop performance specifications for the CW intake tunnels and design requirements which take into account the hazards relevant to the site. The design requirements also account for the safety classification of the structures under consideration as well as South African and international Nuclear regulatory requirements. Both the local and international requirements and regulations will ensure the nuclear safety of the power plant operation.
4. The consultants / contractors engaged will be required to design a system which complies with the performance specifications, design requirements and nuclear regulations contained in the design brief. The CW system however, is backed up by alternate cooling systems which are designed to cool all safety related components independently.
5. Defence in Depth may be provided by 2 tunnels instead of one (redundancy), the use of an alternate cooling system for safety systems (diversity) which uses an independent source of water (independence).
6. Costs for the intake tunnels, including the tunneling and moving of spoil, have been included in the cost estimate.

Comment 4:

4. **Appendix**

“An Estimate of the cost of the intake tunnels for the Thyspunt nuclear site” by Dr Michael Kinroe Charles Roberts is attached. His CV is given on p. 2. He is a recognized authority on tunneling.

1 AN ESTIMATE OF THE COST OF THE INTAKE TUNNELS FOR THE THYSPUNT NUCLEAR REACTOR.

Dr Michael Kilroe Charles Roberts 27/07/2011
Attached as Appendix 1 are excerpts from the document “Revised DEIR Chapter 3 Project description.pdf”, page 19. Namely section 3.11.1 and section 3.11.2 dealing with both the intake tunnels and the outfall tunnels.

1.1 Introduction

An estimate of the cost of the intake tunnels will be approximate in that costs will be estimated at a concept level.

1.2 The intake tunnels

An indication of the volume of water that would be required to report to the reactors via the intake tunnels is given by the statement in Appendix 1 namely section 3.11.2 "It is estimated that **six pipelines of** approximately 3 m diameter will be required for the outfall." This means that the sum of the cross area sections of the intake tunnels would be required to be 42m^2.

As a rough check, Koeberg draws in 80 tons of water per second for cooling purpose. A tunnel or tunnels whose cross sectional sum is 42m^2 will require water to move at a velocity of 2 m/s thus providing 80 tons of water per second to the reactors. These numbers look reasonable.

In order to get 42 m^2 of cross sectional tunnels there are a number of permutations some of which are shown below:

- One rectangular tunnel of dimensions of 6.5 m by 6.5 m, drill and blast, end might be too big for conventional drill and blast.
- Two rectangular tunnels of dimensions of 4.6 m by 4.6 m, drill and blast.
- One circular tunnel with a 7.5 m diameter excavated by tunnel borer.

Each one of these options would have their own costs for excavation complicated by the requirement that the tunnel/s will be required to be lined.

Response 4:

Dr Roberts' quote above "*It is estimated that **six pipelines of** approximately 3 m diameter will be required for the outfall*" refers to the outfall tunnels, not to the intake tunnel. Please refer to the Intake / Outfall Structure section of the Consistent Dataset (Appendix C of the Revised Draft EIR) and to Chapter 3 of the Revised Draft EIR for a description of the marine intake and outfall tunnels.

Furthermore dependent on the rock conditions, the tunnel lining may comprise elements of the following. It should be noted that there are intake tunnels around the world which are left unlined as they are formed in very favourable rock:

- Grouting ahead of the tunnel face where water ingress is considered to be a hazard
- Barring and Removal of loose rock after blasting
- Local rock support by means of rock bolting
- Shotcreting where needed by the rock conditions to ensure temporary support
- Grouting into the rock to block off local water ingress
- Erection of rebar for the tunnel lining around the tunnel circumference
- Erection of formwork
- Casting of the concrete
- Removal of the formwork once the concrete has gained sufficient strength
- Additional consolidation and contact grouting where required.

Comment 5:

1.3 Costs

1.3.1 Establishing the infrastructure

In order to access the intact rock at some depth below surface an 8 m diameter shaft will be required to be sunk. This shaft will give access to the development faces as the intact tunnel/s are developed. Once the intake tunnel/s are developed the shaft will itself be part of the intake as it is here that the water (enclosed in a pipeline) will emerge on surface on its way to the reactors. There will be two cost components namely the pre-sink civils to about 30 m and the sink to an estimated depth of 80 m to intact rock.

- Pre- sink civils - **R 50** million
- Sink to 80 m - **R 40** million (R0.8 million/m)

1.3.2 Developing the tunnel/s

It is assumed that the tunnel/s will be developed for 1500 m to a point where the depth of the ocean is 30 m. A cost per ton of R 2000 will be used and included in this cost is the cost of the lining.

- The number of cubic metres to be developed is 1500 m * 42 m^2 = 63000 m^3
- This represents 63000 m^3 * 2.7 = 173200 tons
- At R 2000 a ton the tunnel/s excavation and lining costs are
- R 2000 * 173200 = R 346500000 rounded off to **R 347** million

1.3.3 Intake tower on sea bed

This tower will stand about 10 m above the sea bed. Estimated cost **R 30** million

1.3.4 Geotechnical drilling

This will be required in order to geotechnically classify the rock that will be traversed and will have to be done from vessels at sea. Estimated cost **R 10** million

1.4 Total cost of the intake tunnels and related infrastructure.

Summing the rand values in bold comes to a value of **R 477** Million

Response 5:

The project amount can only be confirmed upon design evaluations. Any figures at this stage are estimated amounts. However, Eskom will ensure that the envisaged project costs are not exceeded by ensuring that the specifications and designs are robust.

2 CV DR. MICHAEL KILROE CHARLES ROBERTS

Dr Roberts has a PhD in mining engineering from the University of the Witwatersrand, an MSc in structural geology and rock mechanics from Imperial College London. He is a certificated rock engineering practitioner and consultant on hard rock underground mines with 34 years of experience. He was a C2 NRF rated researcher with a record of 54 publications as author or co-author in technical journals. He is a Professional Natural Scientist PrSci Nat Registration number 400117/96.

3 APPENDIX 1

3.1 Excerpt from file: Revised DEIR (Version 1) Chapter 3 Project description.pdf, page 19

3.11.1 Intake tunnels
An undersea intake tunnel will **draw** cooling water from the sea into **the cooling water** intake basin adjacent to the cooling water pump houses. No detailed design for the intake tunnel(s) has been done, but the design will comply with the requirements of the relevant specialist recommendations, so as to minimise the impact on marine ecosystems and sediment movement. The following basic principles will, however, apply. The construction of the intake tunnel(s) will involve sinking of a shaft on land to a depth of **approximately 65** m below mean sea level. At this point the tunnel will be driven seawards underneath the seabed. The tunnels will be lined with precast or in-situ poured concrete. At the other end of the tunnel, a tower extending approximately **5 m to 10 m** above the sea bed floor will be constructed to connect the intake **structure** and the tunnel. Fixed dredging may need to be installed at the base of this tower. The length of the tunnel from the onshore access shaft will be approximately 1 km to 2 km **and the depth of water in which the intake structure will be constructed is limited to 30 m.**

3.11.2 Outfall tunnels
The outfall **pipelines/tunnels** dispose the seawater used to cool the **turbo-generators and other smaller heat exchangers as well as** diluted chemical effluent into the ocean. It is estimated that **six pipelines of** approximately 3 m diameter will be required for the outfall works. The marine biologist recommends the use of multiple **discharge** points in order to facilitate dispersion of the warmed water and mixing with the relatively cooler sea water. The objective of the outfall works will be to transfer the heated water at least beyond the surf zone (estimated to be in the order of 500 m to a depth of **5 m** below mean sea level). The final depth and distance of release of the heated water will be determined by the **results** of the marine specialist study. The water released into the ocean will be 12 °C warmer than the seawater, as a result of the heat absorbed from the process. The primary objective is to ensure that the heated water **has minimal** impact on sea life. The velocity of the water in the pipes will fast enough to ensure adequate dispersion into the sea. A high velocity of the expelled water ensures an adequate rate of mixing with the sea water, which reduces thermal pollution of the benthic environment.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 08 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust.

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE NUCLEAR 1

RESPONSE TO APP 24: HUMAN HEALTH RISK ASSESSMENT

Response compiled by H. Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

General comment

One of our objections to this entire EIA process is the tendency to exclude important material negative factors which could influence the decision-making process. The most extreme is the exclusion of the NNR from the EIA, and with it the awkward question of the viability of the Thyspunt site in terms of emergency planning & evacuation. This is one of the major issues at the Thyspunt site. There is evidence of these exclusions in this report, and it is difficult not to conclude that there is a deliberate policy at high level to evade the implications of viability, and its potential impact on human health issues throughout the EIA. The report is entirely theoretical and pays no attention to the specific issues related to reach site.

COMMENT FORM INDEPENDENT NUCLEAR SPECIALIST
The is a correct statement of the regulatory situation - there is no exclusion of the NNR the EIA process is but one part of an overall set of processes of which the NNR licensing process is another governed by different legislation

Response 1:

As indicated repeatedly in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement, which governs the consideration of radiological issues in EIA processes and the interaction between the DEA and the NNR in terms of their respective mandates for environmental and radiological safety (See Appendix B4 of the Revised Draft EIR). The agreement clearly stipulates that issues of radiological safety are within the mandate of the NNR. Furthermore, it is not within the mandate of the Environmental Assessment

Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement. We must, therefore, conduct the EIA based on their mandates and their agreement.

In this regard you are also referred to the then DEAT's approval of the Scoping Report, dated 19 November 2008, where the following is stated:

> 2.21 All radiological issues raised during the EIA process, which are not comprehensively addressed, must be explicitly referred to the NNR to be addressed as part of their process.

This response by the DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process. However, in recognition of requirements in the NEMA, associated legislation such as the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) and other legal precedents that require the consideration of all relevant socio-economic factors in an EIA process, an assessment of radiological impacts of the proposed power station is included in the current version of the EIR. Although this approach of including an assessment of the radiological impacts of the proposed power station results in a risk of duplication between the EIA and the NNR licensing processes, the risk to the EIA in terms of possible appeals, based on the exclusion of substantive issues such as health issues from the EIA process, is regarded as greater than the risk of duplication. The current version of the EIR therefore departs substantially from the approach in the previous versions of the EIR in terms of the consideration of radiological impacts.

The Human Health Risk Assessment is based on the assumption that the power station will comply with all relevant legal requirements and criteria stipulated by the National Nuclear Regulator. Provided that such compliance is achieved, there will be no health impact on the public during normal operating conditions.

Comment 2:

Specific comment

Accidental releases
Attention is drawn to the total absence of any discussion on unscheduled/accidental releases, and their implications for human health and viability.

Response 2:

Please refer to Appendix E33 of the revised Draft EIR (Version 2) for a discussion on Beyond Design Basis Accidents..

Comment 3:

Generation III technology
The entire EIA is based on the assumption of use of Generation III technology. This is defined in Chapter 3, section 3.5, and has a number of good qualities. These include standardized design, simplifying the process; simple, rugged construction, reducing vulnerability; high availability and longer life; reduced possibility of core meltdown; minimal effect on environment; higher burn-up optimizing fuel use and reducing waste; and absorbers to extend fuel life. All of these are significant potential improvements, but unfortunately the government has pronounced that Gen III is unaffordable!

Everything is expressed in relative terms, in comparison with Gen II. There are no absolutes. Nobody has yet claimed an "inherently safe" technology (apart from the PBMR which was rejected). Even Gen III still requires EPZs, albeit claimed reduced ones.

Response 3:

In 2009, Eskom abandoned the procurement process due to funding constraints particularly in the context of the global financial crisis. At that stage Government supported this decision to ensure that Eskom does not over-extend its balance sheet and that Eskom's ability to provide the economy with competitively priced energy is not jeopardized. The procurement process will now be led by Government.

To make an absolute statement that there can **never** be an incident with a nuclear power station would clearly be deceptive. No technology, whether nuclear or non-nuclear, is completely fool-proof. However, the question that needs to be answered is whether the risk can be mitigated to an acceptable level. The risk of nuclear incidents in a Generation III power station is, due the passive cooling systems, orders of magnitude smaller than with a Generation II power station, such as the Fukushima Daiichi plant, of which the first unit started operating in 1971. In terms of the reduction of the possibility of core melts the IAEA has issued guidance that while a Core Damage Frequency (CDF) of 10^{-4}/yr is acceptable for current reactors, new construction should achieve 10^{-5}/yr as required by the EUR. Construction of Fukushima Daiichi started in 1967. There have been huge advances in nuclear power station safety designs in the intervening four decades. Please consult the Radiological Impact Assessment and the Beyind Design Accident Report in Appendix 32 and 33 respectively.

Comment 4:

"EURs"
The reduced EPZs are in terms of so-called "EURs" – European Utility Requirements (N.B **not** European Union Regulations, as might be expected from the acronym). These are a product of the European nuclear industry, to further its own agenda. There is extreme scepticism in the public mind regarding EURs, which have not been recognized by any national nuclear regulator anywhere in the world. Were South Africa to use EURs as their regulatory criteria, we would be the first country in the world to do so.

Response 4:

The EUR is a specifications document drawn up by electricity utilities to give guidance to designers and vendors on the expectations of the utilities. It is thus not a document that is approved by the Regulatory Authorities. Current plants being plant, EPR and the AP1000, comply to the EUR requirements on the EP zones.

Comment 5:

Fig 3.1, p.7
One of the strategies being employed by Eskom is to suggest that the prevailing wind in the area is from the north-west (for example in the Air Quality assessment). This is a complete fabrication, sucked out of their thumb by Eskom during the nineteen eighties, and not supported by any of the scientific evidence. The reality is that the prevailing wind is from the west to south-west, with a lesser frequency from the east. North-west is fairly rare in this area, and normally associated with a berg wind, which precedes the arrival of a cold front. This materially affects the potential impact on human health, since a north-westerly wind would blow any radio-nuclides released from the plant out to sea (bad news for the chokka industry!), whereas a westerly to south-westerly wind would blow them directly onto the Greater St Francis communities, all of which are within the internationally recognized 16 kilometre EPZ.

We therefore question the source material from which Fig 3.1. on p.7 is drawn. Whilst it does reflect the prevailing westerly and easterly winds, it also reflects a surprisingly large bulge to the south, which would not normally be expected from a westerly or easterly wind. We request the DEA to require evidence of the source material used.

Response 5:

With regards to the issue of wind direction and the potential impact on St. Francis, please refer to the attached detailed response by air quality specialist. Portions of this response relevant to the above-mentioned comment are reproduced for convenience below. GIBB furthermore welcomes any scientifically verifiable data and statements to what is provided by the specialist below:

The Air Quality Report states (Section 2.3.3) that the dispersion of air pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The influence of wind speed on the dispersion of air pollutants is significantly non-linear and is therefore best described through the use of dispersion models and not only through a qualitative description of the wind patterns as depicted by wind roses. An analysis of wind roses provides an indication of the area of most impact (i.e. likelihood), but not necessarily the magnitude. For instance, releases near ground level would result in high ground level concentrations during calm wind conditions at night, whereas the same atmospheric conditions in the case of elevated releases would result in the lowest ground level concentrations. It is therefore also important to consider the wind speed, atmospheric stability and release height together with the wind direction when qualitatively estimating the area of impact. These concepts were also discussed in the Air Quality Report (Section 2.3.2). A significant portion of the Air Quality Report discusses the important result of the assessment, i.e. the predicted ground level concentration patterns, which take into account a number of meteorological parameters in addition to wind speed and direction. A discussion of the latter two parameters alone cannot provide adequate information on the behaviour of the atmospheric dispersion.

The sources of the data used in the Air Quality report are indicated below. It is important to source information that would be useful and essential for the prediction of air pollution impacts. The three sources of meteorological data available at the time of the assessment included:

- *Eskom meteorological stations located at four sites in the vicinity of Thyspunt, namely De Hoek, Thyspunt, Klippepunt, and Brakkeduine (December 1986 to September 1988);*
- *The South African Weather Services' weather station located at Cape St. Francis. Data collection started in 2004; and*
- *Onsite station which consists of a 10 m mast, fully equipped with meteorological instrumentation to measure the wind vector, air temperature, relative humidity, barometric pressure and rainfall. Data have been collected since 10 January 2008.*

The reference to the Eskom measurements was included merely to provide background discussion on the historical information. These measurements were not used in any of the calculations. The atmospheric dispersion modelling was done using the onsite data for the period January 2008 to September 2009. The results included the simulations for every hour of this period and therefore considered actual measurements of the meteorological parameters experienced on the site. The results included in the Air Quality Report therefore did not rely on speculation of impacts due to a discussion of specific wind directions based on wind roses, but were based on actual measurements of all meteorological parameters.

The results that the National Nuclear Regulator would be reviewing are therefore based on the onsite information available at the time of the assessment. In any event, the National Nuclear Regulator follows a very rigorous procedure, in line with the International Atomic Energy Agency, which requires continually updating onsite information and syntheses of these (including onsite meteorological data and dispersion modelling).

Comment 6:

Page 8, para 3
Once again, the Greater St Francis area, which includes Rebelsrus, Mostert's Hoek, Cape St Francis, Sea Vista and St Francis, with an estimated holiday population in excess of 30000, is completely ignored. All of these communities fall within the current internationally recognized 16 km EPZ. The questions raised are why this is, and whether the omission derives from the specialist, or from editing of the report by the EAP. Either way, it is totally unacceptable, and reflects on the allegation contained under "General comment" above.

Response 6:

The dispersion modelling in the Air Quality Assessment is based on risk i.e. it focuses on the area that could experience potentially highly significant impacts.

As far as the EAP's editing of specialist reports is concerned, the editing was focused primarily on:

- grammatical and formatting corrections;
- ensuring that the specialist reports sufficiently answered the questions raised in the EAP's Terms of Reference provided to each specialist;
- ensuring that all specialists correctly and consistently applied the impact assessment criteria for determining impact significance; and
- General quality control.

The EAP has not in any way edited the technical findings of the specialist reports.

Comment 7:

Page 11, section 4.1.2 "Initiating events"
Who in this world is able to predict whether an activity will occur once in 100, or a million years? As a yardstick, this area has had "one-in-200-year" floods four times in the last 15 years. The reality is that accidents do happen, sometimes as a result of human error, sometimes through over-optimistic service & replacement intervals and sometimes through an extreme natural event. In the past few years we have left a spanner in the turbine at Koeberg, have blown up a R3 billion generator at Duve[1] (sic) Power Station, and have had an "inconceivable" tsunami at Fukushima. The three different categories of risk are desk-top exercises, exploring different theoretical categories. They have no practical application. The reality is that nuclear power generation remains a hazardous and potentially catastrophic technology, which demands a strong application of the precautionary principle, especially in the light of Fukushima.

Response 7:

An assessment of risks must include an analysis not only of the intensity or severity of an impact, but also of the likelihood that it will occur. Such risk-based approaches are used commonly in engineering (for instance, in determining the areas subject to inundation during a 1:50 year flood event) in order to ensure human safety.

It goes without saying that the future cannot be predicted with absolute certainty. However, your statement implies that it is worthless to use a risk-based approach by applying statistical analysis to determine the possible return period of major event. To use an analogy, this would for instance mean that return period flood-line analysis (1:50 year analysis is currently used in South Africa)

[1] Presumably a reference to Duvha Power Station

could ever be safe enough to protect residential areas from flooding. This would effectively sterilise decision-making for urban planning purposes.

Return periods of catastrophic events are correspondingly larger in the case of nuclear power station planning, specifically to cater for potential nuclear disaster situations. For instance, nuclear power station planning is based on 1:1,000 and 1:10,000 year extreme rainfall events, with and without climate change. As indicated in the Hydrology Specialist Report (Appendix E6 of the revised Draft EIR), the 1:10 000 year rainfall event is specifically selected in the case of Nuclear Installations with a view to build in a large safety factor.

RESPONSE FROM THE INDEPENDENT NUCLEAR SPECIALIST

Agreed - a risk based approach can identify the likelihood of when and event may transpire but not when - such risk informed decision making is present in most engineering endeavours and where the risk is unacceptable - having applied appropriate conservatism then engineered measures and deterministic assessment is normally applied

Comment 8:

Assessment in terms of pure theory
The assessment is purely theoretical, as is the Social Impact Report. There are no specific impact assessments, no reference at all to the three sites under review, or to unscheduled releases, or to variations in local conditions. It is a pure text-book exercise, and is worthless in terms of assessment of sites for Nuclear 1.

Response 8:

The Air Quality Assessment is based on sound empirical atmospheric data and internationally recognised dispersion modelling techniques. Should you have any information to dispute the validity of the scientific methods used in this specialist study, kindly provide us with a reasoned motivation for your statement.

Yours faithfully
for GIBB (Pty) Ltd

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Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 08 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St. Francis Bay Resident's Association and the St. Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

COMMENT ON IMPACT ASSESSMENT METHODOLOGY, CHAPTER 7

Response compiled by H. Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St. Francis Kromme Trust and the Thyspunt Alliance

Comment 1:
Impact Assessment criteria are essential components in the EIA process, and indeed appear to determine whether or not there are fatal flaws. Specialists are required to evaluate impacts on their areas of discipline in terms of these criteria.

The Peer Group Assessment, Appendix H, section 2.3.1, pages 13 – 15, comments in the last paragraph of p.14 that "the use of the rating criteria is complex, inconsistent and in some instances very difficult to understand." On p. 15 para 3 he states: "The net effect of all of the above is that it is very difficult to determine which impacts are really significant for decision-making and which are not. With the significance rating presented as it is currently, none of the sites appear suitable for the development, yet the conclusion is still drawn that all are suitable."

DEIR 2 has made a number of changes to the criteria in Table 7 – 16 of the Revised Report. This is in response to a complaint by I&APs in the first draft that the criteria as published in Table 7 -10 did not allow anything more than "medium" significance where "extent" and "duration" were medium or lower. "Extent" could only be high if it was regional or national, and "duration" could only be rated above low if it was for more than 9 years. This impacted on all the other categories further down the scale, and meant that the highest possible significance was "medium". This was clearly not acceptable.

Response 1:

In response to the Peer Group reviewers' comments on the Draft EIR, the criteria for rating of impact significance were accordingly changed to provide a more realistic assessment of impact significance and to prevent a situation where, as stated above, impacts are rated as high, in spite of the specialists not identifying any fatal flaws. The concern behind the statement of the reviewers was that the specialists tend to rate impacts unnecessarily high as a precaution. For instance, specialists would assume that the most sensitive elements of the site would be destroyed, without having regard to the fact that the proposed development footprint would avoid such sensitive elements.

The criteria for assessment of impact significance were accordingly amended in consultation with the specialists to ensure their agreement with the meaning and application of the criteria. For instance, the criteria for duration have been amended to the following:

- 0 - 3 years: Low
- 4 - 8 years: Medium
- More than 9 years to permanent: High

One of the outcomes of the revision of impact criteria was a change from only three significance categories (low, medium and high) to five categories. Thus, if an impact is still found to be of high significance with mitigation after the application of these new criteria, there is a greater possibility that it could be regarded as a fatal flaw. After application of these revised criteria, there are very few impacts that remain high after mitigation (one each at Duynefontein and Thyspunt and two at Bantamsklip).

Comment 2:

Changes
The criteria for "Extent", "Duration" and "Consequence" have been materially altered. The changes to "Extent" and "Duration" are positive, but this is immediately countered by the "consequence" criteria, which have been materially altered. These continue to affect all the categories which follow.

Response 2:

The criteria used are a representative of international best practice in environmental impact assessment.

Comment 3:

Under the previous criteria, "**Extent**" recognised three categories. "Low" covered only the footprint; "Medium" covered the footprint and surrounding areas and towns, with no distance stated. "High" covered provincial and national impacts. On this basis, it was reasonable to categorise "extent" of the impact of Thyspunt on the St Francis area as "medium".

The major change in Table 7-16 is that "medium" covers the surrounding area and towns **up to a distance of 10 kilometres**. Anything beyond that is categorised as "high" impact. Since both Cape St Francis and St Francis Bay are more than 10 kilometres from the site, any impact on them places them in the "high impact" category for "extent". This addresses one of the complaints in our response to Table 7 – 10.

Response 3:

We take note of your comment.

Comment 4:

Much the same applies to "**duration**". Under the previous criteria, depending on which table one was using, "Low" was anything of up to nine years' duration; "Medium" was from 10 – 15 years and "high" was 15 – 60 years. Under the new criteria outlined in Table 7 -16, "low" is 0 – 3 years, "medium" is 4 – 8 years, and "high" is 9 years to permanent. On this basis, with a nine-year construction period "duration" should be classed as "high" impact. Here again, this addresses the complaint with regard to 7 -10.

Response 4:

We take note of your comment.

Comment 5:

On the other hand, the explanatory notes below Table 7-16 revert to the previous criteria of medium extent in undefined surrounding areas, and low duration of up to nine years. The contradiction needs to be addressed.

"Intensity" is a much more subjective category, but is a crucial component in the ranking process. According to the explanatory notes in 7 -10 & 7-16:

> ***"This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered? The specialist studies must attempt to quantify the magnitude of the impacts and outline the rationale used"***

According to this definition a “high” impact rating will only occur where the impact will “destroy the impacted environment”. It makes no distinction between “natural” and “social or cultural” impacts. This is defined differently in Table 7-16 itself, where intensity is defined in terms of impact on the environment and social functions.

Medium Intensity is defined as “*alteration of the natural environment, but natural, cultural and social functions and processes continue, but in a in a modified way, and valued, important, sensitive or vulnerable systems or communities are negatively affected.*”
High intensity is expressed in similar terms, but here “*natural, cultural or social functions and processes are altered to the extent that the natural processes will temporarily or permanently cease; and valued, important, sensitive or vulnerable systems or communities are substantially affected.”*

Response 5:

Thank you for your comment. The explanatory notes below Table 7-16 are incorrect with regards to duration of the impact. The criteria in Table 7-16 are correct and are what were used by the specialists in their assessment of the impacts. A correction to the text below Table 7-16 will be made in the final version of the EIR.

The definitions of intensity are consistent with international best practice and relevant guideline documents published by the Department of Environmental Affairs.

Comment 6:

Analysis of this section shows it to be highly subjective and ambiguous. Who decides whether communities are valued, important, sensitive or vulnerable? Is there any community that is not valued by someone? The word “and” between the two sections raises all sorts of questions. Will a high intensity only be allotted where both groups of criteria are met, or is this an either/or situation? It is not difficult to imagine an impact which substantially affects groups or communities without destroying natural processes.

Response 6:

The criteria are applied by each particular specialist as appropriate to the resources they are assessing. From a social point of view, if highly valuable social processes or resources are destroyed, the impact is regarded to have a high intensity. On a biophysical level, if a highly valuable community like a wetland is destroyed, it is regarded to have a high intensity. The definition of intensity does not imply that both social and biophysical resources must be simultaneously affected for an impact to be assessed to have a high intensity.

Comment 7:

In table 7-10 of the first draft, one of the categories for declaring a high consequence could be medium intensity at a regional level, and endure in the long term. In Table 7-16, “regional” is defined as “beyond a ten kilometre radius”. Under these criteria some impacts would receive “high” consequence ratings. Other things being equal, this could lead to a “high” significance rating, with all the implications of that.

As is shown below, the criteria for “consequence” have been altered

The **“consequence**” criteria have been greatly simplified, but made more stringent. According to the explanatory notes:

> ***The consequence of the potential impacts is a summation of above criteria, namely the extent, duration, intensity and impact on irreplaceable resources.***

The new element here is “impact on irreplaceable resources”. In terms of the first DEIR table 7 – 10 “consequence” would be rated “high” where “intensity” is medium at a regional level and endure in the long term. The reference to “irreplaceable resources” came further down the list, and would have no influence on “consequence”.

This has changed in table 7 -16. Consequence will now be rated “high” where “intensity “ and impact on “irreplaceable resources” are high, together with any combination of “extent” and “duration”; or “Intensity” is rated “high”, with all of the other criteria being rated “medium” or higher. In other words, “consequence” cannot now be rated “high” unless “intensity” is high, and intensity can only be rated high where natural and other processes will temporarily or permanently cease, and communities are substantially affected.

Response 7:

Your assessment is correct. One of the points made by the peer reviewers is that significance should strictly be a function of consequence and probability. However, impact on irreplaceable resources was brought into the equation later on (after consideration of consequence) in the Draft EIR. Significance was therefore not purely a function of consequence and probability. Based on the reviewers' comments, consequence has been redefined in the Revised Draft EIR to include impact on irreplaceable resources.

Comment 8:

"Intensity" is critical, but subjective, and can be manipulated. There is likely to be debate on whether intensity is high in relation to the traffic passing St Francis Bay.
Questions raised by this are:

1. Which is correct: table 7 – 16 or the explanatory notes?
2. If Table 7 – 16, why have the explanatory notes not been revised to reflect the changes?
3. What are the reasons for the change in the "intensity" & "consequence" requirements?
4. Have all the specialist reports been reviewed in terms of Table 7 - 16?
5. If not will the EAP have any revisions made, and their implications spelt out, before submission of the Revised EIR to the DEA?
6. Have the changes made addressed the issues raised by the Peer Review Consultant regarding the problems raised in para 2?

Response 8:

Judgement is implicit at various stages in all EIA processes and in the assessment of all impact by all specialists. Each specialist makes a reasoned judgement of the sensitivity of the resource on which he/she focuses, based on his/her professional knowledge of the resource. This knowledge is typically obtained from fieldwork, interested and affected parties, peers and from subject literature. The specialist applies this knowledge to the project to determine how the project will interact with the environment. In determining how serious the impact will be, each specialist applies a reasoned opinion.

1. As indicated in Response 5 above, the explanatory notes below Table 7-16 are incorrect and were mistakenly carried over from the Draft EIR into the Revised Draft EIR. The criteria in Table 7-16 were applied by the specialists in their assessment for the Revised Draft EIR.
2. The explanatory notes were incorrectly carried over from the Draft EIR.
3. Please refer to Response 8 above for the reasons for the change in the consequence criteria. Intensity criteria were reviewed to make them more consistent with accepted intensity criteria in international EIA practice.
4. All specialists applied the criteria in Table 7-16.
5. Refer to 4 above.
6. Changes to the assessment criteria were made to address the issues raised by the peer review consultants.

Comment 9:

One of the complaints in the Peer Review was that the ratings were difficult to understand and difficult to apply. We submit that the new ones are almost worse.

The test case which follows illustrates the potential difference between the application of these criteria.

Test case
As an example, we can take an impact which would be sensitive to these changes, namely the social impact of thousands of heavy vehicle trips across the Kromme River bridge, past St Francis Bay, and up a long, fairly steep hill, as envisaged in Project Description, Table 3-14, (with errors corrected, such as Vendor staff year 4, and the incorrect totals under "total vehicles per day"). Anyone who regards this impact as less than high intensity must be deaf, blind or both. A further factor is that nobody appears to have factored in the huge increase in traffic over peak holiday periods. Unfortunately neither the Noise Specialist nor the Social Impact Specialist appear to have noticed that these will be the case, and the criteria are inconclusive.

An independent ruling is required on whether thousands of heavy-duty trucks per day (and possibly night), passing over the Kromme River bridge, through St Francis Bay, and up a long hill, and then back again,

365 days per year, constitutes high intensity impact in terms of the above criteria. The rationale for the decision must be spelt out in the public domain.

The table which follows compares the impacts in terms of the new criteria with those used in the first draft, assuming that the intensity is judged to be high, and that "sense of place" can be regarded as an irreplaceable resource. Col 1 indicates the rating in terms of the original impact assessment criteria, whilst column 2 shows the effect of the new criteria. In this case, we are concerned with road access, not with the nuclear site itself. For this reason "extent" is deemed to be "medium" impact, with the road itself being the "site".

Impact Assessment	First draft, App E 18, Section 7.7 Table 7-10	Revised draft App E18 Section 7.8.1 Table 7 - 16
Nature	Negative	Negative
Extent	Local	Medium (below 10 km)
Duration	Medium	High
Intensity	Medium	High
Irreplaceable resources (Sense of place)	High	High
Consequence		
Table 7 -10 (intensity + extent+ duration)		Medium
Table 7 – 16 (intensity +extent+duration+irreplaceable resources)		High
Probability	Highly probable	Highly probable/certain
Significance		
Table 7 -10 (consequence + probability)		Medium
Table 7 – 16 (all impacts, including potential cumulative. Cumulative no longer defined, but included in significance)		High to very high
Reversibility	Low	Zero unless road access diverted
Confidence	High	High
Cumulative impacts	Medium	see Significance

Response 9:

We take note of your assessments of the impact of traffic. Traffic impacts on the St. Francis area have been recognised to be serious enough that an alternative construction vehicle route around St. Francis is included in the Revised Draft EIR (Version 2)..

Comment 10:

Let us consider the proposed mitigation measures anyway.

Proposed Mitigation measures (Revised Social Assessment Report, p.174)

1. "*Plan construction activities to minimise disruption to peak traffic"*.
   Unmitigable. Peak traffic times common to community & construction activities.
2. "*Workshop with relevant parties to discuss problems and implement relevant improvements".*
   Toothless talk shop. What status? What relief? Who arbitrates disputes? Too late by then.
   Problem areas should be identified prior to ROD and realism of proposed mitigation measures taken into account in determining a decision to proceed. Alternative route to avoid the problem the only possible effective form of mitigation.
3. "*Implement mitigation measures in traffic impact assessment."* App E 25, p. Only relevant proposal: limit bulk of abnormal loads to 21h00 – 05h00. Abnormal loads not defined. Sleepless nights for entire community for ten years?
4. "*Mitigate impacts on pavement loading by "possible" contribution to roads rehabilitation programme by Eskom".* Why only "possible"? Eskom's transportation proposals will destroy all but the most highly specified roads. This has to be a contractual obligation. How enforced? To what standard?

Comment on mitigation measures

These pay no more than thumb-suck lip-service to the mitigation requirements. The reality is that if the R330 is used for heavy construction vehicles, this will have an unmitigable impact of very high significance

on one of South Africa's successful holiday resorts & tourism destinations. The mitigation measures proposed are almost puerile. They will have minimal effect on the impacts which have been identified, and will most certainly not solve the problems. They are worthless.

Response 10:

We take note of your comments. The Transport Specialist Study has been substantially revised in order to redefine the proposed vehicle routes to the Thyspunt site, so that the route through St. The revised study acknowledges that the Thyspunt site requires significant transport infrastructure upgrades. The R330 is now proposed to be used for light vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operations phases for staff access, light vehicle traffic, heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity.

Comment 11:

Conclusions in test case

1. In terms of the Impact Assessment Criteria contained in Section 7.8.1 of Chapter 7, the decision-making authority must consider whether the proposed use of the R330 for main traffic access to Thyspunt is not fatally flawed in terms of its social impact.

Response 11:

We take note of your comment. Please refer to response 10.

Comment 12:

2. It is essential that remaining ambiguities in the impact assessment criteria be resolved, and that all reports are reviewed for consistency with the revised criteria in Table 7 -16.

Response 12:

As indicated in Response 5 above, all specialists applied the assessment criteria in Table 7-16.

Comment 13:

3. If it is concluded that the use of the R330 is fatally flawed, Eskom should be instructed to identify another main access route, situated a minimum of 1 kilometre from any urban edge, or regard this as a fatal flaw.

Response 13:

As indicated in response 10, the Transport specialist study has being revised so that heavy vehicles to Thyspunt bypass St. Francis.

Comment 14:

Conclusions on Impact Assessment Methodology

This assessment derives from criticism raised by the Peer Review in Appendix H of the first DEIR. The specific criticisms are outlined in the second paragraph of this submission, namely inconsistency and difficulty to understand and apply. The question raised is whether the revised version reflected in Table 7 -16 has improved or aggravated the situation, and whether this affects the drawing of correct conclusions regarding impacts. We believe that the criticisms remain. It is yet another example of a sloppy approach, which allows too much room for misunderstanding and manipulation in a crucial component of the overall EIA.

Response 15:

We take note of your comment. In general it is important to to cognisance of the fact that every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts has developed over the last three decades and includes a

number of criteria that are applied almost universally in EIAs. These criteria typically include nature (is the impact negative or positive?), extent (or scale), duration, intensity (degree of change), consequence (seriousness), reversibility, probability (how certain is it that the impact will occur?) and significance (overall importance of the potential impact).

Although there is general agreement about the nature of the criteria for assessment and there are local and international guidelines on this, there is no single agreed method. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria, as well as any requirements that the environmental authority might have regarding the criteria. In the case of the Nuclear-1 EIA the EAP sought assistance from other senior EAPs, namely Mr. Neal Carter and Mr. Reuben Heydenrych, as well as an advisor on EIA process, Mr. Sean O'Beirne.

Furthermore, based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 08 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

COMMENT ON THE TRANSPORT IMPACT REPORT

THYSPUNT NUCLEAR 1 DRAFT ENVIRONMENTAL 2nd DRAFT IMPACT ASSESSMENT REPORT

Prepared by: Trudi Malan & Ray Parker on behalf of the Thyspunt Alliance.

Although the revised traffic impact assessment contains significantly more information than the original TIA that we commented on in 2010, it would appear that the main issues have not been adequately addressed. This relates primarily to the effect that construction traffic, including abnormal loads, will have on the road network and communities within Humansdorp, adjacent to the R330, and the greater St Francis Bay area.

The TIA infers, in section 10.1.1 of the report, that the bulk of construction traffic (i.e. construction materials, construction workers and staff, and aggregate) will be transported via the proposed secondary access to the site, i.e. via the Oyster Bay road. In principle, this arrangement would appear to be the best option, as this would minimise the effect on the R330, and hence on the adjacent communities in St Francis Bay and Humansdorp.

However, the traffic analysis and trip distribution diagrams do not indicate this, and it would appear that the bulk of the traffic has been "loaded" onto the R330 (see typically diagrams C13 to C16). This situation is exasperated by the proposals to direct the bulk of construction traffic through Humansdorp. It is patently obvious that, firstly, Saffery Street and Main Street are not suitable for the conveyance of large volumes of construction traffic. Saffery Street is a residential road and is mostly bordered by residential properties along most of its length. Main Street serves business properties and the ongoing in-and-out parking movements will clash severely with the high volumes of construction traffic (during and outside of peak periods).

Secondly, the high incidence of pedestrian traffic along the R330 between Humansdorp and Kwanonzamo should be a major cause for concern. The TIA proposes "grade separation" – does this mean a pedestrian footbridge over the R330? Pedestrian footbridges are known to be problematic, as

pedestrians then need to be prevented (by for example physical barriers / walls) from entering the road reserves at any place other than the footbridge.

We have been informed by the consultants that they are currently busy reviewing the Transport Impact Report. This would be the third revision and it should be clear that there is major problem with regard to access to the Thyspunt site. We find it unacceptable that although most of the concerns about the access roads were raised in the Scoping phase of the project, the specialists ignored these very valid concerns and persisted in presenting a report that favours the developer. We believe that one of the main reasons for this is that changing the access routes will incur further costs for the developer at the Thyspunt site.

Response 1:

Your comments are noted. Similar concerns from the public have been raised and acknowledged regarding the transportation infrastructure around the Thyspunt site. As such the Transport Specialist study was revised to address the comments and the revised report will be made available for public comment and review as part of the Revised Draft EIR Version 2. The revised report recommends that the main street through Humansdorp and Saffery Street be bypassed. New transport roads for abnormal load vehicles were therefore considered and a number of alternate bypasses have been investigated,

The revised transport specialist study further acknowledges that the Thyspunt site requires significant transport infrastructure upgrades. The recommended routes in Version 9 of Transport Report were revised after the Revised Draft EIR was provided for public comment in May 2011. Based on this revision, the R330 is now proposed to be used only for passenger vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operations phases for staff access and heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. The DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity. As stated the bypass roads to the east and west of Humansdorp are also now proposed to be constructed to reduce the traffic impact on central Humansdorp.

Comment 2:

The TIA makes the following statement:

> 3.3.1 Locality of the Site
> Thyspunt is situated on the east coast of South Africa and lies within the Eastern Cape Province approximately 80 km west of Port Elizabeth as shown in Figure 3.5. It is located in the Cacadu District Municipality on the Kouga Coast.
>
> Vaalputs is located in the Northern Cape Province cross-country from Thyspunt approximately 750 km to the north-west. Humansdorp is located 15 km to the north, Oyster Bay is located 7 km west of the site, and Umuzamawethu is located 5 km from the site.

Please note, that although some of the highest impacts will be felt by the communities of St. Francis Bay, Sea Vista & Cape St. Francis – the names of these towns are not mentioned in the locality of the site. Furthermore it is clear that the approximate situations of the various towns listed were not actual road distances, but more of a “as the crow flies” measurement.

Response 2:

In recognition of the potential traffic impacts on St. Francis, the Traffic Impact Assessment has been substantively revised so that heavy construction traffic will bypass Humansdorp. Only ultra-heavy

vehicles (>100 tonnes; a total of 63 trips over the nine-year construction period) are proposed to use the Eastern Access Road and the R330.

Comment 3:

Figure 6.2 of the Traffic Impact Assessment does not correlate to any of the proposed access routes. The road indicated in figure 6.2 as the main access road is the road leading to Rebelsrus, this road has never before been indicated as the main access road to the site. The confusion that wrong information like this creates is completely unacceptable in a document of this importance. This again clearly indicates that there is not only confusion between the consultant and the developer but even the specialists are not quite sure where they need to place the main access road.

Response 3:

Your comments are noted. The entire Traffic Impact Assessment, including figures, has been revised.

Comment 4:

In 10.1.2 of the TIA the specialists described the scope of their assessment and requirements for a main access route. They state that route lengths and impact on settlements were assessed.

The specialist then completely ignores the impact on settlements and comes to the startling conclusion that the R330 must be used as main access route. It is clear that the impact on settlements was not the main driver behind this conclusion but rather the length of the route and the ease of traverse. Both of these criteria favour the developer. The consultant does acknowledge that the impact on people will be substantial.
Three possible alignments for the eastern access route are discussed and the statement is then made that:

> Alignment E3 is the longest route. It starts 2 km south of the R330 and crosses land that has low environmental sensitivity in a westerly direction, and then travels in a westerly direction through a corridor between St Francis Links and the "Dunes" development towards the site. To avoid impacting the St Francis Links this route alignment does not use the St Francis Links service road. Alignment E3 is therefore the recommended eastern access alignment.

We would like to contest the statement that alignment 3 crosses land that has a low environmental sensitivity. We would like the specialist to define "low environmental sensitivity". The fact that this road will cross a wetland that caused the washing away of the R330 in 2007 is not mentioned in the report. The statement of "low environmental sensitivity" is also in stark contrast to the following statement in the Freshwater Ecology Study:

> *Infilling of the ecologically important, largely un-impacted wetlands that occur on and near to the Thyspunt site, and the impacts on wetland function and habitat quality that would be associated with this infilling, has been assessed as a negative impact of high ecological significance. This assessment applies to all of the road alternative*

On page 90 the TIA states:

> *Detailed assessments of all the major structures will be conducted. Bypasses for several interchanges will be constructed as a result of height restrictions for overhead bridges.*

We fail to understand how these assessments cannot be included in the TIA for the Thyspunt Site. We are of the opinion that these details were left out of the report to favour the developer. No mention is made in the report about either the Kromme River Bridge or the culvert bridge that crosses the Sand River. This bridge has subsequently been washed away during the 2011 flood event and has in fact been threatened by floods in prior years. Furthermore none of the details available in the Abnormal

Load movement to Duynefontein is mentioned in the Thyspunt study. This study will not be deemed complete until all the relevant information is included.

In section 10.8 of the TIA a list of mitigation actions are recommended. There is no indication as to who will be responsible for these actions, when these actions will be implemented, what the costs of these actions will be and who will be responsible for these costs.

Response 4:

Your comment is noted. As per our Response 1 the Traffic Impact Assessment Report has been revised to address comments received in terms of access to the Thyspunt site. Furthermore the impact of the proposed infrastructure upgrade on the Social Environment has been assessed as part of not only the Social Impact Assessment (Appendix E18 of the Revised Draft EIR Version 1) but also the Noise and Visual Impact Assessments. The recommendations of these studies as well as those of the Heritage, Wetland and Botany Specialists have informed not only the revised Traffic Impact Assessment (as mentioned in Response 2 above) but also in a recently commissioned report which reconsiders the options for western access to the Thyspunt site. This report is attached as Appendix 31 to the revised Draft EIR Version 2.

Yours faithfully

_____
For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

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Dear Ms Abrahams

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Support for the Legal Resource Centre submission, prepared on behalf of Earthlife Africa and associated organizations, on the Nuclear-1 EIA

Comment 1:

The Commission for Gender Equality (CGE) is an independent state institution established in terms of Chapter 9 of the Constitution, Act number 108 of 1996 of the Republic of South Africa. The Constitutional mandate of the CGE is to promote respect for, protect and attain gender equality, and to make recommendations on any legislation or policy affecting the status of women

As part of its work under the theme Gender and Poverty, the CGE has made a number of interventions in the fields of energy and climate change. As part of this work, the CGE expresses its concern over the gendered effects of nuclear radiation. It recognizes that women are disproportionately sensitive to the effects of radiation, as compared to men, and has thus identified the planned expansion of nuclear energy under the Integrated Resource Plan II as a gender equality issue.

Because women are generally smaller than men, with lower body mass and a higher proportion of fatty tissue, they are more susceptible to what has been considered “safe” radiation levels. We note that the results of a 1991 longitudinal study of over 25 000 Canadian women which seemed to demonstrate that women who has regular mammograms were 52 % more likely to suffer breast cancer then women who did not. A follow-up study at the University of Oxford designed to dispel this conclusion instead increased the uncertainty.

http://jnci.oxfordjournals.org/content/84/11/832.extract

While research continues on this matter, the precautionary principle which should guide policy-making indicates that we need to be cautious even in our exposure to “safe” radiation levels.

We note further that:

“Ionizing radiation has long been regarded as the most established environmental risk factor for breast cancer. Ionising radiation from the nuclear industry affects women especially, because the breast tissue is particularly susceptible to it.”
http://www.dianuke.org/nuclear-power-and-women/

This concern is doubly of relevance where nuclear power has failed to be contained to low levels, as in the cases of Three Mile Island, Chernobyl and Fukushima reactors. Thus the CGE further notes that:

“It was found that women's critical organ doses and effective doses (as defined by the International Commission on Radiological Protection 60 [ICRP 60] are about 25% higher than those for men across all these studies.”

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1469927/

Lastly, it is matter of deepest concern to us that the effect of all forms of radiation on pregnant women and girl-children in the womb are devastating. It is most alarming to note a number of studies demonstrating that: “After exposure to nuclear radiation events, women may be more likely to give birth to boys than to girls…. "proof that the low-dose radiation that no one wants to have an effect has an effect," [head researcher] Scherb said. "And this effect is rather large in absolute numbers."
http://news.discovery.com/human/nuclear-radiation-exposure-gender-110607.html

Cf. also http://www.dailymail.co.uk/sciencetech/article-1394553/Is-U-S-heading-baby-boy-boom-Japan-disaster-Study-finds-nuclear-radiation-results-millions-fewer-female-births-worldwide.html

In view of the gravity of these findings, the CGE is of the opinion that the planned expansion of nuclear energy should follow the precautionary principle, and only act when science can clearly demonstrate that there is no risk. The concept of “low” risk is clearly not applicable to a form of activity such as nuclear fusion. It is the mandate of the CGE to monitor government. Over fourteen years of monitoring, we have come across human error every day in our line of work. This observation has been strengthened by our own recent monitoring of the Nuclear-1 EIA process in Thyspunt during May-June, 2011. Our conclusion is that any form of energy which relies for its safety on the absence of human error is simply not implementable.

At the very least, the people who experience the highest risk should be empowered to make their own choices, and consulted to the fullest in the development of government policy. It is the duty of the CGE to uphold the Constitution. The law of South Africa provides for the rights of women and other historically disadvantaged groups to be correctly informed and extensively consulted on matters affecting the environment. The law further provides that administrative action must be reasonable, just, and transparent.

In any administrative action, the law must be observed to the letter. It is our position that, in view of the seriousness of the risks to be faced, the findings of current research, and the potential price to be paid by women and those yet unborn, these legal provisions gain added weight. For this reason we support the submission made by the Legal Resource Centre, on behalf of Earthlife Africa and associated organizations, concerning the recently conducted Nuclear-1 EIA.

Response 1:

Your comment is noted. As an organ of government, the Commission for Gender Equality has a responsibility to base its opinions on peer reviewed, objective scientific data. Some of the above-mentioned websites, however, provides no scientifically verifiable facts to support its claims and is based largely on the opinion of the authors. Also please refer to Appendix E32 where the potential radiological impacts on the public and the environment at the three proposed sites, Thyspunt, Bantamsklip, and Duynefontein, were investigated as part of an assessment of the feasibility of each of the sites. The investigation included the following aspects:

1) Nuclear power plant radiological discharges to the environment during normal operation and public dose.
2) Nuclear power plant accidents and radiological risk to the public.
3) Radiological risk to non-human biota.
4) Background radiation at the three sites.

The results of the investigations into these four aspects provide responses to four possible questions that interested and affected parties may have regarding nuclear safety.

1) *What is the radiological health risk by living next to one of the sites?*

South African radiological safety regulations specify an annual effective dose limit of 1 milli-Sievert (mSv) to a member of the public from all authorised actions involving nuclear and radioactive material. To ensure that the limit is not exceeded and protective measures are applied to achieve a dose as low as reasonable achievable (ALARA), a dose constraint is also specified for individual sources such as a NPP. In South Africa, the dose constraint is 0.25 mSv per year. The dose constraint value is representative of an extremely low health risk when compared to normal operational discharges of noxious materials from many other industrial activities. The dose constraint is also a small fraction of the natural background radiological dose of 2.4 mSv per year, the global average.

An assessment of operational radioactive discharges from representative GEN III nuclear power plants was carried out by considering specific characteristics of each site and using conservative assumptions. The regulatory dose constraint of 0.250 mSv per year to a member of the public can be met at each of the three sites**.**

2) *What is the risk of a nuclear accident?*

The majority of NPPs operating today were built in the nineteen seventies and eighties. NPP accidents at Three Mile Island, Chernobyl, and Fukushima resulted in serious questions about nuclear safety and the future of nuclear power plants. An overview is provided of the nuclear safety criteria applicable to accidents and some of the safety assessment methodologies. The safety features of GEN III reactors and the fundamental objective to practically eliminate large releases of radioactivity in the event of a severe accident that involves reactor fuel damage are discussed. It is concluded that GEN III NPP designs should meet the regulatory risk criteria. An assessment of a specific NPP design selected for a site will have to provide the final nuclear safety case before NPP operation will be allowed by the National Nuclear Regulator.

3) *What are the radiological risks to non-human biota?*

The radiological protection of non-human species has evolved considerably over recent years. Where radiological protection used to focus on human protection based on the assumption that, if humans are protected, non-humans living in the same environment would be sufficiently protected, the explicit consideration of Radiological Protection of the Environment is now recommended by the International Commission on Radiological Protection (ICRP). A screening assessment was performed of the radiation dose rates to a set of reference animals and plants from radioactive discharges during normal operation of a NPP. The dose rates are less than the reference value of 10 microgray per hour (µGy/h), a value well below any dose rate where measureable effects in organisms would be detected.

Much research is carried out to determine the effects nuclear accidents on non-human biota. The United Nation Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) produced an authoritative Fukushima report in which radiological exposures of selected non-human biota were estimated. UNSCEAR concluded that the possibility of effects on non-human biota in both the terrestrial and aquatic (freshwater and marine) environments was geographically constrained and that, in areas outside the constrained area, the potential for effects on biota may be considered insignificant.

4) What are the current ionising radiation and radioactivity levels at the sites' environments?

Background radiation surveys were carried over a period of approximately one year at each of the sites. The results indicate that the radiation dose to people living at the coastal areas near the three sites is lower than global average dose of approximately 2.4 mSv per year. One of the objectives of the surveys was to identify any radioactivity anomalies that may exist in the regions where the sites are located.

High terrestrial radioactivity of natural origin was detected at a location west of the Thyspunt site. The radioactivity results of marine biota confirmed international findings on the naturally occurring radionuclide polonium-210 and its potential high dose contribution to humans when compared to other radionuclides. Artificial radionuclides, for example Cs-137, were detected at all three sites. Globally, the presence of Cs-137 is attributed to historic events such as atmospheric atomic weapons tests.

The results of the prospective radiological assessments for the three sites presented in this report confirm environmental impacts of low significance and low cumulative effects.

We take note of your support for the submission of the Legal Resources Centre.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

05 August 2015

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Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

Environmental Affairs
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Dear Dr Alan Boyd

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

COMMENTS ON THE PROPOSED CONSTRUCTION, OPERATION AND DECOMMISSIONING OF THE PROPOSED NUCLEAR-1 POWER STATION AND ASSOCIATED INFRASTRUCTURE

Comment 1:

I would like to thank you behalf of the Oceans and Coasts Branch of the Department of Environmental Affairs, for the opportunity to comment on the draft Environmental Impact Report (EIR) as well as the comprehensive presentation to DEA staff and the Review Panel at the workshop held between the DEA and Arcus GIBB (Pty) Ltd as the Environmental Assessment Practitioners (EAP) on the 28th July 2011.

The proposed Nuclear-1 station, as well as any others that may be proposed in future, will be planned for construction and operation within the coastal zone, due to the cooling requirements of the nuclear station which require large amounts of seawater as a coolant source. Due to the fact that this is the first proposed nuclear site since comprehensive environmental legislation is in place, as well as the likelihood of proposals for additional nuclear stations in the near future for the provision of the projected 40 000 MW requirements for South Africa, it is imperative that Integrated Coastal Management (ICM) concerns and information on any and all ICM implications are provided to the EAP for the Nuclear-1 project, to ensure that coastal development requirements and the prevention/minimisation of adverse effects on the coastal environment are taken into account.

The following ICM areas of consideration, prepared by the Chief Directorate: Integrated Coastal Management (CD ICM), were deduced from the review of the draft EIR, presentation by the EAP at the workshop, as well as general discussions during the workshop:

1) Noting, Utilisation and Consideration of Current Legislation and Regulations

The current revised draft EIR does not take note of the Integrated Coastal Management Act, 2008 (No. 24 of 2008) (ICM Act) as well as the latest activities within the listing notices of the 2010 EIA regulations. It is therefore recommended that the EAP takes note of the above and reviews the list of activities for coastal developments that may be triggered for coastal activities that has been prepared by the Directorate: Coastal Conservation Strategies of the CD ICM and which will be sent to you shortly.

Response 1:

Chapter 6 of the Revised Draft EIR provides a discussion of the implications of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) for the Nuclear-1 project.

Your reference to the 2010 EIA listing notices refers. Please note in this regard that the application for Nuclear-1 was lodged in terms of the 2006 EIA Regulations (Government Notices No. R 385 to 387 of 2006) and that, in terms of the transitional arrangements provisions of the 2010 EIA Regulations, any application commenced under the 2006 Regulations continues under the requirements of the 2006 regulations. Thank you for alerting us to the requirements of the National Environmental Management: Integrated Coastal Management Act, 2008 (NEM: ICMA) in terms of coastal activities. The development of Nuclear-1 is subject to authorisations under a number of different pieces of legislation and from different authorities at local, provincial and national government level. It is estimates that more than 30 different authorisations will be required. Eskom is aware of these authorisations and will engage with the relevant authorities.

Comment 2:

2) Discharge of Effluent and Dumping Considerations

A multitude of considerations from a Marine Pollution perspective were raised at the workshop by CD ICM officials, namely:

- Intake and Outlet pipelines for the Nuclear-1 station, including near-shore and offshore pipelines for the abstraction of seawater, discharge of heated seawater back into the receiving environment (12 ° Celsius differential);
- Intake and Outlet Pipelines for a multi-nodal desalination plant as associated infrastructure, with multiple intake and outlet points for the abstraction of seawater and subsequent discharge of hyper-saline (potentially 50 - 100 times more than normal seawater), heated effluent;
- The discharge of fine-spoil effluent resulting from excavation activities;
- The dumping/disposal of larger sediment spoil out to at sea;
- The possibility of intermediate to high heavy-metal loads in effluent as well as dumped materials; and
- Radiological implications for effluent and dumped materials.

Response 2:

Your comments are noted. These aspects have been assessed in the relevant specialist studies (Appendix E) included in the Revised Draft EIR (Version 2).

Comment 3:

3) Authorisations in Terms of the ICM Act

In addition to the duty of care and environmental authorisations stipulated in NEMA, the EAP must also take into account sections 58 and 63 in the ICM Act, which speaks to the duty of avoidance of adverse effects on the coastal environment, and environmental authorisations for coastal activities respectively. The noting and adherence to these sections are imperative to the compliance with ICM principles by the EAP.

Response 3:

Your comment is noted. It is estimated that there are more than 30 different authorisations required for Nuclear-1 under the jurisdiction of various authorities at local, provincial and national government level. It is not the intention of the EIA process, neither it is possible, for the EIA to address the requirement of all these authorisation requirements.

However, the avoidance of impacts on the coastal environment is accepted as an important principle in environmental management and where possible, impacts on the coastal environmental have therefore either been avoided or mitigated as far as possible, bearing in mind constraints of a project

that is restricted to coastal sites and cannot be located inland due to the need for large volumes of cooling water. Impacts on the marine environment due to activities like spoil disposal and the release of warmed cooling water have therefore been modelled in detail and terrestrial-based impacts in close proximity to the coast have also been assessed. Furthermore, the potential impacts of future sea-level rise (including storm surges) have been modelled and the power stations have accordingly been placed at heights above sea level at which the impacts of such a rise in sea level would be mitigated. In recognition of the ecological sensitivity of the coastal zone and the high concentration of heritage sites in the coastal zone, an undeveloped buffer zone of 200 m wide (inland from the shoreline) will be maintained at all three sites.

Comment 4:

4) Off-Road Vehicle Permitting Protocols

Although Eskom as an entity is exempt from the requirement of Off-Road Vehicle (ORV) permits for the use of vehicles (construction or other) on the seashore on any of the localities, it must be noted that any external parties that may be contracted by Eskom for any activities relating to the development of the station and associated infrastructure on the seashore must be communicated by Eskom to DEA's Oceans and Coasts branch, including the provision of copies of the appointment letter or contract between Eskom and the contractor/sub-contractor as the service provider. Additionally, the impact on existing marine and coastal activity right/permit holders in each of the proposed sites that were not identified in the report must be taken into account, with special regard to any possible restrictions that Nuclear-1's safety and security measures may impose on these holders.

Response 4:

Your comment is noted. Eskom will communicate with the DEA's Oceans and Coasts branch if and when a contractor is appointed to ensure that the contractor applies for the necessary authorisations for the operation of off road vehicles in the coastal zone.

The security exclusion zone imposed by the National Key Points Act, 1980 (Act No. 102 of 1980) may result in loss of access to the coastal zone for current users. However, it is Eskom's intention to allow permitted access to this zone so that current economic activities such as fishing and harvesting of kelp for commercial abalone farms can continue.

Comment 5:

5) Hazard Zones and Setback Lines

The revised EIR, at present, has not considered the impact of the 800m development exclusion zone, as well as the 2-3 kilometre radial "owner controlled zone" on development setbacks in terms of NEMA, as well as any coastal setback lines that may be established by the respective coastal province for each of the proposed sites. These setback lines have the potential to conflict with the demarcated safety zones (particularly the owner-controlled zone) and as a result, the EAP must ensure that any potential legislative conflicts are accounted for and incorporated into the assessment factors for each of the proposed sites where necessary. Additionally, coastal Hazard Zones that are currently being developed by the DEA need to be taken into account and the EAP and Eskom should communicate with the Department on a regular basis throughout the finalisation of the EIA phase and beyond to ensure that all potential challenges and conflicting principles are addressed.

Response 5:

Your comment is noted and it is acknowledged that there is a potential for interaction between the zones established by different legal regimes. The Emergency Planning Zones (EPZs) of 800 m and 3 km likely to be established by the National Nuclear Regulator have the potential to be complementary to the zones being established under the NEM: ICMA, since the 800 m radius Proactive Action Zone would effectively prevent any private development within an 800 m radius of the proposed power station.

However, it must also be recognised that the EPZ are established for different purposes than the setback zones being established under the NEM: ICMA. The EPZs are defined in order to provide security to the power station and to provide radiological protection to the surrounding public, and to ensure that sufficient emergency evacuation infrastructure is available in the surrounding areas[1].

Coastal Hazard Zones and Setback Lines will be considered when they are formally gazetted by the responsible authorities. Eskom will maintain communication with these authorities in order to keep abreast of the development of these setbacks and to make inputs to their development with respect to the proposed alternative sites for Nuclear-1.

Comment 6:

6) Contingency Plans to Reduce Adverse Effects on the Environment

Several concerns were raised over the storage of high level irradiated waste known commonly as "spent fuel." The storage of the spent fuel is planned to take place on-site at the Nuclear-1 station. However, concerns were raised as to the storage capacity of the station, especially in light of Koeberg nuclear station's storage capacity for spent fuel, which is expected to reach storage limit capacity by 2013, some 12-17 years before its decommissioning. As a result, the potential for adverse effects on the coastal environment in light of the lack of a contingency plan to address this factor is potentially high and the need for contingency plans are urgent in this regard, as well as a specialist study in light of ICM concerns and challenges. Additionally, the transport of the low-level and intermediate level waste to the Vaalputs storage facility also raised health, safety and environmental impact concerns, for which there was also no contingency or management plan that is currently proposed.

Response 6:

Internationally, in situations where there is no long-term storage facility for the disposal of high level radioactive waste, it is an acceptable practice to store high level waste on the site of the nuclear power station. Eskom will continue to store HLW on site (Koeberg) until such time that the national disposal facility

Transport of low-level and intermediate level nuclear waste to Vaalputs will be done according to the appropriate provisions of the Regulations of the International Atomic Energy Agency (IAEA) for the Safe Transport of Radioactive Material. The objective of the Regulations is to protect persons, property, and the environment from the effects of radiation during the transport of radioactive material. According to these regulations, transport of nuclear waste is subject to the following provisions:

- an appropriate radiation protection programme to ensure adequate protection for workers and the public along the transport route. Compliance criteria for this purpose are published in the safety standards;
- an emergency response programme and procedures; and
- a quality assurance programme for the design, manufacturing, testing, documentation, use maintenance and inspection of waste packages to ensure compliance with the relevant provisions of the Regulations.

Emergency planning for Nuclear-1 falls within the ambit of the nuclear licensing process of the National Nuclear Regulator.

Comment 7:

7) Sediment Deposition and the Potential for Land Reclamation

The CD ICM is of the opinion that provision should be made for possible reclamation ramifications in terms of the ICM Act caused by the potential creation of sandbars and reclaimed land. As a result, it is recommended that the EAP takes section 27 of the ICM Act into account should the possibility of reclamation be considered as a likelihood in other/further modelling scenarios and scrutiny.

[1] It is to be noted that the EPZs apply only to the inland areas and do not apply seawards.

Response 7:

Reclamation is not being considered for Nuclear-1. Modelling of sediment movement has been modelled in the Oceanographic Assessment. This confirms that the proposed offshore disposal of spoil will not result in the creation of any new offshore areas. The offshore disposal areas are located deep offshore at all three alternative sites.

Comment 8:

8) Weighted Assessment Variables

It was observed that, as a general principle, environmental factors were not weighted as highly as those of engineering, economic or socio-economic in nature, as part of the assessment methodology and execution. It is therefore recommended that consideration towards the allocation of proportionate weighting to coastal environmental factors is undertaken, due to the coastal locality of all of the proposed sites.

Response 8:

Every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts has developed over the last three decades and includes a number of criteria that are applied almost universally in EIAs. These criteria typically include nature (is the impact negative or positive?), extent (or scale), duration, intensity (degree of change), consequence (seriousness), reversibility, probability (how certain is it that the impact will occur?) and significance (overall importance of the potential impact).

Although there is general agreement about the nature of the criteria for assessment and there are local and international guidelines on this, there is no single agreed method. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria, as well as any requirements that the environmental authority might have regarding the criteria. In the case of the Nuclear-1 EIA the EAP sought assistance from other senior EAPs, namely Mr. Neal Carter and Mr. Reuben Heydenrych, as well as an advisor on EIA process, Mr. Sean O'Beirne.

Furthermore, based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

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Comment 9:

9) Cumulative Impacts

Although the EAP addressed the validity and degree of impact of each of the factors individually as well as by each respective sector (i.e. tourism, seismic, etc.), ICM believes that there is a need for further investigation into the cumulative impact of the Nuclear-1 station itself, as well as its associated infrastructure over time. Some of the particularly evident potential cumulative impact include, amongst others:

- The housing development for power-plant workers and the impact of the development on each of the proposed sites;

- The cumulative impact of the hyper-saline effluent and heated (possibly contaminant-laden) effluent into the receiving ocean environment;
- The cumulative effects of storage of spent fuel on-site;
- The impact on marine recreational and subsistence activities over time;
- Cumulative deposition of fine spoil in the marine environment; and
- The cumulative impact on dune systems, wetlands and the littoral active zone, which is the proposed location of the multi-nodal desalination plant at each proposed site.

Response 9:

Your comments regarding potential cumulative environmental impacts are noted.

- Cumulative impacts have as far as reasonably possible been assessed in Chapter 10 of the Revised Draft EIR (Version 2).

- The potential impact of the marine disposal of brine from the desalination plant has been assessed in the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1).

- It is acknowledged that the issues of radioactive waste management is important and integral to debate surrounding nuclear energy and as stated the only alternative currently available in South Africa is long-term storage of the spent fuel in the nuclear power station. However please note that a Radioactive Waste Management Institute has only recently been established. One of the functions of this institute will be to identify a repository for high level waste in South Africa..

- The potential short-term and medium-term impacts of the marine disposal of spoil as assessed in both the Oceanographic and the Marine Ecology Assessments (respectively Appendices E16 and E15 of the Revised Draft EIR Version 1).

- A comprehensive assessment of the impacts on dune systems was undertaken in the Dune Geomorphology Assessment (Appendix E2 of the Revised Draft EIR Version 1). The desalination plant will not be located in the littoral active zone. In fact the exact location of the desalination plant is not indicated in the Revised Draft EIR. The desalination plant will be situated inland of the proposed coastal buffer zone of 200 m (refer to Response 3) at all three of the potential alternative sites for Nuclear-1.

Comment 10:

10) Protected Areas and Adjacent Land to Proposed Sites

At least one of the proposed sites is adjacent to an area that forms part of the Protected Areas Expansion Strategy. It is also possible that state-owned land adjacent or proximate to the proposed sites may be impacted. These possibilities warrant investigation with requisite consultation with the appropriate parties to be undertaken and included in the EIR.

Response 10:

South African National Parks and conservation bodies such as CapeNature have been involved as key stakeholders (or interested and affected parties) in the EIA from the start of the Nuclear-1 EIA process.

Comment 11:

11) Coastal and Marine Access

As mentioned above, the owner-controlled zone poses the risk of hindering or altogether prohibiting access to coastal public property (CPP) at each of the sites. This owner controlled zone also runs the risk of placing restrictions into the sea if implemented. As a result, section 18 of the ICM Act referring

to coastal access needs to be taken into account by the EAP, with a strategy to ensure reasonable access to CPP by member of the public where required and/or necessary. Additional to this the stated uncertainty over whether there will be a 1 or 2 km marine exclusion zone and its implications needs to be addressed.

Response 11:

Your comment is noted.

The principle of maintaining public access to the "coastal public property", which is recognised under the NEM: ICMA is acknowledged. Where possible, Eskom will minimise the intrusion on the right of the public to access to this area. As is the case with the Koeberg Nuclear Power Station, the nature reserve that is proposed to be established around Nuclear-1 will be accessible to the public. Furthermore, Eskom proposes to have permit-based access to the coastal public property lying within the safety exclusion zone.

Unfortunately the width of the marine exclusion zone is not definite at this stage, as it will be dependent on the findings of an investigation by the National Intelligence Agency, to be undertaken in terms of the National Key Points Act, 1980.

Comment 12:

12) Structures below the High-Water Mark (HWM)

There are a number of concerns of the construction and excavation activities that are planned to take place as part of the power station and its associated infrastructure, specifically the excavation of the seabed for the placement of intake and outfall pipelines, the desalination plant and any security structures that may be built as a result. Therefore, the EAP must be aware of the requirements and stipulations of sections 7-15 of the ICM Act, as well as the Sea Shore Act with regards to any potential leases below the HWM.

Response 12:

Your comment is noted. Eskom will have to apply for the appropriate authorisations required by the NEM: ICMA for any construction below the high-water mark.

Comment 13:

13) Climate Change Considerations

Although sea-level rise projections were taken into account in the EIR, a number of additional climate change-related impacts must also be considered. These include Tsunami (and meteo Tsunami) contingency plans in addition to specialist studies showing vulnerability. It is therefore recommended that further considerations of climate change be included in the EIR including safety zone, disaster management planning and evacuation areas, coastal vulnerability indices, setback lines and hazard zone demarcations.

Response 13:

Tsunami and meteo-tsunami events have been considered in the Coastal Engineering Reports in Appendix E16 of the Revised Draft EIR (Version 1 and 2).

Comment 14:

14) Marine ecology considerations

The marine ecology specialist report examined both biodiversity and likely impacts on species and ecosystems largely oceanographic modelling outputs, in particularly peak sea temperatures during the operational phase, and sedimentation in the marine environment (at Thyspunt). Here it was noted that

relatively few marine ecology problem issues had been identified at the sites apart from potential impacts on the squid spawning at Thyspunt and abalone spawning at Bantamsklip.

As the EIA specialist reports need to consider all marine biodiversity and not just major commercial resources, this was taken further by questions being posed to the marine ecology specialist Prof Griffiths on 1 August 2011. This resulted in confirmation that the main marine ecological concern at Thyspunt was squid (which was why the warm water discharge was proposed to be discharged inshore) whilst in contrast at Bantamsklip the warm water discharge point would have to be offshore to avoid impacting one of the remaining abalone breeding centres. This example of an interactive approach between the specialist studies and infrastructure planning is appropriate and welcomed but residual impacts should continue to be addressed. In addition I am informed that further reports/workshops which include ways of further reducing the potential impact of sedimentation on squid spawning were still awaited (and thus were not included in documentation made available). Issues and recommendations raised should be addressed as part of the EIA.

Regarding marine biodiversity (other than the key commercial species noted above) it was also confirmed by Prof Griffiths that a field survey of the intertidal resources and appropriate literature studies of the inshore benthic resources had been undertaken. Due to the geographic range of the species found in the area it was concluded that no species would be particularly vulnerable to raised temperatures at Thyspunt. The specialist noted he regarded these findings as robust. Nevertheless it should be emphasised that appropriate comprehensive monitoring of marine biota should be undertaken on an ongoing basis during construction and operation, to check on whether impacts on species remain in line with anticipations, and also that any new species occurrence/settlement in the environmentally impacted areas (mainly close to the outfall) do not pose a danger to surrounding marine and coastal areas. This comment would apply to all sites.

Response 14:

Your comment is noted.

On-going monitoring of various environmental variables, including variables in the marine environment, is recommended for the pre-construction, construction and operational phases. Such monitoring is essential to confirm the impact predictions, to ensure early warming of potential unintended impacts and to ensure that the Environmental Management Plan for construction can be continually updated to minimise and avoid environmental impacts.

Comment 15:

15) Socio-economic costs and benefits – as presented by the EAP

Lastly, the factors which have the highest weighting in the EIA are seismic and socio-economic issues, and such findings (and weightings) in these categories were pivotal in Thyspunt being the preferred site. Although the seismic arguments were clear in the report and in the consultant's presentation on 28 July 2011, there was no clarity in the presentation about the way various socio-economic issues had been scored or had contributed to the recommended site, even after questions. In this regard all parties present at the meeting (not considering the EAP) concurred about this matter and strongly put it to the EAP that the socio-economic section of the report needed to be redone in such a manner so that the findings would be clear - to the Department and others.

Response 15:

Please refer to response 8 above.

Comment 16:

I trust that these comments and recommendations are in order and I look forward to your response. Should you have any queries please do not hesitate to contact the office of the Chief Director of Integrated Coastal Management, Dr Razeena Omar, for any aspects that require detail and/or clarification.

Response 16:

Your comment is noted. Your organisation is on the stakeholder database for the Nuclear-1 EIA process and as such will be kept informed of any further developments in the EIA.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 08 August 2011

Heritage Representative
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Dear Mr Reichert

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment A:

SITE SPECIFIC COMMENTS WITH REGARD TO THE HERITAGE IMPACT ASSESSMENT AND THE EIA PROCESS WITH REGARD TO THYSPUNT. THE GAMTKWA KHOISAN COUNCIL IS A MEMBER OF THE THYSPUNT ALLIANCE.

We have studied the Heritage Impact Assessment, the Revised Draft EIR, the minutes of a previous Key Stakeholder meeting held with us, the responses received from GIBB dated 21 December 2011 on our written submission as well as the minutes of the Public Meeting held in St. Francis Bay after the release of the revised second draft. Following is our original objections, the responses received from GIBB and our further objections:

1. **REGIONAL HERITAGE CONTEXT**

Our comment (1)

The regional heritage synopsis for Thyspunt is poorly described with regard to the colonial period heritage of the KhoiSan people. The fact that an effort was made to describe the Khoikhoi people and their history in the vicinity of Duynefontein and Bantamsklip, but not at Thyspunt shows that this area did not receive the necessary attention to provide an accurate picture of the cultural landscape. The Gamkwa (sic) tribe is briefly mentioned in the report by referring to the fact that they:

- "are particularly concerned about the future of their heritage",
- " must be informed and consulted when human remains are uncovered", and
- have expressed concern with respect to the future of archaeological material which they see as the heritage of their people

The last statement is of particular concern, because it appears that the author's opinion differs from what we regard to be our heritage. If this is the case we would like clarification on this point with specific reference by the author on who should be regarded as the lawful claimants of the heritage linked to the Khoikhoi "occupation" of the area, and if it is us, why consultation should be restricted to human remains alone?

The tribe's name is even spelled incorrectly despite the fact that our information appears on the I&AP list. It shows a clear lack of respect for our traditional structure, and the consultant's lack of cultural sensitivity is further illustrated by the fact that no attempt was made to consult with us with regard to the findings, or to obtain further information that could have been used to enhance the report.

Initial Response (1)

The miss-spelling of name of the Gamtkwa Tribe is a mistake for which an apology is offered and will be rectified in the revised Heritage Impact Assessment Report. The background to the presence of the Khoikhoi people in South Africa is described on a number of occasions throughout the report. Since the section on Thyspunt was the last site discussed in the Heritage Impact Assessment, and the Khoisan had already been discussed under the 1st two sites, it was felt that the topic had been sufficiently covered and did not need not be repeated. Published and verifiable information on the proto-historic period in the Thyspunt area is scarce. However, your comments and any available information which the specialist has not yet considered will be considered and included into the Revised Draft EIR.

FURTHER OBJECTION

We do not agree with the above statements that the discussion of the KhoiSan under the first two sites gives enough information to provide an acceptable regional heritage context of the KhoiSan people in the Eastern Cape. We did not request a general discussion of Khoikhoi peoples heritage in South Africa but that proper research be done to provide an accurate picture of the KhoiSan people's presence in the Eastern Cape. Published and verifiable information on the proto-historic period in the Thyspunt area may be scarce but no attempt has been made to source the available information by the specialist. We maintain that the regional heritage context is lacking in the HIA and we request that a historian be appointed to provide the correct information. The best opportunity to consider information that is available to the Gamtkwa KhoiSan Council is a Key Focus Group meeting. At the first meeting some informal information was shared with the consultants during the break. This information was not included in your report, and no formal attempt was made during the meeting to obtain this information from us. We have requested through the Thyspunt Alliance that a further Key Focus Group meeting must be held before the end of this comment period. The request has not yet been approved, and we wish to formally repeat this request.

Response A:

Your comment is noted. There is more than one group in the Eastern Cape that has contrasting claims to represent the KhoiSan people, of which the Gamtkwa KhoiSan Council is one. None of these claims regarding representation of the KhoiSan or Gamtkwa people can be verified, since these claims are based largely on oral history and none of these bodies have recognition in terms of South Africa's official traditional leadership structures.

Nevertheless a Focus Group Meeting with a group of the Chiefs of the First Nations was conducted on 20 November 2015 at the Gamtoos Hotel and Caravan Park. It was noted that you wished not to attend the meeting and requested that a separate meeting be scheduled the group you represent.

Comment B:

Our comment (3)

It is also not clear why we need to be consulted when human remains are uncovered if no information about our historical connection to the area is provided. We therefore insist that:

- further research must be done to describe the presence of the Gamtobakwa people (Gamtkwa is an abbreviation of the original tribal name), or the so called "Gamtousch nation" (as described by early travelers such as Ensign August Beutler in 1752) within the regional heritage context.
- further information must be supplied on what causes ended the long "occupation" of the area by Khoikhoi people and what factors led to their eventual presence at Missionary Stations in Bethelsdorp, Hankey, and Clarkson. The statements that "European farmers (Trekboere) were the vanguard of formal colonization and accelerated granting of land by the British Colonial Government", and "Land which was viewed as a shared resource by the Khoekhoen was no longer available to them" are simplistic and do not provide the full reasons why our original cultural structures disintegrated and why we lost access to our ancestral land.
- the living heritage associated with the KhoiSan people with specific reference to medicinal and other useful plants that occur within the study area be investigated further. If the "intangible heritage" associated with the St. Andrews shack has been investigated, surely we should be afforded the same consideration.

Initial Response (3)

Should additional information become available, it will be considered and included in the Revised Draft EIR. No particular groups of people were identified during the course of the study as the archaeology of the study area is of overall massive antiquity and therefore national heritage, and in some aspects, international heritage. Furthermore the limited amount of detailed study that has taken place to date does not provide secure enough evidence to equate the archaeological material to any particular grouping of people, other than to state that the presence of ceramics on some sites indicated that they developed during the last 2000 years, which coincides with the broad time period that the Khoikhoi were present in the area. Archaeological sites characteristic of this period are to be found throughout much of the Eastern Cape, Northern Cape and Western Cape, hence in broad terms, all three of these provinces are ancestral land, however defining the boundaries of ancestral land for the various groups is a highly complex task that needs acknowledgment of the detailed dynamics of the movement of groups over space and time. Mostly this history, apart from small glimpses of it in historic records, has been lost.

As regards consultation requirements in respect of any human remains that might be found, the requirements of section 36 of the National Heritage Resources Act, 25 of 1999 require public participation with respect to the exhumation, treatment and disposal of human remains that fall within the ambit of that statute, and accordingly this issue was identified during this environmental assessment process, in the expectation that there could be human remains from the historic period on the site.

The site of the St Andrews cottage was identified as it is in active use. The broader area is owned by Eskom and is access controlled. The land that comprises the Thyspunt property is not actively used for the collection of medicine.

FURTHER OBJECTION

The above response does not provide an answer to the first two issues raised by us. We requested that accurate information about the proto – historic period of their presence in the general area should be provided. The fact is that you are unable to provide us with the information and this is the real reason why you are not able to: **to equate the archaeological material to any particular grouping of people.** If proper historical research was done by a historian you would have been able to provide us with the requested answers. It is also interesting to note that although archaeological material cannot be linked to any particular group of people that you still recommend that: **"At Thyspunt, for example, the Gamtkwa community who are listed as I&APs must be informed and consulted when human remains are uncovered, and if necessary the reburial of any human remains should be facilitated."**

We also do not agree that consultation should be conducted with regard to human remains alone. If this was the case why did the consultants agree to a Key Focus Group meeting with the specialist where the HIA was discussed? We maintain that consultation with regard to human remains and archaeological material should be discussed with the affected community since section 38(3)(a) of the National Heritage Resources Act, 25 of 1999 requires that the results of consultations with an affected community should be included in the report. In our view this should have been extended to your permit application for test excavations. The fact that this was not done further illustrates your lack of respect for our traditional structure and that you as scientists claim the sole right to make decisions about the heritage of our people.

The fact that the Thyspunt site is not actively used for the collection of medicine is due to the fact that there has been access control to the site for a number of years. This does not mean that medicinal and other useful plants are not present on the site. The fact that an ethno-botanist did not provide a report as part of the HIA makes the report incomplete and creates the risk that these plants will be destroyed if this project was allowed to continue. An assessment of intangible heritage also does not have active use as a pre-requisite and is also not limited to the collection of medicinal plants alone.

Response B:

The scale and significance of the human tragedy associated with the loss of ancestral land and livelihood by the KhoiSan across South Africa, which was not confined to the project area or indeed to the Eastern Cape, and the disintegration of their traditional culture is fully acknowledged. However, in the context of the Nuclear-1 EIA process, it is questioned what responsibility Eskom (as the applicant) or GIBB (as the Environmental Assessment Practitioner) have to historical issues like the reasons why KhoiSan people ended up at missionary stations. It is well known that land was regarded as a shared resource by KhoiSan cultures but that land tenure imposed by white settlers was based on private land ownership and that KhoiSan communities were therefore dispossessed. However, the focus of an EIA process is to assess the potential impacts of the proposed development i.e. to determine how the proposed development will alter the prevalent environmental conditions and not to resolve the reasons for historical conflicts, as tragic as the outcomes of such conflicts may be. Although the proposed on-site curation facility for archaeological artefacts that must be established as part of the heritage mitigation strategy should include a full history of the peoples that produced these artefacts, it is not the function of this EIA process to provide this interpretation.

One of the outcomes of the post-Apartheid political settlement was a decision, codified in South African law, that only land claims originating after the 1913 Land Act would be considered for restitution. Whilst the tragedy of land dispossession of KhoiSan people cannot be downplayed, it is not the function an EIA process to resolve issues related to dispossession of ancestral land.

Owing to the scarcity of accurate written records of the history of the KhoiSan people, in general but also particularly for the Eastern Cape region and for this site, it is questioned what additional value further research would contribute. Given this scarcity, is it further questioned how any tenable and verifiable link could be established between the KhoiSan people who occupied the site during the last several thousand years and any particular grouping of people today. As indicated in Response 1, the Gamtkwa KhoiSan Council is only one of the bodies that claim to represent the Gamtkwa people in the Eastern Cape. As such, the Environmental Assessment Practitioners cannot be expected to involve this council as the sole representative of the KhoiSan people with respect to the heritage resources on the Thyspunt site.

Section 38(3)(a) of the NHRA requires “the identification and mapping of all heritage resources in the area affected” and we therefore presume that you refer instead to Section 38(3)(e) with respect to consultation, since this latter section requires “the results of consultation with communities

affected by the proposed development and other interested parties regarding the impact of the development on heritage resources" should be recorded. It is to be noted that in terms of Section 38(8) of the NHRA, Section 38 of the NHRA does not apply if an environmental impact assessment is required under the prevailing EIA legislation (i.e. the National Environmental Management Act. 1998). Considering that the Nuclear-1 EIA process is being undertaken in terms of the EIA regulations, the public participation requirements of these regulations and the NEMA are applicable instead. The results of the consultations undertaken in terms of the EIA are available in the Environmental Impact Report.

Subsection 35(4) of the NHRA states that no archaeological material may be excavated without a permit issued by the responsible heritage authority. Test permit excavations for the Thyspunt site were obtained from SAHRA in terms of this portion of the NHRA. The NHRA does not specify any consultation requirements with respect to an application for such permit. In any event, the purpose of the test excavations was not to disinter human remains or to remove any material from the site, but simply to determine what is present so that a better understanding could be obtained about the distribution and quality of the heritage sites at Thyspunt, so that the impact confidence in the prediction of the impact of the proposed power station could be more improved.

Additional input from the Heritage Specialist Dr Tim Hart: The purpose of the trial excavations was not to excavate archaeological material but to check a hypothesis with respect to the apparent absence of archaeological sites in certain areas. The application itself was submitted as a precaution in case archaeological material was encountered. However retrospectively no permit application was required as no archaeological material was found in the trial excavation areas. The permit application required the position of the landowner to do the work,

The study area has been in private ownership since the first title deeds were issued in the early part of the 19th century, and off-limit as a nature reserve for the 21st century, There is no indication that legal use of plant resources has been used unless by the property owners or their staff. For most of the 20th century the site was in shocking condition and effectively over-run by alien vegetation. This has been cleared by Eskom staff to some extent and indigenous vegetation has retained a foothold. The significance of this has been appraised by the project botanist. Eskom should be approached with respect the future propagation and exploitation of medicinal herbs and plant foods on site, Since no traditional activities have been permitted on site in the past, an ethno botanical study is not deemed necessary as part of an impact assessment. A future study may be worthwhile if Eskom agrees to exploitation of plants.

The general environmental sensitivity of the Thyspunt site is well known and this is why the recommended position of the power station is in the vegetated dunes, within the area of lowest environmental sensitivity (including heritage). It is one of the recommendations of the Botanical Assessment (Appendix E11 of the Revised Draft EIR) that search and rescue operations need to be conducted on rare and/or sensitive plant species prior to the start of construction.

Comment C:

Our comment (5)

The following statement was issued on 8 August 2005 in Pretoria by the Special Rapporteur of the UN on the Human Rights and Fundamental Freedoms of Indigenous People:

"… All indigenous peoples of South Africa were brutally oppressed by the colonial system and the apartheid regime up to 1994. The Khoi-San were dispossessed of their lands and territories and their communities and cultures were destroyed. The tragic consequences of apartheid cannot be overcome in a few years and the Special Rapporteur is fully conscious of the tremendous efforts that have been made by the democratic government of South Africa to redress the many injustices inherited from the old regime. Through his conversations with Government authorities and Khoi-San

people, he is also aware of the challenges faced by these communities and their longstanding demands for land rights, official statutory recognition, respect of their cultural identities and full and equal access to social services.

The Special Rapporteur is encouraged by the government's declared commitment to meet the demands of the indigenous groups in the country and by the ongoing efforts to formulate and implement appropriate legislation and policies to address issues such as land restitution, multilingual and multicultural education, the representation of traditional authorities in public life and the delivery of health and other service

Without the above information the regional heritage synopsis is incomplete and misleading. The KhoiSan people did not just "occupy" the area for thousands of years and then disappear from the face of the earth. They lost their land by force and through conflict, and the current government recognizes the genocide that took place in colonial times. We, the descendants of these people are very much alive today and represented by various organizations, a fact that should be recognized in the HIA.

Initial Response (5)

Agreed and comment noted. The Draft Environmental Impact Report (EIR) and the associated Heritage Impact Assessment report acknowledge that the heritage of the area is the "heritage of many South Africans who are alive today". The heritage section of the EIR report is of a general nature and tries to be impartial in view of the fact that the heritage of the study area is part of "the National Estate". The study has truthfully informed the public of the presence of a wide variety of archaeological sites but cannot ascribe those sites to particular groups of people apart from in the broadest of terms. The archaeological studies proposed prior to and during construction can include this aspect in the scope of work.

FURTHER OBJECTION

The archaeological studies proposed prior to and during construction of an activity that will destroy a cultural landscape will serve no purpose whatsoever. This information should have formed part of your HIA and the fact that it was not done is due to the fact that proper historical research was not conducted and the fact that recent developments with regard to the recognition of KhoiSan structures were ignored. The inputs of the Department of Provincial and Local Government in this regard should have been obtained and this may have solved several uncertainties that you have at this stage with regard to the rights of indigenous people and would have provided the Government's official position in this regard to the decision maker in this application. Your failure to link the site to any particular group (Please see our further objection to your response 6(3)) apart from the broadest terms cannot serve as an excuse to strip people of their rights, and your failure to place to correct information before the decision maker may have severe consequences for your client.

Response C:

Our above initial response remains valid.

Please provide details regarding the "recent developments with regards to recognition of KhoiSan structures". We re-iterate that the Gamtkwa KhoiSan Council is only one of the organisations claiming to represent the KhoiSan in the Eastern Cape and that there is no formal recognition of KhoiSan structures in official traditional leadership structures in South Africa. Although the Traditional Affairs Bill provides for recognition of KhoiSan leadership structures, it is well-known that the passage of the bill through parliament has been fraught with difficulties and constitutional challenges. We would welcome the opportunity to engage with the officially recognised structures but at this point in time there are, as mentioned above, different structures that claim to represent

the KhoiSan people. GIBB has met with these structures in the Eastern Cape but cannot be expected to recognise one or another of these structures as the only valid representative.

As indicated in Response 2 above, the archaeological sites on the Thyspunt site cannot be linked to any specific present-day group, apart from a generic link to the KhoiSan people who are known to have occupied not only this area but many areas in South Africa during the past several thousand years.

Comment D:

2. PRE-COLONIAL HERITAGE/MITIGATION

The information provided about the archaeology of the area is accurate, and substantiates the fact that the KhoiSan community does have a vested interest and rights with regard to the majority of the cultural heritage situated within the study area. We do not regard mitigation as a viable option for an area with the unique non – renewable resources as specified in the HIA.

Mitigation will have no benefits for the cultural group affected by the "rescue operation", especially if the majority of the archaeological sites will be destroyed as a result. The Khoikhoi and San heritage of this area will only have benefits for the research community if it is removed, and in our view it should be preserved in context for future generations as part of a National Cultural Heritage Site. Our view is supported by the HIA results and the author confirms that:

"Mitigation can be achieved through scientific recording, sampling or excavation - however these are also destructive processes. In general, full rectification of heritage impacts is not normally possible in the case of archaeology unless the archaeological sites can be conserved in their entirety."

We agree with the statement that:

"However, given the broader picture, the procurement of power (in particular non-greenhouse gas producing alternatives) is critical for the future well-being of the nation, which is currently suffering from a deepening energy shortage."

We disagree however that this can presented as a motivation for the destruction of the cultural heritage of indigenous people, especially if other alternatives are available but were either not investigated or scoped out of the process due to financial or other implications. The specialist concludes that the cost to the National Estate is going to be high, unless properly mitigated (In the case of Thyspunt all indications are that there are severe constraints for proper mitigation).

The author states that further that:

"The sites that have been selected for the proposed activity are primarily based on their geological and engineering suitability to the task (a primary consideration in nuclear engineering). It would appear that other disciplines were either not considered or viewed as sacrificial under the primary concerns of safety and engineering suitability. The result of this legacy is that the sites of Duynefontein, Bantamsklip and Thyspunt, despite their exceptional heritage qualities, have been identified for the proposed NPS"

This supports the general view of various I&AP's that the planning for Thyspunt is out-dated.

The construction of facilities to house heritage material removed from the site will cost millions. The cost for excavation work by a team of specialist over a prolonged period in an area that will be difficult to mitigate will be equally high. The total budget for the destruction of our heritage should in our view rather be used to purchase a more appropriate site with less impact on the environment and on heritage resources.

The consultants have indicated that even mitigation is destructive, and since Thyspunt is regarded as the most sensitive of the sites it should have been scoped out of the process on its cultural heritage value alone. The fact that it has not been done shows that they do not understand that the issues that should be considered are far more complex than merely providing power to the country.

Initial Response 7

Your comments are noted. The heritage specialist indicated to the Applicant (Eskom) and the South African Heritage Resources Agency (SAHRA) that the work required is potentially very demanding on both hard-pressed archaeological expertise resources and existing state capacity. At Thyspunt the final site location has a critical bearing on how much archaeology will be affected. The heritage specialist agrees with the notion expressed that archaeological sites are best preserved in-situ for future generations and conservation minded archaeologists will always strive to achieve this goal. Mitigation by excavation is always a second best and should be avoided, where possible. However it is important to remember that the comparative assessment of the three alternative sites was based on the following:

- Results of the specialist studies: specialists have indicated the relative significance of potential impacts with mitigation at each of the three alternative sites;
- An integration workshop, involving all specialists, on 24 and 25 November 2009, where potential impacts and ranking of the alternative sites was discussed;
- Costs; and
- Transmission integration requirements.

Although there are obvious differences between the significance of the potential impacts of the three alternative sites, all specialists agreed that there are no fatal flaws at any of the sites (provided appropriate mitigation is implemented). The specialists further collectively agreed that all three alternative sites are suitable for development of a nuclear power station in time, given sufficient mitigation of impacts. The power station has been positioned on the site to avoid the highest concentration of archaeological sites. This concentration occurs in a thin strip along the coastline west of the proposed position of the power station on the Thyspunt site. The position of the power station has been set back by at least 200 m from the high water mark in order to avoid this particularly rich concentration of archaeological sites.

FURTHER OBJECTION

SAHRA has already indicated that they do not approve of this development at Thyspunt. The test excavations that have been carried out will not change this decision and served no purpose at all. It is not a matter of where the power station is positioned but what the affect will be on the cultural landscape. Please see your own response at the Key Focus Group meeting in this regard as well in the post meeting notes by SAHRA.

The entire area is a cultural landscape in term of the UNESCO definition, and the concentration of the archaeological material is not limited to a thin strip along the coastline. How can you make a statement like this if your own report indicates that these sites only constitutes a small percentage of what may be present at the Thyspunt site?

From the above it is clear that the integration workshop ignored clearly established cultural issues in favour of cost and transmission requirements. The fact that the Thyspunt site can be regarded as a cultural landscape does constitute a fatal flaw at the site and the SAHRA decision not to allow this development further substantiates this fact. We do not accept that the weighting given to Thyspunt was accurate in the light of the availability of alternative sites

Response D:

Your opinion regarding the mitigation of archaeological impacts not being viable is noted.

It is not correct to state that the majority of the archaeological sites will be destroyed. The test excavations conducted in 2011 established that the central portion of the site within the vegetated dunes (which includes the recommended position of the power station) has very few archaeological sites and that the most significant archaeological sites, both in number and in quality, occur along the western coastline of the Thyspunt site. Therefore, the revised Heritage Impact Assessment (which will be provided to all I&APs for comment) concludes that "*it is possible to position the proposed nuclear power station in such a way that physical impacts to heritage sites of an archaeological nature can be minimised. Mitigation of any heritage material through sampling by controlled excavation, or creation of local exclusion areas is considered feasible with resources currently available."* Some on-site storage (a small museum) may be necessary. Your opinion regarding the test excavations serving no purpose is noted. However, this is a conclusion better left to SAHRA itself based on the findings of the test excavations.

Your comment regarding the consideration of alternative sites is noted. Consideration of additional alternative sites is not feasible or reasonable in this instance, since the five sites initially identified in the scoping phase of the Nuclear-1 EIA process are the only sites confirmed to be technically suitable for a nuclear power station. Due to the long lead times required for development of a nuclear power station (it is generally accepted that the entire lifetime of such a power station from planning to decommissioning is 100 years), the sites were acquired by Eskom decades ago. Should the identification of suitable sites have to be started from scratch, it would result in a delay of at least 5 to 10 years, since the critical task of determining a site's seismic suitability takes at least 5 years.

It is well known that South Africa is a water-stressed country and does not have sufficient inland water resources to provide cooling for a nuclear power station. A coastal site is therefore the only feasible option for a nuclear power station. Thus it is a foregone conclusion that a nuclear power station would have to be constructed on a coastal site. Without detracting for the significance of the heritage resources found at the Thyspunt site, it is known that generally speaking the highest concentrations of KhoiSan heritage are found along the coast, particularly in the Western Cape and Eastern Cape. Some impact of KhoiSan heritage virtually anywhere along the coastline is therefore probable. The concentration of KhoiSan heritage sites on the Bantamsklip site is an indication of the richness of heritage sites in other coastal areas. An alternative (coastal) site would therefore not be guaranteed to have less significant or fewer KhoiSan heritage sites than either the Bantamsklip or Thyspunt sites.

The direct financial cost of heritage mitigation will be tiny compared to the cost of finding an alternative site and the economic impact of delays in supplying sufficient baseload power to the South African economy and the potential impact of load shedding. The test excavations have found that there are far fewer heritage sites in the recommended footprint of the power station than originally anticipated and the cost of heritage mitigation will therefore be manageable. As indicated above, the heritage specialist has concluded that heritage mitigation will be achievable with currently available resources. Prior to the test excavations it was suspected that significant resources would have to be imported into South Africa to make the mitigation possible.

The issues of a UNESCO cultural landscape and the concentration of archaeological sites refer. As indicated above, the test excavations found very few archaeological sites within the vegetated dune environment in the central portion of the Thyspunt site. The concentrations of KhoiSan archaeological sites correlates closely with the availability of fresh water i.e. they are concentrated primarily along the coast (where there are coastal seeps), further inland (e.g. close to wetlands) and in the mobile dunes (where there are inter-dune wetlands). There are no sources of fresh water in the vegetated dunes and hence there are very few archaeological sites in this area.

Your opinion regarding the weighting of decision factors is noted. GIBB (as the environmental assessment practitioner) stands by the decision on weighting, which was taken in consultation with the entire specialist team, including the Heritage Impact Assessment team.

Comment E:

3. LEGISLATION / INDIGENOUS PEOPLES RIGHTS

Our comment (6)

It appears that Eskom is under the impression that by meeting South African legal criteria there is no obligation on them to act in terms of the UN's declaration of indigenous peoples rights (of which the South – African Government is a co-signatory), the UNESCO or ICOMOS: Burra Charter guidelines, and the Kari-Ocha and Kimberley declarations. These declarations and guidelines all require "informed consent" before any development can take place on indigenous peoples land.

The response we received from Eskom on the above statement in the Revised PoS was:

"**Eskom is the current owner of the Thyspunt site. As indicated above all due process has been followed with respect to the archaeological sensitivities on site, which Eskom considered to be serious."**

This type of response is indicative that Eskom does not have any understanding of current developments with regard to indigenous people's rights in South – Africa, or they are ill-advised by their consultants.

The fact that they under the impression that due process has been followed to date is also incorrect. In the Revised PoS we objected against drilling operations that took place without any archaeological supervision, and we indicated that : "We have been informed that little damage was done to some of the sites, but this is still an offence in terms of section 35 (4)(a) of the South-African Heritage Resources Act, no. 25 of 1999."

Eskom responded as follows:

"It should be noted that all drilling sites were inspected by the EIA Archaeologist who indicated that no damage to any sites of significant archaeological importance had occurred. In addition Eskom has a drilling EMP that requires that should any archaeological site be identified all work must stop until such time that an archaeologist has inspected the site. Eskom has been in communication with SAHRA who have indicated their satisfaction with the current process."

With regard to the above statement:

- Firstly, The Act does not distinguish between "significant" and "insignificant" archaeological sites. The disturbance of any archaeological site without a permit is a transgression of the Act.
- Secondly, The EIA archaeologist noted the following in the "Inventory of Observations" at 6 drilling sites : "*Buried midden deposit turned up by borehole drilling"*
- Thirdly, We followed the matter up with SAHRA and this was their response to the claim that SAHRA has indicated their satisfaction with the current process:

"Dear Mr. Reichert

SAHRA is obviously very concerned about the NPS development and what impact it will have on the heritage resources of the Thyspunt area. To my knowledge SAHRA did not convey to Eskom

that we were happy with the process or that drilling etc. can start without the relevant studies being completed and the APM Unit have commented on these. The APM Unit had expressed its concern regarding the proposed project and the enormity of the task at hand. However, no permission was given that destructive work may continue (if this is the case) without the input from the SAHRA.

Yours sincerely

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In view of the above it is not only a case of a lack of understanding of indigenous rights issues from Eskom's side, but also a deliberate attempt to hide actions that cannot be justified. It is of no use to play with words in your responses to serious issues. If this can serve as an example, it becomes apparent that Eskom cannot be trusted to manage any aspect with regard to our heritage in a project of this size.

Eskom must be held accountable for their actions since they allowed drilling operations to proceed being fully aware of the archaeological sensitivity of the site. (Please see previous reports by Dr. Binneman commissioned by Eskom and the desktop study that formed part of the Scoping Phase for this EIA.). Possible damage to archaeological material due to the recent construction of gravel roads should also be investigated.

Initial Response 9:

In terms of the Environmental Impact Assessment process, the Heritage Assessment is conducted under the auspices of the national environmental legislation and SAHRA is a commenting authority and not the competent authority in terms of granting the environmental authorisation (see sections 38(8) and 38(10) of the National Heritage Resources Act, 1999). As such, the EIA practitioners have consulted with SAHRA regarding this matter and all evidence and records of the consultation will be included in the Revised Draft EIR as well as the Final EIR, for the attention of the competent authority as part of the decision-making process.

Secondly please note that the National Heritage Resources Act (NHRA) does consider significance in that the Act requires that Heritage Resources be graded.

Lastly, an environmental authorisation was not required for the drilling operations and an HIA for this activity was not triggered and an HIA for the drilling did not take place. The identifications of transgressions of the NHRA is a SAHRA function. The matter was discussed telephonically with Dr Jerardino (who has since left SAHRA).

FURTHER OBJECTION

Section 38 (8) of the National Heritage Resources Act, 1999 states that: The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation: **Provided that the consenting authority must ensure that the**

evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

We submit that the evaluation did not fulfill the requirements of SAHRA and that a positive Record of Decision cannot be issued for Thyspunt if the SAHRA comments have been taken into account.

Response D:

The Section of the National Heritage Resources Act (NHRA) from which you quote is designed to ensure co-operative governance and provides for the integration of a Heritage Impact Assessment in an Environmental Impact Report in instances where an EIA would in any event be required by the National Environmental Management Act. The relevant portion of the NHRA further requires the decision-making authority in terms of the NEMA (the "consenting authority") to consult with the relevant heritage resources authority prior to making a decision.

Your assertion in the last paragraph that the HIA did not fulfil the requirements of the SAHRA requires substantiation. Furthermore the Department of Environmental Affairs (DEA - the "consenting authority" in this instance) has not yet been provided with a final Environmental Impact Report for decision-making and it is, therefore, not yet in a position to request official comments from SAHRA to be taken into account in decision-making by the DEA. Your opinion in this regard is therefore premature, since SAHRA has not yet had an opportunity to provide its official comments on the final Environmental Impact Report and the Heritage Impact Assessment (Appendix E20 of the Revised Draft EIR) to the DEA.

Comment E:

FURTHER OBJECTION

Your response does not answer the statement that the Act does not distinguish between "significant" and "insignificant" archaeological sites. The statement does not refer to the grading of Heritage Resources, but to the application of section 35(4)(a) of the South-African Heritage Resources Act, no. 25 of 1999 which provides general protection to archaeological sites. Archaeological sites were impacted upon and disturbed by drilling operations while your client was fully aware of the archaeological sensitivity of the site

Response E:

Section 35(4)(a) of the NHRA does indeed provide general protection to archaeological sites. However, as indicated by the facts in the initial response, the site disturbed in this instance was a buried midden. The borehole drilling team could not reasonably have been aware of the presence of the midden prior to the start of drilling, by virtue of the fact that the midden was buried.

Please note that subsection 38(3)(b) of the NHRA, with respect to the contents of Heritage Impact Assessment reports, requires "an assessment of the ***significance*** of such resources[1] in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7. Section 7 of the NHRA in turn is concerned with heritage assessment criteria and grading. Clearly, therefore, irrespective of the general prohibition on disturbance of archaeological sites, an assessment of the significance of the affected heritage resources is required.

[1] Our emphasis

Section 38 of the NHRA list a number of activities for which a Heritage Impact Assessment (HIA) is required prior to undertaking the activity. None of these activities include the drilling of boreholes and Eskom was therefore under no obligation to apply for authorisation to perform drilling operations. Had it known ahead of time of the presence of the (buried) midden, it would have moved the borehole position accordingly or would have accordingly performed an initial investigation to determine the significance of this particular midden.

Nevertheless, as indicated in the initial response, Eskom has an EMP that governs measures to be taken during drilling operations to prevent damage to the environment, including archaeological sites. Furthermore the drilling sites were inspected by an archaeologist to confirm the significance of the damage to the midden and Ms Gerardino of SAHRA was informed of the damage.

Had SAHRA considered the damage to the midden to be serious enough, there are several remedies available to it under Section 35(5) of the NHRA to force the landowner to cease the potentially damaging activity or to apply mitigation measures. Furthermore SAHRA has a right, under section 25(6) of the NHRA to serve a notice of the landowner to stop any activities and to prevent any activities within a specified distance of a heritage site. Although Eskom cannot speak for SAHRA, it would stand to reason that if SAHRA considered the damage to the midden to have been significant enough, it could have used its substantial powers under Sections 35(5) and 35(6) of the NHRA to take appropriate action against Eskom. However, no such punitive action was applied.

Comment F

Initial Response 6 (3)

Lastly, an environmental authorisation was not required for the drilling operations and an HIA for this activity was not triggered and an HIA for the drilling did not take place. The identifications of transgressions of the NHRA is a SAHRA function. The matter was discussed telephonically with Dr Jerardino (who has since left SAHRA).

FURTHER OBJECTION

It doesn't matter if a ROD or a HIA was required for the activity or not. The disturbance of an archaeological site is a criminal offence in terms of the Act and your continued justification for the actions of the contractors is unacceptable.

Response F:

Please refer to Response 6.

Comment G:

Initial Response 6 (4):

We take note of your comments regarding the various international declarations on rights of indigenous peoples. In the South African context, the applicable legal processes for indigenous peoples to regain access to land and resources of which they had been dispossessed has been put in place by the Restitution of Land Rights Act, 1994 (Act No. 22 of 1994). Had the Gamtkwa Khoisan Council or the broader representatives of Khoisan believed that it had rights to the land, this is the mechanism that should have been followed to confirm these groups' rights to the land. To our knowledge, no such claims have been registered with respect to the Thyspunt site.

FURTHER OBJECTION

We disagree with the statement that: the applicable legal processes for indigenous peoples to regain access to land and resources of which they had been dispossessed has been put in place by the Restitution of Land Rights Act, 1994 (Act No. 22 of 1994). Indigenous people of this country lost their land and resources long before to the cut of date of 1913 for Land Claims as you are fully aware of. The Act therefore does not provide for claims before that date. The Act can therefore not be regarded as an applicable process for indigenous people to regain access to land and resources. This is the reason why the Gamtkwa KhoiSan Council was unable to follow this mechanism. This does not change the fact that the Gamtkwa people regard Thyspunt as part of their ancestral land and we are therefore claiming our rights to the archaeological sites linked to the Khoikhoi culture that are present on the site. In this regard we are objecting against this project due to the fact that the development will destroy a cultural landscape where the Khoikhoi artefacts and sites constitute the majority of the archaeological sites described to date.

Response G:

Your comments in noted and it is not disputed that KhoiSan people lost rights to their land before 1913. However, in the South African context, the cut-off date for valid land claims is 1913, as stipulated in the Restitution of Land Rights Act. This date was agreed between all political parties during constitutional negotiations prior to the 1st democratic elections. The Restitution of Land Rights Act is therefore the only recognised legal instrument in South Africa for people to regain access to ancestral land. If this is not the applicable process for the Gamtkwa KhoiSan Council to follow, please advise what is the applicable process that the Council wants to follow?

Eskom as the applicant and GIBB as the environmental assessment practitioner must work within the confines of the law and have no mandate to challenge the provisions of the law or the democratically determined cut-off date for land claims with respect to a specific claimant such as the Gamtkwa KhoiSan Council.

Comment H:

Initial Response 6 (5):

In terms of “informed consent” - the notion of “informed consent” as stipulated by international conventions and/or declarations must be read against the backdrop of the more specific public participation and information requirements set out in the NEMA EIA legislative regime. The Nuclear 1 EIA is continuing in terms of the provisions of the 2006 NEMA EIA regime and the only requirement regarding consent (which consent requirement has been removed from the 2010 NEMA EIA Regulations) relates to obtaining the written consent “of the landowner…” in a situation where the applicant is not the owner of the land on which the activities are to be undertaken. In the circumstances, the notion of “informed consent” as provided for in the international legal milieu does not create a binding obligation that exceeds that imposed by the NEMA EIA Regulations.

FURTHER OBJECTION

We disagree with the above statement. The term “informed consent” in terms of international conventions and declarations cannot be read against the backdrop of NEMA since it clearly has two different meanings. We refer to informed consent for developments on ancestral land and we submit that NEMA EIA Regulations cannot over ride the UN Declaration on Indigenous Peoples Rights when there is binding obligation on the South African Government to ensure that it is implemented.

Response H:

As indicated in responses above, there is a specific mechanism created in the South African legal framework for restitution of land rights. Your opinion that the UN Declaration of Indigenous People's rights overrules the NEMA EIA regulations is noted. However, neither GIBB not Eskom can operate outside the provisions of South African law.

Comment I:

Initial Response 6 (6):

Despite the Restitution of Land Rights Act being the only legal mechanisms for indigenous people enforce their land rights, Eskom is sensitive to the intangible connection that the descendents of the KhoiSan people have to the heritage resources at the site and to the intent of the applicable international declarations. The "*informed consent*" provisions of the UN Declaration relate to the following:

- Relocation of indigenous peoples (not applicable in this instance);
- Redress related to cultural, intellectual, religious and spiritual property that has been taken without the free, prior and informed consent of indigenous people or in violation of their laws, traditions and customs (not applicable in this instance);
- The adoption and implementation by UN Member States of legislative or administrative measures that may affect indigenous people (not applicable in this instance, as the obligation is on the government to enact legislative or administrative measures); and
- That UN Member States must take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent. There is no specific measure in South African law to give effect to the intent of this article of the UN Declaration.

Whilst Eskom respects these provisions, and has taken all reasonable measures to minimise the impacts on heritage resources at Thyspunt, the Gamtkwa Khoisan Council has not established any proven legal claim to the land in terms of the relevant legal mechanisms established for this purpose by the South African government.

FURTHER OBJECTION

We do not agree that Eskom is sensitive to the intangible connection that the descendents of the KhoiSan people have to the heritage resources at the site. If this was the case your specialists would have investigated this "intangible connection" as part of the HIA. They however found this unnecessary due to the fact that there was no active use of the site. Please see your response 6 (3) as well as our further objection. The following statements further illustrate your lack of sensitivity for our concerns:

The "*informed consent*" provisions of the UN Declaration relate to the following:

- Relocation of indigenous peoples (not applicable in this instance);

- Redress related to cultural, intellectual, religious and spiritual property that has been taken
  without the free, prior and informed consent of indigenous people or in violation of their laws,
  traditions and customs (not applicable in this instance)

We submit that if a proper historical assessment was done about the KhoiSan people of this region that the above statements will be proven to be false. Indigenous people of this region were relocated and lost their cultural and spiritual property without their free, prior and informed consent and in violation of their laws. To state that this not applicable is an insult and shows a clear disregard for our history and is misleading to the extreme. We insist that the person who made this statement will attend a Key Focus Group meeting with us to personally explain on what basis these statements were made. We have requested that the author/s of your responses should be identified. This request was ignored by GIBB despite a request by e-mail and at the St Francis Public meeting. We once again request that we be provided with this information since this was done in other specialist responses to other I&AP's. There can be no reason why the identity of the author should not be disclosed.

Response I:

Your opinions are noted. As stated above, the tracing of origin of the heritage sites on the Thyspunt site to KhoiSan people in general who lived on the site during the past several thousand years is not disputed. The dispossession of the KhoiSan people is an unfortunate and tragic reality. However, "informed consent" with respect to relocation of indigenous people relates to current actions, not to historical actions. No "informed consent" is possible with respect to the dispossession that has taken place in previous centuries. Therefore informed consent is not applicable in this instance.

Responses are written by a team of environmental assessment practitioners in GIBB and where necessary, the relevant specialists are consulted.

Comment J:

We also refer to the following statements:

- The adoption and implementation by UN Member States of legislative or administrative measures that may affect indigenous people (not applicable in this instance, as the obligation is on the government to enact legislative or administrative measures); and
- That UN Member States must take effective measures to ensure that no storage or disposal of hazardous materials shall take place in the lands or territories of indigenous peoples without their free, prior and informed consent. There is no specific measure in South African law to give effect to the intent of this article of the UN Declaration.

We submit that these provisions are indeed applicable and that it places a binding obligation on the Government to enact legislative and administrative measures to address the above issues. The fact that there are not specific measures in place at present does not mean that it will NOT be in place in future. To lose sight of this fact as well as the current process of recognition of KhoiSan structures through the DPLG constitutes a fatal flaw in the EIA process since the obligation on the state to act in terms of the UN Declaration will have far reaching effects for the proposed NPS.

Response J:

Your opinion is noted. GIBB, as the environmental assessment practitioner, can only act within the provisions of the law in place at the time of the EIA process and cannot anticipate the content of laws may be in place at some future date.

Comment K:

As far as your statement is concerned that the Gamtkwa people has not established any legal claim to the property please refer to our further objection to your response 6 (4). If you are of the opinion that we have established no legal claim to the heritage resources linked to our culture and to developments proposed on the site, please provide us with a detailed explanation why your heritage specialists recommended in the HIA that: "At Thyspunt, for example, the Gamtkwa community who are listed as I&APs must be informed and consulted when human remains are uncovered, and if necessary the reburial of any human remains should be facilitated." Does this mean that our legal rights are limited to human remains alone, and that human remains should therefore be seen in a separate context to the archaeological material associated with those remains?

Response K:

Your quote from our initial response above refers: "*Despite the Restitution of Land Rights Act being the only legal mechanisms for indigenous people enforce their land rights, Eskom is sensitive to the intangible connection that the descendants of the KhoiSan people have to the heritage resources at the site and to the intent of the applicable international declarations*". This response remains valid.

Comment L:

Our Comment (7)

Although the HIA includes various examples of damage caused to archaeological material prior to and during the Scoping Phase, the fact that legislation was transgressed appears nowhere in the report. This shows a lack of objectivity on the part of the consultants by not disclosing the correct facts.

The following articles of the United Nations Declaration on the Rights of Indigenous Peoples are applicable:

Article 11

Indigenous Peoples have the right to practice and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts, designs, ceremonies, technologies and visual and performing arts and literature.

Article 25

Indigenous Peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources, and to uphold their responsibilities to future generations in this regard.

Article 29

2. States shall take effective measures to ensure that no storage or disposal of hazardous materials shall take place in lands and territories of indigenous peoples without their free, prior and informed consent.

Article 32

2. States shall consult and cooperate in good faith with the indigenous peoples concerned through their own representative institutions in order to obtain free and informed consent prior to the approval of any project affecting their lands or territories or other resources …

Several other articles are also applicable, and although many of these articles bind the state it does not mean that it does not have implications for Eskom. To ignore the principles contained in this declaration will have far reaching effects in future. The Government is already in the process of implementing these principles and the White Paper on the recognition of Khoi and San structures has already been published. This will provide our communities with far stronger rights in future than provided for in current legislation.

The Khoi and San people regard all archaeological material and sites linked to their culture as of spiritual significance and sacred. These heritage resources are equally deserving of protection similar to the protection offered to other religious minorities in the country (See the Supreme Court of Appeal decision in: Oudekraal Estates (Pty) Ltd v. City of Cape Town and others)

We therefore want to place on record that we are opposed to the proposed project and that neither Eskom nor the Government have approached us to date to obtain free and informed consent to develop a Nuclear Station on our ancestral land.

Response L:

Your statement that the HIA provides various examples of damage caused to archaeological material prior to and during the scoping phase is not substantiated. There are two instances of damage to buried middens recorded in Appendix 1 of the Heritage Impact Assessment. If such damage occurred due to the negligence of the landowner or due to wilful action, then the relevant heritage authorities have the right to take appropriate action against the landowner. If damage occurred prior to the scoping phase, this is clearly outside the scope of the Scoping and EIA process and such damage cannot be resolved through this process.

Regarding the damage to one shell midden during borehole drilling, please refer to Further Response 6.

Your opposition to the project is duly noted.

Comment M:

Initial Response (7)

Your comment is noted however more facts are required, on the assertions made in the first unnumbered paragraph to which this response relates, and where the assertion is made that there is a “lack of objectivity on the part of the consultants by not disclosing the correct facts.” Without those facts it is not possible properly to formulate a response to those assertions. What are the “various? examples of damage” referred to in the circumstances? In terms of “free and informed consent” please refer to response 6.

FURTHER OBJECTION

We do not need to provide you with further facts. Please read the Thyspunt inventory of observations that forms part of the HIA. Please note the comments: ***"Deposit turned up in borehole drilling upcast. Proves existence of buried deposit"*** and other similar comments. Also see our further objection to your response 6 (3).

Response M:

Of the 234 points recorded in the inventory of observations for Thyspunt (Appendix 1 of the Heritage Impact Assessment), there are two points (14 and 42) where archaeological deposits were discovered from borehole upcasts. Two such instances of discovery of buried archaeological material can hardly be described as "various instances of damage". Furthermore, it is questioned how providing information on these finds in publicly available documents could be construed as a failure to disclose the facts.

Comment N:

4. CONSULTATION

Our comment (8)

We have indicated that we find the public participation process lacking with regard to local KhoiSan community. It is of even bigger concern that National KhoiSan structures were not consulted as part of this process.

The Department of Provincial and Local Government is in the process of negotiations with the National Khoisan Council (N.K.C) and the National Khoi-San Conference Facilitating Agency (N.K.C.F.A) about various First Nation matters. These two structures are however unaware of this EIA process.

The N.K.C represents all the major Khoi and San groupings in South – Africa, while N.K.C.F.A has a membership of more than 70 indigenous organizations.

The HIA results show that a project of this nature will not only have an impact on the resources of a local KhoiSan community, but that the cost to the national estate may be high. It is therefore also a national issue, requiring consultations with national Khoi and San structures as specified above. The fact that this has not been done to date constitutes a serious flaw in the public participation process.

Initial Response (8) (1)

Your comments are noted. The importance of the N.K.C and N.K.C.F.A is not disputed and as such consultation has taken place as part of the formal EIA process.

FURTHER OBJECTION

The consultation process with N.K.C and N.K.C.F.A only started after the Key Stakeholder meeting with us at a very late stage of the EIA process. We provided you with their contact details after the said meeting. Please provide us with the correspondence and the minutes of Key Stakeholder meetings held with these organizations.

Response N:

Your request is noted. A Focus Group Meeting with the Chiefs of the First Nations is still planned as part of the Nuclear-1 Public Participation process but has to date not taken place. The minutes of any meetings conducted will however be made available for public review.

Comment O:

Initial Response (8)(2)

According to ACER records, information on the project has continuously been sent to Mr. Kobus Reichert of Gamtkwa Khoisan Council since June 2007, i.e. from the early stages of Nuclear-1 EIA and/or project announcement.

There are various levels of consultation that take place in an EIA process. The Public Participation Process creates various channels through which stakeholders can participate. During the EIA process, I&APs could contribute issues either in writing by completing and returning comment sheets, or by attending meetings (public meetings/focus group meetings/stakeholder meetings), or submission of information at any stage of the process.

Mr. Reichert has represented and submitted comments on behalf of the Khoisan Community during the Scoping Phase as well as during the EIA Phase. In addition, various project correspondence has been sent to Mr. Reichert as per table below.

ID Description
L02E Acknowledgement of Comments Received June 07
L04E Letter 04E Scoping Extension 26 July 07
L05E DSR Availability Letter - 28 Jan 08
L08E DSR Comment period extension - 14 Mar 08
L11E Final Scoping Report Availability - 4 Aug 08
L12E Project Update Letter 22 Jan 09
L13E Letter 13 Revised POS for EIA 18 May 09
L14E Draft EIAR Availability 3 Mar 10
L15E Invitation to Key Stakeholder Feedback Meeting, 03 Mar 10
L17E DEIAR Comment Period Extension 6 May 10
L23E DEIAR Further Comment Period Extension 27 May 10

The EIA Team would however very much like to meet with the Khoisan Council to discuss the comments submitted on the Draft EIR and as such a Key Focus Group meeting was held with the Gamtkwa Khoisan Council in Hankey on 27 August 2010.

FURTHER OBJECTION

Comments were submitted by the Gamtkwa Khoisan Council and not on behalf of the entire KhoiSan community in South Africa whose heritage will be affected by this project. We are well aware of your list of project correspondence but this is only applicable to the Gamtkwa KhoiSan Council and no other group or organization.

Response O:

It is virtually impossible for an environmental assessment practitioner to be aware of all directly and indirectly affected interested and affected parties at the commencement of an EIA process. The EIA regulations therefore require a combination of targeted stakeholder participation to those I&APs that are known (e.g. surrounding landowners, municipalities, councillors and organs of state) as well as

broad-spectrum participation (through press advertisements, and site notices) to try to ensure that all relevant stakeholders are identified. Throughout the EIA process since 2007, there have been numerous regional, local and national press advertisements to inform potentially affected parties of their right to participate in the EIA process.

As you indicate above, there is currently no official recognition of the KhoiSan community's representative structures in South Africa and these structures are therefore not generally known. Since Mr Reichert has been kept informed of the Nuclear-1 EIA process since 2007, he was in a position to provide GIBB with the details of these structures since this time. Consultation with these structures commenced as soon as Mr Reichert provided the EIA team with the contact details for these structures.

Comment P:

5. CONCLUSION

Our comment (9)

The HIA report mentions that:

Johan Binneman of Albany Museum, Grahamstown, has conducted by far the most detailed archaeological work in the area. He has completed surveys of the Cape St. Francis Dunefield, visited and sampled sites at Thyspunt on a number of occasions since the early 1980's as well as completed a preliminary survey commissioned by Eskom. Binneman (1996) has identified a suite of sites in the area that contain artefactual material characteristic of the full range of archaeological sites that are known to have occurred over the last 7 000 -10 000 years.

The report also indicates that he has been consulted as part of this HIA. His opinion with regard to the suitability of a Nuclear Station at this particular site as a specialist who "has conducted by far the most detailed archaeological work in the area" has however not been provided.

We have therefore approached him for his input in this regard and it will be attached to the comments by the Thyspunt Alliance.

Response P:

Your comment is noted and we welcome Dr Binneman's comments. Please disclose, as required by the EIA regulations, what Dr Binneman's direct personal, financial, business or other interest is in the matter, as we note that Dr Reichert and Dr Binneman have jointly established a heritage consultancy.

Comment Q:

Response (9)

Dr Binneman spent an evening with the heritage specialist team at Thyspunt. He provided useful information to the Heritage Impact Assessment practitioner and it was jointly agreed that the proposed Thyspunt site was highly sensitive, a finding that has been reflected in the HIA Report. Dr Lineman was the author of the first report prepared for Eskom (1987), which has been reviewed by the HIA practitioner. Dr Binneman concluded that the area was rich with archaeology and that extensive mitigation would be required if the proposed activity was to take place. The HIA specialist has used all information available to him as background to his study as well as to his site assessments.

FURTHER OBJECTION

Please see Dr Binneman's response to the above statement in annexure A of this submission. He has not formally been consulted as part of the HIA. Important information has therefore been excluded from both reports. The "valuable" information he shared with you at an informal social gathering cannot be regarded as formal consultation for the purpose of a project of this magnitude. His opinion as a specialist who: **has conducted by far the most detailed archaeological work in the area** about the suitability of this project at the Thyspunt site is as follows:

From an archaeological heritage perspective I can only state that the coastline from Oyster Bay to Cape St Francis and the adjacent dune pass system is a rich and unique archaeological and palaeontological landscape - only one of its kind in South Africa and therefore the entire area should be declared/protected as an Archaeological and Palaeontological Cultural Landscape. Archaeological resources are non-renewable and any large scale development will no doubt have a devastating effect on the archaeological and palaeontological resources. No matter what monitoring, precautions and mitigation processes, hundreds of sites will be damaged and destroyed and an important part of the KhoiSan pre-colonial history will be lost forever. It should be a no-go zone for development.

Response Q:

Dr Binneman has published widely on the result of his research and his published information is referenced in several places in the Heritage Impact Assessment (HIA). Additionally, as indicated in the, the Nuclear-1 HIA team consulted directly with Dr Binneman.

We thank you for Dr Binneman's comments.

Comment R:

6. MINUTES OF KEY STAKEHOLDER MEETINGS

We have indicated on several occasions that the minutes of the Key Stakeholder Meeting with us are incorrect and should be amended. We also requested that the minutes on your website titled: Final Minutes should be removed and replaced by the amended minutes. The request was ignored and the incorrect version remained on your website for a number of months. The Final Minutes included in your Revised Draft EIAR is still incorrect. We request that you consult the recording and have it amended. If you are of the opinion that your version is more accurate than the changes we requested, please provide us with a copy of the recording to enable us to proof the contrary.

Response R:

Your comments are noted and your correspondence regarding the content of the minutes were received and reviewed by GIBB. GIBB made changes to the minutes were it considered them to be appropriate and factually correct.

Comment S:

7. MITIGATION REPORT

At the St Francis Bay Public Meeting we received the following response when the validity of the Mitigation Report was questioned:

JMB responded that GIBB was not involved in the open day and mitigation workshop at UCT; it was not part of the EIA. Dr. Tim Hart arranged the workshop on his own accord, and therefore GIBB cannot comment on the proceeding of the workshop, but can say that we have discussed the curation of artefacts, should authorization be given. The SAHRA, Eskom, Dr. Hart and GIBB are well aware of the capacity of Albany Museum. Eskom has undertaken that should mitigation need to take place, Eskom would consider a facility to curate and store these artefacts.

We will appreciate it if you can indicate why the report was included in the EIA if it was not part of this process. The so called Mitigation Report starts off by providing all the reasons why development could not take place at the Thyspunt site but then concludes that mitigation will be possible despite all the constraints. We wish to place on record that we do not accept this report due to the following reasons:

- No consultations were conducted with the KhoiSan community or other I&AP's in the Eastern Cape about the proposed measures included in the report
- The Albany Museum is recognized as the Provincial Archaeological Data Resource Center but was not invited to the workshop to discuss the mitigation measures.
- Academics and students from the rest of the country were invited to contribute towards the report while key stakeholders in the province were ignored.

We will also appreciate it if you can indicate how you can be well aware of the **current** position of the Albany Museum if no consultation with them took place during the course of this process.

Response S:

The response with regards to the Albany Museum was to indicate that the EIA team is aware that the Albany Museum has no capacity to curate further heritage artefacts. This is one of the reasons (besides keeping the material as context-specific as possible after mitigation) why an on-site curation facility and museum is proposed for the Thyspunt site.

Further the previous director of the Albany Museum is a member of the ACO (Heritage Specialist) project team and is very familiar with the situation with respect to storage. The specialist has had conversations with the current museum archaeologist who has indicated the situation continues to be difficult and also discussed with her issues with respect to storage should mitigation be required.

Comment T:

8. CONCLUSION (REVISED DRAFT EIAR)

It is clear that the Heritage Issues have not received the necessary attention as part of the Revised Draft EIAR. SAHRA's decision not to allow the development is not even mentioned in the Executive Summary of the report. Instead a concerted effort has been made to create the impression that the SAHRA decision may change as a result of the test excavations and that certain mitigation issues must be resolved. This is not correct. The results of the test excavations will have no affect on the SAHRA decision and GIBB is well aware of this fact. The mitigation issues have also not been resolved as part in the Draft EIAR. We fully support SAHRA's decision and we continue to object against this project since the majority of our concerns have not been addressed.

The Thyspunt site is a cultural landscape in terms of the UNESCO definition and should be preserved for future generations. Nobody denies the power needs of the country, but this cannot be used as an argument when alternative sites are available. The site selection process was flawed and Thyspunt should not even have been considered further than the Scoping Phase. The fact that

ESKOM still regard Thyspunt as their preferred site is an insult to the KhoiSan people and a repeat of all the injustices we have suffered during the course of the history of this country.

Response T:

Your opinion with regards to SAHRA's decision is noted. The test ecavations on the Thyspunt site do in fact substantially change the prediction of direct impacts for the Thyspunt site. This information will be provided to SAHRA for consideration. GIBB cannot respond to your opinion that new information from the test excavations will not affect the SAHRA decision.

All SAHRA correspondence, including letters in which it expresses opposition to the Thyspunt site, are included in Appendix B3 of the Revised Draft EIR Version 1. The executive summary cannot provide information on the comments of all staturoty bodies.

As indicated in the Revised Draft EIR, a number of key decision factors were considered in the selection of a recommended site for Nuclear-1. Given the fact that the largest concentration of archaeological sites falls outside the recommended power station footprint, and the fact that the impact on the directly affected sites can be mitigated with available resources, the recommendation of Thyspunt as the preferred site for Nuclear-1 is still supported.

Comment U:

Annexure "A"

Comments on the archaeological heritage of the Thyspunt area

20 July 2010

Gamtkwa KhoiSan Council (Member of the Thyspunt Alliance)
P.O. Box 196
Hankey
6350

Dear Mr Reichert

Here are the comments on the following issues as requested by the Gamtkwa KhoiSan Council:

1. What is your experience of the Thyspunt area?
2. Provide a brief summary of the archaeology of the Thyspunt area.
3. To what extent were you consulted by the HIA specialist team?
4. In your opinion how suitable is the Thyspunt site for the development of a nuclear power station?

1. What is your experience of the Thyspunt area?

I visited the Thyspunt area for the first time during December 1981. Access to the dunes was open and easy from the gravel road east of Oyster Bay, and vehicles entered the dunes with ease and caused damage to sites. The first few hundred meters into the dunes were littered by archaeological remains – Middle and Later Stone Age stone tools and fossil bone. By 1992, when we recorded sites in the dune field, large areas and sites previously exposed were already covered by dune and alien vegetation. A few years later in 1996 these sites were also covered by vegetation. It is estimated that now in 2010 the dune system is half the size it has been in 1981 and one can only imagine how many sites have been covered since then.

Many visits followed between 1982 and 1996 and eventually the observations from the region comprised an important part of my D.Phill. These observations included large numbers of Later Stone Age shell middens, stone features and stone wall fish traps along the coast, Earlier, Middle and Later Stone Age lithic and fossil bone sites in the adjacent dune bypass system. The exceptional aspect of this region is the richness and diversity of archaeological and palaeontological sites. This large number and variety of sites provide excellent information to 'reconstruct' the early pre-colonial history of the Cape St Francis region and further afield. The information collected from the Thyspunt area provided valuable background for the identifying and classifying of a 'new' stone tool industry for the south-eastern Cape coast during the past 4 500 years.

Response U:

Your comment is noted.

Comment V:

2. Brief summary of the archaeology of the Thyspunt area

The Cape St Francis region, especially the Thyspunt and adjacent shifting dune bypass system, is among the richest and most exciting archaeological and palaeontological landscapes in the Eastern Cape and South Africa. Little is known about the first inhabitants of the region, but the large Earlier Stone Age handaxes found in the Thysbaai dune field indicate that people were already living in the area at least 1,4 million years ago. Not much information about the people who made the handaxes is available because no other associated remains have survived. The large Acheulian stone tools were replaced by smaller stone tools called the Middle Stone Age (MSA) flake and blades industries. MSA stone tools occur throughout the region and may date between 250 000 and 30 000 years old. There are some exceptionally large concentrations of MSA stone tools in the dunes east of Thyspunt.

The Thysbaai area is situated less than 20 km east from the world famous Middle Stone Age Klasies River Caves. The earliest skeletal remains of anatomically modern people (*Homo sapiens sapiens*) in the world were found there and date to approximately 110 000 years old. Well-preserved fossil bone of extinct mammals, are found throughout the shifting dune system, which indicate that it is highly possible that similar remains of anatomically modern people may be present in the region. Although humans were already anatomically modern by 110 000 years ago, they were not yet exhibiting 'modern behaviour' (symbolic expression) and only developed into culturally modern behaving humans between 80 000 and 70 000 years ago. This occurred during cultural phases known as the Still Bay and Howieson's Poort time periods/stone tool traditions/industries. The Howison's Poort Industry is well represented at the Klasies River Caves and also in the dunes, a few hundred meters inland from Thyspunt. This site yielded well-preserved faunal remains and numerous hyaena coprolites. Among the faunal remains identified from this remarkable site were extinct giant buffalo, elephant, Cape buffalo, hippopotamus, eland, black wildebeest and Cape fur seal. The faunal remains and pollen extracted from the hyaena coprolites indicate that the environment during the Howieson's Poort time period was very different from the modern-day one and composed of open grasslands, large water bodies in the proximity of the site and dense close habitats in the river valleys.

Some 30/25 000 years ago the MSA gave way to the Later Stone Age (LSA) a time period marked by large scale technological changes. The period between 20 000 and 14 000 years ago experienced extremely cold climatic conditions (Last Glacial Maximum - the last ice age). The cold temperatures created favourable conditions for grassland expansion, which in turn gave rise to large herds of grazing animals. The mammal remains from archaeological sites in the wider region indicate that there were several large grazing animal species living on the grassland, for example giant buffalo, giant hartebeest and the Cape horse. After 14 000 years ago the climate started to

warm up again and caused the previously exposed grassland to disappear, causing the extinction of many grassland species including the giant buffalo, hartebeest and the Cape horse.

Shell middens are by far the most numerous archaeological features associated with the Later Stone Age (LSA). The majority of the middens are concentrated along the immediate coastline, but may be found as far as 5 km inland. Shell middens represent the living sites of prehistoric groups (San, KhoiKhoi, and KhoiSan people) who lived along the coast, either seasonally or permanently, and exploited the marine resources. Each midden contains its own unique composition of food and cultural remains. In general they are short-term occupation sites (a few days to a few weeks), or put differently, 'rubbish heaps' of food waste (mainly marine shell, some mammal, fish and reptile bone), mixed with cultural material (stone and bone tools, pottery and ornaments) and occasionally human remains. Several human burials were recorded from the coast and dune field.

The oldest open-air middens in the wider Thyspunt area date to approximately 6000 years old. These middens contain microlithic silcrete and quartz stone tools similar to those found in caves and rock shelters in the adjacent Cape mountains. The nearest source of silcrete and quartz is in the Cape mountains and it can therefore be speculated that these middens were the camp sites of small hunter-gatherer groups who visited the coast sporadically in search for food. Approximately 4500 years ago, a 'new' stone tool industry was introduced along the coast. This industry, called the Kabeljous Industry, was manufactured of local quartzite cobbles and 'replaced' the microlithic stone tools industries in caves and rock shelters by 3000 years ago. However, open-air middens with both industries are found side by side along the coast until 1800 years ago. This would indicate that inland groups still, or were allowed by the coastal inhabitants, to visit the coast. As the Kabeljous Industry contained no silcrete or quartz stone tools may indicate that the people who made these stone tools did not move beyond the coastal foreland and settled permanently along the coast.

Approximately 1800 years ago KhoiKhoi pastoralists occupied the Eastern Cape coast and introduced pottery and domesticated animals, such as sheep, goat and cattle to the region. One of the richest pastoralist sites (number of sheep remains) in South Africa and dating to 1 250 years old is situated in the dunes field east of Thyspunt. The KhoiKhoi sites can be divided into two types; those which contain pottery and domesticated animal remains (true pastoralists) and those which only contain pottery. Although these sites are scattered throughout the area, it would appear that sites with large numbers of sheep remains, or true pastoralist sites, are situated in the dune fields rather than along the immediate coastline. A few hundred years later the first Europeans rounded the Cape and altered the 'prehistoric' socio-economic landscape forever.

Response V:

Your comments are acknowledged with thanks and will be incorporated, where relevant, into the revised Heritage Impact Assessment.

Comment W:

3. To which extent were you consulted?

There was no 'formal' consultation, but there were some 'informal' comments made during one or two telephone conversations. I did pay a courtesy/social visit to the survey team in Oyster Bay on the evening of 8 July 2008 before their return to Cape Town, but little conversation regarding the survey took place.

Response W:

The comment is noted. This statement by Dr Binneman is not in dispute.

Comment X:

4. In your opinion how suitable is the Thyspunt site for development of a nuclear power station?

From an archaeological heritage perspective I can only state that the coastline from Oyster Bay to Cape St Francis and the adjacent dune pass system is a rich and unique archaeological and palaeontological landscape - only one of its kind in South Africa and therefore the entire area should be declared/protected as an Archaeological and Palaeontological Cultural Landscape. Archaeological resources are non-renewable and any large scale development will no doubt have a devastating effect on the archaeological and palaeontological resources. No matter what monitoring, precautions and mitigation processes, hundreds of sites will be damaged and destroyed and an important part of the KhoiSan pre-colonial history will be lost forever. It should be a no-go zone for development.

Dr Johan Binneman
Department of Archaeology
Albany Museum
Grahamstown

Response X:

Your opinion in this regard is noted.

The ACO team (Heritage Specialist) has seen in this area some of the finest archaeological sites it has ever recorded in 24 years of operation based on the quality of preservation, the cohesive set of landscape qualities and diversity over space and time. If one considers the place to be a cohesive cultural landscape, mitigation cannot be achieved. The law however only protects individual archaeological sites and does not apply to broad landscapes, although it does require landscape qualities to be assessed in an EIA. For a landscape to be protected as an entity in its own right, it has to be declared at either provincial or national level by the heritage authority. Therefore the law acts on individual archaeological sites as things stand at present. Given this situation the proposed activity could break the law if it damages archaeological sites, but will not be breaking the law if it changes the landscape. Enough is now known about the area to engage in the proposed activity in an area where archaeological sites do not exist, and permanently protect those that do exist. In terms of the landscape, which we consider to be very significant, this is lamentable but is the status-quo until such time a heritage authority defines the landscape and declares it. SAHRA has not indicated that it will do this as yet.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

Cape Nature
Scientific Services
Private Bag X5014
STELLENBOSCH
7599

Dear Samantha Ralston

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

RE: REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED ESKOM NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (NUCLEAR 1)

Comment 1:

CapeNature would like to thank you for the opportunity to comment on the above report. Please note that our comments relate only to the potential impacts on biodiversity and not the overall desirability of the proposed development. Please also note that we have not commented on any human health or safety issues, as this is beyond CapeNature's mandate and expertise.

We note that very little has changed in Draft Environmental Impact Report (EIR) Report with regards to the impacts on biodiversity the since this report was revised. We are therefore of the opinion that most of our previously raised comments remain relevant.

Alternatives

We note Thyspunt remains the preferred alternative. It is beyond CapeNature's mandate to comment on this alternative as it falls outside of the Western Cape, although we do note with concern that there are significant negative ecological impacts associated with this site. CapeNature's lack of further input with regards to this site should in no way be interpreted as support for this alternative. Given the ecological sensitively of all three sites under consideration, we once again reiterate our concern that some site alternatives (i.e. in the Northern Cape) were dismissed very early on in the process, without thorough investigation.

We suggest further that given the strategic nature of this development, alternatives should not have been limited to sites owned by Eskom. Rather, the site alternatives should have been informed by what is most appropriate in terms of the potential environmental impacts of the facility on the receiving environment.

Response 1:

Your comment regarding the alternative Northern Cape sites is noted. GIBB's exclusion of these alternatives at the end of the Scoping Phase and DEA's acceptance of this recommendation remains valid.
It is not necessarily true that the alternative sites in the Northern Cape would necessarily lead to lesser degradation of the environment. Although it is true that a large portion of the Northern Cape around the proposed sites has already been heavily degraded by diamond mining, the Northern Cape is also home to some of the most endangered and endemic succulent plant species on earth, since the Succulent Karoo Centre of Endemism, with critical biodiversity areas like the Knersvlakte, lies between the Northern Cape sites and the Western Cape. Furthermore the transmission lines would have to traverse the Namaqua National Park.

Comment 2:

Associated infrastructure

CapeNature reiterates its concern that the proposed nuclear facility is being considered separately from its associated infrastructure. We understand that one of the factors that caused the Northern Cape site alternatives to be dismissed was that new transmission lines would be required and this would be prohibitively costly. This was not assessed in any detail in the impact assessment. Bantamsklip will also require new transmission lines and these are also expected to be costly - this time to the environment (the transmission lines associated with Bantamsklip are anticipated to have significant negative impacts on biodiversity).

Unfortunately, the impacts of associated infrastructure appear to be selectively considered in this EIA. Further, we understand that expensive infrastructure upgrades could be required for construction and transportation of components of the facility. This could, for example, require a barge landing at Bantamsklip. This would be both costly and could have significant negative impacts on the sensitive coastal strip. We suggest that this should be considered and assessed in detail, *as part of a single process*; to ensure that the cumulative impacts of the proposed facility at all locations can be better understood.

It is essential that the impacts of all associated infrastructure as well as the footprint of the facility are clearly outlined and assessed before and informed decision can be made. We are of the opinion that piecemeal decision-making could result in a fatally flawed process.

Response 2:

Your comments are noted. The Revised Draft EIR (Version 2) has considered, as far as possible, the level of information available for each site, as well as whether the same level of assessment could be performed for each site not only in terms of the planned NPP but also (as far as possible) the associated infrastructure required to support the power station. It is as a result of the assessment that the Bantamsklip site has been excluded as a feasible site for the current application for Environmental Authorization. Please see Chapter 5 of the Revised Draft EIR (Version 2) for a more detailed discussion.

Comment 3:

Conservation value of Bantamsklip and Duynefontein

CapeNature is of the opinion that the faunal, botanical and freshwater ecological impact assessments were thorough, well presented and were adequately reflected in the main EIR. These assessments were, however, constrained by lack of detailed information with regards to the exact location the proposed facility (and associated infrastructure, as discussed above). At this stage, only a very broad understanding of the area potentially impacted is possible.

We do suggest that the fact that both sites have been identified as Critical Biodiversity Areas (CBAa) by systematic biodiversity plans for their municipalities need to be highlighted. This CBA status means that both sites are required to help meet biodiversity pattern and process thresholds (which includes targets set at national level). The desired management objective for a CBA is: "Maintain natural land. Rehabilitate degraded to natural or near natural and manage for no further degradation". The

compatibility of the proposed development with this desired management objective should be critically assessed, something which the EIR fails to do.

We will not repeat the specialists' findings here other than to support the conclusion that there are potentially significant negative impacts on biodiversity associated with both proposed sites in the Western Cape. While these can be reduced to some degree buy carefully selecting the footprint, it must be recognised that the boarder ecological context within which these footprints would be located remains important and sensitive. Introducing a new node of disturbance to these areas is not undesirable.

There appears to be some debate as to the conservation value of the dunes at the Duynefontein site. We suggest that the value of this feature should be considered both in terms of its geomorphological value and its importance in terms of both biodiversity pattern (e.g. what species and habitats it contains) and ecological processes (e.g. is it an important ecological driver?). These are slightly different factors and the findings of one specialist should not necessarily negate those of another (i.e. there is not necessarily once "right" answer).

Mobile dunes in the vicinity of infrastructure would need to be artificially stabilised. The knockon effects of this must be carefully considered in terms of the broader ecological functioning of the area.

Given the ecological sensitivity of both sites in the Western Cape, we suggest that, should the proposed facility be approved at either of these sites, it is imperative that the recommendations for mitigation contained in the EIR, the Environmental Management Plan (EMP) and in the specialist studies be included as conditions of approval and strictly implemented. We suggest that it must be confirmed *within this process* that the mitigation measures that have been suggested by the specialists are considered feasible. For example, it recommended that the location of the planned facility is moved away from the sensitive and mobile transverse dunes, is this possible?

We suggest further that a biodiversity offset would be appropriate and necessary for *both sites* in the Western Cape and request that DEA advises whether this option should be explored further before environmental authorisation is considered. Although we recognise that opportunities for an on-site offset are limited at Duyenfontein (sic), it is our opinion that nothing precludes the option of exploring an *off-site* offset and we strongly encourage that this be investigated further.

Response 3:

Information regarding the location of the power station

Your comments about the lack of detailed information regarding the proposed location of the power station refer. The approach followed in this EIA is precisely not to present a proposed exact location, but to provide a proposed "EIA Corridor" that would be technically preferable for the placement of the power station. The results of the EIA specialist studies confirmed which portions of the site were environmentally suitable for the placement of a power station (i.e. the power station would be placed preferably on areas of low environmental sensitivity). Thus, spatial information from all relevant disciplines (e.g. botanical, faunal, invertebrates, heritage and wetlands) on the sensitive and non-sensitive areas was overlaid to identify environmentally preferable positions for the proposed power station. The recommended positions for the power station shown in the Revised Draft EIR reflect the areas of lowest sensitivity at all three of the alternative sites.

Critical Biodiversity Areas

Your comments are noted. Please find response from the Botany and Dune Ecology Specialist, Mr. Barrie Low, below:

The City recognises Duynefontein as being a Category A CBA (Appendix E11, Botany and Dune Ecology Report, pg. 4-42). CBA's for the Bantamsklip area had not been prepared when the report was compiled.

Further, it is important to note that the main reason Duynefontein is a high priority area for the City is because of the Koeberg Private Nature Reserve, particularly due to their alien clearing programme. Eskom's efforts at Bantamsklip are also to be applauded – the site is subject to heavy acacia invasion and frequent burns, both of which are compromising the integrity and diversity of these systems.

Again, Eskom has undertaken a massive alien clearing programme, surely contributing to the overall quality of the area. Much if not most of the recommendations contained in the CBA layers are impractical to implement, certainly in terms of the high costs involved and the limited resources of private landowners.

Conservation value of the dunes at Duynefontein

Your comments are acknowledged. Both the geomorphological value and biodiversity value of the transverse mobile dune system at Duynefontein have been assessed. From a geomorphological perspective the dune system was assessed not to be of critical importance, as there are better protected and larger intact and functioning mobile dune systems further north on the West Coast of the Western Cape. From a biodiversity perspective, the dune system was not found to contain unique species of high conservation value, but it is valued from an ecological process perspective. It is in recognition of this value (in spite of the geomorphological finding that the dune system has a low conservation value) that it is recommended in the Revised Draft EIR that the proposed Nuclear-1 power station should be located to the east of the mobile dune system at Duynefontein.

It is noteworthy that Koeberg Nuclear Power Station (KNPS) was developed within the mobile dunes and that the current status of the dunes is the result of stabilisation that was carried out for the KNPS. The functioning of the mobile dune system at Duynefontein is therefore far from natural.

Considering that neither Duynefontein nor Bantamsklip are recommended for authorisation in the Revised Draft EIR, the EIR has not focused on establishing the feasibility of the proposed mitigation measures for the Duynefontein site.

Biodiversity offset

Your suggestion for an offset is noted. The Department of Environmental Affairs, the relevant decision-making body in this instance, will be alerted of your recommendation for a conservation offset. Please note in terms of the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998), the decision-making authority is required to consult all other organs of state who have any forms of interest or jurisdiction over the matter concerned, and that CapeNature would have the right to make representations to the DEA on the proposed for a conservation offset during the DEA's review of the Environmental Impact Report.

Comment 4:

Protected area status

Not only are both sites in the Western Cape ecologically sensitive, but they have also both been declared as Private Nature Reserves (in terms of the Western Cape Nature and Environmental Conservation Ordinance, 1974 (Ordinance 19 of 1974). This poses some significant environmental and *administrative constraints* to development of these sites. According to Section 12 of the Protected Areas Act, a protected area which was reserved or protected in terms of provincial legislation for any purpose for which an area could, in terms of this Act, be declared as a nature reserve or protected environment, must be regarded to be a nature reserve or protected environment for the purpose of this Act. The definition of Nature Reserve in the Act also includes "an area which before or after the commencement of this Act was or is declared or designated in terms of provincial legislation for a purpose for which that area could in terms of section 23(2) be declared as a nature reserve". *It can safely be assumed given the biodiversity value of both sites, these would both be deemed a Nature Reserve in terms of the Protected Areas Act.*

This Nature Reserve status means that the Minister or MEC must assign a management authority for the Nature Reserve (section 38) and a management plan must be prepared, with consultation with interested and affected parties and organs of state and submitted to the MEC or Minister for approval (section 39). As far as this office is aware, no management authority has been assigned for either site and while we understand that a management plan has been drafted, this has not been approved by the MEC.

According to Section 50 (1)(a) the Act the management authority of a nature reserve *may*, *subject to the management plan* of the reserve of site, carry out or allow a commercial activity or an activity aimed at raising revenue in the reserve. However, Section 50(2) also indicates such an activity may

not negatively affect the survival of any species in or significantly disrupt the integrity of the ecological systems of the nature reserve.

As no *approved* management plan exists, no commercial activity should be permitted until a management plan is approved by the MEC and takes into account any planned commercial activities (which would include electricity generation facilities and any infrastructure associated with this). Importantly, it must be demonstrated that the activity will not negatively affect the survival of any species in or significantly disrupt the integrity of the ecological systems of the nature reserve. This may be hard to do in the case of the proposed Nuclear 1 facility, where a biodiversity offset may be required to achieve this for both sites.

Eskom needs to meet the above requirements or deproclaim the reserve (or parts thereof) *before they may commence* with the proposed activity. While this may not be an insurmountable obstacle (although CapeNature is unlikely to support the deproclamation of large portions of either site), there are certain administrative requirements that must be met before development can be considered on these sites.

The protected area status also has implications for the no-go alternative and how this should be assessed in this EIA process.

Response 4:

Only the Duynefontein site has been declared as a Private Nature Reserve. Farm Duynefontein No. 34 was declared as a Private Nature Reserve in terms of Section 12(4) of the Nature and Conservation Ordinance, 1974 (Ordinance 19 of 1974).

Bantamsklip is not registered as a Private Nature Reserve, but Eskom has registered it voluntarily as a Natural Heritage Site under the (now defunct) Natural Heritage Site programme of the Department of Environmental Affairs.

Eskom submitted management plans for the Duynefontein and Bantamsklip properties to CapeNature for approval in March 2012. The management plans was subsequently lost by CapeNature and a copy was immediately supplied to them. At the time of responding to your comments the approval of the management plans is outstanding.

Eskom is aware that the status of an approved management plan may place restrictions on the use of the land and that there are restrictions on commercial activities. However, Section 41(2)(g) of the National Environmental Management: Protected Areas Act (NEM:PAA), 2003 (Act No. 57 of 2003) stipulates that a management plan must include "*zoning of the area indicating what activities may take place in different sections of the area, and the conservation objectives of those sections.".* This recognises that different parts of a protected area may have different objectives, based on their environmental sensitivity and conservation status, and that strict conservation objectives may apply only to specific sections of a protected area.

Eskom takes note of the restriction in Section 50(2) of the NEM:PAA that activities may not negatively affect the survival of any species in or significantly disrupt the integrity of the ecological systems of the nature reserve. One of the purposes of the Nuclear-1 EIA has been to confirm whether Nuclear-1 would affect the survival of any species or disrupt the integrity of ecological systems. Findings of the EIA process thus far indicate that there are no environmental fatal flaws associated with either the Duynefontein or Bantamsklip sites.

Comment 5:

Restrictive conditions in appeal decision

The appeal decision dated 23/11/10 regarding a training centre is planned on Cape Farm No. 34, Duynefontein includes a condition that "…*before any further development on Cape Farm 34 is* submitted for environmental authorisation*, the applicant must submit its management plan for its private nature reserve to CapeNature for approval and must enter into a stewardship agreement with Cape Nature*" (emphasis added). Unfortunately there has been little progress in this regard. Once

again, this is not an insurmountable obstacle, but does have implications for the further consideration of this site at present.

Response 5:

In response to the authorisation of the Koeberg Training Centre, Eskom met with CapeNature and indicated that it is willing to enter into a first tier stewardship programme on Farm 34. This proposal was not acceptable to CapeNature as they wanted a stewardship agreement of the highest level on the entire property under Eskom's control at the Duynefontein site.

Eskom representatives then arranged a meeting with Ms Willeen Olivier of the Department of Environmental Affairs and Helen van der Westhuizen of CapeNature to discuss this issue. At this meeting Eskom explained in detail why the environmental authorisation condition of the Training Centre cannot be expanded to include all of the land under Eskom's control at the Duynefontein site. Eskom also made it clear that the organisation cannot enter into a stewardship programme that will prevent Eskom in any way from using the site for the expansion of the nuclear programme or for other uses related to Koeberg Nuclear Power Station.

Eskom also explained that the National Key Point Act and the National Nuclear Regulator Act governing Eskom's activities on the Duynefontein nuclear site will always take precedence over any agreement with CapeNature or any other environmental organisation.

Eskom also discussed the possibility of a stewardship agreement on an additional property that Eskom is in the process of acquiring. CapeNature inspected the property in September 2012 and at the time of writing this response, Eskom were awaiting their decision.

Comment 6:

Conclusion

It is CapeNature's opinion that this process has been severely constrained by limiting the site alternatives available for consideration. Further, it is our opinion that the alternatives put forward were identified based on informants which are largely outdated. This has resulted in unfortunate conflicts and administrative constraints. We urge that site selection for any further nuclear facilities planned is based on up-to-date and transparent criteria. CapeNature will gladly assist with the ecological screening of potential new sites in the Western Cape.

It is also CapeNature's opinion that this process has been compromised by separating the assessment of the impacts of the proposed nuclear plant, from its associated infrastructure. As a result the true impact of the proposed facility cannot be fully understood. CapeNature reserves the right to revise initial comments and request further information based on any additional information that might be received.

Response 6:

Your comments regarding site alternatives are noted and your offer of assistance for the identification of potential new sites is gratefully acknowledged.

The sites considered as alternatives for the Nuclear-1 EIA were identified during the Nuclear Sites Investigation Programme (NSIP), a process which included a number of criteria, including environmental, technical and other. An extended process (at least five years) is required to confirm a site's seismic suitability for a nuclear power station. Therefore, there are constraints with regards to the addition of new sites for consideration in the EIA process. Furthermore, project planning for large construction projects typically includes a pre-feasibility and feasibility assessment prior to detail planning and environmental impact assessment. Considering that the NSIP was focused on initial identification of potential nuclear power station sites, it should be regarded as an initial feasibility or even pre-feasibility study. The socio-economic realities that underlie the choice of sites in the Western Cape and Eastern Cape have not changed to such an extent since the NSIP was undertaken that the major load centres (centres of electricity demand) in the Eastern and Western Cape (Port Elizabeth and the Cape Metropole) have changed. Therefore, the location of power station sites in each of these

regions (close to the Cape Metropole and close to Port Elizabeth) therefore remains as valid today as it was when the NSIP was undertaken. Whilst not all relevant ecological data was available at the time that the NSIP was compiled, extensive and in-depth specialist assessments have been undertaken for the Nuclear-1 EIA process and these assessments have confirmed that there are no fatal flaws at any of the alternative sites.

With regards to the separation between the EIAs for the power station and the transmission lines, please refer to Response 2.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

Email: anthony.reed@uct.ac.za

Dear Mr Reed

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

ANTHONY REED – SUBMISSION ON DEIR FOR NUCLEAR-1: PROBLEMS WITH THE EIA'S PROCEDURAL ISSUES

Comment 1:

The whole rationale for the urgency of the nuclear build, as well as for the decision made by Arcus-Gibbs alone to drop the Brazil and Schulpfontein sites was based on the urgent need for extra base-load. However the evidence for this as an absolute need is not supported in the EIA, and there are other options to approach this problem that are not mentioned such as considering the short-term closing of smelters that rely on cheap electricity, particularly the aluminium smelters that rely on mostly imported ores combined with Eskom's cheap, consumer subsidized electricity.

Need for urgency to increase base-load is not clear. 3 mothballed coal stations are all just about to be commissioned and we have Kusile (4800MW) and Medupi (4 800 MW) (both massive coal stations) coming on-line.

Concern and objection raised Number 1:

- So if there is no proven urgency to increase base-load, then there is no justification for dropping the Brazil and Schulpfontein sites in the EIA. This then renders the EIA procedurally flawed
- Cheaper options to the country, and to domestic consumers, may be to remove the appropriate high user smelters, and consider using a portion of the nuclear spend to subsidise those smelter's workers for lost employment. This is not considered as an option.

Response 1:

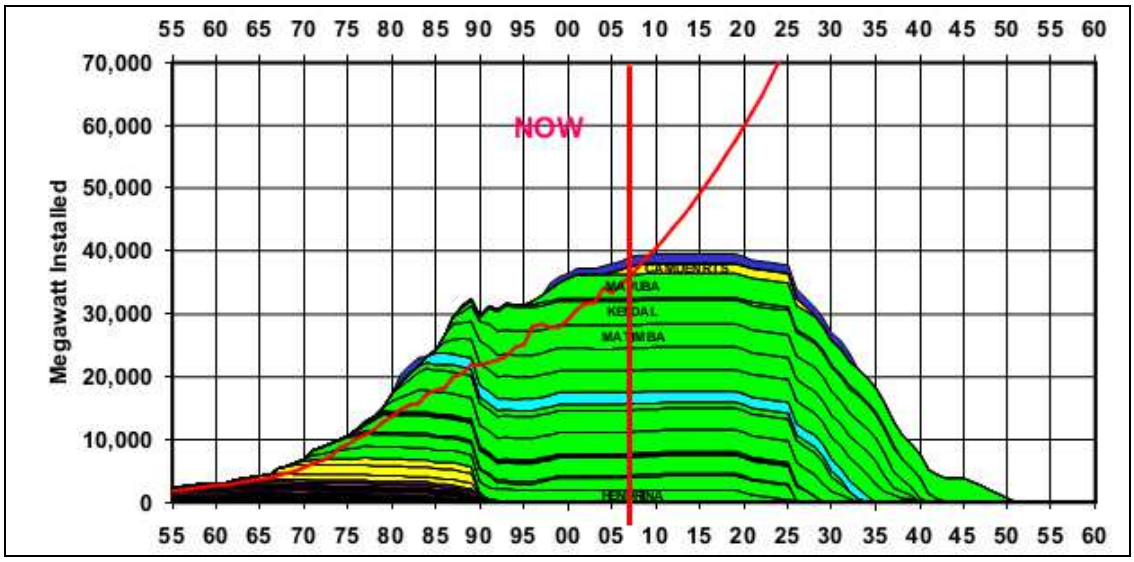
Your comments are noted. The recommendation to discontinue consideration of the Brazil and Schulpfontein sites at the end of the scoping phase, in November 2008 was made on the basis of a number of facts, including the long distances over which electricity would need to be transmitted to the Western Cape load centre (resulting in significant losses) and the fact that there are highly sensitive ecosystems like the Succulent Karoo along the transmission line routes between Northern Cape and the Cape Metropole, which would make finding an environmentally suitable transmission line corridor very difficult.

It is to be noted that the Scoping Report was accepted by the then Department of Environmental Affairs and Tourism, including the recommendation that the Brazil and Schulpfontein sites be excluded from further consideration during the EIA phase.

Your comment regarding the shutting down of smelters is noted. However, the question can be asked if any electricity consumers should be told to discontinue using electricity, how a particular sector, group of people or geographical region could equitably and justifiably be targeted for this. Who would decide and based on what criteria that some people may continue to use electricity and some not? Why should an aluminium smelter be targeted and not domestic consumers, for that matter?

Aluminium smelters, although they are large consumers of electricity, provide employment opportunities. If they are to be shut down, all the employees and thousands of people in their families will be left without an income. Added to that would be the refusal of potential investors to create new industrial facilities in a country that cannot provide security of electricity supply, and the associated loss of potential employment opportunities for millions of currently unemployed people. The long-term economic implications of a decision to close major industrial facilities and the message this would send to potential domestic and foreign investors about security of energy supply are severe. Such a decision would undoubtedly lead to an immediate slump in investor confidence in South Africa and movement of investment from South Africa into other markets where electricity supply can be guaranteed.

Your comment regarding the return to service of mothballed power stations and the construction of Medupi and Kusile is noted. However, the construction of new power stations does not make up for the future shortfall of electricity that will be experienced once existing power stations reach the end of their operational life spans. This is illustrated by the figure below (from the Nuclear-1 Scoping Report), which indicates that major coal-fired power stations such as Majuba, Kendal and Matimba will all reach the end of their operational lives by approximately 2025. Unless plans are put in place to construct power stations to replace these existing stations, which provide in existing demand, as well as to construct new power stations to increase supply of electricity, it is a given that South Africa will experience a critical shortfall of electricity supply by 2025.The Integrated Resource Plan (IRP) 2010, the strategic government policy for securing electricity supply over the next two decades, indicates that at least 40,000 MW of new generating capacity needs to be created to cater both for the expected increase in demand, as well as existing power stations that will reach the end of operation.



Comment 2:

If emissions are really the issue, then we could add scrubbers at a lesser cost than nuclear generation (for a coal plant) to deal with the sulphur residues in coal generation, and plan to fund carbon capture for all our coal generation plants when it comes on line and commercially viable around 2025. The EIA includes plans to deal with the high level nuclear waste by “technological and legislative” advances, and these are further away from being possible than carbon capture, never mind the unlikelihood of the recycling of high level nuclear waste ever becoming commercially viable; so why not use the same approach for coal as an alternative? Kusile and Medupi will both include sulphur scrubbers and it may be possible that CO_2 capture and storage for coal stations will be available quicker than the new nuclear build will take.

Concern and objection raised Number 2:

The EIA does not appraise the alternatives of a high efficiency sulphur and CO_2 scrubber coal option, against the nuclear option to mitigate greenhouse gas generation in the medium term energy planning. Thus the EIA does not place before the decision makers all the required options.

URGENCY BASED ON PEAK CHALLENGES POORLY ARGUED

Revised DEIR Chapter 4, pg6

Figure 4-7 shows a typical demand profile for the hours of the day during winter and summer of 2008. The figure clearly shows the peak in the electricity demand each day in the morning and late afternoon periods. The peak demand exceeded 36 000 MW in the late afternoon/ early evening. The figure also clearly shows that in 2007 the minimum base load demand for electricity in the early hours of the morning was approximately 21 000 MW.

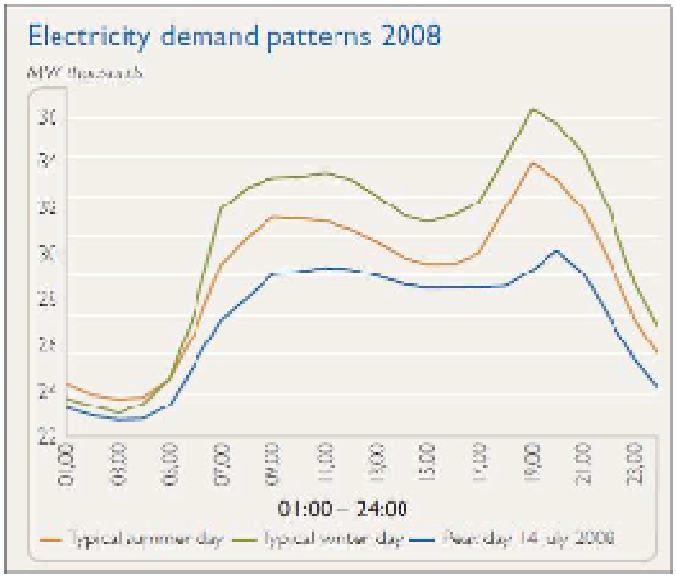


Figure 4-7: Daily electricity demand patterns (Eskom 2009)

The increasing demand for electricity impacts both the base-load demand as well as the peak-load demand. It is thus essential for Eskom to construct new base-load and peak-load power stations. The Nuclear-1 project is aimed at increasing the base-load supply capacity. Other projects are aimed at increasing the peak supply capacity.

Revised DEIR Chapter 4, pg 1

South Africa is still experiencing an electricity baseload-capacity deficit. Eskom needs to increase its generation capacity to improve the reserve margin (the difference between the peak demand and generation capacity) back to within acceptable limits. The reserve margin of 14 % in January 2009 was still below the international norm of 15 % (Eskom 2009). Eskom requires approximately 3,000 MW of generating capacity in reserve to take generating units off-line to perform essential maintenance (Eskom Integrated Report 2012 – accessed at http://financialresults.co.za/2012/eskom_ar2012/integrated-report/index.php on 23 July 2012).

Response 2:

The environmental application for Nuclear-1 is for a nuclear power station and the Nuclear-1 EIA process is not a strategic level review of potential power generation alternatives, such as the alternative of using coal-fired generation with scrubbers. Strategic review of the power generation alternatives to determine the mix of generation alternatives that need to contribute to total generation capacity, was the function of the Integrated Resource Plan (IRP) 2010 (government's strategy for security of energy supply over the next two decades) and is not the function of project-specific decision making within the scope of an EIA.

The EIA process is, by its very nature, a project-specific tool that focuses on a particular form of technology. However, government and Eskom are pursuing a number of technologies in parallel to nuclear generation. It is to be noted that the IRP requires a balanced mix of generation technologies, including 9,600 MW of nuclear and 18,700 MW of renewables. The purpose of nuclear generation is to provide reliable base-load power, which can be supplied by either coal or nuclear generation. It is also pointed out in the Revised Draft EIR that a mixture of generation technologies is required in order to

meet South Africa's future energy needs and that we cannot place reliance on only a single form of technology or a limited number of technologies.

The project-specific nature of the EIA has also been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction.

As with these previous instances of power station EIAs, the scope of the Nuclear-1 EIA is restricted to a specific power station on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa's electricity needs. Government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades. The conclusion of the IRP 2010 process is that 9,600 MW of nuclear generation must form a part of the mix of generation technologies.

Comment 3:

The EIA is not clear in chapter 4, where it is attempting to describe "need and desirability", about whether it is the peak or base-load that has the urgent requirement. Nuclear is a base-load provider and this would be a potential argument for nuclear. Whilst peak needs a base-load to build the peak on, the EIA describes the building of Kusile and Medupi, in addition to the commissioning of 3 moth-balled coal power-stations, and these will contribute significantly to base-load in the short-term.

However on the opening page (pg1), the EIA uses peak and peak reserve margin challenges as its particular argument for the acute need for more generation capacity.

If one looks at the electricity use requirements through a 24 hour cycle as provided on DEIR page 6 chapter 4 (fig 4.7) it shows that peak nears capacity between 17.00 and 21.00.

There may be other ways (these are not discussed) of dealing with the peak problem-

- Address causes of peak (seems a lot of domestic on top of background)
- Shift peak use into base load times where spare capacity exists
- Explore different time zones in South Africa to shift peak (07.00-09.00 and 17.00-21.00). If it were possible to lengthen peak period and flatten peak requirement we would have more time to make correct decisions.

Concern and objection raised Number 3:

- The EIA use "peak" usage challenges as an argument for the building of a nuclear power station, which is described in the same paragraph as being required for improving base-load generation. *The EIA needs to place before the decision-maker the correct information*. If peak usage is the problem there are alternatives to address this issue that have not been adequately discussed. This renders the whole motivation for the need, invalid.
- Daytime base-load could be well assisted by solar, and this could include covering in to the evening peak, but the only comparison in the EIA is against coal. The omission of the solar option to increase day-time base-load is a critical omission from the EIA.

Response 3:

It has been made clear throughout the EIA process that the purpose of a nuclear power station is to supply base load electricity. The reference to peak demand in Chapter 1 of the EIR is to illustrate the fact that the reserve margin (the difference between supply and demand) is still unacceptably low and does not to provide security of supply at all times. South Africa needs both base load and peaking power stations to provide greater security of supply. Although peaking power stations may be sufficient to deal with a poor reserve margin in the short term, it is clear (with reference to Response 2), that additional base load generation is also necessary to deal with supply challenges. The introduction to Chapter 4 of the Revised Draft EIR is also clear in that it refers to the need to additional baseload generating capacity.

Your comments regarding alternative ways of dealing with peak demand and using solar power to deal with daytime peak load are noted. There is no denying that renewable electricity generation has an essential part to play in South Africa's energy supply and these alternatives are being explored. Renewable energy indeed forms an important part of recommended electricity strategy in the IRP. It is not, however, the purpose of his EIA to review all the electricity generation alternatives. The Nuclear-1 application is for a baseload generating nuclear power station. Please refer to response 2 above regarding the reasonable and feasible alternatives considered in the Nuclear-1 EIA process.

<u>Comment 4:</u>

a) UNVALIDATED SCORING SYSTEM USED
AND
b) INACCURATE CLAIM OF PEER REVIEW

The scoring system Arcus Gibb have created to compare the three sites (see Ch 9 p316).

a) Scoring system used to predict best site:

I asked, at the Melkbos meeting, where your team got this scoring system and how it had been validated, especially taking into account best international practice and how the categories had been classified and weighted. At the meeting your response was that this was an "in-house" formulated classification and you were unable to explain it. On further reading of the draft EIR and your response, it is clear that this scoring system was established post-hoc i.e once you had most of the results of the specialist studies at your disposal in 2009.

Scoring systems are widely used in the medical field, particularly in critical care where I have extensive experience. Scoring systems use a number of data variables (over a range of this variable) that are measurable in each patient, a weighting is applied to each variable and the sum of the variables is used to give a severity score or a predictor score. The scoring system used in the EIA is clearly attempting to perform a similar function - to make sense and create a measurable prediction of an outcome from a complex set of data. However the scoring system in the EIA is not referenced and its development and validation is not adequately explained.

There are good descriptions of scoring system development and validation available (see below). In order to develop a scoring system, a database incorporating a large amount of detail from several sites, preferably from different sites around the world is required. Once a scoring system has been produced its performance should be measured (assessed and validated). This process must be carried out on a different data set to the one the scoring system was developed from, as a scoring system should always be predictive in its original data set. The references below are from the medical literature where there is extensive experience in developing scoring system to predict outcomes from complex sets of variables. A, excellent review of the development of scoring systems can be found in: Continuing Education in Anaesthesia, Critical care and Pain, volume 8, number 5, 2008. [This is published with the British Journal of Anaesthesia, and is available on-line]. Other good references critiquing scoring system development can be found at:

Lemeshow S, Le Gall JR. Modelling the severity of illness of ICU patients: a systems update. JAMA 1994; 272: 1049–55

2. Le Gall JR. The use of severity scoring systems in the intensive care unit. Intensive Care Med 2005; 31: 1618–23

3. Ridley S. Severity of illness scoring systems and performance appraisal. Anaesthesia 1998; 53: 1185–94

4. Mourouga P, Goldfrad C, Rowan KM. Does it fit? Is it good? Assessment of scoring systems. Curr Opin Crit Care 2000; 6: 176–80

b) The EIA report is also described as being peer reviewed, but this is clearly a process that additional 'consultants" have been paid to do.

Concern and objection raised Number 4:

- You cannot legitimately devise a scoring system post-hoc. There is an enormous risk of bias in such a process, and therefore the whole weighted system used to determine the most suitable site in this EIA is completely flawed.
- Once a scoring system is developed (often based on an initial data set) it needs to be tested against other data sets to ensure that it remains a useful predictor of desired risk /outcome that it

is designed to measure. Only then can it be considered a robust scoring system. Typically a scoring system will predict the outcome in the data set that was used to develop the scoring system, so you can never validate it against the original data. This "scoring system" devised in the EIA, is not a validated scoring system and therefore cannot be used to predict the best site.

- The peer review process was by 2 paid consultants, sourced and appointed by Arcus-Gibb. There is no independence in this process, this is not a peer review as would be generally accepted when using this term - this is merely an opinion by reviewers selected by the authors of the report. Peer review means independent, sometimes blinded review by acknowledged experts in the particular field. Paying two "tame" peer reviewers is not a peer review, and the EIR must therefore be declared as "not including" a formal peer review.

Page 314 (chapter 9) - below

9.32.4 Selection of key decision factors

In view of the above findings, and the fact that Table 9-93 does not provide a robust and defendable way to identify a preferred site, Arcus GIBB made use of the findings of a specialists integration workshop, which was conducted in November 2009, to determine which impact categories (both environmental and technical) have more relative importance than others. This led to the ranking of impact categories and determination of the key "decision factors" to be used in site selection. Table 9-94 shows the results of the ranking of the key decision factors.

Consensus was sought at the specialist integration workshop to align the recommendations of the specialist with each other. However, this was not always possible. In many cases recommendations of particular specialists with regards to site preference are opposed to those of other specialists. Therefore, both to reduce the number of decision factors to a manageable number and to ensure that responsible trade-offs can be made between decision factors that point to contrasting preferred sites, the categories of potential impacts have been weighted in order to select a preferred site. The integration meeting therefore included the development of weightings (indications of importance) for the different decision factors (specialist disciplines). The weightings are the results of the weighting developed at the integration meeting in November 2009, as well as the Arcus GIBB team's consideration of the changes to specialist studies after the integration workshop.

Response 4:

Your comments regarding the scoring system are noted.

Ranking system

Every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts has developed over the last three decades and includes a number of criteria that are applied almost universally in EIAs. These criteria typically include nature (is the impact negative or positive?), extent (or scale), duration, intensity (degree of change), consequence (seriousness), reversibility, probability (how certain is it that the impact will occur?) and significance (overall importance of the potential impact).

Although there is general agreement about the nature of the criteria for assessment and there are local and international guidelines on this, there is no single agreed method. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria, as well as any requirements that the environmental authority might have regarding the criteria. In the case of the Nuclear-1 EIA the EAP sought assistance from other senior EAPs, namely Mr. Neal Carter and Mr. Reuben Heydenrych, as well as an advisor on EIA process, Mr. Sean O'Beirne.

Furthermore, based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of

the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

Peer review of the EIR

Your objection to the payment of the peer review consultants are noted. Payment for work performed is implicit in any EIA work. EIA consultants (including peer reviewers) need to be remunerated for work performed. The EIA regulatory regime (the National Environmental Management Act, 1998 and the EIA regulations thereunder - Government Notice Numbers R 543 to 546 of 2010) provided by government provides for the payment of EAPs.

In this regard, Government Notice No. R 543 of 2010 provides the following definition:
"'*independent*', in relation to an EAP or a person compiling a specialist report or undertaking a specialised process or appointed as a member of an appeal panel, means—
(a) that such EAP or person has no business, financial, personal or other interest in the activity, application or appeal in respect of which that EAP or person is appointed in terms of these Regulations other than fair remuneration for work performed in connection with that activity, application or appeal; or
(b) that there are no circumstances that may compromise the objectivity of that EAP or person in performing such work".

Thus the EIA regulatory regime provides for the fair remuneration of consultants involved in compiling or reviewing an EIA.

In the context of EIA practice the term "peer review" is understood to mean review of an EIA process and the associated deliverables by another EAP. It may have a different meaning in academic circles.

The following quote from the Integrated Environmental Management Guideline Document[1] on EIA review provides an indication of the purpose of EIA peer review (or "process review" as it is called in the guideline) in the South African context: "*The principle of process review is to assess whether the EIA process has been fair to all involved parties. Process review is especially important in terms of regulatory compliance. An experienced EIA practitioner will be able to review a process ensuring that it meets legal and procedural requirements, as well as criteria for good practice*". It is, therefore understood that review of EIRs is undertaken by other EIA practitioners. It must also be noted that the Department of Environmental Affairs has appointed an independent review panel of five members to assist in the authority review of the Nuclear-1 EIR.

Comment 5:

This workshop was done after you had the data (post hoc) and therefore you could see the impact of what you were doing with the factors, when you gave them a weighting. Post hoc weighting is not a valid assessment methodology.

Arcus Gibbs (*sic*) team then considered further changes after the integration workshop. It is not clear what these are, and they could have differed materially from the group of specialists (which in itself is methodologically questionable).

Concern and objection raised Number 5:

- This methodology would not pass on ethical, scientific or peer review methodology, and would not stand up to a true peer review of the process.
- The lack of detail as to what decided at the integration workshop and what was decided (and changed) after that by the Arcus Gibb team does not allow me to interpret this process. I therefore request that these details be provided in the report so that we can rationally interpret the critical conclusions in this final part of the report. This is crucial as these weighting are what your final recommendations are heavily based upon.

[1] DEAT (2004) Review in Environmental Impact Assessment, Integrated Environmental Management, Information Series 13, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

Response 5:

Your opinion in this regard is noted. Prior to the receipt of the specialist studies, the GIBB EIA team could not have known that there were findings and recommendations in different specialist studies that were, for instance, opposed to each other.

Further changes in the methodology, based on facts that only became available after the 2009 integration workshop, are indicated in Chapter 9 of the EIR. Thus, for instance, it is indicated on page 9-317 of the EIR that impacts on heritage resources was not considered an important decision factor during the integration workshop, but that the weighting of this factor was increased in response to changes in the Heritage Impact Assessment.

Comment 6.1:

If you look further at the scoring system used (all available at http://projects.gibb.co.za/Projects/EskomNuclear1RevisedDraftEIR/tabid/314/language/en-US/Default.aspx (page 318 of chapter 9).

The scoring system is not based on any previous examples, or international "best practice", but has arbitrarily been created post-hoc with weighting scores for each of the categories below:

> Nuclear-1 EIA Version 2.0 / March 2011
> Revised Draft Environmental Impact Report
> **9-318**
> ***Transmission integration factors (4);***
> ***• Seismic suitability of the sites (4);***
> ***• Impacts on dune geomorphology (3);***
> ***• Impacts on wetlands (3);***
> ***• Potential conservation benefits33 (3);***
> ***• Impacts on heritage resources34 (3);***
> ***• Economic impacts (3);***
> ***• Impacts on invertebrate fauna (3); and***
> ***• Impacts on vertebrate fauna (2).***

EIA weighting scores of 1 were allocated to all of the following and then because they were weighted as 1, they were not considered when an attempt was made to create a "value driven" assessment to **compare the three sites.**

- Geohydrology
- Floral impact
- Marine ecology impact
- Noise impact
- Tourism impact
- Agricultural impact
- Social impact

Even using their scoring (which cannot be substantiated) they have left these 7 weighting points out for no validated reason.

Concern and objection raised Number 6.1 (point 1 on scoring system usage):

- You are using concluding arguments in an EIA (based on an arbitrary and unvalidated classification) that therefore excludes all factors to do with:
    - Geohydrology
    - Floral impact
    - Marine ecology impact
    - Noise impact
    - Tourism impact
    - Agricultural impact
    - Social impact

- This cannot be accepted as an environmental assessment, if these clearly environmental factors can be completely discounted in the final assessment for a nuclear power station at environmentally rich sites, on stretches of undeveloped coastline.

Response 6.1:

Your comments are noted.

The weightings allocated to different decision factors are not arbitrary or unsubstantiated. The reasons for the weightings are explained in Chapter 9 of the Revised Draft EIR.

As indicated in the Revised Draft EIR the most important factors for decision-making were selected so that a reasoned recommendation on the appropriate site could be made, based on a manageable number of decision factors. Again please note again that based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

Comment 6.2:

When considering the detail of the alleged "scoring system" only 2 categories score a weighting of 4 points- *seismic suitability* one can understand is important in this EIA. However *Transmission integration factors* also scores a weighting of 4 points. It is not clear how this is part of the EIA. The authors' justification that the Eastern Cape needs electricity generation is not part of any EIA process that I can find in the literature on EIAs. So Thyspunt scores very high for a category that should not be there in an EIA scoring system. As I understand it, there is a separate EIA being undertaken for some of the sites, exploring the transmission corridors.

Concern and objection raised Number 6.2 (point 2 on scoring system usage):

- Transmission integration factors, as used in the scoring system, should not be part of the EIA. This is part of the motivation for the need, but is not a consequence of building and running a new nuclear power station.
- Transmission integration factors are what grid planners need to take into account when looking for sites, but this cannot be used in the EIA for a particular site. The EIA is designed to assess the potential impacts (positive or negative) of the planned facility.

Response 6.2:

Your comments are noted.

As indicated in the EIR, no fatal flaws were identified at any of the sites, provided that mitigation is applied (e.g. in terms of the positioning of the power station on the least sensitive portions of the site). The power station could therefore be developed at any of the potential sites. Technical factors (seismic and transmission integration factors) were considered.

Transmission integration considers the strategic location of the power station relative to the areas where electricity is needed (load centres), which are located in the Eastern Cape and Western Cape. From a transmission integration perspective, it is preferable to place a power station as close as possible to the load centre. The EIA processes for the transmission lines are indeed being conducted. However, they consider the project-specific impacts of the transmission lines but do not consider strategic factors related to matching the supply and demand of electricity.

In the case of coal-fired power stations, such transmission integration factors may be less important, because the main factor for the location of a coal-fired power station is that it needs to be close to the source of coal. There is, therefore, relatively little leeway for consideration of location alternatives for coal-fired generation. However, location of the source of fuel for the proposed Nuclear-1 power station

is not a consideration as it could be delivered at similar cost irrespective of the location of the power station. Therefore, in the absence of any fatal environmental flaws, technical factors do become important for decision-making, since the reasonable and feasible sites that have been identified for Nuclear-1 have differing implications for transmission integration, cost of transmission lines, security of supply and stability for the national grid. Ultimately these technical factors are important from a social environmental perspective, since without security of electricity supply, South Africa's economy would be at risk of suffering serious negative consequences.

The way that technical factors are considered in the Nuclear-1 EIA is no different to the way that they may be applied in any other EIA process where there is little difference between the overall potential environmental impacts of the alternatives. In the absence of significant differences in the environmental impacts of alternatives, it makes sense in an EIA to come to the conclusion that technical and financial factors can be the drivers for decision-making.

Comment 6.3:

When considering the detail of the alleged "scoring system" 6 categories score a weighting of 3 points- Those scoring a 3 are:

- ***Impacts on dune geomorphology (3);***
- ***Impacts on wetlands (3);***
- ***Potential conservation benefits (3);***
- ***Impacts on heritage resources (3);***
- ***Economic impacts (3);***
- ***Impacts on invertebrate fauna (3); and***

The first two may be acceptable, however the 3rd on conservation benefits may also be acceptable, but they give Duynefontein a very low value because it already has a no-go zone around it, making it a protected reserve. I have reservations about scoring that differently just because currently it has greater protection; because ultimately they would all have the same protection, it is just that Duynefontein already has that status so there would be no change?

The economic impacts are also a concern, because they have attributed a significant positive to this; my understanding from the Scottish and United Nations guidelines on EIAs is that the EIA process looks for negative impacts, and does not look to try to assess the positive impacts in economic terms, and that this should be looked at strictly in terms of the impact of the environmental changes, usually degradation, that the planned development will cause.

Concern and objection raised Number 6.3 (point 3 on scoring system usage):

- It is not acceptable to compare three sites that will ultimately have the same degree of restricted access, and claim that because one already has restricted access that the environmental protection offered by the exclusion will be more positive for the 2 currently unprotected sites. What should be measured is the long term change, and benefits of this exclusion.
- It is not clear what the significant benefits would be with the introduction of a restriction zone (to 800-1000 metres, or even to 3000m) would have on the environment. Whilst benefits are claimed, the proposed sites are therefore so small that the benefits may not be as clear as claimed.
- If seismic risk scores 4 points- and there would be few who would argue that this is an important factor when considering potential environmental impacts of a site in combination with a nuclear power station; then how can the "conservation benefits" of essentially a tiny parcel of land be weighted on a weighting of 3, unless it can be demonstrated that the small area around Koeberg has had a highly significant conservation benefit?

Response 6.3:

Environmental Impact Assessment is in essence the prediction of changes that could occur in the environment, i.e. the difference between the current (pre-development) condition and the predicted condition of the environment after development. In the case of Duynefontein, there would be no change in the environment with respect to its protected status. However, in the case of Bantamsklip and Thyspunt, there would be a change from unprotected status to protected status. In the case of both the latter sites, the current condition of the environment is degraded in that they are significantly invaded by alien plant species. The Duynefontein site was similarly invaded prior to the establishment of Koeberg Nuclear Power Station, but alien species have been virtually eliminated from that site by

active conservation management. Therefore, the potential conservation benefit that will be experienced at Thyspunt and Bantamsklip is indeed a factor to be considered.

Environmental protection is not simply a matter of restriction of access. Simply closing off a site to public access will not provide protection to natural resources. The invasion by alien plant species is a case in point. Natural systems are affected by a range of human influences and need active management in order to control processes such as alien plant invasion and accelerated erosion.

Regarding the benefits that restricted access[2] would provide, it is to be noted that the larger Bantamsklip and Thyspunt sites both contain natural and cultural features of high sensitivity and value. Provided that the proposed power station is placed in an area of low sensitivity on the sites, the elements of high value can be conserved. Clearly the sites are of small extent, but concentrations of features of high value such as the mobile dune field, coastal heritage sites and the wetlands at Thyspunt do provide an opportunity to add significant value for conservation.

Comment 6.4:

The economic impacts (weighting 3 points) are also a concern, because they have attributed a significant positive value to some of the sites. My understanding from studying the published (and freely accessible) Scottish and United Nations guidelines on EIAs, is that the EIA process looks for negative impacts, and does not look to try to assess the positive impacts in economic terms (hugely speculative), and that this (economic impacts) should be looked at strictly in terms of the impact of the environmental changes, usually degradation, that the planned development will cause.

Concern and objection raised Number 6.4 (point 4 on scoring system usage):

- The use of such positive economic impacts is purely speculative, and should not form part of the EIA in this manner

Response 6.4:

Environmental Impacts Assessment is required to assess both positive and negative environmental impacts. The National Environmental Management Act, 1998 defines "environment" as follows

"'environment' means the surroundings within which humans exist and that are made up of -(i) the land, water and atmosphere of the earth;
(ii) micro-organisms, plant and animal life;
(iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and
(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing"

In terms of this definition, and in terms of the DEA's requirements for this particular EIA process, negative and positive impacts of all forms need to be assessed.

Comment 6.5:

The final two weighted categories are:
- ***Impacts on invertebrate fauna (3); and***
- ***Impacts on vertebrate fauna (2).***

It is quite possible to accept these values attributable to invertebrate and vertebrate fauna. However the report's authors have decided that the "floral impacts" and "marine ecology" impacts are allocated a score of one (1), and they then made the decision that these factors may be discarded from the final analysis? I would have thought that given the large "tailings" [6-10 million cubic metres] that they are going to dump into the sea (planned 5 km off Thyspunt), that they would have included the marine ecology in the equation. I also struggle to see how they can ignore the floral component, which must be so critical for the invertebrates and vertebrates that they have included. Now a scoring system may be able to say that the vertebrates and invertebrates, scored at that value in this scoring system, behave as a good indicator for the floral component and therefore they have used them as such. But

[2] Mr Reed's term. Note as stated above the benefits relate to active conservation and not only to restricting public access to the site.

to do that you need to produce the evidence that they are a reliable indicator, in this situation. There is no evidence for this sort of assessment having been made.

Concern and objection raised Number 6.5 (point 5 on scoring system usage):

- It cannot be acceptable to discard the marine ecology weighting for a coastal site nuclear power station, at three very different sites. Even if they are considered equal (at a very high level) for all three sites- there needs to be more detail on how these decisions were made, and on what best practice they are based.
- The decision to give the impact on the marine ecology a weighting of 1 (when the first effect of the construction of Nuclear-1 will be from dumping between 6.4 and 10 million cubic metres of sand/soil into the marine environment), AND then scoring the value of protecting the small areas around the Nuclear 1 with a weighting of 3 is not reasonable or validated. This disparity in these 2 scores highlights the failure of this non-validated scoring system.
- The floral assessment was discarded as the invertebrate and vertebrate fauna were considered to provide a reliable indicator of the floral component. However this assumption and statement are not clearly backed by fact.

Response 6.5:

Your comments regarding the weighting of marine, floral and invertebrate impacts are noted.

One of the considerations in determining the weighting of impacts is the significance of the impacts and the degree to which these impacts, in the professional opinion of the relevant specialists, could be effectively mitigated. Although several million cubic metres of spoil is proposed to be disposed in the marine environment, the marine specialist team has indicated that these impacts can be mitigated by disposing of the spoil at depths and distances from shore where they would not affect critical species like chokka squid, which spawn only at depths up to 50 m. The spoil is proposed to be discarded deeper than the spawning zone of chokka squid at a medium pumping rate to prevent excessive turbidity.

The marine specialist team's professional judgement in this regard is informed by their involvement in monitoring programme for the marine environment at Koeberg Nuclear Power Station (KNPS), which has been on-going for more than 20 years. In the case of the KNPS, no appreciable negative impacts on the marine environment have been detected.

Floral, vertebrate and invertebrate impacts cannot necessarily be regarded as synonymous or as indicators of similar impact. The relative weighting of each decision factor was based on the merits of the respective specialist findings and the professional judgement of the specialists. Although in some cases the distribution of invertebrate species is closely correlated with floral habitats, this is not always the case.

With respect to floral impacts, the impacts can be mitigated by placing the proposed power station outside of the most sensitive zones, since sensitive features are restricted to specific areas on the sites. Floral impacts were therefore allocated a low weighting.

Comment 6.6:

This scoring system that shows Thyspunt to have a value of +5 compared to values of -8 for the other 2 sites, is completely without basis. For argument's sake if you leave out *Transmission integration factors* (arguably not part of the EIA), conservation (weighting factor clearly over rated and outcomes desired not well considered) and economic (because incorrectly done) you come up with a score of -28, -31 and -32. Now I am not sure this is any better, but just shows what can be done by playing with numbers. All just a bit of pseudo-science when done like this, and about as useful as witch-craft.

Concern and objection raised Number 6.6 (point 6 on scoring system usage):

- The use of a post-hoc, unvalidated scoring system sheds more concern than clarity on the matter, and the scoring system needs to be discarded completely in its current form.

Response 6.6:

Your comments are noted.

Your comment about the economic impacts being "incorrectly done" is however rejected for the reasons provided in Response 6.4. Your comment regarding conservation not being a valid factor to consider is rejected for the reasons provided in Response 6.3.

ISSUES OF CONCERN FROM THE MARINE SPECIALIST'S REPORT ON MARINE ECOSYSTEM

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exploitation due to a safety exclusion zone. Experience at KNPS has shown that many of these impacts can in fact have minimal effect on marine habitats and although the proposed plant will be larger than the Koeberg plant (4 000 MW in comparison with 1 800 MW), the findings at KNPS offer a sound base from which to assess potential impacts.

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Abstraction of cooling water and subsequent entrainment of organisms

As with Bantamsklip, the effects of cooling water abstraction and the resulting impacts on plankton have not been quantified for this site. Again higher ambient water temperatures than those occurring at KNPS (i.e. maximum and minimum sea surface temperatures of 22.5 and 16.6°C respectively (Shillington 2007)) are expected to increase the toxicity of chlorination (Huggett and Cook 1991) when compared to the west coast site. However, long-term climate change induced decreases in sea-surface temperatures along this section of coast (Rouault *et al.* 2009) may reduce this effect in the long term. The lower productivity of nearshore waters in this area is, however, expected to result in less entrainment of organisms and little effect on the marine environment at Thyspunt. No species of commercial value are likely to be affected by entrainment. As at the other potential sites technical design aspects and screens will prevent the uptake of larger marine organisms, such as squid, fish and marine mammals. The exact positioning of the uptake pipes is not of importance from a marine ecology perspective. The impacts resulting from abstraction and entrainment will occur during the entire operational phase of the development.

Comment 7:

This extract above describes the heat and chlorine changes on the West coast (based on Koeberg Nuclear Power Station experience), and describes increased chlorine toxicity in warmer waters of the south coast. It then relies on potential sea temperature cooling (secondary to climate change) to mitigate that unwanted temperature difference.

Some of the heat and chlorination impacts may be possible to extrapolate for the Duynefontein site, but the other two sites are on the Southern Cape coast, and thus this statement no longer holds true as both marine conditions (average water temperature) and the marine ecosystems are significantly different to that at the Duynefontein site.

Concern and objection raised Number 7:

- The issue of the impact of seawater temperature changes needs to be addressed more comprehensively for both the Bantamsklip and Thyspunt sites as they differ significantly from Duynefontein.

  Mitigation cannot depend on potential sea water temperature changes, supported by a single speculative paper that relies on the effect of long-term climate change to cool the water. Even in worst case scenarios those temperature changes are predicted to be only a few degrees, and nothing like the measured 4.1 degree sea water temperature difference between Duynefontein and Thyspunt. The clause referring to the long-term climate change induced decreases in sea-surface temperatures for the Thyspunt site (Rouault et al 2009) is speculative and misleading. It should be removed from the text.
- What does the term "long term" mean in the paper references. We are looking at an 8-10 year building period, thereafter the water difference will start. This is not long-term at all and unless the

predicted cooling of seawater secondary to climate change is predicted to occur in the next 10-20 years, then this statement needs review.

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> treatment, this effluent ***may*** be discharged into the ocean via the cooling water outfall tunnels. As required by the Department of Water Affairs and Forestry this water will meet the required standards as set out in the South African Water Quality Guidelines for Coastal Marine Waters at the point of release. As such no impact on the marine environment is anticipated.

Response 7:

The ambient seawater temperatures at the respective sites are indeed very different. Your comment seems to assume that the only basis for the marine specialist team's conclusion about the impacts of warmed cooling water is their professional judgement and reference to the Koeberg Nuclear Power Station experience. However, their prediction of the impact in this respect is based on very detailed oceanographic modelling, which takes account of seawater temperatures and movement patterns. The results of the oceanographic modelling, which has been referred to in the Marine Ecology Assessment (Appendix E15) is contained in Appendix E16 of the Revised Draft EIR. The Marine Ecology Assessment considers the site-specific conditions at each site and to this end makes reference to a number of academic sources of information about each of the alternative sites.

Mitigation is not dependent on potential climate-change induced seawater changes. Mitigation measures for warmed cooling water (multiple release points, release above the ocean floor to prevent impact on the benthic environment and a very high flow rate at the point of release to maximise mixing with cool surrounding water) are well-documented in the Marine Ecology Assessment.

"Long-term" with reference to climate-induced changes in seawater temperature refers to a time scale of several decades. As stated above, the Marine Ecology Assessment does not rely on long-term climate-change induced changes in seawater temperature to offset the impacts of warmed cooling water. Thus, the issue of the time scale is largely academic as it does not materially affect the mitigation of the impact. Furthermore, the area that will be affected by the release of warmed cooling water at Thyspunt is very limited in extent. The Marine Ecology Assessment indicates that "*if a nearshore outfall is used a mean increase of 3ºC near the seabed will be limited to an area of roughly 0.2 km² (2 ha) around the outlets of a 4 000 MW plant and an area of 0.7 km² will experience a maximum increase of 3ºC or more at any time*".

Comment 8:

Is there evidence to back the statement that meeting the DWAF Water Quality Guidelines will result in no impact on the marine environment? There are certainly marine changes in sites such as Mouille Point in Cape Town and Cape Recife near Port Elizabeth, so there would need to be some monitoring and assessment around this site.

DWAF's water quality guidelines for marine coastal waters clearly states how increases in seawater temperature (the primary environmental impact in this case) can have an effect on primary producers (plants) and secondary consumers (animals) in the natural marine environment. Temperature is the primary reason the South African Coastline in divided into 'West Coast, South Coast and East Coast'

Concern and objection raised Number 8:

It cannot be simply stated that there will be "no impact on the marine environment"

3.3.1 Disruption of the marine environment during construction

As at the other sites, the construction of an intake and ***outfall*** system for cooling water will result in temporary ***but severe localised*** disruption to the marine environment. Under such circumstances the benthic habitat and in particular egg beds of the chokka squid *Loligo* **reynaudII** are at risk of damage due to smothering, while turbidity may result in adults temporarily moving out of the area. This disturbance will be focussed within the construction phase and is likely to be localised and of short duration.

Additionally, the discarding of an estimated 6.37 million m^3 of spoil from the excavation of the nuclear island, turbine ***hall and contractors' yards*** hall poses a threat to the marine environment. As described for the previous two sites mentioned in this report, both the physical and biological marine environment would be affected. From a biological perspective impacts would occur due to

While some fish species show site fidelity and may be displaced from their home ranges during the construction phase, these species are widely dispersed along the South African coast. Thus while individuals may be affected, the species concerned will not be compromised and recovery is expected once the benthic community re-establishes.

Response 8:

Your comments regarding the impact of an increase in seawater temperature are noted. However, as indicated in Response 7, the increase in sewater will be of very small spatial extent and concentrated near the surface, as warm water rises. The assessment of the significance of impact is based on oceanographic modelling and on the marine ecology specialist team's collective expertise and experience in this matter, including their monitoring of the marine environment at the Koeberg Nuclear Power Station.

Comment 9:

To my knowledge there are several threatened reef and rocky coast fish species that are teritorial on the Rebelsrus/Thyspunt site and these have enjoyed relative protection within this area through the actions of the Rebelrus landowners, coupled with difficult access to the Eskom land at Thyspunt, especially since the banning in the 1990's of vehicles on the intertidal zone of the beach.

Concern and objection raised Number 9:

- The report makes:
  - No mention of these threatened fish species (pages 13-15)
  - Of the relative protection of these species, despite published work by Sauer
  - Of the potentially critical role of this "protected area" in close relation to the Tsitsikamma marine reserve, thereby creating an extended range of protection for these fish.
- To be complete, the report needs to consider these fish species and the absence of any comments is an omission.

decreases in sea-surface temperatures along this section of coast (Rouault *et al.* 2009) may reduce this effect in the long term. The lower productivity of nearshore waters in this area is, however, expected to result in less entrainment of organisms and little effect on the marine environment at Thyspunt. No species of commercial value are likely to be affected by entrainment. As at the other potential sites technical design aspects and screens will prevent the uptake of larger marine organisms, such as squid, fish and marine mammals. The exact positioning of the uptake pipes is not of importance from a marine ecology perspective. The impacts resulting from abstraction and entrainment will occur during the entire operational phase of the development.

Response 9:

In respect of the marine environment specifically there is no suggestion that the proposed development will have any impacts on biodiversity at the species level, since no species are known to **be restricted to this site**. Indeed marine species generally have much wider distributions than terrestrial species, so this impact would be unlikely. The members of the Nuclear-1 marine specialist team are also themselves among the leading marine biodiversity researchers in the region, and are both authors of the most recent marine biodiversity assessment for the region (Griffiths *et al.* 2010).

The marine specialist team is well aware of and has participated in the Marine Protected Area (MPA) project of the SA National Biodiversity Institute (SANBI). They have been deeply involved in plotting biodiversity patterns on which the MPA network proposals are partially based. From the information generated by this process and from other sources considered in the Marine Ecology Assessment, there is no reason to single out the marine environment at the Thyspunt site as an area of particular significance for marine conservation.

Comment 10:

"No species of commercial value are expected to be affected by entrainment" is the quoted issue raised.

Concern and objection raised Number 10:

- Are we only interested in *commercial value* here, or is protection of species diversity not the issue, particularly for threatened or endangered species?

Response 10:

Commercial species (e.g. chokka squid) are of particular importance and concern at the Thyspunt site since a significant proportion of chokka squid vessels operate from St. Francis. Given the intensity of concern regarding the impacts on the chokka squid fishery, it would indeed be unwise to not specifically consider potential impacts on commercially important species. Therefore commercial species were singled out for special mention at the Thyspunt site.

This does not mean that non-commercial species were neglected in the assessment. The finding of the Marine Ecology Assessment is that the entrainment impacts will be insignificant at all three alternative sites, based on inclusion of screens and technical design of the cooling water intake system, which in any event needs to be designed to prevent the uptake of large organisms for effective functioning of the cooling system.

Comment 11:

The report states that there is no marine conservation benefit for Duynefontein and Thyspunt, but more for Bantamsklip because of the abalone population. However the concern expressed is that near-shore disposal near Bantamsklip poses a significant threat to the juvenile abalone population in this critical area for the species.

Concern and objection raised Number 11:

- The conservation benefit for Bantamsklip is dependent on successful far off-shore dumping, and this is not guaranteed. Should this not be successful then the high allocation of points awarded to this site in the final chapter is not valid.

Spoil disposal at sea

5.1.6 Closure of site to exploitation

This impact has the potential to have a positive effect on the marine environment. In particular a safety exclusion zone at Bantamsklip may be of great benefit, as it could offer much needed protection to the abalone *H. midae*. However, the level of organisation and the brazenness of poachers in this area will necessitate dedicated active policing of this exclusion zone if this benefit is to be realised. It should be noted that this positive impact will not compensate for the negative impacts on the abalone. No additional benefit will be gained at the Duynefontein and Thyspunt sites. Should no development occur and the sites were reopened to exploitation and development, no significant negative impact is anticipated for any of the sites.

Impacts on terrestrial vertebrate fauna (Positive)	**Medium**	**High**	**High**
Oceanographic impacts	**Low-Medium**	**Medium**	**Low-Medium**
Impacts on surf breaks	**n.a.**	**n.a.**	**Low**
Marine impacts	**Medium**	**High**	**Medium**

Additionally, spoil from the excavation of the intake tunnel, intake basin, nuclear island and turbine hall ***and contractors' yards will*** be discarded out at sea. At this site 6.48 million m^3 of sand will need to be discarded. When disposed at sea this sediment will essentially have two impacts:

- Firstly as a sediment plume within the water column (consisting mainly of fine muds), which may block light penetration and filtering apparatus of filter feeders; and.
- Secondly as a layer covering the sea bottom (consisting mainly of coarser sands) that will bury the current benthic environment and biota.

The nature of these two impacts and how they are affected by currents and local water movement have been modelled by Prestedge *et al.* (2009a). These models considered the disposal of both the full volume (6.48 million m^3) and a mitigation option of half the volume of spoil (3.24 million m^3) at both a shallow and deep site. In addition, both a medium and high discharge rate were considered. ***See Table 3 and Prestedge et al. (2009a) for details of the various disposal alternatives, including depth and rate of discharge.*** At this site Alternatives 4 (i.e. disposal of all the spoil at a deep[1] site using a high discharge rate[2]), 5 (i.e. disposal of all the spoil at a deep site using a medium discharge rate[3]) and 6 (i.e. disposal of half the spoil at a deep site using a medium discharge rate) are considered preferred options from a marine ecology perspective. As the most severe impacts are associated with Alternative 4 this alternative is assessed. For this option the maximum suspended sediment concentration reaches levels above 80 mg/l near the water surface over a very limited area ***(i.e. not more than 3 km²)*** at any time during or after disposal (Prestedge *et al.* 2009a). This is considered to be a restricted impact as this sediment plume will occur offshore and avoids any potentially sensitive areas such as nearshore kelpbeds. The level of 80 mg/l has previously been identified as a threshold above which probable adverse ecological effects will occur, while 100 mg/l has been used as a critical value above which proven negative impacts occur (Cater 2006). These levels were applied in the environmental impact assessment of the deepening of the Ben Schoeman Dock Berth on the marine ecology of the Table Bay region. In addition, an area of only 0.5 km² will experience these elevated turbidity levels for longer than two days. Given the fact that this west coast region is exceptionally productive and this impact will be both spatially and temporally limited (and avoid sensitive areas) ***it is anticipated that the predicted increased turbidity will have*** little impact on the open water environment. ***By contrast,*** initial disposal of spoil will cover an area of 3 km² with sediment layered up to 2.95 m high, resulting in a dramatic affect on benthic communities, which will be totally smothered. However, this will occur over a limited area and will not affect any organisms of conservation importance. While recolonisation from surrounding areas is expected to occur, this will be over the long-term (years). In the first five years after disposal, the sediment on the sea bottom is expected to spread very little to cover an additional area of just 4.5 km² in greater than 5 cm of sediment. Very importantly, only 1 km² of this additional area ***is estimated to*** be covered by more than 10 cm of sediment (Prestedge *et al.* 2009a). In the period of six to ten years following disposal, sediment on the sea floor will continue to spread to cover 12.7 km² in more than 5 cm of sediment, with 60% of this area covered in sediment as shallow as ***0.5*** – 1 cm. While benthic communities at the initial disposal site will still not have recovered, a variety of species are likely to have become established on the disposal mound by this time and areas covered in less than ***1*** cm of sediment are expected to support

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48 m
3.93m³/s
2.06m³/s

Response 11:

Your comment is valid. Successful mitigation of the impact on abalone at the Bantamsklip site is dependent on offshore release of both spoil and warmed cooling water. Should such release not be possible at Bantamsklip, it would influence the environmental acceptability of the Bantamsklip site, since abalone is a species of great conservation concern at this site.

Comment 12:

This final statement is not clear[3]. Thysbaai is on a rough, open section of the Southern Cape coast, and is seldom accompanied by mild sea conditions, so to anyone who knows that part of the coast-line it is exceptionally difficult to envisage how it will be possible to establish a reliable mechanism for pumping the 6 million+ tons of sand and soil to 5-6km off-shore. The whole EIA depends on getting this distance from the shore to mitigate the effects of inshore disposal on Cape St Francis and Seal Point.

I submit that you cannot include a mitigating factor (disposal 5 km off-shore when the feasibility study is not completed and included) in the EIA, unless it is proved to be possible at that site.

Concern and objection raised Number 12:

- The inclusion of a mitigating strategy that is not feasible, could result in an EIA approval based on an incorrect premise, and if a site is chosen in that flawed process, inadequate mitigation could occur if the development proceeding incorrectly.
- Thus the feasibility study for a 5km off-shore disposal at Thyspunt needs to be concluded, and included in the EIA, before the document can be assessed in a holistic fashion.

Page 32 Marine Ecology Impact assessment

Additionally, the discarding of an estimated 6.37 million m^3 of spoil from the excavation of the nuclear island, turbine ***hall and contractors' yards*** hall poses a threat to the marine environment. As described for the previous two sites mentioned in this report, both the physical and biological marine environment would be affected. From a biological perspective impacts would occur due to

And Pg 318 (chapter9)

Marine eoology impaot	*Marine impaots are similar at all sites, although higher at Bantamsklip, but there are no impaots of oritioal nature. The marine speoialist indioated that the area that will be affeoted by the disposal of spoil in the sea oan be justifiably saorifioed.*	*1*

Response 12:

Your comment is noted. Indeed the mitigation of the marine impacts at this site are dependent on pumping the spoil 5-6 km offshore. Should this, or any of the other key assumptions of the EIA prove not to be feasible, the EIR has stated that it would no longer be valid. In the event that an environmental authorisation is issued, it would be conditional on the implementation of the recommended mitigation measures.

Comment 13:

The report clearly describes the planned dumping of 6.37 million cubic metres (Thyspunt and Duynefontein) and over 10 million cubic metres (Bantamsklip) of spoil, the environmental consequences of this, and need the need to mitigate this by dumping this spoil 5 km or more out to sea (Thyspunt), and yet in the final analysis of points for the consideration of various sites you decide to completely omit the consequences on the marine environment.

[3] With reference to this statement (GIBB's insertion): "At present a technical feasibility study is underway, considering the logistics of spoil disposal at sea at the Thyspunt site. To date no technical fatal flaws have been identified (Eskom position paper 2011). As a necessity, recommendations made in this specialist report assume technical feasibility of the proposed disposal options at Duynefontein and Bantamsklip".

Concern and objection raised Number 13:

- What is the rationale for weighting the effects on the marine environment as 1 on a scale with a maximum of 4, when your specialist's report describes significant effects with this volume of spoil, requiring the planning of expensive mitigating factors, with concomitant extreme engineering requirements?
- That you have taken a single specialist's "indication" that 6-10 million cubic metres of spoil can be disposed of in the marine environment and that the environment be "justifiably" sacrificed.

    1. This decision needs more than 1 person to make the decision
    2. What does "justifiably" mean. What is it compared to, what is the rationale for "justifiably" in this setting? Does the marine ecology specialist have the ability to take into account the marine ecosystem compared against the national requirement for energy as suggested?

- If this statement cannot be left in the report due the inappropriate comment by the marine specialist, does the argument still hold that the "Marine ecology impact" can be given a weighting of 1 (given that the whole weighting in itself is contentious)? And if the weighting is greater than 1 then the whole scoring system and results obtained are invalid.

Response 13:

The statement is based on the fact that the impact can be mitigated by pumping the spoil to an offshore location beyond where it would impact on chokka spawning areas. Based on international experience with the construction of nuclear power stations, and liaison with construction and marine engineering companies, such a disposal system for spoil is considered feasible.

The marine specialist team's finding is that although the seafloor in the area where spoil will be disposed will be completely smothered, the limited size of affected area (compared to the total seafloor environment of the South African coast), and the fact that the disposal areas would eventually be recolonized, would render the impact insignificant. This conclusion was reached by recognised and well-published marine scientists who are at the forefront of marine research in South Africa.

Comment 14:

The report claims that renewable options are not as reliable as nuclear as a low green-house gas emitting base-load supply option, but what about the "down-times" that many nuclear facilities require including Koeberg? What is the percentage of time that Koeberg has been down in the past 10 years?

Concern and objection raised Number 14:

- The "need and desirability" and "project alternatives" sections discuss nuclear power as if it is a continuous source, as compared to some of the renewable technologies.
- It is clear from being resident in Cape Town, that our current, sole NPS at Koeberg is not a constant source of power, but that on a fairly frequent basis a unit is "down" for maintenance and not infrequently during these times we have seen the second reactor being taken off-line for unscheduled reasons.
- The EIA should include an assessment of what percentage of time KNPS has had reduced output in the past 10 years.
- Therefore the complete envelope of information has not been placed in the EIA, to assist decision-makers to make the correct decision.

INCOMPLETE COMPARISON OF NUCLEAR WITH ALTERNATIVE TECHNOLOGIES

Page10 of Chapter 5

then an area of 345 600 ha will be required for 13 333 MW of installed capacity. Due to the fact that wind is not available at all times, a capacity factor[2] of 30 % is assumed and the effective power produced will be 4 000 MW. EPRI (2010) indicates that wind turbines at an unspecified coastal location have a capacity factor of 29.1 to 40.6 %. If a rotor diameter of 80 m is assumed instead of 90 m, the space requirement would be

Response 14:

Statistics from Koeberg Nuclear Power Station indicate that it had an average load factor (percentage of time it was operating at full generating capacity) of 79.2 % in the 5 years up to and including 2011 and an average load factor of 78.3% in the 15 years up to and including 2011 .

Downtime for maintenance purposes is a reality of any power generation technology, including nuclear, coal and some renewable technologies such as wind turbines.

Comment 15:

FAILURE TO ASSESS WORST-CASE SCENARIO AND FACTOR IN LESSONS FROM 2011:

The Revised EIA fails to assess worst-case scenario impacts, a particularly important point in light of what has happened at Fukushima. The longest time used in the risk assessment seems to be a 1:70 year flood, considered only after the R330 road collapse at St Francis Bay in 2007. There is no doubt that where-ever nuclear-1 is built, that it will be there for well over 100 years. This statement is based on the 50-60 year operational life-span and the "at least 10 years" that spent fuel will remain on-site after the operational life-span of the power station. Given these likely scenarios, coupled with the lack of a cost-effective and easy way to deal with high-level waste, it is likely that this nuclear station will be there for more than a century, with its nuclear fuel. Therefore planning needs to take place for all manner of natural events that could occur over a much longer period of time, if we are to fully assess the potential environmental impacts of this facility.

The US Nuclear Regulatory Commission's "THE NEAR-TERM TASK FORCE REVIEW OF INSIGHTS FROM THE FUKUSHIMA DAI-ICHI ACCIDENT" (Published 12 July 2011) report finds that the Commission's longstanding defense-in-depth philosophy, supported and modified as necessary by state-of-the-art probabilistic risk assessment techniques, should continue to serve as the primary organizing principle of its regulatory framework. **However** the Task Force concludes that the application of the **defense-in-depth philosophy can be strengthened by including explicit requirements for beyond-design- basis events**.

Concerns and objection raised Number 15:

- This Revised EIA has not dealt with potentially significant events that could threaten the nuclear power station, and by implication deal with the effect of such an event on the surrounding environment

- This Revised EIA has not factored in the lessons learnt from the Fukushima accident earlier this year, and this is in the face of many industrialised nations undertaking urgent and significant reviews of their use of nuclear generation. These include the Germany, Switzerland, Italy, Japan and the USA. The USA has taken the decision to establish a near-term task force to assess what can be learnt from the Fukushima accident, in an urgent attempt to ensure that this does not occur in the USA.

Response 15:

Risk assessment for nuclear power stations use very long return periods for the assessment of risks to plan for these risks. For instance, nuclear power station planning is based on 1:1,000 and 1:10,000 year extreme rainfall events, with and without climate change. As indicated in the Hydrology Specialist Report (Appendix E6 of the revised Draft EIR), the 1:10,000 year rainfall event is specifically selected in the case of nuclear installations with a view to build in a large safety factor to protect against flooding.

Information about radiological emissions under normal operating conditions is provided in the EIR (Appendix A10 and A32 of the Revised Draft EIR Version 2) and the environmental impact of these emissions is assessed. Assessment of the radiological emissions during emergency events and the readiness of the relevant role players to deal with such events is, however, within the ambit of the NNR owing to its legal mandate in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). As with many different forms of development, construction is dependent on authorisations by a number of different legal entities, including local, provincial and national authorities. Construction of

such developments is reliant on all these authorisations being obtained from entities with vastly different legal mandates. Reporting requirements to satisfy all these authorisations vary hugely, and it cannot reasonably be expected that information relevant to all these authorisations should be contained in the EIR.

The separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Nuclear Regulator Act, 1999, as well as the DEA / NNR co-operative agreement, which governs the consideration of radiological issues in EIA processes and the interaction between the DEA and the NNR in terms of their respective mandates for environmental and radiological safety (See Appendix B4 of the Revised Draft EIR). The agreement stipulates that issues of radiological safety are within the mandate of the NNR. Furthermore, it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement. We must, therefore, conduct the EIA based on their mandates and their agreement.

In this regard you are also referred to the then DEA's approval of the Scoping Report, dated 19 November 2008, where the following is stated:

> 2.21 All radiological issues raised during the EIA process, which are not comprehensively addressed, must be explicitly referred to the NNR to be addressed as part of their process.

This response by the DEAT clearly acknowledges that there are some radiological issues that cannot be comprehensively addressed in the EIA process and can only be addressed in the NNR's nuclear licensing process. Notwithstanding this fact the current revised Draft EIR (Version 2) in recognition of requirements in the NEMA, associated legislation such as the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) and other legal precedents that require the consideration of all relevant socio-economic factors in an EIA process, includes an assessment of radiological impacts of the proposed power station. Although this approach of including an assessment of the radiological impacts of the proposed power station results in a risk of duplication between the EIA and the NNR licensing processes, the risk to the EIA in terms of possible appeals, based on the exclusion of substantive issues such as health issues from the EIA process, is regarded as greater than the risk of duplication. The current version of the EIR therefore departs substantially from the approach in the previous versions of the EIR in terms of the consideration of radiological impacts.

COMMENT FORM THE INDEPENDENT NUCLEAR SPECIALIST

In addition to what is said and please refer to previous comments regarding these being all matters that should and must be dealt with via the NNR licensing process - in addition to this refer to previous comments regarding the adoption of lessons learned from the Fukushima event and the need to demonstrate performance in the beyond design basis region as part of the plant safety case and licensing process.

Comment 16:

FAILURE TO ESTABLISH COSTS FROM A WORST CASE SCENARIO

At the Blouberg meeting it was asked from the floor what would be the insurance requirements for Nuclear-1. It was pointed out that the NNR decides on those requirements. However the EIA is best placed to determine the "worst case" scenario and the cost thereof. This would allow the NNR to apply their minds to the project.

Mr Stott (*of Eskom*) stated that Koeberg Nuclear Power station is required to carry a R3 billion insurance as determined by the NNR.

Section 29 and 30 of National Nuclear Regulation Act requires the state to carry total cost of any nuclear accident beyond any insured value. This would require consideration when making a decision on whether to go the nuclear route in energy supply.

To address this issue fully, one would be required to estimate the cost of a significant event such as a reactor "meltdown" (or other causes) of significant accidental release of radioactive emissions. Based on Chernobyl and Fukushima experiences in the recent past it would be reasonable to assume that an area with a radius of 20 - 30 km from the plant may be uninhabitable for several generations. Thus all property and livelihoods of residents with that area would need to be covered by this insurance.

Concerns and objection raised Number 16:

- The failure to consider worst-case scenario's (sic) and to cost them is a potential failing of this EIA.
- Personal 'home-owner' insurance policies specifically exclude nuclear events, so that the organization running the power station needs to insure to the required value.
- The EIA needs to put a monetary value to a catastrophic event- using Fukushima Dai-Ichi and Chernobyl long-term evacuation zones for modeling worst case scenarios, and thereby being able to assist in the generation of a realistic and reasonable insurance value. This cost then needs to be factored into the cost of nuclear in the EIA and presented to the decision makers.
- The failure of the EIA to provide a realistic estimated cost of a catastrophic event, which the state would be required to fulfill, demonstrates an *incomplete EIA and significantly limits the quality of the evidence placed before decision makers*.

Response 16:

Your comments are noted. As indicated in your comment, insurance requirements for nuclear power stations in South Africa are governed by the NNR Act and Eskom provides for the appropriate insurance as required.

As indicated in Response 15, planning for worst case scenarios is within the ambit of the NNR licensing process. The state has made a policy decision through the Integrated Resource Plan 2010 to include up to 9,600 MW of nuclear generation to provide the necessary generation capacity for the next 20 years. The state is aware that it is responsible for carrying any cost beyond the insured value that Eskom will provide for.

COMMENT FORM THE INDEPENDENT NUCLEAR SPECIALIST

The minister after consultation with the NNR makes a determination on the level and mode of financial security - this information must be gazetted.

Comment 17:

ESKOM PRE-EMPTING THE RESULTS OF THE EIA AND NNR PROCESS BY BUYING APPROACH ROAD LAND TO THYSPUNT BEFORE A DECISION

ESKOM has purchased significant amounts of land for the Eastern approach road off the R330 from late 2010 and into 2011.

Concerns and objection raised number 17:

- ESKOM is pre-judging the outcomes of the EIA process and all the processes to follow by purchasing this land.
- This advance purchase, together with the scoring system that has been weighted to extensively favour Thyspunt, despite the Heritage report suggesting that Thyspunt is the *least suitable* site, suggests that the EIA and other processes are not being undertaken as a thorough and independent process, but only as a means to satisfy the minimum requirements. If ESKOM have indeed purchased land, as I suggest, then the EIA's independence is suspect.

Response 17:

Eskom is buying land around the Thyspunt site at its own risk, pending the outcome of the EIA process. There is nothing in law that prevents Eskom from acquiring such land. In terms of NEMA, an applicant is prohibited from commencing with construction prior to receiving an authorisation. The development of a nuclear power station is dependent on long-term planning, which is why the potential sites for nuclear power stations were acquired as many as 20 years ago. It would indeed be unwise for Eskom to wait to the proverbial "last minute" before it bought the land.

Eskom's acquisition of additional land around Thyspunt must also be viewed in context of the recommendations of the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR) that wetlands that fall outside the current Eskom owned land must also be secured for inclusion into a de facto nature reserve. The acquisition of these wetlands for conservation is regarded as one of the key "offset" mitigation measures at Thyspunt.

With regards to the heritage assessment, it must be noted that additional test excavations at Thyspunt that were approved by the SA Heritage Resource Agency and conducted in 2011 (after the release of the Revised Draft EIR), have confirmed that the heritage sites in the recommended footprint of the power station at Thyspunt are few in number and of low quality.

Comment 18:

INACCURATE USE OF FACTS ABOUT THE LOCAL AREA IN THE EIA (MAINLY THE THYSPUNT SITE)

Chapter 8, page 167 Figure 8.87 shows the R330 as a *gravel road*

Concern and objection raised Number 18:

- The R330 is the main road past St Francis Bay to Cape St Francis from Humansdorp and has been tarred for more than 30 years.
- The report's use of inaccurate information is of serious concern - did the compiler of this report use current information and have they made any site visits to the area?

Response 18:

Your comments with regards to Figure 8-87 is noted. We apologise for the incorrect information on this map with respect to the R330. The purpose of the map was to show tourism attractions in the area.

Comment 19:

CONCERNS ABOUT HERITAGE REPORT BEING UNDERTAKEN BY AN ARCHAEOLOGIST AND NOT A SOCIAL HISTORIAN OR SOCIAL ANTHROPOLOGIST

Much of the cultural and heritage value of the sites will be from the past 500 years and the use of an archaeologist, rather than an expert able to ascertain the importance of the landscape from a more recent history of the site, may well have resulted in the complete omission of important values that the site holds to descendants of the recent inhabitant of the sites.

Concern and objections raised Number 19:

- The use of an archaeologist coupled with the Heritage Agency's concerns suggest that the heritage component should be reviewed by the appropriate experts before any decision can be made to destroy the landscape at Thyspunt.
- The heritage mitigation plans cannot be seriously considered until the heritage component is adequately addressed.

> Fragments of bone are numerous, however much of this is recent and out of context. Due to shifting vegetation patterns and dune movement the Middle Stone Age *Howiesons Poort* material was not relocated. The evidence collected by ourselves and other authors suggests that the ancient Pleistocene land surfaces that evidently lie preserved under the dune system are highly sensitive. Due to the dynamic state of the dunes, surveys should ideally be repeated over a number of years before a comprehensive picture can be determined.

Response 19:

Your comment is noted. However, your objection to the Heritage Impact Assessment appears to be based solely on the professional background of the leader of the team that compiled this assessment, rather than on substantive grounds with respect to the content of the Heritage Impact Assessment. In

the absence of substantive comment related to the quality of the report, your objection remains groundless.

The Heritage Impact Assessment (Appendix E20 of the Revised Draft EIR) was supplemented by additional test excavations at Thyspunt that were approved by the SA Heritage Resource Agency and conducted in 2011. A revised Heritage Impact Assessment that considers findings of these test excavations will be provided for public comment. The findings indicate that heritage sites in the recommended footprint of the power station at Thyspunt are few in number and of low quality.

Comment 20:

The above statement from the EIA suggests that a study over several years would be required to obtain a comprehensive picture of the heritage/historical value of the landscape

Concern and objection raised Number 20:

- The EIA has failed take the comments and recommendations of its own experts seriously; by rushing the heritage assessment, the heritage report is not comprehensive, and therefore the EIA report is flawed

Response 20:

As indicated in Response 19, additional test excavations have been conducted and these excavations significantly improve the confidence of the assessment of heritage impacts.

Comment 21:

CONCERNS ABOUT ACCURANCY ABOUT THE SECTION ON THE PHYSICAL AND BIOPHYSICAL ENVIRONMENT

Pg119/173	from	chapter

believe there would be any e"ect on demersal (deep-sea) fsh ng. Its ~ain concern relates to the demarcation of an exclusion zone at Tnyspunt of ar assumed s~ilar size tc that at Koeberg which is 3.2 km wide and extends 2 km ~to the ocean fro~ the shore. Esko~ has adv sed the authors, however. that the exclusion zone at Thyspunt and Bantamsklip will not exceed I km o' coastline and I km out to sea. The closure of such an area off Thyspunt would have no more than a slight ~pact on pelagic fishing. Longline catches o' hake have averaged 2 500 tons per annum in the Eastern Cape and 800 tons per annu~ for Port St. Francis-based vessels at an average pr ce of €5.50/kg. During 'ield interviews with the local fishing ndustry, it was 'ound that two o' the richest fishing grounds are in Thysbaai and Oyster Bay, and catching occurs between 500 metres and 4 - 5 k~ offshore.

Concern and objection raised Number 21:

- The inclusion of the statement ”Eskom has advised the authors, however that the exclusion zone at Thyspunt and Bantamsklip will not exceed 1km of coastline and 1km out to sea” is not sufficient to address these concerns.
- There needs to be a written undertaking, preferably with reasons outlining why this would be different from the Duynefontein site, and giving a assurance from Eskom that this was indeed there (sic) plan, and it would need to be signed off by a senior manager.
- The statement in the EIA is unsupported and is so vague as to be meaningless.

Response 21:

The Revised Draft EIR contains a number of assumptions, as is the standard practice with Environmental Impact Assessments. Some of these assumptions relate to the project description and it is expressly stated in the Revised Draft EIR that if these assumptions prove to be incorrect, the information in the EIR would no longer be valid and the EIA would need to be redone. Should Eskom substantially change any information on the basis of which the EIA has been prepared, the EIA would no longer be valid, resulting in Eskom not being able to obtain authorisation. Similarly, should the project description change substantially after authorisation has been granted, a supplementary

assessment would need to be undertaken to determine how significant the changes are and if they provide to be substantive enough, the authorisation would be withdrawn.

Comment 22:

Revised DEIR Chapter 3 Pg 1 (below)

3 PROJECT DESCRIPTION

3.1 Introduction

Eskom proposes to construct a Nuclear Power Station, referred to as Nuclear-1, consisting of a combination of units with a total capacity of up to 4 000 MW and associated infrastructure for location at either Duynefontein, Bantamsklip or Thyspunt (See **Figures 1-1 to 1-4**). Similar power stations to Nuclear-1 are proposed for the remaining two sites in the future. A description of the sites is provided in **Chapter 5**, while details of the baseline environments at each of the three sites are provided in **Chapter 8.**

The area of the footprint assessed in this EIA makes provision for the potential future expansion of the power station, to allow for a total capacity of approximately 10 000 MW. It is estimated that the total area required for this nuclear power station is approximately ***250 - 280*** hectares depending on the terrain. ***This footprint includes the reactor and auxiliary buildings, laydown areas required during construction, including topsoil storage areas.***

In addition to the actual footprint of the power station, there will be two categories of exclusion zones for emergency planning purposes, around the power station complex. ***The Emergency Planning zone sizes of the European Utility Requirements (EUR) have been used as a basis for these new nuclear installations.***

The proposed zone sizes are as follows (expressed as radii):

These radii of the zones are measured from the extremities of the station footprint in which the nuclear installations are located. The station footprint is located within a preferred owner-controlled boundary that demarcates the property owned by Eskom. This owner controlled boundary has a radius of 2 km. The extremity of the footprint may not be closer that 0.8 km from the owner-controlled boundary. This means that the no off-site evacuation will be necessary.

And
Pg 4 of Gibbs letter to DEAT letter dated 2 September 2009

5. Response

In addition to the response provided in Response 5 it should be noted that potential land use impacts as a result of the proposed nuclear development will be assessed as part of the EIA. Although emergency planning issues will be discussed they will not be assessed, rather all assessments will focus on the various social and economic implications. In this regard a maximum EPZ of 3 000m will be utilised for all assessments.

6. Your comment: Nuclear waste management

The issue of nuclear waste handling, management, storage and disposal does not seem to be covered explicitly by any of the specialist studies. How will this matter be addressed in the EIA?

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beachscapes, natural heritage and mild climate. Accelerated property development activities have had a devastating impact on the functioning of the large headland-bypass dune system which is a significant natural feature of the area. The interruption of the natural feeding and flow of aeolian sands has resulted in vegetation changes and the cessation of sand deposition at St. Francis Bay Beach, which is now severly eroded. Eskom's land holding in the area has in part, put a brake on seemingly uncontrolled westwards expanding property development.

The Thyspunt study area, which is a natural heritage site, includes a number of landforms which have played a role in the distribution and quantity of heritage sites. The most inland portion (a long panhandle of land) consists of cultivated meadows which have been leased out for dairy farming. Between the agricultural lands and the coast is an extensive dune field, a very large

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e) Surrounding land use

The land use between the coast and the ridgeline of inland vegetated dunes is primarily nature reserve.

The western edge of the reserve abuts the coastal village of Oyster Bay while the eastern edge borders land that is undeveloped and in private ownership.

This land has a number of private houses, mostly holiday homes which are built near the edge of the consolidated dunes and overlook the rocky sea shore. Refer to **Figure 8-78** and **Figure 8-79**.

It is noted that an application for a township has been lodged on the farm Ongegunde Vryheid east of the site and adjacent to the western town boundary of Cape St. Francis. This property is known as Rocky Coast Farm. The current proposal is for a cluster layout in the vicinity of existing houses. The balance of the area will be a nature reserve.

The report highlights potential development on Rocky Farms immediately west of Cape St Francis township, but does not highlight the efforts over several decades, of the Rebelsrus landowners to preserve the area. The Rebelsrus holding is not just “a number of holiday houses” but a longstanding “association” with a constitution. Several conservation strategies have been initiated, in a coordinated fashion, to preserve this area for future generations, and the report does not mention these, and therefore cannot take these initiatives into account.

Concern and objection raised Number 22

- The Rebelsrus combined property is the most significant easterly neighbour of the Eskom site and has been all but overlooked in this EIA report on the area. This is an oversight and the EIA report needs to include a comprehensive account of the Rebelsrus property, and only then can a valid conclusion be drawn on this.
- In considering the environmental impact therefore the report gives an exaggerated impact to any improved control on the Eskom land.

Response 22:

The contribution of the owners of Rebelsrus Private Nature Reserve to conservation of the natural heritage around the Thyspunt site is noted. The Botany and Dune Ecology Assessment (Appendix E11 of the Revised Draft EIR) considers the conservation areas in proximity to all three alternative sites. The figure below is from that specialist report.

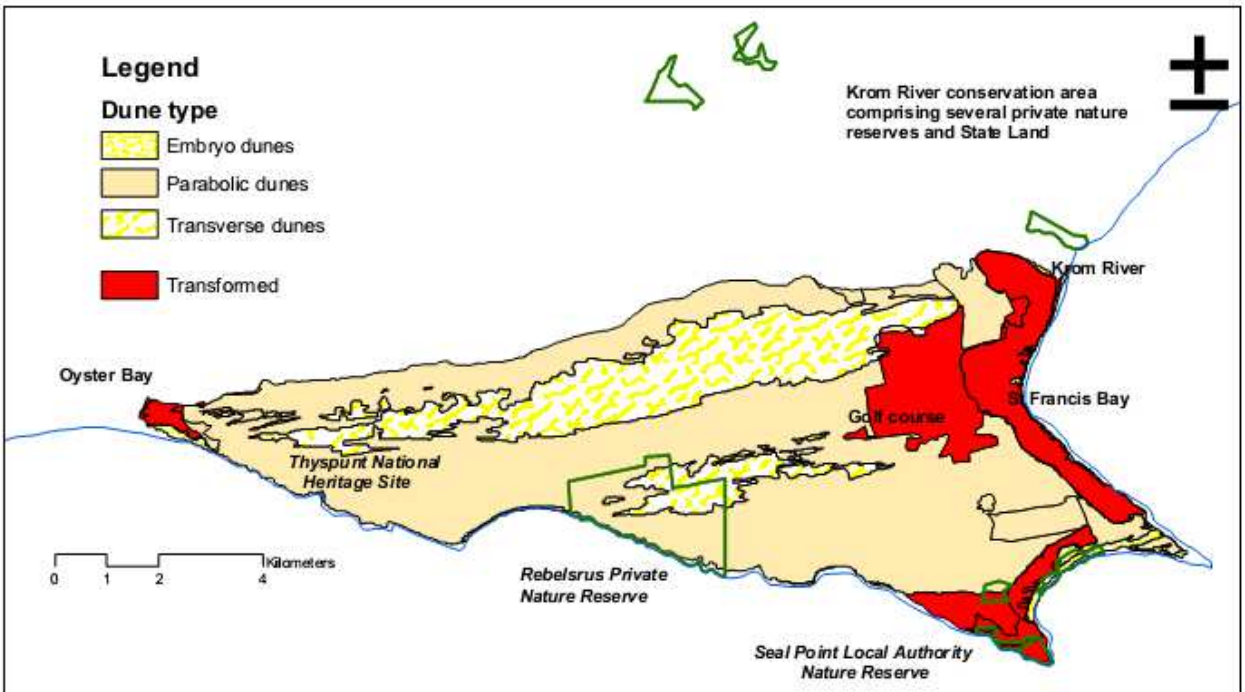

Figure 5.3.8. The Oyster Bay-Cape St Francis headland bypass dune (HBD) showing conservation areas in green. The only statutory reserve in the area is the Local Authority Nature Reserve at Cape St Francis, which does not contribute towards the conservation of the HBD. The two reserves which do - Thyspunt National Heritage Site and Rebelsrus Private Nature Reserve - both have no guaranteed long-term tenure

As evident from the above figure, the specialist report acknowledges the conservation value of Rebelsrus Private Nature Reserve and Thyspunt Natural Heritage[4] Site. The efforts of the Rebelsrus owners to conserve the land are to be commended. However, the conservation of the environment in Rebelsrus, in spite of the well-meaning and very valuable efforts of the landowners, has no long-term tenure as the land remains privately owned and has no statutory protection.

Pressure for development remains in the surrounding area, as evident from recent developments like St. Francis Links Golf Estate. Even in the absence of residential development, Rebelsrus remains one of the very few parcels of land that is responsibly managed from an environmental perspective. Other adjacent tracts of land in this area are virtually overrun by invasive alien species.

Comment 23:

The statement "Eskom's land-holding in the area has in part put a brake on seemingly uncontrolled westwards expanding property development" attributes limited expansion westward to Eskom's holdings with no evidence to substantiate the claim.

Concern and objection raised Number 23:

- Various groups of landowners including, but not limited to, the long established Mostertshoek landowners association, the well established and promulgated Rebelsrus Private nature reserve, several landowners between these 2 tracts, as well as the significant portion of land owned by other landowners have been the buffer to westwards expansion. The Rebelsrus Private Nature Reserve has launched several initiatives mitigating any exploitation of the marine environment, limiting development within the reserve and improving the terrestrial environment through the eradication of aliens on large portions of the land.
- These facts have not been included in the EIA, suggesting that *it has not made a thorough assessment of the issues at hand.*

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[4] A now defunct programme of the Department of Environmental Affairs

veritable paradise for pre-colonial people. It is quite likely that there is a drop off in the frequency of pre-colonial sites adjacent to the the beach at Thysbaai as beaches were not nearly as attractive to pre-colonial people as resource rich rocky shorelines. A recent survey of land adjacent to Thysbaai beach although very restricted by dense vegetation growth indicated a drop off in the frequency of archaeological site in this area opening up a possible less sensitive option within the proposed nuclear corridor.

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Response 23:

Thank you for your comments. Please refer to Response 22 above regarding the valuable contributions of the Rebelsrus owners to conservation.

However, the purpose of environmental impact assessment is to assess the potential change in the conditions of the environment brought about by a specific project, namely the proposed Nuclear-1 power station on the Eskom property at Thyspunt. Bearing this purpose in mind, it is not required of the EIA to provide a detailed assessment of the activities of other landowners.

Comment 24:

What do these rail-networks have to do with this EIA? Both of these are far north-east of the area under discussion. This appears to be a *cut-and-paste error*, and if so the authors need to provide the report that this was cut from so that we are able to compare the rest of this document with the original document so that we can address any similar errors, and assess to what extent this is truly an *independent report* created to address the particular environmental issues at Thyspunt.

b) Rail network

There are currently two railway services operating on the railway lines in the Cacadu District Municipality, as shown in **Figure 8-90**, and these are as follows:

- Alicedale – Grahamstown; and
- Port Alfred – Bathurst.

The Alicedale – Grahamstown service is mostly used by work seekers and shoppers travelling to Grahamstown, whereas the Port Alfred – Bathurst service is mostly used by tourists to explore the Bathurst area.

Concern and objection raised Number 24:

- The inclusion of the description of railways in Bathurst 100 km north-east of Port Elizabeth and 200km from the site at Thyspunt suggests that the writers of this report have made a mistake in this section.
- This raises concerns about the accuracy of the whole report

The main air access to the Cacadu District is via the national airport in the Nelson Mandela Metro as shown in **Figure 8-90**. However, there are other airports in the District which perform significant regional functions.

The provincial government owned air landing field in Ndlambe Municipality is leased by a private company that owns the property around the facility and utilised for training pilots. About 200 to 250 learners are taught to fly an aircraft per year for both commercial and air transport plane licenses.

The facility has three grass runways and no sophisticated landing instruments are used due to unavailability of tarred runways and other facilities. The private company has requested funding from the Province to surface one of the runways.

Response 24:

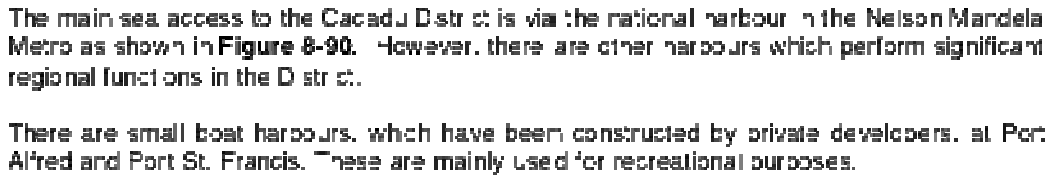
The Transportation Assessment (Appendix E25 of the Revised Draft EIR) considers all forms of transport within the regional environment around the sites. An assessment on both a regional scale and a more detailed scape around the site is necessary in order to gain a complete understanding of the current state of the transport facilities that may be affected or used by the proposed project.

Comment 25:

What is the relevance of this airport to the EIA in the Humansdorp area? If this airfield near Port Alfred (Ndlambe Municipality) is indeed of significance to the Thyspunt EIA then that would need to be explained.

Concern and objection raised Number 25:

- The inclusion of the description of airports in Bathurst/Port Alfred 100km north-east of Port Elizabeth and 200 km from the site at Thyspunt suggests that the writers of this report have made a mistake in this section.
- This raises concerns about the accuracy of the whole report



The main sea access to the Cacadu District is via the national harbour in the Nelson Mandela Metro as shown in **Figure 8-90.** However, there are other harbours which perform significant regional functions in the District.

There are small boat harbours, which have been constructed by private developers, at Port Alfred and Port St. Francis. These are mainly used for recreational purposes.

Response 25:

Please refer to Response 24 with respect to the consideration of transport facilities located far from the Thyspunt site.

Comment 26:

What is the significance of the Port Alfred harbour to Thyspunt?

Concern and objection raised Number 26:

- The inclusion of the description of small-boat harbours in Bathurst/Port Alfred 100km north-east of Port Elizabeth and 200km from the site at Thyspunt suggests that the writers of this report have made a mistake in this section.
- This raises concerns about the accuracy of the whole report

Response 26:

Please refer to Response 24 with respect to the consideration of transport facilities located far from the Thyspunt site.

Comment 27:

INCOHERENCE OF SITE FOOT-PRINTS AND HIGH-SENSITIVITY AREAS

The combined sensitivity maps in the last few pages of chapter 8 show Duynefontein to have a single 158 hectare site close to the coast that fits within the EIA corridor, the Bantamsklip site has a single 172 hectare site within the EIA corridor and the Thyspunt site has a 73 hectare site split into 3 portions, and a separate 51 hectare site (for the high voltage yard) that are separated by several high sensitivity areas.

Concern and objection raised Number 27:

- It is therefore impossible to exit power lines and roads from the Thyspunt site without crossing areas considered sensitive, whereas it would appear that Duynefontein offers an alternative across non-sensitive areas.

Revised DEIR Chapter 3, pg 1

> The area of the footprint assessed in this EIA makes provision for the potential future expansion of the power station, to allow for a total capacity of approximately 10 000 MW. It is estimated that the total area required for this nuclear power station is approximately ***250 - 280*** hectares depending on the terrain. ***This footprint includes the reactor and auxiliary buildings, laydown areas required during construction, including topsoil storage areas.***

Response 27:

Different forms of development imply different levels of transformation of the natural environment. An activity like a power station, which would completely transform a contiguous area of more than 200 ha would result in a completely different impact to a road or a power line, the latter of which is a permeable linear barrier with foundations that would have footprints in the tens of square meters each as opposed to the several hundred hectares of the proposed power station. However, in recognition of the sensitivity of the dune systems, it has been recommended that transmission line pylons and stringing of the transmission line may only be done by helicopter over the mobile dunefield at Thyspunt.

The fact that an area has been designated as sensitive does not imply that no development is possible. Certain forms of development with limited footprints may still be possible provided that the recommended mitigation measures are applied.

Comment 28:

The introduction in Chapter 3, page 1 describes site sizes of 250 - 280 hectares as being required and then mentions that the plan includes a capability to expand to 10 000 MW. It is not clear whether this footprint (is for the 4 000 MW, or for the increased 10 000 MW)? This is important - if the EIA is for 4 000 MW then we need to know what the required planning is for that size generation plant. If the application includes a potential 10 000 MW facility then we need to know what size footprint is needed for that capacity.

The EIA describes Duynefontein as having a single 158 hectare site the Bantamsklip site having a single 172 hectare site and Thyspunt site has a 73 hectare site split into 3 portions.

Concern and objection raised Number 28:

- If the EIA criteria have been based on 4 000 MW, but the planning/terms of reference are for 10 000 MW then this EIA process is fraudulent.
- It is not clear why the EIA has identified suitable sites of 158, 172 and 73 hectares when the requirement is for 250 - 280 hectares?

Response 28:

It is made clear in several places in the Revised Draft EIR and in public participation material that the EIA assesses a proposed power station with a maximum capacity of 4,000 MW. However, Eskom has also requested GIBB to provide an opinion whether additional power stations, with a capacity of up to 10,000 MW, could be constructed at any of the sites, in view of Eskom's stated intention to construct additional nuclear power stations in future.

Whilst Eskom has indicated that it wants an area of up to 280 ha for a power station, the EIA has identified what land is, from an environmental perspective, regarded to be of sufficiently low environmental sensitivity for the construction of a nuclear power station. Eskom will therefore have to consider all mitigation measures in the EMP in the design of the requested terracing layout area.

Comment 29:

EIA for power-line corridors not part of this process:

The generation of power requires transmission of that to the national grid. Bantamsklip and Thyspunt are both off the national grid so that a completely new power corridor will be required, whereas

Duynefontein already has several corridors linking it to the grid so it does already have lines spanning underlying ground and associated usage of that land.

Concern and objection raised number 29:

- The assessment of this EIA for Bantamsklip and Thyspunt in isolation from the EIA's for the transmission corridors cannot be contemplated. One of these corridors may have particular sensitivity on EIA assessment compared to the other, and in particular compared to the Duynefontein site.
- Even more critical may be the exclusion of the 2 Northern Cape sites where transmission corridors have had much lesser environmental impacts (and this is an issue raised by the Peer Review commissioned by Gibbs) (see below)

> GIBB concludes, in response to DEA&DP, that on the basis of Eskom's 20 GW Nuclear Transmission Grid Draft Impact Report (2007), which was included as an Appendix to the Scoping Report the two northern Cape site alternatives are not considered to be feasible and reasonable alternatives for the short and medium term.
>
> The use of environmental arguments as a reason for excluding the Northern Cape sites from the EIA appears thinly motivated. It is possible that the overall cumulative environmental impact of a power station in the Northern Cape (given its location), together with its associated power lines, could be less than that of the power station in the more sensitive localities in the Southern or Eastern Cape, with the shorter power line infrastructure required. It would be impossible to draw reasonable conclusions about this without having done a comparison. We also do not agree with GIBB's argument (stated elsewhere in response to questions concerning cumulative impacts) that the inclusion of power infrastructure as a part of the NSS EIA would make the study too complex to understand. It is the responsibility of the EIA team to synthesize and evaluate complex information. In circumstances where other factors (such as timing) do not make it impossible it would be better to base the decision about the preferred nuclear site on an understanding of all the key cumulative effects, and not simply those associated with the power station itself.
>
> The main arguments supporting the exclusion of the Northern Cape sites appear to be related to network integration, time delays and costs. These are not environmental arguments and we are not in a position to comment authoritatively on their legitimacy. It would seem that the timely completion of additional generation capacity is a matter of National interest in South Africa, given the problems over the past few years, and that a significant delay in the completion of Nuclear-1 would be considered by Eskom and Government to be unacceptable. If this is the case, then it may be reasonable that the two sites are excluded from the present site selection process, particularly now that Eskom has committed to an application for a single site (rather than a joint application for all three sites), which means that the three sites carried into the full EIA are genuine alternatives.

Response 29:

The Duynefontein site does indeed have existing transmission corridors from the Koeberg Nuclear Power Station. However, new viable transmission corridors from the Duynefontein site would still need to be found for the proposed Nuclear-1 power station. The fact that existing transmission corridors exist does not avert the need for identify new corridors. Due to environmental and other constraints, new corridors may not necessarily be able to run parallel to the existing transmission corridors.

The statement of lesser environmental impact for the transmission line corridors for the Northern Cape sites is not supported by fact. Whilst the social impacts for these sites may arguably be lower than for either the Western or Eastern Cape sites due to lower population densities in the Northern Cape, the biophysical impacts would undoubtedly be much higher, for instance due to crossing of the Succulent Karoo centre of endemism and Namaqua National Park (NNP) that would be required. The Northern Cape sites are located north of the NNP. The lines would either need to bisect the NNP or would need to reach the Western Cape via a detour of several hundred kilometres inland of the NNP, in which case they lines would transect the botanically highly sensitive Kamiesberg region.

One of the co-authors of the Nuclear-1 EIR has experience of the EIA for the Kudu transmission line in 2007 – a single 400 kV transmission line from the then proposed Kudu gas-fired power station[5] near Oranjemund in Namibia – approximately 130 km north of the Schulpfontein and Brazil sites. To find a corridor for a single transmission line for this project was very challenging. To find a corridor for five parallel 400 kV transmission lines from Nuclear-1 from either of the Northern Cape sites to the Western Cape, through the same terrain as the Kudu transmission line, would be an extreme challenge in view of the biodiversity issues.

[5] Plans for this power station, which at the time was proposed by Nampower, now appear to be on hold.

Comment 30:

INADEQUATE APPRAISAL OF NO-GO ALTERNATIVES

The No-go alternative is very poorly described as "not logical" in the EIA, and the only alternative seriously compared to nuclear is coal generation.

Concern and objection raised Number 30:

- Demand side management is not considered in the EIA despite good published evidence suggesting that it would be the cheapest and the quickest way of dealing with the short-term power crisis. Winkler in his book *"Cleaner energy, cooler climate"* HSRC Press 2009 page 222 provides a good argument for the mitigation of the need for increased electricity by improving the efficiency/insulation of domestic housing and the use of solar geysers/geyser blankets.
- In addition Winkler's book provides a more thorough assessment of the options for balancing green-house gas emissions with electricity supply and a developmental economy (with the requirement to create more jobs).
- The lack of references to Winkler's book (above) suggests that the authors of the EIA have not done a complete appraisal of current evidence and knowledge. This is a key flaw in the introductory section of the EIA, and really highlights *the simplistic nature of the "not logical" answer to the serious matter of considering alternatives, as required in the legislation for an EIA.*

Response 30:

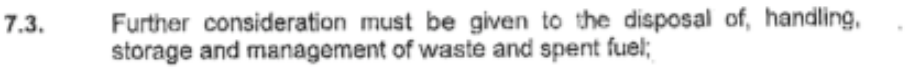
The no-go alternative is not considered a feasible and reasonable alternative in this instance, given the current backlog in the construction of new electricity generation capacity and the requirement for an additional 40,000 MW of generation capacity by 2025. A mixture of generation options will be required, as indicated by the Integrated Resource Plan, and no single generation technology will be sufficient to cater for the expected increase in demand in its own. The Department of Environmental Affairs, the decision-making authority for this application, has accepted the reasonable and feasible alternatives that were identified for further assessment at the end of the Scoping Phase. These alternatives excluded the no-go alternative.

Your argument in favour of improvements in domestic demand side management is quite valid. However, as stated in Response 3, it is not the purpose of his EIA to review all the possible alternatives, including alternatives in terms of efficiency of domestic insulation and other measures such as passive heating and cooling or solar water heating. Such demand-side management (DSM) measures are factored into the IRP recommendations. The IRP 2010 comes to the conclusion that DSM would reach be capable of reaching a maximum saving of 3 420 MW by 2017. Whilst this is a valuable and necessary saving, it would not completely remove the need to additional generation capacity. Please refer in this regard to Response 1, especially with respect to replacing currently operating but ageing power stations.

Comment 31:

POOR CONSIDERATION OF CONCERNS RAISED IN: THE D.E.A.T. SUBMISSION AND THE "PEER" REVIEW PROCESS

DEIR APP B2 DEA&DP Comment on draft scoping report [POINT 1]



7.3. Further consideration must be given to the disposal of, handling, storage and management of waste and spent fuel;

It is not clear that this has been dealt with adequately.

DEIR APP B2 DEA&DP Comment on draft scoping report, Page 3 of Gibbs response to DEAT letter dated 2 September 2009 [POINT 2]

3. Your comment: Decommissioning

Impact methodology is presented for the construction and operation phases of the development. The decommissioning phase of the development seems to have been disregarded. Although this phase will only come onto (into) effect after 60 yrs of operation making it practically difficult to assess all the impacts associated with this phase at present, there are impacts that must be assessed in the EIA. For example, the consequences for future land use options around the sites and the economic impacts related to the decommissioning phase must be assessed. The public and authorities must be in a position to understand what the long term implications of the project on the environment will be and adequate forward planning must be done to ensure that the environment is protected for future generation. These aspects must be assessed as part of the EIA.

3. Response

The specialists will assess the potential impacts associated with the decommissioning phase to the best of their ability in the Environmental Impact Report, given the information available at present. The impacts and the management will also be determined by the selected decommissioned strategy coupled with technological and legislative advancements. Arcus GIBB will provide generic guidelines, principles and criteria based on international literature and best practice. The EMP will also contain specific 'in principle' commitments which will ensure responsible decommissioning.

Further, the EIR will also elaborate on the NNR's role and requirements on decommissioning and address the long-term impacts and the long-term sterilisation of land, as requested by DEAT in their letter dated 19 November 2008.

It is not clear where the 2 concerns expressed above have been addressed adequately. “To the best of their ability” is not good enough. There is no detail that enables us to assess what, if any, plans are in place to deal with the decommissioning phase, and the long-term handling of spent fuel at that stage. Your response then proceeds to suggest that you do not need to deal with the concern raised by the DEAT and your reply relies on “technological and legislative advancements”. The pioneering nuclear facilities were built in the 1960’s relying on the expectation that technology would provide a solution to the high level waste. **To date there is no evidence for this.**

As a rule there is little that legislation can do to deal with the waste to make it actually safe or to neutralize it. **All that legislation can do is define how or where we can store it**- this does not actually deal with the problem.

Concern and objection raised Number 31:

1. This EIA has not adequately with (sic) the handling of nuclear waste, and the decommissioning of the planned facility. This has been raised by several parties as a requirement in the EIA, and the EIA therefore cannot be considered complete.
2. It would be helpful if you could explain what the NNR (as quoted by you to deal with the problem) will do to manage the high level radioactive waste, all the time being mindful that technologically more advanced countries have not been able to do this yet. If there is a clear management plan to deal effectively to neutralise high level waste, then the EIA could be considered to have covered the environmental impact of nuclear power generation at this additional site. Failing that this environmental impact is incomplete.

Responses to your comments are as follows:

1. Your comment: Alternative sites

Based on the findings of the Scoping Report, the Brazil and Schulpfontein sites were not considered feasible for further assessment based on severe time constraints associated with Nuclear-1's development coupled with limited local demand and the lack of existing power corridors. Now that three nuclear power stations are being considered with the last envisaged to be constructed in 2016, it is argued that it may not be reasonable to exclude these two sites from the current EIA process. Furthermore, much needed specialist studies at these two sites may provide information to suggest that these sites are more appropriate for development than the other sites identified. It is this Department's view that the Brazil and Schulpfontein sites should be included in the EIA based on the fact that the reason for excluding them in the first place may no longer be valid.

If the DEAT have agreed in principle with Eskom's approach to submit a combined application, it is not understood why Eskom cannot pursue the proposed combined application at present i.e. why Eskom is waiting for the amended EIA regulations to be promulgated.

1. Response

As correctly highlighted by yourself, originally five (5) alternative sites were considered namely, Schulpfontein, Brazil, Thyspunt, Bantamsklip and Duynefontein. The Schulpfontein and Brazil sites were excluded during the Scoping Phase. The Final Scoping Report was approved by DEAT on the 19th of November 2008. Section 2.17.1 of the DEAT letter states that "The Department accepts the exclusion of the

and continued on next page (see over).

Brazil and Schulpfontein sites for further investigation in this EIA process, as they are not technically feasible at this stage. The Department has also however noted that these sites will be considered for future Nuclear projects."

In terms of Section 29 (b) of Government Notice No. R 385 of 2006 under the National Environmental Management Act, 1998 (Act No. 107 of 1998), scoping reports should include "a description of the proposed activity and of any feasible and reasonable alternatives that have been identified". Based on the information contained in Eskom's 20 GW Nuclear Transmission Grid Draft Impact Report (2007), which was included as an appendix to the Scoping report, it is evident that Brazil and Schulpfontein are not considered as feasible alternatives to be pursued in the EIA process for Nuclear-1.

Furthermore, your assertion that Eskom's investigation of the potential roll out of up to 20 000MW of nuclear power negates the time constraints originally identified as one of the reasons for the Northern cape sites, neglects to consider the remaining issues that prevent the development of Brazil and Schulpfontein as part of the initial phase of the 20 000MW as indicted in the Plan of Study for Scoping.

In this regard the final Scoping report states the following:

*"Thus, the Brazil and Schulpfontein sites require the construction of new power corridors and the exportation of the majority of the power to areas of demand given the limited local demand (**Figure 78**). Thus, the Brazil and Schulpfontein sites are deemed unfeasible for the proposed NPS based on the following reasoning:*

- *Optimal, strategic and cost effective utilisation of existing infrastructure associated with the Duynefontein, Bantamsklip and Thyspunt sites, with respect to local integration and exportation of power via existing power corridors;*
- *Prevention of lengthy time delays associated with the authorisation and construction of the new power corridors applicable to the Brazil and Schulpfontein sites, which will prevent Eskom from providing the power within the required timeframes;*
- *Unnecessary environmental impacts associated with the construction of new power corridors given that there is existing infrastructure; and*
- *Cost implications associated with the development of new power corridors"*

All issues identified above are considered to be relevant for nuclear development on the Northern Cape sites for the short- to medium-term.

Severe time constraints to the nuclear programme are still applicable. In spite of the current economic down-turn, the programme for Eskom to meet energy demands in South Africa is very stringent. The EIA for Nuclear-1 remains on the critical path of Eskom's nuclear programme, with the first Nuclear Power Station (NPS) expected to be operational by 2018.

DEAT can only approve a proposed development in terms of current legislation. Thus there is no legal basis for approval of the combined application before the amended NEMA EIA Regulations are promulgated. In this light Eskom has only indicated its intention to apply to DEA to have all three sites approved. The realisation of such an intention will depend on the final promulgation of the amended NEMA regulations and DEA's approval thereof based on the legislation and consideration of public comment received on the revised Plan of Study for EIA.

As well as

decommissioning of a single power plant, referred to as Nuclear-1. During the scoping phase of the EIA, 5 sites were assessed as alternative options. These were based on the work done by Eskom in the Nuclear Site Investigation Programme, which had, over an extended period, evaluated the options for the location of a nuclear plant and made recommendations to Eskom to purchase portions of land on 2 of the sites.

The five sites were:

- Duynefontein	W Cape	Part of the Koeberg site
- Bantamsklip	W Cape	Land purchased by Eskom
- Thyspunt	E Cape L	Land purchased by Eskom
- Brazil	N Cape	
- Schulpfontein	N Cape	

The work done to determine these sites was mostly under the auspices of the Environmental Evaluation Unit of UCT (pers. comm. Ms. J. Ball, GIBB). The EIA provides a synopsis of the approach that was followed. In the Draft Scoping Report, GIBB advised that the Schulpfontein and Brazil sites in the Northern Cape would not be considered further in the EIA phase of the work.

In addition, during the EIA Phase of the study, a proposal was made by the Coega CTZ to site the power station in the Coega CTZ.

The main issues about alternatives that have arisen during the course of the EIA are as follows:

(i) The exclusion of alternatives to nuclear power from the EIA
(ii) The exclusion of the Schulpfontein and Brazil sites from detailed analysis in the EIA (DEA&DP and other stakeholders)
(iii) Objections to the failure of the EIA to review the findings of the Nuclear Site Investigation Programme or 'NSIP', which was the basis for the selection of the 5 nuclear sites under consideration but which was completed 20 years ago (DEA&DP and other stakeholders)
(iv) The exclusion of the Coega site as a possible alternative (Coega IDZ)
(v) Eskom's intention to apply for the future use of all three of the sites considered in the EIA phase of the project, as long as none exhibited any 'fatal flaws. This objection was based on the grounds that under these circumstances, the sites could not be considered to be alternatives and that NEMA's requirements for investigation of alternatives would therefore not be met
(vi) The absence of material process alternatives in the EIS scope of work (DE&ADP)

These issues are discussed individually below.

And DEIR APP B2 DEA&DP Comment on draft scoping report

3. Furthermore, this Directorate does not support the exclusion of the Brazil and Schulpfontein sites from the EIA phase of the project since, based on the summary table of the preliminary comparative assessment of the five proposed sites (page ix of the Executive Summary), there are other aspects of the site (e.g. geotechnical, heritage and cultural, tourism and some aspects of the ecology of the sites) that might recommend them above other sites once informed by specialist studies conducted during the EIA phase;

4. In view of the above, all five alternative sites proposed should be assessed during the EIA phase of the application;

Response 31:

The issue of nuclear waste and spent fuel is assessed in the Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR). This report contains detailed descriptions of the proposed waste storage and disposal mechanisms, which are in conformance with international requirements and the requirements of the NNR, which has legal competence over the storage and disposal of nuclear waste.

The international practice, in the absence of geological storage, is to store the usednuclear fuel safely in spent fuel pools (wet storage) or purpose-designed containers (dry storage) on the site of the nuclear power stations. It is to be noted that of all significant nuclear incidents over the past decades, they related primarily to the operation of the nuclear fuel within the power station due to the failure of the cooling systems, but less related to the release of radioactivity from the spent fuel that is kept on the site. The impacts of decommissioning are assessed in the Revised Draft EIR and all the specialists were required to assess this.

Management of the high level waste is achieved through measures as indicated in Section 5.5 of the Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR). The responsibility for management of high level waste lies with the operator of a nuclear facility (i.e. Eskom). The NNR's responsibility is to oversee and regulate the process to ensure that human health and the environment is protected at all times. The NNR itself is therefore not responsible for the management of nuclear waste. The NNR operates within a well-defined and consistent national and international regulatory framework of safety standards consisting of regulation, principles, requirements and guidelines, subject to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, 1997, of which SA is a signatory.

Technically the safe long-term management of high level waste is possible. The reason why it has not been implemented in all countries may vary, and is not necessarily technical. However, as with anything else, technological developments do play an important role, in that more advanced methods of waste management become available, thereby deferring the implementation of a given solution (such as geological storage). This may be one of the reasons why more emphasis than in the past is placed on the long-term storage of high level waste (up to 100 years). This management option has been demonstrated to be safe over some decades at existing operating facilities. What is important is that whatever short and long-term solution is pursued, that the fundamental principles of radiation safety are adhered to.

Therefore, whilst it is important as part of the overall justification of nuclear power to pursue solutions for the management of high level waste, long-term storage of high level waste remains a feasible, technically sound and safe option, while disposal solutions are being developed locally and internationally.

COMMENT FROM THE INDEPENDENT NUCLEAR SPECIALIST

In addition to what is said which confirms that the installation will adopt international best practice in so far as waste management interim storage is the responsibility of the applicant - as part of the NNR licensing requirements a decommissioning strategy will be required as part of the safety case together with waste management strategies. In addition institutional arrangement in respect of ultimate disposal arrangements are the responsibility of the NRWDI decommissioning.

Comment 32:

Your responses to these concerns raised both by the DEAT &DT and your own peer review about the ability to discard the other 2 sites during the EIA is not acceptable to me. It does appear that the main reason, if not the sole reason, for the EIA removing these sites at the outset is the haste required to complete the report, so that the nuclear power-stations can begin to be procured and commissioned.

Concern and objection raised Number 32:

1. The decision to construct a nuclear power-station is a serious and responsible one, and you cannot decide for matters of expediency that you can drop 2 sites, as these two sites may well have been the preferred sites if the EIA was completed to include them. So that decision would make any decision favouring one of the other 3 sites invalid.
2. Building nuclear has long-term consequences for any site, and for the country, and previous lack of planning cannot be allowed to determine that we now must make decisions in haste. There are potential mechanisms to mitigate medium term electricity challenges, that will not have a long-term impact. Building a nuclear power station is a commitment for at least 100-200 years, and therefore requires thorough planning, and hasty decisions are not acceptable.

Response 32:

Your comments relating to the exclusion of the Brazil and Schulpfontein sites are noted. Please refer to our Responses 1 and 29 in this regard.

The planning for future nuclear power stations post-Koeberg is not hasty. The Nuclear Site Investigation Programme (NSIP) was undertaken to identify potentially suitable sites in the 1980s and 1990s. The EIA for Nuclear-1, which is based on the alternative sites identified in the NSIP, commenced in 2007.

Comment 33:

ADDITIONAL CONCERNS

1. Could the staggering nuclear energy costs crowd out investment in cleaner, safer renewable energy sources? The EIA has failed to assess this risk.
2. Are we taking a decision to add significant cost to electricity generation, when the single biggest user (a smelter) could be closed and therefore negate the requirement for Nuclear-1 completely. Surely in a democratic age we need to consider whether we should be making household consumers (tax-payers) pay for the subsidized electricity for smelting, particularly for the benefaction of minerals that are not from South Africa?

Response 33:

It is not the role of the Nuclear-1 EIA process to assess the merits of nuclear electricity generation vs. other forms of electricity generation. As indicated in previous responses, a strategic decision on the mix of generation alternative to meet South Africa's electricity needs was taken in the IRP 2010.

With regard to the proposed closure of smelters, please refer to Response 1.

Yours faithfully

_____

For GIBB (Pty) Ltd
Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

Daniel Reinecke
20 Cathcart Close
Kenridge
7550

Dear Mr Daniel Reinecke

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

The report which identified the 5 original sites developed in the 1980's looked at 5 sites between Cape St Francis and the Titsikamma River, 2 east of Oyster Bay and 3 west. The 3 west sites were identified as those preferred to the 2 on the east for certain, and I think most criteria, but the 2 eastern sites were preferred for geomorphology reasons. It looks to me as if the problems with the Thyspunt site from a dune, freshwater and conservation point of view was not properly assessed.

I believe there is a need to review a comparison between these 5 sites as it is possible that one of the 3 sites on the west of Oyster Bay could be a better choice than Thyspunt for the following reasons;

- cheaper, no moving sand dunes to influence the platform, access road and transmission lines, closer access to N2;
- less people around the site, easier evacuation, but yet still close enough to H'dorp and J'bay for accommodation of workers, shops, hospitals etc;
- less pristine environment, most land is farmed, whereas the Oyster Bay and Thyspunt headland bypass dune system should be declared a national park as has been requested by many people; and
- less excess sand to dispose of.

Response 1:

Your comments are noted. We refer the author to the extract below taken from page 13 of the Nuclear Siting Investigation Programme (NSIP) Eastern Cape Summary Report Revision 1 - December 1994. The full report may be downloaded from the GIBB website at: http://projects.gibb.co.za/en-us/projects/eskomnuclear1.asp

"Six potential sites were identified in the area between Cape St Francis and the Tsitsikamma River, namely at De Hoek, Thyspunt, Tony's Bay, Klippepunt, Morgan's Bay and Brakkenduinen. The location of these sites is shown in Figure 3 overleaf. During the course of the site specific studies, a major geological fault was found to run through the Klippepunt site and under the Morgan's Bay and Brakkenduinen sites (See ref. ACC1162454). Although the initial movement on this fault occurred during the Cape Fold Mountain building activity several hundred million years ago, there was evidence to indicate that it was reactivated in the Gondwanaland split, between 30 to 80 million

years ago. However there was no direct evidence to indicate that it had moved within the last 1 million years, and thus could not be positively categorized as a capable fault, as defined in the US Reactor Siting Criteria 10 CRF 100. But there is also no evidence to indicate that no movement had taken place over this period of time, and although it could not be positively categorized as a capable fault, the NSIP Geological team decided that there was insufficient evidence available to provide the confidence that a nuclear power station could be located in the fault zone.

The same fault system that was identified at Klippepunt, was found to extend westwards along the coastal cliffs of the 'western portion of the Oyster Bay Area, thus effectively ruling out this portion of coastline as well. It was therefore decided to deem the Klippepunt, Morgan's Bay and Brakkenduinen sites unsuitable for the siting of a nuclear power station.".

It is therefore clear, in terms of the above extract, that the sites were eliminated due to geological considerations. Further to initiate another siting process and to carry out the requirement monitoring would take between 5 -10 years to qualify the site and only then could the EIA be initiated it is therefore not an acceptable alternative for Nuclear 1. However, these sites could be included in the sites to be studied in future.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 07 August 2011

Southern African Faith Communities Environment Institute (SAFCEI)
PO Box 106
KALK BAY
7990

Dear Bishop Geoff Davis

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (DEA REF. NO.: 12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE – REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: SAFCEI SUBMISSION

Comment 1:

The Southern African Faith Communities Environment Institute (SAFCEI) believes that the current preoccupation with nuclear energy is a dangerous distraction for South Africa. South Africa needs to ensure energy security for all South Africans and the most sustainable way of doing so is to focus on renewable energy.

Response 1:

As indicated in Chapter 3 of the Revised Draft EIR (Version 1), the application for Nuclear-1 is targeted at providing baseload power generation, which renewable sources such as wind and solar cannot provide. Furthermore, all available sources of power generation will have to be employed to make up the estimated 40,000 MW of new generation capacity required by 2025.

The fact that Eskom intends to develop a nuclear power station does not imply that it opposes renewable technologies. However, the conclusion of the Integrated Resource Plan, which is the South African government's strategic plan for electricity security, is that 9,600 MW of nuclear generation must (in parallel to renewable technologies) form a part of the mix generation technologies. The EIA process, which is a project-specific environmental management tool, does not have any mandate to revisit the strategic analysis of power generation alternatives that was completed in the IRP.

The Nuclear-1 EIA process is therefore not in a position to assess the merits of different power generation alternatives e.g. nuclear power vs. other forms of renewable power generation. The environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a specific power station, for specific electricity generation source, on a specific site or sites and within a defined geographical area.

Comment 2:

The nuclear1 EIA is a deeply flawed document that we would contend contravenes the EIA regulations (including section 81(1). The report fails to consider alternatives in any substantive manner, particularly renewable energy. The consultants appear biased towards the nuclear industry and have produced reports where their specialists appear to be either incompetent or deliberately misleading in their analysis.

Response 2:

Your comment is noted. Please refer to Response 1 regarding the alternatives considered in the Nuclear-1 EIA process. The EIA report is not pro- or anti-nuclear. However, the decision whether or not to include nuclear generation in South Africa's generation is, as indicated in Response 1, not a decision that can be influenced by a project-specific EIA.

Comment 3:

In order to effectively assess the environmental impacts of a nuclear reactor, the entire life cycle costs must be assessed. This report is fatally flawed in that it only addresses the nuclear reactor, and fails to address the issues of decommissioning costs, waste storage and disposal in any meaningful way. By failing to assess the total life-cycle impacts of the proposed nuclear 1 reactor, the costs of any such generator are passed on to future generations. That is ethically insupportable, as well as contravening the legal principles of NEMA.

Response 3:

Life-cycle assessment of the entire supply chain of nuclear energy generation from mining of uranium ore to final disposal of high-level nuclear waste is not practical within the bounds of a project-specific EIA. Such an approach would imply that all other construction projects should likewise be subjected to complete life-cycle assessments of the entire supply chain for all materials making up part of a construction project (e.g. extraction of clay for bricks, extraction of lime for cement, extraction of raw materials for a range of other construction resources, transport of materials to and from site, disposal of building rubble, etc.). However, these aspects are covered in various other processes that a company is required to carry out in order to progress a project such as to obtain funding, the licensing of the plant through the National Electricity Regulator and so on.

Waste disposal of nuclear waste is addressed in the Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR).

Your comment regarding the impact on future generations refers. The fact that impacts are produced that will be felt in future does not imply that the development cannot be considered. All forms of development in a modern technologically-driven society produce waste and all forms of waste and all these forms of waste produce burdens for future generations, since no waste (whether nuclear or domestic waste) disappears, unless it is recycled or re-used. Once waste is disposed, it is effectively permanently stored on a disposal site, irrespective of whether it is a domestic waste, hazardous waste or nuclear waste disposal site. Leachate, for instance, needs to be continually managed after the closure of a domestic or hazardous waste disposal site.

What is of greater importance than whether the activity will result in a future impact is whether or not the potential impact can be responsibly managed? Arguably, a nuclear waste site like Vaalputs could be regarded as potentially more secure than a domestic waste site, since the controls on waste that get disposed at a nuclear waste site as well as the mechanisms for containment of potentially hazardous waste are significantly more stringent on a nuclear waste disposal site. The potentially most hazardous nuclear waste (Intermediate level waste or ILW) that is disposed at a nuclear waste disposal site is encased in impermeable concrete drums to prevent leakage. That is only one of the control measures, besides other engineering methods that are applied to prevent movement of leachates into the groundwater.

Should we as a society wish to remove or avoid all burdens on future generations, we should avoid all forms of waste disposal, since all forms of waste disposal create potential future liabilities. If waste avoidance is an absolute priority, then even renewable forms of electricity generation should be avoided, since they also generate various forms of waste, which places burdens on future generations.

Comment 4:

It is estimated that there are at least 2 million households without access to electricity in South Africa. Electricity prices are rising at 25% per year and this will place an increasing burden on poor households. Fuel costs for both coal and nuclear generation will continue to escalate. There are no fuel costs for wind and solar generated electricity! Furthermore, nuclear energy by its nature supplies centralised grid electricity and is obviously designed for the energy intensive users. It will not benefit the 2 million rural households who cannot be reached by a centralised grid. The government's responsibility should be to provide decentralised renewable energy for rural homesteads, not subsidising the massive costs of nuclear.

Response 4:

Please refer to Response 1. The development of a nuclear power station does not imply that renewable electricity generation has no place in South Africa's energy future. Each form of generation needs to be rolled out in parallel to provide in South Africa's future electricity needs.

As indicated in Response 1, Nuclear-1 will be a baseload power station providing constant supply. A mixture of baseload generation (to provide consistent electricity supply throughout the day) and peaking generation (to provide additional power during periods of peak demand) is required.

In an electricity deficit situation, as was experienced some years ago when load shedding had to be applied, all users of electricity are affected, whether they are large industries that are bulk users of electricity or domestic consumers.

Your argument that rural households need to be provided with electricity is entirely valid. However, this does not negate the needs for baseload power supply and does not imply that other bulk users of electricity, who supply employment to thousands of people (who might otherwise be unemployed) should be neglected. South Africa needs to demonstrate that it can provide security of electricity supply in order to sustain current industries and to an attractive destination for the establishment of industries in future.

Comment 5:

The recently completed IRP2010 concluded that the most affordable electricity plan for South Africa did not include new nuclear plants. But nuclear generation was then forced back into the revised IRP, implying that the overall costs of implementing the electricity plan will rise yet again. It is our view that nuclear energy is the most costly form of energy known to humans – it is expensive to build, dangerous to operate and leaves a legacy of toxic waste for which a permanent solution has yet to be found.

Response 5:

Electricity generated from a nuclear power station has two advantages it is a base load technology and it is a low carbon technology. Nuclear power stations do not emit carbon dioxide. Alternative base load energy in South Africa is coal and possibly natural gas in the future, South Africa has pledged to reduce its carbon intensive activities in the interest of climate change. It is for this reason that nuclear is considered appropriate for the South African electricity mix.

Comment 6:

It is noted that Koeberg was projected to have an operating life of 40 years (Eskom 1996), yet its waste remains toxic for more than 240 000 years. Future generations who gain no benefits from this reactor will have to pay for its impacts, including its waste storage. How can we pass such a burden on to our grandchildren?

Response 6:

Your comment is noted. Please refer to Response 3 regarding the issue of nuclear waste management.

Comment 7:

This report fails to address recent events in Japan. The terrible consequences of such a nuclear accident have implications for any proposed new nuclear plants, both in terms of design improvements and in terms of the environmental costs for such a scenario. While we understand the specialists studies and EIA report were prepared prior to Fukushima, the Japanese nuclear accident has forced a rethink on nuclear energy, and several nuclear countries in the world have now turned away from nuclear energy as part of the mix. The implications of Fukushima must be included in the EIA report, particularly its impacts on financial costs, design, risk and worse case accident assessment.

Response 7:

Your comment is noted and the Revised Draft EIR (Version 2) contains an analysis of the Fukushima events and the implications therefor for future nuclear power station design and operation (see Appendix E32 and E33).

Comment 8:

SAFCEI believes that the information as presented by the specialists in the EIR fails to address the issues raised above. SAFCEI therefore believes that the EIR is incomplete and should be rejected as it fails to meet its legal obligations in terms of presenting sufficient information before the decision-maker to enable such authority to make an informed decision.

In principle, SAFCEI endorses the comprehensive analyses put forward by Greenpeace Africa, KAA and the LRC, all of whom have prepared detailed technical inputs.

We urge the authorities to reject the proposed nuclear application as we believe it fails to promote sustainable development as per our constitutional right.

Response 8:

Your comments and endorsement of the submissions by Greenpeace Africa, KAA and the LRC are noted.

Yours faithfully

for GIBB (Pty) Ltd

_____

The Nucelar-1 EIA Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

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Dear Liz McDaid

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (DEA REF. NO.: 12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE – REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT:

Comment 1:

Submission

We refer to our submission into the draft EIR and the Arcus Gibb response (your reference J27035). Our submission referred to the failure of the consultants to consider alternatives, particularly renewable energy. The EIR has discussed coal as an alternative to nuclear but has failed to provide a similar analysis for solar, wind or other renewable options. In this way it fails to assess the alternatives.

The box below is an extract from Arcus Gibb response to the Green Connection's submission regarding renewable energy and base load.

Your comment (2)
Consideration of alternatives:
The need and desirability report claims that renewable energy cannot supply base-load. However, no references are provided to justify this. If this is an opinion of one of the consultants, then such a consultant would obviously need to be considered an expert in renewable energy. We believe that this statement must be removed from the report or corrected to reflect that there are a number of renewable options for meeting the energy needs of the country.

Response (2)
The statements provided in the report are based on ……

We submit that " …." Is not in any way an adequate response to our issue raised. Despite attempts to gain clarity from the consultants, no further information was provided.

Response 1:

The environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a a specific power generating technology, on a specific site or sites within a defined geographical area. It cannot reasonably be expected that each application for a power station must revisit strategic government decisions that have been taken on the mix of generation technologies that are necessary to meet South Africa's electricity needs. This is especially the case in the instance of the Nuclear-1 application, where the government has, through a consultative process, already taken a decision on the mix of generation technologies required to supply South Africa's future electricity needs for the next two decades. The conclusion of the IRP process is that nuclear technology must form a part of the mix generation technologies.

Comment 2:

No public meeting was held in the nearby vicinity (despite such a meeting having been held in the first round of consultation) and the restrictive public participation process prevented us from getting clarity. Our submission referred to the admission by Eskom that there was no commercial generation 3 reactor in commercial operation and therefore it would be impossible to assess.

Arcus Gibb has responded to say that chapter 9 of the EIR draft addresses all the gaps in knowledge that apply.

However, the section 9.2 of the revised EIR fails to address the generation 3 issue.

Response 2:

It is unclear to which site your comment applies with respect to the holding of a public meeting. As you may be aware, there are various avenues available through the public participation process for questions and comments to be raised, including public meetings, key stakeholder workshops, the release of Draft Reports on the Eskom and GIBB websites, the provision of hardcopy reports at public venues and the inclusion of the executive summaries of the Revised Draft EIR reports in letters to stakeholders. Lastly, there is a dedicated Nuclear-1 email address for public participation issues. Thus, there are a variety of avenues that could be used to engage with GIBB.

It is indeed so that there are no Generation III nuclear power stations in operation. However, four plants are currently under construction in China with more units committed for the future. Furthermore, nuclear power station technology and Pressurised Water Reactor (PWR) technology (the technology on which Nuclear-1 is proposed to be based on) has been in use for several decades and the environmental impacts of operations of this technology are known, both internationally and with respect to the operation of Koeberg Nuclear Power Station in South Africa over more than 20 years.

The key difference between Generation II and Generation III power stations is the addition of passive cooling systems in Generation III power stations to ensure continuing operation of the cooling systems, allowing safe shutdown of the reactors in the event of loss of power. However, the remainder of the nuclear technology still operates on the same principles as in previous generation nuclear power stations. It is, therefore, feasible to predict the environmental impacts of a Generation III power station. Please see Appendix E31 and E33 of the Revised Draft EIR (Version 2) for a more detailed discussion.

Comment 3:

In addition, the report contains the following paragraph:

It is assumed that the NNR will accept Eskom's proposal, adopted from the European Utility Requirements (EUR) for new reactor designs, for emergency planning zones (EPZs) of 800 m and 3 km for the Proactive Action Zone (PAZ) and the Urgent Protective Zone (UPZ), respectively. Should this not be the case, a re-assessment of the impacts in relevant specialist studies and in the EIR may need to be undertaken.

It has been pointed out that the EUR proposal is based on an industry proposal to the national regulator. It is submitted that the consultant proposes that the regulator adopt an industry proposal that we understand has no legal standing anywhere in the world.

Firstly, the report fails to state (in any way that we can find) that the European utility requirements have no legal status. We submit that this cannot be viewed in any way than an attempt to mislead the public.

Given that EUR proposal has no legal standing, the EIA should have assessed the impacts of legally applicable emergency planning zones. By its own admission, Arcus Gibb have failed to fully consider the impacts as they state that they may have to redo some of the specialist studies if the EPZs exceed the industry wish list!

Response 3:

Section 3.20.2 of the Revised Draft EIR deals with emergency planning zones. It is stated clearly in this section that the EUR standards "*were initiated by a group of power utilities from six European countries".* There has never been any suggestion that the EUR standards carry any legal status. It is also stated clearly as an assumption in Chapter 9 of the Revised Draft EIR (Version 1) that the NNR will accept the EUR recommendations. Should this not be the case, then a key assumption of the EIA process would be invalid and a re-assessment would be required.

As also stated in the Revised Draft EIR, it is an assumption that the NNR will accept the EUR's Emergency Planning Zone (EPZ) recommendations during the nuclear licensing process. Initial indications provided by the NNR are that it is likely that the EPZ will be reduced. For instance, in a presentation to the Parliamentary Select Committee on Economic Development on 1 June 2010, the Chief Executive Officer of the NNR stated the following: "*One major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, which is the zone within which evacuation of the public has to be catered for, would in all likelihood be reduced from 16 km in the case of Koeberg, to a much smaller radius which could fall within the property owned by the holder* …".

Lastly, the basis for adopting the EUR by Eskom is that the EUR aims at ensuring that the design that adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs.

COMMENT FORM THE INDEPENDENT NUCLEAR SPECIALIST

Ultimately the emergency planning assumptions and plan basis will form part of the safety case to be considered by the NNR as part of the licensing process as such applicant's basis is being established however this must be independently verified as part of that process.

Comment 4:

We submit that this demonstrates lack of objectivity by the consultants. Further, the fact that the consultants failed to acknowledge that the standards discussed above were not legal standards shows that they did not have competency in their stated field of expertise.

Further, the study is fatally flawed in that it fails to fully assess the impacts of the proposed activity by its own admission as raised above.

We would therefore submit that the EIR is fatally flawed and that the report should be withdrawn and further investigations carried out in order to produce a report that complies with the legal provisions of PAJA and NEMA.

We support the submissions of LRC, Greenpeace and KAA.

Response 4:

Your comment is noted.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015.

Our Ref: J27035
Your Ref: PAE/lm/4144
Email received 10 August 2011

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Dear Ms Mc Laughlin

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

ARCUS GIBB (PTY) LTD

THE APPOINTED ENVIRONMENTAL ASSESSMENT PRACTITIONER
ATTENTION: MS JAANA-MARIA BALL

PER E-MAIL: nuclear1@gibb.co.za
Cc: MS JAANA MARIA-BALL : jball@gibb.co.za

AND TO:

THE DEPUTY DIRECTOR GENERAL
THE DEPARTMENT OF WATER AND ENVIROMENTAL AFFAIRS
ATTENTION: MS TRUDI MALAN
PER E-MAIL: msolomons@environment.gov.za

Dear Sir/Madam

RE: REVISED DRAFT ENVIRONMENTAL ASSESSMENT REPORT FOR ESKOM HOLDINGS LIMITED'S PROPOSED NUCLEAR POWER STATION (NUCLEAR 1) AND ASSOCIATED INFRASTRUCTURE AT THE THYSPUNT SITE

Comment 1:

1 INTRODUCTION

We refer to the above matter and again confirm that we act on behalf of the South African Squid Management Industry Association ("SASMIA" or "our client") who has instructed us to make written representations on their behalf. We confirm that we previously made representations on our client's behalf in our detailed letter dated the 30 June 2010.

Our previous letter summarised our client's main objects, membership profile and official status as a recognised body in terms of the Marine Living Resources Act ("MLRA").

A reply to our written representations was received from yourselves in an e-mail dated the 28 April 2011 to which was attached a 40 page letter dated 20 July 2010. The said letter, although prepared on the 20 July 2010, was only e-mailed to us on the 28 April 2011 with no explanation for such delay.

We are instructed that a revised draft environmental impact report ("EIR") was made available for review and comment apparently from the 9 May 2011 until the 7 August 2011. As the 7 August 2011 is a Sunday we are assuming that the deadline is naturally extended to Monday the 8 August 2011 as was advised by yourselves to the Thyspunt Alliance (of which our client is a member).

Our client has again mandated us to make further representations on certain aspects of the purported consultation process and the said revised EIR read together with the response of the environmental assessment practitioner ("EAP") dated 20 July 2010. With regard to the revised EIR, due to time constraints theses representations focus predominately on the revised marine ecology report and the revised economic report.

1. SASMIA MAINTAINS ITS POSITION

Despite the content of the aforesaid response letter received from the EAP and the said revised EIR, our client maintains the stance as set out in detail our previous letter. These representations accordingly supplement our client's previous representations.

With a turnover of approximately R500 million (five hundred million rand) in foreign exchange revenue per annum and with employment of 5000 (five thousand) sea and land based jobs, not to mention the support of the families of such employees, the squid fishery is of vital importance to the Eastern Cape economy. At a time when South Africa is still feeling the effects of the global recession and in particular the fishing industry is struggling due to a strong rand and a depressed export market, the threat of the construction and operation of this nuclear power plant is extreme to the squid industry.

Our client maintains the view that there has been a lack of meaningful consultation (in the true meaning of the word) and proper investigation into the effect of nuclear 1 on the squid fishery. Particularly from an environmental and economic perspective, the risks of this project to a vital fishery in the Eastern Cape have not been sufficiently assessed and reported on.

In this regard it is submitted that the issues raised in our previous comments (dated 30 June 2010) have not been adequately dealt with at all and on the contrary the responses and revisions to the EIR serve to further confirm our client's fears.

As a consequence our client is led to believe that despite the declarations of independence by the relevant (specialists), their continued approach of claiming minimal disruption to the marine habitat and more importantly to the squid fishery without thorough investigation and consultation, shows a bias in favour of the Applicant (Eskom) who ultimately is responsible for the fees of these specialists.

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Response 1:

The Marine Impact Assessment (Appendix E15 of the Revised Draft EIR) has comprehensively assessed the potential impacts of the proposed nuclear power station on the fishing industry, based on currently available knowledge from a variety of sources, including the reliable scientific resources.

The findings of the Marine Ecology Assessment are based on comprehensive oceanographic modelling of the effects of marine spoil disposal and cooling water release and on the extensive experience on the marine ecology specialists with monitoring of the marine environment at Koeberg Nuclear Power Station - a power station based on a similar technology (a Pressurised Water Reactor) to the proposed technology for Nuclear-1.

Response by the marine ecology specialists:

The marine specialists again confirm that they have no vested interest in the outcome of their study, whether this be in favour of any particular site, or indeed construction or not of Nuclear-1. The opinions given are their best professional advice, based on available data and consultation with no bias in favour of any party.

2. CONSULTATION ISSUES REGARDING THE EAP'S RESPONSE TO OUR PREVIOUS REPRESENTATIONS

Relating to the issue of lack of consultation, our client notes the EAP's responses without admission.

Comment 2:

Regarding the lack of consultation with SANBI, the response by the EAP is unacceptable as a project of this magnitude and with this potential impact on the biodiversity should have been investigated carefully with the head of SANBI in Cape Town. In the EAP's response they claim that a certain Mr Japie Buckle being the Eastern Cape provisional co-ordinator of SANBI has "participated in the EIA". Our client contests this statement and puts the EAP to the proof thereof, and in particular requires to see in writing what input Mr Japie Buckle on behalf of SANBI has in fact given.

Response 2:

According to the public participation records, provided to GIBB by ACER Africa, Mr Buckle registered as an interested and affected party and indicated his position as Provincial Coordinator of South African National Biodiversity Institute (SANBI) based in the Eastern Cape. The last record of his participation is his attendance of the Key Stakeholder Feedback Meeting held in Port Elizabeth on 12 April 2010.

Although the EIA public participation team can provide information to interested and affected parties, it cannot force these parties to submit written responses. It is the right of interested and affected parties to respond or not. So, for instance, although several meetings have been held with the Eastern Cape Department of Economic Affairs Environment and Tourism, as a key government stakeholder, this department has never provided a written comment on the EIA process. Similarly, no written response is available from Mr Buckle, apart from the record of his verbal comments in the

minutes of the above-mentioned meeting he attended. These minutes are available at the following website under Appendix D4:http://projects.gibb.co.za/en-us/projects/eskomnuclear1drafteir.aspx However, Arcus Gibb will engage with SANBI at a National level and request their input.

Response by the marine ecology specialists:

In respect of the marine environment specifically there is no suggestion that the projected development will have any impacts on biodiversity at the species level, since no species are known to be restricted to this site. Indeed marine species generally have much wider distributions than terrestrial species, so this impact would be unlikely. The consultants are also themselves among the leading marine biodiversity researchers in the region, and are both authors of the most recent marine biodiversity assessment for the region (Griffiths *et al.* 2010), so do not necessarily require input from SANBI to assess this matter. However, the marine specialists have consulted all relevant and reliable academic sources to assess the impact of Nuclear-1.

Comment 3:

The further excuse contained in the response that it is not always the responsibility of the EAP to identity and engage stakeholders is also unacceptable particularly as the SANBI MPA project has been well documented. It is not appropriate for SANBI and Dr Sink to merely be expected to comment as interested and affected parties in the EIA process. They should be actively consulted and their work on the MPA project investigated in order to see what impact nuclear 1 may have on it. Our client also denies the statement that the SANBI exercise is "indeed focused on offshore" (i.e. "continental shelf and beyond"). The SANBI project which ties in with the eco-system approach to fisheries of the Department of Agriculture, Forestry and Fisheries ("DAFF") looks at both offshore and inshore habitats.

Response 3:

Response by the marine ecology specialists:

We are well aware of and have participated in the SANBI MPA project and have been deeply involved in plotting biodiversity patterns on which the MPA network proposals are partially based. While submissions by SANBI are welcome we are not exclusively reliant on these to assess marine biodiversity impacts.

Comment 4:

Regarding the response from the appointed marine specialists Dr Tammy Robinson and Professor Charles Griffiths to the minutes of the Sea Vista meeting on the 25 May 2010, it would appear that the response of such specialists differs from what was recorded in the minutes of the meeting by the EAP. In this regard we hereby request you to confirm that the minutes of such meeting are accurate or whether in fact you have erroneously and negligently recorded what was said at such meeting. Please refer to page of 37 of our original representations.

Response 4:

The draft minutes of all public meetings are provided for comment to the attendees of the meeting for a period of two weeks. If no comments are received on these minutes, the minutes are taken as

an accurate reflection of what was said at the meeting. As such, the published minutes of the meeting are regarded as an accurate reflection of the meeting's proceedings.

Comment 5:

What is also more alarming about the latest response from the marine specialists is that as at the 20 July 2010 (the date of the EAP response letter) the EAP / Griffiths apparently maintain that: "the published scientific literature has been adequately reviewed and using the most up to date and scientifically sound information available a sound assessment of potential impact on the squid has been made."

This statement is factually incorrect for a number of reasons. Firstly, if one looks at the revised marine ecology report the references have changed with the insertion of a number of research papers on squid which were not previously contained in such references. It is submitted that as at the 20 July 2010 the draft EIR had not as yet been revised to include these further squid papers and accordingly it is submitted that the statement at the time that "the published scientific literature has been adequately reviewed" is not correct. It is doubted whether between the 30 June 2010 and the 20 July 2010 these papers were reviewed.

Response 5:

Response by the marine ecology specialists:

The period during which the marine ecology report was revised was between the dates stated above. As shown on the email correspondence with members of the Squid Working Group we contacted them during this period and it was through this interaction that some new papers were considered. In addition, at this time we re-reviewed additional published literature and added supplementary papers to the review presented in the report. The literature coverage in the report is thus a progressively improving with each iteration and the final report will contain yet more references than the previous one.

Comment 6:

This lack of research and consultation regarding the impact of the project on the squid resource is further uncovered by the following events. Only on the 20 June 2011 did the EAP present its EIA report for Thyspunt to the squid Scientific Working Group ("SWG") at DAFF in order for them to comment on the specialist study findings and outcomes relevant to the squid resource. The aid memoire to this meeting which was prepared by DAFF recorded that this was the first formal meeting for the SWG to consider this matter and contrary to normal practice no documentation had been circulated to the SWG (other than an e-mail listing comments by Greg Christy on various items in the EIA report). The aid memoire further records that the terms of reference / objectives of the meeting were unclear.

Only at this meeting did the EAP concede that they were now required to obtain the expert opinion / comment from the SWG on information which their consultants had used and the conclusions which they had made. However, despite the fact that this project has been on going from at least 2007, they requested formal comments / recommendations from the SWG already by the 7 August 2011.

Apparently a further internal meeting was held on 4 July 2011 between select members of the SWG but for some unknown reason our client was not invited to such meeting. Our client would have wanted its own expert Dr Berg to make his own contributions regarding the issues at such meeting.

A further meeting was called for on the 8 July 2011 between the SWG and the EAP. Unfortunately and of grave concern to our client, two scientists who have been at the cutting edge of squid research Mike Roberts and Warwick Sauer were unable to attend the second meeting despite them informing the secretary that the date for the meeting conflicted with a conference on Climate Change which they were both involved with.

Response 6:

The EIA team does not have control over the composition of the Squid Working Group (SWG) in general or over the attendance of particular members of the SWG at specific meetings of this group. The EIA team requested a meeting with the SWG through Dr Jean Githaiga-Mwicigi, the convenor of this group and relied on the convenor to invite the members of the group. The EIA team does not have a mandate to invite individual members of the group to specific meetings. If the EIA team did that, it could be accused of manipulating the outcome of the meetings by inviting only members who may be in support of a finding of low impact from Nuclear-1. Thus the EIA team did not extend invites for this meeting directly to Prof. Sauer, Dr Roberts or to any other members of the SWG.

Prof. Sauer is on the Nuclear-1 interested and affected party database and has taken part in a number of key stakeholder meetings and public meetings in the Eastern Cape. As such he has been kept informed of the Nuclear-1 EIA process and could have responded in his personal capacity or raised his concerns through the Squid Working Group, of which he is a member. Dr Roberts is recognised as a widely published marine scientist and thus the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR) quotes from a number of his publications on marine ecology.

Comment 7:

Of further concern to our client is that at the meeting of 4 July 2011 it would appear that the agenda for the 8 July meeting was set and unbelievably certain aspects of the dumping of 6,3 million cubic metres of sand into the offshore environment was taken off the table as a discussion point and the main focus was on possible turbidity events. This is a key issue which requires much more investigation into its impact.

Response 7:

The agenda of Squid Working Group (SWG) meetings is controlled by the group itself and not by the members of the EIA team. The change in the agenda of the particular meeting was controlled by the SWG, which comprises most of the experts on this topic. . At the meeting the Nuclear-1 EIA team members were informed that the DAFF scientists deliberated the issue and felt that the placement spoil on the sea floor was not of grave concern with relation to the squid fishery due to its limited spatial extent. The SWG maintained that the turbidity related to this disposal required further consideration and this is being expanded on in further revisions of the Marine Ecology report.

Comment 8:

In any event from the *Aid Memoire* of the meeting held on the 8 July 2011 it would appear that there is still research to be undertaken by the SWG who must then submit a report and recommendations to the EAP by the 7 August 2011.

It is submitted that this time constraint on the SWG is wholly unreasonable taking into account the length of time this project has been on-going and the fact that the SWG should have been consulted properly years ago.

Response 8:

The Nuclear-1 marine ecology team contacted Dr. Mike Roberts, Dr. Jean Mwicigi, Dr. Hans Verhey, Ms. Nicola Downey and Prof. Warwick Sauer, all recognised marine ecology specialists, during the course of the Nuclear-1 EIA since the specialist's appointment in 2007. GIBB indicated to the SWG in a meeting held with them that they should not feel pressurised by time constraints and should submit comment as and when they can. The comment received by the SWG on the Revised Draft EIR (version 1) was received by GIBB and will be included in the IRR.

Comment 9:

In addition and more importantly, our client as the legally recognised industrial body in the squid industry, is entitled to be consulted on the SWG's report and recommendations prior to the submission thereof to the EAP. Furthermore it is submitted that in terms of Section 80 of the MLRA, in the event of our client being unhappy with any findings or recommendations reached by the SWG, our client will be entitled to appeal such findings. Pending the outcome of such appeal process where our client will be entitled to present its own expert evidence, the recommendations or findings of the SWG cannot be taken into account in any revised EIR.

In this regard our client's rights remain fully reserved.

As such our client must reserve its rights to supplement these comments once the scientific working group recommendations / findings have been finalised.

Response 9:

Your comment is noted.

It is to be noted that SASMIA is an observer member of the SWG and thus had ample opportunity to express its opinions at the various meetings of the SWG. These views will thus have been heard by and taken account of in the SWG comments to the Nuclear-1 EIA team.

Section 80 of the Marine Living Resources Act, 1998 (Act No. 18 of 1998) [MLRA] provides an opportunity for appeal against an administrative decision taken in terms of a delegation under that Act. As such, it is unclear how this right of appeal has a bearing on the SWG's inputs into the Nuclear-1 EIA process, as the SWG has not taken any administrative decision in terms of the MLRA for the Nuclear-1 EIA process. It is our understanding that the SWG is a scientific advisory body to the Department of Agriculture Forestry and Fisheries (DAFF) and therefore does not have administrative decision-making authority. Therefore, the nature of the SWG's inputs to the Nuclear-1 EIA process does not amount to an administrative decision under the MLRA.

Comment 10:

3. THE MARINE ECOLOGY REPORT

Firstly we deal with in summary fashion certain of the responses apparently from the appointed marine specialists to our client's previous comments contained in our letter dated the 30 June 2010.

Comments on marine specialist responses

Under general comments it is stated that "the main objective of the marine ecology report is to assess the potential impacts of the development on the marine biota and hence the squid as a species (a biological issue) and not the economic impacts on the fishery (an economic issue)." The specialists continue that "since squid occurs from Southern Namibia to approximately East London impacts which may have a significant negative impact on the fishery may have far less effect on the species." The specialist then states that his report should be read in this context and readers are referred to the economic report for details on the economic impacts.

This superficial distinction between the species and the fishery in our clients view causes a substantial flaw in the assessment of Thyspunt in the EIR. This is because the economic report relies heavily on certain aspects of the marine ecology report regarding its determinations on the economic impact the project will have on the squid sector. Therefore the down played conclusions regarding the overall effect on the species as found in the marine ecology report have fed into the economic report. This is clearly evidenced by the fact that the economic report only calculates losses based on a reduction of 1.8% of squid catchers due to the exclusion zone and the proposed dimensions of such zone. The economic report makes no provision for the potential huge losses of catches due to the dumping of spoil and the increased turbidity not to mention the temperature changes due to the outflow water.

In any event our client does not concede that the project and particularly the construction phase will have a minimal effect on the species as a whole.

Response 10:

Response by the marine ecology specialists:

We maintain our position that the marine ecology report is required to consider ecological impacts and is not focussed on impacts of the economics of the fishery, which is the domain of economists and not marine ecologists. Nevertheless we are going to great lengths (aided by valuable input from the Squid Working Group) to provide a clear indication of the potential impacts on the squid populations (not just the species) which are targeted by the fishery in the Thyspunt area and this is providing the data (such as percentage loss in catch) needed for a proper economic analysis.

Response by the Environmental Assessment Practitioner:

The Economic Impact Assessment (Appendix E17 of the Revised Draft EIR) has estimated the economic value of the impacts on the squid fishery, based on the findings of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR).

The Marine Ecology Report bases its assessment of the significance of the impacts on all potential sources of impact, including the marine exclusion zone, the release of warmed cooling water, the increase in turbidity in seawater and the disposal of spoil on the seafloor. However, the recommendations of this report are that spoil must be released at a disposal site deeper than the relatively shallow spawning grounds of chokka squid. This report found that the maximum suspended sediment concentration (based on a medium discharge rate of 2.06 m^3/s) is not expected to reach levels above the critical 80 mg/l (above which definite impacts can be expected) near the water surface at any time during or after spoil disposal and will be confined to less than 1.4km^2 near the seafloor. In addition, these turbidity levels will be temporally limited outside the

actual disposal site, occurring for a maximum of two days throughout the entire disposal period. Therefore, the impacts of increased turbidity on chokka squid are predicted to be very limited.

Furthermore, the Marine Ecology Report concluded, based on oceanographic modelling, that a near shore outfall for warmed cooling water would result in an average increase of 3ºC near the seabed over an area of roughly 0.2 km² (2 ha) around the outlets and an area of 0.7 km² will experience a maximum increase of 3ºC or more at any time. Given this limited spatial extent of impact, it is reasonable to conclude that the significance of the potential impact on chokka squid would be insignificant.

Comment 11:

Under the executive summary reference is made to the turbidity being mitigated by the reduction of pumping speed of the discarding of spoil. It is stated that by reducing the pumping speed the consequence and significant impact will go from high to medium. Our client does not concede this academic and untested conclusion. The clear fact of the matter is that over two tons per second of building spoil is going to be pumped out of the end of the disposal pipe and will in time cover the bottom environment. Even if a medium consequence and impact is accepted, in our view this is sufficient for the precautionary approach to apply and for the project to be abandoned at this site. We also point out that the engineering feasibility study has as not yet been proven and without this feasibility study our client cannot understand how these conclusions can be drawn in a vacuum.

Response 11:

Response by the marine ecology specialists:

Based on the assessment criteria provided to us, the change in pumping speed decreases the significance of the impact rating as it dramatically reduces the turbidity associated with the disposal process. SASMIA are referred to the PRDW Oceanographic Modelling / Coastal Engineering Report (Appendix E16 of the Revised Draft EIR) for details With regards to the impact on chokka squid. It must be borne in mind that spoil will be disposed at an offshore site deeper than the depths at which chokka squid spawn. Construction of a pipeline 6 km offshore will not be without its challenges but based on international experience with the construction of nuclear power stations, and liaison with construction and marine engineering companies, such a disposal system for spoil is considered feasible.
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Comment 12:

The marine experts responded further to say that the squid stock is currently well managed and not under threat from over exploitation and that as squid is mobile it can move great distances both along shore and offshore to avoid adverse conditions at a particular location.

Our client submits that whilst the stock is well managed, it is well managed on an eco-system basis and should an area in which at least 30% of squid catches are made be rendered unsuitable as a squid spawning ground, it is highly unlikely that this will not have a severe impact on the squid stock. There is no indication or research done as to whether or how long it will take for this stock to recover. Certainly from an economic point of view if the industry loses one season of profitable fishing many businesses particularly those with bank finance and mortgage bond repayments on their vessels may be liquidated. As mentioned previously the global economic climate and the strong rand has already impacted severely on the entire fishing industry including the squid sector.

Response 12:

Response by the marine ecology specialists:

The 30% figure quoted by SASMIA appears to have been calculated using only four selected vessels – a gross under-representation of the chokka squid fleet. Data for the same area provided by DAFF (i.e. the commercial database) showed that 14.7% of total catches are taken in the wider area (two quarter degree squares of approximately 22 x 27 km each) around the proposed site – itself a much larger area what will in fact be impacted. In this regard, please refer to Response 10, which indicates that the total area affected by a temperature increase of 3ºC or more will be less than 1km^2. In the current revision of the report the area potentially lost to the fishery (based on the commercial info provided by DAFF) is presented. While still under review, this figure ranges from 2.86% (worst-case scenario) to 2.53% (least-case scenario) to the fishery in the **local area** under question, and between 0.42% and 0.37% for the fishery as a whole. The 30 % figure used by SASMIA is therefore not supported by independent information on the total chokka squid fishery that has been provided by the DAFF and the SWG.

Comment 13:

Furthermore, the statement that squid occur from Southern Namibia to approximately East London misrepresents the position. The commercial harvesting of this species is only possible in a very small area off the Eastern Cape coast with the prime grounds falling on the coast of the proposed Thyspunt site. If these primary breeding grounds are destroyed or compromised it is not for the fishing industry simply to pick another area to fish from between East London and Southern Namibia. The industry is based in Port Elizabeth and St Francis Bay and there are no viable catching areas other than the very limited area within which the vessels currently catch. Our client also states that in its view the species of squid found in the southern Namibia area are most likely a sub species and not the same species of squid found off the Eastern Cape Coast. This is backed by current scientific research presently being undertaken by Dr Warwick Sauer. Furthermore the occasional occurrences of squid off East London does not accurately depict the extent of the resource in that area.

Response 13:

Response by the marine ecology specialists:

The overall distribution of the species (as clearly articulated in the wording of the report repeated above) is indeed quite different from that of the economically viable resource. The marine ecology report clearly acknowledges that and says that 'Coastal spawning is largely focused in shallow bays along the South African south coast (Augustyn 1991), with the most important coastal spawning grounds occurring between Plettenberg Bay and Algoa Bay (Downey et al. 2010). Recently there has also been recognition of offshore spawning grounds in the mid-shelf region of the eastern and central Agulhas Bank (Roberts and Mullon 2010)'. We acknowledge the comment regarding the potential distinction of a subspecies in southern Namibia and will contact Prof Sauer for confirmation of this. However, such a distinction does not change the conclusions of the report.

Comment 14:

The response continues to state that "while the initial disposal site will be lost as a breeding area to squid, the areas to which sediment spreads (the new habitat referred to in the submission) are unlikely to affect these animals as they lay eggs on both sandy bottoms and rocky reefs."

This response in our clients view highlights the complete lack of understanding of the squid species. Squid are very specific as to their breeding area and this is evidenced by the fact that they do not breed throughout the region and will only breed in specific grounds where our client's members catch the species. There are specific reasons why squid attach their eggs in this region and this point appears to be ignored by the marine specialists, or for some reason they do not deem it necessary to research further. Previously industry and research has shown that there are specific breeding areas where the sub-strata lends itself to the attachment of the egg pods. The "new" bottom environment will be dissimilar and perhaps more like loose gravel which can in no way support the same biotic environment. In fact Professor Griffiths mentions this in his report.

Response 14:

Response by the marine ecology specialists:

Taking into account discussions with the SWG this specific wording will be clarified in the final revision of the report. However the exact substratum on which squid in fact lay their eggs is not material to the way in which the impact has been calculated, since a 'worst case scenario' assumption has been applied that the entire region impacted by only 5mm of sediment will be lost as a breeding area. The loss of breeding area has been calculated on that basis.

Comment 15:

The crux of the matter is that the main area which is to be affected is the area with the highest catch per unit effort for the squid species. Data has been submitted to Professor Griffiths to prove this.

In the response (dated 20 July 2010) under study approach a statement is made that the marine ecology report made use of all appropriate information available.

This is denied as it is only recently after SWG meetings with the EAP that the EAP have accessed published scientific literature which now appears in the references of the revised EIR.

The response actually confirms this by stating further that the current review of the marine ecology report has been "offered the welcomed opportunity to include more recent references and the opinions of South African squid experts". With respect this should have been done years ago and a proper investigation conducted rather than a "rush job" immediately prior to comments having to be submitted on this latest revised EIR. This is again evidence of improper consultation with the relevant experts in the field.

Response 15:

Response by the marine ecology specialists:

The data provided to us by SASMIA reflects the catch positions of four vessels and does not reflect catch per unit effort. Much more complete data has been provided by the SWG. The comment about literature which is included in the report is unclear. While we included all literature we deemed

appropriate at the time in the version of the report currently in the public domain, the recent interaction with the SWG has provided further insight and literature that we are currently including in the revision of our report. The more recent data supports our conclusion that the impact will be minimal

Comment 16:

Furthermore, in the response a reference is made to the Koeberg experience. Firstly, the Koeberg power station is three times smaller than the proposed nuclear 1 and is in a completely different eco-environment. As such our client and other experts for that matter deem this comparison irrelevant.

The response concedes that no benthic surveys were done in the near shore environment with no sampling done whatsoever. It is submitted that this research was essential as the inshore will be effected by temperature changes, brine and chemicals from out flowing water whereas offshore will be effected through the sub tidal pipe which is proposed to extend 6 kilometres out to sea for the pumping of building spoil. Under the assumptions and limitations heading, the response states that "the impacts of spoil on the benthic environment and particularly on squid at Thyspunt have been clearly described and assessed in the report ….. "

This statement is simply untrue which is confirmed by the very recent and rushed purported consultation with the squid experts within the SWG who have not as yet even submitted a report to the EAP or the marine specialists.

Response 16:

Response by the marine ecology specialists:

As stated in our previous response to SASMIA, while there are obvious differences between the marine environments around Thyspunt and Koeberg Nuclear Power Station, these are taken into account. However, the Koeberg experience still provides an equivalent South African study as the KNPS uses similar technology (pressurised water reactor) to the proposed Nuclear-1 and the cooling systems work on the same principle, although the water volumes used for cooling will be greater at Nuclear-1. Monitoring at the KNPS is on-going, representing a large body of work over more than 20 years. It would be neglectful not to consider its findings and it is furthermore a requirement of the DEA that the Koeberg Nuclear Power Station experience should be considered.

Koeberg has a capacity of 1 800 MW, which is approximately half of Nuclear-1's generation capacity. Although the application for Nuclear-1 is for 4 000 MW, this is the maximum capacity to deal with the potentially different capacities provided by different vendors as there are a range of possible reactor configurations (e.g. three reactors of smaller capacity or two reactors of larger capacity).

It is not correct to say that no sampling was done as both rocky and sandy shores were sampled. Sampling of the nearshore is not useful at this stage as there has been relatively sparse sampling of the nearshore subtidal benthos off the South African coast and as such it would be almost impossible to say how representative the habitats present at each of the proposed Nuclear-1 sites might be. A list of benthic species that would be obtained by sampling would not serve to inform decision-making any better than the current information that is available. This is not considered a fatal flaw as:

(1) sufficient information relating to commercially important benthic resources exists to enable a scientifically rigorous evaluation the relative importance of the sites; and
(2) warmed cooling water from the proposed development will be concentrated near the surface and is unlikely to impact these habitats.

Therefore it is thus highly unlikely that benthic surveys would have revealed information that would influence the conclusions of this study. This approach has been endorsed by Professor GM Branch (Appendix 3 of the Marine Ecology Assessment).

Specifically with reference to squid there are also several published surveys that include this region.

Comment 17:

Regarding the comment that it is irresponsible of SASMIA to describe the impact of the spoil as "creating an undersea dessert or wasteland", this is exactly what has happened in the area which was used as a dumping ground in the Kouga[1] (sic) Project. It has negatively affected both the pelagic, squid and line fishery and it has been nicknamed as the "wastelands". This was a productive area before but no longer.

Response 17:

Response by the marine ecology specialists:

While the experiences of the fishing industry in the Coega Harbour area are acknowledged, this has not been scientifically documented and thus no hard data are available on which to base a comparison. The fact that a number of construction activities took place in the area, besides disposal of spoil, also means that it cannot be conclusively said that that spoil disposal is to blame. It was also noted at SWG meetings that the Niuclear-1 marine specialists attended that there has been no decline in the squid fishery subsequent to the Coega Harbour development.

Comment 18:

Regarding the proposed mitigation of the disposal of the sediment by reducing the pump speed as proposed in "alternative 6" even on this version it is admitted that there will be a 5 to 10 millimetres covering which will be "colonised by organisms". The response further states that "the communities supported here are however, expected to be different from original communities". Our interpretation of this is that they admit that the existing biota will be destroyed and there is no certainty as to what will take its place and how long this will take. They have in any event not done any transect studies to prove their assumptions.

Response 18:

Response by the marine ecology specialists:

The marine ecology report acknowledges that current biotic communities will be lost in the spoil disposal area. Biota will, however, recolonize the area through time. It is important to note that the spatial area affected by spoil disposal is limited. Sampling current biota would merely provide a species list and no information that could be used to predict recovery of communities or refine the

[1] Presumably with reference to Coega (also called the Port of Ngqura)

assessment of the potential impacts that are considered. The marine ecology report recommends that should Thyspunt be chosen for the placement of the proposed development, sampling be undertaken to track initial changes and recovery of communities through time. This would provide a valuable measure of this kind of disturbance in the south coast context.

Comment 19:

A further point is that in their response the specialists state that in this area there are "no species of special conservation status". This is blatantly untrue as both abalone and red steenbras exist in this marine environment and both enjoy maximum protection under our existing legislation. The non-disclosure of the existence of these species in the area further undermine the credibility and impartiality of the specialists.

Response 19:

Response by the marine ecology specialists:

The wording here implied that there are no species of special conservation status **restricted to, or with nationally significant populations in** this area and will be changed this. Both species indicated above have wide distributions with ranges over 1000 km long. While any abalone in the immediate localised vicinity of the outfall may be affected, steenbrass would be able to move out of the immediate site.

Comment 20:

Regarding the spread of sedimentation to Seal Bay it is submitted that contrary to the specialist response, alternative 6 states this clearly and our client accordingly refers you to your specialist's modelling.

Response 20:

The meaning of SASMIA's comment in this regard is unclear.

The Surf Breaks Addendum (Appendix I of the Revised Draft EIR) to the oceanographic modelling report predicts the distribution of sand on the ocean floor due to the off-shore disposal of spoil from the power station. This Addendum indicates that the disposal of spoil at a deep disposal site would result in a column of sand between 0.005 m (0.5 mm) and 0.01 m (1 cm) thick extending towards Seal Point from the deep offshore disposal site, with another small portion of spoil settling in the bay (at approximately 10m depth) between Seal Point and Cape St Francis five years after the disposal has taken place.

Comment 21:

In the response a reference is made to "recent communications with leading squid expert Dr W Sauer" where he allegedly indicated that "marked squid have been recorded spawning on various spawning grounds". Our client hereby requests a copy or record of such communications indicating exact dates and times of any meetings or telephone conversations and / or copies of e-mails.

In any event our client has never refuted that there may be multiple spawning grounds used. During specific environmental and seasonal conditions the squid will choose to spawn in an area, which means that when spawning occurs it does not occur all at once on all of the spawning grounds. They will only spawn on certain grounds which are suitable. However, what is uncontested is that they only spawn where conditions are perfect for spawning and that these perfect spawning conditions only occur in limited areas during certain time frames. This can be deduced from the fact that squid tend to come back to exact locations for spawning and hence the industry's reliance on GPS plotters. Our client further submits, and was supported by Dr Warrick Sauer at a recent SWG meeting held on the 20 June 2011, that although squid might choose another known breeding ground, the rate of successful spawning may be compromised due to competition. The SWG will confirm this submission.

Response 21:

Response by the marine ecology specialists:

As there is no dispute as to the facts (para 2 above) which are indeed published (Sauer *et al* 2000) and referred to in the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR), there is no need to release personal correspondence..

Comment 22:

Under the heading the release of cooling water, the specialist quotes the experience at Koeberg as a reason for not applying the precautionary approach in this case.

As stated previously Koeberg as a comparative is totally unacceptable due to the fact that the current plant will be three times the size of Koeberg with the environment and biozone around Koeberg being totally different. Furthermore, at Koeberg, the release of warmed water is based on completely different methods and technology, and in particular there are no squid spawning grounds in the surrounding Koeberg area.

In fact the revised marine ecology report states that "there is a complex interplay between a variety of factors such as dissolved oxygen, temperature, turbidity and swell size is thought to be important". It is submitted that due to this very "complexity" one is obliged environmentally and legally to adopt the precautionary approach and a more in depth study is mandatory.

Response 22:

Response by the marine ecology specialists:

At no point does the Marine Ecology Assessment suggest that the precautionary approach should not be applied and indeed a precautionary approach has been used, since a worst case scenario has been applied to the prediction of impacts (e.g. refer to Response 14). The relevance of the Koeberg experience is explained above in Response 16. The limited area in which significant changes in water temperature and turbidity are predicted to occur result in a more in-depth study being superfluous, as we are assuming the unlikely 'worst case scenario' that the affected area will be lost as a squid ground, However, even then the overall impacts on the species and on the fishery are minimal.

Response by the Environmental Assessment Practitioner

As indicated in Response 16, the generation capacity of Koeberg Nuclear Power Station (KNPS) is 1,800 MW, which is roughly half of that of the proposed Nuclear-1, since Nuclear-1's capacity will not be exactly 4,000 MW. The environmental application provides for a generating capacity of 4,000 MW maximum to cater for different reactor configurations, which will in effect be anywhere between 3,000 and 4,000 MW.

The KNPS experience with release of warmed cooling water is indeed relevant to Nuclear-1, since Nuclear-1 will be based on a Pressurised Water Reactor, the same as the KNPS. Although the KNPS's mechanism of release of cooling water is not exactly the same as the proposals for Nuclear-1, the KNPS experience provides valuable information on the impacts that can be expected from the release of warmed cooling water. It is, furthermore, a requirement of the Department of Environment Affairs that the EIA must assess environmental impacts with reference to the monitoring results obtained from the KNPS.

Comment 23:

The response furthermore acknowledges that the "area around Thyspunt is very important for the squid fishery". The marine specialist then continues "it needs to be remembered that it is the mandate of the marine specialist report to consider the impacts on the squid and not the fishery." This statement points to a fatal flaw in the marine ecology report. The squid resource and the fishery are inextricably linked and are managed as a whole. In fact as would have been apparent to the marine specialist had they properly consulted, the effort determination in the squid fishery is determined by the state of the resource. At this juncture one wonders whether the marine specialist has in fact perused the squid sector policy published in 2005 which sets out the main management principles for this resource.

From the industry point of view squid is targeted when it aggregates on in-shore spawning grounds and hence the fishing grounds and areas of catches correlate very closely to spawning grounds and spawning activities. Our client stresses that the spawning grounds in question being Thyspunt, Mosterts, Seal Bay and Oyster Bay have never been mapped or the extent of them studied by this marine ecology report. This should have been a vital focus on the marine ecology report but it has been ignored. There may well be some minor breeding occurrences which occur at certain times of the year in the far flung regions of Mossel Bay and Port Alfred but the primary and most consistent breeding area of this species is concentrated around Thyspunt. This is uncontestable.

The importance of this area for the fishery and therefore also for the fish stocks is made abundantly clear if one noted the percentage of catches taken 10 kilometres taken either side of the proposed outfall pipe (i.e. +/- 30 – 40%). The reason for the high abundance in this area and the consistency as to breeding and catching has not been fully analysed by this report. The risk of substantial damage to the fishery and the resource as a whole is too great for the precautionary principal (sic) not to be applied.

Our client does not accept that the impacts are "spatially and temporally limited – not posing an important threat to the species." This comment flies in the face of the previous assessment of the impact being of high consequence and significance which is only reduced to medium because of the pumping rate of sediment. This reduction in pumping rate so as to mitigate the high consequences has not been tested and an error on this issue has as a consequence the closing of an entire fishery supporting thousands of livelihoods in the Eastern Cape area. The bottom line is that the development is going to be under construction for 9 years (historical data on the

construction timeframes of nuclear power plants suggests much longer) and during this period there will be turbidity, sedimentation, severe disturbing of bottom strata and effluent pumped into the sea. After construction and during operational phase the sedimentation issue will still exist as the dumped spoil is not going to disappear. Furthermore during the operational phase turbidity could still be an issue depending on sea conditions, and cooling water discharge together with the brine and anti fouling chemicals will all have a negative impact. The impact during the construction and operational phase is unfortunately in the most productive squid breeding and catching area in South Africa.

Response 23:

Response by the marine ecology specialists:

While we are acquainted with the sector-specific and general fisheries polices guiding the management of the squid fishery, SASMIA is using the words 'squid resource' as a synonym for the species *Loligo reynaudii.* This is incorrect. While the species has a wide distribution, the squid industry is based in Port Elizabeth and St Francis Bay and targets the resource in these areas. The resource is that portion of the species which is able to support a fishery. Just because the cost vs. income of fishing in a certain area restricts the fishery does not mean that it restricts the distribution of the species.

The marine ecology should and does consider ecological issues, including the population status of squid. The impact this has on the economics of fishery is in fact an economic issue, and has been considered in turn in the Economic Impact Assessment (Appendix E17 of the Revised Draft EIR). Through consultation with the SWG, discussion on the exact location of the squid egg beds will be included in the current revision of the report for completeness sake. It should be noted that the spatial extent of the potential impacts is very limited (as shown in the report and presented at the SWG meeting where SASMIA was present). The data provided by DAFF is currently being used to calculate the area that may be impacted vs. the catch taken by the fishery in the area. While still under review, it appears that losses by the fishery in the area will range between 2.5 % (least-case scenario) to 2.9 % (worst-case scenario) and to the fishery as a whole between 0.42 % and 0.37 %.

Again we draw attention to the fact that the figures provided by SASMIA for percentages of catches made (30-40%) in the area are not factually correct. The independent figure provided by the SWG and the DAFF is 14.7 %. SASMIA was present at the SWG meeting at which this figure was provided and the 30 % figure quoted by SASMIA was refuted at this meeting.

As specialists we are required to use a predetermined assessment procedure when assessing impacts associated with the proposed development. Based on review by internationally experienced peer reviewers these criteria were changed for the Revised Draft EIR to make them more rigorous and consistent with international best practice. Based on current criteria, the various impacts assessed in the marine report can only be assessed as spatially and temporally limited – they are local in extent (i.e. limited to the site and the immediate surroundings within a 10 km radius) and some impacts (e.g. turbidity above 80ml/l) are expected to occur for less than a week.

The assessment has been done based on extensive oceanographic modelling (Appendix E16 of the Revised Draft EIR) and we have to base our analysis on those objective scientific data.

Comment 24:

The marine specialist seems to be taking the view that as long as the squid species is not made extinct or endangered through this project then the project does not have a significant impact on the resource. However, the economic report assumes that this means that if the species survives that the industry will also survive. This is clearly not the case and industry will confirm that it can take just one season of record low catches to close down many businesses in the sector.

Response 24:

Response by the marine ecology specialists:

The Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR) does not state that extinction or endangerment are criteria for measuring impacts of a specific development and it would be ridiculous to do so. Indeed the impact on the stock is discussed in detail (and will be expanded on further in the revised report based on additional inputs from SWG). The report thus deals mainly with impacts on the resource.

Comment 25:

It is unacceptable that the marine specialists use logistical, time and economic restraints as excuses for not doing detailed surveys of egg beds as the marine ecology report is the basis for the economic report regarding the squid industry, which could find itself closing should the project impact severely on catches. The marine ecology report should not have been prevented by time and economic constraints from doing this necessary research. This lack of research and lack of budget could have even costlier implications for the squid fishery.

Response 25:

Response by the marine ecology specialists:

Every environmental impact study and research project is constrained by time and money, but the report is based on far more than the research done specifically for this EIA. Indeed it draws on many man years of research on the taxonomy, biodiversity, distribution and ecology of marine species in the region, including a large amount of work specifically on squid. It should also be borne in mind that cost and effort need to be weighed against the value of the information that would be gained for decision-making.

Instead of doing new work as part of the current review we are liaising with the SWG and DAFF scientists who have worked in the area. We are applying a worst case scenario of assuming that all squid egg beds will be lost in the areas that will be directly impacted. By applying such a precautionary approach and working with a worst-case-scenario we are able to envelope the impacts and give them proper consideration without spending additional time and money on new studies that would not result in better information for decision-making.

Comment 26:

Regarding our client's comments on the suitability of the peer reviewer of the marine ecology report, our client maintains its viewpoint that it is not acceptable where a report could have such wide

ranging effects on social and economic conditions in a region that the reviewer is in the same department at the same university. Our client vehemently objects to this.

Revised marine ecology report

At the outset we submit that many of the comments and concerns of our client have been dealt with previously herein when dealing with the responses of the marine specialists and in addition are the same concerns set out in our previous letter dated 30 June 2010. As our client believes that its concerns and comments were not at all adequately dealt with either in the response from the marine specialists or in the revised marine ecology report, our client accordingly maintains its previous position on the marine ecology report.

In summary, our client objects to the assumptions, conclusions and ratings determined in the marine ecology report, and maintains that such report has been compiled without sufficient investigation into the effect of the proposed project on the squid stock. In particular the report has failed to take into account that 30-40% of the industry's catches occur in the area which will be impacted during the construction and operational phase of the project.

Response 26:

Response by the marine ecology specialists:

Your comment is noted and indeed the key sections of the report that deal with squid have now been through an extremely rigorous review, by not the usual one or two, but a whole team of squid researchers, in the form of the SWG. This goes far beyond the usual scientific review process.

As indicated in other responses above the figure of 30-40 % of industry catches quoted by SASMIA is not supported by the DAFF's independent figures or by the SWG.

Comment 27:

The report in essence attempts to motivate that there will be a limited impact on the overall squid stock due to the fact that squid occurs naturally over a large area from East London up to Southern Namibia but ignores the fact that the viability of the squid fishery depends on the spawning and catches of squid in the area directly impacted in the construction and operational phase of the project.

The thrust of the marine ecology report's submissions can be summarised in a statement contained in the executive summary which reads as follows:

"The temporal and spatial limitations of the impacts associated with the disposal of soil on Chokka Squid at Thyspunt will have limited impact on the overall squid stock, when taken within the context of the extensive area over which this species spawns."

Response 27:

Response by the marine ecology specialists:

Your comments are noted. However, we maintain our position based on the objective scientific evidence available. In the current revision we will provide greater clarity to show how the impacts are limited through time and space. It is surprising that SASMIA still holds this view after attending

the detailed presentations made at the SWG meeting, which made it quite clear that the impact would be limited.

Comment 28:

On the marine experts own version it is conceded that "when associated with the discarding of spoil, disruption to the marine environment is significant." Their only mitigation which they feel reduces the significance of the disposal of spoil is a medium pumping rate. Even on their own version with a medium pumping rate the impact is reduced to medium consequence and medium significance. It is also conceded by the report that the impact will be at least 10 kilometres either side of the outlet pipe although our client argues that due to current and wave action this area will be further extended.

Response 28:

Response by the marine ecology specialists:

In the area where spoil will be deposited the impact will be significant, this has never been disputed. However, when the assessment criteria are applied, the spatial and temporal aspects of the impact result in the assessment rating provided in the report. Nowhere in the report does it say that the impact will be at least 10 kilometres either side of the outlet pipe. Maybe SASMIA is misconstruing the meaning of the extent rating applied. The rating of this impact criteria is given as Medium, this is defined as 'Local (limited to the site and its immediate surroundings including the surrounding towns and settlements within a 10km radius)'. This means that the extend of the impact is greater than the development footprint (Low rating) but will not exceed a 10 km radius. In the report details of the impact are given and the extent is in fact much less than 10km but as it falls outside the development footprint the extend rating is correctly given as medium.

Comment 29:

Furthermore regarding the release of warm water used for cooling purposes, it is conceded by the report that the water temperatures which are elevated above the thermal tolerance range of squid will cause the squid to avoid the area. Without any proper research the report then assumes that this affected area represents less than 1% of the coastal spawning ground. While we disagree with such percentage and put the scientists to the proof thereof, our client also states that whilst there may be other spawning grounds for squid this is the primary spawning ground which supports catches which in turn allow for a viable squid industry.

The report in terms has admitted that it focuses on the survival of the species rather than the fishery. Therefore, yes the squid species may survive notwithstanding the project but it is our client's view that the viable squid fishery will not survive as the project will effectively wipe out the prime catching area. What follows is our clients summarised concerns and queries regarding the balance of the revised marine ecology report.

Response 29:

Response by the marine ecology specialists:

The figure of 1% is based on published work by Dr Mike Roberts, one of the scientists that SASMIA acknowledges in Comment 6 as being 'at the cutting edge of squid research'. This figure has been

backed by information provided by DAFF at the SWG meetings. Reference to the SWG meetings will be included in the revision of the marine ecology report. Note also that the warmed water is less dense and then rises to the surface, so has little or no effect on organisms deeper in the water column or on the bottom, such as squid.

The Marine Ecology Assessment does consider the stock, not only the species and its findings are that the impacts on the catching area around Thyspunt are minimal.

Comment 30*:*

"Study approach"

As stated previously the reference and reliance on Koeberg to offer insight into possible impacts is objected to as the proposed plant is three times the size of Koeberg with water intakes, outflows, spoil discharges and design entirely different. Furthermore the proposed project at Thyspunt is also in a totally different marine eco-system.

Response 30:

Your comment and previous comments regarding Nuclear Power Station (KNPS) are noted. Please refer to Responses 16 and 22 above.

Comment 31:

Regarding the listed marine experts which have now been inserted in the revised version of the report, our client poses a question whether such experts were actually consulted in the true meaning of the word or merely interacted with informally. Our client requests copies of all correspondence to such experts and their replies thereto together with any other documentation generated during this so called consultation process.

Response 31:

Response by the marine ecology specialists:

These and other squid researchers have not only been extensively consulted, but directly involved in providing detailed inputs to the report. As SASMIA were present at the meetings of the SWG, of which these researchers are members, SASMIA is aware that the report has been reviewed by the squid research community and that the findings of the report are consistent with scientific data and information.

Comment 32:

Our client is of the further view that three months of field surveys between August and September 2007 spread over three different sites is wholly insufficient bearing in mind the potential impact of this project.

Response 32:

Response by the marine ecology specialists:

Sampling is not the only form of research that offers insight into the ecological issues surrounding this development. As explained above sufficient sampling has been undertaken and when combined with extensive research into the South African and international scientific literature, this enables a high level comparison of impacts between the three sites and assessment of the potential impacts. It is clearly stated in section 5.5.2 of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR) that in depth sampling and monitoring programs be instituted at the selected site prior to the commencement of the proposed development. This would enable monitoring of both changes in biological communities and future recovery thereof.

Comment 33:

Furthermore in the study approach there is no mention of any offshore study done. This is another omission in the marine ecology report.

Response 33:

Your comment is noted. Please refer to Response 18.

Comment 34:

"Assumptions and limitations"

Regarding the proposed exclusion zone our client has been advised that they will have to be in accordance with international norms and any promises by Eskom as to special concessions are therefore misleading and are falsely raising expectations.

There is also a reference that if disposal constraints are not met then there will be a "refinement of current models". It would appear that already at this stage there is an expectation that the disposal of spoil at sea may not be within the constraints set. The problem with refining the current models at the stage when the constraints have not been met is that the proverbial "horse would have bolted" and the damage done to the marine environment. Accordingly the refinement of current models regarding disposal should be finalised now prior to the submission of the EIA as this could change impact ratings and significance levels.

Response 34:

Response by the marine ecology specialists

Section 1.2.1 of the Marine Ecology Assessment says that the current assessment is based on the oceanographic modelling of spoil disposal. As this model only holds within the limitations of the parameter currently considered (i.e. exact location of disposal site, the volume to be disposed, etc.) should any of these parameters be changed later the current assessment would no longer be applicable. The wording of this section will be clarified but it is providing a safety net, not an opportunity for the applicant to change its design.

Response by the Environmental Assessment Practitioner

As indicated by Item 3.20.3 of the Revised Draft EIR, the size of the marine exclusion zone will be determined by the National Intelligence Agency in terms of the National Key Points Act, 1980 (Act No. 102 of 1980). This exclusion zone is, therefore, not dependent on any international standards.

Should an environmental authorisation be issued to Eskom, it would bind Eskom to the parameters, assumptions and limitations currently considered as they authorisation is issued for a particular design as specified in the EIR. Should any of the key assumptions in the EIR prove to be incorrect, then the EIR would cease to be valid and a re-assessment would need to be undertaken based on the new facts.

Comment 35:

As regards the technical feasibility study which is apparently underway regarding spoil disposal options, this needs to be finalised and scrutinised prior to any marine ecology report being completed as it may also affect the impact levels substantially.

Response 35:

This has been finalised with no technical flaws being found (Eskom 2011).

Comment 36:

"Description of affected environment"

It would appear that the only study relied on is one by Jackson & Lipschitz of 1984 and our client poses the question whether any more recent studies have been undertaken.

Response 36:

Response by the marine ecology specialists

In the section describing the affected environment at Thyspunt the Marine Ecology Assessment makes use of 15 studies ranging in date from 1984 to 2010. All these references are fully referenced in the report.

Comment 37:

"Benthic environment"

With regard to this environment, our client submits that there has been no mention of any recent studies done and that this is a vital zone with regard to this project. In particular the fact that there is no mention of abalone suggests that this zone has not been fully studied or investigated by the specialists.

Response 37:

Response by the marine ecology specialists

The fact that the benthic information was collected in 1988 does not render it any less useful. The current revision of the study will reflect the presence of abalone.

Comment 38:

"The open water environment"

The specialists quote a report by Dr Augustyn of 1989 regarding the occurrence of the squid species from Southern Namibia to East London. This report is 22 years old and our client poses the question whether this study has in fact been replaced and in particular by Warrick Sauers later study. On the strengths of Dr Warwick Sauers study our client submits that in its view the species found up the West Coast may in fact be a sub-species of squid.

Response 38:

Response by the marine ecology specialists

As Prof Sauer's study has not been published he will be contacted for comment and the Marine Ecology Assessment will be amended as necessary. Whether the west coast species is genetically distinct or not is, however, not central to the question of whether this development will impact significantly on the South Coast stock, which is the key issue addressed here.

Comment 39:

Regarding egg laying, it is not strictly accurate to say that squid lay their eggs on the bottoms of "relatively large sheltered bays". They do lay eggs in other areas other than such bays. Thyspunt is in fact outside of both Oyster Bay and Kromme Bay.

Response 39:

Response by the marine ecology specialists

Your comment is noted. The Marine Ecology Assessment says 'spawning is **largely** focused in shallow bays along the South African south coast'. This agrees with the comment above that other areas are also used for spawning.

Comment 40:

Regarding the report of Roberts and Moulon our client submits that while the area from Plettenberg Bay to Port Alfred might be the extent of the catching area, the central and primary area of the industry is a much narrower defined area which centres around Thyspunt.

Response 40:

Response by the marine ecology specialists

The industry derived data provided to us by the DAFF agrees with Roberts & Moulon (2010) and shows that 14.7% of catches are taken in the area immediately surrounding Thyspunt. This will be elaborated on in the current revision of the report.

Comment 41:

Our client also submits that there is no reference to any effects in the open water environment to pelagic fish. Our client raises this concern because there is a growing pilchard fishery with vessels operating out of Port St Francis. This fishery may also be severely impacted the further offshore the spoil outfall pipe is placed during the construction phase.

Response 41:

Response by the marine ecology specialists

Your comment is noted. The limited spatial and temporal extent of turbidity related to spoil disposal and the fact that pilchard catches are not taken in the immediate area negates any significant impact on the pilchard fishery.

Comment 42:

Furthermore, the report also omits to confirm that whales and dolphins are seasonally in abundance in this area to the extent that a whale watching permit has been issued to an operator out of Port St Francis. The spoil disposal and construction of the pipelines in our clients view could have a major impact on the migration routes of these marine mammals especially as this point is the second furthest point in Africa.

Response 42:

Response by the marine ecology specialists

Marine mammals are dealt with in section 2.3.4 of the report. The occurrence of whales and dolphins around the Thyspunt site is dealt with this section of the report.

Comment 43:

"Disruption of the marine environment during construction"

This part of the report concedes that during the construction period there will be a severe localised disruption to the marine environment. The report concedes further that under these circumstances the benthic habitat and in particular egg beds of the Chokka Squid are at risk of damage due to smothering, while turbidity will result in adults temporarily moving out of the area. The report confirms further that this disturbance will be focused within the construction phase (i.e. 9 years) and is likely to be "localised and of short duration". History shows that the construction period of nuclear power plants have always considerably exceeded original estimates.

The report continues to state that "the discarding of an estimated 6.37 million cubic meters of spoil from the excavation of the nuclear island, turbine hall and contractors yards fill poses a threat to the marine environment". Furthermore, "both the physical and biological marine environment would be affected". Therefore on the specialists own version this is an absolute given and it is just the extent of the disruption which is in debate.

The report further confirms that such impacts would occur due to “the increased turbidity in the water column as a result of the suspension of fine particles and due to the smothering of benthic habitat”.

After making these concessions the report tries to downplay the effect of the disposal of 6.3 million cubic meters of spoil by posing different discharge rates. The marine specialists apparently recommend alternatives 5 and 6 as the suspended sediment concentration is not expected to reach levels above 80mg/l near the water surface at any time during, or after disposal. Regarding turbidity levels of 80mg/l, this must be compared to the natural average of only 5mg/l. Our Client has requested that the modelling depicts the turbidity level modelling depicting turbidity levels of 10mg/l >. These modelling results have still not been presented.

The report continues to state that at using these alternatives the turbidity levels will be very temporally limited outside the actual disposal site appearing for a maximum of two days throughout the entire disposal period. As the construction of the project is over a period of 9 years (at the very least) we place in dispute this estimate and consequent downplaying of the effect of the disposal of building spoil into the ocean. The uncertainty as to the effects of this occurrence call out for the application of the precautionary approach.

Response 43:

Response by the marine ecology specialists

The comments as given above are loaded with inferences and innuendo (‘concede that’, ‘downplay’ etc.). From a scientific point of view such inferences are regrettable. The authors of the Marine Ecology Assessment have attempted to provide an unbiased analysis, based on the scientific information provided by experts, including other consultants in the team.

The Marine Ecology Assessment has always been clear about the impacts associated with the construction phase and a large project like this will always have impacts (which have to be evaluated against the benefits gained). The EIA team would be legally amiss if we did not recommend mitigation measures wherever possible.

There are two aspects to the potential impact of spoil disposal that need to be understood. Firstly, the actual deposition of the sediment on the seafloor and secondly, the turbidity associated with the disposal process. As described in our report the deposition of the spoil can only be mitigated by disposing the spoil deeper than 50m so as to avoid squid spawning sites. Hence the marine ecology report does not consider disposal at a shallower site where it would impact on squid spawning grounds. The elevated turbidity can in turn be mitigated by reducing the pumping speed, hence the recommendation in our report.

It should be noted that as was pointed out by Dr Robinson at the SWG meeting held on 2 August 2011, the background turbidity level of 5mg/l was measured at depths of 5-30m. As the area under question is much deeper (84m) this figure may not be representative of the true background turbidity. The consultants are currently awaiting information on background turbidity levels at the appropriate depth from Dr Mwicigi of DAFF.

The level of 80 mg/l is referred to since this has previously been identified as a threshold above which probable adverse ecological effects will occur, while 100 mg/l has been used as a critical value above which proven negative impacts will occur. Nevertheless, information regarding the extent of turbidity levels lower than 80mg/l is in the process of being generated by the

oceanographic modellers and will be included in the current revision of the Marine Ecology Assessment.

As explained at the final SWG meeting, pumping of spoil will be continuous and will be completed in 143 days if Alternative 5 is chosen and 72 days if Alternative 6 is chosen. Should SASMIA have any scientific basis to question expert modelling conclusion that turbidity will only rise above 80 mg/l for two days during this time, the EIA team would amend its reports accordingly. To assert otherwise is purely speculative.

Comment 44:

On the marine specialists own version "following disposal on the sea floor roughly three metres of sediment will cover an area of 1.5 or 3 kilometres squared depending on whether only half or the full volume of the sediment is disposed of." Three meters is about one story high over an area of three kilometres squared. Over the next 10 years this spoil is going to spread. The report admits that while the initial disposal site will be lost as a breeding area to squid, "the areas to which sediment spreads is unlikely to affect the squid permanently as they lay eggs on both sand bottoms and rocky reefs". The word "unlikely" is used which in our client's view shows a strong element of doubt. The report presupposes that because the squid lay eggs on sandy bottoms and rocky reefs they should also lay eggs on the new sea bed covered with building spoil. Building spoil is completely different in make up to the current sea bed. Therefore this assumption is untested and for a marine specialist to simply make this conclusion is irresponsible not to mention unethical.

The words "unlikely to affect squid permanently" are also used. Thus according to the report, the areas to which the sediment spreads are definitely going to affect the squid negatively but not permanently. No time period is given for any such recovery which is a further ground for the precautionary approach to be applied. Perhaps the marine specialist is hoping that after say ten years the squid in this affected area will recover, however by that time the squid industry would have been long ago decimated by the impact on its prime catching area.

In particular our client vehemently denies the assumption that "the inshore jig fishery is unlikely to be greatly affected by the disposal of spoil as only a small portion of catches are taken in the area expected to be impacted." Our clients have stated categorically that between 30-40% of their catches are caught in the area impacted. It is highly unethical and irresponsible for the marine specialist who has stated that he is only analysing the species and not the fishing industry to state in his report that it is unlikely that the jig fishery is to be greatly affected by the disposal of spoil.

It is further irresponsible for the marine specialist to state that although the species will be affected "recovery is expected once the benthic community re-establishes." After the disposal of soil there will be a completely different benthic environment and it is highly unlikely that squid who require special conditions for laying eggs will return to this area. In any event how long will it take for them to recover? The industry does not have the resources to compromise its fishing for 9 years or even one year or six months for that matter.

Response 44:

Your comments are noted.

Response by the marine ecology specialists

Firstly it is important to note that it is not building spoil that will be disposed of and the sediment is not totally different to what is already there. As has been stated in the Marine Ecology Assessment, the oceanographic modelling report considers the fate of the spoil in the marine environment and as was explained at the SWG meetings that SASMIA attended on 20 June, 8 July and 2 August 2011), the sediment that will be disposed of will come from the dune sands that will need to be excavated during the construction phase – not building rubble. The median grain size of sediment to be disposed is 0.23 mm. Data collected at Thyspunt as part of the Site Safety Study at Thyspunt (PRDW 2009) has shown that naturally occurring sediments in the area have a median grain size ranging from 0.17 mm to 0.58 mm. The fact that we apply a precautionary approach is evident in the fact that we bring attention to the fact that despite similarities in median grain size, the habitat offered by the spoil will be dissimilar to natural sediments as at it will not be consolidated with a rippled veneer as is the current benthic sediment (based on sidescan sonar measurements).

It is not possible to give an exact figure with regards to recovery time. The fact that it will occur in the long term is certain. This is reflected in the duration of this impact being rated as High (i.e. more than 15 years to permanent). Please note there are two aspects to this impact: the recovery of the area where spoil is placed on the one hand (which will be of long duration) and increased turbidity (which will be of short duration). This distinction will be clarified in the current revision in the report.

The area chosen for spoil disposal was particularly chosen so as to avoid the inshore area that is most important to the fishery.

Again we point out that the figure provided by SASMIA of 30-40% of catches which come from the area under question is exaggerated. The figure provided independently by the DAFF is 14.7%. In this regard please refer to Responses 14, 23 and 40.

It should be noted that the 3km² where spoil will be placed is much deeper (84m) than the area fished by the fishery (shallower than 50m). As a worst-case-scenario, the area to which to the spoil has been modelled to move in 10 years represents an area accounting for only 2% of catches taken in the immediate area, and 0.3% of catches taken by the fishery as whole. Should any new figures be provided by DAFF in the course of amending the Marine Ecology Report they will be reflected accordingly.

Comment 45:

"Abstraction of cooling water"

The report concedes that squid will be impacted by the release of warm cooling water. It admits further that adults will avoid the area and there will be a certain amount of egg mortality. However, the report incorrectly states that only 1% of the coastal spawning ground centred between Plettenberg Bay and Port Alfred will be affected. This is an unsubstantiated remark. Whilst there are other spawning grounds in the area mentioned, the spawning ground at Thyspunt is the prime spawning ground for squid and once this area is eliminated a viable squid fishing industry will be eliminated simultaneously. The report simply assumes that adults will avoid the warm water plume and move to other spawning grounds. If this is true how will the squid fishing industry react to this? Squid industry records depict catches in certain areas at certain times year after year. If this project goes ahead the entire squid fishery and the management of the resource will be severely affected, and in all likelihood rendered unviable.

Response 45:

Response by the marine ecology specialists

The figure from the Marine Ecology Assessment is not unsubstantiated as it is based on the work by Dr Mike Roberts (i.e. Roberts Moulon (2010) as referenced in the report). This has also been backed by industry derived data provided by DAFF. Consultation with Prof Warwick Sauer, a scientist that SASMIA recognises as 'at the cutting edge of squid research') indicated that any squid that avoid the plume will move to other spawning grounds, rendering the impact of little overall significance to the species or to the fishery. In order to aid the assessment of impacts on the fishery, the current revision of the marine ecology report will provide a cumulative measure of catches that may be lost to the industry based on commercial data provided by DAFF.

Comment 46:

"Closure of the site to exploitation"

The closed zones are not the main issue which needs to be assed (*assessed?*) (sic). The environment which is no longer suitable for squid catching due to changes in the benthic environment over a large area is of importance and has not been properly investigated and in a sense ignored.

Furthermore, as stated previously, although Eskom appears to be proposing a smaller exclusion zone, these zones are apparently governed by international standards and Eskom may not have the required control to give such guarantees.

Response 46:

Response by the marine ecology specialists

As indicated in several responses above, figures provided by the DAFF and the SWG show that predicted losses to the fishery in the immediate area around Thyspunt range from 2.53 % to 2.86 % while losses to the fishery as a whole are expected to be in the range of 0.37% to 0.42% for the fishery as a whole. These figures will be reflected in the revision of the Marine Ecology Assessment.

Response by the Environmental Assessment Practitioner

As indicated by Item 3.20.3 of the Revised Draft EIR, the size of the marine exclusion zone will be determined by the National Intelligence Agency in terms of the National Key Points Act, 1980 (Act No. 102 of 1980). The size of this exclusion zone is, therefore, not dependent on international standards.

Comment 47:

"Relevant legislation"

Regarding relevant legislation a glaring omission is the Marine Living Resources Act of 1998 ("MLRA") which is not referred to. With regard to marine living resources (e.g. squid), the MLRA in fact takes precedence over other legislation. This is of vital importance to our client in that in

Section 2(c) of the act it states “the need to apply precautionary approaches in respect of the management and development of marine living resources”.

Even on the marine specialists own version, there is going to be a significant effect on the squid species in the area concerned which in turn will have a knock on effect on the management of such resource. The precautionary approach will have to be applied in the circumstances.

Response 47:

Response by the marine ecology specialists

The Marine Ecology Assessment does not indicate there will be a significant effect on the squid species as a whole. As indicated in our above responses all the impacts are localised and not of threat to the species. With regard to the implications for management of the resource, the current revision of the report will be guided by the recommendations of the SWG. However, it should be borne in mind that the Marine Ecology Assessment has no input into the management of the squid resource. As such this report is guided primarily by the overarching legal framework of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA], in terms of which the Nuclear-1 EIA process is being conducted.

Response by the Environmental Assessment Practitioner

The MLRA is referred to in section 6.4.10 of the Revised Draft EIR.

Section 2(4)(a) of the NEMA similarly requires that “sustainable development requires the consideration of all relevant factors, including the following:
(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions”. This is similar to the MLRA’s requirement that a precautionary approach should be followed.

It is for this very reason that the Marine Ecology Assessment and other assessments have, where relevant, assumed a “worst case scenario” impact. The application of the worst case scenario assumption to the assessment of marine impacts is referenced in several responses above.

With regards to your assertion that that MLRA takes precedence over any other Act, it is presumed that you refer to Section 4 of the MLRA, which states “*If any conflict relating to marine living resources dealt with in this Act arises between this Act and the provisions of any other law, save the Constitution or any Act expressly amending this Act, the provisions of this Act shall prevail.*” It is to be noted that the precedence of the MLRA is context-specific, as it relates expressly to a matter regarding marine living resources dealt with in the MLRA. Such precedence does not extend to all forms of decision-making regarding activities in the marine environment. It is to be noted that Section 4 of the MLRA does not confer power on the DAFF to overturn a decision taken by an environmental decision-making authority that has been delegated to it in terms of NEMA. However, in reaching a decision on the application for EIA authorisation, the DEA is required to consult with other departments such as the DAFF. Section 24O(2) of NEMA requires the Minister and an MEC or identified competent authority to “*consult with every State department that administers a law relating to a matter affecting the environment when he or she considers an application for an environmental authorisation*.”

Comment 48:

"Mitigation measures"

Our client notes that there will definitely be impacts during the construction phase and would like to point out that this construction phase is a period on nine years at least and any recovery referred to will only occur after such nine year period if it does in fact occur. The report again admits that the discarding of the building spoil will act over the "long term". However, the marine specialist is of the belief without any testing or research that a medium pumping velocity will mitigate against the severe impact on the benthic environment. In addition the engineering feasibility study has still not been completed regarding the disposal of the building spoil and this may in fact impact on this part of the environmental assessment.

Regarding the purported mitigation of pumping the spoil into a deeper area, our client is of the view that this does not change the fact that huge volumes of spoil is being pumped out into the ocean and will ultimately settle on the sea bed and effect the benthic environment.

Response 48:

Response by the marine ecology specialists

As explained in previous responses, and to Mr Christy at the SWG meeting that took place on 20 June, 8 July and 2 August 2011, the reduction in pumping velocity during the disposal of spoil does not affect the total volume of spoil. What it does mitigate is how much turbidity is released into the water column. As turbidity is a concern with regards to the formation of spawning aggregations, the marine ecology specialists recommended that a reduction in the pumping speed is a vitally important mitigation measure. Applying the precautionary approach requires that turbidity be minimised, hence reduced pumping is recommended by the specialists.

Should SASMIA have any verified evidence that contradicts the findings of the very detailed oceanographic modelling that was done to investigate the fate of the discarded spoil, this would be considered by the EIA team and if necessary the EIR and relevant specialist studies would be revised. If SASMIA can raise specific concerns then these can be answered by the scientists who completed the work.

Comment 49:

"Monitoring and evaluation programmes"

It is submitted that the research and sampling of the benthic and inter tidal habitats in the area should actually be conducted now at EIR stage rather than before construction or after construction when it will be too late. It is also submitted that these studies should also be conducted from Oyster Bay to Seal Bay.

Response 49:

Response by the marine ecology specialists

As stated in Response 16 above: Sampling of the nearshore is not useful at this stage as there has been relatively sparse sampling of the nearshore subtidal benthos off the South African coast and as such it would be almost impossible to say how representative the habitats present at each of the

proposed Nuclear-1 sites might be. A list of benthic species that would be obtained by sampling would not serve to inform decision-making any better than the current information that is available. This is not considered a fatal flaw as:
(1) sufficient information relating to commercially important benthic resources exists to enable a scientifically rigorous evaluation the relative importance of the sites; and
(2) warmed cooling water from the proposed development will be concentrated near the surface and is unlikely to impact these habitats.

It is thus highly unlikely that benthic surveys would have revealed information that would influence the conclusions of this study. This approached has been endorsed by Professor GM Branch (Appendix 3 of the Marine Ecology Assessment).

The location of the sampling undertaken at the chosen site will include areas which will be affected as well as control areas for comparative purposes. Should Thyspunt be the site chosen, it would be recommended that the area between Oyster Bay and Seal Bay should be included.

Comment 50:

"Conclusions and recommendations"

Our client again denies that the disposal of the spoil will result in little potential impact on the squid and that the inshore jig fishery is unlikely to be seriously affected. These conclusions have not been properly investigated. The report refuses to address that this is a major spawning ground which is consistently producing egg beds and is the most important area in the viability of the species and the industry.

Response 50:

Your comment is noted. Please refer to Responses 7, 14, 15, 23, 25 and 27.

Comment 51:

Our client again also denies the statement that the elevated water temperatures will only affect less than a percent of the coastal spawning ground. Furthermore it is submitted that the conclusions fail to address the possibility of the effects of chemicals which would be added to the cooling water to stop entrainment and growth on the intake and heat exchanges. No quantification of the chemical concentrations have been given and we would presume that there must be some international standards which should apply.

Finally regarding the revised marine ecology report we note that it is date (sic) the 24 March 2011. This is long before the meetings held with the SWG commencing on the 20 June 2011. Accordingly the marine specialists have reached their conclusions on the effect of the project on the squid species and fishery without having properly consulted those responsible for the management of the fishery.

Response 51:

Your comment regarding the size of the area to be impacted is noted. Please see Responses 12, 23, 29 and 45.

Please refer to Response 8 regarding the dates since when marine scientists, who serve on the SWG, have been consulted.

Comment 52:

4. THE ECONOMIC REPORT

Response by EAP to letter dated 30 June 2010

The response by the EAP to clients' previous representations on the 30 June 2010 relating to the economic impact assessment report are minimal to non-existant. Either they merely note our comments or state that:

"the economic and marine assessment are being revised and omissions, if found will be addressed in the revised reports. The revised reports together with the revised draft EIR will again be made available for public review and comment."

Response 52:

Your comment is noted. The Economic Impact Assessment (Appendix E17 of the Revised Draft EIR) was revised in response to the comments received in 2010 and includes a quantification of the impacts on the fishing industry.

Comment 53:

Furthermore, an interesting and staggering response relating to the market perceptions of a fishing ground near a nuclear plant is made as follows:

"One needs to consider why the same negative market perceptions not applied in the case of fresh produce grown around nuclear power stations in France, for example? At the Koeberg nuclear power station, vessels trespass into the exclusion zone from time to time to catch fish in the proximity of an outflow pipe. The economic specialists stand by their argument that perceptions can be overcome by appropriate marketing using scientific evidence."

The very superficiality and naivety of this comment in our view illustrates the biased attitude of the authors of the economic report. Clearly these specialists have done little to no research on this marketing aspect. For instance we reiterate that the specialist has not approached overseas agents and markets to establish this viewpoint and furthermore has not properly interviewed the major exporters of squid in South Africa.

In this regard it is submitted that our comments on this aspect stand along with our other comments on the report.

Response 53:

The quoted comment from the Economic Impact Assessment is borne out by the fact that organic wine farming takes place within sight of the Koeberg Nuclear Power Station with no apparent negative impact caused by proximity to the power station.

Comment 54:

A further quote from the response is as follows:

"In compiling the economic report a discussion with a marine specialist, during which no fatal flaw for the economic study was indicated, was taken into account. No more work could be done with the information that was available at the time."

It is submitted, in this event, that either the marine ecologist or the economic specialist chose to ignore the severe effect of the disposal of 6.3 million cubic metres of building spoil on prime fishing grounds and the potential loss of income to be caused to the fishing industry. This loss of income is not reflected at all in the revised economic report. It is a glaring omission.

Revised Economic Report

It is submitted that the economic report has not been substantially revised as undertaken in the response by the EAP to our letter dated 30 June 2010. Due to the very few changes made to the economic report, our client simply refers the EAP to the comments made previously on the economic report in its letter dated 30 June 2010 and request that they be incorporated by reference.

Response 54:

Your comment is noted. Please refer to Responses 7, 14, 15, 23, 25 and 27 above. These responses and the Marine Ecology Assessment (Appendix E15 of the revised Draft EIR) clearly indicate that the impacts of spoil disposal will be minimal, provided that the recommended depth of disposal, distance of disposal from shore and a medium pumping rate are maintained.

The estimated economic impact on the fishing industry is assessed in section 3.2.1.3.10 of the Economic Impact Assessment (Appendix E17 of the Revised Draft EIR). The Economic Impact Assessment has been substantially revised since 2010, based on the revisions to the Marine Impact Assessment and other specialist assessments.

Comment 55:

Furthermore, our client raises the following further points:

Under paragraph 2.1.4 the specialist references to information in this section being drawn from an interview with the largest commercial fishing company in Port St Francis, interviewers with researchers at marine and coastal management and the report of the South African Squid Management Industrial Association dated 2007;

Firstly the scope of the economic study should not be a twenty kilometer radius from the site but should include Port Elizabeth where the largest percentage of squid vessels operate from and where there are further processing factories and infrastructure relating to the industry. These vessels also fish in the affected area and as such the economic impact will be felt not only in the twenty kilometre radius of the site but also in the Port Elizabeth area. The specialist should also have interviewed some of the other major squid fishing companies based in Port Elizabeth to get a more detailed understanding of the squid fishing industry. In this regard the report lacks necessary detail regarding catching costs, closed seasons, financing of vessels, market price deviations/conditions, margins and details of investment in the sector. Furthermore we request copies of the notes of any interviews with researchers at Marine and Coastal Management including

names and dates of the interviews. In this regard it is denied that the specialist obtained accurate catch data regarding catches in the affected area which data could be translated into potential losses. When referring to the affected area we are referring to the area affected during the construction phase and during the period when 6.3 million cubic meters of building soil is going to be pumped onto the ocean floor in the prime catching area of the South African squid industry where between 30-40% catches are made.

Response 55:

Your comment is noted. It is unclear what further value information about fishing vessels operating from Port Elizabeth would add to the value of the potential economic loss to the squid fishing industry, since this loss has been based on the total area around the Thyspunt site that would be potentially affected by the construction and operation of the power station.

As indicated in the above responses by the marine specialist team, accurate statistics regarding the extent of the fishing areas and catches were obtained from the SWG and the DAFF. Your quoted figure of 30-40% catches being made in the St. Francis region is not supported by independent data provided by the SWG and DAFF, which indicates that 14.7% of total catches are taken in the wider area (two grid squares of approximately 22 x 27 km each) around the Thyspunt site (see Response 12).

Comment 56:

Our client submits that an analysis of the catch data information from DAFF will indicate that between 30-40% of catches of squid are made in the area to be directly affected by the disposal of building soil during the construction stage of the project. Accordingly we report that this economic report is fatally flawed by only referring to losses incurred due to the post construction exclusion zone apparently to be of a one kilometre width. Due to this exclusion zone the specialist has only calculated 1.8% loss to catches of squid. As we have previously done in our 30 June 2010 representations, using the economists calculation method, with catch losses of say 32%, the estimated yearly impact would be around R156,000,000.00 (One Hundred and Fifty Six Million Rand) per annum which translated over twenty years would be about R3.136 billion Rand.

Response 56:

Your quoted figure of 30-40% catches being made in the St. Francis region is not supported by independent data provided by the SWG and DAFF, which indicates that 14.7% of total catches are taken in the wider area (two quarter degree grid squares of approximately 22 x 27 km each) around the Thyspunt site (see Response 12). The calculation of potential economic losses in the Economic Impact Assessment is based on the total potential affected area assessed in the Marine Ecology Assessment. The area on which spoil will be dumped is not considered to be part of the affected area, since this disposal area is deeper than the zone shallower than 50m where squid are known to spawn.

Comment 57:

Accordingly, we dispute as irresponsible and unprofessional the statement by the specialist that “the fears of the local fishing industry about lost catches of squid appear to be groundless, given the conclusions of the marine ecology impact assessment report”:

Response 57:

The conclusions of the Economic Impact Assessment, and those of the Marine Ecology Assessment on which it is based, are founded on objective information obtained from published academic sources and other information obtained through the SWG and the DAFF.

Comment 58:

This is a further flaw of the economic report. It relies on only certain conclusions in the marine ecology report but ignores others. The marine ecology report in turn categorically states that it is analysing the effects on the species as a whole and not the fishery. Accordingly as we understand the marine ecology report, although the species will be impacted and that spawning grounds will be lost and the squid will move to other areas, the species will survive. The economic specialist appears to have translated this conclusion into an assumption that the negative effects on fishing will be "slight". The economic specialist needs to independently analyse and investigate the effect of the project on the squid fishing industry and not rely on isolated comments of the marine specialist taken out of context.

Response 58:

Your comment is noted. Kindly refer to Response 23, which has been reproduced here for ease of reference.

The marine ecology should and does consider ecological issues, including the population status of squid. The impact this has on the economics of fishery is in fact an economic issue, and has been considered in turn in the Economic Impact Assessment (Appendix E17 of the Revised Draft EIR). Through consultation with the SWG, discussion on the exact location of the squid egg beds will be included in the current revision of the report for completeness sake. It should be noted that the spatial extent of the potential impacts is very limited (as shown in the report and presented at the SWG meeting where SASMIA was present). The data provided by DAFF is currently being used to calculate the area that may be impacted vs. the catch taken by the fishery in the area. While still under review, it appears that losses by the fishery in the area will range between 2.53 % (least-case scenario) to 2.86 % (worst-case scenario) and to the fishery as a whole between 0.42 % and 0.37 %.

Comment 59:

Regarding the perception of squid caught in waters opposite a nuclear power plant we have already commented on the naïve comments of the specialist where an attempt is made at comparing the position of agricultural and live stock near similar facilities in France. In fact the specialist goes further to state "the main market for squid is the EU and it must be questioned whether consumers in a country such as France, for example would react differently to squid as opposed to fresh produce in terms of their proximity to a nuclear power station."

This comment is made without any research having been done. Squid exported into the EU is far different from agricultural produce grown in France. The export market of squid to the EU is fickle and any negative perceptions can affect the market price. Another difference is that the vegetables do not come into contact with any of the cooling water discharge which contains chemicals and nuclides in varying concentrations. Squid and Marine organisms on the other hand would be swimming and breathing in this tainted water.

The purported mitigation measure proposed at paragraph 5.2 of the report is preposterous. It proposes an extensive and expensive advertising campaign to international markets and including regular testing of squid for contamination and the issuing of certificates stipulating that the product is free of contamination. It is submitted that such a process would in fact do the very opposite and exacerbate the negative perceptions already created. We repeat the submission that this measure has clearly not been researched and the economist again appears to be "shooting from the hip". Recent fish marketing woes of the Japanese fishing industry, especially those in the vicinity of Fukushima and its surrounding waters are documented in the latest publications of the Seafood International – a trade magazine for the fishing industry.

Response 59:

Your comments are noted. In this regard, please refer to several responses above where the monitoring of marine conditions at Koeberg Nuclear Power Station (KNPS) are referenced. These monitoring programmes, which have been in place for more than 20 years, have indicated no significant impact from the nuclear power station. Although radionuclides are found in marine species at this site, it was concluded, based on the very few affected individual organisms at KNPS, the low concentrations at which they have been recorded and the fact that compounds at equivalent levels of radioactivity have previously been recorded in these species under natural conditions, these findings are not considered indicative of any significant effect resulting from the power station on the surrounding marine environment (Section 3.1.5 of the Marine Impact Assessment). Furthermore there is no known negative market perception associated with marine products caught offshore of the KNPS.

Comment 60:

Under paragraph 3.2.1.3.10 of the report a reference is made to the "fishing impact". The specialist states that "in the case of Thyspunt only the value of squid is used as it is perceived as the one segment that could be negatively impacted". He goes further to state that "the figures used however could be overstated and the marine ecology impact assessment report found that a nuclear power station would have no significant impact on squid."

Firstly, as stated previously the specialist has not taken into account the effect on the industry of the discarding of building spoil during the construction phase and the fact that the spoil is to be dumped on a prime catching site where between 30-40% of catches are made annually. We have referred to the potential losses previously herein. Secondly, the specialist has again taken a statement of the marine specialist out of context where the marine specialist was discussing the squid species rather than the squid fishery. Rather than being overstated it is submitted that the losses to the squid fishing industry have been grossly understated and in fact the economic report should have concluded that there was a high probability that a low volume (but expensive) yet viable squid fishing industry could be terminated by the impact of this project.

In conclusion with regard to the economic impact of the project at Thyspunt, our client wholly rejects the economic report as totally inadequate and failing to investigate and analyse the true extent of the losses on the squid fishery and particularly during and caused by the construction phase.

Response 60:

We take note of your comment but stand by the figures as they are based on objectively evidence.

Your quoted figure of 30-40% catches being made in the St. Francis region is not supported by independent data provided by the SWG and DAFF, which indicates that 14.7% of total catches are taken in the wider area (two quarter degree grid squares of approximately 22 x 27 km each) around the Thyspunt site (see Response 12). The calculation of potential economic losses in the Economic Impact Assessment is based on the total potential affected area assessed in the Marine Ecology Assessment. The area on which spoil will be dumped is not considered to be part of the affected area, since this disposal area is deeper than the zone shallower than 50m where squid are known to spawn.

Comment 61:

5. INFORMATION OUTSTANDING

Our client has recently been advised by Dr Tammy Robinson that the revised marine ecology report is going to be substantially amended due to further information to be provided by DAFF / the SWG *inter alia* regarding catches and the effects of turbidity on the squid species. Furthermore, DAFF has not forwarded its written report with recommendations and findings after its recent meetings with the EAP during July 2011. As stated previously herein our client reserves the right to appeal any findings or recommendations by DAFF in terms of Section 80 of the MLRA. Our client also submits that due to the expected substantial changes which are envisaged by the authors of the Marine Ecology Report, this report should be opened for a further mandatory comment period of 45 days before the report is finalised.

Response 61:

Your comment is noted.

Please note that the comment regarding what Dr Robinson is claimed to have said is factually incorrect. Dr Robinson said that **IF** the marine ecology report is substantively changed, then there is a legal requirement that it be re-released back into the public domain for comment. Should any substantive changes be made to any of the specialist reports or the EIR, these documents will be released into the public domain for further comment.

The DAFF, as an independent organ of state, cannot be forced to provide any written comments or recommendations to the Nuclear-1 EIA team. The DAFF and the SWG are interested and affected parties in the Nuclear-1 EIA and they are free to comment or not comment on the EIA as they choose. Nevertheless, the meetings and other interactions between the marine specialists, the SWG and the DAFF have provided valuable information and recommendations that will be applied in the revision of the Marine Ecology Assessment and the Nuclear-1 EIR.

With regards to your potential appeal against findings or recommendations of the DAFF in terms of Section 80 of the MLRA, you are referred to Response 9, copied here for ease of reference.

Section 80 of the MLRA provides an opportunity for appeal against an administrative decision taken in terms of a delegation under that Act. As such, it is unclear how this right of appeal has a bearing on the SWG or the DAFF's inputs into the Nuclear-1 EIA process, as neither of these bodies has taken an administrative decision in terms of the MLRA during their inputs to the Nuclear-1 EIA process. It is our understanding that the SWG is a scientific advisory body to the DAFF and therefore does not have administrative decision-making authority. Therefore, the nature of the SWG's inputs to the Nuclear-1 EIA process does not amount to an administrative decision under the MLRA.

Comment 62:

6. RECAUTIONARY APPROACH

We have referred you to the well documented and legally applicable precautionary approach in our previous submissions. We record that the EAP made no comment regarding this aspect of our representations. Due to the current reports as they stand and the on-going deliberations thereon, it appears on a balance of probabilities, that a sufficient level of uncertainty now exists regarding the impact of the project at Thyspunt on the environment and particularly the squid fishery, for the decision maker to apply the precautionary approach and to determine Thyspunt as a "no go" site.

Response 62:

At no point does the Marine Ecology Assessment suggest that the precautionary approach should not be applied and indeed a precautionary approach has been used, since a worst case scenario has been applied to the prediction of impacts (e.g. refer to Response 14).
With regards to the application of the precautionary principle, you are referred to Response 47, reproduced here for ease of reference:

Section 2(4)(a) of the NEMA similarly requires that "*sustainable development requires the consideration of all relevant factors, including the following:*
(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions". This is similar to the MLRA's requirement that a precautionary approach should be followed.

It is for this very reason that the Marine Ecology Assessment and other assessments have, where relevant, assumed a "worst case scenario" impact. The application of the worst case scenario assumption to the assessment of marine impacts is referenced in several responses above.

Comment 63:

7. FURTHER SUPPORT OF SUBMISSIONS BY THE THYSPUNT ALLIANCE

As per our previous submission we again confirm that our client as a member of the Thyspunt Alliance, in addition to the representation set out in this letter, fully supports the submissions and objections raised in the responses submitted by the Thyspunt Alliance in respect of the revised Draft Environmental Impact Report for Nuclear 1.

Response 63:

Your comment is noted.

8. CONCLUSION

Comment 64:

In conclusion, our client looks forward to the information requested throughout our submissions and reserves its rights should such information not be provided, and in addition reserves its rights to

supplement these comments should any further information be submitted to the EAP and / or should the EAP revise any of the reports forming part of the EIR.

Response 64:

Your comment is noted.

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

05 August 2015

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Our Ref: J27035
Your Ref: Email received 08 August 2011

Renee Royal
John Royal Architects
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Dear Ms Royal

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

COMMENTS ON DRAFT EMP (APPENDIX F) FOR TYUSPUNT ALLIANCE TO BE READ IN CONJUNCTION WITH THE THYSPUNT SUBMISSION

2nd DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT:

ESKOM NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE:

Prepared by
Renee Royal, Planner and Environmental Consultant, B.SC Honours, MTRP
(Certified Environmental Assessment Practitioner of SA)
5 August 2011

A submission focuses on the Thuyspunt site in respect of the 2nd Draft Environmental Impact Assessment (DEIA) Report prepared by Arcus Gibb. DEA Ref No: 12/12/20/944.

Please note that in instances where verbatim extracts from the DEIA has been incorporated this has been indicated as italics.

Regarding this report the right to add, revise or withdraw comments is reserved and the following is submitted without prejudice:

1 Draft EIA

1.1 Complexity of single EIA for three sites and lack of project detail. For a project of this magnitude it is not possible to assess three different sites in one Draft EIA. It is anticipated that this is to be a huge industrial project. By way of comparison, Olkiuoto 3 in Finland, the first uncompleted Generation lll Nuclear Plant in the world, is Northern Europe's largest ever industrial project.

The above highlights the magnitude and complexity of the proposal and as such there is not enough project detail provided for the Eskom Nuclear 1 project. The use of an "Envelope" is not acceptable for a project of this complexity and size, approximately R 100 billion (reactor costs only exclusive of site specific works and infrastructure). In the context of the project it is not appropriate to conduct one EIA for three sites in parallel and this is considered a superficial comparative study. It is not appropriate to rank sites and compare them as was done in this EIA. It has merely presented site sensitivities and site evaluations resulting in a proposed footprint for development for each site. This cannot be considered an Environmental Impact Assessment. Individual site specific EIAs should be undertaken for each site where detailed development

plans, layouts, visual models of plant on landscape, cross sections, excavation details, stock pile areas, engineering drawings, storm water management plans, wetland delineations and functionalities, infrastructure plans, etc are developed and carefully assessed.

Response 1:

Your comments are noted.

In the light of the requirement in the EIA regulations that alternatives needs to be assessed and compared to each other, we question your statement that it is not appropriate to conduct one EIA for three sites in parallel. Alternative sites could not be effectively compared to each other if the sites are discussed in separate reports.

Your statement of the inappropriateness of ranking sites and comparing them refers. The approach taken in this EIA is that the environmental sensitivities of each site have been defined and overlaid to provide a composite environmental sensitivity map that outlines a variety of sensitivity zones on the alternative sites. The outcome, for each of the alternative sites, is an indication of the least sensitive areas that could be potentially suitable for the construction of a nuclear power station. In this way the environmental sensitivities of the site guide the development rather than accepting the proposed development detailed layout as a *fait accompli*.

It is common practice in EIAs for large infrastructure projects (e.g. for power lines) for the authorities to issue an authorisation for a corridor, but for the detailed positioning of pylons to be determined through a "walkdown assessment" of the corridor and for this assessment to be submitted to the authorities. Such assessments are undertaken typically by a team consisting of an archaeologist, botanist and avifaunal specialist (although the team may be adapted depending on the specifics of the site) and the focus of the walkdown is to determine the exact location of various forms of infrastructure. This is also the proposed approach in this instance.

It is interesting to note your comment that it is not possible to assess three different sites in one EIA. A contrasting view is held by many stakeholders that the entire life cycle of the nuclear power generation process must be assessed and compared to the life cycle of other forms of power generation, and that in addition to the potential impacts of the power station, the potential impacts of the transmission lines also need to be assessed in a single EIA report.

Comment 2:

1.2 Gaps in Studies and Mitigations

Chapter 10 : Conclusions and Recommendations, Section 10.3 Key Mitigations and conditions for authorisation, list many "mitigations" in the specialist studies, which are actually information gaps and investigations that should be done during the planning stage as part of the EIA and assessed according. However the EAP has taken these gaps through to the EMP. It is not appropriate to forward these items to the EMP with the assumption that an Authorisation will be granted for an EIA and this needs to be addressed.

For example in Section 10.3 Key Mitigations it is noted:
That it is " *imperative that the recommendations for mitigation contained in this EIR, the specialist studies and the Environmental Management Plan (EMP) be strictly implemented. The mitigation measures for botanical impacts, vertebrate and invertebrate fauna, wetlands and heritage resources are particularly important. Mitigation of heritage impacts particularly will require the work of a site-specific team dedicated to excavations over a period of several months prior to the onset of construction. It will also be important to involve qualified and experienced botanical, vertebrate fauna, invertebrate fauna, dune geomorphology and heritage specialists to fine-tune the location of the power station on the site."*

Response 2:

Your comment is noted. Kindly refer to our Response 1 above with respect to walk-down assessments after authorisation. It is also common practice in large infrastructure projects to have specialists appointed on a contract basis to provide relevant input when required. The independent Environmental Control Officer would be accountable for determining the when and how often a specialist is required on site based on the phase of construction and the related potential risks.

Comment 3:

Many of these mitigations are in fact gaps that require further studies that should be done prior to an Environmental Authorisation being issued. Regarding Social Services as documented in Section 10.3.1 Key Mitigations for all sites.

"Eskom must enter into negotiations with local authorities and other relevant authorities well before the start of construction to identify how it can be ensured that municipal services are capable of providing sufficient capacity for the expected influx of people into the affected area. Agreement must be reached between Eskom and these bodies on the apportionment of financial responsibility for infrastructure upgrades."

This cannot be considered a mitigation, it should be included, quantified and assessed in the EIA. Especially in the Eastern Cape where service delivery is problematic. Gaps in information and further studies that need to be undertaken prior to an Authorisation being issued specifically for Thyspunt are listed in Section 10.3.4 of the DEIA as follows:

"The following key mitigation measures are recommended at the Thyspunt site:

1.2.1 Heritage:

Mitigation of impacts on heritage sites is a priority at this site. In order to achieve effective mitigation, the following conditions need to be in place:

- A suitably qualified and experienced heritage impact assessment practitioner must conduct excavations in the central portion of the power station footprint and along the routes of the proposed access roads in order to confirm the significance of the heritage resources in the areas where sampling was not possible during the initial investigation.

- Pending SAHRA's acceptance of the findings of these excavations, a comprehensive heritage mitigation plan must be drawn up by the appointed heritage specialist.

- Eskom must make the necessary resources available to give effect to this mitigation plan. Steps that may need to be taken include the development of the necessary resources in South Africa through support for academic institutions, or the importation of heritage excavation personnel if the resources are not available in South Africa.

- On-site curation and interpretation facilities need to be provided and sufficient resources need to be provided for the ongoing maintenance of these facilities throughout the operational life span of the proposed power station.

- Excavation in an area needs to be complete prior to the commencement of clearing for construction purposes. In this respect, the construction of the power station could be phased to happen in parallel to excavations, but it must be ensured that excavation is complete before construction starts.

Response 2:

Your comment is noted. There are, however, certain measures that can only be taken once it is confirmed:

- whether or not the projects is authorised; and
- which site is authorised.

Although the EIA team has recommended a site for authorisation, the authorisation decision is in the hands of the Department of Environmental Affairs. In the absence of this decision, Eskom cannot start preparing

all necessary mitigation measures (some of which require substantial investment) prior to certainty about the authorised site.

Furthermore, preparation of some of these mitigation measures could be interpreted to be tantamount to pre-empting the authority's decision. For instance, Eskom's purchase of additional properties around the Thyspunt site (in line with the ecological specialists' recommendations of creating a larger conservation area) has drawn criticism that it is pre-empting the authority decision.

It is to be noted, with respect to the heritage mitigation recommendations quoted above, that at the time of the release of the Revised Draft EIR for comment there was uncertainty about the occurrence of additional archaeological sites within this central area of vegetated dune and it was assumed that a large scale excavation of the site would be required prior to construction. However, in the time since the Revised Draft EIR was released for public comment, additional test excavations have been conducted at the Thyspunt site. These excavations were done under authority of a SAHRA a permit for test excavations. The finding of these test excavations (which will be released with the next revision of the EIR) is that the recommended location of the power station (within the vegetated dunes) has a much lower concentration of heritage sites than initially suspected, that large scale excavation of heritage sites would not be required and that heritage excavations could be completed with existing resources.

Comment 3:

With respect to these "Mitigations" it is specifically noted that the Revised Heritage Report conducted at Thyspunt as part of the DEIA for the proposed Nuclear 1 power station, has reconfirmed that , *"Thyspunt to be extremely rich in archaeological material, to the extent that almost the entire sequence of human development in Africa is to be found in the study area."*

It further notes:
" The archaeological and paleontological heritage is diverse and prolific. Mitigation without excessive impacts is going to be technically difficult to achieve due to the character of the site and difficulties with respect to accessibility, however the final location of the proposed facility will play a role in the degree of impact expected. "

And the *"The wilderness qualities of this portion of the coast in contiguity with the archaeological heritage are exceptional and make a substantial contribution to the character of the region. Given the mass and bulk of the proposed activity, un-mitigatable cultural landscape impacts are expected."*

Response 3:

Please refer to Response 2 above. The revised Heritage Impact Assessment, which considers the results of the above-mentioned test excavations is attached as Appendix E20 of the Revised Draft EIR (Version 2).

Comment 4:

Further to the above, SARHA do not support the development proposal, the Minister of Arts and Culture, (Parliamentary file number 7/1/2/B to written question number 360), states that:

"As indicated above, the HIA (Heritage Impact Assessment) is not approved by SAHRA (South African Heritage Resource Agency), so the development will not proceed."

Yet, the EAP recommends in Chapter 10, Conclusions and Recommendations, *"Provided that the SAHRA deems that the potential impacts on heritage resources at the Thyspunt site are acceptable it is concluded that all three sites are environmentally acceptable for a nuclear power station. The Thyspunt site is considered the preferred site and it is recommended that it be authorised by the DEA (with conditions) for Nuclear-1.*

Eskom must ensure that the required mitigation measures, particularly with regards to the mitigation of heritage impacts are effectively implemented. The pending authorisation from the SAHRA for test

excavations at Thyspunt, as well as the findings of the test excavation, are critical in this regard. It is therefore recommended that this additional excavation (once approved by SAHRA) must commence as soon as possible and that the results thereof must inform the development of the Thyspunt site. "

How can an "independent" EAP, in light of the above, recommend Thyspunt as the preferred site to be authorised by the DAE (sic) prior to these critical studies being completed and approvals being granted? These very critical and potential "fatal flaw" issues are taken through to the EMP for mitigation. This is considered inappropriate, disrespectful and totally unacceptable.

Response 4:

The comments from the South African Heritage Resource Agency (SAHRA) and the Minister of Arts and Culture regarding the suitability of the Thyspunt site for Nuclear-1 are noted. It is important to note that no formal application has yet been lodged with SAHRA for the excavation of the site and that any statement by SAHRA or the Minister in this respect are therefore premature, since not all the facts in respect of an archaeological excavation permit have been placed at SAHRA's disposal.

The finding of these test excavations is as follows (from the Revised Heritage Impact Assessment):

"*The potential for destruction of Late Stone Age middens will be particularly acute with respect to areas within 300 m of the coast and very much less acute further inland in the vegetated dune areas. The location of the facility will be a key factor in determining the extent to which impacts will occur. Any facilities placed within 200 m of the rocky shoreline or crossing the rocky shoreline will result in impacts.* ***However, if a site were to be selected*** *adjacent to Thysbaai beach, or* ***within the vegetated dunes as proposed***[1]*, the* ***degree of impact will be greatly reduced*** *as Late Stone Age middens tend to be more common adjacent to rocky shores, and in areas where there are surface water sources.*" The central vegetated dune portion of the site where power station has been recommended to be placed also happens to be the area where the least other environmentally sensitive features occur.

It is the EIA team's opinion, based on the findings of the Heritage Impact Assessment (including the findings of the test excavations completed in 2011) that the heritage issues at the Thyspunt site can be successfully mitigated.

Comment 5:

1.2.2 Wetlands

The DEIA states in Chapter 10, Section 10.2 that:

"Wetland mitigation measures that must be taken include the following key measures:

- Properties currently outside the Eskom-owned areas as specified by the wetlands specialist need to be acquired by Eskom for incorporation into the conserved area of the Eskom property. The acquisition of the Langefonteinvlei wetland is critical in this respect.

- A suitable hydrological cut off wall must be installed prior to groundwater drawdown to ensure that the impacts of groundwater drawdown on wetlands are mitigated.

- Monitoring of groundwater levels must continue through the construction phase in order to determine the effectiveness of mitigation measures.

Further investigations are required regarding the hydro-geological conditions of the site. Especially in the light of the recent flooding of the Sand River and the bridge wash away on two occasions.

Response 5:

[1] GIBB's emphasis

Extensive monitoring of geo-hydrological conditions and wetlands was undertaken during 2010 and the findings thereof are contained in Appendix E12 of the Revised Draft EIR. This investigation found that the water table that feeds critical wetlands such as the Langefonteinvlei on the Thyspunt site is not geo-hydrologically linked to the water table where the power station excavation is proposed.

Comment 6:

1.2.3 Dunefields

No development (apart from the construction of the transmission lines between the power station and the HV Yard) is allowed within the Oyster Bay mobile dunefield. Construction of pylons and stringing of lines must be undertaken by helicopter (provided that safety considerations allow this). No permanent access roads may be constructed through the dunefield, and access for maintenance purposes during operation of the power station must be done with lightweight vehicles.

Further investigations are required regarding the hydro-geological conditions of the site. Especially in the light of the recent flooding of the Sand River and the bridge wash away on two occasions.

Response 6:

Please refer to Response 5.

Comment 7:

1.2.4 Access Road

Access to the site by Ultra Heavy and Heavy Vehicles should be by way of an access road developed around Humansdorp. No access for these vehicles must be allowed through the Humansdorp Central Business District.

This has not been addressed in the DEIA.

Response 7:

The Transport Assessment (Appendix E25 of the Revised Draft EIR) was substantially revised after the release of the Revised Draft EIR. One of the most significant recommendations of this report is that construction traffic must be routed around Humansdorp via a new interchange on the N2 to the west of Humansdorp and that construction traffic must access the Thyspunt site from here via the Oyster Bay Access Road. It is further recommended that only labour transport and an estimated 21 ultra-heavy loads over the nine-year construction period may use the R330 through St. Francis.

Comment 8:

"1*0.4 Way Forward.*
Should the DEA authorise the proposed nuclear power station, it is recommended that it be authorised strictly according to the conditions as indicated above and according to the requirements of the EMP. Should some of the required mitigation measures not be implemented prior to the start of construction, as recommended (e.g. the conditions with respect to excavation of archaeological and palaeontological sites), then construction should not be allowed to commence."

This is a serious issues and an EIA should not be issued until this is resolved.

Should there be any substantive changes to the design of the proposed power station after submission of the Final EIR to the DEA for decision-making, a re-assessment of the environmental impacts may be required. The assumptions with respect to technical details of the power station (as detailed in the

Consistent Dataset – Appendix C) are key in this respect. Once a nuclear power station vendor has been identified, it must be confirmed that the specifications of the power station continue to conform to the Consistent Dataset, which acted as the basis for this EIA process. It is recommended Eskom must provide such confirmation to the DEA well prior to construction of the power station.

This is considered a fatal flaw as detailed plans, vendor, etc, should be determined prior to the EIA process so that appropriate assessment can be undertaken. An Environmental Authorisation should not be issued until this has been undertaken.

Response 8:

As indicated in Response 2, the required excavations of archaeological sites can be achieved with existing resources and the assumptions that were made in the Revised Draft EIR about an extensive and time-consuming heritage mitigation programme are no longer valid.

Your comments regarding selection of a vendor prior to the issue of an authorisation are noted.
It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known and the environmental impacts can be predicted or deduced from these inputs and outputs with reasonable certainty, it is not necessary to know the brand name of the technology.

As has been done in other issues and response reports, it may be appropriate to explain the envelope of criteria in colloquial terms, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel type, fuel efficiency, catalytic convertor performance, type of tyres and wheels, fuel tank size, effective range, CO_2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBD. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would not qualify. Similarly, if a vendor proposes a power station design that fails to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration

Comment 9:

2 Draft EMP

2.1 Gaps in Knowledge / Residual Environmental Issues

Many "mitigations" that have been proposed in the specialist studies, which are actually information gaps and investigations that should be done during the planning stage as part of the EIA and assessed according, have been taken through to the EMP. These gaps have been termed "Residual Environmental Issues". It is not appropriate to forward these items to the EMP with the assumption that an Authorisation will be granted for an EIA. This needs to be amended.

As stated in the DEMP, *"Residual Environmental Issues are issues that have been identified during the EIA, but are considered unresolved at the time of compilation of this EMP.* (or for that matter the EIA). *These issues are as such therefore not yet addressed or not yet fully addressed by the mitigation measures derived in the EIA. Opposed to 'resolved' issues, specific environmental specifications for Residual Environmental Issues were thus still outstanding at the time of compiling this EMP. The reasons for residual issues vary, but are generally associated with lack of information at the time; e.g. lack of project design details, Environmental Authorisation conditions, contractor specific designs, etc. However, Eskom shall resolve Residual Environmental Issues as the Nuclear-1 project unfolds; most notably during the Pre-construction Planning and Design Phase. This will be done through e.g. additional specialist studies followed by appropriate amendments to the EMP amendments to the EMP (and associated environmental specifications) and/or through Method Statements or Standard Operating Procedures.*

In summary, key Residual Issues include the following:

• Geo-hydrological monitoring to model the impact of the abstraction of groundwater on wetlands and the interpretation of these results by the geohydrological and wetlands specialists;

• Data from additional fieldwork for invertebrates; and

• The excavation of heritage features from the sites prior to construction of the power station.

This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted.

Response 9:

As indicated in the above responses, further geo-hydrological monitoring and test excavations of archaeological sites have been completed. Additional invertebrate monitoring has been completed by Eskom with the intent to inform the EMP. The archaeological excavations have been completed and confirm that there are not archaeologically sensitive sites where the nuclear footprint is planned for. The excavation of archaeological finds would not be carried out unless approval was obtained to construct on the site.

Comment 10:

2.2 Pre-construction Planning and Design Phase (page 22)

It is stated in the EMP that:

" Due to the sensitivity of the environment, the complexity of the environmental requirements for the Nuclear-1 project and the fact that a number of Residual Environmental Issues remain (refer to Section 2.6 for the latter), it is important for Eskom to consider environmental management requirements during the Preconstruction Planning and Design Phase of the project. It is for this reason that such a phase is specifically covered in this EMP and associated environmental specifications.

The key activities undertaken during this phase involve:

• Undertaking additional specialist studies and/or investigations to address any residual environmental issues; - This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted.

• Final planning and design of the site layout/ footprint and nuclear power station; This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted.

• Development of a set of site management master plans, e.g. for stormwater, water supply, facilities, waste, remediation, etc. (as indicated in Section 7). This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted.

• Tendering, adjudication and induction of Contractor/s; and

• Addressing certain environmental requirements, concerns, roles and responsibilities in preparation for the construction phase; e.g. through contract negotiations.

Response 10:

Your comments are noted and have been addressed in preceding responses.

Comment 11:

2.3 Additional Specialist Studies

"Additional specialist studies, (Section 3.1.1) will be undertaken to address Residual Environmental Issues (refer to Section 2.6) in accordance with and based on recommendations of specialists and direction from the relevant environmental authorities..... Considering that extensive specialist studies have already been undertaken, these studies are in effect a 'fine tuning' of information to aid detail site layout planning and design. Specialists will thus as such also assist Eskom in such planning and design.

The following additional studies are required:

• Monitoring of the interaction between water levels in wetlands and groundwater, in order to model the impact that the drawdown of groundwater (during excavation of the foundations of the power station) would have on wetlands at the site; and

• Invertebrate studies.

This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted.

Response 11:

As indicated in the above responses, additional groundwater and wetland monitoring has taken place.

Comment 12:

2.4 Layout

Further detailed studies that should form part of the EIA that have been taken through to the EMP include as listed in Section 3.1.2, Walk-down Assessment, which states:

"After authorisation, but prior to decisions about the detailed location of elements of infrastructure on the site, a team of specialists must perform a detailed "walk-down" assessment of the site. This assessment must investigate, in detail, the recommended footprint for the power station (in accordance with the recommendations of the Final EIR) and associated infrastructure, as well as all elements of the construction site.

In addition to the Eskom project representatives, the walk-down team must consist of appropriately qualified and experienced specialists from the following fields:

• Archaeology / Heritage
• Wetlands;
• Vertebrate Fauna;
• Vegetation;
• Dune Geomorphology; and
• Invertebrates.

Should the ECO be appointed at this stage he/she should also form part of the walkdown team. Based on the findings of the walk-down assessment, the layout of the power station and elements of construction infrastructure must be planned and placed on site to ensure that environmental impacts are minimised. The layout plan produced at the end of this process must be regarded as binding on Eskom and the contractor and may not be changed without their approval."

This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted. It is necessary to have a detailed project layout prior to authorisation.

Response 12:

Your comments are noted. Please refer to Response 1.

Comment 13:

2.5 Additional Information

For a project of this magnitude, additional project information and studies that should be undertaken prior to an Authorisation being granted have been deferred by the EAP to the EMP as described in Section 3.1.3: Integration of Environmental Considerations into Project

Design as follows:

"*The Library of Specifications in accordance with Section 7 includes several specifications that must already be considered during pre-construction planning and project design in order to prepare for effective and consistent environmental management. These include, for example, specifications relevant to siting of the nuclear power station and associated facilities and infrastructure; access route planning; development of various master plans (e.g. stormwater management, rehabilitation, emergency procedures); community sensitisation, etc).*"

This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted. It is necessary to have a detailed project layout prior to authorisation.

Response 13:

Your comment is noted. The approach in the EMP is consistent with the proposed "walk-down" as indicated in Response 1.

Comment 14:

2. 6 Library of Environmental Specifications to address specific aspects and impacts

As stated above, the EAP intends to include many unresolved issues as "mitigations" and "residual environmental Impacts" into the EMP into the Planning and Design phase. This phase (indicated as a blue colour coded bar) spans the pre-construction phase, including master planning and detailed site surveys / investigations. This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted. It is necessary to have a detailed project layout prior to authorisation.

Most of the items assigned with a blue colour coded bar require consideration in the EIA. Examples of this as listed below:

Section 7.1.1 Geology and Dunes, points 1 – 5, 8 – 11, 9 out of 14, all require further planning, buffers, site plans, no-go areas,

Response 14:

Your comment is noted.

Comment 15:

Section 7.1.2 Hydrology, Erosion and sedimentation and surface water quality, points 1-9, 9 out of 12 require planning input, more detailed planning, stormwater management plan

Response 15:

Your comment is noted.

Comment 16:

Section 7.1.3 Groundwater and geohydrology, points 1- 5, 7-17, 16 out of 17 require planning, site plans, dewatering and draw downs,

Response 16:

Your comment is noted.

Comment 17:

Section 7.1.4 Loss of Habitat Compensation (page 59), points 1-8 all require planning. It is noted that An Off Set is not a mitigation. This is unacceptable and these issues are to be incorporated into the EIA process prior to an Authorisation being granted "Develop a Loss of Habitat Compensation Plan in accordance with the recommendations of Fauna Specialist Study of the EIA and that meets the requirements of the relevant environmental authorities; and ensures that this plan addresses the areas that have been proposed to be added to the conserved Eskom property following the Construction Phase to secure the conservation of wetland habitats."

Response 17:

Your comment is noted. CapeNature, as one of the interested and affected parties for the proposed Nuclear-1 sites is the Western Cape, has specifically requested offset mitigation to be considered. All the biophysical specialists on the Nuclear-1 EIA team are in agreement about the value that conservation of the site around the proposed power station would achieve.

Comment 18:

Section 7.1.5 Wet areas and Wetlands, points 1-17, 17 out of 19 require planning input, detailed planning, delineation and buffers.

Response 18:

The Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR) accepted the currently available information (including data from the wetland and groundwater monitoring undertaken in 2010) as sufficient for assessing the potential impacts on wetlands.

Comment 19:

Section 7.1.6 Flora, points 1-11 require further planning, Search and Rescue,

Response 19:

Your comment is noted.

Comment 20:

Section 7.1.7 Point 12, 13, corridors in master planning should be included in up front planning, points 14, 19, 20, detailed planning.

Response 21:

Your comment is noted.

Comment 22:

Section 7.1.8 Oceanographic and Marine Systems, notes that:

"The marine-biology assessment also found spoil disposal at sea to be a viable and the preferred option as it will greatly reduce the footprint of the development in terrestrial habitats. ..... Ensure that results of any new engineering solutions for offshore outfall of heated seawater are either optimised or equivalent to the current design proposal; should the engineering solution be amended."

This is technically very challenging so these issues are to be incorporated into the EIA process prior to an Authorisation being granted

Response 22:

The quoted section from the Environmental Management Plan indicates that the current designs for the heated cooling release are acceptable, but that if any changes to these designs are considered, it must be similar to the current designs. This is stated to provide for any (as yet unknown) design changes.

Comment 23:

Section 7.2.3 Public and Social Services and Service Infrastructure Use and Impact

A project of this magnitude will place a high demand on local and in some cases even regional and provincial public and social services, and would thus also impact on such services. Appropriate planning well in advance of such demands or impact is essential.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation.

1. Negotiate with local authorities, well before construction, to determine what the needs are for upgrading of essential infrastructure such as sewage treatment plants and waste disposal sites that the Project will utilise and/or impact on; including inter alia to what extent Eskom will, in co-operation with the local authority, provide resources to assist with the upgrading of these facilities to ensure that they are capable of providing in the needs of the peak number of construction personnel.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 24

Your comment is noted. In this regard, please refer to Response 2.

Comment 25:

2. Liaise closely with the relevant municipal, provincial and other authorities on all matters related to potential use of or impact on public services or service infrastructure, e.g. roads, pipelines, telecommunication, waste facilities, health services, emergency services, law enforcement services, etc.; including development and mitigation plans.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 25:

Your comment is noted. In this regard, please refer to Response 2.

Comment 26:

5. Provide for and ensure adequate capacity of medical facilities are available:

• Base planning for provision of medical facilities on the sustainable human settlement strategy; which implies that that the provision of health facilities for all staff involved as proposed for the Construction Village and Staff Village will be vital to ensure a sustainable human settlement; and

• Make the relevant Department of Health aware of the requirements.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 26:

Your comment is noted. In this regard, please refer to Response 2.

Comment 27:

6. Ensure that adequate capacity for law enforcement is made available by notifying the involved authorities, local municipality as well as the SAPS about additional needs for law enforcement services as based on the sustainable human settlement strategy.

Need this information during the EIA phase and prior to the issue of an Environmental authorisation.

Response 27:

Your comment is noted. In this regard, please refer to Response 2.

Comment 28:

7. Eskom must enter into negotiations with education authorities in order to allow these authorities to plan to ensure local schools have sufficient capacity. The following actions need to take place in this respect:

• Make provision of schools for the children of all staff involved, as proposed for the staff village (and possible other areas), as vital to ensure a sustainable human settlement;

• Provide for schools to accommodate children (number to be confirmed) into the area of the nuclear power station, signifying that either existing schools should be enlarged, or a new schools should be built in the area where staff will be residing; and

• Make the relevant Department of Education aware of the current schooling needs in the area as well as the potential impact that the proposed development will have on the status quo.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

8. Provide for and ensure adequate capacity of sports facilities, as follows:

• Make provision of sport facilities for all staff involved as proposed for the Construction Village and Staff Village, as vital to ensure a sustainable human settlement.

• Develop or contribute to recreational facilities and sport facilities, in order to cater for the increase in population in specific areas.

The Eastern Cape, has poor service delivery with enormous backlog, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 28:

Your comment is noted. In this regard, please refer to Response 2.

Comment 29:

7.2.5 Construction Village, Staff Village and Vendor Housing

1. Conduct a detailed assessment for a new residential development, once the preferred nuclear power station location, as well as the location for residential and accommodation needs are finalised.

The Eastern Cape, has a huge housing back-log and poor service deliver, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 29:

Your comment is noted. In this regard, please refer to Response 2.

Comment 30:

2. Establish the construction village, staff village and staff and vendor housing (if any) as follows (subject to the conclusions and recommendations of a project-specific EIA for such developments):

The Eastern Cape, has a huge housing back-log and poor service deliver, so this information is required during the EIA phase and prior to the issue of an Environmental authorisation. Imperative to ensure that the local communities dire requirements and poor service are not exacerbated by influx.

Response 30:

Your comment is noted. In this regard, please refer to Response 2.

Comment 31:

7.3 Protection of Heritage Resources SAHRA has not approved this application so no mitigations is appropriate.

As stated above With respect to these “Mitigations” it is specifically noted that the Revised Heritage Report conducted at Thyspunt as part of the DEIA for the proposed Nuclear 1 power station, has re-confirmed that *“Thyspunt to be extremely rich in archaeological material, to the extent that almost the entire sequence of human development in Africa is to be found in the study area.”* In addition, SARHA do not support the development proposal, the Minister of Arts and Culture, (Parliamentary file number 7/1/2/B to written question number 360), states that: “As indicated above, the HIA (Heritage Impact Assessment) is not

approved by SAHRA (South African Heritage Resource Agency), so the development will not proceed. These very critical and potential "fatal flaw" issues are taken through to the EMP for mitigation. This is considered inappropriate and unacceptable.

Response 31:

Your comment has been noted above. Please refer to Response 4.

Comment 32:

7.4.2 Geological and Seismological Risk Profiling and Geotechnical Suitability Assessment

Need this information during the EIA phase and prior to the issue of an Environmental authorisation.

Response 32:

The seismic information contained in the EIR is regarded as sufficient for decision-making for a preferred site for Nuclear-1.

Comment 33:

7.4.3 Site Elevation and Footprint Development, Layout Planning and Establishment

Points 1, 2, 3, 4, 6, 8,9, 10, 11, 12, 13.

Need this information during the EIA phase and prior to the issue of an Environmental authorisation.

Response 33;

Your comment is noted. Please refer in this regard to Response 1.

Comment 34:

7.4.6 Access Roads Development, Maintenance and Use

Points 1, 2, 3, 4,
Need this information during the EIA phase and prior to the issue of an Environmental authorisation.

Response 34:

Your comment is noted. Please refer in this regard to Response 1.

Comment 35:

7.4.8 Water Supply Abstraction Point 1, 4, 5,

Need this information during the EIA phase and prior to the issue of an Environmental authorisation.

Response 35:

Your comment is noted.

Comment 36:

7.4.11 Stormwater Management

Consider Stormwater Management Plan prior to Environmental Authorisation.

Response 36:

Your comment is noted.

Comment 37:

7.4.12 Wastewater Management

Consider Wastewater Management Plan prior to Environmental Authorisation.

Consider radioactive emissions prior to the issue of the Environmental Authorisation.

Response 37:

Your comment is noted. Radioactive emissions are subject to nuclear licensing in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).

Comment 38:

7.4.13 Brine Management

Consider Desalination Plant and Brine Management Plan prior to Environmental Authorisation.

Response 38:

Your comment is noted.

Comment 39:

7.4.14 Air Quality

Consider radioactive emissions prior to the issue of the Environmental Authorisation, Especially in the light of the Fukushima Accident in March 2011.

Response 39:

The final plant to be selected will be reviewed to ensure that it has taken cognissance of the basic nuclear power plant design objectives and the recent events related to Fukushima.Also see Appendix E33 of the Revised Draft EIR (Version 2) for an in depth discussion.

In addition, the nuclear industry has a culture of evaluating, in depth, the performance of other nuclear facilities and the performance of its own plant. In doing so they ensure that the ALARA (as low as reasonably achievable) principle is implemented. This principle ensures that activities during operation are continuously improved and remains well below regulatory limits. Incidents that are evaluated can be small, all contributing to best practice or significant such as Fukushima.

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Comment 40:

7.4.17 Emergency Preparedness and Response

Consider radioactive emissions prior to the issue of the Environmental Authorisation. Especially in the light of the Fukushima Accident in March 2011.

Response 40:

Emergency preparedness and response is within the ambit of the nuclear licensing process in terms of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).

Comment 41:

7.4.18 Fire Prevention and Response

Consider radioactive emissions prior to the issue of the Environmental Authorisation. Especially in the light of the Fukushima Accident in March 2011.

Response 41:

Please see Appendix E32 and E33 of the Revised Draft EIR for a detailed discussion.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

Rod Gurzynski Architect
Building Environment Consultant
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Dear Rod Gurzynski

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

SUBMISSION ON REVISED DRAFT EIAR FOR THE ESKOM NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (NUCLEAR-1) DEADP REF NO. 12/12/20/944

Comment 1:

The scope of Nuclear-1 EIA

The Revised Draft Nuclear-1 EIA recommends one site, Thyspunt, and initially one nuclear power plant of up to 4 000 MW capacity[1] with reservation for future expansion of the site up to 10 000 MW. The original EIA was for 3 alternative sites and 3 nuclear power plants with a maximum capacity of 12 000 MW. An approval of Thyspunt will lead to Eskom applying for the other two, with Eskom's stated intention being 'to pursue up to 20 000 MW of nuclear power generating capacity"[2]. This nuclear scenario hinges on Nuclear-1 EIA. The sequence of events depends on whether or not Nuclear-1 is to be part of a 'fleet strategy' as suggested in IRP2, which would include payment of 'royalties' for use of the technology. A decision based on the Nuclear-1 Revised EIA recommendation is therefore more than it purports to be: it unleashes a massive, partially costed and probably un-costable capital investment in a highly complex, inherently dangerous technology[3] with impacts on associated infrastructure and on the future development model of South Africa. The decision-maker is effectively forced make a strategic decision based on a site-specific assessment, which is illogical.

Response 1:

It is not factually correct to state that the original EIA was for three nuclear power stations on three alternative sites.

[1] Nuclear-1 Revised DEIR Executive Summary
[2] Nuclear-1 Revised DEIR Introduction pg. 1-8
[3] The phrase "inherently dangerous" refers to the fission process used to create artificial radioactive isotopes, including plutonium and transuranics, together with a large amount of heat.

As indicated in Section 1.2.1 of the Revised Draft EIR, the initial application for Nuclear-1 was for a single nuclear power station. Eskom indicated its intention in 2009 (based on expected changes in the 2010 EIA regulations) to apply for authorisation at all three alternative sites. However, this amendment of the application was never carried through and therefore the application is still for a single nuclear power station at a single site.

Since the publication of the Nuclear-1 Revised Draft EIR, the Integrated Resource Plan 2010, which is government's official strategy for ensuring security of electricity supply, 9,600 MW of nuclear generation is required, as well as 17,800 MW of renewable sources, 6,300 MW of coal and 8,900 MW from other sources. For the moment therefore, even though Eskom, indicated its intention to develop up to 20,000 MW of nuclear generation (prior to the publication of the IRP), only 9,600 MW is required by the IRP.

Your opinion of the inherent danger in nuclear technology is noted. There is indeed risk involved in electricity generation using nuclear technology. Generally all forms of technology and developments have some form of risk associated with them. Environmental Impact Assessment is a tool to ensure that environmental, including social and infrastructure development risks are evaluated and appropriate mitigation measures put in place to address risks which are not considered fatal flaws.

As indicated in the Revised Draft EIR, nuclear generation is intended specifically to contribute to base load electricity supply, which renewable technologies are not able to provide, given current technology constraints.

The EIA process, which is by its very nature a project-specific environmental management tool, does not have any mandate to revisit the strategic analysis of power generation alternatives that was completed in the IRP. The Nuclear-1 EIA process is therefore not in a position to assess the merits of different power generation alternatives e.g. nuclear power vs. other forms of renewable power generation. The environmental application for Nuclear-1 is for a nuclear power station, as has been the case with other power stations such as the gas-fired power stations that have been constructed at Mossel Bay and Atlantis and the Medupi and Kusile coal fired power stations currently under construction. In all these previous instances, the scope of the EIA was restricted to a specific power station on a specific site or sites within a defined geographical area.

The strategic decision regarding the need for nuclear generation was taken in the IRP, outside the ambit of the EIA process.

Comment 2:

An assessment of the macro-impact of a full-blown nuclear power industry cannot be made from the information contained in Nuclear-1 EIA or in the superficial Economic Impact Report. An assessment could have been made in the course of the Integrated Resource Plan for electricity IRP2010 public process, but was not. The Department of Energy has nevertheless recommended the 'Revised Balanced' scenario with 1600 MW of nuclear energy proposed for year 2023.

Response 2:

Your comment is noted. As indicated above, an EIA is a project-specific tool of environmental management and is not designed to deal with strategic information on the life-cycle impacts of a particular industry.

Comment 3:

IRP2 was not a strategic environmental assessment, and is not yet complete, as the Executive Summary recognises:

'It [the Integrated Resource Plan] is not a plan that deals with the overall energy needs of the country nor does it deal with the wider infrastructure plan for the country"[4]...An assessment of the plan's anticipated price path and investment requirements will be done. This assessment will also identify whether other policy objectives, not considered specifically in the scenarios, are met, such as competitiveness, social development issues, localisation, etc."[5]

Nuclear power requires such an assessment and Nuclear-1 EIA is premature. Since IRP2 claims

[i]The National Planning Commission (10.06.2011), also aware of the lack of a full impact assessment, states:

"Nuclear power is one of the options...yet the financial cost, environmental safety, waste disposal and decommissioning costs have to be taken into account"[6].

This statement is actually an expression of the precautionary principle. The NPC Report also defers the issue of nuclear power, correctly, to further democratic process: "South Africa needs a national debate on the future of development and use of nuclear energy"[7]. The current Nuclear-1 EIA in contrast does not adopt the precautionary principle and does not amount to a national debate. It accepts at face value Eskom's preference with regard to nuclear power and it accepts the 3 sites chosen by Eskom as a given. It does not consider the no-go option at any level and it excludes any alternative scenario, with biased evidence. Nuclear-1 EIA also fails to assess anything to do with safety, leaving that to the NNR, even though safety also has financial, social and environmental impacts. These are the main limitations and shortcomings of Nuclear-1 EIA.

Response 3:

As indicated in Responses 1 and 2, an EIA, as a project-specific tool of environmental management, does not have the capacity to lead such a national strategic debate on the principle of using or not using nuclear power. However, it has to be pointed out that the national justification for nuclear has been undertaken under the public process leading to the gazetting of the IRP2010.

This environmental impact assessment is only one of many authorisations. Issues related to a national debate on Nuclear should be raised directly with the Department of Energy.

Comment 4:

Need and desirability for the project

With regard to power generation options, Nuclear-1 EIA accepts Eskom's generation model assuming a constant minimum "base load" demand and "base-load power stations" or "plants that produce energy at a constant rate" to supply it. The EIA does not inform the decision-maker of alternative models where inflexible nuclear "base-load" power generation is actually harmful to managing a balanced energy grid incorporating renewable energy. Germany for example is aiming to do away with nuclear power and to build a "much more flexible power plant fleet"[8].

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[4] Executive Summary of the Draft Integrated Electricity Resource Plan for South Africa - 2010 - 2030. pg. 2.

[5] Executive Summary of the Draft Integrated Electricity Resource Plan for South Africa - 2010 – 2 that the assessment of investment requirements, competitiveness, social development issues, localisation etc. will be done, then it should be done. But it has not been done. Thus we still do not know the financial, environmental, social and developmental impact of this choice. Nuclear-1 EIA becomes by default the arena for this macro-assessment even though the limited terms of reference are: 'Eskom + 4 000 MW PWR nuclear power plant + 3 sites'.

[6] National Planning Commission. Dept.: The Presidency. Diagnostic: material conditions: nuclear.

[7] National Planning Commission. Dept.: The Presidency. Diagnostic: material conditions: nuclear.

[8] Federal Ministry of Economics and Technology and Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply. 28 September 2010.

Nuclear-1 EIA accepts without comment or analysis Eskom's position that:

"coal-fired and nuclear power stations are currently the only feasible options in South Africa for base-load electricity generation"[9].

The statement is inaccurate and only relevant to Eskom's current generation model. A nuclear power plant could only be operational by 2023 at the earliest. Long before this date, any number of feasible alternative generation options could be in place, amongst others: run of river hydroelectric power from Inga, Congo; solar concentrated thermal power with storage, with or without gas back-up (South Africa has much better solar resources than Germany); wind as a lowest-cost energy resource, and combined heat and power for those large industries like smelters that require constant heat (because electricity is not an economic source of heat).

Response 4:

Your comment is noted. The point is made in the Revised Draft EIR that nuclear power is not being pursued by Eskom to the detriment of other forms of power supply and that a variety of generation technologies, including renewable technologies, are required in order to meet South Africa's energy needs. Reliance on only one technology does not provide a guarantee of sufficient and reliable supply. A combination of proven base-load, peaking and other generation technologies are required.

With regard to "an inflexible system" this is given consideration in the accepted Integrated Resource Plan(IRP).. Base load power will be required to ensure quality and security of supply. However a balance between this with other technologies must be achieved. There are several coal-fired power stations, which will be decommissioned from the 2020's. These need to replaced and in terms of South Africa's climate change commitments low carbon base load options need to be pursued.

Eskom is indeed pursuing other forms of generation technology such as solar thermal and depending on the success of these pilot projects, more such projects may be implemented in future. The South African government is also pursuing projects such as the Inga hydroelectric project on the Congo River and other countries in the SADC region. However, risks including political and social aspect also create uncertainty and protracted processes and no guarantee of timelines. . The IRP relies on a balanced approach that includes a range of different supply options rather than relying on only one technology such as wind, solar, coal or nuclear.

Comment 5:

Greenhouse gas mitigation

Nuclear-1 EIA promotes nuclear power as a greenhouse gas mitigation strategy[10]. But nuclear power will not help with greenhouse gas reduction before 2023 at earliest, and not until after it has paid off its carbon debt from construction etc. The time to act to keep the global temperature from rising 2 deg C is now. There is even a 25% chance that by 2027 it will be too late to achieve this target. This means nuclear power may be too late in which case it would be detrimental in that it would tie up money that would have been better spent on alternatives and efficiency strategies. Nuclear-1 EIA does not assess these probabilities or the cost of the alternative strategy.

Response 5:

Your comment is noted. The proposal is a do nothing alternative (because as you mentioned reliance on nuclear to lower greenhouse gas emissions may be too late) or exclusive reliance on other forms of generation, which in itself is risky. It is in recognition of these risks that the Integrated Resource Plan included nuclear generation as a proven source of base-load electricity generation. The manufacture of other technologies equally includes the release of greenhouse gases in their life-cycles. As

[9] Nuclear-1 Revised DEIR Version 2/Sept 2010 pg. 4-73
[10] Nuclear-1 EIA Revised DEIR. Ch. 4. Need and Desirability for the project. pg. 4-7.

indicated by the publications referenced in Chapter 4 of the Revised Draft EIR[11], nuclear generation has a similar greenhouse gas profile over its life-cycle to some renewable technologies such as wind and solar. There would, therefore, be little effective benefit in terms of greenhouse gas emissions to using renewable technologies in favour of nuclear technology. If a nuclear power station has to "pay off its carbon debt", renewable technologies would, having similar life cycle greenhouse gas emissions, presumably also have to pay off such debts.

Comment 6:

Project Alternatives

The Executive Summary states[12]:

"The consideration of alternatives is a **key requirement** of an EIA...alternatives to be considered during the EIA include the following:

- location of the power station
- forms of power generation
- nuclear plant types... "

In the light of this it is inexplicable to find the following in the Final Peer Review:

"...many stakeholders wanted to re-open the nuclear debate, raising issues about nuclear energy compared with other forms of power generation...Gibbs has correctly not been drawn into a debate...[t]he consultants simply assert that the approved terms of reference of the EIA concerns the investigation of options for a nuclear power station."[13]

This shows, at the very least, a contradiction in the Peer Review with the stated requirement of EIA process. Nuclear-1 EIA Project Alternatives and the Economic Impact Report do however make numerous debatable assertions about alternatives while Gibbs EIA practitioner Jaana Ball has argued in favour of nuclear power in reply to my earlier comments.

Nuclear-1 Revised DEIR adds more comment on wind power, and therefore I would like to add comments to the new information. Nuclear vs wind: land area Nuclear-1 EIA Revised DEIR gives the land area required for 4,000 effective MW of wind as 2,730km2.[14] The larger area of land taken by wind farms vs. a nuclear power plant is not a fair or full comparison. In the case of wind, the remains in use and generates an income for the farmer. In the case of nuclear power, apart from the plant itself, large areas of land are used for mining, processing, fuel fabrication and for storage of waste and spent fuel. To assess the land area impact, you have to add all that up. The EIA does not do this, so let me do so: the total land area to support a 4 000 nominal MW of nuclear power plant 4,000 - 40,000 km2 (based on 1-10 km2 4 per MW installed, over the full life cycle[15]).

Response 6:

Environmental Impact Assessment is, by its very nature, a project-specific tool of environmental management and it not equipped to deal with strategic issues like the principles of using or not using nuclear power. It is recognition of this that the quoted comment by the reviewers was made.

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[11] Meinshausen et al (2009). Greenhouse-gas emissions targets for limiting global warming to 2°C. Published in 30 April 2009 issue of Nature. "We would exhaust the CO2 emission budget by 2024, 2027 or 2039 depending on the probability accepted for exceeding 2°C (respectively 20%, 25% or 50%)".

[12] Nuclear-1 EIA Executive Summary Version 1/February 2010. pg. 4

[13] Nuclear-1 Revised DEIR Final Peer Review Appendix H cl.2.2.1. pg. 8.

[14] Nuclear-1 EIA Revised DEIR. Project Alternatives. pg. 5-10: (273 000 Ha = 2 730km2)

[15] Sustainable Development Commission UK. Position Paper: the role of nuclear power in a low carbon economy. 2006.

Further, the comparable area of the wind farm required to generate 4,000 MW was provided in response to a specific request by stakeholders in the St. Francis area close to the Thyspunt site. Thus, the effective area impacted by renewable technologies be much larger than was stated in the Revised Draft EIR Version 1. Such a debate is however largely academic within an EIA since such an analysis cannot be performed within an environmental impact assessment. Only a complete life-cycle assessment for all alternatives, including renewable alternatives, would generate such information.

Comment 7:

Nuclear vs wind: water
Nuclear-1 EIA Project Alternatives does not mention water. Wind turbines do not use any water (other than for human use). On the other hand, nuclear power plants use 170m3 of water per kWh for cooling[16], not all of it is sea water. The amount of water used in mining uranium, in processing and in fuel fabrication is not known, but it will also be very high, as will the radioactivity levels in leaky detention ponds. In a water-stressed country, one would think this would be assessed.

Response 7:

As indicated above, the EIA process for Nuclear-1 does not intend to, nor is it equipped to assess the merits in principle of nuclear power generation vs. other forms of power generation.

Chapter 3 of the Revised Draft EIR and the Consistent Dataset (Appendix C of the Revised Draft EIR) clearly indicates that all water used during construction and operation of the proposed power station will be obtained from desalinated seawater. There would therefore be no impact on freshwater sources due to the power station's freshwater needs. All cooling water will be obtained from the sea and will be released back into the sea.

As indicated above, the issue of life-cycle impacts would equally need to apply to other forms of power generation. However, an analysis of life-cycle impacts cannot be dealt with in an EIA process. The outcomes of the IRP also illustrate that South Africa is not choosing between one technology or the other but rather determining which suite of technologies to employ to effectively and economically meet the current and growing demand of electricity.

Comment 8:

Nuclear vs wind: comparative cost
The value of wind power is not to provide "baseload" (although it can provide some, according to that definition) but as an energy source where the cost of fuel is nil. It is a generation resource to be used first in a hierarchy of power providers. When the wind is blowing it will be the cheapest energy source if it is not tied to a REFIT.

The cost of nuclear power assumed in the EIA, taken from sources such as the EPRI report[17] in IRP2010, excludes the following costs: "owner's costs" (this can include the sea-water intake infrastructure), royalties, cost-escalation (real cost-escalation for nuclear power plant construction), foreign exchange and interest rate movement impacts, worst-case accident insurance, maintenance costs beyond the operational life of the plant, decommissioning costs, and long-term (i.e. off-site) spent fuel management. Even if there is some provision for post operational costs, these are discounted in present value, based on accumulated value and unlikely to be adequate in future time. EPRI also makes favourable assumptions about capacity factor and extended life-time for the plant, unsupported by historical data e.g. from Koeberg NPS itself. Until these exclusions are costed and these assumptions are interrogated, the conclusions about the cost of nuclear power in Nuclear-1 EIA must to be considered unreliable.

[16] Certified Environmental Product Declaration EPD of Electricity, for Fosmark Nuclear Power Plant, Sweden. EPD 2007.11.01.
[17] Electric Power Research Institute costing report, in Integrated Resource Plan 2010

Response 8:

Please refer to Response 7 with regards to the assessment of nuclear power generation vs. other forms of power generation.

The KNPS's load factor averaged 71.5 % over the past 20 years and 76.5 % over the past 10 years (up to 2009). This is lower than the 90% capacity factor assumed by the EPRI but twice that of wind power.

Comment 9:

Impact analysis

The Impact Analysis eliminates the no-go option on the basis that:

"If [Eskom] does not...[provide additional large-scale base-load power stations, either through nuclear power or through... coal-fired power stations]...the country will grind to a halt."[18]

The statement is biased. It assumes Eskom must control the supply of power and offer only two generation alternatives, and where only Eskom can provide sufficient electrical power, which if it is not allowed to do so, the country will "grind to a halt". The no-go option means that many independent power producers will have to step in. With that would come more manufacturing, constructing and operating of smaller power generation facilities (other than nuclear) and the jobs and skills development that would follow would result in the very opposite of grinding to a halt. In particular, concentrated solar thermal would be ideally suited to our existing manufacturing technology and skills base, so it could be entirely home-grown and an export opportunity.

Response 9:

The decision as to what generation technology to construct is not Eskom's decision. Eskom is required to implement projects which are allocated by the Department of Energy and in terms of the IRP. As indicated in previous responses above, the IRP has already allocated electricity generation projects. The IRP recognizes the need for base load power supply.

Comment 10:

Seismic Risk Assessment

There is no mention of Fukushima in Nuclear-1 EIA Seismic Risk Assessment, (dated 16.03.2011 The Fukushima earthquake took place on 11.03.2011 yet the damage of the nuclear power plant is not mentioned[19]. This is inexplicable. Of particular concern would be unanticipated damage to emergency cooling power generators, breaks in cooling pipes and breaks in spent fuel pools structures.

Response 10:

The Fukushima incident will be dealt with in detail in the Nuclear-1 Draft EIR Version 2 (the next revision of the EIR).

There are a number of reasons why an incident like that at Fukushima (which was caused by failure of the cooling water system and not due to any form of structural damage to the power station) cannot occur at Koeberg or to the proposed Nuclear-1, which is designed to be constructed at a terrace height of at least 12 m above sea level:

[18] Nuclear-1 Revised DEIR Chapter 9 Impact Analysis pg. 9-216 5 in the document properties).

[19] Nuclear-1 Revised DEIR Seismic Hazard Environmental Impact Report.

- The original design of Koeberg provided protection against earthquakes and tsunamis and loss of off-site power supplies.
- The two nuclear reactors at the KNPS are constructed on an “aseismic” raft, and all the components and plant systems that are important to nuclear safety have been designed to these seismic specifications so that they will be able to perform their expected functions during and after an earthquake.
- A 4 m tsunami (as a result of an earthquake in the South Atlantic) was considered in determining the Koeberg terrace height. This was considered to coincide with a maximum spring tide and a major storm surge and maximum wave set-up and run up, leading to a water level of 7 m above mean sea level. The Koeberg terrace height is at the 8 m level above mean sea level.
- During normal operation, each unit at Koeberg is supplied from two 400 kV lines connected to the national grid. The station also has supply from a 132 kV line connected to the national grid.
- If there is a problem with the normal 400 kV and 132 kV supply, the Acacia open cycle gas turbine power station (far inland) supplies electricity to Koeberg through a dedicated 132 kV line.
- Koeberg has two emergency diesel generators of 5MW each for each unit respectively to provide backup power supply. A fifth emergency diesel generator that can be switched between either of the two units is also installed. These five diesel generators are all located on the Koeberg terrace at 8 m above mean sea level.
- Two smaller (1 MW) diesel generators are installed, one for each unit, and are independent of the emergency diesel generators and physically located in a different place (at a higher elevation [14 m] above mean sea level). They will provide power to the batteries and hence the instrumentation & control systems, and will ensure the integrity of the reactor coolant pump seals – thus enabling the fuel to be cooled through natural convection if all other systems fail.
- There are a further two portable generators on site that could also provide emergency power supplies.

None of these additional measures were available at Fukushima Daiichi to provide power to the power station’s cooling system. The emergency diesel generators at Fukushima Daiichi were based on an assumption of only a 5 m tsunami, which is inappropriate for a country characterised by frequent earthquakes.

Comment 11:

Economic Impact Assessment

I have previously commented on Nuclear-1 EIA Economic Impact Assessment. I would like to add the following, as it was not answered in any way by the EIA practitioner.

City of Cape Town

There is no analysis in the economic assessment of the impact of extending the life of the Koeberg/Duynefontein site (beyond the operational life of Koeberg) on city planning, growth and expansion of the city as a result of a new NNP at Duynefontein. Population density of a city is a necessary requirement for cost-effective infrastructure and service delivery but population density around a NPP has to be restricted for evacuation logistics reasons. The EIR does not assess the economic cost to the city as a result of spread-out, leap-frogged infrastructure or the opportunity cost of this.

There is also no assessment of the cost of insurance or the exclusion in household insurance policy for any radiation or nuclear-related damage. The lack of any such assessments is inexplicable, unless it is based on the erroneous assumption that no such event can occur? If comprehensive insurance was imposed as a condition it would render the project uneconomic. "Liability" is not the same as having the funds. Comprehensive insurance would affect Eskom's balance sheet and ability to borrow

funds whereas the maximum insurance cover required by Eskom at present is only R3bn. The EIA is the correct place to assess insurance: if you don't have the money the socio-economic impact could be huge.

Response 11:

The establishment of a new nuclear power station at Duynefontein in close proximity to the Koeberg Nuclear Power Station (KNPS) will have an impact for longer term planning but the City would have to consider it in its long term planning that Duynefontein will remain a nuclear site long into the future. The Emergency Planning Zones (EPZs) that will be applied to Nuclear-1 are significantly smaller than the zones currently applied for the Koeberg Nuclear Power Station (KNPS). Therefore, implications for spatial planning will continue to be governed by the KNPS rather than by Nuclear-1.

Comment 12:

Human health risk

Nuclear-1 Human Health Risk Impact Report only considers a 'technology envelope', not a specific design. But it claims to assess a design-basis accident (DBA). This is illogical. It also does not assess a worst-case scenario.

The assessment of protection of human health is transferred from the EIA to the NNR licencing process according to the DEADP-NNR agreement. But the NNR is only mandated to consider design-basis accidents. Therefore neither this study nor the NNR consider the impact of severe accidents (INES scale 7):

"...beyond-design-basis accidents do not form part of this assessment but are considered as part of the emergency response environmental impact assessment".[20]

By excluding beyond-design-basis accidents, the report concludes that:

"...there would be no measurable difference...[in health effects]..whether a nuclear power station is constructed or not".[21]

The logic is self-serving and faulty.

Response 12:

Your comment is noted. We need to point out that whilst some “Site Safety Reports” prepared as part of the authorisation process for nuclear licensing have been included as appendices in this draft EIA Report (Appendices E24, E26 and E27), radiological issues was not be assessed in detail in the RDEIR Version 1 since qualitative assessment of radiological safety is the mandate of the NNR. It is therefore important to note that The Emergency Response (Appendix E26) and Site Access Control Report (Appendix E27) and Human Health Risk Assessment (Appendix E24), which have been prepared on a high level,, are appended to this EIR for information only. Further details on these reports will be prepared as part of the NNR nuclear licensing process, as their findings will be evaluated by the NNR

However, in recognition of requirements in the NEMA, associated legislation such as the Promotion of Administrative Justice Act, 2000 (Act No. 3 of 2000) and other legal precedents that require the consideration of all relevant socio-economic factors in an EIA process, an assessment of radiological impacts of the proposed power station is included in the current version of the EIR. Although this approach of including an assessment of the radiological impacts of the proposed power station results in a risk of duplication between the EIA and the NNR licensing processes, the risk to the EIA in terms

[20] Nuclear-1 Revised Draft EIR. Appendix E24. Human Health Risk Assessment. pg. 11.
[21] Nuclear-1 Revised Draft EIR. Appendix E24. Human Health Risk Assessment. pg. 22: the no-go scenario. 6

of possible appeals, based on the exclusion of substantive issues such as health issues from the EIA process, is regarded as greater than the risk of duplication. The current version of the EIR therefore departs substantially from the approach in the previous versions of the EIR in terms of the consideration of radiological impacts.

In this context, it must be mentioned that the approaches of the EIA process and the NNR licensing process differ substantially. The focus of the EIA process is to assess the potential impacts of radiological releases (including normal operational releases and upset conditions). However, the focus of the NNR licensing process is to demonstrate beyond reasonable doubt that defence-in-depth measures (multiple, redundant, and independent layers of safety systems) employed in the proposed power station design and operation are sufficient to reduce the probability of a failure leading to core meltdown or a failure of reactor containment to acceptable and highly-unlikely levels. Thus, the EIA process focuses on the consequences of radioactive releases. The NNR licensing process also focuses on consequences but is also designed to reduce the probability of such releases. Please refer to Appendix E32 of the RDEIR Version 2 for the Radiological Impact Assessment report.

Lastly the safety case of the specific design will definitely address clusively beyond –design basis accidents and that of design base accidents.

Comment 13:

Emergency response

Nuclear-1 EIA Emergency Response Impact report states that, despite having no final design:

"...design features are included...to practically eliminate severe accidents"[22]..."there will be "minimal need for evacuation beyond 800 m from the reactor, and **not at all** beyond 3km."[23]

Thus the Human Health Impact report transfers the assessment of beyond-design-basis accidents to the Emergency Response Impact Report which in turn states that no such event that may require evacuation beyond 3km will occur.

Considering that the Fukushima evacuation zone is 20km with hot spots much further than that, there is no logic to the above statements, rather it is an expression of wishful thinking. Additional threats not considered are terrorist threats, cyber security threats and airplane crashes.

That is not good enough for an environmental impact assessment.

Response 13:

The evacuation zones for Fukushima (based on a Boiling Water Reactor design from the late 1960s) cannot be directly compared to either those of the KNPS (which is a Pressurised Water Reactor design from the late 1970s) or to the current Generation III Pressurized Water Reactor designs on which Nuclear-1 is proposed to be based. The design of the nuclear technology, structure and passive and active safety systems of Generation III nuclear power stations are very different to those of Fukushima Daiichi.

However, it needs to be pointed out that the basis for adopting the EUR by Eskom is that the EUR aims at ensuring that the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and

[22] Nuclear-1 Revised Draft EIR. Appendix E26. Emergency Response Impact Report. pg. ii.

[23] Nuclear-1 Revised Draft EIR. Appendix E26. Emergency Response Impact Report. pg. 1

environment. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs

In addition, the assessment of external events (aircraft crash, Tsunamis, etc), on a particular design forms part of the safety case that will need to be presented to the NNR for evaluation

Management of Radioactive Waste

Comment 14:

Nuclear-1 EIA Management of Radioactive Waste report says this about high level waste stored on site in ponds:

"At present, South Africa does not have an authorised facility for the disposal of high level waste. Thus, the only currently feasible alternative is for Eskom to store high level waste in spent fuel pools on the Nuclear-1 nuclear island, as is the case at Koeberg'.

This statement is false in two ways. Firstly, there is a feasible alternative, which is not to have nuclear power at all and secondly, if you have it, to store fuel assemblies, after they have cooled down, in dry casks. But this would cost more. "As is the case at Koeberg" means that the fuel rods will be stacked and re-stacked in the fuel pools. We know now after Fukushima, if we did not already, that storing spent fuel in ponds on site is not safe. Even in "Generation III" reactors, fuel pools are not inside the double containment structures of the reactors.

The Management of Radioactive Waste report mentions actinides, specifically plutonium but nothing more than that. It does not mention that plutonium, is the most toxic element but also the fuel for nuclear weapons. A 4 000 MW nuclear power plant would produce 800 kg of plutonium a year (at 200kg plutonium per 1GW per year)[24]. A spent fuel pool containing a 4-year inventory of spent fuel rods would contain enough plutonium to make 400 plutonium weapons. A 4 000 MW nuclear power plant with a 40 year operational life would produce 32 tons of plutonium, enough for 4 000 plutonium weapons. It is hard to say what is more difficult: protecting the environment from this substance for hundreds of thousands of years or protecting the plutonium from a mad man intent on nuclear weapons. The EIA says nothing about this. Instead, the problem is transferred to the National Radioactive Waste Management Policy, although there is no final solution offered. The report states instead:

"...public acceptance of radioactive waste isolation projects remains one of the major challenges"[25]

Response 14:

Eskom, in line with global practise, use both wet (pool) storage and dry (cask) storage for the generated spent fuel from the reactors. Much so wet storage in which the pools are within the same concrete steel reinforced containment building as the reactors. The Dry storage casks are stored in the waste buildings. Highly sophisticated security measures are in place to control access to these buildings and each and every employer is screened and passes through devises that monitor absorbed doses received by entering from these employees to ensure no limits are exceeded from a regulatory compliance perspective. Furthermore, Eskom accounts for all nuclear fuel material on site (U-235, total uranium and total plutonium mass) through its Nuclear Fuel Accountancy System ("NFAS"). This report is scrutinised by the IAEA as part of the non-proliferation treaty agreement of which SA is a signatory.

The spent fuel pools and reactors at Fukushima are of a different design. The reactors are within the containment whereas the spent fuel pools are within a steel structure.

[24] Burton Richter. Beyond Smoke and Mirrors. Climate Change and Energy in the 21st Century. Cambridge University Press. 2010.
[25] Nuclear-1 Revised Draft EIR. Appendix E29 Waste Assessment.

The disposal of nuclear waste is the remit of the Nuclear Radioactive Waste Disposal Institute that has been established by Parliament under Act 53 of 2008. It is the policy of the DoE to establish a central interim spent fuel store (under the NRWDI) for South Africa by 2025. Therefore spent fuel would be shipped to this store from the power station on its closure.

Comment 15:

Footnote

There is a bias to be found in parts of Nuclear-1 EIA, as for example in the quotation above, that implies that the major disadvantage or challenge of nuclear power is "public perception". As a member of the public who has studied these documents and found numerous fault lines as indicated in my comments, I take exception to the implication that it is my 'perceptions' that is the greatest challenge rather than the issues and problems that I raise.

Response 15:

Your perception of bias is noted.

Whilst it is true that there are (managed and well-controlled) risks associated with nuclear power generation, there are many other common risks (that have a far greater potential to lead to fatalities or serious and debilitating injuries) that the public is happy to accept on a daily basis. A sober analysis of risks (taking into account both the consequence of the risk and the probability of its occurrence) shows that commonplace risks such as travelling in vehicles (more than 16,000 South African's killed on our roads each year)) results in a much higher probability of fatality or disabling injury than a nuclear power station. . In spite of the comparatively low risk of sickness or death from nuclear incidents (bearing in mind that there has been not a single fatality recorded from the release of radioactivity from Fukushima Daiichi but more than 20,000 combined deaths and missing persons recorded as a result of the tsunami), there remains a perception that nuclear technology holds an inherently greater risk of death or injury than other forms of commonplace risks.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Hard copy received 05 August 2011
Word format by email 12 August 2011

Email: ebonzet@pgwc.gov.za and golivier@pgwc.gov.za

Dear Mr Bonzet

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Your letter under reference J27035, dated 9 June 2011, refers.

Comment 1:

From an Environmental Health point of view the following comment are given should any one of the two proposed alternative sites situated in the Western Cape (Bantamsklip and Duynefontein) be chosen as the preferred site:

Response 1:

Your comment is noted.

Comment 2:

No ground or surface water sources shall be polluted during either the construction or operational phases of the nuclear power station.

Response 2:

Your comment is noted. Mitigation measures to prevent the pollution of groundwater and surface water resources are contained in several specialist studies, including the Hydrological and Geo-hydrological Assessments (respectively Appendices E6 and E7 of the Revised Draft EIR).

Comment 3:

A sufficient supply of water that complies with the SABS standard for household water (SANS 241) shall be constantly available to personnel working on the site.

Response 3:

Your comment is noted. Potable water will be supplied from a desalination plant at all of the alternative sites. The quality of the water will comply with relevant legal requirements.

Comment 4:

All sewage generated at the site must be disposed of in such a way that no pollution of water sources (ground or surface) or any health hazard occurs. The preferred disposal system must further comply with the requirements of the Environmental Health Departments of the applicable Municipal Health Services Authorities (City of Cape Town and Overberg District Municipality).

Response 4:

Your comment is noted. Sewage treatment and disposal methods will comply with all relevant legal requirements.

Comment 5:

Solid waste, excluding radio active waste, generated at the site must be stored and transported to a registered and licensed disposal site in such a way that no nuisance or health hazard occurs.

Response 5:

Your comment is noted. Waste storage and disposal methods will comply with all relevant legal requirements. The development of Nuclear-1 is also subject to the issuing of a Waste Management License in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008). Specific conditions of waste management may be imposed in terms of a license issued under this Act.

Comment 6:

All recommendations for mitigation contained in the EIR, the Environmental Management Plan and in the specialist studies must be strictly implemented and adhered to.

Response 6:

Your comment is noted. Implementation of the conditions of authorisation (assuming that authorisation is granted) will be subject to monitoring by an independent Environmental Control Officer and a proposed Environmental Management Committee.

Comment 7:

Over and above the aforementioned no activity shall be carried out which constitutes or are likely to constitute a health hazard or nuisance.

Response 7:

Your comment is noted.

Comment 8:

Further to the comment given all requirements of the Environmental Health Departments of the applicable Municipal Health Services Authorities (City of Cape Town and Overberg District Municipality) must be adhered to.

Response 8:

Your comment is noted. Eskom is committed to adherence with national as well as provincial and local legislations.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/J31314
Your Ref: Email received 07 August 2011

Katja Vinding Petersen email katja@whalewatchsa.com
Brenda Walter email brenda@dict.org.za
Wilfred Chivell email chivell2@isales.co.za

Dear Katja, Brenda and Wilfred

ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

General Comment:

DYER ISLAND CONSERVATION TRUST: LETTER OF CONCERN ASSOCIATED WITH THE ESTABLISHMENT OF A NUCLEAR POWER STATION AT BANTAMSKLIP

1 EXECUTIVE SUMMARY

Response from Arcus GIBB and MEIS

DICT is thankful for the response and is pleased that some recommendations have been implemented into Arcus GIBBs´ latest version of the MEIS. In particular, the implementation of a monitoring project of the coastal dolphin species is welcomed as a key requirement.

There are however, many concerns that the response and the MEIS fail to address, including queries which remain unanswered from our first submission.

General response:

The Dyer Island Conservation Trust (DICT) uses the acronyms “AA”, “MEIS” and “OSS”, neither of which has been defined. None of these acronyms are used in the Revised Draft EIR Version 1. The DICT also does not provide references to the page numbers or paragraph / section numbers of the quotes from the Environmental Impact Report (EIR) or specialist reports it uses in its comments. Where possible, the context of the quotes has been applied to deduce which reports and sections of the reports the DICT has referred to. However, where it is not clear from the context to which sections of the Environmental Impact Report or specialist reports the DICT’s comments refer, it has been stated that it is not possible to respond to the comments.

Comment 1:

Bantamsklip lies within an environmentally sensitive area, which is recognised internationally for its marine biodiversity. New studies have identified the South African coastline as one of the worlds´ most important marine hotspots.

As with any human developments that have the potential to impact on marine habitats, the proposal to establish an NPS at Bantamsklip must follow a consultative process, involving independent researchers.

Response 1:

Your comment is noted. The conservation significance of the coastline in the Bantamsklip area is acknowledged in the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1).

Comment 2:

2 UNANSWERED QUESTIONS FROM LAST SUBMISSION

In DICTs´ first submission, we raised concerns related to the potential establishment of a NPS at Bantamsklip. Some of these questions have not been attended to in the response from Arcus GIBB, an oversight that we feel should be rectified as soon as possible.

a) What type of filters will be used at the intake?

Response 2:

Screens of similar specification to those used by the Koeberg Nuclear Power Station (KNPS) will be used to prevent the intake of large marine organisms such as kelp, fish and jellyfish. It is in the interests of the power station from a technical point of view that large marine organisms do not obstruct the flow of cooling water. Such screens have been used for more than two decades at the KNPS without any negative impacts on marine organisms.

The blockage of intake pipelines is discussed in Section 5.5 of the Coastal Engineering Report (Appendix E of Appendix E16 of the Revised Draft Environmental Impact Assessment Version 1). The conclusion of this report with regards to potential blockage of the cooling water intakes is that "*There is no extra-ordinary marine debris identified at the site which the intakes could not be designed to cope with and which would be expected to cause a complete blockage of the intake.*"

Furthermore section 3.2.2 the Marine Ecology Report (Appendix E14 of the Revised Draft EIR Version 1) concludes as follows regarding the potential for entrainment of organisms: "*Due to the slow rate at which water will be taken into the cooling system (i.e. a maximum intake rate of 1 m/s), water flow will not be strong enough to entrain large organisms, such as penguins, fish and marine mammals. In addition, filters used will have a grid size small enough to exclude fish and other larger biota from the intake pipes*".

Comment 3:

b) How deep will the pipes be mounted in the sea floor?

Response 3:

A description of the depths to which the intake tunnels will be constructed is provided in section 3.11.1 of the Revised Draft EIR Version 1.

The consistent data set appendix C indicates the depth of water in which the intake structure will be constructed is limited to 30 m and the outfall tunnels will be at approximately 5m..

Comment 4:

c) What are the concentration levels and amounts of brine as well as other chemicals released into the ocean?

Response 4:

Brine concentrations are discussed in Section 3.1 of the Marine Ecology Assessment (Appendix E15 of the revised Draft EIR Version 1).

Brine will be released into the surf zone during the construction phase, physical mixing with surrounding seawater will result in dilution to 1 g/L above ambient salinity within 110 m from the point of release. Any ecological impacts will be focused within the water column due to the high energy of the surf zone[1].

During the operational phase of this development, desalination effluent is not expected to affect the marine environment. This is due to the combination of hypersaline discharge together with the discharge of heated cooling water. Although the brine is expected to have a salinity of 58 ppt (in comparison with seawater which has a salinity of 35 ppt) this effluent will account for less than 1% of the water released. As such the brine will be diluted to undetectable levels within the outflow pipes, prior to release.

While no defined standards exist for the discharge of desalination plant effluent in South Africa, the South African Water Quality Guidelines for Coastal Marine Waters states a target range of 33 ppt to 36 ppt for salinity of effluents entering the sea. These guidelines will be met by this development during the operational phase. Although they will not be met during the construction phase, dilution will occur within 110 m of the point of release.

As indicated in Section 3.1 of the Marine Ecology Assessment, typical pre-treatment of seawater required for the desalination process includes the use of both chlorination and de-chlorination, the addition of anti-scalant agents and surfactants, and the adjustment of pH through the addition of strong acids. The brine would typically contain low concentrations of a variety of chemicals including sodium hypochlorite, ferric chlorite, sulphuric or hydrochloric acid and sodium hexamethaphosphate. It is important to note that the chemicals in the release water are approved by the United States Environmental Protection Agency for use in drinking water systems, at concentrations similar to those found in desalination effluent.

Comment 5

d) Why is it not possible to monitor during the construction phase, and how ”short-lived” will this impact actually be?

Response 5:

The impact referred to is not specified and it is therefore, not possible to provide a response to this comment.

Comment 6:

e) What is the total amount of out- and in-put pipelines?

Response 6:

From the consistent data set , it is anticipated that there will be 3 to 4 outlet pipeline tunnels of approximately 3 m diameter each and either one or two inlet pipelines of between 5 and 10 m diameter will be installed. If a single inlet pipeline is installed, the diameter will be 10m and of two inlet pipelines are installed, the diameter will be 5m.

[1] Recent marine science research indicates that release beyond the surf zone is a safer and more environmentally acceptable alternative. The Marine Ecology Assessment is being amended accordingly.

Comment 7:

f) How far apart will the pipelines be?

Response 7:

The tunnels will be placed as close as practically possible together to avoid unnecessary disturbance of the sea floor.

Comment 8:

g) What type of material is the cofferdam made of?

Response 8:

The coffer dam will be made of rock.

Comment 9:

h) What is the size of the cofferdam?

Response 9:

The coffer dam size will be dependent on the actual channel design and size. This cannot be concluded without a final design. However, the environmental sensitivity study for the marine biology impact considered the most severe impact in the construction process. Also see response 65 below.

Comment 10:

i) Where offshore will the 10.07 million m^3 sediment be dumped?

Response 10:

Spoil will be disposed at a depth of 52 m, 6km from shore. The recommended position of spoil disposal at the Bantamsklip site is indicated in ???.See the marine report table 4 indicates 3 alternatives 6km from the shore

Comment 11:

j) How deep will the pipes be mounted in the sea floor?

Response 11:

Please refer to Response 3.

Comment 12:

k) How many years will the construction phase last?

Response 12:

As indicated in the Revised Draft EIR Version 1, construction is planned to take place over a period of nine years.

Comment 13:

l) When will the construction of the NPS take place?

Response 13:

The start of construction is dependent on all relevant authorisations being obtained.

Comment 14:

m) What type of new habitat will be created?

Response 14:

New types of benthic habitat will be created due to the offshore disposal of spoil. At Bantamsklip spoil is recommended to be disposed at a depth of more than 50 m at a distance 6km from shore.

Comment 15:

n) How will the design of the NPS impact the present swells and currents?

Response 15:

The NPS will not affect swells and currents. It will affect the temperature of the seawater in the water column and at the surface over a small area.

Comment 16:

o) An estimation of the intake of phytoplankton, in particular fish larvae and abalone gametes.

Response 16:

Phytoplankton occur at such high concentrations in the intake water and reproduce at such a fast rate that the impact on these species is not regarded as significant enough to warrant special concern.

Comment 17:

p) Methods to avoid descaling of fish.

Response 17: Response ok - TBR

GIBB consulted the Marine Specialists Dr Robinson and Dr Griffiths who are unsure to what the above comment actually refers however the state that descaling may occur if fish are entrained in the cooling system. There are no methods to avoid this other than to avoid the uptake of the fish in the first place. As detailed in the marine ecology report this has been done through technical design. These design features include: the use of screens will prevent the uptake of fish and water will be drawn into the system slowly (1m/s or less) so as to allow fish and other organisms to swim against the flow of the water.

Comment 18:

q) DICT requests that the Marine Environmental Study take the impacts of the chemical pollution into deeper consideration.

Response 18:

Without a motivation for such a request, the request cannot be considered.

Comment 19:

r) Exact details of the filters and how they are expected to prevent intake of marine life such as seals, penguins and dolphins. This should be made public.

Response 19:

These will be similar filters used currently at Koeberg as follows:

- High efficiency particulate air filters (HEPA) have been in use successfully at Koeberg since the start-up of the plant in 1984.
- HEPA filters are distinguished from ordinary filters by their high efficiency in trapping very fine particles in air streams, typically at an efficiency of 99,9% at a 0,3 micrometre particle size.
- Over 400 efficiency test have been carried out on these filters at Koeberg with a pass rate of 92%.Filters which fail are immediately replaced and re-tested.
- Technetium-99,a radioactive source is used for the testing of the filters. The filters are tested every eighteen months.
- Criteria for filter replacement are a high differential pressure across the filter or a failed test.

Comment 20:

Regarding the terms of reference for the outlet water, please amplify on the following point:

s) Temperature – a visual model is required.

Response 20:

Appendix E16 (Appendix B – Figures) of the Revised Draft EIR Version 1 provides visual representations of the modeled increases in temperate of surface water due to the release of warmed cooling water.

Comment 21:

t) Chemical composition and concentration of chlorine in the water (see chapter 3).

Response 21:

As indicated in the Consistent Dataset (Appendix C of the Revised Draft EIR Version 1), and as per the current practice at Koeberg Nuclear Power Station, it is proposed that a Circulating Water Treatment System will produce sodium hypochlorite by pumping seawater through an electrolyser. The concentration of active chlorine after the electrolysers in the solution is approximately 1.5 mg/kg.

Comment 22:

u) Cumulative effects of temperature and chemicals on the surrounding marine environment.

Response 22:

Considering that the Koeberg Nuclear Power Station has not resulted in any long-term cumulative impact on marine life (based on detailed monitoring by marine scientists over the entire operational life space of the Koeberg Nuclear Power Station), it is not predicted that warmed cooling water and

chemicals released from Nuclear-1 would have any long-term cumulative impacts on marine life. Although predictions were made about the establishment of warm warm-water marine species at the Koeberg Nuclear Power Station, this has never been recorded at KNPS (see Section 3.2.3 of the Marine Ecology Assessment). Neither have chemical nor radiation emissions ever been found to have a detrimental impact on marine life at the Koeberg Nuclear Power Station. Although the capacity of Nuclear-1 will be double that of the KNPS, the technology cooling technology and radiation management practices will be similar, since Nuclear-1 will be based on the same (but newer generation) pressurized water reactor technology.

Comment 23:

Basis of Design

The MEIS is flawed because there is no Basis of design used as a reference (BOD), and therefore lacks credibility.

As a mandatory requirement for a credible process, the need for a BOD was raised in the initial letter of concern and has yet to be addressed.

Response 23:

Your comments are noted. The EIA Team is confident that its predictions, based on the Consistent Dataset, and based on the experience with the Koeberg Nuclear Power Station; provide an adequate foundation for an accurate prediction of the environmental impacts.

Comment 24:

The assessments of the specialists do not have the fundament to be able to model or measure the actual impacts on the environment. They do not use exact, realistic or quantitative measure for eg. the area of the protected zone, the design of the grid on the intake pipes, the amount of pipelines, the size and how the cofferdams will be designed and build (sic).

Response 24:

Your comment is noted. As indicated in the Revised Draft EIR Version 1, the assessment of the impacts of the proposed power station is based on a Consistent Dataset (Appendix C of the Revised Draft EIR Version 1), which represents a worst case scenario of potential inputs and outputs from a Generation III nuclear power station operating under normal conditions. This dataset has been based on the commercially available nuclear power station designs currently available. Additionally, the Nuclear-1 EIA is based on monitoring data from almost three decades of the operation of the KNPS and the experience gained by selected EIA specialists on the operation of the KNPS, as wel as similar large construction projects in similar environments.

Furthermore, sensitivity maps provided by the range of relevant specialists have been overlaid for each site and the preferred footprint for the power station has been defined to exclude areas of high sensitivity on the sites. The EIA team defined this preferred footprint independently of the spatial requirement that Eskom has stated it would require. In most cases, the environmentally recommended footprint is smaller than the area required by Eskom. Eskom will be bound by the preferred footprint, should authorisation be granted, and will have to place all necessary infrastructure within this footprint, thus avoiding sensitive areas. Should all necessary infrastructure not fit within this footprint, some of the infrastructure such as administrative buildings may have to be placed off-site.

Lastly please refer to Appendix E37 of the Revised Draft EIR (Version 2) for peer review reports of all specialist studies. All specialist studies were found to be adequate and none were found to be fatally flawed.

Comment 25:

Access to documents

Documents referenced by Arcus GIBBs are not available in the public domain, which makes it impossible to verify the estimations and claims on which they are based. For example reports from Koeberg. As pointed out in the last submission, the document referred to as “Prestedge et al.“ has been renamed and cannot be found on the Arcus GIBBs webpage.

Response 25:

Eskom has made monitoring reports on radiation around the Koeberg Nuclear Power Station available to the public through requests in terms of the Public Access to Information Act. The reports by Prestedge *et al* are integrated in the appendices of the oceanographic reports (Appendices E16 of the Revised Draft EIR, Appendices A to I). The reports by Prestedge *et al.* are not separate documents.

Comment 26:

3 POTENTIAL IMPACTS OF THE NPS ON THE MARINE ENVIRONMENT

Introduction

This section addresses the impacts of the NPS on the marine environment.

ESKOMs’ commitment to the mitigation objectives

In the EIA the Arcus GIBBs´ specialists refer to an “understanding” that ESKOM will adhere to their recommendations.

Clarity on Eskoms (sic) commitment to follow up on, and adhere to, the recommendations from Arcus GIBB are required to establish credibility.

Response 26:

Environmental authorisations are always issued on condition that the recommendations in the applicable environmental assessment reports (Basic Assessments or Environmental Impact Reports) and/or specialist studies are implemented. These recommendations are also contained in an Environmental Management Plan – EMP (Appendix F of the Revised Draft EIR Version 1). Should an authorisation be issued, it will be issued subject to the implementation of the EMP during the construction and operational phases of the project, and subject to auditing of compliance with the EMP by an independent Environmental Control Officer. Should the detailed design of the Nuclear-1 power station differ substantively from what has been assessed in the EIA process, then a re-assessment of the design would be required.

Comment 27:

3.1 LACK OF QUANTITATIVE AND SCIENTIFIC BACKGROUND

Quantitative

Throughout the whole MEIS there is a lack of quantitative measurements. The specialists´ use of guesstimates in place of exact quantitative measurements and scientifically based models is insufficient.

The following information is required to further our understanding of the MEIS (Quotations in italic are copied directly from the MEIS)**:**

1. *"continuous low- level chlorination".* What is the exact concentration and flow of chlorine that will be returned to the ocean with the cooling water?

Response 27:

Please refer to Response 21.

Comment 28:

2. The NPS safety zone is cited as 1 km x 800m. This seems to be inconsistent with international safety zone standards for nuclear power stations. Please provide reference for the source of this safety zone calculation.

Response 28:

There is no proposal for a 1km by 800 m safety zone. There is a proposal for a 1 km wide marine security exclusion zone (1km wide from shore along the length of the Eskom-owned land). Apart from that, the proposed radius of the Urgent Proactive Zone (the smaller of the two Emergency Planning Zones for emergency evacuation purposes), which extends inland from the power station, is 800m. These two zones are for different purposes.

Comment 29:

3. *"Significant organic matter"* – what is the exact amount being?

Response 29:

The quote is presumed to be with respect to spoil disposal as per the assumptions and limitations on page 2 of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1). Spoil will be primarily sand overburden stripped from the area where the power station is proposed to be constructed. Vegetation will be removed from the overburden and used for revegetation, hence the assumption that spoil will contain insignificant organic matter.

Comment 30:

4. Pipelines: What is the diameter of the pipeline? And how much water will be sucked in per. second?

Response 30:

A description of the proposed pipelines is provided in section 3.11.1 of the Revised Draft EIR. As per this description, the intake pipelines will have diameters between 5 and 10 m. The flow rate (as per the Consistent Dataset – Appendix C of the Revised Draft EIR Version 1) will be approximately 1 m/s at the point of intake.

Comment 31:

5. Spoil: How will the spoil be transported to the dumping site off shore?

Response 31:

The spoil will be transported pumped in suspension via a tunnel.

Comment 32:

6. How small is the *"very small"* area, which will be impacted by the thermal plume?

Response 32:

As indicated in Section 3.2.3 of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1), oceanographic modeling indicates that for an offshore tunnel releasing at a depth of 25 m the mean increase in temperature will not exceed 1ºC near the seabed. However, for a nearshore release a mean increase of 7ºC or more near the seabed will affect an area of roughly 0.5 km² for a 4,000 MW plant and 1.5 km of shoreline will experience a maximum increase of 7ºC or more at depths of 0-10 m. It must be noted that offshore release of warmed cooling water is the recommended alternative for the Bantamsklip site and that a nearshore release has been assessed to have an unacceptable impact on Abalone.

The Marine Ecology Assessment further indicates that Abalone (*Halyotis midae*) adults will be able to tolerate a maximum temperature increase near the sea bottom of 7ºC. No mortality is therefore predicted for the recommended offshore release, since the maximum increase in temperature near the seabed will be less than 1ºC.

Comment 33:

7. Water temperature will increase by 12°C in certain points – How many points will there be?

Response 33:

The temperature of the warmed cooling water will be 12°C higher than the intake water upon release. Please refer to Response 31 above regarding the mean temperature increase near the seabed.

Comment 34:

8. Water temperature will increase in an area of .75 km2 with approx. 1°C. Is that based on 1 reactor or 4 reactors? A model is needed. This model must be based on the different parameters influencing the spreading of the plume and the different current systems.

Response 34:

As stated in the Marine Ecology Assessment the assessment is based on a 4000 MW plant. This is irrespective of the number of reactors. The total output of the power station is important as this (and not number of reactors) determines the required cooling. There may be a number of different reactor configurations (for argument's sake three smaller reactors or two large reactors) that may make up the total of 4,000 MW maximum.

Comment 35:

9. *"is likely to be spatially localised (hundreds of m radius)".* How big of an area will be disrupted precisely?

Response 35:

As indicated in your quote, the area is hundreds of square meters. From a marine biology perspective this is an insignificant area of disruption and does not need to be quantified exactly. If the impact were to occur over an area of several km radius it would be regarded as significant.

Comment 36:

10. What is the *"technical design"* behind the water intake?

Response 36:

The "technical design" of the water intake refers to the design of the water intake as described in the Consistent Dataset (Appendix C of the Revised Draft EIR). The concept design for the intake currently involves tunnels which collect water from the sea to the channel inside the plant area. These tunnels have to be designed taking all the environmental factors into account. This design is different from the current Koeberg one and it allows the beach line to be accessible, subject to the security exclusion zone, still to be esatblished. The implications of different intake design alternatives are discussed in Section 5 of the Coastal Engineering Report (Appendix E of Appendix E16 of the Revised Draft EIR).

Comment 37:

11. "*The most likely source of radiological releases into the marine environment is through the unintentional release of contaminated cooling water. This risk has been minimised through the technical design of the cooling system. This approach has proved adequate at KNPS, where no radionuclide release has been detected."*. What is the *"technical design"* which will minimize the unintentional release of radiological contaminated water? What is the amount of intentional radiological contaminated water?

Response 37:

Please refer to the description of the cooling system for a typical Pressurized Water Reactor nuclear power station in section 3.6.1 of the Revised Draft EIR Version 1. There is no direct contact between the cooling water and the radioactive components of the power station since the cooling water system is a closed system.

As indicated by Section 5.1.5 of the Marine Ecology Assessment: "*At a design level the risk of radiological releases into the marine environment has been minimised through the incorporation a 'triple cooling system' whereby at no stage is there direct contact between the reactor and the coolant or between the coolant and the sea water.*"

The fact that it is termed "unintentional" means exactly that. It is to be noted that monitoring of the marine environment has not picked up radiological releases into the marine environment during the more than 20 years of operation of the Koeberg Nuclear Power Station (KNPS). The NNR sets strict limits with regards to such releases and the proposed nuclear power station will not be approved if it cannot be demonstrated that the proposed plant will meet these limits and there are regular sampling to monitored the radioactivity levels and to determine if they are still within regulatory limits.

As indicated in Section 5.3.4 of the Nuclear Waste Assessment (Appendix E29 of the Revised Draft EIR Version 1, the nuclear license application to the National Nuclear Regulator (NNR) is required to present discharge levels for liquid emissions based on an assessment of their expected radiological impact to the most highly exposed individual and is expected to include best estimates activity discharges for Normal Operations and Anticipated Operational Occurrences based. The NNR will review these proposed discharge levels, with the view to approve safe Annual Authorised Discharge Quantities (AADQs) for the Nuclear-1 Nuclear Power Station to ensure that there is no adverse impact on human populations or on ecosystems.

As indicated by the Consistent Dataset (Appendix C of the Revised Draft EIR Version 1), the maximum effective dose due to liquid releases from Nuclear-1 will be limited to less than 1 mSv/a. The radioactivity in liquid and gaseous discharges from the Koeberg power station during 2007 and 2008 for example contributed a projected total individual dose of 0.004 mSv to the hypothetically most exposed public group. The projected doses, as a result of gaseous and liquid discharges, were 0.00047 mSv and 0.0038 mSv respectively for 2008 (0.00094 mSv and 0.003 mSv respectively for 2007), which is well within the NNR dose constraint of 0.250 mSv per annum (NNR 2009).

Comment 38:

12. What is the "*worst conditions"* related to release of cooling water?

Response 38:

The "worst conditions" referred to is with reference to the current warmed cooling water release of the KNPS. It refers to the worst case scenario recorded to date.

Comment 39:

3.2 ABIOTA

Introduction

This chapter deals with the impacts from abiotic factors on the marine environment in relation to a NPS.

3.2.1 Chemicals

Chemicals

The MEIS fails to mention important pollution sources and does not sufficiently deal with the impacts on the marine environment or the decommission of liquid radioactive waste.

Response 39:

Should you be able to provide examples of the types of chemicals that you claim have not been assessed, the EIA team could consider the allegation.

Comment 40:

The main focus is:

- Chlorine
- Contamination related to chemicals
- Liquid waste – decommission
- Air pollution

Response 40:

Your comment is noted.

Comment 41:

Chlorine and the disregards (sic) of its impact on the marine environment

The impacts of chlorine from the returning cooling water have not given sufficient attention. The negative effects of chlorine, are well documented, with even small amounts of chlorine (down to 0.01 mg/L) having a lethal effect on a wide range of fish, benthic invertebrates and phytoplankton. It is stated in the EIA that chlorine levels of up to 2mg/kg will be released with the cooling water.

DICT has not been able to find any model for the potential impacts of the chlorine on the environment. The specialist claims that it is very difficult to isolate the effects of chlorination from other impacts related to entrainment and therefore does not investigate this matter further.

Response 41:

As chlorination and temperature interact it is not valid to consider them independently. While this does not mean that their individual actions in the environment are not important, it does mean that what is relevant at an environmental scale is the sum of their impacts. This is what the marine ecology report considers. The specialist's conclusion is based on experience of the monitoring of the impacts of the KNPS over a period of more than 20 years. No long-term impact of chlorination has been found at the KNPS. No modeling has been done of the fate of chlorine in the marine environment as early work at KNPS found that the impact is localized and heat and chlorine dissipate quickly beyond the outfall area (Huggett 1987). REF: Huggett J 1987 The effects of heat chlorination and physical stress on entrained plankton at Keoberg Nuclear power Station. Submitted to Koeberg Nuclear power Station.

Comment 42:

In the MEIS it states.

"*Chlorination of cooling waters is commonly used by power plants throughout the world (Huggett and Cook 1991). It is, however, very difficult to isolate the effects of chlorination from those of entrainment itself, as during entrainment organisms are also exposed to heat and physical stress, such as mechanical buffeting, acceleration and changes in hydrostatic pressure (Marcy et al. 1978). Thus, in this report, all the above impacts will be considered collectively as impacts resulting from entrainment of organisms*."

The paragraph cited above does not address the effect of chlorine out flow on the marine life and its impact must be monitored and assessed.

"*Although the volume of water to be utilised by a 4 000 MW plant is roughly twice that of KNPS, the above conclusions are still deemed valid, as the extent of the impact is localised, heat and chlorine dissipate quickly beyond the outfall area (Huggett 1987) and plankton populations regenerate very rapidly, especially along the west coast (Huggett and Cook 1991). This impact will continue during the entire operational phase of the development*."

Response 42:

Please refer to Response 41.

Comment 43:

It is stated in the MEIS that chlorine will be released continuously into the marine environment, and yet chlorine is not mentioned in this quote from the EIA: "*The only compounds to be released from cooling water pipes are warmed sea water, sewage (at levels meeting the South African Water Quality Guidelines for Coastal Marine Waters) and desalinisation effluent (undetectable at the point of release)."*

It is essential that the effects of chlorine and other chemicals returned to marine environment are analysed and modelled.

The environmental impacts of contaminants are presented in the MEIS as being minimal. It must be clarified how the chemical contamination of the local marine environment is affecting the local species as well as the specific concentrations of the expected discharge of chlorine, waste water and other contaminants. If the concentrations and effects of the chemicals and contaminants are unknown, it is not possible to make any modelling of the impacts of the contamination on the marine environment.

In the EIA it is argued that it is not possible to monitor the toxicity due to the lack of a South African baseline. The absence of a baseline does not negate the requirement for monitoring to take place.

Response 43:

With regards to the impacts of chlorine, please refer to Response 41.

The need for monitoring has never been contested. It is a given that monitoring must take place before construction (to establish a baseline), during construction and during operation. Recommendations for monitoring are included in the Revised Draft EIR Version 1 and in the Marine Ecology Assessment.

Comment 44:

3.2.2 Brine

Brine

As quoted from the MEIS below, brine will be released straight into the surf zone during the operational phase.

"During the construction phase small volumes of hypersaline effluent will be released directly into the surf zone. Physical mixing in this high energy environment will result in sufficient dilution of the brine so as to ensure minimal impacts on the marine environment."

Please provide information about the effect of this release into flat calm seas as well as a model for the distribution of brine during different sea scenarios.

Response 44:

The movement of brine has been modeled under various scenarios (PRDW 2008 – PRDW 2008).??

Comment 45:

3.2.3 Radionuclides

Radioactive waste

It is not specified what happens to the 8000 m3 pr year pr unit of liquid radioactive effluent mentioned in chapter 3 in the EIA p. 3-23. It is stated that the "Liquid radioactive effluent will be collected, treated and stored in the effluent storage tanks."

Response 45:

Section 5.3.2 of the Radioactive Waste Assessment (Appendix E29 of the Revised Draft EIR Version 1) contains a discussion on the mechanisms used for the management and treatment of liquid radioactive waste.

Comment 46:

In the EIA it is stated that "To the knowledge of marine ecology specialists the compounds listed by the DICT (i.e. Boric acid, Lithium hydroxide, Hydrazine: Ammonia, Morpholine, Ethanolamine, Trisodium phosphate, Detergents and Metals and suspended solids) will not be released into the sea."

Response 46:

The Dyer Island Conservation Trust (DICT) has not stated where this quote is from. It is unclear which report is referred to as the "EIA" or which section of the "EIA" this quote is from. It is therefore not possible to provide a response.

Comment 47:

Information about the plan for the decommission of liquid radioactive waste is requested, as well as the listed contaminants in the EIA.

Presumably some of this radioactive waste will find its way into the ocean. As quoted below, the MEIS concedes this fact but does not link increased levels of radionuclides in the marine environment to the NPS:

"Importantly, due to radionuclides having been recorded in very few individual organisms at KNPS, the low concentrations at which they have been recorded and the fact that compounds at equivalent levels of radioactivity have previously been recorded in these species under natural conditions, these findings are not considered indicative of any significant effect resulting from the power station on the surrounding marine environment (Griffiths and Robinson 2005)."

Another source of radionuclides is through air pollution, which the EIA confirms will occur. It is inevitable that some of these compounds will end up in the ocean, which invalidate the specialists' conclusions. The specialist is aware of the fact that contamination is likely to occur. Therefore the impacts need to be monitored.

Response 47:

Please refer to Responses 37 and 45.

Atmospheric emissions will occur at doses far below the authorised dose that ensure prevention of harm to the public. As indicated in previous responses, and in the above-mentioned quote from the Marine Ecology Assessment (which quote is based on the marine ecology team's monitoring of the KNPS's impacts over more than 20 years), no significant impact on marine life has ever been found at the KNPS. This monitoring programme determines the level of radioactivity in marine organisms, no matter the origin or pathway thereof (liquid or gaseous). It is therefore unclear how the DICT has deduces that the specialists' conclusions are invalidated.

The DICT's statement "Therefore the impacts need to be monitored" refers. This seems to infer that the Revised Draft EIR denies the need for monitoring, which is not factually correct. Section 10.3.1 of the Revised Draft recommended that "*Various baseline monitoring programmes (e.g. terrestrial vertebrate fauna and marine monitoring), as specified in the respective specialist reports, must be implemented well before the start of construction to ensure that pre- and post-construction environmental conditions can be compared."* Furthermore Section 5.2.2 of the Marine Ecology Assessment recommends the following: "*An environmental surveillance programme should be implemented to monitor for radiation emissions in the marine environment. This would form part of the strict requirement of the National Nuclear Regulator Act. The design of such a programme is outside our area of expertise, but is likely to follow the Eskom Radiation Protection Environmental Surveillance Standard. Organisms which we recommend for inclusion in such a monitoring programme are abalone H. midae at Bantamsklip and chokka squid Loligo reynaudii at Thyspunt, as both are consumed commercially*".

Comment 48:

3.2.4 Water temperature

Water temperature

There is not sufficient information in the MEIS regarding how much energy will be released into the water, even though the AA states that there is a reliable model and sufficient information. This information is necessary to model a heat balance as well as model of how the warm water dissipates. The visual model should also take into account variations of current, swell and wind.

Response 48:

It is clearly stated in the Marine Ecology Assessment (Appendix E12 of the Revised Draft EIR Version 1), the warmed cooling water will be 12˚C warmer than the intake water. The impact of the release of this water is modeled in detail for different scenarios (including offshore and inshore releases) as illustrated in Appendix B of Appendix E16 of the Revised Draft EIR. For ease of reference selected figures from this appendix are shown in the pages to follow for the Bantamsklip site.

Comment 49:

3.2.5 Spoil

Spoil –dumping and transportation

The MEIS does not provide any information about how the spoil will be transported to the off shore position and what the impact of this transportation might be. This information is required to complete the MEIS.

Although it is stated that the spoil will stay in the water for 2 days, it is not clear how many cumulative days of dumping will occur. This information is required.

It is stated that the amount of spoil in the water will not exceed 10.07 million m3. Information about the monitoring and regulation of this process is required.

Response 49:

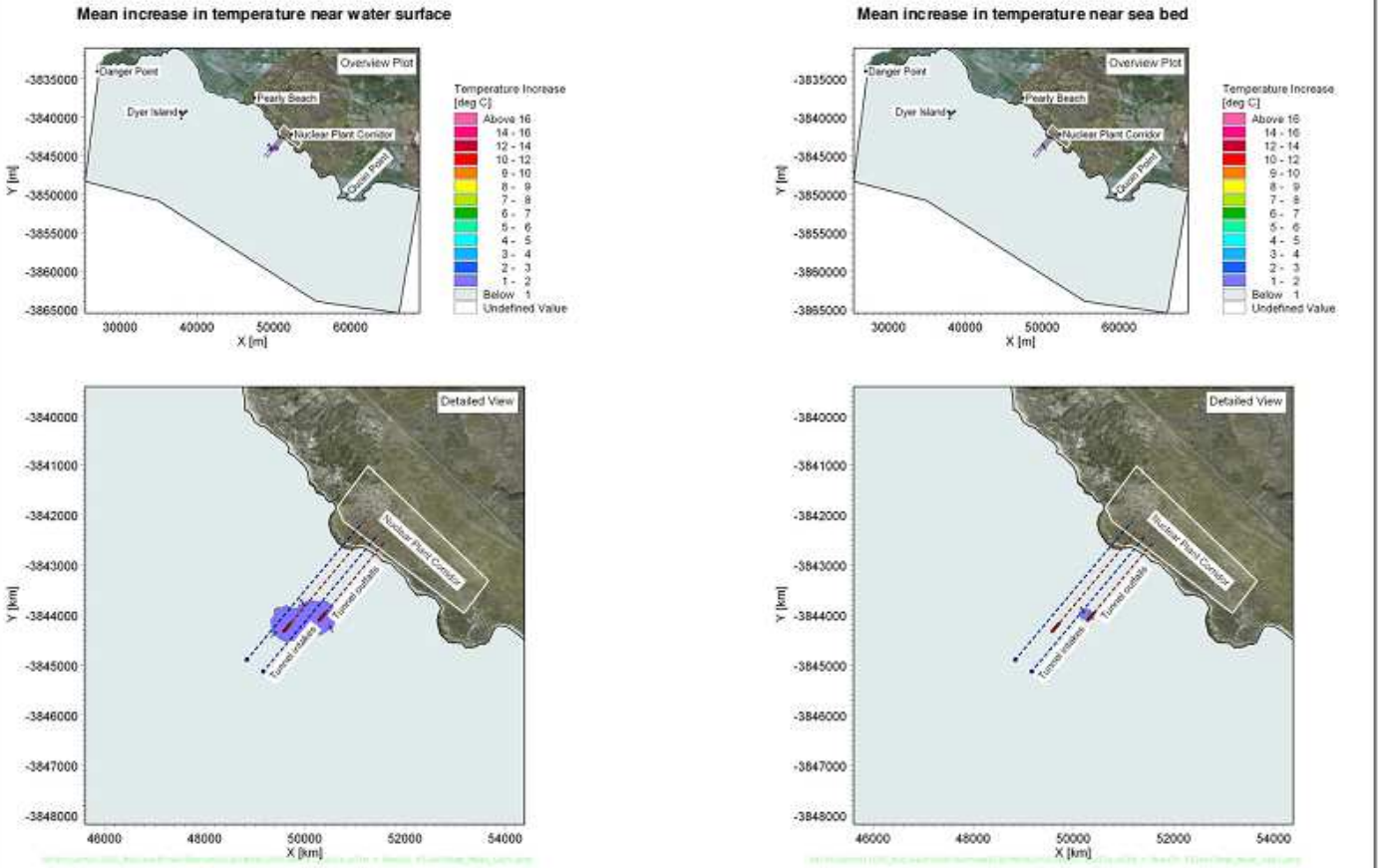
As indicated in the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1), two disposal alternatives for spoil are assessed at each of the sites: a nearshore and an offshore disposal option. These alternatives are also discussed in Section 5.12 of the Revised Draft EIR Version 1. Different pumping rates for the spoil are also considered.

It is stated in the Marine Ecology Assessment that the impacts of spoil disposal will be twofold:

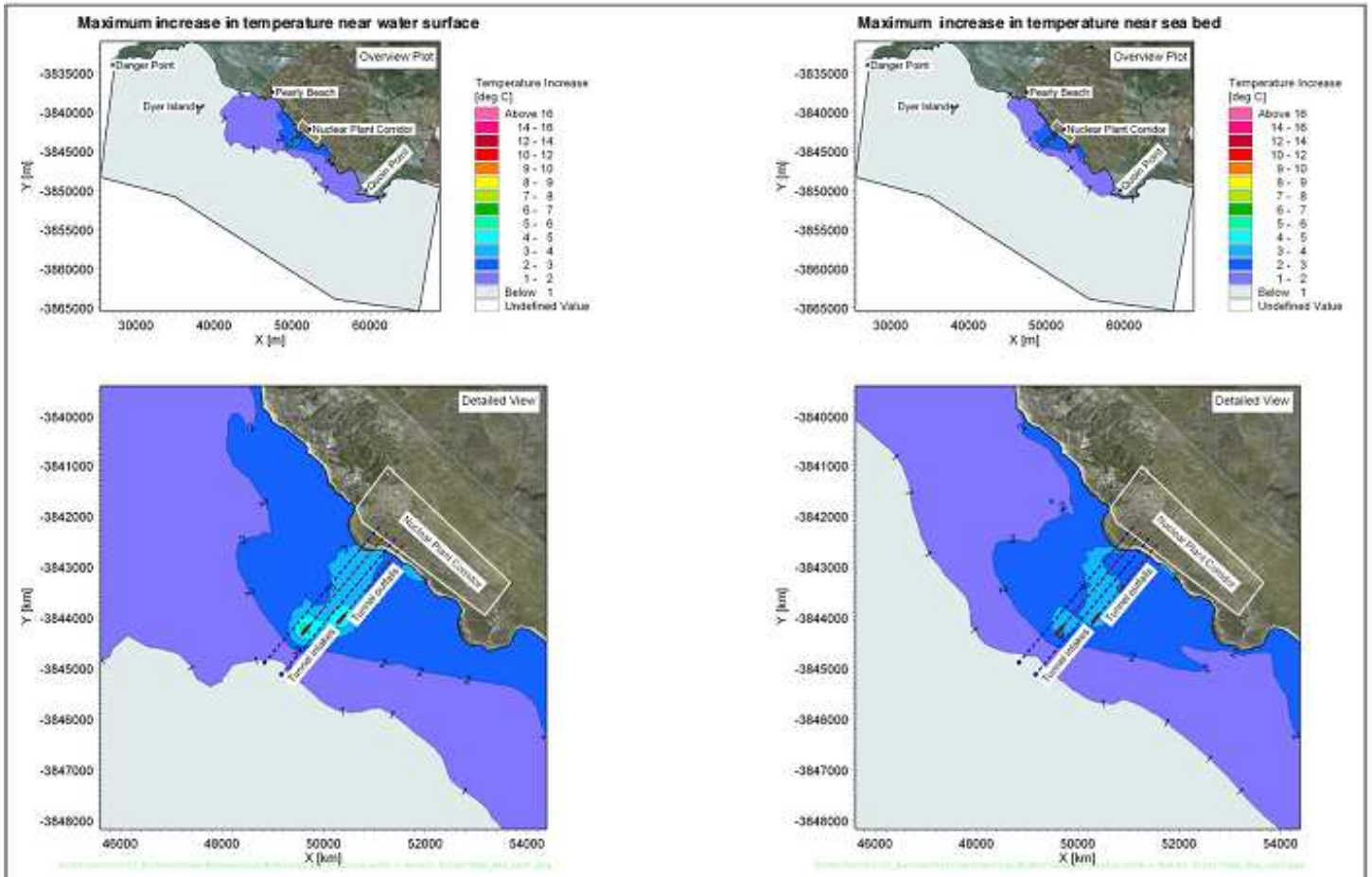
- Firstly as a sediment plume within the water column (consisting mainly of fine muds), which may block light penetration and filtering apparatus of filter feeders; and
- Secondly as a layer covering the sea bottom (consisting mainly of coarser sands) that will bury the current benthic environment and biota.

Impacts of the spoil disposal alternatives in terms of the movement of the spoil over time are assessed in Appendix I of the Oceanographic Assessment (Appendix E16 of the Revised Draft EIR Version 1). The assessment of impacts in the Marine Ecology Assessment is based on the spoil movement patterns modeled in the oceanographic assessment. Section 3.2.1 of the Marine Ecology Assessment states that "*Alternatives 4, 5 and 6 (i.e. either the full or half the volume of spoil disposed offshore at either a medium or high flow rate) are considered preferable*". Based on these alternatives, the total length of time over which disposal will occur could be 29 days (at a pumping rate of 3.93m^3/s) or 56 days (at a pumping rate of 2.06m^3/s) if pumping takes place without interruption, 24 hours per day.

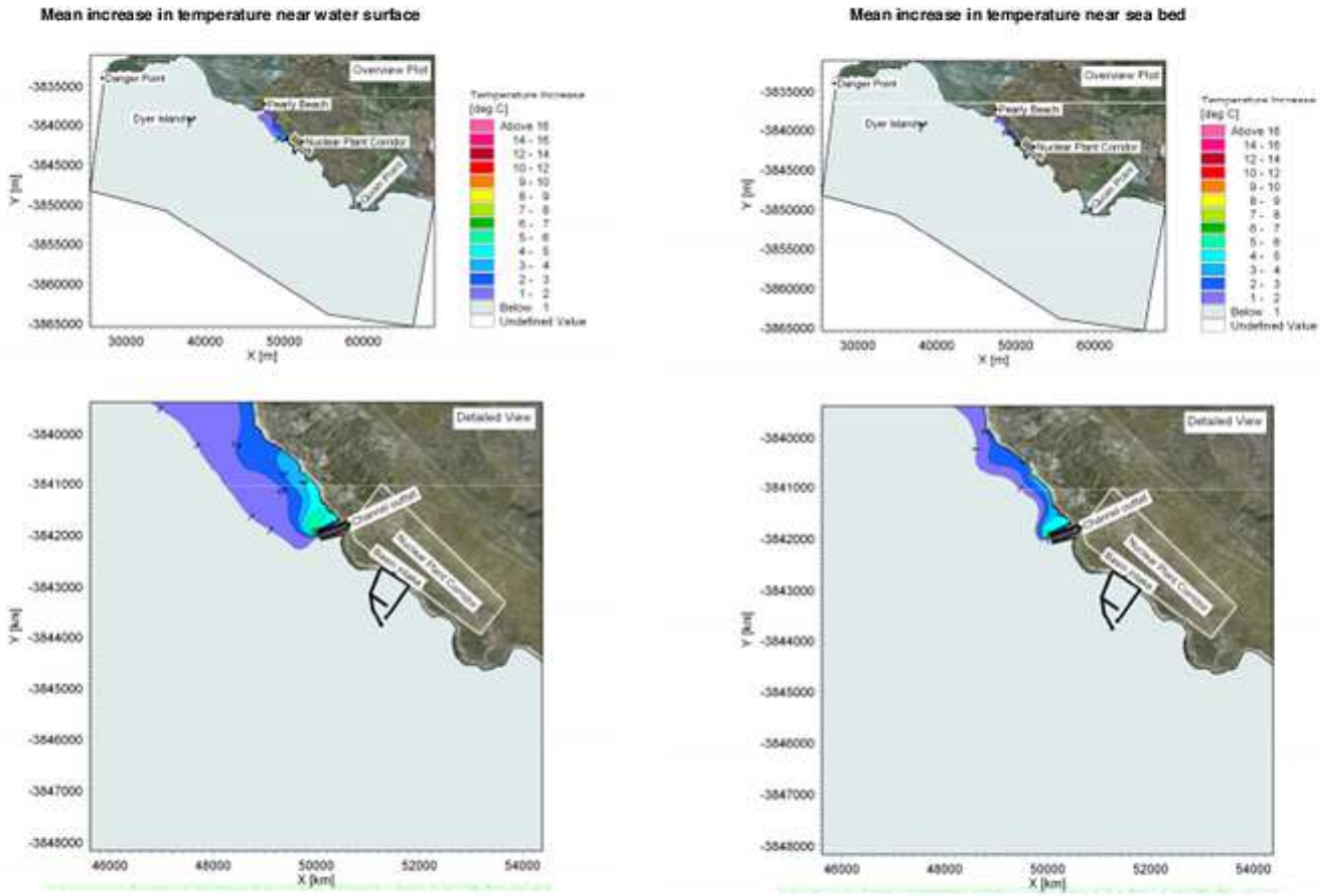
The disposal of spoil, together with other potential environmental impacts that will occur during construction, will be monitored by an independent Environmental Control Officer who will report to an independent Environmental Monitoring Committee and to the environmental authority.



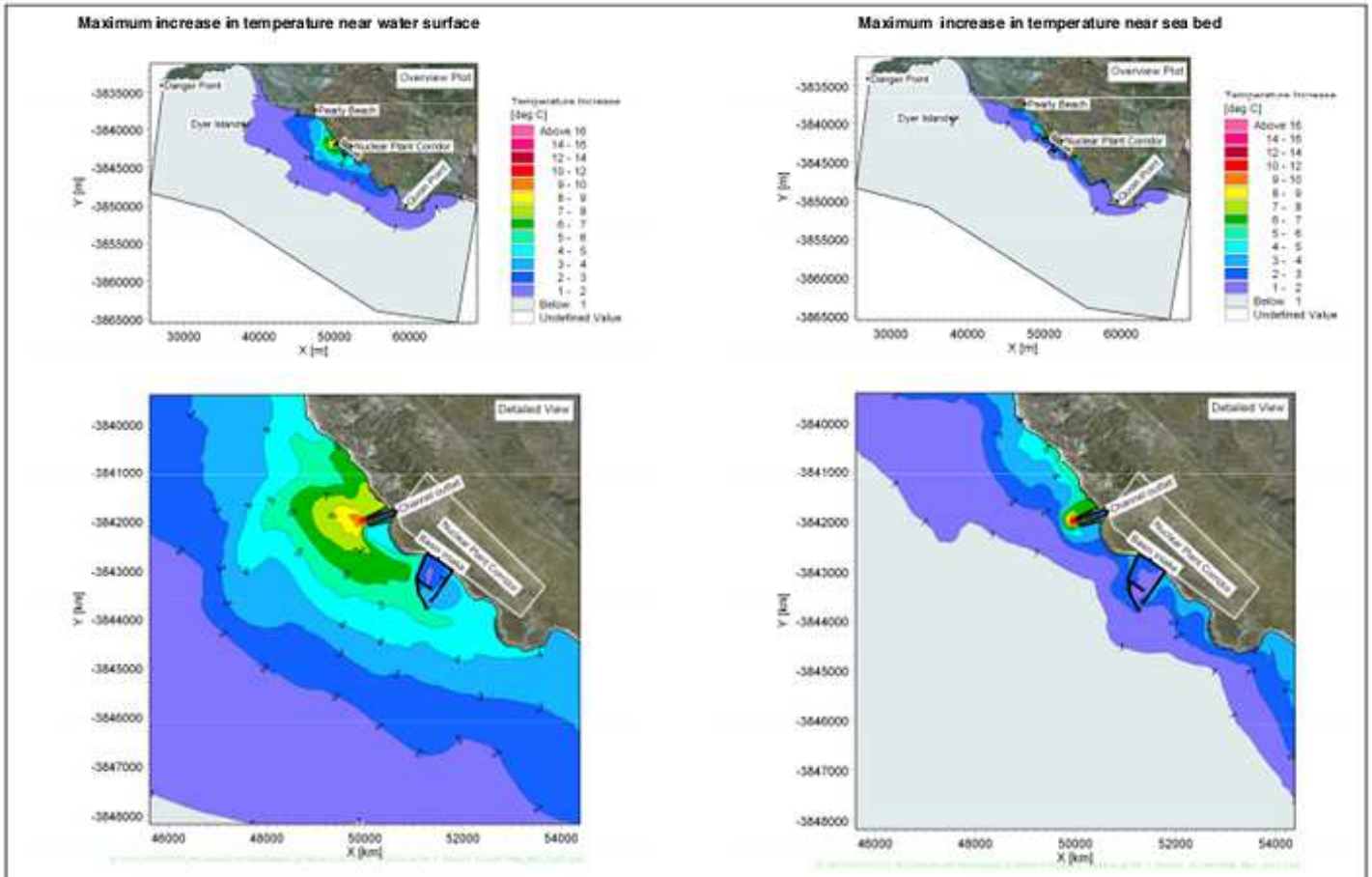
	Title:	Thermal plume modeling: Mean increase in temperature due to power station at Bantamsklip (Option 1)	**Figure 4.3**	
	Origin:	PRDW 2009d (Figure 9.23)	Date:	Feb 2011



	Title:	**Thermal plume modeling: Mean increase in temperature due to power station at Bantamsklip (Option 1)**	**Figure 4.4**	
	Origin:	**PRDW 2009d (Figure 9.24)**	**Date:**	**Feb 2011**



	Title:	Thermal plume modeling: Mean increase in temperature due to power station at Bantamsklip (Option 2)	Figure 4.5	
	Origin:	PRDW 2009d (Figure 9.24)	Date:	Feb 2011



	Title:	Thermal plume modeling: Maximum increase in temperature due to power station at Bantamsklip (Option 2)	Figure 4.6	
	Origin:	PRDW 2009d (Figure 9.24)	Date:	Feb 2011

Comment 50:

3.2.6 Pipe drilling

Pipe drilling

DICT would like to know if modern techniques for construction of the pipelines have been considered, especially those relating to digging from the shoreline into the seabed without the need for a cofferdam.

Will written guarantees will be provided to state that no explosions will occur during the construction phase?

Response 50:

As indicated in Response 2, the construction of the intake tunnel(s) will involve sinking of a shaft on land to a depth of approximately 65m below mean sea level and driving the tunnel seawards underneath the seabed. The coffer dam will be required only for the construction of the cooling water outlet tunnels. The intake system will be made of tunnels whilst the outfall will be channels. The latter require a different measure taken in their construction.

On a large construction projects such as this, some loosening of bedrock through the use of explosives will be required. However, Section 7.1.7 of the Draft Environmental Management Plan - EMP (Appendix F of the Revised Draft EIR Version 1) requires the development of a blasting plan to prevent impacts on sensitive seabird populations and non-resident sensitive birds. A method statement for blasting (a detailed technical description to indicate and describe in detail how contractors will implement and achieve environmental compliance) is required by the EMP. All method statements are required to be authorised by the independent Environmental Control Officer prior to the commencement of the relevant activities. Furthermore, Section 7.5.4 of the EMP requires blasting to be planned well in advance so that it is restricted to the period of June to October, in order to avoid blasting in the peak breeding season (November to May) of sensitive populations of seabirds.

A variety of low-impact blasting methods (e.g. the use of blasting mats) and micro-timing of small blasts) are available for inclusion in method statements to reduce noise, dust and vibration impacts of blasting.

Comment 51:

3.2.7 Noise

Noise

The vulnerability of cetaceans to increased background noise was raised in our initial letter of concern, and although the AA included a limited response to this, it did not address the long term impact over the projected 5 year construction phase.

Detailed information is requested concerning the duration of any construction phase that will involve oceanic noise pollution, such as the driving of pillars into the seafloor for a cofferdam.

It is necessary to monitor the background noise levels before and during the construction phase, to establish if these have any impact on behaviour changes in the cetacean species.

Response 51:

Please note that the construction period is 9 years, not 5 years as indicated in your comment. Noise is by definition a short-term impact, which occurs only over the duration of the noise occurrence. As such no long-term impact on cetaceans is expected.

No significant noise impacts are expected during the operational phase, since the most significant impacts during operation will be caused by the operation of cooling fans on the reactor buildings.

It is agreed that noise monitoring must commence prior to the start of construction. All forms of monitoring must commence prior to the start of construction in order to build up a database of background levels.

Comment 52:

3.2.8 Climate change

Climate change

DICT agrees with the statement in the "EIA" that it is important to include global climate change when calculating the models for Bantamsklip (or any other nuclear power station).

The point of DICT in the first Letter of Concern was that the two specialist studies (MES and OSS) use different reference temperatures in their models!

Response 52:

It is unclear which report is being referred to as the "OSS". No response can therefore be provided to this comment.

Comment 53:

In the MES it is mentioned, more than once, that the "Climate change" would decrease the water temperature and this would be able to counter---current the effect of the warm cooling water that will be pumped into the water column. While in the OSS a temperature increase is used as reference for the "Climate change".

Arguments like climate change should be taken into account for the models, but these models must include scenarios for temperature increases and decreases.

The fact that the MES and the OSS build their argumentation on different scenarios (respectively, a decrease in the water temperature and an increase in the water temperature) is not scientific or objective.

Response 53:

The Marine Ecology Assessment's statement that cooling of water temperatures has been observed is based on empirical monitoring data. The predictions of temperature increases are based on global models of climate change. It is acknowledged that climate change models make general predictions of trends, but this does not exclude contradictory trends in some geographical areas, such as the cooling trends observed along sections of the South African coastline.

Comment 54:

3.3 BIOTA

Introduction

This chapter deals with the impacts on biota in relation to the potential construction of the NPS.

3.3.1 African penguins

African penguins

Although the AA refers to the African penguin being classified as "*vulnerable*", this is incorrect. They were re---classified as "endangered" in 2010.

We recommend that DICT and CapeNature are consulted during this process, as they are collectively involved in the management of Dyer Island and research conducted in this "Important bird area". Essential research must be carried out on African penguin foraging behaviour, as the proposed NPS lies within their feeding range.

Response 54:

CapeNature has been involved as an interested party in the Nuclear-1 EIA process from the commencement of this EIA.

Your comment regarding the change in the conservation status of African Penguin is gratefully acknowledged.

Extensive information is available on African Penguin foraging behaviour and it is unclear how additional site-specific research would add to the prediction of impacts resulting from Nuclear-1. It is well known that African Penguins forage at distances of 30 to 70 km per day. Recent research on their foraging behaviour by Pichegru et al[2] indicates that closing off an area of commercial fishing (as will be the case with the proposed 1 km wide marine exclusion zone at Nuclear-1) results in almost immediate benefits to African Penguins in terms of reduced foraging effort.

Based on oceanographic modeling recorded in the reports by PRDW (Appendix E of Appendix E16 of the Revised Draft EIR Version 1), Section 3.2.1 of the Marine Ecology Assessment reports that maximum suspended sediment concentrations reaching the Dyer Island will remain five times below the ecological threshold of 80mg/l, with turbidity above this level remaining at least 300m clear of the Island.

Comment 55:

3.3.2 Cetaceans

Cetaceans

Within the EIA, the following inadequacies where noted.

[2] Pichegru L., Grémillet D., Crawford R.J.M. & Ryan P.G. (2010) Marine no-take zone rapidly benefit threatened penguin. *Biology Letters* 6: 498-501.

The specialists:

- Do not use references

Response 55:

Presuming that the "EIA" refers to the Revised Draft EIR Version 1, the specialist references to other sources have not been repeated in this document, since they are referenced in each of the specialist reports themselves.

Comment 56:

- Do not include relevant dolphin species in the Thyspunt area and do not reference the other information.

Response 56:

Section 2.3.4 of the Marine Ecology Assessment (Appendix E14 of the Revised Draft EIR Version 1) discusses the occurrence of marine mammals such as Indo-Pacific bottlenosed dolphin (*T. aduncus*), Long-beaked common dolphin (*D. capensis*), Humpback whale (*Megaptera novaeangliae*) and Southern right whales (*E. australis*) in the Thyspunt area. It is stated that these species are observed in the general vicinity of Thyspunt but that they are transient within the area and therefore of relatively low environmental concern.

Clarity is required as to what "other information" is not referenced.

Comment 57:

- Use incorrect information on page 11 concerning the most frequently seen species in the Bantamsklip Area

Response 57:

Clarity is required as to what information regarding frequently seen species is claimed to be incorrect.

Comment 58:

- The "EIA" neglects the fact that the area around Pearly Beach is an important area for mating and breeding where significant cow---calf interactions of the Southern Right whale occur.

Response 58:

Your statement is not factually correct. Section 2.2.4 of the Marine Ecology Assessment (Appendix E14 of the Revised Draft EIR) contains the following information regarding Southern Right Whales in the Bantamsklip area:

"*Four marine mammals are regularly observed in the vicinity of Bantamsklip. These are the Southern right whale (Eubalaena australis), Indo-Pacific bottlenosed dolphin (Tursiops aduncus), Long-beaked common dolphin (Delphinus capensis) and South African fur seal (Arctocephalus pusillus pusillus). Southern right whales occur mainly within 1 km of the shore from April to January, with peak abundances in September - October (Barker 1988).* ***During the later part of this yearly cycle inshore populations are dominated by cows with calves.*** *This species is not believed to feed while*

in the region (Barker 1988). While no major calving area occurs close to Bantamsklip, Walker Bay (to the west) has been identified as an important mating ground (Barker 1988). Southern right whales are listed in the category of 'least concern' by the IUCN (IUCN 2010)".

Comment 59:

- The specialists themselves mention on page 15, that according to Peter B. Best the presence of southern right whales is not random, but linked to the birth of calves.

Response 59:

Your comment is noted. Please see Response 58 and 60.

Comment 60:

- Claims that *"While no major calving area occurs close to Bantamsklip, Walker Bay (to the west) has been identified as an important mating ground (Barker 1988)."* But since no studies has (sic) been carried out in the area of Bantamsklip so far – the specialist must be guessing. If the specialist holds information proving that there is no calving ground at Bantamsklip, DICT would like to see this study.

Response 60:

The section in the marine ecology report dealing with marine mammals has been updated by a marine mammal expert (Please refer to the Revised DEIR (Version 2).

Comment 61:

- The specialist failed to cite a very important reference (Karczmarski et al. 2000, Marine Mammal Science, vol 16. No.1.), stating that; "The dolphins´ dependence on this restricted type of habitat within an already restricted inshore distribution makes them particularly vulnerable to alteration or loss of this habitat" this article also confirms that the habitat of the humpback dolphins are within the 25m isobath, which can involve area further than 1.5km off shore. Within the Bantamsklip the dolphins are observed as far as Dyer Island, which is 8 km off shore. Instead the specialist reference "*While the shy Indo-Pacific humpback dolphin is likely to leave the immediate area during construction of the cooling water intake system, the disposal of spoil is unlikely to affect this species, as these animals do not venture more than 1.5 km offshore (Karczmarski et al. 1999) (spoil will be placed 6 km offshore) and show no obvious preference for clear or turbid waters (Karczmarski et al. 2000)."*

The impacts concerning marine mammals must be re---analyzed by a qualified marine mammal specialist.

Response 61:

A marine mammal expert has updated the relevant sections of the report and the revised report will be made available for public comment and review as part of the Revised Draft Eir Version 2.

Comment 62:

3.3.3 Great white sharks

Great white sharks

Recent studies from DICT have proven that great white sharks are highly impacted by changes in water temperature and visibility. Even though they are temperature tolerant and occupy warm as well as cold water habitats, localized variations in temperature have a noticeable impact on their distribution. The population composition of great white sharks utilising the area in the Greater Dyer Island area changes particularly in the summer months, which seems to be linked to temperature changes as well as oxygen levels. At present there is a lack of research concerning the distribution and behaviour of great white sharks in the Greater Dyer Island area, and it is to (sic) early to conclude that sharks are not dependent on temperature changes.

South Africa holds more than half of the worlds´ population of great white sharks, and the majority which depending on the Greater Dyer Island area. Dyer Island is recognised internationally as one of the most important areas for great white sharks.

The impacts concerning great white sharks and fish species in general must be re-analyzed by a qualified ichthyologist. The water temperature, oxygen level and visibility need to be monitored to be able to quantify the impacts on the great white sharks as well as the cage diving industry (see Chapter 4).

Response 62:

Your demand for impacts to be re-analysed by a "qualified ichthyologist" refers. The Marine Ecology Report is required to comment 0n a full range of taxa and issues, and as such the team members need to have a wide general knowledge and to be able to synthesize information generated by specialists (rather than necessarily generate it themselves).The team, consisting of Prof Charles Griffiths, Dr Tamara Robinson and Dr Simon Elwen, are all respected, published and peer-reviewed marine scientists with collective academic experience of more than 50 years. Prof. Griffiths has also published more than a dozen research papers on the biology and fisheries of local fish species, including sharks. He has also supervised several theses on this topic, including two current studies on the population biology of Great White Sharks. The team is this well familiar with the literature, and ongoing studies, on this topic.

The specialist team recognize the importance of this area for Great white sharks (GWS), but would contest the assertion that 'the majority of South African GWS depend on the Dyer island area'. Not only are GWS highly mobile, both within the region and across its borders, but reliable population estimates are not yet available (although several researchers are currently working on such population models). GWS may be sensitive to temperature, but the area of elevated temperature predicted to result from this development is tiny and will not extend to the Dyer Island site, so is highly unlikely to adversely effect this highly-mobile, wide-ranging species

Comment 63:

3.3.4 Abalone

Abalone model

Again as mentioned in the first submission by DICT it is highly doubtful how much the abalone stock with (sic) in the protected zone will actually benefit from this "protection".

Response 63:

Your comment is noted. The authors of the Marine Ecology Assessment themselves express doubt about the efficacy of the protection, since policing of the area would continue to be the responsibility of the South African Police Service, which in under-resourced with respect to abalone poaching. The

Marine Ecology Assessment therefore states that "… the level of organised crime associated with abalone poaching in this region has resulted in this practice occurring relatively unchecked, despite the best effort of the police. As such the degree of benefit derived by abalone populations remains unclear".

Comment 64:

The design of the cofferdam is not specified and it is important to verify, the size of the dry area within the cofferdam and how much of the abalone in the vicinity will be impacted. DICT request information about the size of the abalone occupied area that will displaced by the cofferdam.

According to the specialist 17---26% of all zooplankton die off when entrained with the cooling water. In a relatively small area as the specialist refer to as the protected zone (1kmx800m) the gametes of the "protected abalone" will be sucked in with the cooling water, which will have an effect on the "protected stock". The effluent chlorine might also have an impact on the gametes of the abalone.

In the EIA it is argued that it is not possible to establish a model for the population in the area. DICT is questioning how it is then possible to prove if the protected zone actually benefits the abalone stock. A baseline of the current situation must be provided.

A monitoring programme during the construction, operational and final phase, must be presented.

Response 64:

The actual coffer dam size will be dependent on the actual channel design and size. This cannot be concluded without a final design. However, the environmental sensitivity study for the marine biology impact considered the most severe impact in the construction process.

Please provide a reference for the statement that "the AA argues that it is not possible to establish a model for the population in the area". As indicated in the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1) and in the Revised Draft EIR, the potential for protection of abalone is based on the declaration of marine exclusion zone, which is required in terms of the National Key Points Act, 1980 (Act No. 102 of 1980). The exclusion zone will definitely be required along the length of the Eskom property if it does become a nuclear power station site. The establishment of the exclusion zone (if the site does become a power station site) is therefore a *fait accompli*.

It cannot be proven that the zone will result in real benefits to abalone. As indicated in Response 62, the Marine Ecology Assessment itself has little confidence in the protection that the South African Police Service will be able to provide to abalone given the brazenness that poaching has reached. The effectiveness of the exclusion zone will be entirely determined by the policing of this zone.

It is agreed that monitoring of abalone must take place at Bantamsklip, should this site be developed.

Comment 65:

3.3.5 Cape fur seals

Cape fur seals

DICT agree with the "EIA" that the population of cape fur seals are doing very well and that this species is not endangered.

DICT does encourage Arcus GIBB to consult Dr. Steve Kirkman from Ocean & Coast to obtain information about the fur seals behaviour and distribution in the area. Dr. Kirkman has tagged mothers and pups and studied the colony extensively. He will able to advise Arcus GIBB concerning the status and potential impacts of the colony.

Response 65:

Your comment is noted with thanks.

Comment 66:

3.3.6 More research needed

The establishment of an NPS will provide permanent changes in the present marine habitat, due to several factors such as increases in temperature, sediment, contamination and noise.

DICT stresses that more research must be carried out prior to the construction of the NPS. This research must provide data on the present distribution of fish populations, foraging penguins, sharks, seals and cetaceans in the impacted area. Potential habitat changes could lead to fish populations abandoning the area, which would be likely to change the behaviour of the predators in the area.

Response 66:

Your comment is noted. The marine specialist team is confident that the information at its disposal provides it with a sufficient basis on which to assess the potential impacts on marine life at the Bantamsklip site.

It is to be noted, as indicated in several responses above, that the assessment of marine impacts at all three sites is based on long-term monitoring of impacts that has taken place at the KNPS over more than two decades. Catastrophic impacts at the KNPS were predicted by many interested parties prior to the KNPS's construction, but in fact never occurred. For instance, as indicated in the Marine Ecology Assessment, the establishment of warm-water species at the KNPS was predicted, but has never occurred. Many lessons have been learnt from the KNPS experience, resulting in completely different designs for Nuclear-1 that will further reduce the environmental impact. For instance, the outlet of the KNPS's warmed cooling water is nearshore and at surface, whilst the recommended alternative for Nuclear-1 is an offshore release below surface with release points designed to dissipate the warm water as quickly as possible.

Comment 67:

4 IMPACTS ON TOURISM

Marine tourism

DICT are still concerned about the impact on marine tourism, primarily because this unique form of tourism provides a platform for introducing the general public to conservation issues surrounding great white sharks and cetaceans.

Aside from the obvious negative impact of the NPS on local marine life, the presence of a NPS is likely to deter many tourists from visiting this area, which will impact directly on the local economy. This may result in compensation claims from local business owners that are reliant on tourism.

Response 67:

Your comments are noted. The EIA team is aware of the reliance of towns around Bantamsklip on marine-based tourism, particularly shark cage diving. Whilst short-term impacts on nature-based tourism may occur, particularly during the construction phase, the experience of the nature reserve around Koeberg shows that eco-tourists are not detracted by the presence of a nuclear power station. The presence of the KNPS has produced no long-term impacts on tourism in the Cape Metropole. On the contrary, the Koeberg Nature Reserve itself has become a tourism and recreational attraction.

The potential impacts on Nuclear-1 on the tourism market around Bantamsklip are discussed in Section 4.1.3 of the Tourism Impact Assessment (Appendix E22 of the Revised Draft EIR). This report concludes that shark cage diving is unlikely to be affected and that Nuclear-1 would directly affect approximately 10% of current whale watching activities, which would then have to move to the larger area. An even lesser impact is possible if Eskom is successful in applying (as it has indicated to the authors that it intends doing) for permission to allow access for whale-watching trips.

Although nature-based tourism may be negatively affected, the overall potential impact on bed-nights around Bamtamsklip is predicted to be positive, given the increase in business-based tourism caused by an influx of construction and operational personnel.

Comment 68:

4.1 SHARK CAGE DIVING AND WHALE WATCHING

DICT refer to the first Letter of concern for detailed description of the shark cage diving and whale watching tourism in the area.

DICT is highly concerned about the nature experience of tens of thousands of tourists visiting the area each year.

Tourists who care about nature conservation and who may question the South African Governments´ capability to protecting the fragile environment. Tourists that travel to Kleinbaai to go shark Cage diving, whale watching, leisure fishing or for recreation, expect to experience a unique nature experience. But the impacts of NPS will in addition to changing the marine environment also have severe impacts on the visual experience. The nature that the visitors will experience will simply be ruined by the physical presence of the NPS.

Response 68:

Your comment is noted. Please refer to Response 66.

It is acknowledged that there may be short-term impacts on the sense of place, particularly during construction, but that in the long-term (as is the case with the KNPS), surrounding tourism-based economies will evolve into a longer-term integration of mutual proximity and acclimatisation to the presence of a nuclear power station.

Comment 69:

Shark Cage Diving

The area is a world known for its Shark Cage Diving, which is a main tourist activity in South Africa. The area around Dyer Island and the shallow waters of Joubertsdam are one of the most popular areas in South Africa used for Shark Cage Diving.

The overall impact of visitors traveling to South Africa specifically to experience Shark Cage Diving is estimated at a staggering R2 Billion per year. It is stated in the MEIS that viewing of GWS[3] might be affected for a few days. Please provide reference documents supporting this statement as we know of no such studies carried out in this area.

Response 69:

The prediction of impact on shark cage diving due to increase turbidity is based on the oceanographic modeling in Appendix E16 of the Revised Draft EIR Version 1.

Comment 70:

Whale watching

It is stated in the "EIA" that whale watching boats are likely to be given permission to enter the exclusive zone. This aside, the visual impact of the NPS during and after construction will have a negative impact on the whale watching tour.

Response 70:

Your comment is noted. The Tourism Impact Assessment (Appendix E22 of the Revised Draft EIR Version 1) does indicate that the potential impact on visual amenity enjoyed by tourists at Bantamsklip would be high without mitigation and medium with mitigation.

Comment 71:

5 RECOMMENDATIONS

1. Argus GIBB to respond in full to all points raised in Sections 2, 3 and 4.

Response 71:

Please refer to our responses above.

Comment 72:

2. More research concerning the Great White shark and the fish species in the area.

Response 72:

Please see our responses above.

Comment 73:

3. More research concerning the cetacean species in the area.

Response 73:

Please see our responses above.

[3] Presumably an acronym for Great White Sharks

Comment 74:

4. The DICT want to be provided with the BOD and demand a new Marine Environmental Assessments to be provided based on the actual design of the Nuclear power station.

Response 74:

In the absence of a definition of the term BOD it is impossible to respond to this comment.

Comment 75:

5. All documents referenced by Arcus GIBBs and those within the MEIS to be made available for public scrutiny.

Response 75:

All relevant documents have been made available on the website:

http://projects.gibb.co.za/en-us/projects/eskomnuclear1reviseddrafteir.aspx

Comment 76:

6. Request information on the process that reviewed and dismissed alternative technologies such as cooling towers, drilling pipe lines from sea shore and ultra violet light.

Response 76:

The cooling towers (especially dry cooling towers) are used in water starved regions. The choice of coastal sites was primarily linked to the volumes of cooling water required and the sea was seen as that source. Cooling towers would alter the environment drastically during construction and in the final outlook of the landscape. The only cooling towers considered are the smaller ones which would be an alternative/backup cooling system in case of loss of the sea. These are orders of magnitude smaller and would not be for keeping the plant at power, but for supporting the safety systems.
Use of other non-industry standard biofouling prevention techniques would be considered over plant life as the nuclear industry's strength is that of continuous improvement.

As indicated in the above-mentioned responses, the intake cooling water pipelines will be drilled below the seabed.

Comment 77:

7. Information concerning ultra violet light used to cleanse intake water for settling organisms.

Response 77:

Please refer to Response 76.

Comment 78:

8. Information about the amount of water intake from the ocean using cooling towers compared to the amount of water used when the NPS is based solely on water intake from the ocean.

Response 78:

The heat exchange process in cooling towers will require substantially more water to be used to make up. This is to replace the water that is lost as steam that is generally observed from a cooling tower.

General Response

Please note that as per Chapter 5 of the Revised Draft EIR (Version 2). With the completion and subsequent approval of the Scoping report in 2008, the intention was to conduct a detailed assessment of three alternative sites for Nuclear 1 namely Duynefontein, Bantamsklip and Thyspunt. All three sites have been investigated in equivalent detail subsequently as part of the assessment phase of the EIA. In those investigations it has become clear that while Bantamsklip remains a viable site for a nuclear power station, it is the least favourable of the three sites for Nuclear 1. Given that the detailed assessment of Bantamsklip has already been presented in the public domain as part of earlier drafts of the Environmental Impact Report, the decision has been made to exclude Bantamsklip from further consideration in this EIR in the interests of brevity.

The three primary reasons for excluding Bantamsklip at this point relate to transportation risks, urban planning and the level of assessment available to the Nuclear-1 EIA team on the transmission lines that will be required to evacuate power from the operational power station. In respect of transportation, the route between Cape Town Harbour and Bantamsklip is both longer and topographically more complex, with the need to traverse Sir Lowry's pass being particularly challenging, in comparison to the access routes to the other two sites. This route therefore poses major technical difficulties to heavy load transportation vehicles and thus has a greater associated safety risk (to other road users and transportation staff) than the other routes. There are also significant bridge obstructions and steep grades along this route, which are not present along the routes that would service the other two sites.

The second reason is based on an urban planning perspective. All three sites were considered and investigated by the Urban Town Planners (Appendix E34). The sites were ranked and scored in terms of development criteria for a Nuclear Power Station, in which the Bantamsklip site scored the lowest. The scoring is influenced by the limited workforce available in close proximity to the site which is a challenge experienced on the Bantamsklip site as compared to Duynefontein or Thyspunt. This shows that the site is currently not the best choice for Nuclear-1 from an urban planning perspective.

The third reason is because there is a direct obligation (as required by the EIA regulations) to assess the full suite of impacts that would be associated with not just the nuclear power station but associated infrastructure too. A large-scale associated facility is of course the transmission lines that would be needed to supply power during the construction phase, but also to evacuate power from the operational power station. For both Duynefontein and Thyspunt, detailed assessments of the power lines are available to the EIA team but not yet for Bantamsklip. The detailed environmental assessments conducted for Thyspunt and Duynefontein have been taken into consideration with the impact assessment for these sites, giving effect to cumulative impact assessment as shown in Chapter 10. Due to the fact that similar information is not available for Bantamsklip, the EIA team cannot sufficiently assess the cumulative impact for the Bantamsklip site. As such it is simply not possible currently to provide an adequately comparative assessment between the three sites.

The EIA team is confident that excluding Bantamsklip from this EIR does not undermine the obligation to thoroughly investigate alternatives or disqualify the site for future nuclear use. The inclusion of the Bantamsklip site would add significant further complexity to an already complex EIR without improving decision-making in any material way. The Bantamsklip site will therefore not be further considered in this EIR. Readers interested in the previous assessment of the Bantamsklip site can access the information at http://projects.gibb.co.za/Projects/Eskom-Nuclear-1-Revised-Draft-EIR.

With the above said readers should be cautioned that this does not mean that Bantamsklip can never be considered for a future Nuclear Power Station. The site is not fatally flawed as per the assessments previously conducted; however with the challenges mentioned above Bantamsklip will not be ready to meet the construction timeframe anticipated for Nuclear-1, and as such will not be further considered for this EIA.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

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Dear Helen Manson-Kullin and the WAG Action Group

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

Having spent much time and effort trawling through the 56kg's of the latest EIA report, it is with some disappointment that I can honestly say you still have not managed to actually address our villages concerns. We have still not met with any of your specialists on the ground who we were told would be visiting our area. You still seem to be unaware that people actually live here! On most of the detailed maps in this new EIA Wolvengat isn't even registered as a village...

Response 1:

Your comment is noted. The technical team will make changes to maps contained within the Revised Draft EIR Version 1 in order to give a clearer indication of the position of your village where required.

The Nuclear-1 specialist team visited the Duynefontein, Bantamsklip and Thyspunt sites and surrounding areas during the Scoping and Draft EIA phases of the project. Selected specialists have revisited certain sites after this as required to undertake their assessments. No need has been identified for the team to revisit these areas however if there are any questions you wish to address to a specific specialist please feel free to submit these to the Nuclear-1 Public Participation office during the review of the Revised Draft EIR Version 2. All registered Interested and Affected Parties will be informed of the availability of the Revised Draft EIR for public comment and review.

Comment 2:

Regardless of the endless fauna and flora implications, tourism, ecotourism and small business opportunities that will be completely obliterated by the development of Bantamsklip as a Nuclear power station site [whether Nuclear 1, 2, or 3], Eskom still proposes to build this thing in our back yard. We've been told not to over react, we've been told it will never happen, we've been told it will be good for business, but people actually live here! People have you all forgotten how many people died in the Chernobyl disaster? These are our homes that Eskom is threatening, our livelihoods!!

Then to add to the endless list of reasons Bantamsklip [and frankly any proposed nuclear development site] should not be developed as a nuclear power station we have the earthquake in Japan earlier this year to demonstrate just how easy it can go wrong. Countries with far more

advanced nuclear programs are CANCELLING their plans and opting to phase out nuclear power all together. Surely we should take notice of this move???

Response 2:

Your comment is noted however it is inappropriate to suggest that the tragedy which occurred at Chernobyl could be forgotten.

It is acknowledged that the incident at Fukushima as a result of this natural disaster has highlighted many important safety factors in terms of the future of nuclear energy and is indeed a stark reminder of the unpredictability of the natural environment. However it is also well known that South Africa is located on a vastly more stable tectonic environment that that of Japan which is situated close to a major subduction zone within the Pacific Ocean and the two cannot, in all fairness, be compared to one another.

South Africa will not build its nuclear power stations on fault lines or on coasts susceptible to tsunamis, and it has already reviewed its regulatory system. We therefore stand by our assessment that serious incidents in South Africa are unlikely. We also reiterate that the architecture and technology of nuclear power stations have changed significantly since the Soviet built Chernobyl and that the safety factors incorporated in new nuclear power stations render the occurrence of a Chernobyl-type disaster extremely unlikely to say the least. Thus, the improbability of such incidents occurring in South Africa makes a scale assessment purely academic and not worthwhile. Please see Appendix E32 and E33 of the Revised Draft EIR (Version 2) for a more detailed discussion.

Lastly a team of over 30 independent specialists have found no fatal flaws at any of the three sites under investigation. In the event that the Thyspunt site is approved by the Department of Environmental Affairs for the construction and operation of Nuclear-1 Eskom would need to re-apply for Environmental Authorisation if Bantamsklip is put forward as a site alternative for Nuclear-2.

Comment 3:

So, to end with, the members of WAG [Wolvengat called Viljoenshof on some maps] continue to object and oppose in the strongest possible terms any and all proposed development of nuclear power stations at Bantamsklip or any other site and any and all associated infrastructure [powerlines etc].
See our mission statement attached. We don't plan to change our minds.

Response 3:

Your comment is noted and your objection will be included in the Revised EIR Version 2 which will be made available for public comment and review.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 Augsust 2015

Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

Email: Andrea.VonHoldt@coega.co.za

Dear Andrea Von Holdt

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

COEGA DEVELOPMENT CORPORATION'S CONSIDERED COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE PROPOSED NUCLEAR POWER STATION AT THYSPUNT AND THE PROPOSED HV TRANSMISSION LINES TO SERVE THE NUCLEAR POWER STATION

The Coega Development Corporation (CDC) has been intimately involved in the EIA process for Nuclear-1 at Thyspunt from the beginning. The CDC's interest in the success of this project and its associated EIA process lies in the provision of safe and reliable base load power, which is needed for the successful development of the Coega IDZ and the future growth of the NMBM, the Eastern Cape and the country. However, the CDC's support is for the nuclear new build programme per se and any flaws in the process to determine a preferred site have to be brought to the attention of the public and the authorities.

Notwithstanding the foregoing comments, the CDC has serious concerns in the way both projects (Nuclear 1 and transmission line EIA) are being managed, particularly from a co-operative governance perspective, since the one project is directly related to the other and neither can proceed without the other. In our view, the two projects should have been investigated as if they were one project with two different aspects. Of particular concern, bearing in mind the co-operative governance aspects, is that the content of the EIA report and associated specialist studies for Nuclear1 at Thyspunt contradict each other. The result is a flawed process, which has been and is still being rightly criticised, and which is very likely to be appealed. The result will be the delayed provision of reliable power which will negatively impact the growth and development of the NMBM, the Eastern Cape and the country as a whole. With all the other challenges facing the country, we simply cannot afford this. Further, as is clearly demonstrated below, the process to determine the preferred locations for Nuclear1 is flawed and hence the choice of the preferred site, being Thyspunt, is seriously flawed.

Set out below are some of the points that the CDC would like to raise regarding the contents of both EIRs, but this is not necessarily an exhaustive list.

1. COMMENTS ON THE REVIEW OF NSIP:

Comment 1:

1. The basis for the further site investigation process which led to the choice of 5 sites for Nuclear1, then reduced to 3 sites with Thyspunt as the preferred site, was the NSIP studies. These studies

were not rigorously re-assessed before embarking on that (sic) current EIA process. For example, one of the reasons for not looking at sites near Port Elizabeth/Coega IDZ was the probable higher seismic risk but this is all relative since Koeberg is also near a fault and all along the Cape Fold Mountain Chain there are seismic risks. Another key reason was that such sites were within 100km of the old homelands (Ciskei and Transkei). That aspect is irrelevant in the current democratic dispensation. Further and indisputably, at that time, the Eastern Cape was definitely not a Province favoured by the old dispensation and Eskom would have followed that lead. It is acknowledged that Thyspunt is in the Eastern Cape but it is rather remote and certainly away from the main opposition centres pre the democratic elections. Effectively, the whole contextual environment changed in 1994 but that has not been factored in to the selection of sites forming the basis of the current process for Nuclear1 at Thyspunt. If the fundamental basis of any process has flaws, then the process itself becomes flawed.

Response 1:

Your comments regarding the site selection process are noted. Planning cycles for nuclear power stations are known to be long-term processes, due to the long time frames for construction and the long life spans of these power stations. Typically, the life cycle of a nuclear power station from start of planning to decommissioning can take up to 100 years. Early identification of potential sites for a nuclear power station is therefore an essential part of the planning process.

Whilst the political limitations of the Nuclear Site Investigation Programme (NSIP) that was undertaken during the last two decades of the 20th century are acknowledged, seismic and geological factors that were used in the identification of the sites have not changed since the NSIP. Furthermore, the distribution of the main population centres in the Eastern Cape and Western Cape that act as load centres (centres of electricity demand) have also not changed.

Your statement that potential seismic risks of sites near Coega should not be considered is noted and it indeed true that the Duynefontein site does have higher seismic risks than either Bantamsklip or Thyspunt. However:

- the seismic risk of the Duynefontein site is a known factor, and it is known that design measures can be put in place to mitigate the seismic risks at Duynefontein. The design of the Koeberg Nuclear Power Station is an example of such design, as it includes a seismic raft specifically designed to protect the power station against earthquakes experienced in the Cape Folded Belt; and
- the scientific identification of seismic risk is based on the accumulation of at least 5 years' worth of micro-seismic monitoring, which has not been undertaken for any sites near Coega, but has been undertaken for the sites identified in the NSIP. Thus, the seismic suitability of sites near Coega cannot be confirmed at this time.

You note above that the delayed provision of power will impact negatively on the Nelson Mandela Bay Municipality, the Eastern Cape and Country as a whole. However, if the seismic suitability of sites around Coega were first to be confirmed to include it as a potential candidate site for Nuclear-1, it would result in a delay of at least another five years. It could then be questioned, if it is found the Coega environment is not seismically suitable, why the urgent development of additional power generation capacity was unnecessarily delayed for investigation of a site that could in any event be considered for future nuclear power stations. The Integrated Resource Plan provides for 9,600 MW of nuclear generation, and Eskom has indicated its intention to developed more than one nuclear power station. A site around Coega or in the former Eastern Cape homeland areas could therefore be investigation in future nuclear power generation EIAs.

Project planning for large construction projects typically includes a pre-feasibility and feasibility assessment prior to detail planning and environmental impact assessment. Considering that the NSIP was focused on initial identification of potential nuclear power station sites, it should be regarded as an initial feasibility or even pre-feasibility study. Given this focus of the NSIP, it is reasonable that it would not have addressed associated infrastructure, environmental impacts, emergency planning and economic considerations. As indicated above, the socio-economic realities today have not changed to such an extent that the major load centres in the Eastern and Western Cape (Port Elizabeth and the Cape Metropole) have changed, and the location of power station sites in each of these regions therefore remains as valid today as it was when the NSIP was undertaken.

Your argument regarding review of the NSIP after the 1994 Constitutional changes is noted. Such an approach would imply that all planning undertaken prior to 1994 should have to be frozen pending review – a situation that is untenable as all planning and delivery processes would necessarily have been in limbo for the time it took to review planning priorities in view of the new political dispensation. In the case of the NSIP, planning would have been delayed by many years, since the NSIP process took in excess of a decade. It can be questioned whether the freezing of all power supply planning for a full review of planning conducted over a period of two decades (and the resultant delay in rolling out of power supply) would be of benefit to South African society. Apartheid era planning did not serve all the people of South Africa, yet planning for the development of a power station does in fact serve the entire population, no matter where it is planned, as it feeds electricity into South Africa's national grid.

Comment 2:

2. Almost 30 years have passed since Eskom undertook the studies to identify possible coastal sites for Nuclear 1 in RSA. The current EIA for Nuclear-1 is being done based on the contents and outcomes of those studies. Many aspects (mainly political and social but also environmental) may have changed between then and now. Therefore, there exists the possibility that the three selected / preferred sites on which the EIA for Nuclear 1 is currently being done, may not necessarily be the optimal sites. The fact that Eskom considers that the process is too far down the line to identify alternative sites is not an acceptable response to the flawed basis on which the current EIA for Nuclear 1 has been undertaken. One of the fundamental principles underlying the EIA process, in South Africa and most of the world, is the proper consideration of alternatives and this is an unqualified requirement. Further, there have been advances in technology and lessons have been learnt by the nuclear industry at large in the intervening 30 year period. There is no indication that such information has been incorporated into the decision making process before proceeding with the 5 sites previously selected for Nuclear1.

Response 2:

Please refer to Response 1 above.

Indeed many technological advances in nuclear power generation have been made in the last two to three decades.

However:

- the decision of a suitable site for a nuclear power station is still largely driven by factors of seismic suitability, as this is arguably one of the prime factors that influences the design and cost of nuclear power stations. Nuclear power station (such as those built along the Pacific Rim) can be designed to withstand earthquakes[1], but at considerably higher cost than a "standard" nuclear power station design.
- irrespective of the type of technology (nuclear vs. non-nuclear or renewable), it is preferable on a strategic level to place power generation as close as possible to major "load centres" where it will be required to prevent power loss due to long transmission lines and to stabilise the grid. In this respect, nothing has changed in the last 30 years – the Duynefontein and Thyspunt sites are still close to two major urban centres.

Comment 3:

3. Some regions were ruled out on the basis of a single constraint, although they were not necessarily less favourable in any other respect. This must be regarded as a serious weakness in the investigation of alternatives.

[1] In this respect it is important to note that the Fukushima nuclear incident was caused by the tsunami and not by the earthquake itself.

Response 3:

It is unfortunately not clear from this comment whether the disqualification of sites on the basis of a single constraint refers to the NSIP or the Nuclear-1 EIA process. As such it is not possible to respond to this comment.

Comment 4:

4. The regional suitability study (Phase 3a) did not take into account anticipated future power demands and ease of connection to the national grid. This has to be a major consideration.

Response 4:

Your comment is noted. Whilst the NSIP may not have considered future power demands and ease of connection to the national grid, these factors are explicitly considered in the Transmission Integration / Grid Planning Report (Appendix E28 and E35 of the EIR). This contains more updated information than was available at the time that the NSIP was produced and provides more current information on the location of the power demands and transmission integration.

Comment 5:

5. Power transmission only gets mentioned in Phase 3b, site specific studies, and anticipated future demands are not mentioned at all which is a very serious oversight bearing in mind the huge environmental impacts of major HV transmission lines. This is particularly true where visual impacts are likely to be some of the most significant because of future tourism considerations.

Response 5:

Your comment is noted. Comprehensive environmental impact assessments (EIAs) of the proposed transmission lines from each of the proposed Nuclear-1 sites have been commissioned. With the exception of the transmission line from the Bantamsklip site, these EIAs have been completed and provide detailed accounts of the potential environmental impacts, including the visual impacts, of the transmission lines.

Comment 6:

6. Comments and possible actions to revisit certain aspects of the findings are given in the Tables and hence there was clearly the anticipation of further reviews which either have not happened or have not been made public.

Response 6:

No further review of the NSIP has been undertaken.

It is clearly preferable to base current decision-making on current information. The Nuclear-1 power station EIA and the EIAs for the transmission lines from the proposed Nuclear-1 sites provide publicly available documentation on the potential environmental impacts of the power station and transmission lines. This information in these studies is current and as such, provides more valuable knowledge than that contained in the NSIP.

Comment 7:

7. A description of the process that was followed in the elimination of sites is also needed to ensure transparency.

Response 7:

The description of the process with reference to the NSIP is discussed in the NSIP studies. The process is briefly discussed below:

- The process starts off by performing a comprehensive screening desk top study at national level, involving all relevant stakeholders and multiple inputs at national level, culminating in the identification of typically the four most appropriate regions based on negative mapping. Transmission network requirements, regional seismicity, mineral resources, population densities, defence force operational areas, developmental planning, etc. all play a pivotal role in the selection and prioritisation of focus regions. The ultimate aim of the National Desk Top Study (NDTS) is to identify the four most appropriate and suitable regions.
- Each of the selected regions is studied and through further negative mapping typically three candidate areas were selected per region.
- Each of these selected areas was studied in further detail, typically resulting in 6 to 10 candidate sites per area.
- Each candidate site was then investigated in more detail and ranked through an appropriate selection technique like MADA (Multi-Attribute Decision Analysis model). The site selection ranking is based on predetermined criteria and weightings.
- Confirmation of the suitability of the two highest ranked sites per area results in what is termed selected sites.
- Selected sites were qualified by performing siting investigations.

2. THE NEED FOR BASE LOAD POWER GENERATION:

Comment 8:

Any developing industrial country, and South Africa is such a country, needs base load power generation. South Africa's indigenous primary energy sources are coal and nuclear and, to a limited extent, hydro-power. With current technology, nuclear has a significantly lower carbon footprint than coal but carbon sequestration technologies must be pursued and fossil fuels may conceivably be used in the future

From South Africa's perspective, the preferred nuclear technology is Generation III PWR reactors of which the Westinghouse AP 1000 and the ERP are the best known.

Response 8:

Your comment is noted. As indicated in Chapter 3 of the revised Draft EIR, nuclear electricity generation has a carbon footprint similar to many of the renewable power generation technologies. It is agreed that carbon sequestration may play a part in coal-fired power generation in future.

Comment 9:

It is recognized that fissile nuclear power is not currently sustainable, as it relies on non-renewable resources and breeder reactors are still a challenge as is fusion nuclear power. However, it is the best option for now for base load generation, especially considering that coal is the alternative and coal is far more damaging to the environment.

Response 9:

Your comment is noted.

Comment 10:

The renewable energy sector can contribute to the energy mix but most renewable energy technologies are still intermittent energy sources. With advances in those technologies and particularly with energy storage technologies, concentrated solar and to a lesser extent photovoltaic, wind, wave,

tidal and geothermal energy sources will have a place in the global energy mix but not necessarily all of them in South Africa.

Response 10:

Your comment is noted.

3. COEGA IDZ AS AN ALTERNATIVE SITE:

Comment 11:

The Coega IDZ could be an alternative site for the development of Nuclear 1 or some or all of additional nuclear power stations that will be constructed to achieve the 9.3 GWH nuclear contribution to the latest IRP.

Response 11:

Your comment is noted. Please refer to Response 1 for the reason why Coega is not considered as an alternative in the Nuclear-1 EIA. However, it may be considered as an alternative site for nuclear power stations after Nuclear-1.

Comment 12:

1. Coega's location is better for integration with the national grid, for the export of power to the hinterland and as a local power demand centre, compared to the Northern Cape which has no local demand and no grid connection.

Response 12:

Your comment is noted. The Northern Cape sites were not further considered in the Nuclear-1 EIA process at the end of scoping.

Comment 13:

2. Compared to Thyspunt, Coega is better for transmission and for network security and stability as there would now be an "anchor' for the long transmission lines from up country. There would also be support to the Eastern Cape generally to enable greater growth and socio-economic development which is so urgently needed.

Response 13:

Similar to Coega, Thyspunt is also suitable for transmission and network security and stability. As pointed out in Response 1, Coega's seismic conditions are still unknown and still need significant investigations compared to the Thyspunt site. It also needs to be considered that the emergency planning zones of Nuclear-1 may effectively sterilise significant parts of Coega, should Nuclear-1 be constructed there.

Comment 14:

3. Coega is located in the NMBM and therefore can support the significant demands on local amenities including accommodation, education, medical, retail, recreational, land, sea and air transport, etc. During operation, maintenance and refueling, the same local amenities can provide continuing support.

Response 14:

Your comment is noted. All of these points with regards to goods and services being supplied in Port Elizabeth are valid points and apply equally to a site like Duynefontein, which is located in the Cape Town metropole. The Economic Assessment (Appendix E17 of the EIR) assesses the economic benefits of the alternative sites and found that Thyspunt would have a higher economic benefit than either Bantamsklip or Duynefontein. Macroeconomic indicators favour the Western Cape sites but household and social indicators favour Thyspunt. The cost-effectiveness analysis indicates that Thyspunt has a very slight edge over Duynefontein and a somewhat larger edge over Bantamsklip. These benefits would continue to accrue to the Eastern Cape economy, whether Nuclear-1 is constructed at Thyspunt or Coega.

Comment 15:

4. "The current environment would not be affected by the No-Go decision" is an incorrect and misleading statement in the Nuclear1 Draft EIR. Global warming will result in significant biophysical changes (e.g. greater water stress) leading to economic challenges and ultimately social unrest and doing nothing is not an option.

Response 15:

The statement made in the first paragraph of Section 5.1.5 of the Revised Draft EIR is: "*The current biophysical, social and economic environments would not be altered* ***by the development of the proposed project***". It is therefore not suggested, as indicated by your comment, that there would be no changes in the environment. Global warming is a reality and continuing to rely exclusively on fossil fuels will aggravate this situation. It is, further, acknowledged in the EIR that there are other stresses on the environment (e.g. coastal urban development) that would, in the absence of Nuclear-1, also cause continuing transformation of the environment at the Bantamsklip and Thyspunt sites.

Comment 16:

5. An EIA cannot be based on information which may not be relevant anymore, due to the passage of time, and, further, the generation capacity should be placed where the highest local current and future demand is, i.e. Port Elizabeth (Coega IDZ) or East London. The massive power lines that now have to be considered between Thyspunt and the Coega IDZ will not have to be installed if Nuclear1 is located close to Coega or in the IDZ.

Response 16:

The EIA is based on current information.

From a transmission perspective the Thyspunt site can be easily integrated into the current network. Transmission lines from the Thyspunt site will feed into existing sub-stations (Grassridge and Dedisa) and a new proposed Port Elizabeth substation.

4. CAPACITY OF THE KOUGA MUNICIPALITY:

Comment 17:

One institutional aspect which has not been given enough emphasis in the Nucelar1 Draft EIR is the capacities and capabilities of the local municipality and other local institutions. In terms of the required human and financial resources to effectively interface with the main players, being Eskom, the prime contractor and all of the sub-contractors, the present Kouga Municipality is hopelessly under resourced.

Response 17:

It is acknowledged in the Revised Draft EIR that there are severe current service delivery backlogs, particularly in the Kouga Municipality, and that the municipality does not have the capacity to cater for current demand, never mind additional demand that will be created by the influx of construction and operational personnel for Nuclear-1. It is therefore a key recommendation that Eskom must engage with the relevant municipalities well before construction to agree on the apportionment of financial responsibility for upgrades to infrastructure.

Comment 18:

In terms of the above, the serious weaknesses in the specialist studies for Nuclear1 at Thyspunt had to be pointed out by I&AP's and there is still no clear resolution unless Eskom is willing and able to step in with significant financial and human resources.

Response 18:

Please refer to Response 17. It is clearly acknowledged in the Revised Draft EIR that Eskom will be responsible for a portion of infrastructure upgrades that will be required due to Nuclear-1. However, Eskom cannot be held responsible for funding the "catch-up" plans for existing service delivery backlogs that are the result of poor planning by the responsible service providers, including provincial and local government.

5. BENEFITS/POSITIVE IMPACTS OF NUCLEAR:

Comment 19:

1. Although seemingly counter-intuitive, a nuclear site has a large surrounding area of land with formal protected status which will give benefits for conservation. The terrestrial ecology study has identified already degraded adjacent areas which theoretically should not be impacted by the low level of development. However, such a prime coastal location will undoubtedly come under increasing pressure from developers who are unlikely to make environmental considerations a priority above purely financial considerations. In previous comments, it has been suggested that the whole area from Oyster Bay to the outskirts of Cape St. Francis and St. Francis Bay should be declared a reserve with a highly protected status. To make the impact even more positive, a visitors' centre should be constructed which would show humankind's development from simple hunter-gatherer societies (Strandloper) thorough the stone, iron and subsequent ages to the 22nd century as epitomised by the iconic nuclear power station. Effectively, the St. Francis Bay area would become the hub of the Garden Route and tourists could continue in which ever direction they are going or cross over to the Langkloof and Gamtoos Valley and onwards to Baviaanskloof and the other magnificent wilderness areas.

Response 19:

Your comment is noted. The potential conservation benefits of the large surrounding areas, particularly with respect to the wetlands areas around the recommended power station position, is well-recognised by the terrestrial ecological specialists. It is a key recommendation that the Eskom property should be expanded to maximise on the benefit created by the creation of a *de facto* nature reserve around the proposed power station.

Comment 20:

The social impacts, identified as generally negative during the construction phase, can be mitigated or even turned into a positive by adopting the CDC's unique and proven approach to managing labour and skills development. Humansdorp and the surrounding areas will be revitalized if the Project is planned and developed as it should be.

Response 20:

Your comment is noted with thanks. It will be recommended that the CDC's model of "Zone Labour Agreements" should be considered in the development of labour and skills development policies for Nuclear-1.

Comment 21:

2. Accommodation for construction workers will also be a positive and not a negative if the CDC's approach is adopted. The project would add to the permanent housing stock of the area.

Response 21:

Your comment is noted.

Comment 22:

The greatest positive impact is country wide with a future guarantee of sufficient power for both the industrial and residential sectors as those who do not have access to electricity now are connected and as the general living standard of the country rises so that the inequalities of the past are eliminated. Those of us who are lucky to have all our energy needs met and who can afford such a lifestyle cannot deny those opportunities to all of our fellow countrymen in the future. This is about the future and not the privileges of the past.

Response 22:

Your comment is noted. It is to be noted that some interested and affected parties instead recommend switching off power supply to large industrial facilities rather than generating more power.

6. SPECIALIST STUDIES:

Comment 23:

Reading the specialist reports supporting the EIA process for Nuclear 1 at Thyspunt and hearing how some of the specialists responded to questioning at the public meeting on 25th May 2010 in St. Francis Bay, the almost inescapable deduction is that Eskom's desired outcome is driving the conclusions of the specialists' reports. This deduction is reinforced by the fact that, some time ago, Eskom purchased the land for the three preferred sites, bearing in mind that these three sites were arrived at by a process which can be considered to be flawed – see Section 1 above.

Response 23:

As indicated in Response 1, the planning and development of nuclear power stations is subject to very long time-frames. Had Eskom not taken a strategic decision to acquire the potentially suitable sites several decades ago, their options would today be limited. Furthermore, it is well known that demand for a particular piece of land drives prices. Should Eskom not have acquired these properties when it did, the price today would have been astronomical, after it became known that these sites were wanted for power station development. Eskom has, therefore acquired the sites at risk, knowing that there are several legal processes (of which the EIA process is only one) required prior to the construction of a power station.

Comment 24:

There appears to be a decidedly generic approach to the Terms of Reference of the specialist studies supporting the EIA process for Nuclear 1 at Thyspunt. Further, there is a serious lack of real local

knowledge and there has been insufficient engagement with local people who do have domain knowledge. It is suspected that the specialists had minimal engagement with local people who do know their surroundings intimately and, further, the specialists did not widen their approach to include comparable projects/information from other parts of the world.

Response 24:

All the Nuclear-1 EIA specialists were required to engage with local specialists and have indeed done so. Specialists based their assessments on data obtained through field visits and secondary data collection, experience with similar large construction projects, experience in similar environments and through consultation with relevant local specialists or interested and affected parties.

7. THE TRAFFIC AND TRANSPORT ASSESSMENT:

Comment 25:

A good example of an inadequate assessment of realistic alternative routes to the proposed site at Thyspunt is the option to come off the N2 near the Kromme River Bridge. The reason for looking at this option is that it should be practical to have a dedicated haul road to the site thus avoiding mixing heavy construction traffic with school children, pedestrians, cyclists and cows crossing on the existing roads. This separation of traffic was a key strategy when the CDC was assessing the construction requirements of the now discontinued Coega Aluminium Smelter Project. As it stands, the study just looks at existing roads or tracks and there are many problems with this approach, not least being their exclusion from the EIA process and the lack of clarity in terms of who will fund and implement this significant piece of infrastructure. Even the transport specialist understood that Humansdorp would be a bottleneck but the study has continued in this wrong direction. It is worth bearing in mind that the main traffic scenario presented assumed that the existing R330 would take the heavy construction traffic and an upgraded minor road would take the buses bringing the workers to the site. This is the wrong way round.

Response 25:

Your comment is noted. The Thyspunt site requires transport route upgrades with regard to public roads, access and emergency evacuation during the construction phase. The recommended routes in Version 9 of Transport Report were revised after the Revised Draft EIR was provided for public comment in May 2011. Based on this revision, the R330 is now proposed to be used only for passenger vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operations phases for staff access and heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. The DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity. Bypass roads to the east and west of Humansdorp are also now proposed to be constructed to reduce the traffic impact on central Humansdorp.

Comment 26:

The recent (June and July 2011) flooding in the Kouga area and subsequent washing away of a bridge and portion of road that links St Francis Bay, Port St Francis, Cape St Francis and the residents of the Rebels Rus Nature Reserve to the outside world is an example of how inadequate the existing infrastructure is to deal with a relatively small natural disaster. Evacuation of residents was near impossible. How would Eskom deal with a nuclear disaster at the proposed Thyspunt site? It is imperative that more information is supplied regarding the evacuation protocols in the event of a disaster, and equally importantly, the adequacy of the existing and proposed transportation infrastructure must be assessed in the EIA for Nuclear1 at Thyspunt. This critical aspect has been overlooked/left out in the EIA and it must now be included.

Response 26:

Your comments are noted. A revised Transport Assessment has been compiled to discuss this issue. This report will be made available for public comment and review as part of the Revised Draft EIR Version 2.

The study notes that the section of R330 across Sand River was destroyed by flood in July 2011. The destruction of the bridge by flood was linked to unauthorised channels constructed on the Links Golf Course that placed a large amount of water in the dune field. The damming of this water was released in conjunction with the flood water in the Sand River and caused the bridge to wash away (twice). The box culvert was severely damaged and inhibited traffic flow between Humansdorp and St. Francis Bay while it was being repaired for a few days.

Bridges and culvert are generally designed for 1:100 year floods. The flood experienced in 2011 was, however, considered to be a flood with much greater scale than designed for and the additional release of the dammed water exacerbated the problem. Construction and operation of Nuclear-1 may be affected should the flood occur again during the construction and operations phase of the proposed nuclear plant. It is, therefore, suggested that a Stormwater Assessment Plan should be undertaken for the flooding situations of Sand River at the R300 crossing. Design specifications of the bridge should be reviewed and mitigation measures, such as embankment protection, should be implemented.

Comment 27:

A realistic noise impact assessment on residents in the St Francis Bay area has not been undertaken and that is one of the big advantages of the alternative route from the N2. This route was pointed out by local residents which clearly showed the superficial local work undertaken by the specialists; lateral thinking is key to a project like this.

Response 27:

The Noise Impact Assessment (Appendix E23 of the Revised Draft EIR) was undertaken strictly in accordance with the applicable SABS standard. However, as indicated in Response 26, the TIA has been extensively revised so that construction traffic will not use the R330.

8. THE SOCIAL IMPACT ASSESSMENT:

Comment 28:

There are many social issues which will arise from the implementation of a project of the magnitude of Nuclear1 at Thyspunt including inward migration of job seekers, additional schooling and medical facilities, greater demand for municipal services such as potable water supplies, sewerage and sewage disposal, refuse collection, security and safety services, etc. There are also the other social factors with such large projects including a higher incidence of infections, more crime, greater risk of labour instability, etc. The CDC's experience with the above aspects can be accessed by the role players, particularly the Kouga Municipality.

Response 28:

Your comment is noted with thanks. A recommendation will be included in the next revision of the EIR (Draft EIR Version 1) that the Coega Development Corporation be consulted with regards to the design of social mitigation measures, employment and labour policies.

Comment 29:

Provided it is approached in the right way, the housing that will be required for skilled imported labour can be a useful addition to the local housing stock but expectations need to be managed. As far as

possible, skilled and semi-skilled labour must be sourced from the surrounding communities but a proper recruitment process must be put in place. Again, the CDC's experience could be invaluable.

Response 29:

Your comment is noted with thanks. A recommendation will be included in the next revision of the EIR (Draft EIR Version 1) that the Coega Development Corporation be consulted with regards to housing development policies and recruitment.

Comment 30:

There is lack of clarity in terms of who will fund and implement this significant piece of social and municipal infrastructure and ensure sustainability into the future.

Response 30:

It is a key recommendation of the Revised Draft EIR that Eskom must reach agreement with municipalities regarding the funding of infrastructure upgrades that would be required to cater for the influx of construction and operational personnel for Nuclear-1 prior to the start of construction, so that the required upgrades can take place before the start of the Nuclear-1 construction.

Comment 31:

The labour requirements for the construction phase are massive (estimated at 7 700). Where will the labour be sourced from? Any high level technical skills must not simply be imported from abroad.

Response 31:

Your comment is noted. The use of local labour must be maximised as far as possible. On a high-technology project such as the construction of a nuclear power station, it is inevitable that some labour will be imported and it is likely that the vendor will provide significant staffing from abroad. However, it has been recommended that a minimum of 25% of construction phase labour must be local.

9. ECOLOGY OF THE THYSPUNT SITE:

Comment 32:

Thyspunt is special and an innovative approach to the disturbance of flora will be required. Further, there should be an independent oversight committee with local and other NGO representatives starting from the planning and design phase, through the construction phase and including the operation phase. This would be similar too but an improvement on the EMC set up for the Coega Project.

Response 32:

Your comment is noted and it is agreed that an innovative and original approach to the conservation of the site outside the immediate power station footprint will be required. The Thyspunt site has significant natural and cultural history assets that need to be protected. As you mention in Comment 19, the conservation of the site could provide substantial conservation benefits. Therefore the effective protection of these natural and cultural assets throughout the construction phase is essential, as most this is the phase of development during which there is the greatest potential for negative impacts.

It is a key recommendation of the Revised Draft EIR that an Environmental Monitoring Committee (EMC) should be set up, with representation from local communities. The proposed terms of reference for the EMS are specified in the Draft Environmental Management Programme (Appendix F of the Revised Draft EIR).

10. GENERAL COMMENTS:

Comment 33:

How much hazardous (non nuclear) waste will be generated during construction and operation of the nuclear power station at Thyspunt? Insufficient information is given on where and how the waste will be (temporarily) stored on site and then where it will be taken for disposal? The only reasonably close licensed H:H waste facility is Aloes in Port Elizabeth. No information is supplied regarding the life span of this waste facility and whether it can accept the volumes and types of hazardous waste anticipated.

Response 33:

Information of the capacity and expected life-span of the Aloes waste disposal site is provided in Section 9.29.3 of the Revised Draft EIR. This section states the following: "*This site has an H:H rating and is estimated to have a remaining lifespan of only approximately 5 years. This site in its current design would therefore run out of capacity prior to completion of construction at Thyspunt. However, expansion of the site is currently being planned. General waste would also have to be disposed at this site*."

Comment 34:

Is RSA ready to handle nuclear? Who will fund the construction and operation of the proposed Nuclear-1 facility at Thyspunt; it shouldn't automatically be Eskom? It is more than 30 years since Koeberg was constructed and the expertise from that time has now either gone or has been seriously diminished. The IAEA recognizes that a nuclear renaissance will be challenged by the lack of experienced engineers and a new cadre of suitably trained engineers.

Response 34:

Government made a decision in late 2012 that Eskom will be the operator and owner of nuclear plants. However, the procurement and investment process is currently still being driven by Government.

Comment 35:

It is proposed that Generation III technology is used and Emergency Planning Zones (EPZ's) of 800m and 3km have been stipulated based on European utility companies' proposals. How will RSA afford this technology? If a more affordable technology is selected and more extensive EPZ's are required, what process will then be followed? Will the EIA be re-started?

Response 35:

The application of EPZs based on European Utilities Requirements is a key assumption of the Nuclear-1 EIR. If another form of technology is used that needs larger EPZs, then this assumption would be incorrect and the EIA would have to be amended.

References to detailed assessments of the Life Cycle Cost of Electricity (LCOE) of nuclear technology vs. other forms of electricity generation are provided in Chapter 5 of the EIR Version 2. These indicate that although nuclear power stations have a high capital cost compared to other generation alternatives, their operational costs is low and therefore the overall cost of nuclear generation over its life cycle is comparable to other forms of generation.

Comment 36:

It is strongly recommended that a thorough revision of the investigation of alternatives (specifically alternative sites) is done, as the basis for the current Nuclear1 EIA (NSIP studies) was determined

more than 30 years ago. There have been substantive changes in our political regime, and our social and environmental legislation, all of which will impact on the investigation of alternatives that will ultimately define the preferred site(s) for nuclear power stations in the country.

Response 36:

Your comment is noted. Please refer to Response 1 regarding the consideration of alternative sites. It is also to be noted that GIBB has reviewed the NSIP and has found the proposed alternative sites to be reasonable and feasible. The DEA, in its approval of the Nuclear-1 Scoping Report, also found the proposed sites to be reasonable and feasible.

Comment 37:

The engineering feasibility study that was done for the seawater intake pipelines for Thyspunt during June 2011 should be made available to the public for review and comment.

Response 37:

GIBB is not aware of an engineering feasibility study that has been undertaken for the offshore pipelines.

Comment 38:

At the public meetings and at various key stakeholder meetings, Eskom was asked what it would do with the land should a negative environmental authorisation be issued for the Thyspunt site. The response has always been that Eskom would sell the land to the highest bidder. However, it has also been made clear in the EIA Report, including in some of the specialist studies (e.g. VIA), that Eskom will be constructing nuclear power stations on all three of the proposed sites, as and when required. These statements are contradictory. Again, this leads to the clear need for the investigation and assessment of alternative suitable sites along the South African coastline for nuclear power stations.

Response 38:

The statement in the VIA is incorrect. The three sites considered as alternatives in the N uclear-1 EIA process are alternative sites for nuclear power station development. Eskom has been it clear that it intends developing additional power stations after Nuclear-1 (in line with the Integrated Resource Plan, which requires 9,600 MW of nuclear power by 2025), and would consider these sites for the development of Nuclear-2 or Nuclear-3. However, the development of the remaining alternative sites for Nuclear-2 or Nuclear-3 is dependent on future EIA processes, which may identify additional sites besides those considered in Nuclear-1.

Comment 39:

It is understood that there is or will be a review panel which will peer review the recommendations and conclusions that will come out of the EIA process for Nuclear1. In the interests of transparency and good corporate governance, the constitution of that panel should be made known. Such a panel must not include any entities or individuals who have a vested interest in the outcome of the current EIA process. It would be hoped that at least one of the panel members would be from the IAEA and another from an internationally recognized and benchmarked operational nuclear power plant; Koeberg would be excluded but not for reasons of poor operation.

Response 39:

The review panel has been appointed by the Department of Environmental Affairs (DEA) to assist it with the review of the Nuclear-1 EIA. As such, a request to make the names of the review panel members known should be directed to the DEA.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 07 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

We respond as follow to the attached report "Assessing Power Plant Cooling Water Intake Systems" that was prepared for the California Energy Commission.

Response 1:

Your comments and the attached paper entitled "Assessing Power Plant Cooling Intake Systems" are noted and acknowledged and have been provided to the Marine Specialist for their consideration. Please also note that the Marine Specialist Assessment has been revised (independently of this submission) and will be made available for public comment and review as part of the Revised Draft EIR Version 2.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

ASSESSING POWER PLANT COOLING WATER INTAKE SYSTEM ENTRAINMENT IMPACTS

CONSULTANT REPORT

Prepared For:

California Energy Commission

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OCTOBER 2007

CEC-700-2007-010

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ACKNOWLEDGEMENTS

It should be obvious that large studies like these require the coordinated work of many people. We would first like to thank the California Energy Commission, especially Rick York and Dick Anderson, for funding this study and recognizing the importance of publishing this work so it could be used by other researchers and decision makers. Thanks also to Duke Energy and Pacific Gas and Electric Company (PG&E) for the use of the data from the Duke Energy South Bay and Morro Bay power plants and the PG&E Diablo Canyon Power Plant. Special thanks go to James White and Brian Waters from Duke Energy, and Kathy Jones, Anne Jackson, Jim Kelly, and Bryan Cunningham from PG&E. We also want to thank Michael Thomas from the Central Coast Regional Water Quality Control Board who organized the Technical Workgroup that provided input on the Diablo Canyon and Morro Bay studies, which provided a model of cooperative science used in other studies throughout the state. More special thanks go to the Technical Workgroup members from various state and federal resource agencies and academia who provided valuable input on all three studies. Dr. John Skalski helped develop the models used in the assessments, and Drs. Roger Nisbet, Allen Stewart-Oaten, Alec MacCall, and others provided valuable input on various aspects of the studies. We want to thank Chris Ehrler and Jay Carroll from Tenera Environmental and Rick York and Joanna Grebel from the California Energy Commission for their editorial assistance with the report. We also received helpful comments on the final draft from Larry Barnthouse, Shane Beck, Kathleen Jones, Erika McPhee-Shaw, Roger Nisbet, and Pat Tenant. Finally we want to thank all of the scientists and technicians at Tenera Environmental who collected all of these data and processed the hundreds of samples collected from the three studies.

ABSTRACT

Steam electric power plants and other industrial facilities that withdraw cooling water from surface water bodies are regulated in the United States under Section 316(b) of the Clean Water Act of 1972. Of the industries regulated under Section 316(b), steam electric power plants represent the largest cooling water volumes with some large plant withdrawals exceeding 2 billion gallons per day. Environmental effects of cooling water withdrawal result from the impingement of larger organisms on screens that block material from entering the cooling water system and the entrainment of smaller organisms into and through the system. This paper focuses on methods for assessing entrainment effects (not impingement), and specifically, entrainment effects on ichthyoplankton. This report describes three studies that assessed entrainment at coastal power plants in California and discusses some of the considerations for the proper design and analysis of entrainment studies.

KEYWORDS

Once-through cooling, entrainment, impingement, Clean Water Act, 316(b), coastal power plants, marine life

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Steam electric power plants and other industries that withdraw cooling water from surface water bodies are regulated in the United States under Section 316(b) of the Clean Water Act of 1972. Of the industries regulated under Section 316(b), steam electric power plants have the largest cooling water volumes with some large plants exceeding 2 billion gallons per day. Environmental effects of cooling water withdrawal result from impingement of larger organisms on screens that block material from entering the cooling water system and the entrainment of smaller organisms into and through the system.

Concerns regarding the environmental effects of entrainment result from the large volume of cooling water potentially used by coastal power plants. In California, the 21 coastal power plants potentially withdraw up to 17 billion gallons of seawater per day. This process results in the loss of billions of aquatic organisms, including fishes, fish larvae and eggs, crustaceans, shellfish, and many other forms of aquatic life from California's coastal ecosystem each year. There has been increased focus on the effects of power plant cooling water intake systems because the biological resources of the world's oceans, and California's coast in particular, are in serious decline. Long-term declines, which started in the early 1970s, have occurred in 60 percent of the fishes for which landings are reported. Despite the potential contribution of cooling water withdrawal to these declines, recent studies have only been completed at a few of the California power plants (California Energy Commission 2005). Regulations for Section 316(b) of the Clean Water Act published in July 2004 (USEPA 2004) will result in new studies on the environmental effects of cooling water systems at many of the existing power plants in California and throughout the country. The results of these studies will help determine the environmental effects of cooling water withdrawal on biological communities.

While the assessment of impingement effects is relatively straightforward, the assessment of entrainment effects requires thoughtful consideration of all aspects of the study design. The difficulties in entrainment assessments arise from several factors. The organisms entrained include planktonic larvae of fishes and invertebrates that are difficult to sample and identify. The entrained larvae are also part of larger source water populations that may extend over large areas or be confined to limited habitats, making it difficult to determine the effects of entrainment losses. The early life histories of most fishes on the Pacific Coast are also poorly described, limiting the usefulness of demographic models for assessing entrainment effects. All of these factors make the assessment of cooling water system entrainment difficult. This report will present, by example, some of the considerations for the proper design and analysis of entrainment studies.

This report describes three studies for assessing entrainment at coastal power plants in California. They represent a range of marine and estuarine habitats: the South Bay Power Plant in south San Diego Bay and the Morro Bay and Diablo Canyon power plants in Central California. These studies used a multiple modeling approach for assessing entrainment effects. When appropriate life history information was available for a species, demographic modeling techniques were used to calculate the numbers of adults represented by the losses of fish eggs and larvae due to entrainment. The primary approach for assessment at these plants was the "Empirical Transport Model" (ETM), originally developed for use with power plants entraining water from rivers, and then adapted for use on the open coast and in estuaries in Southern California. The Empirical Transport Model uses the same principles as fishery management to estimate effects of fishing mortality on the sustainability of a stock. Just as fishery managers use catch and population size to estimate fishery mortality, the Empirical Transport Model requires estimates of both entrainment and source water larval populations. The source water population is the abundance of organisms at risk of entrainment as determined by biological and hydrodynamic/oceanographic data. The process of defining the source water and obtaining an estimate of its population varied among the three plants and also among species within studies. This paper will present the multiple modeling approaches used for power plant entrainment assessments, with the main focus being a comparison of the processes used to define the source water populations used in the Empirical Transport Modeling from the three power plants.

The results showed that standard demographic models were generally not usable with species found along the California coast due to the absence of life history information for most of them. The results for the Empirical Transport Model ranged from very small levels (<1.0 percent) of proportional mortality due to entrainment for wide ranging pelagic species such as northern anchovy to levels as high as 50 percent for fishes with more limited habitat that were spawned near power plant intake structures. The results of the Empirical Transport Model were generally consistent with the biology and habitat distributions of the fishes analyzed.

Based on experiences with these and other studies, the authors believe that a prescriptive approach to the design of entrainment assessments is not possible, and therefore, some general considerations are provided that might be helpful in the design, sampling, and analysis of entrainment impact assessments. These include ensuring that organisms that could be affected by entrainment are effectively sampled and that the sampling will account for any endangered, threatened, or other listed species that could be affected by entrainment. In addition to identifying species potentially affected, it is critical to determine the source water areas potentially affected, including the distribution of habitats that might be differentially affected by cooling water intake system (CWIS) entrainment. The sampling plan also needs to account for the design,

location, and hydrodynamics of the power plant intake structure. The sampling frequency should accommodate important species that might have short spawning seasons. This may require that the sampling frequency be seasonally adjusted based on presence of certain species. The relative effects of entrainment estimated by the ETM model should be much less subject to interannual variation than absolute estimates using "fecundity hindcasting" (FH), "adult equivalent loss" (AEL), or other demographic models. Therefore, if source water sampling is done along with entrainment sampling, then one year is a reasonable period of sampling for these studies. The size of the source water sampling area should be based on the hydrodynamics of the system. In a closed system, this may be the entire source water. In an open system, ocean or tidal currents and dispersion should be used to determine the appropriate sampling area for estimating daily entrainment mortality (PE) for the larger source water population.

Some practical considerations for sample collection and processing include adjusting the sample volume for the larval concentrations in the source waters. This is best done using preliminary sampling with the gear proposed for the study. Age of larvae are best determined using analysis of otoliths, but if this is not possible, be sure that length frequencies measured from the entrainment samples are realistic based on available life history and account for egg stages that would be subject to entrainment if fish eggs are not sorted and identified from the samples. This is easily accommodated in the Empirical Transport Model approach by adding the duration of the planktonic egg stage to the larval duration calculated from the otolith or length data.

Although the authors believe that the Empirical Transport Model is best approach for assessment, results from multiple models provide additional information for verifying results and for determining effects at the adult population level. One approach for assessment at the adult population level is through converting Empirical Transport Model results into an estimate of the habitat necessary to replace the production lost due to entrainment ("area of production foregone" [APF]). The area of production foregone is calculated by multiplying the area of habitat present within the estimated source water by the proportional entrainment mortality estimated from Empirical Transport Model. This approach may be useful for scaling restoration projects to help offset losses due to entrainment. The ETM can also be used to estimate the number of equivalent adults lost by entrainment by applying the mortality estimate to a survey of the standing stock. This can be compared with estimates from Fecundity Hindcast and Adult Equivalent Loss. When making these types of comparisons, it is important to hindcast or extrapolate the Fecundity Hindcast and Adult Equivalent Loss model estimates to the same age. This may not necessarily result in the same estimates from both models unless the data used in the two models are derived from a life table assuming a stable age distribution. The USEPA (2002) used Adult Equivalent Loss and another demographic

modeling approach, production foregone, to estimate the number of age-1 individuals lost due to power plant impingement and entrainment. The accuracy of estimates from any of these demographic models is subject to the underlying uncertainty in aging, survival, and fecundity estimates and population regulatory, behavioral, or environmental factors that may be operating on the subject populations at the time the life history data were collected.

Uncertainty associated with the Empirical Transport Model is primarily derived from sampling error that can be controlled by careful design using some of the guidelines provided in this report. With a good sampling design, the Empirical Transport Model provides a site-specific, empirically based approach to entrainment assessment that is a major improvement over demographic modeling approaches. In addition, the results can be used to estimate entrainment effects on other planktonic organisms, in estimating cumulative effects of multiple power plants and other sources of mortality, and in scaling restoration efforts to offset losses due to entrainment. The authors hope that the information in this report will assist others in the design and analysis of cooling water intake system assessments that will be required as a result of the recent publication of new rules for Section 316(b) of the Clean Water Act (USEPA 2004).

CHAPTER 1: INTRODUCTION

Steam electric power plants and other industries (for example, pulp and paper, iron and steel, chemical, manufacturing, petroleum refineries, and oil and gas production) use water from coastal areas for cooling resulting in impacts to the marine organisms occupying the affected water bodies. Industries that withdraw cooling water from surface water bodies are regulated in the United States under Section 316(b) of the Clean Water Act of 1972 [33 U.S. Code Section 1326(b)]. Section 316(b) requires "…that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts." Of the industries regulated under section 316(b), steam electric power plants have the largest cooling water volumes ranging from tens of thousands to millions of cubic meters per day (m3 d-1) (Veil et al. 2003). A survey in 1996 reported that 44 percent of the power plants in the United States used a steam electric process involving once-through cooling (Veil 2000). Electricity is generated at these plants by heating purified water to create high-pressure steam, which is expanded in turbines that drive generators and produce electricity (Figure 1). After leaving the turbines, steam passes through a condenser where high volume cooling water flow cools and condenses the steam, which is then recirculated back through the system.

Regulatory guidance for complying with Section 316(b) that was first proposed by the U.S. Environmental Protection Agency (EPA) in 1976 was successfully challenged in the courts by a group of 58 utility companies in 1977 and never implemented (Bulleit 2000). As a result, Section 316(b) was implemented by the states using a broad range of approaches; some states developed fairly comprehensive programs while others never adopted any formal regulations (Veil et al. 2003). The EPA has recently published new regulations for 316(b) compliance (USEPA 2004) as part of the settlement of a lawsuit against the EPA by environmental groups headed by the Hudson Riverkeeper (Nagle and Morgan 2000). As a result of these new regulations, power plants throughout the United States are now required to reduce the environmental effects of their cooling water intake systems (CWIS).

The withdrawal of water by once-through cooling water systems has two major impacts on the biological organisms in the source water body: impingement and entrainment (Figure 1). Almost all power plants with once-through cooling employ some type of screening device to block large objects from entering the cooling water system (impingement). Fishes and other aquatic organisms large enough to be blocked by the screens may become impinged if the intake velocity exceeds their ability to move away. These organisms will remain impinged against the screens until intake velocity is reduced such that organisms can move away or the screen is backwashed to remove them. Some organisms are killed, injured, or weakened by impingement. Small

planktonic organisms or early life stages of larger organisms that pass through the screen mesh are entrained in the cooling water flow. These organisms are exposed to high velocity and pressure due to the cooling water pumps, increased temperatures and, in some cases, chemical treatments added to the cooling water flow to reduce biofouling.

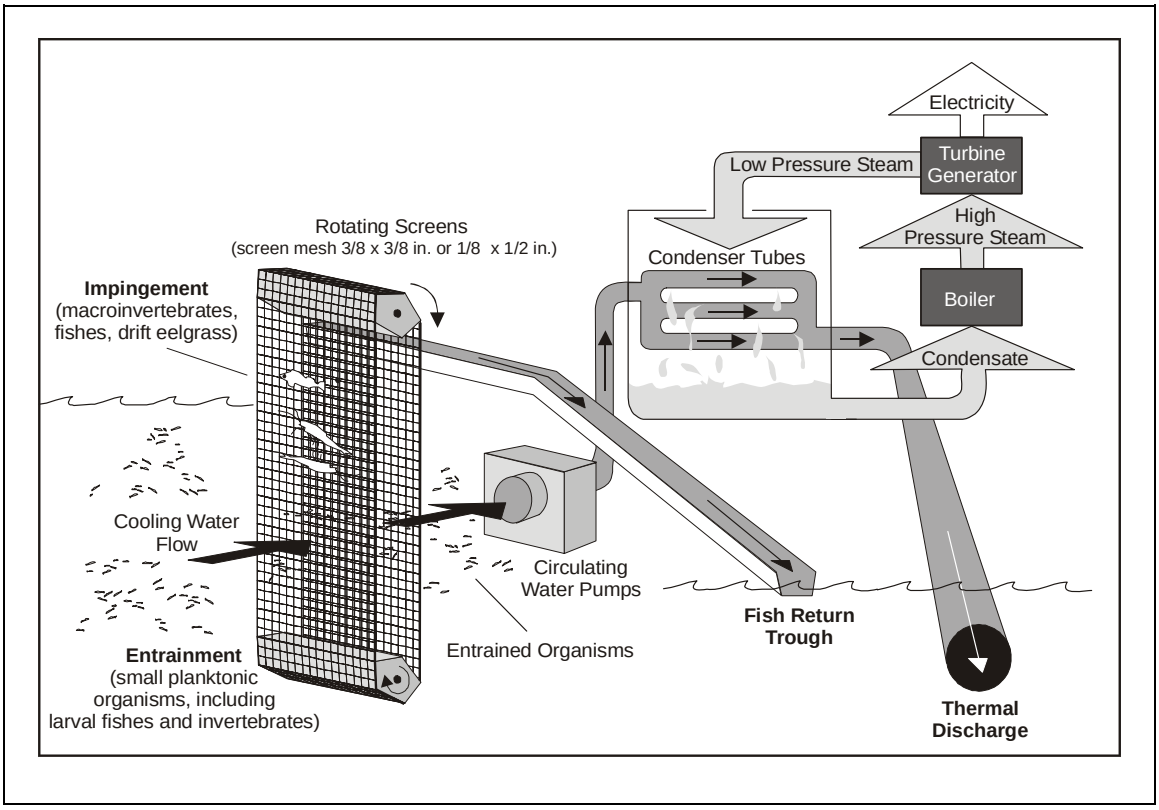

Figure 1. Conceptual diagram of power plant cooling water systems at South Bay, Morro Bay, and Diablo Canyon Power Plants, and relationship of impingement and entrainment processes to circulating water system. A fish return trough is present only at the South Bay Power Plant.

Most impingement and entrainment (316[b]) studies on CWIS effects at power plants were completed in the late 1970s and early 1980s using draft guidance issued by the EPA (USEPA 1977). More recently, many power plants throughout the country began to upgrade and expand their generating capacities due to increased demands for power. The California Energy Commission (Energy Commission), which had regulatory authority for these projects in California, required utility companies to determine the impacts of these CWIS changes. Although existing CWIS are regulated in California through National Pollution Discharge Eliminations System (NPDES) permits issued by the nine Regional Water Quality Control Boards (RWQCB) in the state, the projects done under the regulatory authority of the Energy Commission also required coastal zone permits under the California Coastal Act and therefore were conducted in compliance

with the California Environmental Quality Act (CEQA). The Energy Commission and the RWQCBs required new studies in anticipation of the publication of new EPA regulations, but also because data on CWIS impacts were not available for some of the plants and studies at other plants were usually over 20 years old. As a result, the authors had the opportunity in California to develop approaches to assessing CWIS impacts that might prove useful to researchers at power plants throughout the United States. These studies involved regulatory agency staff, scientists, consultants, and industry representatives, usually meeting and working under the heading of Technical Workgroups. This collaborative process was first used for studies at the Pacific Gas & Electric Company Diablo Canyon Power Plant and was initiated and directed by Michael Thomas at the Central Coast Regional Water Quality Control Board (CCRWQCB) (Ehrler et al. 2003). This process was also used on studies for plant repowering projects under Energy Commission and RWQCB review at the Moss Landing, Morro Bay, Potrero and Huntington Beach power plants.

This paper focuses on methods for assessing only entrainment effects (not impingement) and, specifically, entrainment effects on ichthyoplankton. Entrainment affects all types of planktonic organisms, but most studies do not assess holoplankton (phytoplankton and zooplankton that are planktonic for their entire life) because their broad geographic distributions and short generation times reduce the effects of entrainment on their populations. In contrast, the potential for localized effects on certain fish populations is much greater, especially for power plants located in riverine or estuarine areas where a large percentage of the local population may be at risk of entrainment (Barnthouse et al. 1988, Barnthouse 2000). Although the potential for similar effects exists for certain invertebrate meroplankton (for example, crab and clam larvae), taxonomy of early larval stages of many invertebrates is not sufficiently advanced to allow for assessments at the species level. The different larval stages of many invertebrates may also require different mesh sizes and sampling techniques that increase the costs and complexity of a study. In contrast, as a result of programs such as the California Coastal Oceanographic Fisheries Investigations (CalCOFI) program, operating since 1950, ichthyoplankton of the West Coast have been well described, and long-term data sets exist on the abundances of many larval fishes (Moser 1996).

The best-documented and most extensive 316(b) studies from the period of the late 1970s and early 1980s were from the Hudson River power plants (Barnthouse et al. 1988, Barnthouse 2000). Impacts of cooling water withdrawals from three plants were extensively studied using long-term, riverwide sampling and analyzed using mathematical models designed to predict the effects on striped bass and other fish populations. After many years of debate surrounding a lawsuit, the case was settled out of court. Two of the most important factors in laying the groundwork for the settlement were the converging estimates of the effects from different researchers and the

development of models that estimated conditional mortality from empirical data that reflected the "complex interactions of a host of factors" and helped identify the "relative importance of each component of the analysis" (Englert and Boreman 1988).

Numerous demographic modeling approaches have been proposed and used for projecting losses from CWIS impacts (Dey 2003). Equivalent adult (Horst 1975, Goodyear 1978), production foregone (Rago 1984), and variations of these approaches and models (Dey 2003) translate entrainment losses of egg and larval stages into equivalent units (adult fishes, biomass, and so forth) that otherwise would not have been lost to the population. Although these models are the most commonly used methods for CWIS assessment and were used by the EPA to support the new 316(b) regulations (USEPA 2004), there can be problems with their application and interpretation. The models require life history parameters (larval duration, survival, fecundity, and so forth) that are available for only a limited number of species, generally those managed for commercial or recreational fishing. Our experience has shown that on the California coast, taxa (the term 'taxa' ['taxon' singular] is used to refer to individual species or broader taxonomic categories that cannot be identified to species) that are usually entrained in highest numbers are small, forage fishes that have very limited life history information available.

However, these models are attractive because their interpretation appears to be straightforward since they convert larval forms into "equivalent units" that are more easily understood by the public, regulators, and managers. The estimates of numbers or biomass of fish from the models can also be added to losses from impingement and compared with commercial or recreational fishery data to provide cost estimates of the losses. Unfortunately, these interpretations are available for only a few taxa, there is usually no scale for determining the significance of the losses to the source water populations, and the studies are only done for a one- to two-year period, not accounting for inter-annual variation in larval abundances. The source water population is the abundance of organisms at risk of entrainment as determined by biological and hydrodynamic/oceanographic data.

Our assessments included a modified version of the Empirical Transport Model (ETM) (Boreman et al. 1978, 1981), which circumvented the problems with existing demographic modeling. This model was first developed for use with power plants entraining water from rivers, but MacCall et al. (1983) used the same general approach for entrainment assessments at power plants on the open coast and in estuaries in Southern California. In contrast to demographic models, it does not require detailed life history information. The ETM provides an estimate of the mortality caused by entrainment to a source water population independent of any other sources of mortality, such as conditional mortality (Ricker 1975). Inherent in this approach is the requirement

for an estimate of the source water population of larvae affected by entrainment. The ETM is based on the same principles used in fishery management to estimate effects of fishing mortality on a source water population or stock (Boreman et al. 1981, MacCall et al. 1983). Although not specifically required for calculating estimated losses, an estimate of the source water population is also required to provide a context for the losses estimated by demographic models.

The process of defining the source water and obtaining an estimate of its population varies among studies and among taxa within studies. This paper will present the multiple modeling approaches used for power plant entrainment assessments, with the main focus being a comparison of the processes used to define the source water populations used in the ETM modeling from three power plants in California, South Bay Power Plant (SBPP), Morro Bay Power Plant (MBPP), and Diablo Canyon Power Plant (DCPP), which represent a range of marine and estuarine habitats (Figure 2). This comparison allows us to compare the approaches and assess the influence of the source water on the proportional mortality of affected fish and invertebrate larval taxa.

The source water population definitions for the three studies were based on the hydrodynamic and biological characteristics of the water bodies where the facilities were located. This is necessary to characterize the sources of the water that is drawn into a power plant. This is fairly simple if the source of cooling water is a lake that is so well mixed that the larval concentrations are uniform. In this case the only necessary information to estimate the mortality on the larvae is the volume of the lake and the plant cooling water volume. In this simple example, the mortality is the ratio of the cooling water volume to the source water volume since the concentration of larvae entrained will be equal to the concentration in the source water. In the case of SBPP, samples were collected throughout the entire source water since the larval composition in the habitats within the south part of San Diego Bay were potentially different even though the source water volume for SBPP was treated as a closed system similar to the lake in the above example. The source water for MBPP included both bay and ocean components requiring biological sampling in both locations and calculations to include the effects of tides on the source water. The effects of ocean currents affected the source water potentially entrained for DCPP and the ocean component of the MBPP source water. As a result, the source water potentially affected by entrainment was much larger than the areas sampled for these two studies requiring additional measurements and modifications to the model. The many factors that need to be considered in the design of these kinds of studies can be examined by comparing the different approaches taken at the three facilities.

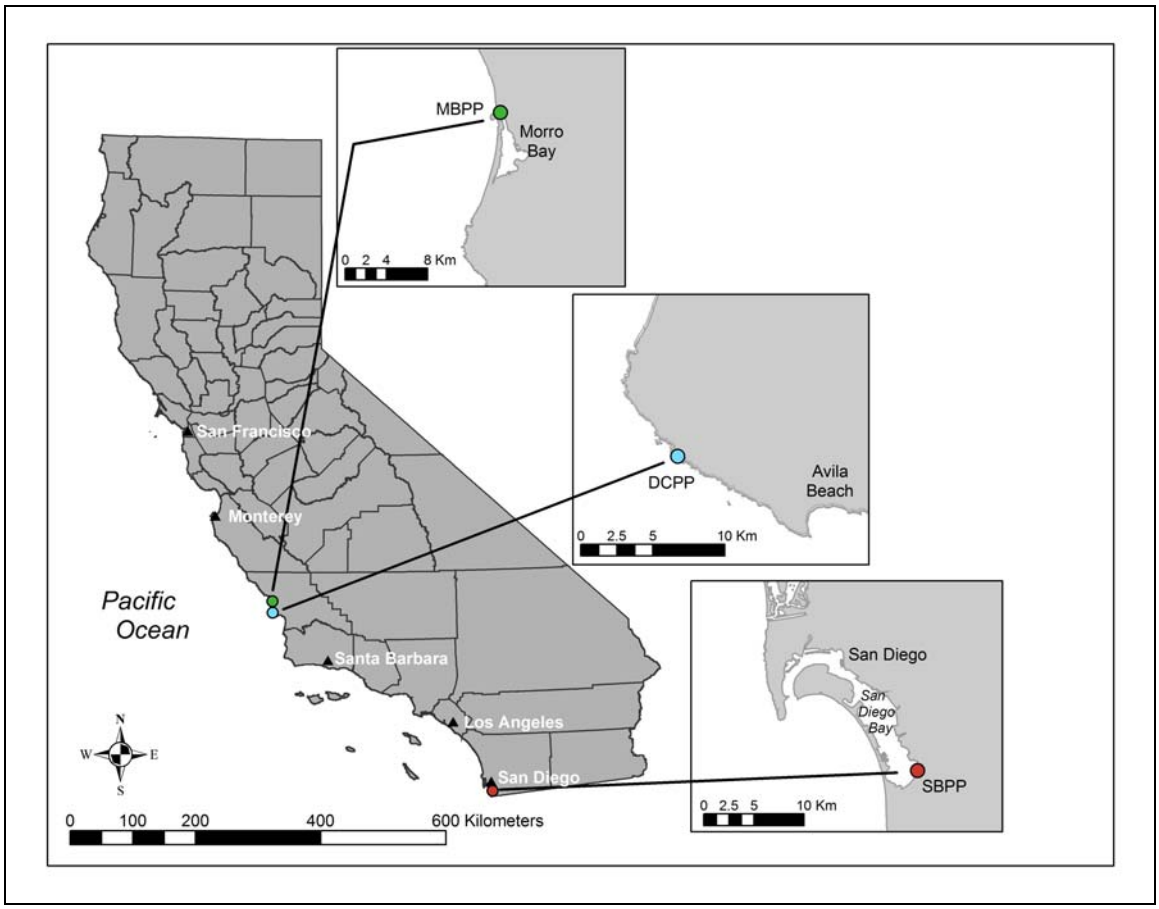

Figure 2. Locations of Morro Bay (MBPP), Diablo Canyon (DCPP), and South Bay power plants (SBPP).

During the course of these studies, the authors have modified the assessment approaches, and this process has continued as the authors have participated in additional, more recent studies. Therefore, one of the additional purposes of this paper is to present these more recent changes in assessment methods even though they may differ from methods presented in the three example studies.

The experiences resulting from these studies are especially pertinent with the recent publication of new rules for Section 316(b) of the Clean Water Act (USEPA 2004), and Energy Commission and California Coastal Commission (CCC) requirements for modernizing power plants in California. The new 316(b) rules require that information on the source water body be submitted as part of 316(b) compliance (40 CFR 125.95[b][2]). Although not stated in the new rules, it seems appropriate that CWIS impacts would be evaluated based on the source water body information. The Energy Commission and CCC have required this in recent studies and most likely will continue this practice. Hopefully the information in this paper will assist others in the design and evaluation of CWIS assessments that will be required under the new rules.

CHAPTER 2: METHODS

Power Plant Descriptions

The studies to be presented as examples were conducted at three power plants: SBPP, MBPP, and DCPP (Figure 2). The CWIS for all three plants share several features: shoreline intake structures with stationary trash racks that consist of vertical steel bars to prevent larger objects and organisms from entering the system and traveling water screens (TWS) located behind the bar racks that screen out smaller organisms and debris from the system (Figure 1).

Entrainment occurs to organisms that pass through the smaller mesh of the TWS. These organisms are exposed to increased temperatures and pressures as they pass through CWS. The surfaces of the piping in the CWS can be covered with biofouling organisms that feed on organisms that pass through the system. Although studies have shown that there may be some survival after CWS passage (Mayhew et al. 2000), most of these studies were conducted at power plants in rivers and estuaries on the East Coast or in the Gulf of Mexico where biofouling was not recognized as a large problem compared with coastal environments. In addition, these studies only examined survival after passage through the system and did not include comparisons of intake and discharge concentrations where losses due to cropping should be factored into CWS survival. For example, during testing used to determine the appropriate entrainment sampling location, losses between the intake and discharge at the Moss Landing Power Plant sometimes exceeded 95 percent and were always greater than 50 percent (Pacific Gas and Electric Co. 1983). For these reasons, our assessments of CWS effects have assumed that entrained organisms experience 100 percent mortality.

The SBPP, operated by Duke Energy, is located on the southeastern shore of San Diego Bay in the city of Chula Vista, California, approximately 16 km north of the U. S. – Mexican border (Figure 3). The plant draws water from San Diego Bay for once-through cooling of its four electric generating units, which can produce a maximum of 723 MW (Table 1). With all pumps in operation, maximum water flow through the plant is 1,580 m3min-1 (2.3 million m3d-1).

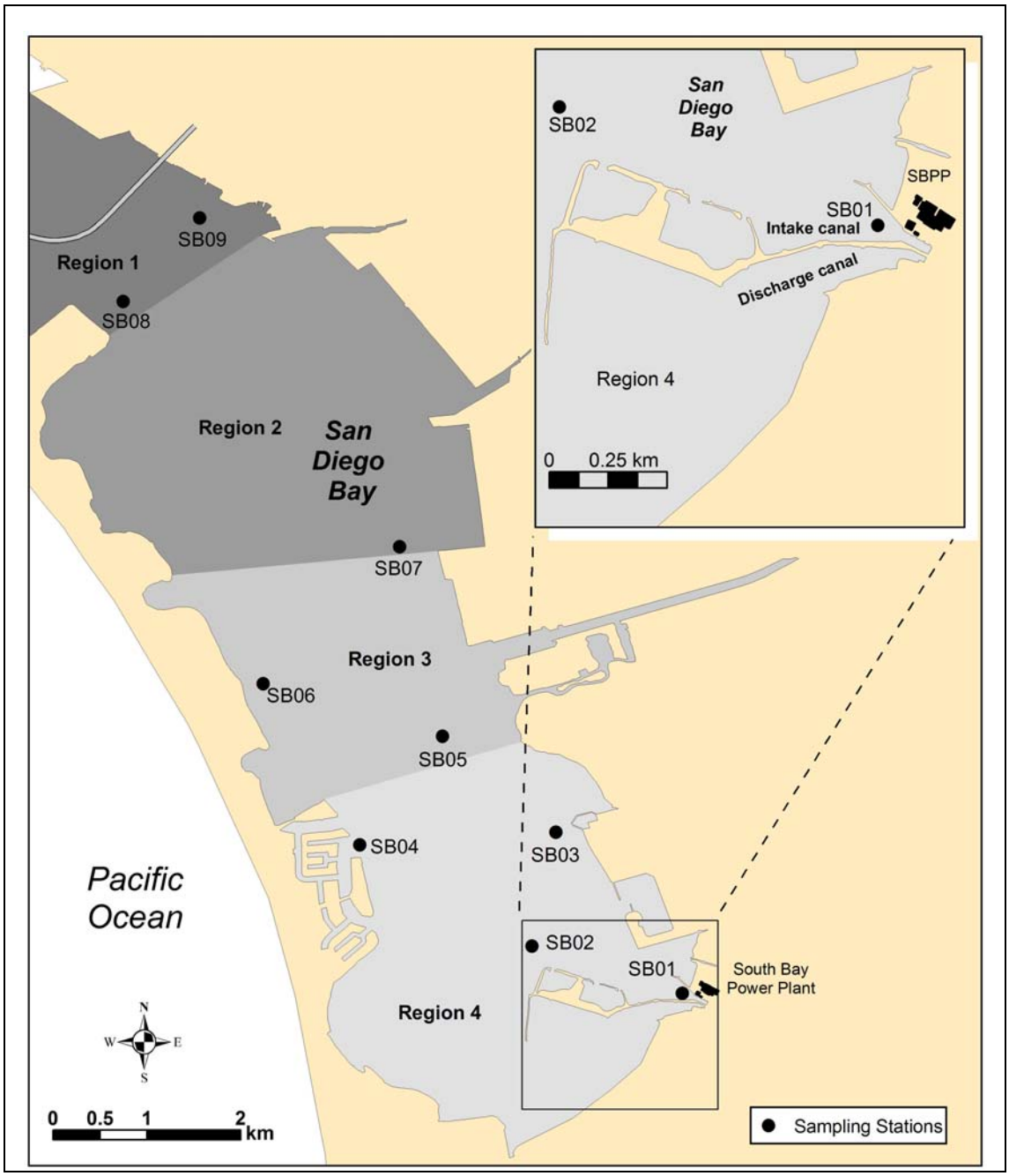

Figure 3. Location of South Bay Power Plant entrainment (SB01) and source water stations and detail of power plant intake area. Shaded areas represent regions of the bay used in calculating bay volumes.

The MBPP, operated by Duke Energy, is located on the northeastern shoreline of Morro Bay, which is approximately midway between San Francisco and Los Angeles, California (Figure 4). The plant draws water from Morro Bay for once-through cooling of its four electric generating units, which can produce a total of 1,002 MW (Table 1).

With all pumps in operation, water flow through the plant is 1,756 m3min-1 (2.53 million m3d-1). Morro Bay studies were done as part of the permitting requirements for an upgrade to the plant that result in a decrease in flow to 1,086 m3min-1 (1.56 million m3d-1). Therefore, all of the entrainment estimates and modeling were calculated using this flow rate.

Table 1. Characteristics of the South Bay (SBPP), Morro Bay (MBPP), and Diablo Canyon (DCPP) power plants.

Power Plant	Number of Power Generating Units	Total Maximum Megawatt (MW) Electric Output	Number of Circulating Water Pumps	Total Maximum Daily Flow (m^3)
SBPP	4	723	8 (2/unit)	$2.3x10^6$
MBPP	4	1,002	8 (2/unit)	$2.5x10^6$
DCPP	2	2,200	4 (2/unit)	$9.7x10^6$

The DCPP, operated by Pacific Gas and Electric Company, is located on the open coast midway between the communities of Morro Bay and Avila Beach on the central California coast in San Luis Obispo County (Figure 5). The intake structure for the plant is located behind two breakwaters that protect it from waves and surge. The plant has two nuclear-fueled generating units that can produce a total of 2,200 MW (Table 1). With the main pumps and smaller auxiliary seawater system pumps in operation, total water flow through the plant is 6,731 m3min-1 or (9.7 million m3d-1).

Source Water and Source Population Definitions

The concept of defining the source water potentially affected by CWS operation is inherent in the assessment process but was not defined as a necessary component of a 316(b) assessment until the recent publication of the new 316(b) rules. The new rules require all existing power plants with CWS capacities greater than 189,000 m3d-1 to complete a Comprehensive Demonstration Study that includes a qualitative description of the source water. A more detailed quantitative definition of source water is not necessary for demographic modeling approaches but is required to place calculated losses into context. The Empirical Transport Model (ETM) requires a more specific definition since the model calculates the conditional mortality due to entrainment on an estimate of the population of organisms in the source water that are potentially subject to entrainment.

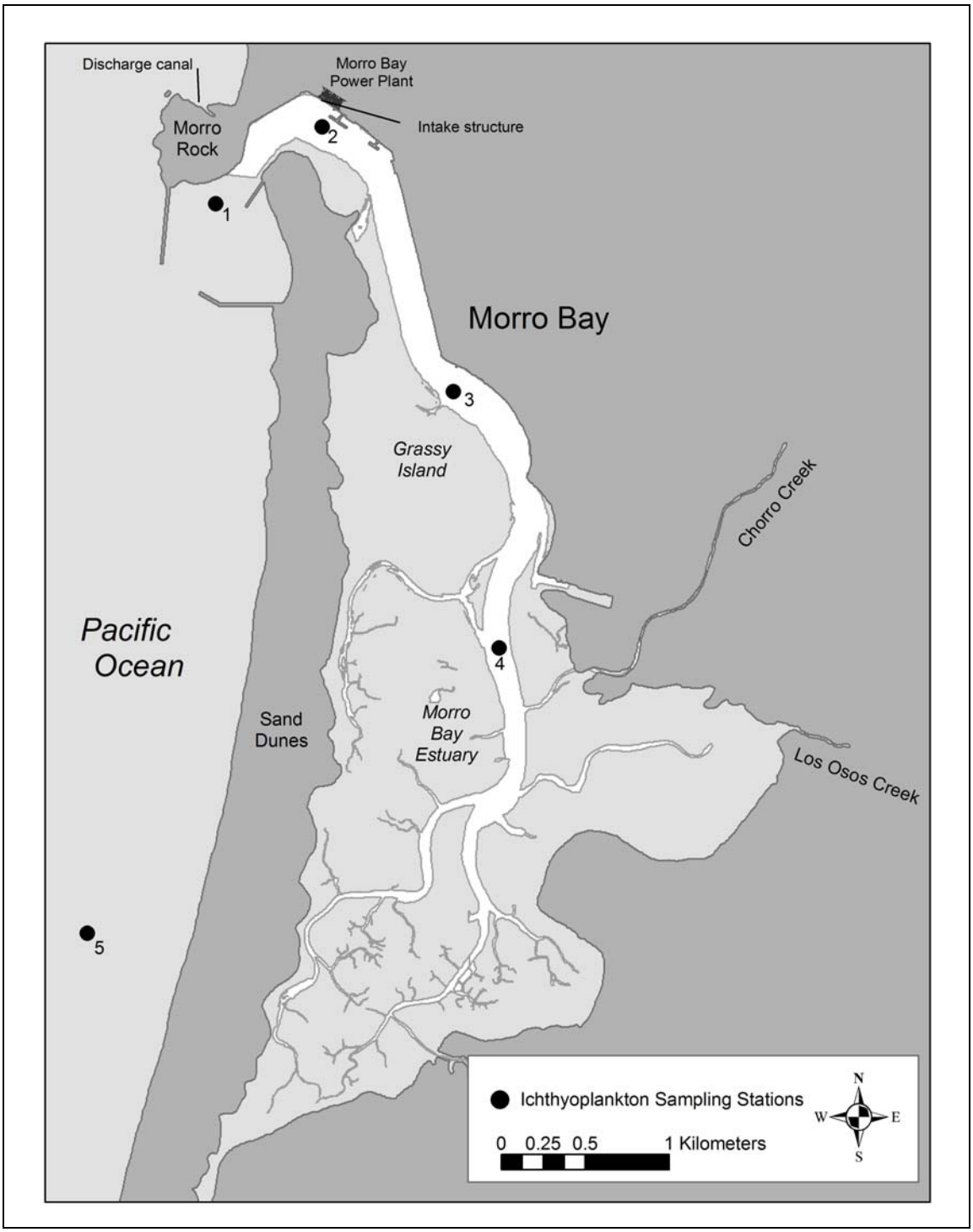

Figure 4. Locations of Morro Bay Power Plant entrainment (Station 2) and source water stations. White area depicts the main tidal channels in the bay, light gray areas are submerged at high tide, and dark gray areas are above the mean high tide line.

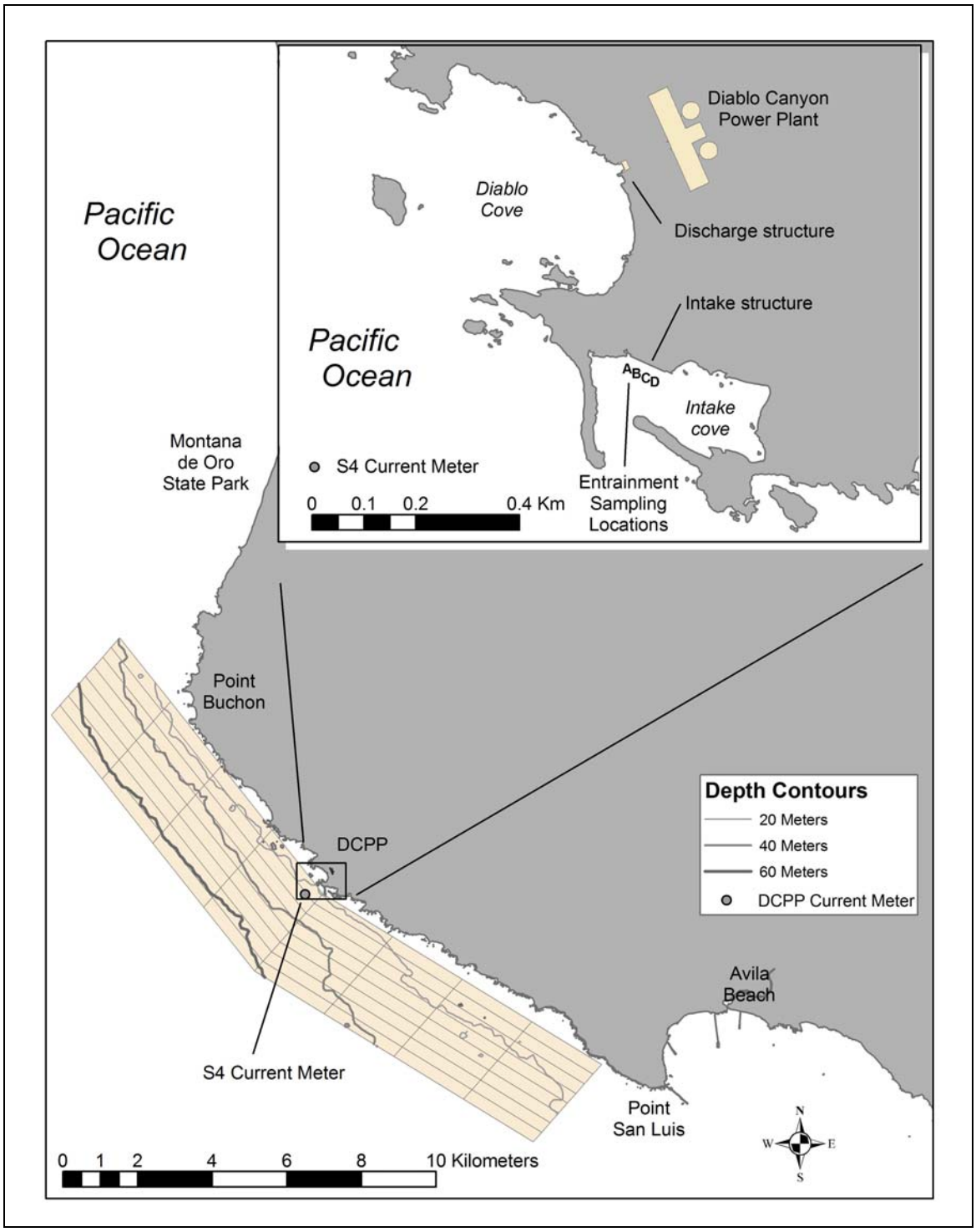

Figure 5. Locations of Diablo Canyon Power Plant (DCPP) entrainment stations (A, B, C, D, in insert) and source water sampling grid.

Critical to properly defining the source water for these studies was physical data that was collected either during the studies or from other sources to estimate the volume of the areas sampled and the total size of the source water. At SBPP and MBPP, hydrographic data collected for the study from several sources was used to estimate volume of the two water bodies. That volume was used as the total source water volume for SBPP. In addition to the volume of Morro Bay, current data from offshore and information on tides was used to estimate the total source water volume that included both bay and ocean components. Data from the same current meter used in the DCPP study were used in the MBPP study to calculate an average current speed over the period of January 1, 1996 – May 31, 1999. Current direction was ignored in calculating the average speed. The current speed was used to estimate unidirectional displacement over the period that the larvae in the sampling area offshore from Morro Bay were exposed to entrainment (described below). At DCPP, hydrographic data from National Oceanic and Atmospheric Administration was used to estimate the volumes of each of the 64 nearshore sampling stations (described below). In addition, data on alongshore and onshore current velocities were measured using an InterOceans S4 current meter positioned approximately 1 km west of the DCPP intake at a depth of approximately 6 m (Figure 5). The direction in degrees true from north and speed in cm/s were estimated for each hour of the nearshore study grid survey periods. These data were used to estimate the size of the area that could have acted as a source for larvae in the nearshore sampling area (described below).

South Bay Power Plant

The SBPP draws ocean water from the southernmost end of San Diego Bay (Figure 3). Allen (1999) divided San Diego Bay into four eco-regions and defined the south and south-central eco-regions as the area from the Coronado Bridge to the southern end of San Diego Bay. Analyses of current patterns and tidal dispersion were used to justify the use of the south and south-central eco-regions (south of the Coronado Narrows) as an appropriate source volume for modeling the effects of entrainment by SBPP. These analyses were done by Dr. John Largier, formerly at Scripps Institute of Oceanography, and now at Bodega Marine Laboratory of the University of California at Davis, and Dr. David Jay, Oregon Health and Science University (Tenera Environmental 2004). The analysis of tidal currents measured at 18 locations throughout the interior of San Diego Bay showed that tidal currents exhibited a local maximum in the south bay at the Coronado Narrows and increased toward the bay mouth. Estimates of tidal dispersion were formed using data from the same 18 current meters, which showed spatial patterns generally similar to those from Largier (1995).

The results of Largier (1995) showed that tidal dispersion had a local maximum at the Coronado Narrows, consistent with the idea that the Narrows acts as the “mouth” of

south bay. South of the Narrows, currents and tidal dispersion are much reduced. Mixing throughout the south bay was estimated to take from one week to a month, typical of the period of time that the larvae were estimated to be exposed to entrainment. The results suggested that larvae are likely removed from the south bay primarily, but not exclusively, by dispersion and that advection may be dominant only during winter river-flow events. The analyses confirmed, quantitatively, Allen's (1999) definitions of eco-regions in San Diego Bay and helped verify the use of the Coronado Narrows as a logical seaward boundary for the SBPP source volume.

Since retention times in the south bay exceeded the average larval durations for most of the taxa examined, the source water was treated as a static volume. Volume was calculated as the volume of water below "mean water level" (MWL, the average of a large number of tidal observations) from the southern end of San Diego Bay northward to the Coronado Narrows (Figure 3). Computing the source volume required compiling the areas and volumes below fixed elevations (horizontal strata). Variations in tidal range required that the South Bay be divided into four regions, with tidal datum levels determined for each, either directly from a tide gauge in the region or by interpolation from adjacent gauges. Tide gauges were available in Regions 2, 3, and 4, whereas datum levels in Region 1 had to be determined by interpolation. Bathymetry for Regions 1 and 2 and the periphery of Regions 3 and 4 were obtained from the U.S. Navy and supplemented with data collected for this study. Estimates of the average concentrations of the organisms inside the bay were multiplied by the sum of the estimated volumes from the four areas (Table 2) to obtain estimates of the bay source water populations that were used in the calculations of mortality for the ETM.

Table 2. Source water body surface area and water volume at mean water level (MWL) by region for south San Diego Bay.

Region	Datum	Height (m)	Area (m^2)	Volume (m^3)
1	MWL	0.90	4,241,241	33,754,018
2	MWL	0.90	10,173,006	70,387,388
3	MWL	0.91	6,355,524	25,060,179
4	MWL	0.93	9,556,875	20,410,508
			30,326,646	149,612,092

Morro Bay Power Plant

The MBPP source water was divided into two sub-areas, bay water and nearshore coastal water, because the location of the intake structure near the harbor entrance entrained both bay and nearshore taxa (Figure 4). The source water for MBPP could not be treated as a static volume, such as the source water for SBPP, because of the location of the power plant intake near the harbor entrance, which made it subject to daily tidal

flows, and the smaller volume of the bay relative to an area such as San Diego Bay. To compensate for daily tidal movement past MBPP, the volume of the Morro Bay source water component was calculated as the sum of the bay's twice daily exchange of its 15.5 million m3 tidal prism, adjusted for tidal exchange, (mean high water to mean low water) and the bay's non-tidal volume of 5.4 million m3. The volume of the tidal prism was adjusted to account for the portion of the Morro Bay outflow that returned with the incoming tide. Since volume was used to estimate the total supply of entrained larvae, inclusion of the recirculated tidal prism volume would double count a portion of the larval supply and underestimate potential entrainment effects. This was accounted for using a tidal exchange ratio (TER), calculated for Morro Bay. The TER is the fraction of the total tidal exchange that consists of "new" water coming into the estuary, or water that did not leave the estuary on the previous tidal cycle (Largier et al. 1996). In Morro Bay, the "total tidal exchange" is synonymous with the tidal prism, except for the amount estimated by TER.

The TER is difficult to estimate from measurements because the currents that prevail outside any estuary mouth are complex and variable, and it is quite sensitive to processes inside and outside the estuary, especially complex currents, river inflow, and density stratification (Largier et al. 1996). However, a method was developed (Largier et al. 1996) that measures the TER from the change in salinity of water flowing in and out of the entrance of an estuary. Applying this method, the Morro Bay TER was calculated to be between 70 and 80 percent of the average daily tidal prism by Dr. David Jay (Tenera Environmental 2001). A TER of 75 percent was used in calculating the bay source water volume, which was equal to the twice-daily tidal exchange of the average tidal prism, adjusted for the TER, added to the bay's non-tidal volume. Estimates of the average concentrations of organisms from the stations inside the bay (Stations 1–4) were multiplied by this volume to obtain estimates of the bay source water populations (Table 3). Since tidal exchange was used in calculating the source volume for Morro Bay, the plant's intake flow volume was calculated over a complete daily tidal cycle of two highs and two lows, which was 24 hours and 50 minutes.

Table 3. Volumes for Morro Bay and Estero Bay source water sub-areas.

Area	Volume (m^3)
Morro Bay	15,686,663
Estero Bay Sampling Area	20,915,551

The area sampled outside Morro Bay in Estero Bay was treated as a static volume (Table 3) that was equal to the volume of Morro Bay uncorrected for tidal exchange. This

volume for Estero Bay was used because it represented the volume of water exchanged with the bay that could be subject to entrainment. Estimates of the average concentrations of the organisms from the station just inside the bay (Station 1) and the station down-coast (Station 5) were multiplied by this volume to obtain estimates of the Estero Bay populations in the area sampled. The total size of the source water beyond the area sampled was estimated using ocean current data. Morro Bay and Estero Bay larval estimates were calculated separately so that the large source volume in Estero Bay did not inflate the source water estimates for bay taxa that were in much lower abundances outside the bay.

Diablo Canyon Power Plant

The DCPP nearshore sampling was designed to only provide information on abundance and distribution in the vicinity of DCPP of larval fishes and the invertebrates selected for detailed assessment, since it was recognized that the actual source water would be much larger for some taxa and vary by taxa and seasonally due to changing oceanographic conditions. In establishing the nearshore sampling area, the authors considered that ocean currents in the area generally move both up and down the coast past DCPP. The currents also showed inshore/offshore oscillations, but these occurred less frequently and generally at a lower magnitude. The nearshore sampling area contained 64 stations or "cells" (Figure 5) that were centered on the Intake Cove at DCPP. The northern extent of the sampling area was near Point Buchon, and the southern half, a mirror image of the northern portion, extended to near Point San Luis. The shape of the sampling area reflected a slight bend (approximately 20º) in the coast at DCPP. The sampling area extended a distance of 8.7 km to both the north and south and an average distance of 3 km offshore. Regions inshore of the sampling area were in shallow water with partially submerged rocks, making the areas unsafe for boat operations and sampling. Volumes in each of the 64 cells were estimated using the surface area of the cell and the average depth based on available bathymetry data. The number of larvae in each cell was estimated by multiplying the average concentration during each survey by the volume of water sampled.

Sampling

Sampling at all three of the facilities was designed to provide estimates of both entrainment and source water concentrations that accounted for the differences in the cooling water volumes at the three plants and were representative of the range of habitats and organisms potentially affected by entrainment in each area. As a result of the differences among the three plants and funding available, the combined entrainment and source water sampling efforts ranged from five stations for the MBPP study to 68 stations for the DCPP study.

Sample collection methods were similar to those developed and used by CalCOFI in their larval fish studies (Smith and Richardson 1977). Sampling at all three plants was conducted using a bongo frame with two 71-cm diameter rings with plankton nets constructed of 333-micrometer mesh. Each net was fitted with a Dacron sleeve and a cod-end container to retain the organisms. Each net was equipped with a calibrated General Oceanics flowmeter, which allowed the calculation of the amount of water filtered. Net lengths varied according to the depth of the water sampled. Shorter nets, 1.8 m in length, were used for entrainment sampling in the shallower intake cove at DCPP. Longer nets, 3.3 m in length, were used for all other sampling. All of the nets were lowered as close to the bottom as possible and retrieved using oblique or vertical tows to sample the entire water column. Once the nets were retrieved from the water, all of the collected material was rinsed into the codend. The target volume of each tow at both the entrainment and source water stations was 40-60 m3 for both nets combined. The sample volume was checked when the nets reached the surface, and the tow continued or started over if the target volume was not collected. The contents of both nets were either combined into one sample immediately after collection or treated as a single sample for analysis.

Entrainment sampling at all three plants was done in the waters outside the plant CWIS as close as possible to the intake structure bar racks. This sampling design assumed that the concentrations from the waters in front of the CWIS are the same as the concentrations in the cooling water flow. Sampling was done outside the CWIS because of the numerous problems involved in sampling inside the plant or at the discharge. Sampling inside the plant usually involves sampling with a pump that generally obtains a small volume relative to plankton nets in a given period of time. Although samples inside the CWIS may be well mixed, the cooling water flow inside the system is exposed to biofouling organisms that can significantly reduce the concentration of larval fish and other organisms. Sampling outside the plant also allowed entrainment samples to be used in characterizing source water populations. This was critical to the ETM calculations and allowed source water estimates to be calculated for taxa that may have only been collected from entrainment samples.

South Bay Power Plant

Entrainment and source water sampling was conducted monthly from January 2001 through January 2002 (Tenera Environmental 2004). Entrainment samples were collected from Station SB1 located in the SBPP intake channel (Figure 3). Each tow proceeded out the intake channel against the prevailing intake current. The intake channel was bounded by a separation dike to the south and a shallow mudflat to the north, and there was a constant current flow toward the intake structure. Therefore it was assumed that all of the water sampled at the entrainment station would be drawn through the SBPP

cooling water system. Entrainment samples were collected over a 24-hour period, with each period divided into six 4-hour sampling cycles. Two replicate tows were collected consecutively at the entrainment station during each cycle. Source water samples at Stations SB2-SB9 were collected from the same vessel during the remainder of each cycle (Figure 3). A single tow was completed at each of the source water stations during each of the six 4-hr cycles.

The stations for the SBPP study (Figure 3) were stratified to include four channel locations on the east side of the bay and four shallower locations on the west side of the bay. The source water stations ranged in depth from approximately –2 m mean lower low water (MLLW) at SB8 to –12 m MLLW at SB9. This station array was chosen to include a range of depths and adjacent habitats in south San Diego Bay that would characterize the larval fish composition in the source water. For example, stations on the east side of the bay were adjacent to salt marsh habitat and would tend to have a greater proportion of larvae from fishes with demersal eggs that spawned in salt marsh channels, such as gobies, while deeper channel stations in the northern end of the study area would tend to have more larvae of species that spawn in open water such as northern anchovy *(Engraulis mordax).*

Morro Bay Power Plant

Entrainment and source water sampling was conducted from December 1999 through December 2000 (Tenera Environmental 2001). Entrainment samples were collected weekly from in front of the MBPP intake structures (Station 2; Figure 4). Samples were collected over a continuous 24-hour period with each period divided into six 4-hour sampling cycles. Two tows were conducted during each cycle. During the same period, monthly source water samples were collected at four stations in addition to the entrainment station (Figure 4). Initially, source water surveys were collected twice per day during daylight hours on high and low tides, but after two months of sampling in February 2000, sample collection for source water surveys was expanded to cover the entire 24-hour period and was no longer linked to tidal cycle.

Fewer stations were sampled in the MBPP study relative to the SBPP study due to the smaller size of the estuary. Station 1 was located just inside the entrance to Morro Bay and was intended to characterize water from outside the bay that was subject to entrainment during incoming tides. Only two other source water stations (Stations 3 and 4) were located in Morro Bay because the areas that could be sampled in the south part of the bay were limited to narrow navigation channels. This was not considered to be a problem because of the large tidal prism relative to the size of the bay that resulted in shallower portions of the bay draining through the deeper navigation channels where the sampling occurred. Station 5 was located outside the bay approximately 4.7 km

down coast (or, south of the harbor mouth) and was intended to characterize open coastal taxa potentially subject to entrainment.

Diablo Canyon Power Plant

Collection of the DCPP entrainment samples occurred from October 1996 through June 1999 (Tenera Environmental 2000). This was the longest period of sampling among the three studies. The sampling was continued longer than one year because of El Niño conditions during the first year, which were agreed by the Technical Workgroup as not representative of normal conditions. Entrainment samples were collected once per week from four permanently moored sampling stations located directly in front of the intake structure that were sampled in a random order during eight three-hour cycles (Figure 5). Two samples were collected at each station during each cycle. The first nine surveys were collected with 505 um mesh nets, but due to extrusion of larval fishes through the net mesh observed during these first few surveys, subsequent surveys were collected with 335 um mesh.

The boundaries and shape of the nearshore sampling area were chosen to ensure that the area would be large enough to characterize the larvae from the fishes potentially influenced by the large volume of the DCPP CWIS and would be representative of the variety of nearshore habitats found in the area. These were the same reasons used to justify the large sampling effort (64 stations) relative to the SBPP and MBPP studies. Sampling of the nearshore study area occurred monthly from July 1997 through June 1999. Two randomly positioned stations within each of the 64 cells of the grid were sampled once each survey. The study grid was sampled continuously over 72 hours using a "ping-pong" transect to limit temporal and spatial biases in the sampling pattern and to optimize shipboard time. The starting cell (constrained to the 28 cells on the perimeter of the grid) and the initial direction of the transect (constrained to the two cells diagonally, adjacent to the starting cell) were selected at random. When the adjacent diagonal cell had previously been sampled, one of the two adjacent cells in the direction of travel was randomly selected to be sampled next. To minimize temporal variation between entrainment and study grid sampling, source water surveys were scheduled to bracket the 24-hour entrainment survey, overlapping by one day before and after the collection of entrainment samples.

Entrainment and nearshore sampling efforts did not start at the same times, and therefore the entire sampling period was divided into five analysis periods. All of the weekly entrainment samples from October 1996 through November 1998 were processed so this period was divided into two yearlong analysis periods. Results for these periods are not presented because they were only used to generate estimates directly from entrainment data. The nearshore sampling period was also divided into

two yearlong analysis periods. Only the entrainment samples collected during the sampling of the nearshore area were processed from December 1998 through June 1999 so entrainment data from July 1998 through June 1999 were used to generate model estimates for a fifth analysis period that could be directly compared with model estimates that incorporated data from the nearshore sampling area.

Selection of Taxa for Detailed Assessment

Although almost all planktonic forms (phyto-, zoo-, and ichthyoplankton) are affected by entrainment, these three studies and most other 316(b) studies have focused on a few organism groups, typically ichthyoplankton and zooplankton. The effects on phytoplankton and invertebrate holoplankton are typically not studied because their large abundances, wide distributions, and short generation times should make them less susceptible to CWIS impacts. The groups of organisms selected for assessment in these studies included larval fishes and larvae from commercially or recreationally important invertebrates such as Cancer spp. crabs and California spiny lobster *(Panulirus interruptus).*

The workgroup also looked at including kelp spores, fish eggs, squid paralarvae, and abalone and bivalve larvae in the assessment. The risk of a significant impact on adult kelp populations by entrainment of kelp spores was determined to be negligible due to the large number of spores produced along the coast. Additionally, it is not possible to identify the species of kelp based on gametes or spores. Fish eggs were not included because they are difficult to identify to species, and the most abundant fishes in these studies had egg stages that were not likely to be entrained; they either have demersal/adhesive eggs or are internally fertilized and extrude free-swimming larvae. Squid paralarvae are also unlikely to be entrained because they are competent swimmers immediately after hatching. Abalone larvae were not included because they are at low risk of entrainment and cannot be effectively sampled or identified during early life stages when they would be susceptible to entrainment (Tenera Environmental 1997). In addition, algal spores, fish eggs, and abalone and bivalve larvae would all require smaller mesh than the mesh used for ichthyoplankton and separate sampling efforts.

The final list of fish and invertebrates analyzed in each of the studies (Table 4) was determined by technical workgroups after all of the samples had been processed and data from the entrainment samples summarized. The assessments included taxa from the organism groups that were in highest abundance in the entrainment samples (generally those comprising up to 90 percent of the total abundance) and commercially or recreationally important fishes and invertebrates that were in high enough abundances to allow for their assessment. It was also realized that organisms having

local adult and larval populations (that is, source not sink species) were more important than species such as the northern lampfish *(Stenobrachius leucopsarus),* which is an offshore, deep-water species whose occurrence in entrainment was likely due to onshore currents that transported the larvae into coastal waters from their primary habitat. These 'sink species' were not included in the assessments.

Table 4. Taxa used in assessments at South Bay (SBPP), Morro Bay (MBPP), and Diablo Canyon (DCPP) power plants.

Scientific Name	Common Name
SBPP – taxa comprising 99 percent of total entrainment abundance	
Clevlandia ios, Ilypnus gilberti, Quietula y-cauda	CIQ goby complex
Gillichthys mirabilis	longjaw mudsucker
Anchoa spp.	anchovies
Atherinopsidae	silversides
Hypsoblennius spp.	combtooth blennies
MBPP – taxa comprising 90 percent of total entrainment abundance plus commercial taxa	
unidentified Gobiidae	gobies
Leptocottus armatus	Pacific staghorn sculpin
Stenobrachius leucopsarus	northern lampfish
Quietula y-cauda	shadow goby
Hypsoblennius spp.	combtooth blennies
Sebastes spp. V_De	KGB rockfishes
Atherinopsis californiensis	jacksmelt
Clupea pallasii	Pacific herring
Genyonemus lineatus	white croaker
Scorpaenichthys marmoratus	cabezon
Cancer antennarius	brown rock crab
Cancer jordani	hairy rock crab
Cancer anthonyi	yellow crab
Cancer gracilis	slender crab
Cancer productus	red rock crab
Cancer magister	Dungeness crab
DCPP – ten most abundant taxa plus commercial taxa	
Sardinops sagax	Pacific sardine
Engraulis mordax	northern anchovy
Sebastes spp. V / *S. mystinus*	blue rockfish complex
Sebastes spp. V_De/V_D_	KGB rockfish complex
Oxylebius pictus	painted greenling
Artedius lateralis	smoothhead sculpin
Orthonopias triacis	snubnose sculpin
Scorpaenichthys marmoratus	cabezon
Genyonemus lineatus	white croaker
Cebidichthys violaceus	monkeyface prickleback
Gibbonsia spp.	Clinid kelpfishes
Rhinogobiops nicholsii	blackeye goby
Citharichthys spp.	sanddabs
Paralichthys californicus	California halibut
Cancer antennarius	brown rock crab
Cancer gracilis	slender crab

The list of taxa reveals one of the problems with these studies. In some cases larvae cannot be identified to the species level and can only be identified into broader taxonomic groupings. Myomere and pigmentation patterns were used to identify many species; however, this can be problematic for some species. For example, sympatric members of the family Gobiidae share morphologic and meristic characters during early life stages (Moser 1996) making identification to the species level difficult. In the MBPP study the authors grouped those gobiids that were not identifiable to species into an "unidentified gobiid" category (that is, unidentified Gobiidae). In the SBPP study the authors were able to determine that the unidentified gobies were comprised of three species (Table 4). Larval combtooth blennies *(Hypsoblennius spp.)* can be easily distinguished from other larval fishes (Moser 1996). However, the three sympatric species along the central California coast cannot be distinguished from each other on the basis of morphometrics or meristics. These combtooth blennies were grouped into the "unidentified combtooth blennies" category (that is, *Hypsoblennius spp.*). Many rockfish species *(Sebastes spp.*) are closely related, and the larvae share many morphological and meristic characteristics, making it difficult to visually identify them to species (Moser et al. 1977, Moser and Ahlstrom 1978, Baruskov 1981, Kendall and Lenarz 1987, Moreno 1993, Nishimoto in prep.). Identification of larval rockfish to the species level relies heavily on pigment patterns that change as the larvae develop (Moser 1996). Of the 59 rockfishes known from California marine waters (Lea et al. 1999), at least five can be reliably identified to the species level as larvae (Laidig et al. 1995, Yoklavich et al. 1996): blue rockfish (*Sebastes mystinus*), shortbelly rockfish (*S. jordani*), cowcod (*S. levis*), bocaccio (*S. paucispinis*), and stripetail rockfish (*S. saxicola*). The *Sebastes* larvae collected could only be identified into broad sub-generic groupings based on pigment patterns; these larvae were grouped using information provided by Nishimoto (in prep.; Table 5). The use of these broad taxonomic categories presents problems in determining the most appropriate life history parameters to use in the demographic models. This involved calculating an average value or determining the most appropriate value from different sources and species.

Table 5. Pigment groups of some preflexion rockfish larvae from Nishimoto (in-prep).

The code for each group is based on the following letter designations:

V_ = long series of ventral pigmentation (starts directly at anus)

V = short series of ventral pigmentation (starts 3-6 myomeres after anus)

D_ = long series of dorsal pigmentation (4 or more in a continuous line) extending to above anus

D = short series of dorsal pigmentation (4 or more in a continuous line) not extending to anus

De = elongating series of dorsal pigmentation (scattered melanophores after continuous ones)

d = develops dorsal pigmentation (1-2 or scattered melanophores)

P = pectoral blade pigmentation

p = develops pectoral pigmentation (1-2 or scattered melanophores)

CODE	SPECIES	COMMON NAME
V D	Long ventral series, short dorsal series, no pectoral pigment	
	S. atrovirens	kelp
	S. chrysomelas	black and yellow
	S. maliger	quillback
	S. nebulosus	China
	S. semicinctus	halfbanded
V De	Long ventral series, elongating dorsal series, pectoral pigment	
Or	S. auriculatus	brown
V DeP	*S. carnatus*	gopher
Or	*S. caurinus*	copper
V dep	*S. dalli*	calico
	S. rastrelliger	grass
V	Short ventral series, no dorsal series, no pectoral	
	S. aleutianus	rougheye
	S. alutus	Pacific Ocean perch
	S. brevispinis	silvergrey
	S. crameri	darkblotched
	S. diploproa	splitnose
	S. elongatus	greenstriped
	S. macdonaldi	Mexican
	S. miniatus	vermilion
	S. nigrocinctus	tiger
	S. proriger	redstripe
	S. rosaceus	rosy
	S. ruberrimus	yelloweye
	S. serriceps	treefish
	S. umbrosus	honeycomb
	S. wilsoni	pygmy
	S. zacentrus	sharpchin

Other Biological Data

All of the assessment models required some life history information from a species to enable the calculation of entrainment effects. Age-specific survival and fecundity rates are required for the fecundity hindcasting (FH) and adult equivalent loss (AEL) demographic models. Calculation of FH requires egg and larval survivorship up to the age of entrainment plus estimates of lifetime fecundity, while AEL requires survivorship estimates from the age at entrainment to adult recruitment. Species-specific survivorship information (for example, age-specific mortality) from egg or larvae to adulthood was not available for many of the taxa considered in the assessments at the three plants. Life history information was gathered from the scientific literature and other sources. Uncertainty surrounding published life history parameters is seldom known and rarely reported, but the likelihood that it is very large needs to be considered when interpreting results from the demographic approaches for estimating entrainment effects. Accuracy of the estimated entrainment effects from demographic models such as FH and AEL depend on the accuracy of age-specific mortality and fecundity estimates. In addition, these data are unavailable for many species, limiting the application of these models to large numbers of species.

All three modeling approaches (FH, AEL, and ETM) required an age estimate of the entrained larvae. The larval ages were estimated using the length of the entrained larvae and an estimate of the larval growth rate for each species obtained from the scientific literature and other sources. The size range from the minimum to the average size of the larvae was used to calculate the average age of the entrained larvae that was used in the FH and AEL models, while the size range from the minimum to the maximum size of the larvae was used to calculate the maximum age of the entrained larvae and the period that the larvae were subject to entrainment for the ETM model. Minimum and maximum lengths used in these calculations were adjusted to account for potential outliers in the measurements by using the 1st and 99th percentile values in the calculations. These values were chosen based on examination of the distributions of the length measurements, and other values may be more appropriate for other studies or species depending upon the data. The size range was estimated for each taxon from a representative sample of larvae from the SBPP and MBPP studies, while all of the entrained larvae of the taxa selected for detailed assessment were measured from the DCPP study. All of the measurements were made using a video capture system attached to a microscope and OptimasTM image analysis software.

Data Reduction

Entrainment Estimates

Estimates of daily larval entrainment for all ichthyoplankton and selected invertebrate larvae for all of the plants were calculated from data collected at the entrainment stations located directly in front of the power plant intake structures. Daily entrainment estimates were used to calculate daily incremental entrainment mortality estimates used in the ETM. Estimates of entrainment over annual study periods were used in the FH and AEL demographic modeling.

Daily entrainment estimates and their variances were derived from the mean concentration of larvae (number of larvae per cubic meter of water filtered) calculated from the samples collected during each 24-hour entrainment survey. These estimates were multiplied by the daily intake flow volume for each plant (MBPP and SBPP studies used engineering estimates of cooling water flow and DCPP used actual daily flow) to obtain the number of larvae entrained per day for each taxon as follows:

$$E_i = v_i \cdot \overline{\rho}_i , \tag{1}$$

where vi = total intake volume for the survey day of the ith survey period, and $\overline{\rho}_i$ = average concentration for the survey day of the ith survey period.

Entrainment was estimated for the days within each weekly (MBPP and DCPP) or monthly survey period (SBPP). The number of days in each period was determined by setting the sampling date at the midpoint between sample collections. Daily cooling water intake volumes were then used to calculate entrainment for the study period by summing the product of the entrainment estimates and the daily intake volumes for each survey period. These estimates and their associated variances were then added to obtain annual estimates of total entrainment and variance for each taxon as follows:

$$E_T = \sum_{i=1}^{n} \left(\frac{V_i}{v_i} \right) E_i , \tag{2}$$

where

v_i = intake volume on the survey day of the *i*th survey period (*i*=1,...,n);
V_i = total intake volume for the *i*th survey period (*i*=1,...,n); and
E_i = the estimate of daily entrainment during the entrainment survey of the *i*th survey period.

with an associated variance of

$$Var(E_T) = \sum_{i=1}^{n} \left(\frac{V_i}{v_i} \right)^2 Var(E_i), \quad (3)$$

using the sampling variances of entrainment on the survey day of the i^{th} period, $Var(E_i)$. The daily sampling variance for SBPP and MBPP was calculated using the average concentrations from samples collected during each cycle, while the daily sampling variance for DCPP was calculated by treating each sampling cycle as a separate stratum using data from the four entrainment stations. Both methods underestimated the true variance because they did not incorporate the variance associated with the within-survey period variation and daily variations in intake flow due to waves, tide, and other factors not measured by the power plant. One hundred percent mortality was assumed for all entrained organisms.

For the study at DCPP, estimates of annual entrainment were scaled to better represent long-term trends by using ichthyoplankton data collected inside the Intake Cove at DCPP (Figure 5). These data were used to calculate an index of annual trends in larval abundance for the period of 1990 through 1998. This multi-year annualized index consisted of five months (February–June) of larval fish concentrations from 1990, six months (January–June) from 1991, and seven months (December–June) from all subsequent years. The estimated annual entrainment (ET) was adjusted to the long-term average using the following equation:

$$E_{Adj-T} = \left(\frac{\bar{I}}{I_i} \right) \cdot E_T, \quad (4)$$

where

E_{Adj-T} = adjusted estimate of total annual entrainment to a long-term average, 1990–1998;

I_i = index value from DCPP Intake Cove surface plankton tows for each *i*th year; and

$\bar{I}$ = average index value from DCPP Intake Cove surface plankton tows, 1990–1998.

The abundances used in calculating the index were not expected to be representative of the abundances calculated from the DCPP entrainment data since they were only collected during five to seven months of the year in contrast to the entrainment sampling that occurred continuously from October 1996 through June 1999. The use of the index assumes that the difference in abundance is approximately equal over time, although the validity of this assumption probably varied among taxa. Variance for adjusted annual entrainment can then be expressed as follows:

$$Var(E_{Adj-T}) = \left(\frac{\bar{I}}{I_i}\right)^2 \cdot Var(E_T), \tag{5}$$

assuming the indices are measured without error. Ignoring the sampling error of the indices will underestimate the true variance but will qualitatively account for the change in scale associated with multiplying the annual entrainment estimate by a scalar. The variance of E_{Adj-T}, however, does not take into account the between-day, within-station variance, interannual variation, nor the variance associated with the indices used in the adjustment. Hence, the actual variance of the E_{Adj-T} estimate is likely to be greater than the value expressed above.

The Intake Cove surface tow index was assumed to have the following relationship:

$$E(I_i) = C \cdot E_i\,, \tag{6}$$

where

$E(I_i) =$ expected value of the index for the ith year;
$E_i =$ entrainment for the ith year; and
$C =$ proportionality coefficient.

If this relationship holds true and the differences over time are constant, then the inter-annual variance in the index has the following relationship:

$$Var(I_i) = C^2 Var(E_i). \tag{7}$$

Therefore, the coefficients of variation (CV) for I and E across n years have the following relationship:

$$CV(\bar{I}) = \frac{\sqrt{\frac{Var(I)}{n}}}{\bar{I}} \doteq \frac{\sqrt{\frac{C^2 Var(E)}{n}}}{C\bar{E}} = CV(\bar{E})\,. \tag{8}$$

Hence, the CV for the Intake Cove surface tow index should be a measure of the CV for entrainment across years. In the case of E and I, variances include sampling errors that may not be equal. Therefore, the CV of I was used to estimate variation in entrainment across years.

The use of adjusted entrainment in FH and AEL models at DCPP provided results that better represented average long-term effects. Adjusted entrainment values were not used in calculating ETM results because the computation of ETM relies on a proportional entrainment (PE) ratio using estimates from paired entrainment and nearshore larval sampling. Moreover, if the assumptions of the ETM model are valid,

then the estimate already represents average long-term entrainment effects because the PE ratio should largely be a function of the ratio of the cooling water to source water volumes, which is constant if the plant is operating at full power compared to ichthyoplankton abundances that vary over time. This would especially be true if the PE were averaged over several taxa, assuming that the effects of larval behavior cancel across all the species. As a result, the use of adjusted entrainment in FH and AEL models also provided a better basis to compare results from all three models when they were converted into a common currency through the use of population or fishery stock assessments. This advantage of the ETM could be affected if actual cooling water flows varied considerably seasonally and among years.

Source Water Estimates

Average concentrations calculated from source water stations were used to estimate source water populations of species or taxa groups using the same method used for calculating entrainment estimates for each i^{th} survey period. At SBPP a single source water estimate was calculated, while at MBPP, separate estimates were calculated for Morro Bay and Estero Bay source water components.

At DCPP separate estimates were calculated for each of the 64 grid stations based on the depth and surface area of each station. In addition, an adjustment was made to the estimated number of larvae in the Row 1 cells of the study grid to help compensate for the inability to safely collect samples inshore of the grid (Figure 5). The estimated volume of water directly inshore of the study grid was multiplied by the concentration of larvae collected in the Row 1 cells, except for cells directly offshore from the power plant and the cell farthest upcoast, which is more offshore than the rest of the cells in Row 1 due to the bend in the coastline at Point Buchon. The adjustment was not done for the volume of water inshore of that cell because it would have added a substantial volume to that cell, and the composition and abundance would not have been representative of the other inshore areas. The average concentration from the entrainment stations was used for the areas inshore from the two cells directly offshore from the Intake Cove where entrainment samples were collected. The estimated number of larvae in each grid station and from the areas inshore of the grid was added to obtain an estimate of the sampled source water populations.

Impact Assessment Models

Demographic Approaches

Adult equivalent loss models (Goodyear 1978) evolved from impact assessments that compared power plant losses to estimates of adult populations or commercial fisheries

harvests. In the case of adult fishes impinged by intake screens, the comparison was relatively straightforward. To compare numbers of impinged sub-adults and juveniles and entrained larval fishes to adults, it was necessary to convert these losses to adult equivalents using demographic factors such as survival rates. Horst (1975) provided an early example of the equivalent adult model (EAM) to convert numbers of entrained early life stages of fishes to their hypothetical adult equivalency. Goodyear (1978) extended the method to include survival for several age classes of larvae.

Demographic approaches, exemplified by EAM, produce an absolute measure of loss beginning with simple numerical inventories of entrained or impinged individuals and increasing in complexity when the inventory results are extrapolated to estimate numbers of adult fishes or biomass. We used two related demographic approaches in assessing entrainment impacts at all three facilities: AEL (Goodyear 1978), which uses the larval losses to estimate the equivalent number of adult fishes that would not have been lost to the population, and FH (Horst 1975, Goodyear 1978, MacCall, pers. comm.), which estimates the number of adult females at the age of maturity whose reproductive output has been lost due to entrainment. The method is similar to the Egg Production Method described by Parker (1980, 1985) and implemented in Parker and DeMartini (1989) at San Onofre Nuclear Generating Station except they used only eggs to hindcast adult equivalents.

Both AEL and FH approaches require an estimate of the age at entrainment for each taxon that was estimated by dividing the difference between the smallest (represented by the 1st percentile value) and the average lengths of a representative sample of larvae measured from the entrainment samples by a larval growth rate obtained from the literature. This assumes that the period of vulnerability to entrainment starts when the larvae are either hatched or released and that the smallest larvae in the samples represent newly hatched or released larvae. This minimum value was checked against reported hatch and release sizes for the taxa analyzed in these studies and in most cases was less than these reported values.

Additionally, age-specific survival and fecundity rates are required for calculating FH and AEL. FH requires egg and larval survivorship up to the age of entrainment plus estimates of fecundity, age at maturity, and longevity, while AEL requires survivorship estimates from the age at entrainment to adult recruitment. Furthermore, to make estimation practical, the affected population is assumed to be stable and stationary, and age-specific survival and fecundity rates are assumed to be constant over time. In addition, the FH method assumes that all of the females instantaneously reach 100 percent maturity at the age of maturity.

Species-specific survivorship information from egg or larvae to adulthood was limited for many of the taxa considered in these studies. These rates when available were inferred from the literature along with estimates of uncertainty. Uncertainty surrounding published demographic parameters is seldom known and rarely reported, but the likelihood that it is very large needs to be considered when interpreting results from the demographic approaches for estimating entrainment effects. The ratio of the standard deviation to the mean (CV) was assumed to be 30 percent for all life history parameters used in the models for the SBPP and MBPP studies and 100 percent for the DCPP study. The larger CV was used at DCPP because it was the first study conducted, and the authors wanted to use a large CV to ensure that the confidence intervals adequately reflected the large degree of uncertainty associated with the estimates. The smaller CV used for SBPP and MBPP does not reflect increased confidence in the life history data, but the realization that the larger CV used at DCPP resulted in confidence intervals for the estimates that spanned several orders of magnitude minimizing their usefulness in the assessment.

Fecundity Hindcasting

The FH approach couples larval entrainment losses to adult fecundity using survivorship between stages to estimate the numbers of adult females at the age of maturity whose reproductive output has been lost due to entrainment, that is, hindcasting the numbers of adult females at the age of maturity effectively removed from the reproductively active population. Accuracy of the estimate of impacts using this model is dependent upon an accurate estimate of survival from parturition through the estimated average age at entrainment and total lifetime female fecundity. If it can be assumed that the adult population has been stable at some current level of exploitation and that the male:female ratio is constant at 50:50, then fecundity and mortality are integrated into an estimate of adult loss at the age of female maturity by converting entrained larvae back into adult females and multiplying by two to approximate the total number of equivalent adults at the age of female maturity.

A potential advantage of FH is that survivorship need only be estimated for a relatively short period of the larval stage (for example, egg to larval entrainment). The method requires age-specific mortality rates and fecundities to estimate equivalent adult losses. Furthermore, this method, as applied, assumes a 50:50 male:female ratio; hence the loss of a single female's reproductive potential was equivalent to the loss of two adult fish. Other assumptions included the following:

- Life history parameter values from the literature are representative of the population for the years and location of the study.

- Size of the stock does not affect survivorship or the rate of entrainment mortality (no density dependence).
- Reported values of egg mass were lifetime averages to calculate an unbiased estimate of lifetime fecundity.
- Total lifetime fecundity was accurately estimated by assuming that the mortality rate was uniform between age-at-maturity and longevity.
- "Knife-edge" recruitment into the adult population at the age of maturity.
- Loss of the reproductive potential of one female was equivalent to the loss of an adult female at the age of maturity.

The estimated number of females at the age of maturity whose lifetime reproductive potential was lost due to entrainment was calculated for each taxon as follows:

$$FH = \frac{E_T}{TLF \bullet \prod_{j=1}^{n} S_j}, \tag{9}$$

where

E_T = total entrainment estimate;

S_j = survival rate from parturition to the average age of the entrained larvae at the end of the j^{th} stage; and

TLF = average total lifetime fecundity (TLF) for females, equivalent to the average number of eggs spawned per female over their reproductive years.

While E_T was used in the modeling at SBPP and MBPP, $E_{Adj\text{-}T}$ was used at DCPP. In practice, survival was estimated by either one or several age classes, depending on the data source, to the estimated age at entrainment. The expected TLF was approximated by the following expression:

$$\begin{aligned} TLF &= \text{Average eggs/year} \cdot \text{Average number of years of reproductive life} \\ &= \text{Average eggs/year} \cdot \left(\frac{\text{Longevity - Age at maturation}}{2} \right). \end{aligned} \tag{10}$$

The number of years of reproductive potential was approximated as the midpoint between the ages of maturity and longevity. This approximation was based on the assumption of a linear uniform survivorship curve between these events (that is, a uniform survival rate). Total lifetime fecundity for the studies at SBPP was calculated by adding 1 to the difference between longevity and age-at-maturity. This was done to account for spawning during the two ages used in the calculation. For heavily exploited

species such as northern anchovy and sardine (*Sardinops sagax*), the expected number of years of reproductive potential may be much less than predicted using this assumption. Therefore, for the DCPP study, the estimated longevity for heavily exploited fishes was based on the oldest observed individual caught by the fishery, rather than by the oldest recorded fish. If life table data are available for a taxon, then the lifetime fecundity should be estimated directly rather than using the approximation presented in Equation 10. The variance of FH was approximated by the Delta method (Seber 1982) and is presented in Appendix A.

Adult Equivalent Loss

The AEL approach uses abundance estimates of entrained or impinged organisms to project the loss of equivalent numbers of adults based on stage-specific survival and age-at-recruitment (Goodyear 1978). The primary advantage of this approach, and of FH, is that it translates power plant-induced early life-stage mortality into numbers of adult fishes, which are familiar units to resource managers. Adult equivalent loss does not require source water estimates of larval abundance in assessing effects. This latter advantage may be offset by the need to gather age-specific mortality rates to predict adult losses and the need for information on the adult population of interest for estimating population-level effects (that is, fractional losses). Other assumptions of AEL using data on survivorship from entrainment to recruitment into the fishery assume the following:

- Published values of life history parameters are representative of the fish population in the years and location for the specific study.
- If survivorship values from the literature are limited to single observations, values are assumed constant over time or representative of the mean survivorship.
- Survival rates used in the calculations are representative and constant for the life stage of the larvae or fish in the calculations.
- Size of the stock does not affect survivorship or the rate of entrainment mortality (no density dependence).

In some cases, survival rates estimated for a similar fish species were used. Should survivorship data from one species be substituted for another, then there is the following additional assumption:

- Values of survivorship for the two species are the same.

For fish species where larval survival data are missing, expected survival could be estimated using fecundity combined with juvenile and adult survival data. This approach requires the following additional assumption:

- The fish population is stationary in size such that each adult female contributes two new offspring to the population of adults during its lifetime.

Starting with the number of age class *j* larvae entrained, it is conceptually easy to convert the numbers to an equivalent number of adults lost at some specified age class using the following formula:

$$AEL = \sum_{j=1}^{n} E_j S_j \,, \tag{11}$$

where,

n = number of age classes;

E_j = estimated number of larvae lost per year in age class j; and

S_j = survival rate for the j^{th} age class of the 1..n classes between entrainment and adulthood.

In practice, survival was estimated by either one or several age classes, depending on the data source, from the estimated age at entrainment to recruitment into the fishery. Survivorship to recruitment, at an adult age, was apportioned into several age stages, and AEL was calculated as follows:

$$AEL = E_T \prod_{j=1}^{n} S_j \,, \tag{12}$$

where,

S_j= survival rate over the j^{th} age class.

The variance of AEL was approximated by the Delta method (Seber 1982) and is presented in Appendix A.

Alignment of FH and AEL Estimates

AEL and FH can be compared by assuming a stationary population where an adult female must produce two adults (that is, one male and one female). These two adults are products of survival and total lifetime fecundity (TLF) modeled by the following expression:

$$2 = S_{egg} \cdot S_{larvae} \cdot S_{adult} \cdot TLF, \tag{12}$$

which leads to the following:

$$S_{adult} = \frac{2}{TLF \cdot S_{egg} \cdot S_{larvae}}. \quad (13)$$

Substituting into the overall form of the following AEL equation:

$$AEL = E_T \cdot S_{adult}, \quad (14)$$

yields the following:

$$AEL = \frac{2(E_T)}{S_{egg} \cdot S_{larva} \cdot TLF}. \quad (15)$$

Assuming a 50:50 sex ratio, without independent survival rates, AEL and FH are deterministically related as AEL≡2FH. The two estimates can be aligned so that female age at maturity is also the age of recruitment used in computing AEL. Otherwise, an alignment age can be accomplished by solving the simple exponential survival growth equation (Ricker 1975, Wilson and Bossert 1971):

$$N_t = N_0 \cdot e^{-Z(t-t_0)}, \quad (16)$$

by substituting numbers of either equivalent adults or hindcast females, their associated ages, and mortality rates into the equation where,

N_t = number of adults at time t;
N_0 = number of adults at time t_0;
Z = instantaneous rate of natural mortality; and
t = age of hindcast animals (*FH*) or extrapolated age of animals (*AEL*).

This allows for the alignment of ages for a population under equilibrium in either direction so they are either hindcast or extrapolated to the same age such that AEL≡2FH. Estimates of entrainment mortality calculated from AEL and FH approaches can be compared for similar time periods in taxa for which independent estimates are available for (1) survival from entrainment to the age at maturity, and (2) entrainment back to the number of eggs produced. This comparison serves as a method of cross-validating the two demographic models. Substantial differences between the model estimates may indicate that the population growth rate implied by the model parameters is unrealistically high or low.

FH estimates the number of females at the age of maturity whose reproductive output is lost. The total number of females N_F of all ages in the population can be estimated by the average fecundity as

$$N_F = \frac{E_T}{\bar{F} \bullet \prod_{j=1}^{n} S_j}. \quad (17)$$

AEL can be extrapolated to all mature female ages and summed to make a comparison to $2 \bullet N_F$ using the preceding assumptions. The number of females whose reproductive output is lost in the population, N_F, will be greater than the females estimated by FH. The analogue, sum of extrapolated AEL over adult ages, will be greater than AEL and represents the number of adult males and females lost.

Empirical Transport Model

The ETM estimates conditional probability of mortality (P_M) associated with entrainment and requires an estimate of proportional entrainment (PE) as an input. Proportional entrainment is an estimate of the daily entrainment mortality on larval populations in the source water, independent of other sources of mortality. Following Ricker (1975), PE is an estimate of the conditional mortality rate. Proportional entrainment was calculated using the ratio of intake and source water abundances. In previous entrainment studies using the ETM method, intake concentrations were assumed from weighted population concentrations (Boreman et al. 1981). As proposed by the U.S. Fish and Wildlife Service (Boreman et al. 1978, 1981), ETM has been used to assess entrainment effects at the Salem Nuclear Generating Station in Delaware Bay, New Jersey and at other power stations along the east coast of the United States (Boreman et al. 1978, 1981; PSE&G 1993). Variations of this model have been discussed in MacCall et al. (1983) and used to assess impacts at the San Onofre Nuclear Generating Station (SONGS; Parker and DeMartini 1989).

The ETM estimates conditional mortality due to entrainment, while accounting for spatial and temporal variability in distribution and vulnerability of each life stage to cooling water withdrawals. The original form of the ETM incorporated many time-, space-, and age-specific estimates of mortality as well as information regarding spawning periodicity and larval duration (Boreman et al. 1978, 1981). Most of this information is limited or unknown for the taxa that were investigated for this study. Thus, the applicability of this form of the ETM will be limited by the absence of empirically derived or reported demographic parameters needed as input to the model. The approach used in these studies only requires an estimate of the time the larvae are susceptible to entrainment. By compounding the PE estimate over time, the ETM can be used to estimate entrainment over a period using assumptions about species-specific larval life histories, specifically the length of time in days that the larvae are in the water column and exposed to entrainment.

On each sampling day *i*, the conditional entrainment mortality can be expressed as follows:

$$PE_i = \frac{E_i}{N_i}, \tag{18}$$

where

E_i = total numbers of larvae entrained during a day during the i^{th} survey; and

N_i = numbers of larvae at risk of entrainment, that is, abundance of larvae in the sampled source water during a day during the i^{th} survey.

Survival over one day = 1-PE_i, and survival over the number of days (d) that the larvae are vulnerable to entrainment = $(1\text{-}PE_i)^d$, where d is estimated from the lengths of a representative sample of larvae collected over the entire study period. Values used in calculating PE are population estimates based on respective larval concentrations and volumes of the cooling water system flow and source water areas. The estimate of daily entrainment (E_i) was calculated using the methods described in this document. The abundance of larvae at risk in the source water during the i^{th} survey can be directly expressed as follows:

$$N_i = V_S \cdot \overline{\rho}_{N_i}, \tag{19}$$

where

V_S = the static volume of the source water (N); and

$\overline{\rho}_{N_i}$ = the average larval concentration in the source water during the i^{th} survey.

The authors note that the daily estimate of survival used by MacCall et al. (1983) and Boreman et al. (1981) is $S=e^{-PE}$, which assumes the Baranov catch equation, E=FN, where F corresponds to PE and N is the average population size (Ricker 1975). The authors' estimate of daily survival assumes that N is the population size prior to entrainment. In the authors' studies, the outcome is approximately the same regardless of the type of survival estimates because PE values were weighted by large populations. When entrainment becomes relatively large, it is recommended to use the Baranov-based estimate as in MacCall et al. (1983) because mortality estimates are reflective of average population size and also are larger.

In the SBPP and MBPP studies, the estimated volumes of source water bodies previously described were used to estimate the abundance using an average concentration based on

all of the samples from the source water for a given survey on a single day. At DCPP the equation to estimate PE for a day on which entrainment was sampled was:

$$PE = \frac{N_E}{N_G}, \tag{20}$$

where

$N_E =$ estimated number of larvae entrained during the day, calculated as (estimated concentration of larvae in the water entrained that day) $\times$ (design specified daily cooling water intake volume); and

$N_G =$ estimate of larvae in nearshore sampling area that day, calculated as $\sum_{i=1}^{64}$[(average concentration per cell) $\cdot$ (cell volume)] for i = 1, ..., 64 grid cells.

where the estimated cell concentrations were obtained from the 72-hour source water survey that contained the 24-hour entrainment sampling period. In addition, an adjustment was made to the estimated number of larvae in the Row 1 cells of the study grid to help compensate for the inability to safely collect samples inshore of the grid (Figure 5). The estimated volume of the water directly inshore of the study grid was multiplied by the concentration of larvae collected in the Row 1 cells, except for cells A1, D1, and E1, as described.

Regardless of whether the species has a single spawning period per year or multiple overlapping spawnings the estimate of total larval entrainment mortality can be expressed as the following:

$$P_M = 1 - \sum_{i=1}^{n} f_i (1 - P_S PE_i)^d, \tag{21}$$

where

$PE_i =$ estimate of proportional entrainment for the ith survey ($i = 1,...,n$);
$P_S =$ proportion of sampled source water to total estimated source water;
$f_i =$ annual proportion of total larvae hatched during the ith survey; and
$d =$ estimated number of days that the larvae are exposed to entrainment.

To establish independent survey estimates, it was assumed that each new survey represented a new, distinct cohort of larvae that was subject to entrainment. Each of the surveys was weighted using the proportion of the total population at risk during the i^{th} survey (f_i). In the original study plan and analyses for MBPP and DCPP studies, the

authors proposed to use the proportion of larvae entrained during each survey period as the weights for the ETM model. Weights were proposed to be calculated as follows:

$$f_i = \frac{E_i}{E_T}, \tag{22}$$

where E_i is estimated entrainment during the i^{th} survey, and E_T is estimated entrainment for the entire study period. This formulation conflicts with the formula for PE that uses the population in the source water during each survey to define the population at risk. If the weights are meant to represent the proportion of the population at risk during each survey, then the weights should be calculated as follows:

$$f_i = \frac{N_i}{N_T}, \tag{23}$$

where N_i is the source population spawned during the i^{th} survey, and N_T is the sum of the N_is for the entire study period. Weights calculated using the entrainment estimates redefined the population at risk as the population entrained and represented a logical inconsistency in the model. Weights calculated using the source water estimates were used at SBPP and were used in final analyses of the data from the MBPP and DCPP studies in this paper.

The number of days that the larvae of a specific taxon were exposed to the mortality estimated by PE, was estimated using length data from a representative number of larvae from the entrainment samples. At SBPP, a single estimate of larval exposure was used in the calculations. The number of days (d) from hatching to entrainment was estimated by calculating the difference between the values of the 1st and upper 99th percentiles of the length measurements for each entrained larval taxon and dividing this range by an estimate of the larval growth rate for that taxon that was obtained from the scientific literature. The 1st and upper 99th percentiles were used to eliminate potential outlier measurements in the length data. In earlier studies at MBPP and DCPP, two estimates of d were calculated for each taxon and these were used to calculate two ETM estimates. The first estimate calculated d using the difference in length between the 1st and upper 99th percentiles and was used to represent the maximum number of days that the larvae were exposed to entrainment. The second estimate calculated d using the difference in length between the 1st percentile and the average length and was used to represent the average number of days that the larvae were exposed to entrainment.

The estimate of P_S in the ETM model is defined by the ratio of the area or volume of sampled source water to a larger area or volume containing the population of inference (Parker and DeMartini 1989). If an estimate of the larval (or adult) population in the

larger area is available, the value of P_S can be computed directly using the estimate of the larval or adult population in the sampling area, defined by Ricker (1975) as the proportion of the parental stock. If the distribution in the larger area is assumed to be uniform, then the value of P_S for the proportion of the population will be the same as the proportion computed using area or volume.

For the SBPP study, the entire source water was sampled ($P_S = 1.0$) and P_S was not incorporated in the ETM. At the MBPP, P_S was not incorporated in the ETM for fishes that were primarily associated with the estuarine habitats in Morro Bay. The P_S was included for fish and crab taxa whose adult distributions extended into the nearshore waters. Estimates of the population of inference for these taxa were unavailable; therefore, P_S was estimated using the distance the larvae could have traveled based on the duration of exposure to entrainment and current speed as follows:

$$P_S = \frac{L_G}{L_P}, \tag{24}$$

where

L_G = length of sampling area; and
L_P = length of alongshore current displacement based on the period (d) of larval vulnerability for a taxon.

The length of alongshore displacement was calculated using average current speed for the period of January 1, 1996 through May 31, 1999 from an InterOceans S4 current meter deployed at a depth of -6 m MLLW in approximately 30 m of water about 1 km west of the DCPP Intake Cove, south of Morro Bay. The current direction was ignored in the calculations but was predominantly alongshore. The current speed was used to estimate unidirectional displacement over the period that the larvae were exposed to entrainment. The value of alongshore displacement (L_P) was compared with the alongshore length of the sampled waterbody (L_G). The distance between the west Morro Bay breakwater and Station 5 is 4.8 km; a value of 9.6 km (twice the distance) was used for L_G. This value was used because it places Station 5 in the center of the sampled water body.

For the MBPP study the authors presented only a single estimate of P_M for the taxa that used an adjustment for P_S in the ETM because any changes due to the increased duration were inversely proportional to the changes in P_S and resulted in nearly equal estimates of P_M. (The exponential model [MacCall et al. 1983], $1-e^{P_s PE t}$, gives equal estimates for P_S inversely proportional to t.) The estimate of the standard error is increased due to the

extended period of entrainment risk; so two estimates of the standard error were presented for these taxa.

The sampling for the DCPP study was also extrapolated to provide an estimate of entrainment effects outside the nearshore sampling area. Boreman et al. (1981) point out that if any members of the population are located outside the sampled area, then the ETM will overestimate the conditional entrainment mortality for the entire population. In their study of entrainment at SONGS, Parker and DeMartini (1989) incorporated the inference population (which was an extrapolation to the entire Southern California Bight from the coast to a depth of 75 m, an area extending about 500 km) directly into their estimate of PE. In the DCPP ETM analyses, PE was multiplied by the estimated fraction of the population in the nearshore sampling area (P_S). The size of the population affected by entrainment varied from relatively small (for example, the size of the sampling area) to very large (for example, fishery management units, zoogeographic range). For some species an area approximately the size of the study grid represented the population of inference and, in these cases, $P_S \approx 1$. For other species, the population of inference was larger than the study grid. The population of inference depended not only on the species, but also what appealed usefully to intuition, as a number of methods could be used for extrapolation. Therefore, the ETM was calculated over a range of values of P_S for each of the taxa selected for detailed assessment. The resulting curves were used to determine the ETM at any value of P_S. The curves were interpreted as a continuous probability function representing the risk of entrainment to the larvae at different values of P_S. Point estimates of P_M (and their ranges) were also calculated for each taxon.

The relationship between P_M and P_S was represented by the sets of curves for each of the taxa analyzed for DCPP. Two point estimates of P_S were also computed to account for the variation in the distribution of adult fishes included in the assessment. For offshore and subtidal taxa whose larval distribution extends to the offshore edge of the study grid, P_S was calculated as follows:

$$P_S = \frac{N_G}{N_P}, \tag{25}$$

where N_G is the number of larvae in the study grid, and N_P is the number of larvae in the population of inference. The numerator N_G, presented earlier in the calculation of PE, was calculated as follows:

$$N_{G_i} = \sum_{k=1}^{64} A_{G_k} \cdot \bar{D}_k \cdot \rho_{\mathrm{i,k}}, \tag{26}$$

where

A_{G_k} = area of grid cell k;

$\bar{D}_k$ = average depth of the kth grid cell; and

ρ_{ik} = concentration (per m^3) of larvae in kth grid cell during survey i.

N_P was estimated by an offshore and alongshore extrapolation of the study grid concentrations, using water current measurements. The following conceptual model was formulated to extrapolate larval concentrations (per m^3) offshore of the grid:

$$P_S = \frac{N_G}{N_P} = \frac{\sum_{i=1}^{K_G} L_{G_j} \cdot W_j \cdot \bar{D}_j \cdot \rho_j}{\sum_{i=1}^{K_P} L_{P_j} \cdot W_j \cdot \bar{D}_j \cdot \rho_j}, \tag{27}$$

where

L_{G_j} = alongshore length of grid in the jth stratum;

W_j = width of jth stratum;

L_{P_j} = alongshore length of population in jth stratum based on current data;

$\bar{D}_j$ = average depth of jth stratum; and

ρ_j = average density of larvae in jth stratum.

For this model, the grid was subdivided into K_G alongshore strata (that is, K_G=8 rows in the grid) and the population into $K_G > K_G$ alongshore strata. This approach described discrete values in intervals of a continuous function. Therefore, to ease implementation, an essentially equivalent formula used grid cell concentrations during the i^{th} sampling period, $\rho_{i,k}$ for a linear extrapolation of density (# per m^2 calculated by multiplying $\rho_{i,k}$ by the cell depth) as a function of offshore distance, w:

$$P_{S_i} = \frac{N_{G_i}}{N_{P_i}} = \frac{N_{G_i}}{N_{G_i}\left(\frac{L_{P_i}}{L_G}\right) + L_{P_i}\int_{W_0}^{W_{Max}} \rho(w)dw}, \tag{28}$$

where L_P = alongshore length of population in the i^{th} study period based on current displacement. The limits of integration are from the offshore margin of the study grid, W_O, to a point estimated by the onshore movement of currents or where the density is zero or biologically limited, W_{max}. Note that this point will usually occur outside the study grid area and that the population number, N_P, is composed of two components that represent the alongshore extrapolation of the grid population and the offshore extrapolation of the alongshore grid population (Figure 5).

Alongshore and onshore current velocities used in the calculations were measured at a current meter positioned approximately 1 km west of the DCPP intake at a depth of approximately 6 m (Figure 5). The direction in degrees true from north and speed in cm/s were estimated for each hour of the nearshore study grid survey periods. Figure 6 shows the results of current meter analysis in which hourly current vectors were first rotated orthogonal to the coast by 49 degrees west of north. The movement of water was then tracked during the period from April 1997 through June 1999. A total alongshore length can be calculated from these data using the maximum upcoast and downcoast current movement over the larval duration period prior to each survey period. The maximum upcoast and downcoast current vectors measured during each survey period were added together to obtain an estimate of total alongshore displacement. This contrasts with the approach for the MBPP where average current speed was used in calculating alongshore movement. Transport of larvae into the nearshore via onshore currents was also accounted for and used to set the limits of the offshore density extrapolation. Within this scenario, there were two subclasses:

1. For species in which the regression of density versus offshore distance had a negative slope, the offshore distance predicted where density was zero (that is, integral of zero) was calculated. The alongshore distance was calculated from the water current data.
2. For species in which the regression of density versus offshore distance had a slope of ≥ 0, either the offshore distance from the water current data or an average distance based on the depth distribution of the adults offshore was used. Literature values (for example, CalCOFI) were used to place a limit on both the distance and density values used in the offshore extrapolation.

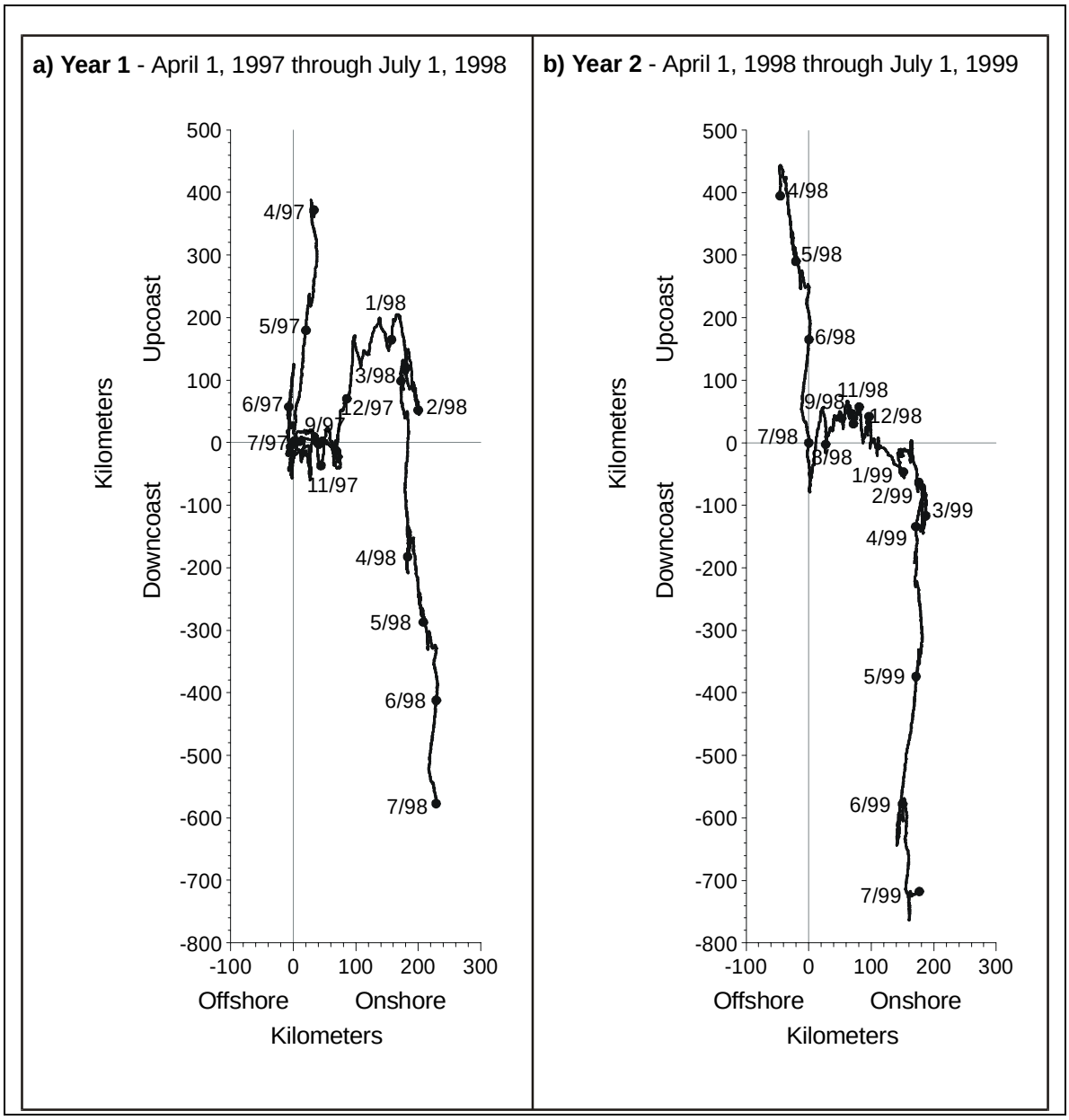

Figure 6. Relative cumulative upcoast/downcoast and onshore/offshore current vectors from current meter located approximately 1 km west of the Diablo Canyon Power Plant intake at a depth of 6 m. Dates on current vectors are the dates of each survey.

Parameter values needed in performing the extrapolation were obtained by using analysis of covariance based on all of the data from the surveys for the study period from July 1997 through June 1999. The following quadratic model was tested in the analysis:

$$\rho_{ij} = \alpha_i + \beta w_{ij} + \gamma w^2_{if} + \varepsilon_{ij}\,, \tag{29}$$

where

$\varepsilon_i =$ normally distributed error term with mean of zero;
$w_{ij} =$ distance for the *i*th observation in the *j*th survey;
ρ_{ij} = larval density per m^2 for the *i*th observation in the *j*th survey; and
α, β, γ = regression coefficients.

The following linear model produced a better fit in all cases:

$$\rho_{ij} = \alpha_i + \beta w_{ij} + \varepsilon_{ij}\,. \tag{30}$$

A common slope, β, for all surveys and unique intercepts, α_i, for each survey were derived from the model. It is reasonable to assume a common slope, but differences in abundance between surveys required fitting different intercepts.

Similar to the demographic models there are also assumptions associated with the ETM approach. Although there are fewer life history parameters necessary for the ETM, it shares with the demographic models the assumption that the life history data used to calculate the period the larvae are exposed to entrainment is representative of the population in the years and location for the specific study and accurately estimates the period of larval exposure. Since the ETM is only estimating the entrainment mortality on the population of larvae, assumptions regarding compensation would only be important in interpreting the effects on adult populations. An assumption inherent to all the models is that the sampling resulted in representative estimates of entrainment for the period surveyed. Additional assumptions of the ETM include the following:

- The sampling resulted in representative estimates of the source water populations of larvae susceptible to entrainment and that the PE estimated from the entrainment and source water population samples is representative of entrainment mortality during the survey period.
- The estimates of the source water population represent the proportion for the survey period (fi) of total larval production.
- The samples during each survey period represent a new and independent cohort of larvae.

Although it would seem that there are also assumptions associated with the definition of the source water population relative to the population of inference, these assumptions become less critical if the ETM results are converted, for example, to "area of production

foregone" (APF). The APF is a useful method for converting the results of ETM into a context for resource managers and is presented in Chapter 4.

Variance calculations for PE are presented in Appendix A. Variance calculations for the estimate of P_M are not presented because of the different approaches and parameters that will be used in the ETM calculations for each study.

CHAPTER 3: RESULTS

Detailed results for an example taxon from each plant are presented to compare the modeling approaches for different source water body types. Results at SBPP are presented for the arrow, cheekspot, and shadow (*Clevlandia ios, Ilypnus gilberti,* and *Quietula y-cauda* [CIQ]) goby complex, which was the most abundant fish larvae collected during the study. At Morro Bay and Diablo Canyon, the kelp, gopher, and black-and-yellow (*S. atrovirens, S. carnatus,* and *S. chrysomelas* [KGB]) rockfish complex results provided illustrative data. These results provide example calculations for the FH and AEL models as well as for the ETM so that all three modeling approaches can be compared between sites.

The example taxa are indicative of the source water at the three study sites. Since SBPP used a fixed source water body volume, the ETM model for all of the taxa analyzed, including CIQ gobies, was calculated similarly. At MBPP, the ETM model for the taxa that were designated as primarily inhabitants of Morro Bay was calculated using a fixed source water volume using calculations identical to those for CIQ gobies for the SBPP study. Therefore, the authors decided to present the ETM results for the KGB rockfish at MBPP since the source water for this taxon included both the bay and a nearshore area, the size of which was estimated using current meter data. A similar approach was taken for the DCPP study and, therefore, the results for the KGB rockfish complex are also presented for that study to provide a comparison with the results for MBPP.

South Bay Power Plant

A total of 23,039 larval fishes in 20 taxonomic categories ranging from ordinal to specific classifications were collected from 144 samples at the SBPP entrainment station (SB1) during monthly sampling from February 2001 through January 2002 (Table 6). These samples were used to estimate that total annual entrainment of fish larvae was 2.42×10^9. Entrainment samples were dominated by gobies in the CIQ complex, which comprised about 76 percent of the total estimated entrainment. Five taxa evaluated for entrainment effects (Table 4) comprised greater than 99 percent of the total number of fish larvae entrained. No invertebrates were evaluated because only a single *Cancer* crab megalopae was collected.

The entrainment and source water stations extend over a distance of greater than 9 km in south San Diego Bay and include both channel and shallow mudflat habitats. Despite the differences in location and habitat, CIQ complex gobies were the most abundant fish larvae at all of the stations (Appendix B). Other fishes showed considerable variation in abundance among stations. For example, combtooth blennies (*Hypsoblennius* spp.) were much more abundant along the eastern shore north of SBPP where there are more piers

and other structures, whereas longjaw mudsuckers (*Gillichthys mirabilis*) were in highest abundance near the power plant. Overall, taxa richness generally increased from the entrainment station in the far south end of the bay to Station SB9 in the north.

Table 6. Total annual entrainment estimates of larval fishes at South Bay Power Plant based on monthly larval densities (sampled at Station SB1 from February 2001 through January 2002) and the plant's designed maximum circulating water flows; *n*=144 tows at one station. Data and estimates for taxa comprising <0.01 percent of the composition not presented individually but lumped under other taxa.

Taxa	Common Name	Total Larvae Collected	Est. Total Annual Entrainment	Entrain. Percent Comp.	Entrain. Cum. Percent
CIQ goby complex	gobies	17,878	1,830,899,000	75.64	75.64
Anchoa spp.	bay anchovies	4,390	514,809,000	21.27	96.91
Hypsoblennius spp.	combtooth blennies	226	22,335,000	0.92	97.83
Gillichthys mirabilis	longjaw mudsucker	249	21,953,000	0.91	98.74
Atherinopsidae	silversides	140	14,521,000	0.60	99.34
Syngnathus spp.	pipefishes	101	10,013,000	0.41	99.75
Acanthogobius flavimanus	yellowfin goby	19	2,261,000	0.09	99.85
Strongylura exilis	Calif. needlefish	8	740,000	0.03	99.88
Sciaenidae	croakers	6	706,000	0.03	99.91
	Other 11 taxa	22	2,291,000	0.09	100.00
	Total	23,039	2,420,528,000		

SBPP Results for CIQ Gobies

The following sections present results for demographic and empirical transport modeling of SBPP entrainment effects. All three modeling approaches are presented for the CIQ goby complex. CIQ goby larvae were most abundant at the entrainment station during June and July (Figure 7). Brothers (1975) indicated that the peak spawning period for arrow goby occurred from November through April, while spawning in cheekspot and shadow goby was more variable and can occur throughout the year. A peak spawning period for shadow goby in June and July of Brothers' (1975) study corresponds to the increased larval abundances during those months in this study.

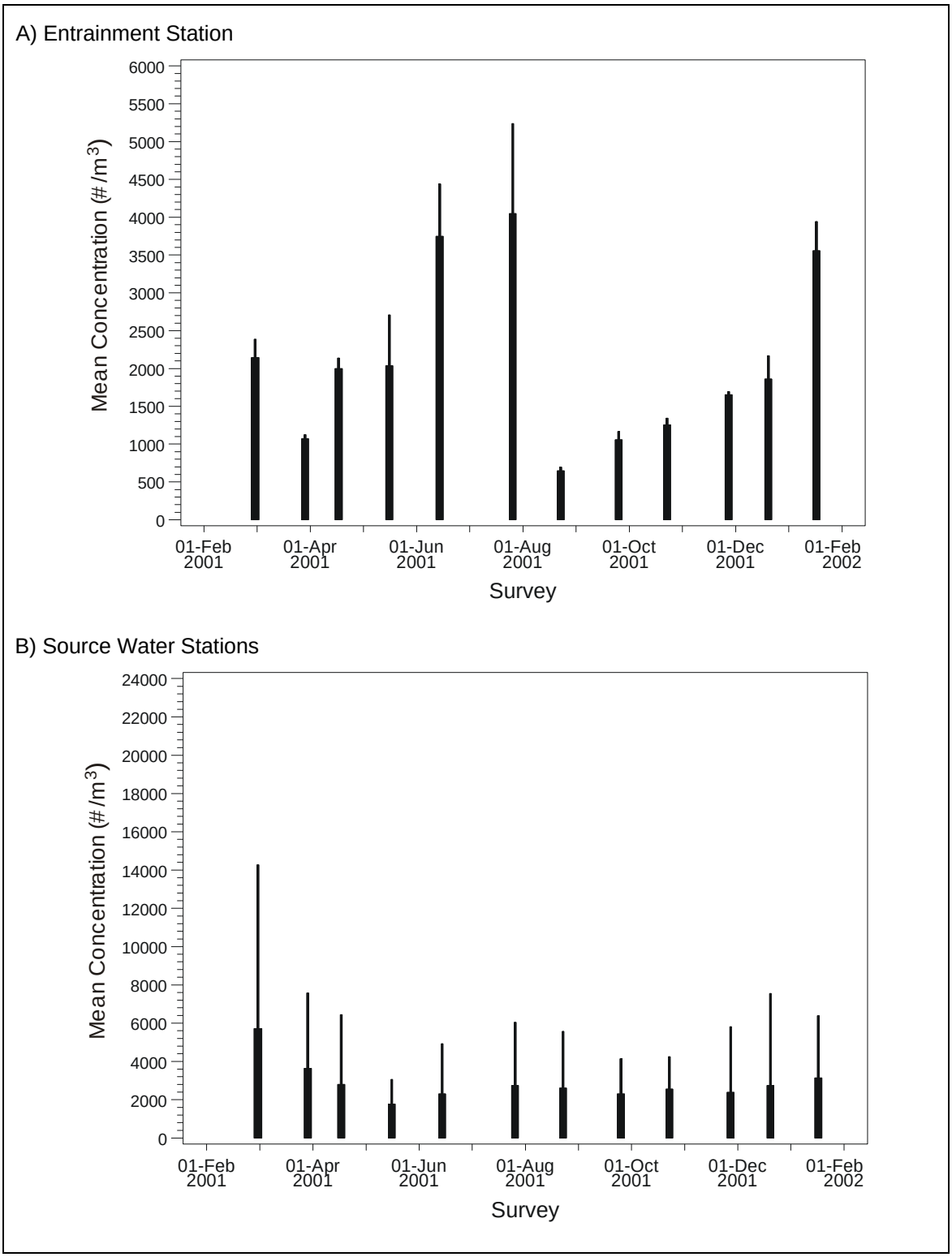

Figure 7. Monthly mean larval concentration (standard error shown at top of dark bars) of the *Clevlandia ios, Ilypnus gilberti*, and *Quietula y-cauda* (CIQ) goby complex larvae at SBPP; A) intake entrainment station and B) source water stations.

The ETM required an estimate of the length of time the larvae are susceptible to entrainment. The length frequency distribution for a representative sample of CIQ goby larvae showed that the majority of larvae were recently hatched based on the reported hatch size of 2–3 mm (Moser 1996) (Figure 8). The mean length of the collected CIQ goby larvae was 3.1 mm and the difference between the lengths of the 1st (2.2 mm) and 99th (5.8 mm) percentile values were used with a growth rate of 0.16 mm^{-d} estimated from Brothers (1975) to determine that CIQ goby larvae were vulnerable to entrainment for 22.9 days. The growth rate of 0.16 mm^{-d} was determined using Brothers (1975) reported transformation lengths for the three species and an estimated transformation age of 60 d.

The comprehensive comparative study of the three goby species in the CIQ complex by Brothers (1975) also provided the necessary life history information for both FH and AEL demographic models and shows how life history data from the scientific literature are used in the modeling.

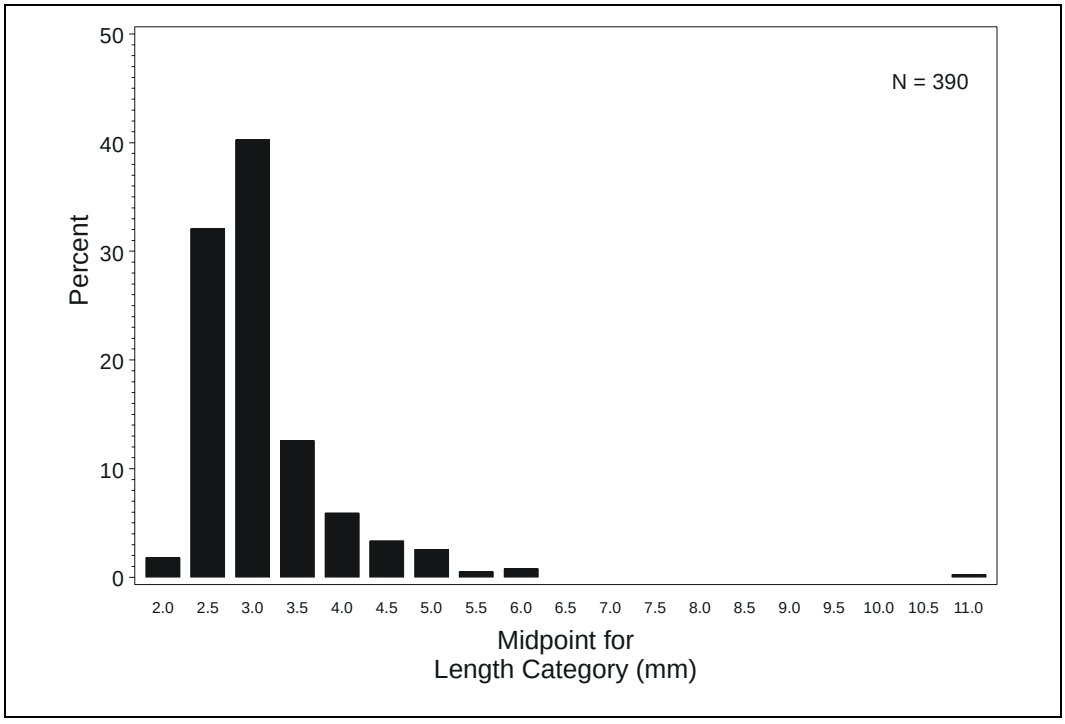

Figure 8. Length frequency distribution for *Clevlandia ios, Ilypnus gilberti*, and *Quietula y-cauda* (CIQ) goby complex larvae from the South Bay Power Plant entrainment station.

Fecundity Hindcasting

The annual entrainment estimate for CIQ gobies was used to estimate the number of adult females at the age of maturity whose reproductive output was lost due to entrainment (Table 7). No estimates of egg survival for gobies were available, but

because goby egg masses are demersal (Wang 1986) and parental care, usually provided by the adult male, is common in the family (Moser 1996), egg survival is probably high and was assumed to be 100 percent. Average larval mortality of 99 percent over the two months between hatching and transformation for the three species of CIQ gobies from Brothers (1975) was used to estimate a daily survival rate of 0.931 as follows: $0.931 = (1-0.99)^{(6/365.25)}$. Mean length and length of the first percentile (2.2 mm) were used with the growth rate of 0.16 mm^{-d} to estimate a mean age at entrainment of 5.8 d. Survival to average age at entrainment was then estimated as $0.931^{5.8} = 0.659$. An average batch fecundity estimate of 615 eggs was based on calculations from Brothers (1975) on size-specific fecundities for the three species. Brothers (1975) found eggs at two to three stages of development in the ovaries; therefore, an estimate of 2.5 spawns per year was used in calculating FH (615 eggs/spawn × 2.5 spawns/year = 1,538 eggs/year). The TLF for the studies at SBPP was calculated by adding 1 to the difference between the average ages of maturity (1.0) and longevity (3.3) from Brothers (1975) to account for spawning of a portion of the population during the first year. The FH model was used to estimate that the number of adult females at the age of maturity whose lifetime reproductive output was entrained through the SBPP circulating water system was 1,085,000 (Table 7). The standard error for the entrainment estimate was used to estimate a confidence interval based on just the sampling variance that was considerably less than a confidence interval for the estimate calculated using an assumed CV of 30 percent for all of the life history parameters.

Table 7. Results of fecundity hindcasting (FH) modeling for CIQ goby complex larvae entrained at South Bay Power Plant. The upper and lower estimates are based on a 90 percent confidence interval of the mean. FH was recalculated using the upper and lower confidence interval estimates for total entrainment.

	Estimate	**Estimate Std. Error**	FH **Lower Estimate**	FH **Upper Estimate**	FH **Range**
FH Estimate	1,085,000	1,880,000	63,000	18,782,000	18,719,000
Total Entrainment	1.83×10^9	21,725,000	961,000	1,209,000	248,000

Adult Equivalent Loss

Three survival components were used to estimate AEL. These were 1) larval survival from the age of entrainment to the age of settlement, 2) survival from settlement to age 1, and 3) from age 1 to the average female age. Larval survival from average age at entrainment through settlement at 60 days was estimated as $0.931^{60-5.8} = 0.021$ using the same daily survival rate used in formulating FH. Brothers (1975) estimated that

mortality in the first year following settlement was 91 percent for arrow, 66–74 percent for cheekspot, and 62–69 percent for shadow goby. These estimates were used to calculate a daily survival rate of 0.995 as follows:

$$0.995 = \frac{(1-0.91)^{1/(365.25-60)} + (1-0.70)^{1/(365.25-60)} + (1-0.65)^{1/(365.25-60)}}{3}$$

This value was used to calculate a finite survival of 0.211 for the first year following settlement as follows: $0.211 = 0.995^{(365.25-60)}$. Adult daily survival from one year through the average female age of 1.71 years from life table data for the three species provided by Brothers (1975) was estimated as 0.99. This value was used to calculate a finite survival of 0.195 as follows: $0.195 = (0.99)^{((1.71*365.25)-365.25)}$. The product of the three survival estimates and the entrainment estimate were used to estimate that the number of larvae entrained through the SBPP circulating water system number were equivalent to the loss of 1,580,000 adult CIQ gobies (Table 8). The standard error for the entrainment estimate was used to estimate a confidence interval based on just the sampling variance that was considerably less than a confidence interval for the estimate calculated using an assumed CV of 30 percent for all of the life history parameters.

Table 8. Results of adult equivalent loss (AEL) modeling for CIQ goby complex larvae entrained at South Bay Power Plant. The upper and lower estimates are based on a 90 percent confidence interval of the mean. AEL was recalculated using the upper and lower confidence interval estimates for total entrainment.

	Estimate	**Estimate Std. Error**	AEL **Lower Estimate**	AEL **Upper Estimate**	AEL **Range**
AEL Estimate	1,580,000	2,739,000	91,300	2.74×10^7	2.73×10^7
Total Entrainment	1.83×10^9	2.17×10^7	1,399,000	1,760,000	361,000

Empirical Transport Model

The ETM estimates for CIQ gobies were calculated using the data in Appendix C and a larval duration of 22.9 days. Average larval concentrations from the entrainment and source water sampling were multiplied by the cooling water and source water volumes, respectively, to obtain the estimates that were used in calculating PE estimate for each survey. Weights were calculated by multiplying the source water estimate for each survey by the number of days in the survey period. Estimates for the surveys were summed and the proportion (f_i) for each survey calculated.

Daily mortality (PE_i) estimates ranged from 0.004 to 0.025 for the 12 surveys with an average value of 0.012 (Table 9). This average PE was similar to the volumetric ratio of

the cooling water system to source water volumes (0.015), which was bounded by the range of PE_i estimates. PE_i estimates equal to the volumetric ratio would indicate that the CIQ goby larva were uniformly distributed throughout the source water and were withdrawn by the power plant at a rate approximately equal to that ratio. The small range in both the PE_i estimates and the values of f_i indicate that goby larvae were present in the source water throughout the year. The largest fractions of the source water population occurred in the February (f_i = 0.2165) and July (f_i = 0.1064) surveys, which was consistent with the spawning periods for arrow and shadow gobies, respectively. June and July surveys also had the highest entrainment station concentrations resulting in higher PE_i estimates for those surveys (Figure 7).

Results for Other Taxa

The modeling results for other taxa selected for detailed assessment showed that both demographic modeling approaches could be calculated only for the CIQ goby complex (Table 10) due mainly to a lack of larval survival estimates for the life stages between larvae and adult. The alignment of the 2*FH and AEL estimates would have been improved by extrapolating AEL to the age of maturity rather than the average female age of 1.7 years. Differences in the FH model results among taxa were generally proportional to entrainment estimates as shown by decreasing 2*FH estimates for the top four taxa. As the results for the ETM model show, proportional effects of entrainment on the source populations vary considerably for the five taxa and do not reflect differences in entrainment estimates, but the combination of larval concentrations at entrainment and source water stations. The ETM estimates of P_M ranged from 0.031 (3.1 percent) to 0.215 (21.5 percent), with the estimated effects being lowest for combtooth blennies and highest for CIQ gobies and longjaw mudsuckers.

Table 9. Estimates of proportional entrainment (PE) and proportion of source water population present for CIQ goby larvae at South Bay Power Plant entrainment and source water stations from monthly surveys conducted from February 2001 through January 2002.

Survey Date	PE Estimate	Proportion of Source Population for Period (*f*)
28-Feb-01	0.0057	0.2165
29-Mar-01	0.0045	0.0977
17-Apr-01	0.0109	0.0491
16-May-01	0.0175	0.0475
14-Jun-01	0.0247	0.0620
26-Jul-01	0.0225	0.1064
23-Aug-01	0.0038	0.0675
25-Sep-01	0.0070	0.0704
23-Oct-01	0.0075	0.0661
27-Nov-01	0.0105	0.0773
20-Dec-01	0.0103	0.0584
17-Jan-02	0.0173	0.0811
Average =	0.0118	

Table 10. Summary of estimated South Bay Power Plant entrainment effects based on fecundity hindcasting (FH), adult equivalent loss (AEL), and empirical transport (ETM) estimates of proportional mortality (P_m) models. The FH estimate is multiplied by 2 to test the relationship that 2·FH≡AEL.

Taxa	Entrainment Estimate	% Source Numbers	*2**FH	AEL	P_M
CIQ goby complex	1.83×10^9	76.75	2,170,000	1,580,000	0.215
anchovies	5.15×10^8	15.12	214,000	*	0.105
combtooth blennies	2.23×10^7	5.93	21,500	*	0.031
longjaw mudsucker	2.19×10^7	0.17	2,960	*	0.171
silversides	1.45×10^7	0.65	*	*	0.146

* Information unavailable to compute model estimate.

Morro Bay Power Plant

A total of 30,270 larval fishes in 87 taxonomic categories ranging from ordinal to specific classifications was collected from 609 samples at the MBPP entrainment station during weekly sampling from January 2000 through December 2000 (Table 11). These data were used to estimate total annual entrainment of fish larvae at 5.08×10^8. Entrainment samples were dominated by unidentified gobies, which comprised 77 percent of the total estimated entrainment of fish larvae. The top seven taxa comprising greater than 90

percent of the total and three other commercially or recreationally important fishes in the top 95 percent (white croaker *Genyonemus lineatus,* Pacific herring *Clupea pallasii,* and cabezon *Scorpaenichthys marmoratus*) were evaluated for entrainment effects along with six species of *Cancer* crab megalopae (Table 4) (results for *Cancer* crab not presented).

Table 11. Total annual entrainment estimates of fishes and invertebrates at Morro Bay Power Plant based on weekly larval densities sampled at Station 2 (n=609 tows) from January to December 2000 and the plant's maximum circulating water flows. Data and estimates for taxa comprising <0.01 percent of the composition are not presented individually but lumped as other taxa.

Taxon	Common Name	Total Collected	Estimated Annual # of Entrained Larvae	Percent of Total	Cumulative Percent
Gobiidae unid.	gobies	22,964	393,261,000	77.37	77.37
Leptocottus armatus	Pacific staghorn sculpin	1,129	17,321,000	3.41	80.78
Stenobrachius leucopsarus	northern lampfish	1,018	14,549,000	2.86	83.64
Quietula y-cauda	shadow goby	845	13,504,000	2.66	86.30
Hypsoblennius spp.	combtooth blennies	572	10,042,000	1.98	88.27
Sebastes spp. V_De	KGB rockfishes	360	6,407,000	1.26	89.53
Atherinopsis californiensis	jacksmelt	384	6,266,000	1.23	90.76
Rhinogobiops nicholsi	blackeye goby	226	3,778,000	0.74	91.51
Gillichthys mirabilis	longjaw mudsucker	186	3,286,000	0.65	92.15
Lepidogobius lepidus	bay goby	181	3,233,000	0.64	92.79
Clupea pallasii	Pacific herring	242	3,030,000	0.60	93.39
Scorpaenichthys marmoratus	cabezon	171	2,888,000	0.57	94.54
Atherinopsidae unid.	silversides	163	2,720,000	0.54	95.08
Atherinops affinis	topsmelt	153	2,575,000	0.51	95.58
Sebastes spp. V	rockfishes	150	2,453,000	0.48	96.07
Tarletonbeania crenularis	blue lanternfish	142	2,213,000	0.44	96.50
Engraulis mordax	northern anchovy	155	2,136,000	0.42	96.92
larval fish - damaged	larval fish - damaged	74	1,283,000	0.25	97.18
Gibbonsia spp.	clinid kelpfish	98	1,141,000	0.22	97.40
Bathymasteridae unid.	ronquils	67	1,119,000	0.22	97.62
Cottidae unid.	sculpins	59	1,009,000	0.20	97.82
Artedius lateralis	smoothhead sculpin	46	739,000	0.15	97.96
Oligocottus spp.	sculpin	40	620,000	0.12	98.09
Stichaeidae unid.	pricklebacks	41	616,000	0.12	98.21
Chaenopsidae unid.	tube blennies	31	551,000	0.11	98.32
Cebidichthys violaceus	monkeyface eel	28	505,000	0.10	98.41
Bathylagus ochotensis	popeye blacksmelt	28	495,000	0.10	98.51
	59 other taxa	483	7,564,000	2.93	100.00
	Total Larvae	30,270	508,296,000		

Species composition for entrainment at MBPP was much more diverse than the results from SBPP. This may have resulted from the more frequent weekly sampling at MBPP and the location of the power plant near the entrance to the bay relative to the back bay location of SBPP. Entrainment was dominated by fishes that primarily occur as adults in the bay, such as gobies, but also included numerous fishes that are more typically associated with nearshore coastal habitats, such as rockfish and cabezon.

MBPP Results for the KGB Rockfish Complex

Detailed results and details on the data used in the three modeling approaches at MBPP are presented for the KGB larval rockfish complex. KGB rockfish had the sixth highest estimated entrainment (6,407,000) or 1.3 percent of the total larval fishes (Table 11). Consistent with the annual spawning period for most rockfishes (Parrish et al. 1989), larvae occurred in entrainment samples from January through June with the highest abundances in April (Figure 9). Results from source water surveys showed the same abundance peaks seen in samples collected at the MBPP intake station (Figure 10). Although not collected every month, KGB rockfish larvae were collected from all of the stations inside Morro Bay during the April survey. They reached their greatest concentration at the Estero Bay Station 5 during the May survey when they were less common at the stations inside Morro Bay.

The length frequency distribution for a representative sample of KGB rockfish larvae showed a relatively narrow size range of 3.4 to 5.4 mm (1st and 99th percentile values = 3.5 and 5.1) with an average size of 4.3 mm (Figure 11). These results indicate that most of the larvae are less than the maximum reported size at extrusion of 4.0–5.5 mm (Moser 1996) and are therefore subject to entrainment for a relatively short period. There are no studies on the larval growth rates for the species in the KGB rockfish complex, so a larval growth rate of 0.14 mm^{-d} from brown rockfish (Love and Johnson 1999, Yoklavich et al. 1996) was used in estimating that the average age at entrainment was 5.5 d, and the maximum age at entrainment, based on the 99th percentile values, was 11.3 d.

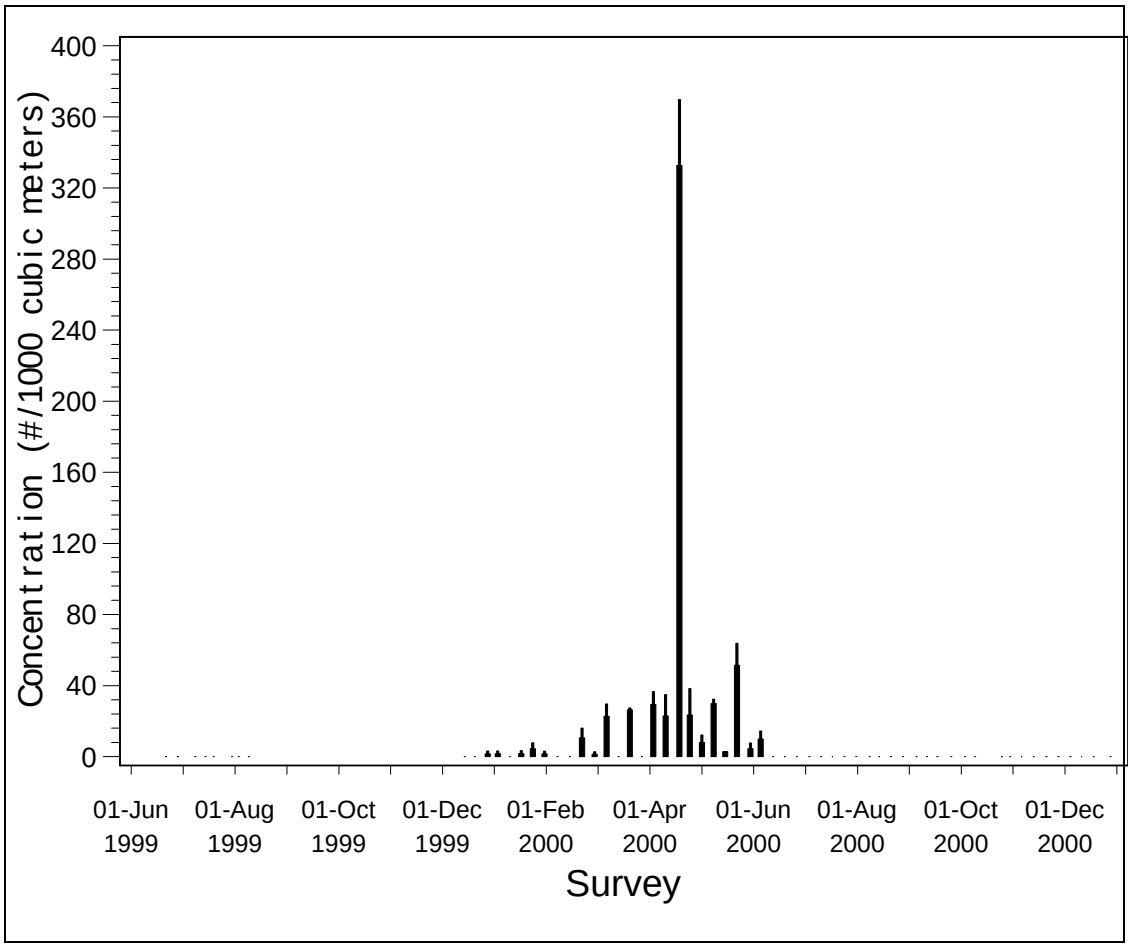

Figure 9. Weekly mean larval concentration of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Morro Bay Power Plant intake entrainment station.

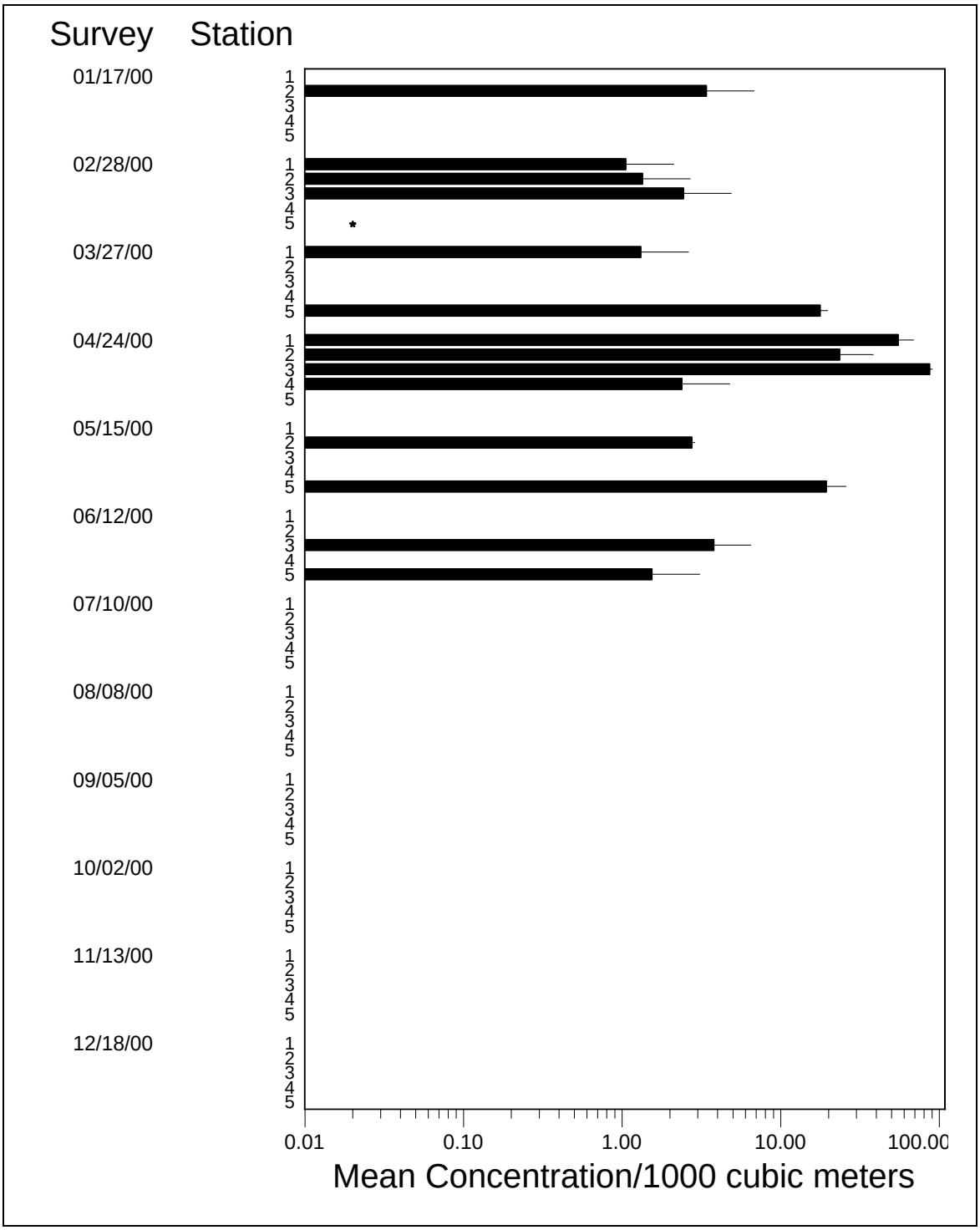

Figure 10. Comparison of average concentrations of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Morro Bay Power Plant intake (Station 2), Morro Bay source water (Stations 1, 3, and 4), and Estero Bay (Station 5) from January 2000 through December 2000 with standard error indicated (+1 SE). Entrainment data only plotted for paired surveys. *No samples were collected during February 2000 at Station 5. Note that data are plotted on a $\log_{10}$ scale.

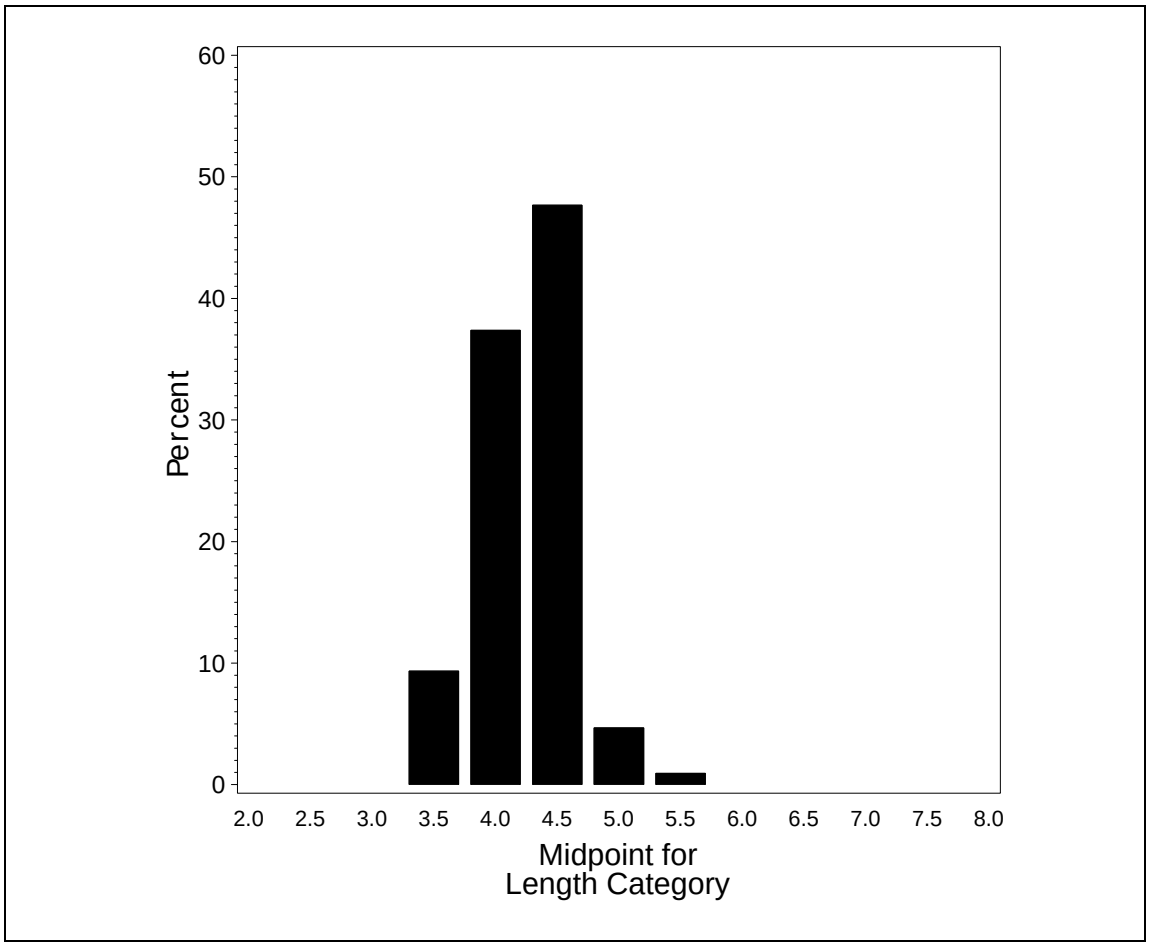

Figure 11. Length frequency distribution for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae from the Morro Bay Power Plant entrainment station.

Fecundity Hindcast Model

Total annual larval entrainment for KGB rockfish was used to estimate the number of adult females at the age of maturity whose reproductive output was lost due to entrainment (Table 12). The parameters required for formulation of FH estimates for KGB rockfishes were compiled from references on different rockfish species. Rockfishes are viviparous and release larvae once per year. A finite survival rate of 0.463 for the larvae from time of release to the average age at entrainment was estimated using an instantaneous mortality rate of 0.14/day from blue rockfish (Mary Yoklavich, NOAA/NMFS/PFEG, Pacific Grove, CA, pers. comm. 1999) over 5.5 days ($0.463 = e^{(-0.14*5.5)}$). An average annual fecundity estimate of 213,000 eggs per female was used in calculating FH (DeLacy et al. 1964: 52,000-339,000; MacGregor 1970: 44,118-104,101 and

143,156-182,890; Love and Johnson 1999: 80,000-760,000). Estimates of five years as the age at maturity and 15 years for longevity were used in calculating FH (Burge and Schultz 1973, Wyllie Echeverria 1987, Lea et al. 1999). The model estimated that the reproductive output of 13 adult females at the age on maturity was entrained by the MBPP (Table 12). Variation due to sampling error had only a small effect on the range of estimates.

Adult Equivalent Loss

Total annual MBPP entrainment of KGB rockfish was used to estimate the number of equivalent adults theoretically lost to the population. The parameters required for formulation of AEL estimates for KGB rockfish were derived from data on larval blue rockfish survival. Survivorship of KGB rockfishes from parturition to an estimated recruitment age of three years was partitioned into six stages (Table 13). The estimate of AEL was calculated assuming the entrainment of a single age class having the average age of recruitment. The estimated number of equivalent adults corresponding to the number of larvae that would have been entrained by the proposed MBPP combined-cycle intake was 23 (Table 14). The uncertainty of the AEL estimate due to sampling error was very small.

Although the FH and AEL estimates were very close to the theoretical relationship of 2FH ≡ AEL, the AEL was only extrapolated to age three. The estimate would decrease by extrapolating to five years, the age of maturity used in the FH calculations.

Table 12. Annual estimates of adult female kelp, gopher, and black-and-yellow (KGB) rockfish losses at Morro Bay Power Plant based on larval entrainment estimates using the fecundity hindcasting (FH) model for the January through December 2000 data. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

	Estimate	Estimate Std. Error	Upper FH Estimate of	Lower FH Estimate	FH Range
FH Estimate	13	8	37	5	32
Entrainment	6,407,000	189,000	14	12	2

Table 13. Survival of the kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae to an age of three years, based on blue rockfish (*Sebastes mystinus*) data.

Lifestage	Day (Start)	Day (End)	Instantaneous Natural Daily Mortality (*Z*)	Lifestage Survival (*S*)
Early larval 1	0	5.5	0.14	0.463
Early larval 2	5.5	20	0.14	0.131
Late larval	20	60	0.08	0.041
Early juvenile	60	180	0.04	0.008
Late juvenile	180	365	0.0112	0.126
Pre-recruit	365	1,095	0.0006	0.645

Note: Survival was estimated from release as $S = e^{(-Z)(Day(end)-Day(Start))}$. Daily instantaneous mortality rates (*Z*) for blue rockfish larvae were used to calculate KGB larval survivorship and were provided by Mary Yoklavich (NOAA/NMFS/PFEG, Pacific Grove, CA, pers. comm. 1999). Annual instantaneous mortality was assumed as 0.2/year after two-year average age of entrainment was estimated as 5.5 days based on average size at entrainment and a growth rate of 0.14 mm/day (0.006 in./day) (Yoklavich et al. 1996).

Empirical Transport Model

The estimated P_M value for the KGB rockfish complex was 0.027 (2.7%) for the period of entrainment risk applied in the model (11.3 days) (Table 15) (All of the data used in the ETM calculations are in Appendix D). The model included an adjustment for P_S (0.088) because this taxon occupies nearshore habitats that extend well beyond the sampling areas. The value of P_S was computed by using alongshore distance of the sampled source water area (9.6 km) and dividing it by the alongshore distance the larvae could have traveled during the 11.3 day larval duration at an average current speed of 11.3 cm/s. The PE estimates ranged from 0 to 0.3097 (Table 15). Although the largest PE estimate occurred for the January survey, the largest fraction of the population was collected during the April survey (f_i = 0.7218) when the PE estimate was an order of magnitude lower.

Table 14. Annual estimates of adult kelp, gopher, and black-and-yellow (KGB) rockfish losses at Morro Bay Power Plant due to entrainment using the adult equivalent loss (AEL) model for the January through December 2000 data. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

	Estimate	Estimate Std. Error	Upper AEL Estimate	Lower AEL Estimate	AEL Range
AEL Estimate	23	15	69	8	61
Total Entrainment	6,407,000	189,000	24	22	2

Table 15. Estimates of KGB rockfish larvae at MBPP entrainment and source water stations from monthly surveys conducted from January 2000 through December 2000 used in calculating empirical transport model (ETM) estimates of proportional entrainment (PE) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 1,619,190 m^3, and the volume of the source water used in calculating the source water population estimates was 15,686,663 m^3. Bay volume = 20,915,551 m^3. The larval duration used in the calculations was 11.28 days. More detailed data used in the calculations are presented in Appendix E.

Survey Date	Bay PE	Offshore PE	Total PE	Proportion of Source Population for Period (f)
17-Jan-00	0.3097	0	0.3097	0.0099
28-Feb-00	0.1052	0.0988	0.0509	0.0239
27-Mar-00	0	0	0	0.1076
24-Apr-00	0.0533	0.0661	0.0295	0.7218
15-May-00	0.3785	0.0220	0.0208	0.1197
12-Jun-00	0	0	0	0.0169
10-Jul-00	0	0	0	0
8-Aug-00	0	0	0	0
5-Sep-00	0	0	0	0
2-Oct-00	0	0	0	0
27-Nov-00	0	0	0	0
18-Dec-00	0	0	0	0
	$\bar{x}$ = 0.0705	$\bar{x}$ = 0.0156	$\bar{x}$ = 0.0342	

Results for Other Taxa

The modeling results for other taxa selected for detailed assessment showed that both demographic models could only be used with about half of the fishes analyzed (Table

16). Differences in the demographic model results among taxa were generally proportional to the differences in entrainment estimates as shown by the decreasing 2*FH estimates for the six fishes analyzed. An exception was KGB rockfishes that had lower model estimates in proportion to their entrainment due to the longer lifespan and later age of maturity of this taxa group relative to the other fishes analyzed. The ETM estimates of P_M for the analyzed fishes ranged from 0.025 (2.5 percent) to 0.497 (49.7 percent) with the estimated effects being lowest for fishes with source populations that extended outside the bay into nearshore areas. The highest estimated effects occurred for combtooth blennies that are commonly found as adults among the fouling communities on the piers and structures that are located along the waterfront near the MBPP intake.

Table 16. Summary of estimated Morro Bay Power Plant entrainment effects based on fecundity hindcasting (FH), adult equivalent loss (AEL), and empirical transport (ETM) estimates of proportional mortality (P_M) models. The FH estimate is multiplied by 2 to test the relationship that 2·FH = AEL. ETM model (P_M) calculated using nearshore extrapolation of source water population.

Taxon	Common Name	Total Entrainment	2*FH	AEL	P_M
Gobiidae	unidentified gobies	3.9×10^8	796,000	268,000	0.116
Leptocottus armatus	Pacific staghorn sculpin	1.7×10^7	*	*	0.051
Stenobrachius leucopsarus	northern lampfish	1.5×10^7	*	*	0.025
Quietula y-cauda	shadow goby	1.3×10^7	12,700	7,440	0.028
Hypsoblennius spp.	combtooth blennies	1.0×10^7	8,720	8,080	0.497
Sebastes spp. V_De	KGB rockfishes	6.4×10^6	26	*	0.027
Atherinopsis californiensis	jacksmelt	6.3×10^6	*	*	0.217
Genyonemus lineatus	white croaker	3.0×10^6	106	*	0.043
Clupea pallasii	Pacific herring	3.0×10^6	86	532	0.164
Scorpaenichthys marmoratus	cabezon	2.9×10^6	*	*	0.025

*** - Information unavailable to compute model estimate.**

Diablo Canyon Power Plant

There were 97,746 larval fishes identified and enumerated from the 4,693 entrainment samples processed for the DCPP study (Table 17). These were placed into 178 different taxonomic categories ranging from ordinal to specific classifications. This list of taxa was much more diverse than the studies at SBPP and MBPP due to length of the sampling effort, number of samples collected, and greater variety of habitats found in the area around the DCPP. The taxa in highest abundance were those whose adults were generally found close to shore, in shallow water. One exception was the thirteenth most abundant taxon, the northern lampfish, whose adults are found midwater and to depths of 3,000 m (Miller and Lea 1972). Fourteen fish taxa (Table 4) were selected for detailed assessment using the FH, AEL, and ETM approaches based on their numerical abundance in the samples and their importance in commercial or recreational fisheries.

There were 43,785 larval fishes identified and enumerated from the 3,163 samples processed from the nearshore sampling area. These comprised 175 different taxa ranging from ordinal to specific levels of classification. Adults of these taxa live in a variety of habitats, from intertidal and shallow subtidal to deep-water and pelagic habitats. The taxa in highest abundance in the nearshore sampling area were those whose adults were typically pelagic or subtidal; the more intertidally or nearshore distributed species were found in lower abundance in the sampling area.

DCPP Results for the KGB Rockfish Complex

Larval rockfishes in the KGB complex showed distinct seasonal peaks of abundance at the DCPP intake structure, with their greatest abundance tending to occur between March and July (Figure 12). An El Niño began developing during the spring of 1997 (NOAA 1999) and was detected along the coast of California in fall of that year (Lynn et al. 1998). This may have slightly affected the density in 1998 compared with the previous year. The El Niño event did not affect seasonal peaks in abundance between years; during both periods KGB rockfish larvae first starting appearing in February, reached peak abundances in April and May, and were not present following late-July.

Table 17. Fishes collected during Diablo Canyon Power Plant entrainment sampling. Fishes comprising less than 0.4 percent of total not shown individually but lumped under "other taxa".

Taxon	Common Name	Count	Percent of Total	Cumulative Percent
Sebastes spp. V_De (KGB rockfish complex)	rockfishes	17,576	18.0	18.0
Gibbonsia spp.	clinid kelpfishes	9,361	9.6	27.6
Rhinogobiops nicholsi	blackeye goby	7,658	7.8	35.4
Cebidichthys violaceus	monkeyface eel	7,090	7.3	42.6
Artedius lateralis	smoothhead sculpin	5,598	5.7	48.4
Orthonopias triacis	snubnose sculpin	4,533	4.6	53.0
Genyonemus lineatus	white croaker	4,300	4.4	57.4
Cottidae unid.	sculpins	3,626	3.7	61.1
Gobiidae unid.	gobies	3,529	3.6	64.7
Engraulis mordax	northern anchovy	3,445	3.5	68.3
Stichaeidae unid.	pricklebacks	2,774	2.8	71.1
Sebastes spp. V (blue rockfish complex)	rockfishes	2,731	2.8	73.9
Stenobrachius leucopsarus	northern lampfish	2,326	2.4	76.3
Sardinops sagax	Pacific sardine	2,191	2.2	78.5
Scorpaenichthys marmoratus	cabezon	1,938	2.0	80.5
Oligocottus spp.	sculpins	1,708	1.7	82.2
Bathymasteridae unid.	ronquils	1,336	1.4	83.6
Oxylebius pictus	painted greenling	1,133	1.2	84.8
Oligocottus maculosus	tidepool sculpin	1,035	1.1	85.8
Liparis spp.	snailfishes	900	0.9	86.7
Chaenopsidae unid.	tube blennies	817	0.8	87.6
Pleuronectidae unid.	righteye flounders	698	0.7	88.3
Clinocottus analis	wooly sculpin	683	0.7	89.0
Sebastes spp. V_D	rockfishes	656	0.7	89.7
Ruscarius creaseri	roughcheek sculpin	633	0.6	90.3
Artedius spp.	sculpins	623	0.6	90.9
Lepidogobius lepidus	bay goby	541	0.6	91.5
Bathylagus ochotensis	popeye blacksmelt	497	0.5	92.0
Paralichthys californicus	California halibut	378	0.4	92.4
Parophrys vetulus	English sole	361	0.4	92.8
Sebastes spp.	rockfishes	357	0.4	93.1
Osmeridae unid.	smelts	356	0.4	93.5
Neoclinus spp.	fringeheads	352	0.4	93.9
	144 other taxa	6,006	6.1	100.0
	Total Larvae	97,746		

There were 17,863 larval KGB rockfishes identified from 774 of samples collected at the DCPP intake structure between October 1996 and June 1999, representing 20 percent of the entrainment samples collected and processed during that period. Annual estimated numbers of KGB rockfish larvae entrained at DCPP varied relatively little between the 1996–97 Analysis Period 1 (268,000,000) and the 1997–98 Analysis Period 2 (199,000,000) (Table 18). An approximation of 95 percent confidence intervals (± 2 std. errors) for the two estimates overlap, indicating that the differences between them were probably not statistically significant and that entrainment of KGB rockfish larvae was relatively constant between years.

Estimates of annually entrained KGB rockfish larvae were adjusted (Table 18) to the long-term average DCPP Intake Cove surface plankton tow index, calculated as the ratio between the nine-year average of DCPP Intake Cove sampling (Figure 13) and the average annual index estimated from these same tows during the year being adjusted. Average indices for 1997 and 1998 were 0.070 and 0.065 larvae/m^3, respectively, and the long-term average index for 1990 through 1998 was 0.072 larvae/m^3. Thus, the ratios used to adjust the 1997 and 1998 estimates of larvae entrained were 1.03 and 1.13, respectively, indicating that larval density was slightly lower than the long-term average during those years. Adjustments resulted in estimates of 275,000,000 entrained KGB rockfish larvae for 1996–97 Analysis Period 1 and 222,000,000 for 1997–98 Analysis Period 2 (Table 18). The same trends in overall abundance as noted for unadjusted entrainment values were apparent in the adjusted values; namely, larval KGB rockfish abundance changed little between analysis periods. Annual estimates of abundance during the study period were low relative to the long-term average index of larval abundance from the Intake Cove plankton tows as indicated by the index ratios greater than one.

Larval KGB rockfishes generally occurred in the nearshore sampling area with similar seasonality to that observed at the DCPP intake structure with peak abundance occurring in May of both 1998 and 1999 (Figure 12). There were 5,377 KGB rockfish larvae identified from 701 samples representing 23 percent of the nearshore sampling area samples collected and processed from July 1997 through June 1999. The mean concentrations in May of each sampling year were very similar (1998: 0.29/m^3; 1999: 0.28/m^3), indicating little change in abundance between the El Niño and subsequent La Niña years. The pattern of abundances in the nearshore sampling area differed between years with larger abundances of larvae in the sampling cells closest to shore during 1999 (Figure 14b). Regression analyses of the data for the two sampling periods showed declining abundances with increasing distance offshore (negative slope) for the 1999 period and almost no change with increasing distance offshore for the 1998 period (Appendix F).

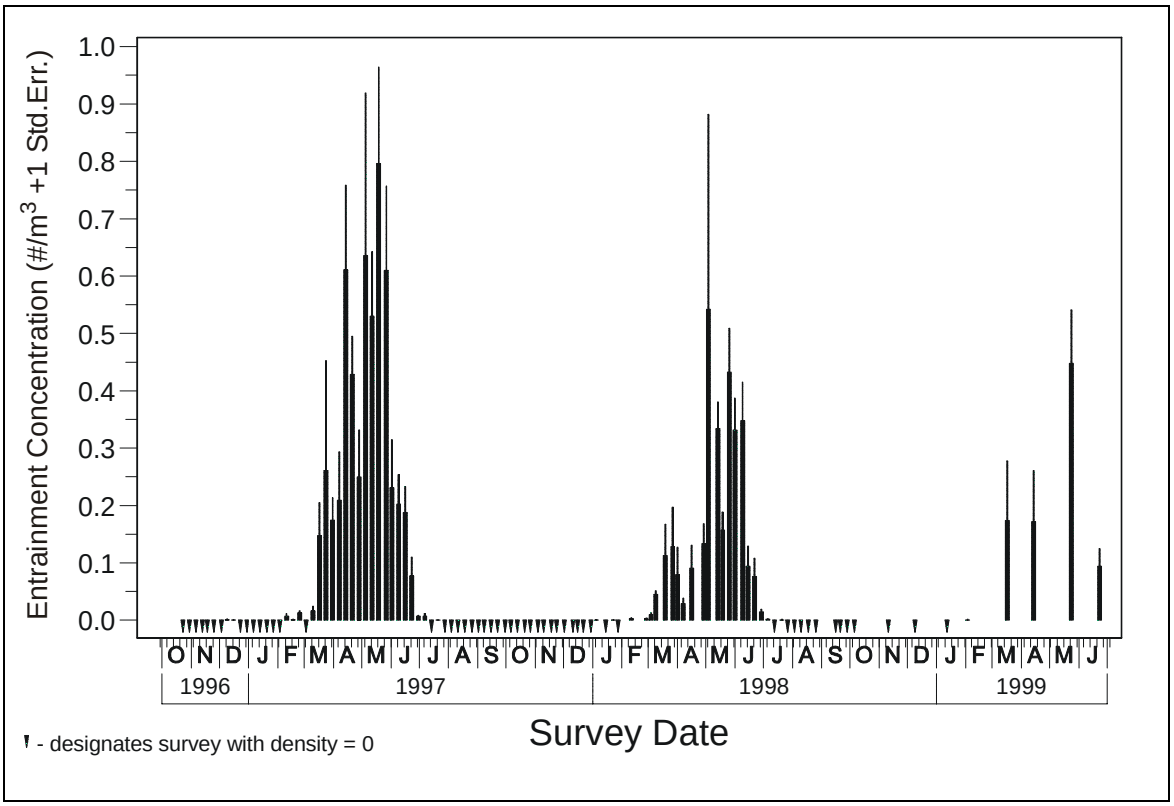

Figure 12. Weekly mean larval concentrations of kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae at the Diablo Canyon Power Plant intake entrainment stations. Dark bars represent mean concentration, and thinner bars represent one standard error.

Table 18. Diablo Canyon Power Plant entrainment estimates (E_T) and standard errors for kelp, gopher, and black-and-yellow (KGB) rockfish complex. E_{Adj-T} refers to the number entrained after adjustment to a long-term mean density. Note: The results for Analysis Periods 2 and 3 are the same because the overlap between the periods occurred during the peak larval abundances of KGB rockfish larvae.

Analysis Period	E_T	$SE(E_T)$	E_{Adj-T}	$SE(E_{Adj-T})$
1) Oct 1996 – Sept 1997	268,000,000	24,000,000	275,000,000	24,700,000
2) Oct 1997 – Sept 1998	199,000,000	25,900,000	222,000,000	28,900,000

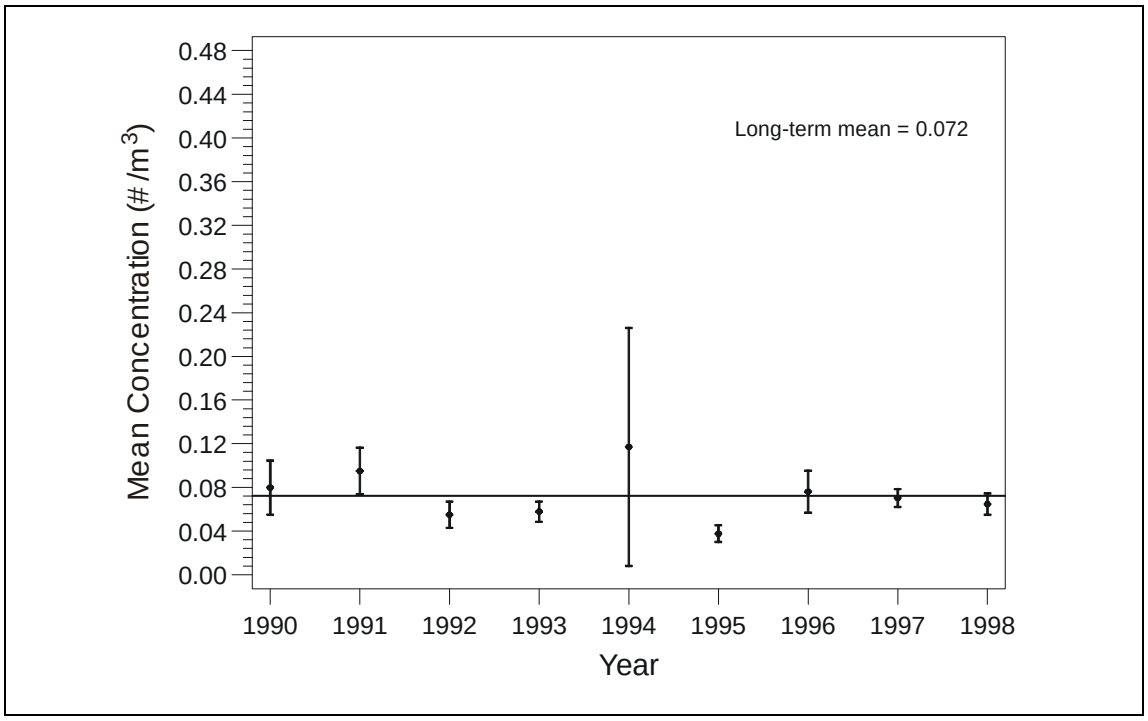

Figure 13. Annual mean concentration (+/- 2 standard errors) for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae collected from surface plankton tows in DCPP Intake Cove. Data were collected from December through June for every year except 1990 when only data from February through June were collected. The horizontal line is the long-term mean for all years combined.

Standard lengths of all measured KGB rockfish larvae collected at the DCPP intake structure between October 1996 and June 1999 (9,926 larvae) ranged from 2.4 to 8.0 mm (mean = 4.2 mm) (Figure 15). The lengths of entrained KGB larvae, excluding the largest 1 percent and smallest 1 percent of all measurements, ranged from 3.3 to 5.6 mm. Similar to the KGB assessment at Morro Bay, a growth rate of 0.14 mm/d (Mary Yoklavich, NOAA / NMFS / PFEG, Santa Cruz, CA, pers. comm. 1999) was used to estimate the age of entrained larvae. Assuming that the size of the smallest 1 percent represents post-extrusion larvae that are aged zero days (d), then the estimated ages of entrained larvae ranged from zero up to ca. 16.4 d post-extrusion for the size of the largest 1 percent of the larvae. The estimated average age of KGB larvae entrained at DCPP was 6.4 d post-extrusion. The reported extrusion size for species in this complex ranges from 4.0–5.5 mm (Moser 1996).

Fecundity Hindcasting

The same life history parameter values used for the MBPP study (Table 13) were also used to calculate FH estimates for the KGB rockfish complex for the DCPP study.

Average age at entrainment was estimated as 6.2 d. This was calculated by subtracting the value of the 1st percentile value of the lengths (3.3 mm) from the mean length at entrainment (4.2 mm) and dividing by the larval growth rate for brown rockfish of 0.14 mm/d (Love and Johnson 1999; Yoklavich et al. 1996) that was also used in the MBPP study. The survival rate of the KGB larvae from size at entrainment to size at recruitment into the fishery was partitioned into six stages from parturition to recruitment using the same approach presented for the MBPP study (Table 19). The survival rate from extrusion to the average age at entrainment using data from blue rockfish was estimated as 0.419 ($0.419 = e^{(-0.14)(6.2)}$).

The estimated number of adult KGB rockfish females at the age of maturity whose reproductive output was been lost due to entrainment was 617 for the 1996–97 period and 497 for the 1997–98 period (Table 19). The similarity between the estimates was a direct result of the similarity between adjusted entrainment estimates for the two periods. Low FH estimates resulted from the relatively high fecundity of adults and young average entrainment age estimated for larvae in this complex and not including other sources of mortality such as losses due to fishing in the model. The variation in the entrainment estimate had very little effect on the model estimates relative to the variation resulting from the life history parameters.

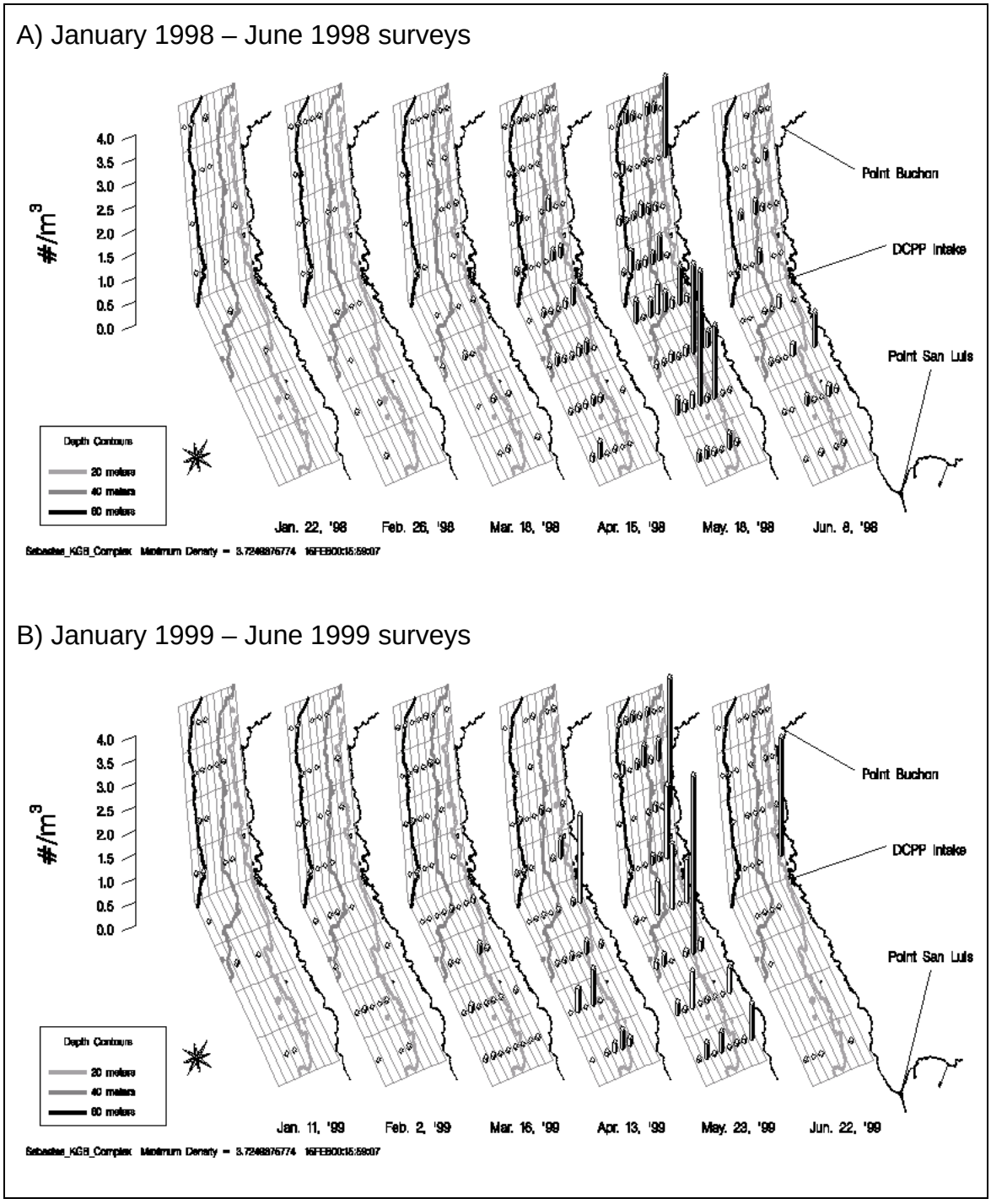

Figure 14. Average concentration for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae in each of the 64 nearshore stations for surveys done from A) January 1998 through June 1998, and B) January 1999 through June 1999 for Diablo Canyon Power Plant. Surveys done in other months are not shown because there were few or no KGB rockfish complex larvae collected.

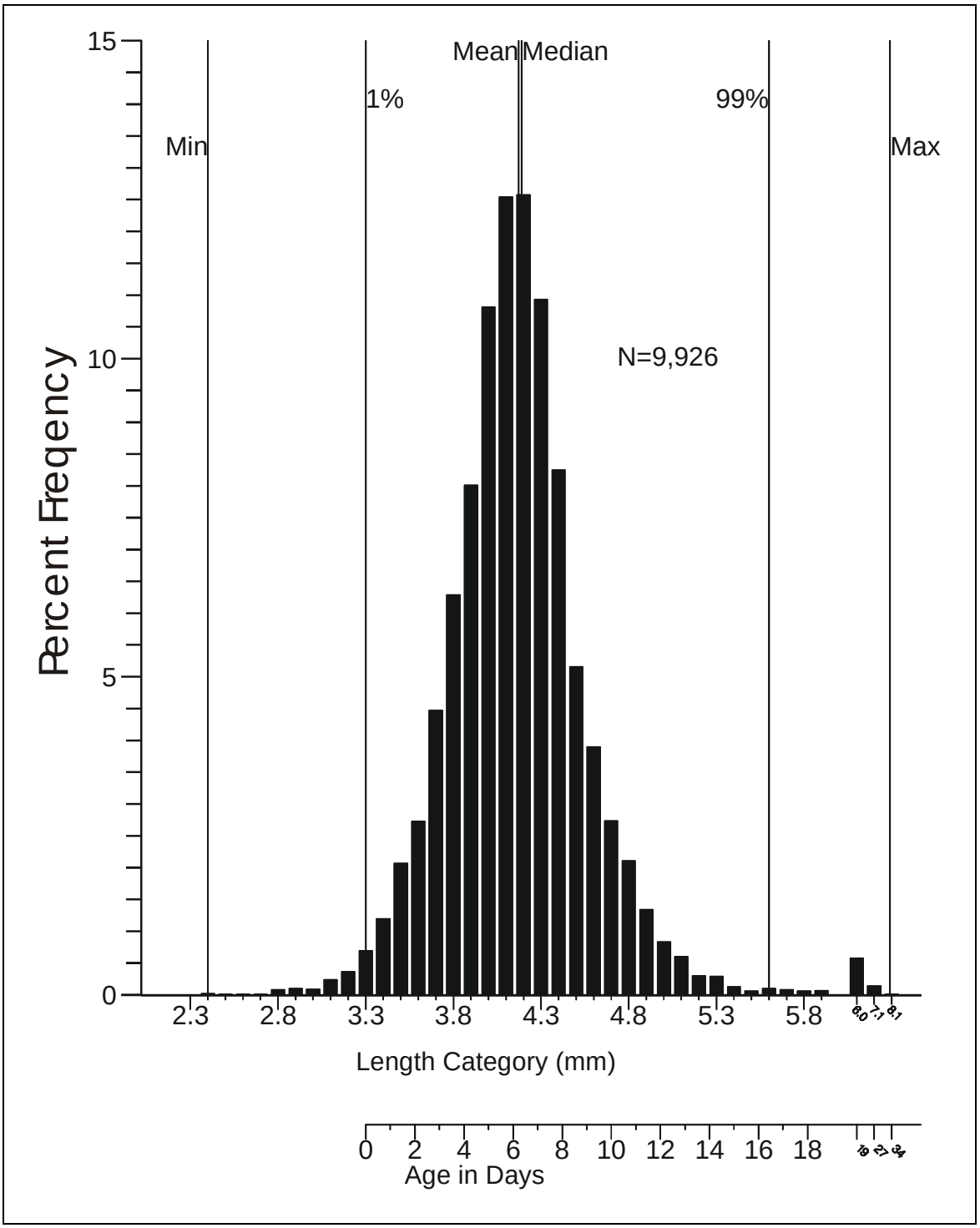

Figure 15. Length frequency distribution for kelp, gopher, and black-and-yellow (KGB) rockfish complex larvae measured from entrainment stations at Diablo Canyon Power Plant intake from October 1996 to June 1999. The x-scale is not continuous at larger lengths. Alternate x-scale shows age in days estimated using growth rate of 0.14 mm^{-d}.

Table 19. Diablo Canyon Power Plant fecundity hindcasting (FH) estimates for kelp, gopher, and black-and-yellow (KGB) rockfish complex for two year-long analysis periods. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

Analysis Period	Adjusted Entrainment Estimate	Estimate Std. Error	Upper FH Estimate	Lower FH Estimate	FH Range
1) Oct 1996–Sept 1997					
FH Estimate	617	1,470	31,500	12	31,488
Adjusted Entrainment	275,000,000	24,700,000	708	526	182
2) Oct 1997–Sept 1998					
FH Estimate	497	1,190	25,400	10	25,390
Adjusted Entrainment	222,000,000	28,900,000	603	391	212

Adult Equivalent Loss

Similar to the FH calculations the same life history parameter values from blue rockfish used for the MBPP study (Table 13) were also used to calculate AEL estimates for KGB rockfish at DCPP. The AEL estimates were extrapolated forward from the average age at entrainment of 6.2 d, the same value used in the FH hindcasting. Survivorship, to an assumed recruitment age of 3 years, was apportioned into these life stages, and AEL was calculated assuming the entrainment of a single age class having the average age of recruitment. Survival from the average age at entrainment (6.2 d) to the age at transformation (20 d) was estimated as 0.145 ($0.145 = e^{(-0.14)(20-6.2)}$). The other stages used the survival estimates from Table 19.

Paralleling the FH results, estimates of adult equivalents lost due to larval entrainment were fairly similar among survey periods (Table 20). The AEL estimate of 1,120 adults predicted from E_{T-Adj} at DCPP during 1996–97 reflects the slightly higher abundance of KGB rockfish larvae present during this year when compared to the 1997–1998 period (AEL= 905). The relatively constant larval abundance and subsequent estimates of effects varied little among survey periods, indicating that recruitment for the species in this complex remained relatively constant over the two years.

Similar to the results for MBPP, the FH and AEL estimates for DCPP were very close to the theoretical relationship of 2FH ≡ AEL, the AEL was only extrapolated to age three. The estimate would decrease by extrapolating to five years, the age of maturity used in the FH calculations.

Table 20. Diablo Canyon Power Plant adult equivalent loss (AEL) estimates for kelp, gopher, and black-and-yellow (KGB) rockfish complex. Upper and lower estimates represent the changes in the model estimates that result from varying the value of the corresponding parameter in the model.

Analysis Period	Adjusted Entrainment Estimate	Estimate Std. Error	Upper AEL Estimate	Lower AEL Estimate	AEL Range
1) Oct 1996–Sept 1997					
AEL Estimate	1,120	3,410	166,000	8	165,992
Annual Entrainment	275,000,000	24,700,000	1,290	958	332
2) Oct 1997–Sept 1998					
AEL Estimate	905	2,750	134,000	6	133,994
Annual Entrainment	222,000,000	28,900,000	1,100	712	388

Empirical Transport Model

The data used in computing the ETM estimates of P_M for KGB rockfish for the two study periods are presented in Tables 21 and 22 and in more detail in Appendices E and F. Average PE estimates for the two periods were similar in value and the values of f_i showed that the largest weights were applied to the PE values for the April and May surveys in both periods (Table 21). The estimate of larval duration of 16.4 days was used in the ETM calculations for both study periods.

The ETM model used for DCPP included adjustments for P_S similar to the model used at MBPP. Unlike the MBPP study, P_S was calculated using two approaches. The first approach was similar to the MBPP study, but instead of using average current speed, alongshore current displacement was used to estimate the alongshore distance that could have been traveled by KGB rockfish larvae during the day of the survey and during the 16.4-day period before the survey that they were susceptible to entrainment (Table 22). The ratio of the alongshore length of the nearshore sampling area to the alongshore current displacement was used to calculate an estimate of P_S for each survey. The second approach used the alongshore current displacement to determine the alongshore length of the source water population, but also used onshore current movement over the same period to determine the offshore distance of the source water population. During the 1997 through 1998 period, when the pattern of abundances within the nearshore sampling area was slightly increasing with distance offshore (positive slope), the offshore extent of the extrapolated source water population was set using the onshore current displacement (Table 22A and Appendix F). When the pattern of abundances showed a decline with distance offshore during the 1998 through 1999 period, the estimated offshore extent was the distance offshore that the extrapolated density was equal to zero (x-intercept), or the offshore extent of the sampling area (3,008

m) if the x-intercept was inside the sampling area (Table 22B and Appendix F). This was typically less than the measured onshore displacement during the surveys. The P_S was calculated as the ratio of the estimated number of KGB rockfish larvae in the nearshore sampling area to the estimated number in the source water area. The average values of P_S were used in the ETM calculations.

The ETM estimates for KGB rockfish are presented with the results of the other taxa included in the assessment for the DCPP (Table 23). ETM estimates of proportional mortality (P_M) were calculated using two methods to estimate the proportion of source water sampled (P_S). One method assumed that the source water only extended alongshore and did not extend outside the nearshore sampling area. Only this first estimate was calculated for three fishes that occur primarily as adults in the shallow nearshore. The other method assumed that the source water extended alongshore and could extend some distance outside the nearshore sampling area. Only this estimate was calculated for two fishes that occur as adults over large oceanic areas. Both estimates were calculated for the other nine fishes. No estimate was calculated for Pacific sardine in the Analysis Period 4 because of very low abundances that year.

Estimates of P_M were relatively similar in value between periods for the estimates calculated using the alongshore displacement estimate of P_S. There was a much greater difference between periods for the estimates calculated using the P_S based on extrapolating the source water population extending both alongshore and offshore. This was a result of the difference in the pattern of abundances in the nearshore sampling area between sampling periods (Figure 14). The source population was extrapolated further offshore during the 1997-1998 period resulting in a larger source water population estimate, which resulted in a smaller estimate of P_S and a smaller estimate of P_M.

Results for Other Taxa

Modeling results for the other taxa selected for detailed assessment showed that, similar to the results for MBPP, demographic models could only be used for half of the fishes analyzed (Table 23). There was a large variation in the demographic model results among taxa that was not necessarily reflective of the differences in entrainment estimates. This was the result of the large variation in life history among the fishes analyzed. For example, although the entrainment estimates for Pacific sardine and blue rockfish were similar, the demographic model results were different by greater than two orders of magnitude.

Table 21. Estimates used in calculating empirical transport model (ETM) estimates of proportional entrainment (PE) for kelp, gopher, and black-and-yellow (KGB) rockfish complex for Diablo Canyon Power Plant from monthly

surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999. The larval duration used in the calculations was 16.4 days. More detailed data used in the calculations are presented in Appendices E and F.

A) July 1997 – June 1998

Survey Date	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-97	0.0107	0.0151	0.0004	0.0004
25-Aug-97	0	0	0	0
29-Sep-97	0	0	0	0
20-Oct-97	0	0	0	0
17-Nov-97	0	0	0	0
10-Dec-97	0	0	0.0003	0.0003
22-Jan-98	0.0008	0.0009	0.0121	0.0053
26-Feb-98	0.0021	0.0013	0.0180	0.0038
18-Mar-98	0.0587	0.0297	0.0279	0.0050
15-Apr-98	0.0076	0.0035	0.1732	0.0214
18-May-98	0.0036	0.0008	0.6384	0.0334
8-Jun-98	0.0353	0.0084	0.1297	0.0165
	0.0167	Sum =	1.00000	

B) July 1998 – June 1999

Survey Date	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-98	0.0033	0.0035	0.0035	0.0011
26-Aug-98	0	0	0	0
16-Sep-98	0	0	0	0
6-Oct-98	0	0	0	0
11-Nov-98	0	0	0	0
9-Dec-98	0	0	0	0
12-Jan-99	0	0	0.0240	0.0053
3-Feb-99	0.0005	0.0005	0.0243	0.0045
17-Mar-99	0.0327	0.0198	0.0809	0.0108
14-Apr-99	0.0137	0.0075	0.1906	0.0328
24-May-99	0.0115	0.0026	0.5926	0.0456
23-Jun-99	0.0170	0.0125	0.0841	0.0509
	0.0131	Sum =	1.00000	

Table 22. Onshore and alongshore current meter displacement used in estimating proportion of source water sampled (P_S) from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999 for kelp, gopher, and black-and-yellow (KGB) rockfish complex at the Diablo Canyon Power Plant. More detailed data is included in Appendices E and F.

A) July 1997 – June 1998

Survey Date	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Offshore P_S	Alongshore P_S
21-Jul-97	31,300	4,820	4,820	0.0153	0.5545
25-Aug-97	–	–	–	–	–
29-Sep-97	–	–	–	–	–
20-Oct-97	–	–	–	–	–
17-Nov-97	–	–	–	–	–
10-Dec-97	146,000	31,600	31,600	0.0000	0.1189
22-Jan-98	120,000	23,400	23,400	0.0020	0.1443
26-Feb-98	33,700	8,710	8,710	0.0693	0.5152
18-Mar-98	181,000	12,400	12,400	0.0090	0.0960
15-Apr-98	76,100	12,800	12,800	0.0404	0.2282
18-May-98	67,100	19,900	19,900	0.0334	0.2589
8-Jun-98	111,000	5,670	5,670	0.0761	0.1559
			Average =	0.0307	0.2590

B) July 1998 - June 1998

Survey Date	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Offshore P_S	Alongshore P_S
21-Jul-98	76,300	11,100	3,010	0.2278	0.2278
26-Aug-98	–	–	–	–	–
16-Sep-98	–	–	–	–	–
6-Oct-98	–	–	–	–	–
11-Nov-98	–	–	–	–	–
9-Dec-98	–	–	–	–	–
12-Jan-99	46,200	24,100	3,010	0.3755	0.3755
3-Feb-99	81,900	19,700	3,010	0.2122	0.2122
17-Mar-99	36,900	8,540	4,170	0.4334	0.4709
14-Apr-99	163,000	10,200	8,000	0.0636	0.1068
24-May-99	180,000	21,800	21,000	0.0251	0.0967
23-Jun-99	158,000	5,970	4,380	0.0986	0.1100
			Average =	0.2052	0.2286

The fishes analyzed were separated into three groups based on their adult distributions: fishes that were widely distributed over large oceanic areas included northern anchovy and Pacific sardine, fishes that were primarily distributed in the shallow nearshore included smoothhead sculpin (*Orthonopias triacis*), monkeyface prickleback (*Cebidichthys violaceus*), and clinid kelpfishes (*Gibbonsia* spp.), and the rest of the fishes that were primarily nearshore, but could be found in deeper subtidal areas. The source water population used in calculating P_S was estimated using both alongshore currents and along- and off-shore extrapolation for the last group of fishes, resulting in two ETM estimates for each analysis period. Only one ETM estimate for each analysis period was made for the other two groups, depending on whether it was primarily nearshore or primarily offshore. The ETM estimates of P_M ranged from <0.001 (0.1 percent) to 0.310 (31.0 percent) with the estimated effects being greatest for the fishes that were distributed primarily as adults in shallow nearshore areas. These fishes such as sculpins (Cottidae), monkeyface pricklebacks, and kelpfishes all had proportional mortalities due to power plant entrainment of greater than 10 percent. The ETM calculations were calculated using both estimates of P_S for snubnose sculpin because they occur slightly deeper as adults than the other nearshore fishes. The results showed that the extrapolated ETM estimates were approximately equal to the estimates using only alongshore current displacement because the densities for this species did not increase with distance offshore. The results for DCPP are similar to the other two studies in showing that the greatest effects occur to fishes that primarily occupy habitats in close proximity to the intake and do not occur at the same level in other areas of the source water.

Table 23. Results of entrainment monitoring and FH, AEL, and ETM modeling for fourteen fishes at Diablo Canyon Power Plant. The four analysis periods correspond to 1) Oct. 1996 – Sept. 1997, 2) Oct. 1997 – Sept. 1998, 3) July 1997 – June 1998, and 4) July 1998 – June 1999. Adjusted entrainment (E_{Adj-T}), FH and AEL not calculated for Analysis Period 4. Nearshore sampling of source waters began in June 1998, so ETM estimates of proportional mortality (P_M) was only calculated for Analysis Periods 3 and 4.

Taxon	Analysis Period	E_{Adj-T}	FH	AEL	P_M Alongshore	P_M Offshore and Alongshore
Pacific sardine	1.	8,470,000	3,170	2,630	–	–
	2.	22,600,000	8,460	7,000	–	–
	3.	22,600,000	8,460	7,000	not calculated	<0.001
	4.				not calculated	not calculated
northern anchovy	1.	136,000,000	16,100	43,200	–	–
	2.	376,000,000	44,700	120,000	–	–
	3.	377,000,000	44,700	120,000	not calculated	<0.001
	4.				not calculated	<0.001
KGB rockfish complex	1.	275,000,000	617	1,120	–	–
	2.	222,000,000	497	905	–	–
	3.	222,000,000	497	905	0.039	0.005
	4.				0.048	0.043
blue rockfish complex	1.	84,040,000	43	353	–	–
	2.	33,800,000	18	164	–	–
	3.	33,900,000	20	142	0.004	<0.001
	4.				0.028	0.002
painted greenling	1.	24,200,000	–	–	–	–
	2.	9,610,000	–	–	–	–
	3.	12,100,000	–	–	0.063	0.051
	4.				0.056	0.043
smooth-head sculpin	1.	57,700,000	–	–	–	–
	2.	115,000,000	–	–	–	–
	3.	129,000,000	–	–	0.114	not calculated
	4.				0.226	not calculated
snubnose sculpin	1.	110,000,000	–	–	–	–
	2.	83,500,000	–	–	–	–
	3.	105,000,000	–	–	0.149	0.139
	4.				0.310	0.310
cabezon	1.	51,900,000	–	–	–	–
	2.	36,300,000	–	–	–	–
	3.	36,300,000	–	–	0.011	0.009
	4,				0.015	0.008
white croaker	1.	305,000,000	5,110	14,700	–	–
	2.	440,000,000	7,380	21,300	–	–
	3.	447,000,000	7,500	21,600	0.007	<0.001
	4.				0.035	0.004
Monkey-face prickleback	1.	83,100,000	–	–	–	–
	2.	61,500,000	–	–	–	–
	3.	60,200,000	–	–	0.138	not calculated
	4.				0.118	not calculated
clinid kelpfishes	1.	181,000,000	–	–	–	–
	2.	308,000,000	–	–	–	–
	3.	458,000,000	–	–	0.189	not calculated
	4.				0.250	not calculated
blackeye goby	1.	128,000,000	12,000	75,200	–	–
	2.	109,000,000	10,300	64,100	–	–
	3.	128,000,000	12,100	75,400	0.115	0.027
	4.				0.065	0.036
sanddabs	1.	7,160,000	426	2,370	–	–
	2.	1,540,000	92	511	–	–
	3.	6,610,000	393	2,190	0.010	0.001
	4.				0.008	0.001
California halibut	1.	8,260,000	–	–	–	–
	2.	15,700,000	–	–	–	–
	3.	15,500,000	–	–	0.005	0.001
	4.				0.071	0.006

CHAPTER 4: DISCUSSION

The results from these studies demonstrate the importance of a site-specific approach to assessing the effects of CWIS entrainment on marine organisms. Even though Morro Bay and San Diego Bay are both tidally influenced embayments, the resulting studies, sampling, and analytical approaches were very different. And both of these studies were dramatically different from Diablo Canyon. The source waters determined to be affected by entrainment were the primary factor responsible for the differences among studies. In San Diego Bay, in the area of SBPP, the turnover in water due to tidal exchange allowed the authors to treat the source water population as a closed system. A larger number of stations was sampled in San Diego compared to Morro Bay because of the potential for reduced exchange among the various habitats in the San Diego source water study area. Differences in fish composition among habitats in San Diego Bay shown by Allen (1999) were also reflected in some of the differences in larval composition among stations. This resulted in site-specific effects on species such as longjaw mudsuckers, which had a relatively high ETM estimate of P_M at SBPP. Mudsucker larvae were not particularly abundant in the source waters but were abundant in the SBPP intake canal, which provided excellent habitat for adults. Similarly, effects on combtooth blennies estimated using ETM were lower than other fishes because they were more abundant in areas of the bay that had extensive pier pilings and other structures that provide habitat for adult blennies. The high level of site fidelity in the community composition in south San Diego Bay was likely due to the lower tidal exchange rates relative to an area such as Morro Bay. The results supported the decision to sample an extensive range of habitats in south San Diego Bay.

The source water sampling in Morro Bay was less extensive than the SBPP study but included sampling at a nearshore station outside the bay that was representative of water transported into the bay on flood tides. The less intensive sampling was justified by the large tidal exchange that results in rapid turnover of the water in the bay relative to a large tidal embayment such as San Diego Bay. The shallow mudflats and tidal channels in Morro Bay are drained out through the deeper navigation channel where sampling occurred. Although this may have resulted in undersampling of larvae from certain fishes that could avoid strong tidal currents, as has been shown for longjaw mudsuckers and other species of gobies (Barlow 1963, Brothers 1975), it was probably representative of the larvae that would be transported on outgoing tides past the plant where they would be exposed to entrainment. The greatest CWIS effects using ETM were estimated for combtooth blennies that occur in the piers and other structures located near the plant. This was similar to the SBPP results for longjaw mudsuckers that occur in highest numbers at the entrainment station in the intake canal. These results showed the importance of sampling all habitats and the potential for increased impacts on species with habitats near plant intakes. This also indicates that potential for large

impacts exist when habitats are not uniformly distributed in the source water for a CWIS and the potential for larger effects on fishes associated with habitats that may not be abundant throughout the source water.

The nearshore sampling area for DCPP was very extensive to represent the range of habitats along the exposed rocky headland where the power plant is located. The size of the sampling area was also designed to be representative of the distance north and south that larvae could be transported by alongshore currents over a 24 hour period to correspond with the ETM model that uses daily estimates of conditional mortality resulting from entrainment to estimate CWIS-related mortality. This extensive sampling showed similar results to SBPP and MBPP by estimating that the greatest CWIS effects using ETM occurred on fishes with nearshore habitats that were disproportionately affected by entrainment. In the ETM model, species that have higher abundances in entrainment samples result in larger PE estimates of daily conditional mortality.

The authors examined the relative distribution of individual species in the sampling areas by comparing the average PE to the ratio of the cooling water to source water volumes. For example, in SBPP the average PE for CIQ gobies was 0.012, which was very close to the volumetric ratio of 0.015. In contrast, the average PE for longjaw mudsuckers was 0.19, which was much greater than the ratio of cooling water to source water. Although this is potentially useful for helping to determine the potential distribution of the larvae in the source water, it may not be a good indicator of impacts. When the PE is close to the volumetric ratio, the resulting impacts are directly dependent on the number of days that the larvae are exposed to entrainment. Therefore, even though the average PE was much greater for longjaw mudsuckers, the time (4 days) that they were exposed to entrainment was much less than CIQ gobies because they were in highest abundance in the areas directly around the CWS intake. In contrast, even though the average PE for CIQ goby was close to the volumetric ratio, the estimated effects of entrainment based on ETM were higher than the estimated effects on mudsuckers (0.215 vs. 0.171) because goby larvae were estimated to be exposed to entrainment for 23 days.

The final source water area used to adjust the PE estimates also affected the CWIS effects estimated using ETM. The MBPP results for KGB rockfish contrast with those for estuarine fishes such as gobies and blennies. Relative to fishes that are primarily estuarine inhabitants, adult KGB rockfishes are more widely distributed, resulting in larger source water body populations and reduced entrainment effects. As a result, the PE estimates were adjusted using P_S to account for the larger source water population beyond the area sampled for KGB rockfishes. All of the results for DCPP were adjusted to account for the onshore and alongshore currents that can transport larvae over

hundreds of kilometers, resulting in very low estimated effects for species, such as northern anchovy, that have widely distributed source populations.

The source water sampling for all three of these studies was done to satisfy the requirements of the ETM. Source water sampling would not have been required if the assessments were done using only more traditional demographic modeling approaches. The source water sampling was necessary because the ETM directly links mortality to a source population. As a consequence, the habitat occupied by that source population can be described, and ecosystem losses can be mitigated. The area of production foregone (APF) is one approach for estimating the amount of habitat that would need to be replaced to compensate for the larval production lost due to entrainment.

Area of Production Foregone (APF) models can be used to understand the scale of loss resulting from an impact and the extent of mitigation that could yield compensation for the loss. It is based on the idea that losses from environmental impacts can usually only be estimated from a group of species and that the true impact results from the sum of direct and indirect losses attributable to the impact. The use of APF allows for the estimation of both the direct and indirect consequences of an impact and provides a currency (that is, habitat acreage) that may be useful for understanding the extent of compensation required to offset an impact.

Probably the most controversial issue in APF assessment is how it treats the few taxa actually analyzed in the assessment. In most assessments, including "habitat replacement cost" (HRC) (Strange et al. 2002), estimates of loss of taxa are implicitly considered to be without error. In APF, each estimate is considered to be prone to (sometimes) massive error (indeed, estimates of confidence intervals in ETM calculations often cross through zero). In APF models the assumption is that each taxon represents a sample and that the mean of the samples is representative of the true loss rate. For example, assume 5 taxa and the ETM calculations indicate that for an estuarine system of 2000 acres the loss rates for the 5 taxa are 5, 10, 3, 22 and 15 percent. In APF the estimate of loss would be the average of the 5 values or 11 percent. Because APF considers taxa to be simply independent replicates useful for calculating the expected impact, the choice of taxa for analysis may differ from HRC assessments. In APF the concern is more that each taxon is representative of other taxa that are either unsampled (most invertebrates, plants and holoplankton) or not analyzed (the vast majority of fish). In APF, the average loss across taxa then represents the average loss across all entrained organisms. This is a fundamental difference between APF and economic based models like HRC. The underlying statistical-philosophic basis of APF addresses one of the most problematic issues in impact estimation: the typical inability to estimate impact for unevaluated taxa.

In APF, the next step is to take the average ETM loss rate and turn it into an ecological currency, which then can be used to understand the impact and form a basis for mitigation. This can be quite a simple step. Loss is turned into habitat from which production is foregone. This is calculated as the area of habitat that would need to be added to the system to make up the lost resources. In the example above, the estimate was that 11 percent of organisms at risk in a 2000-acre estuary were lost to entrainment. The estimate of APF then would simply be 2,000 acres x 11 percent or 220 acres. Therefore the creation of 220 acres of new estuarine habitat would compensate for the losses due to entrainment. This does not mean that all biological resources were lost from an area of 220 acres, which is a common misunderstanding. Instead it means that if 220 acres of new habitat were created, then all losses, calculated and not calculated, would likely be compensated. Here again is an important feature of APF. The currency of impact (acres needed to compensate) includes all impacts, even indirect ones. One common criticism of the approach of focusing more detailed analysis to only a limited number of taxa is that not only are other taxa directly affected by entrainment not assessed, but that there is also no provision for estimation of indirect impacts (often food web considerations). APF addresses this concern by expressing impact in terms of habitat and assuming that indirect impacts are addressed by the complete compensation of all directly lost resources.

In the given example, APF would predict that the creation of 220 acres of new habitat would compensate for all impacts due to entrainment. What sort of habitat should be created? Again the statistical-philosophic basis of APF contributes to the answer. Because taxa in APF are simply independent replicates that yield a mean loss rate, habitat is not directed by taxa. Instead, the approach assumes that habitat should be created that represents the habitat for the populations at risk. If the habitat in the estuary was 60 percent subtidal eelgrass beds, 15 percent mudflats, and 25 percent vegetated intertidal marsh, then these same percentages should be maintained in the created habitat. Doing so would ensure that impacts on all affected taxa would be addressed.

The logic of the example would seem to imply that this approach would only be useful if there were habitat creation opportunities. However, even if there are not local opportunities, the approach is useful for other reasons:

1) Opportunities may exist in other locations (such as another nearby estuary);

2) Area of Production Foregone can be useful in understanding the scale and relative importance of the impact, which helps with permitting decisions, and in establishing a cost-basis for the impact; and

3) Often there are alternative mitigation strategies that could be implemented whose scale would be determined by APF. An example would be the size of the creation of an artificial reef or the area of a marine reserve designated as mitigation for entrainment losses.

In the most general model, APF is estimated from the product of P_M and the source water area for each taxa analyzed. In the example above, the source water area was the same for all taxa as it was the area of the estuary. Clearly, the approach becomes more difficult on the open coast where the source water areas differ across taxa. The task is simplified by the proportional relationship between P_M and the size of the source water population used in calculating P_S. As the size of the source water area increases relative to the sampling area, P_S decreases resulting in a proportional decrease in P_M. If the habitat in the larger source water can be assumed to be distributed in the same relative proportions as the area sampled, then one only needs to use the areas of various habitats in the sampled area to estimate APF by using the uncorrected P_M. This greatly simplifies the application of APF and reduces the need to rely on limited current data information to extrapolate beyond the areas sampled. In practice, when many taxa are impacted, each having varying habitat requirements, APF estimation becomes a matter of restoration using an estimate such as

$$\frac{\sum_{i=1}^{N} \frac{1}{P_{S_i}} P_{M_i}}{N},$$

for I = 1 to N taxa.

One of the advantages of the ETM model over more traditional demographic approaches towards CWIS assessment is the reduced need for life history data. As the results show, the necessary life history information on reproduction and age-specific mortality for the FH and AEL models was only available for a limited number of fishes. The life history information was collected from data in the scientific literature, but the level of uncertainty surrounding published demographic parameters was rarely reported. The likelihood is that the uncertainty associated with the information was very large. This needs to be considered when interpreting results from FH and AEL models because the accuracy of estimated entrainment effects will depend on the accuracy of age-specific mortality and fecundity estimates. This limits the utility of these modeling approaches, especially on the Pacific Coast of California where fishes in highest abundance in entrainment samples are small, forage species with limited life history information. The authors were fortunate that the work of Brothers (1975) provided demographic information on CIQ gobies, the most abundant larvae collected in two of the studies.

Unlike demographic models the only life history information required by ETM, which it shares with FH and AEL, is an estimate of the duration of the period the larvae are vulnerable to entrainment, estimated in these studies by the age of the larvae entrained. This was estimated using larval lengths measured from the samples and larval growth rates obtained or derived from the scientific literature. The average length was used to estimate the average age at entrainment (average length – length at 1st percentile), and the maximum length based on the length at the 99th percentile was used to estimate the maximum number of days that the larvae were exposed to entrainment. It is possible that these estimates were biased. Other reported data (for example, Moser 1996) for various species suggested that hatching lengths could be either smaller or larger than the size estimated from the samples, and indicated that the smallest observed larvae represented either natural variation in hatch lengths within the population or shrinkage following preservation (Theilacker 1980). The possibility remains that all larvae from the observed minimum length to the greatest reported hatching length (or to some other size) could have just hatched, leading to overestimation of larval age.

The extensive weekly sampling at DCPP over more than two years resulted in measurements of almost 10,000 KGB rockfish larvae from entrainment samples. Despite this large data set, the authors did not have a high level of confidence that these data necessarily provided a more accurate estimate of size at extrusion. The reported size of KGB rockfish at extrusion is 4.0-5.5 mm (Moser 1996) indicating that the average size at entrainment, 4.2 mm, could be a more accurate minimum size for estimating age at entrainment than the much smaller value used in the calculations. Although the minimum and average sizes were different than reported in the literature, this shouldn't present a problem in estimating the number of days of exposure to entrainment as long as the growth rate used in the calculations is valid for that size of larvae. The uncertainty regarding the estimation of the period of exposure to entrainment has resulted in reporting of ETM results using larval durations based on the mean and maximum lengths at MBPP and DCPP. This uncertainty can easily be resolved by aging entrained larvae using otoliths. Removing the uncertainty associated with the age of the entrained larvae may justify the additional costs associated with this approach.

The duration that larvae may be subject to entrainment is affected not only by growth and behavior of the larvae, but also by the hydrodynamic characteristics of the source waters. In closed systems such as south San Diego Bay or freshwater lakes, biological factors are probably more important than hydrodynamic factors. In open systems, both biological and physical factors affect the length of time that larvae are subject to entrainment. For power plants located in coastal areas, such as DCPP, the effects of currents and larval growth both need to be considered in determining the size of the source population potentially affected by entrainment, but in estuarine areas such as Morro Bay, hydrodynamic forces have a much greater effect on exposure to

entrainment. The large tidal exchange ratio in Morro Bay results in huge exports of larvae out of the bay and into nearshore waters. Brothers (1975) showed that tidal exchange in Mission Bay, California resulted in much higher larval mortality rates than his calculated values for CIQ gobies. He hypothesized that larval behavior similar to that observed in longjaw mudsucker (Barlow 1963) resulted in the higher observed survival rates. Barlow described that longjaw mudsucker post-larvae are found close to the bottom. The location of MBPP near the harbor entrance of Morro Bay probably results in reduced effects on estuarine fish populations because the large majority of entrained larvae would be exported out to sea. The source water calculations for MBPP did not account for the strong effects of tidal exchange on entrainment exposure, which was used to argue that mean larval lengths should have been used in calculating larval exposure to entrainment instead of the length of the 99th percentile. More sophisticated models incorporating hydrodynamic factors should be considered for estuarine systems similar to Morro Bay where hydrodynamic forces strongly affect the period that larvae are exposed to entrainment. This could have been done by increasing the source water volume to account for tidal outflow that transports larvae out of the bay into the ocean over the same number of days that the larvae are exposed to entrainment. This would also require that the nearshore area be included in the calculation of the source water population estimate because the larvae transported out of the bay would still be subject to entrainment.

The sampling frequency may be another source of bias associated with the authors' estimate of the age of the larvae being entrained. The potential for biased sampling would be more prevalent in fishes that do not have prolonged spawning periods such as KGB rockfishes or on the East Coast where spawning occurs more seasonally. It would be less of a potential problem in fishes such as CIQ goby that have larvae that are present almost year-round. Entrainment sampling occurring monthly or less frequently could miss certain periods when certain age classes are present. Although more frequent sampling may not be required in the source water, this may argue for more frequent weekly or bi-weekly entrainment sampling.

The frequency for source water sampling also needs to be considered for species with limited spawning periods. This should be one of the considerations in selecting taxa for detailed assessment since species with limited spawning periods will have few estimates of PE decreasing the confidence in the ETM estimates for those taxa. Unfortunately, the current sampling approach may also result in the selection of taxa that have prolonged spawning durations. This can be avoided if the period of spawning for important taxa can be accounted for in the study design.

In an entrainment assessment being prepared for the Potrero Power Plant in San Francisco Bay, the source water sampling frequency was increased during the spawning

season for Pacific herring (*Clupea pallasii*), which was identified as an important species during the study design (Tenera Environmental, unpublished data). If this is not accounted for in the sampling and selection of species for analysis, it may result in biased estimates for certain species. This is especially problematical if a species is collected relatively infrequently and in low numbers but is included in the assessment because of its commercial or recreational value. Examples from these studies include Pacific herring at MBPP and California halibut (*Paralichthys californicus*) at DCPP. Both of these fishes represented less than 1.0 percent of the total larvae collected during entrainment sampling but were included in the assessments (Tables 4, 11, and 17). In both cases, the results of the demographic modeling were important in placing the results for these species in context. In the case of Pacific herring at MBPP, the ETM estimate of entrainment mortality of 16 percent represented the estimated loss of 532 adults calculated using the FH method (Table 16). No demographic estimates were available for California halibut at DCPP (Table 23). This problem did not occur at SBPP where the assessment was limited to the most abundant fishes regardless of their commercial or recreational value.

The approach used at SBPP for selecting taxa for analysis is acceptable if the taxa used in the assessment represent the range of habitats and fishes found in the source water potentially impacted by entrainment. If the list of taxa represents a reasonable sample from the fishes in the source water, then the P_M estimates for the fishes can be averaged to obtain an estimate of the expected entrainment impacts on other fish and invertebrate larvae, zooplankton, and phytoplankton not included in the assessment. As the examples in the previous paragraph demonstrate, no single estimate of P_M may be particularly reliable, and therefore the use of the average P_M may be more appropriate as a estimator of average losses to the population. As previously discussed, the average value can be also used in calculating APF estimates for scaling restoration projects that could be used to compensate for entrainment losses.

Using averages for APF does not imply that there is an average mortality within the area estimated by the APF, but rather that averages are useful for estimating the amount of habitat affected. In order to view mortality spatially, it may be useful to allocate the mortality estimate over the area of the source population. A first approximation would be to allocate mortality in a linear or Gaussian fashion across the range of the source population. This was the approach used to estimate the cumulative effects of CWIS at all of the power plants in Southern California (MBC and Tenera 2005). In this way mortality is equal to zero at the periphery of the source population, the furthest distances from the power plant intake. In addition, the source population is subject to stochastic and variable deterministic processes with a result of a changing source population area. Using current measurements, numerical or physical modeling can be used to make further refinements.

The simple volumetric approach for estimating cumulative effects (MBC and Tenera 2005) can be expanded using more accurate estimates of P_M for a range of species. This would involve combining source water population, oceanographic, and hydrographic data from individual power plants. Cumulative effects result when the source water populations for the various power plants overlap. The ETM is easily adjusted to calculate cumulative effects by expanding the estimates of the source water and entrainment populations (Eq. 18) to include all of the power plants being considered.

The period that larvae are exposed to entrainment needs to be adjusted for fishes with planktonic egg stages. This was not considered in these studies because the fishes analyzed for entrainment effects were mostly species that did not have a planktonic egg stage. Therefore, the durations used in the ETM modeling for anchovies, croakers, and flatfishes should have been increased by the average number of days that the eggs for these fishes were potentially exposed to entrainment. Since it would not be feasible to age eggs collected from entrainment samples, this adjustment would need to rely on estimates of egg duration from the scientific literature. This requires the assumption that the estimate of PE applies to both egg and larval stages and that mortality on passage through the cooling system is 100 percent for both egg and larval stages. If there is concern that egg stages are less abundant in the source waters than larval stages, separate PE estimates could be calculated for egg and larval stages using an approach similar to the original ETM concept presented by Boreman et al. (1978 and 1981), which conceptualized an ETM model incorporating separate PE estimates and durations for each life stage. This approach will be difficult to implement for most fishes because fish eggs can only be identified for a few species on the West Coast. Therefore, the most conservative approach would be to assume that fish eggs are entrained in the same relative proportions as fish larvae and account for the egg planktonic duration in the assessment models. For organisms with available life history information, estimates of larval and egg survival can be used to estimate the number of eggs that would have been entrained from abundances of larvae in the samples.

One often proposed method to estimate egg entrainment is to assume a 1:1 eggs to larvae entrainment ratio. However, egg mortality may be significantly different than larval mortality. For example, the estimates of instantaneous natural mortality (M) rates for northern anchovy were 0.191 d^{-1} for eggs and 0.114 d^{-1} for larvae. One million eggs would become 512,477 larvae at the end of 3.5 days, the estimated duration of entrainment for eggs. At the end of a larval duration of 70 days, there would be 175 fish assuming negative exponential survival. The assumption of exponential survival and stable age distribution of eggs and larvae over the 3.5- and 70-day periods can be used to estimate the numbers of all ages by integration as follows:

$$N = \int_0^t N_0 e^{-Mt} dt = \frac{N_0 e^{-Mt}}{-M}\Bigg|_0^t .$$

Separate integration of eggs and larvae results in a 0.568:1 estimated entrainment ratio of eggs to larvae, thus showing a higher risk to larvae due to the prolonged susceptibility.

The focus of the discussion on ETM results reflects the authors' belief that entrainment effects from CWIS are best assessed using this approach. Although these studies focus on ETM, the multiple modeling approaches used in these studies was valuable for several reasons. First of all, the demographic models provide valuable context for assessing effects on commercially and recreationally valuable species that also allows for comparison with ETM. For example, DCPP estimates of AEL for KGB rockfishes were compared to harvest data assuming 100 percent catchability of adult equivalents and assuming no compensatory mortality. These assumptions likely result in overestimating fishery values (for example, price per kilogram). Given these conditions, an estimated economic loss to the local fishery could be based on an average weight of 1.0 kg for a 3 year old KGB rockfish recruiting to the live-fish fishery. The annual average AEL estimate of 1,013 rockfishes translates to a potential direct economic loss of $7,749 based on the average price of $7.65/kg. This value represented approximately 2 percent of the ex-vessel revenue attributed to KGB complex rockfishes landed at ports in the Morro Bay area in 1999 (PSMFC PacFin Database). Similar conversions to fishery value can be performed using FH estimates.

This type of conversion also allows for indirect comparison of demographic model results with ETM by similar conversion of ETM losses into fishery value. To continue the example using the DCPP results for KGB rockfishes, the authors assumed that the probable effect of entrainment losses at DCPP on fisheries was likely localized to the ports within the Morro Bay area since most fishes in this complex demonstrate high site fidelity (Lea et al. 1999). In addition, extension of effects based on alongshore currents and larval duration indicate that the area potentially affected was only three to seven times the size of the nearshore sampling area, which was likely within the range of fishers from either Port San Luis or Morro Bay. The estimate of entrainment mortality (P_M) was between 4 and 5 percent for this area. Applying this range of proportional reduction to the local catch from the Morro Bay area in 1999 yielded estimated dollar losses to the Morro Bay area fishery of approximately $20,000. In this example, the fishery value estimates using ETM and AEL are reasonably close. The same type of indirect comparison could be done for species without any fishery value by converting ETM estimates of P_M to APF. The estimate of APF could be used with data on abundances to obtain estimates of adult populations that could be compared with demographic model results.

The demographic modeling approaches and conversions to fishery value using either demographic or ETM model results ignore any potential effects of compensation. The authors took this approach because there remain conflicting opinions whether larval mortality is compensated in some fashion. One side of the argument is that if compensation occurs, the estimates of FH, AEL and P_M will overestimate the number of adults lost and ecosystem losses (Saila et al. 1997). The response is that it is difficult to determine if compensation occurs at all (Rose et al. 2001, Nisbet et al. 1996). Additionally, if population mortality is density independent or weakly dependent, then the recruited population size will fluctuate in response to either changes in larval abundances or mortality. In the case of large density dependent mortality, little change due to changes in recruitment might be observed in local population sizes (Cayley et al. 1996). Field experiments on West Coast species of fishes have been equivocal (for example, Stephens et al. 1986), and recent studies on bocaccio (*Sebastes paucispinis*) showed no evidence of compensation in the stock-recruitment relationship (Tolimieri and Levin 2005). Currently, the USEPA and the California Energy Commission consider that compensation does not reduce impacts from entrainment and impingement on adult populations.

Results from demographic models are also necessary for combining estimates from entrainment and impingement unless independent data on adult fish populations are available for comparison with impingement losses. Impingement studies are designed to collect data on juveniles and adult fishes that are used to develop estimates of annual impingement. An AEL model is then used to extrapolate the number of impinged fishes either backward or forward to the numbers of adults of a certain age. By using the average age of reproductively mature females in the extrapolation, these results can be combined with FH or AEL entrainment estimates to obtain estimates of the combined effects of impingement and entrainment. This approach assumes that the FH and AEL entrainment estimates are extrapolated to the same age used in the impingement estimates. Combined assessments can only be done on the few fishes with life history data available for estimating FH, AEL, or one of the other demographic models. Fortunately, the total impingement losses at these three plants were relatively low due to the CWIS designs, and species with the highest impingement estimates were not entrained in high abundances (Tenera Environmental 2000, 2001, 2004). This is not always the case, and combining impingement and entrainment estimates into comprehensive CWIS assessments remains problematic for most species due to incomplete life history data.

Another approach for combining results from impingement and entrainment would involve using the numbers of impinged individuals for a species to estimate the relative losses to the population. The impingement mortality and entrainment mortality rate estimated by ETM can be converted to survival and multiplied to estimate cumulative

CWIS effects. This approach involves the assumption that there are no compensatory mechanisms acting on the population between larval and adult stages such that entrainment losses estimated by ETM represent losses to the adult population. It also assumes that impingement and entrainment losses apply to the same stock. Although this is reasonable for a closed system such as south San Diego Bay, it would be much more difficult in an open system. In addition, there are few species with adequate data on adult stocks that could be used in this approach.

Finally, demographic model results provide a direct comparison with ETM results for both fishery and non-fishery species. It is obviously preferable to present data as both percentages relative to a source population using ETM and as absolute numbers of fishes using one or both demographic models. This helps ensure that P_M estimates are properly interpreted and instances where a large P_M that equates to only a few adults fishes are not misinterpreted. Ensuring the species included in the assessment were adequately sampled is the best way to avoid this type of problem. Unfortunately, these types of comparisons are only possible for the limited number of fishes on the West Coast with published life history data. This approach is also complicated by the uncertainty related to the levels of any compensatory, depensatory, or behavioral mechanisms that may have been operating on the subject populations when the life history data were collected. The availability and uncertainty associated with life history information continue to be the greatest limitations to the use of demographic models for CWIS assessment.

Despite these limitations, the USEPA made extensive use of demographic models in the assessments used in the rulemaking for 316(b). This was necessary because of the need to determine the economic costs associated with implementing certain technologies that could be used to help meet performance standards for impingement (80-95 percent) and entrainment (60-90 percent) reduction mandated in the new 316(b) rule. These methods will continue to be used due to the availability of an option for site-specific compliance. This option involves a cost-benefit analysis that compares the costs of technological or operational measures for achieving the performance standards against environmental benefits calculated using benefits valuation methods. As a result of these requirements, there is active research being done to increase the availability of life history data for Pacific Coast fishes.

Guidelines for Entrainment Impact Assessment

The three studies presented in this paper make it clear that it is not feasible to use a prescriptive approach to entrainment assessment design. Based on experiences with these and other studies, the authors provide some general considerations that might be helpful in the design, sampling, and analysis of entrainment impact assessments. These

comments are presented in the hopes that others may benefit from our experiences in conducting CWIS entrainment assessments.

Considerations for Study Design

1. Determine potential species that could be affected by entrainment using historical data on entrainment for the power plant, if available, and data from surrounding waters. Insure that sampling will account for any endangered, threatened, or other listed species that could potentially be affected by entrainment.
2. Determine the source water areas potentially affected by entrainment including the distribution of habitats that might be differentially affected by CWIS entrainment. Different habitats may require use of different sampling gear and methods.
3. The authors have used oblique tows with bongo and wheeled bongo frames that sample the entire water column for both entrainment and source water because the intake structures for these plants were assumed to withdraw water from the entire water column. Power plants with intakes that withdraw water from a discrete depth in the water column may require the use of pumps or closing nets for entrainment sampling at discrete water depths where water withdrawal occurs. Hydrodynamic studies should be done to verify the intake flow field for sampling at discrete depths. The authors have not used pumps to sample inside power plant cooling water systems because of potential bias due to predation by biofouling organisms.
4. Determine appropriate sampling frequency based on species composition and important species that might have short spawning seasons. This could include adjusting sampling frequency seasonally based on presence of certain species. Sampling of entrainment can be done more frequently than source water sampling to provide more accurate estimates of length frequencies of entrained larvae and may also be desirable to provide more accurate estimates for calculating baseline conditions for compliance with new 316(b) rules.
5. These studies were generally conducted over a one-year period except in the case of DCPP where one of the strongest ENSO events of that century occurred during the first year of sampling. The relative effects of entrainment estimated by the ETM model should be much less subject to interannual variation than absolute estimates using FH, AEL or other demographic models. Therefore if source water sampling is done with entrainment sampling, one year is a reasonable period of sampling for these studies.
6. Use hydrodynamics of source waters to determine appropriate sampling area. In a closed system, this may be the entire source water. In an open system, ocean or tidal currents should be used to determine the appropriate sampling area for

estimating daily entrainment mortality (PE) for the larger source water population.

Ad hoc rule 1: Since PE is estimated as a daily mortality the sampling area should include the area potentially affected during a 24-hour period. This area is a pragmatic way to arrive at a first stage estimate of daily mortality and hence survival. The use of a current meter positioned near the intake but outside the influence of its flow allows the estimation of advection in the nearby source water. The current meter approach can be combined with estimates of larval dispersion (Largier 2003) for an understanding of the magnitude of source water population affected.

Ad hoc rule 2: The PE is applied to a larger source population that is potentially affected in the time period of a larval duration. (Another option would be to use the range of the stock.) In an open system, the estimation of P_M includes extrapolating the population of the sampling area to the larger source water population over a larval duration. It is difficult to say that the single current meter accurately reflects the advection of the source water population to the intake. In addition, a single current meter says very little about diffusion processes. Be sure that appropriate physical data are collected during the study to model hydrodynamics and determine size of source population.

7. The uncertainties associated with estimating larval durations and hydrodynamics used in estimating the size of the source water populations make estimating variance for ETM problematic. One approach the authors have used is to base the variance calculations solely on the sampling variances used in estimating the variance of PE. A similar approach would use the CV from the source water sampling (which includes both entrainment and source water data) to estimate the variance for ETM or use a Monte Carlo approach using the upper and lower confidence limit values for the PE values. These approaches have been considered because of the large unrealistic error terms derived using the Delta method that incorporates all of the multiple intercorrelated sources of error in the model.

Considerations for Sampling and Processing

1. The authors have used sample volumes of 30-60 m^3 per sample for these and other studies, but this volume should be adjusted for the larval concentrations in the source waters. The appropriate sample volume is best determined by preliminary sampling using the gear proposed for the study.
2. Be sure that mesh size used for net sampling is appropriate for taxa that might be the focus of detailed analysis. The authors have used 335 μm mesh nets because we have observed fish larvae being extruded through 505 μm mesh nets. Much smaller sized mesh would be needed to sample invertebrate larvae effectively.

3. Although the authors generally combine the subsamples from the two bongo nets for analysis, preserving one of them directly in 70-80 percent ethanol allows for genetic analyses to be conducted and analysis of otoliths to determine age and growth rates. Larval fishes are generally easier to identify when initially preserved in 5-10 percent formalin.
4. If aging using larval otoliths is not done, be sure that length frequencies measured from entrainment samples are realistic based on available life history. The authors applied general rules for using the length data for determining mean, minimum, and maximum ages but would recommend developing criteria based on the length frequency distribution for each species.
5. Be sure to account for egg stages that would be subject to entrainment if fish eggs are not sorted and identified from the samples.

Considerations for Analysis

1. Use multiple modeling approaches to validate results and provide additional data for determining effects at the adult population level.
2. Similar to the approach of using multiple models to provide additional data for determining effects at the adult population level, the ETM results can be converted into another currency using APF. This approach is probably most appropriate for scaling restoration projects that could be used to help offset losses due to entrainment.
3. Although FH and AEL models can be hindcast or extrapolated to the same age, they will not necessarily provide the same estimate unless the data used in the two models are derived from a life table assuming a stable age distribution.
4. FH and AEL are estimates of the number of adults at a specific age. To estimate the number of adult females in the population, N_F, the average fecundity, can be used instead of TLF. The AEL analog is extrapolation to all adult fish ages - AEL′. A comparison can be made using the relation AEL′=2N_F. This age of entry into the adult population may need to be adjusted to the average age of fishery catch if comparisons are being made with fishery data. The use of AEL and FH (Horst 1975 and Goodyear 1978), aligning at fishery age, is one method of estimating losses in terms of adult animals.
5. Another estimate would use production foregone or total biomass that would have been produced by entrained or impinged animals had they not been entrained or impinged (Rago 1984). Production foregone includes all biomass lost through all forms of mortality had the animals survived entrainment or impingement. This measure is most often used for forage species and represents ecosystem losses, for example, to other trophic levels. Age-1 equivalent loss is a measure similar to AEL and FH that is most commonly used for harvested species. The USEPA (2002) used age-1 equivalents to evaluate power plant losses

"because methods are unavailable for valuing fish eggs and larvae." They conservatively estimated fish landings value using the number of age-1 individuals, as the average fishery age is older in most cases. However, the USEPA believed the method may underestimate the true value of reducing impingement and entrainment because life history data were not available for most species. If survival rates from the age of entrainment until adulthood are accurate, FH and AEL underestimate the numbers of lost adults because they are extrapolated to a single age, for example, age of maturity in the case of FH. An improved approach to FH will be to use the average annual fecundity to estimate the equivalent number of females N_F removed from the standing stock of adults. Similarly, AEL can be extrapolated to all adult ages and summed to estimate the number of adult equivalents AEL′ and these measures can then be compared with fishery losses. However, the accuracy of these kinds of estimates is subject to the accuracy of the underlying survival and fecundity estimates.

6. Another estimate of the number of equivalent adults lost by larval entrainment is to use the mortality estimate from the ETM procedure and apply it to a survey of the standing stock. This accuracy of this estimate is subject to the accuracy of the estimate of the source population affected. This method may result in improvements when there is little confidence in survival estimates or when there is conjecture about compensatory processes that may negate the underlying models of AEL and FH.

Conclusion

As should be clear from this report, the authors feel that CWIS impacts are best evaluated using empirically based source water body information and the ETM model and not using demographic models based on life history information derived from various sources with varying, or unknown, levels of confidence. Although demographic models are useful for providing context for ETM estimates, there is no reason to base an assessment solely on demographic modeling results with the availability of approaches such as the ETM that provide estimates based on empirically derived estimates. In contrast to demographic models, uncertainty associated with ETM model estimates can be controlled through changes to the sampling design for the entrainment and source water sampling. The Energy Commission and CCC have all required the ETM approach in recent studies. Hopefully the information in this paper will assist others in the design and analysis of CWIS assessments that meet the requirements of both 316(b) and regulatory requirements of other agencies.

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APPENDIX A

VARIANCE EQUATIONS FOR IMPACT ASSESSMENT MODELS

A1. Fecundity Hindcasting (*FH*)

The variance of *FH* was approximated by the Delta method (Appendix E2) (Seber 1982):

$$Var(FH) = (FH)^2 \left[CV^2(E_T) + \sum_{j=1}^{n} CV^2(S_j) + CV^2(\bar{F}) + \left(\frac{Var(A_L) + Var(A_M)}{(A_L - A_m)^2} \right) \right]$$

where

CV(E_T)= CV of estimated entrainment,

CV(S_j) = CV of estimated survival of eggs and larvae up to entrainment,

CV($\bar{F}$) = CV of estimated average annual fecundity,

A_M = age at maturation, and

A_L = age at maturity.

The behavior of the estimator for *FH* appears log-linear, suggesting that an approximate confidence interval can be based on the assumptions that ln(*FH*) is normally distributed and uses the pivotal quantity

$$Z = \frac{\ln FH - \ln FH}{\sqrt{\frac{Var(FH)}{FH^2}}}.$$

A 90% confidence interval for *FH* was estimated by solving for *FH* and setting Z equal to +/-1.645, i.e.

$$FH \cdot e^{-1.645\sqrt{\frac{Var(FH)}{FH^2}}} \quad \text{to} \quad FH \cdot e^{+1.645\sqrt{\frac{Var(FH)}{FH^2}}}.$$

A2. Adult Equivalent Loss (*AEL*)

The *AEL* approach uses estimates of the abundance of entrained or impinged organisms to forecast the loss of equivalent numbers of adults. Starting with the number of age class *j* larvae entrained (E_j), it is conceptually easy to convert these numbers to an equivalent number of adults lost (*AEL*) at some specified age class from the formula:

$$AEL = \sum_{j=1}^{n} E_j S_j ,$$

where

n = number of age classes,
E_j = estimated number of larvae lost in age class j, and
S_j = survival rate for the jth age class to adulthood (Goodyear 1978).

Age-specific survival rates from larval stage to recruitment into the fishery (through juvenile and early adult stages) must be included in this assessment method. For some commercial species, survival rates are known for adults in the fishery; but for most species, age-specific larval survivorship has not been well described.

Survivorship to recruitment, to an adult age, was apportioned into several age stages, and *AEL* was calculated using the total entrainment as

$$AEL = E_T \prod_{j=1}^{n} S_j ,$$

where

n = number of age classes from entrainment to recruitment and
S_j = survival rate from the beginning to end of the jth age class.

The variance of *AEL* can be estimated using a Taylor series approximation (Delta method of Seber 1982) as

$$Var(AEL) = AEL^2 \left(CV^2(E_T) + \sum_{j=1}^{n} CV^2(S_j) \right).$$

A3. Proportional Entrainment and *ETM*

The Empirical Transport Model (*ETM*) calculations provide an estimate of the probability of mortality due to power plant entrainment. The values used in calculating proportional entrainment (*PE*) are population estimates based on the respective larval densities and volumes of the cooling water system flow and source water areas. On any one sampling day, the conditional entrainment mortality can be expressed as

$$PE_i = \frac{\text{abundance of entrained larvae}_i}{\text{abundance of larvae in source population}_i}$$
$$= \text{probability of entrainment in } i\text{th time period } (i = 1,\ldots,N).$$

In turn, the daily probability can be estimated and expressed as

$$PE_i = \frac{E_i}{R_i}$$

where

E_i = estimated abundance of larvae entrained in the ith time period $(i = 1,\ldots,N)$;

R_i = estimated abundance of larvae at risk of entrainment from the source population in the ith time period $(i = 1,\ldots,N)$.

The variance for the period estimate of *PE* can be expressed as

$$Var\left(PE_i\right) = Var\left(\frac{E_i}{R_i}\middle| E_i, R_i\right).$$

Assuming zero covariance between the entrainment and source and using the delta method (Seber 1982), the variance of an estimator formed from a quotient (like PE_i) can be effectively approximated by

$$Var\left(\frac{A}{B}\right) \approx Var(A)\left(\frac{\partial\left[\frac{A}{B}\right]}{\partial A}\right)^2 + Var(B)\left(\frac{\partial\left[\frac{A}{B}\right]}{\partial B}\right)^2.$$

The delta method approximation of $Var(PE_i)$ is shown as

$$Var\left(PE_i\right) = Var\left(\frac{E_i}{V_S \cdot \rho_{Si}}\right)$$

which by the Delta method can be approximated by

$$Var\left(PE_i\right) \approx Var\left(E_i\right)\left(\frac{1}{V_S \cdot \overline{\rho_{S_i}}}\right)^2 + Var\left(V_S \cdot \bar{\rho}_{S_i}\right)\left(\frac{-E_i}{V_S \cdot \left(\bar{\rho}_{S_i}\right)^2}\right)^2$$

and is equivalent to

$$= PE_i^2\left[CV\left(E_i\right)^2 + CV\left(V_S \cdot \bar{\rho}_{S_i}\right)^2\right]$$

where

$$R_i = V_S \cdot \overline{\rho}_{S_{ij}} \text{ and}$$

$$CV\left(\theta\right) = \frac{Var\left(\theta\right)}{\theta^2}.$$

APPENDIX B. Mean larval fish concentrations (larvae per 1000 m^3) by station for monthly surveys from February 2001 through January 2002 in San Diego Bay.

		Stations									
Taxon	**Common Name**	**SB1**	**SB2**	**SB3**	**SB4**	**SB5**	**SB6**	**SB7**	**SB8**	**SB9**	**Mean**
CIQ goby complex	gobies	2,095.9	1,549.6	2,391.7	2,914.0	3,003.0	4,109.9	3,995.8	2,743.1	2,400.4	**2,800.4**
Anchoa spp.	bay anchovies	556.5	476.4	231.4	159.6	938.9	1,327.7	1,042.7	520.4	73.3	**591.9**
Hypsoblennius spp.	combtooth blennies	27.2	45.7	140.8	81.6	210.8	84.6	575.7	94.4	453.6	**190.5**
Atherinopsidae	silversides	18.2	57.1	6.0	42.2	11.4	22.4	5.3	58.5	18.2	**26.6**
Syngnathus spp.	pipefishes	12.5	13.7	8.3	4.5	16.0	8.1	12.8	6.9	9.2	**10.2**
Gillichthys mirabilis	longjaw mudsucker	27.1	4.3	11.5	3.1	15.9	1.5	12.2	0.7	1.2	**8.6**
Engraulis mordax	northern anchovy	0.4	0.8	0.9	-	6.9	0.8	18.6	15.1	11.1	**6.1**
Hypsopsetta guttulata	diamond turbot	0.4	0.8	1.9	2.1	5.9	2.6	10.7	11.8	18.4	**6.1**
Acanthogobius flavimanus	yellowfin goby	2.4	3.5	0.6	12.0	2.9	15.1	1.0	1.9	2.0	**4.6**
Paralabrax spp.	sand basses	-	0.2	0.6	-	12.2	1.1	17.6	1.7	6.9	**4.5**
Labrisomidae	labrisomid kelpfishes	-	1.4	2.5	4.8	2.0	1.1	10.1	9.0	5.5	**4.0**
Genyonemus lineatus	white croaker	0.5	1.0	1.8	2.3	6.3	5.3	6.7	4.3	4.8	**3.7**
Sciaenidae	croakers	0.7	0.4	1.0	0.2	5.1	0.3	10.1	0.2	4.2	**2.5**
Cheilotrema saturnum	black croaker	0.2	0.3	0.5	0.8	4.1	3.0	3.9	0.8	3.8	**1.9**
Paralichthys californicus	California halibut	0.1	0.5	0.2	0.2	0.5	0.7	2.0	0.4	2.4	**0.8**
Gibbonsia spp.	clinid kelpfishes	-	-	0.2	1.8	0.8	0.5	-	0.7	0.8	**0.5**
Trachurus symmetricus	jack mackerel	-	-	-	-	-	-	-	-	3.5	**0.4**
Serranidae	sea basses	-	-	-	-	-	-	-	0.9	1.5	**0.3**
Lepidogobius lepidus	bay goby	0.1	-	0.3	0.4	0.2	-	0.5	0.2	0.4	**0.2**
Roncador stearnsi	spotfin croaker	-	-	0.4	-	0.6	-	0.4	0.4	0.2	**0.2**
Menticirrhus undulatus	California corbina	-	-	-	-	0.9	-	0.5	-	0.1	**0.2**
Citharichthys stigmaeus	speckled sanddab	-	-	-	0.4	-	-	-	0.2	1.0	**0.2**
Clupeiformes	herrings and anchovies	-	-	-	-	-	1.2	-	-	0.2	**0.2**
Odontopyxis trispinosa	pygmy poacher	0.3	-	-	0.6	-	0.3	-	-	0.2	**0.2**
Gobiesox spp.	clingfishes	0.2	-	-	0.3	-	-	-	0.6	-	**0.1**
Hippocampus ingens	Pacific seahorse	-	-	0.3	-	-	0.3	-	0.4	-	**0.1**
Clinocottus analis	wooly sculpin	-	-	-	-	-	-	0.7	-	0.2	**0.1**
Typhlogobius californiensis	blind goby	0.1	-	-	-	0.3	-	0.3	-	0.2	**0.1**
Strongylura exilis	California needlefish	0.9	-	-	-	-	-	-	-	-	**0.1**
Ruscarius creaseri	roughcheek sculpin	0.3	-	0.3	-	-	-	-	-	0.2	**0.1**
Leptocottus armatus	Pacific staghorn sculpin	-	-	-	0.2	-	-	0.3	0.3	-	**0.1**
Artedius spp.	sculpins	-	-	-	-	0.3	-	-	-	0.2	**0.1**
Hyporhamphus rosae	California halfbeak	0.4	0.2	-	-	-	-	-	-	-	**0.1**
Paralichthyidae	lefteye flounders & sanddabs	-	-	-	-	-	0.3	-	0.2	-	**0.1**
Cottidae	sculpins	-	-	-	-	0.2	-	-	0.2	-	**0.1**
Oligocottus spp.	sculpins	-	-	-	-	-	-	0.2	0.2	-	**0.1**
Pleuronichthys ritteri	spotted turbot	-	-	-	-	-	-	-	0.4	-	**0.1**
Atractoscion nobilis	white seabass	-	-	-	-	0.2	-	-	0.2	-	**<0.1**
Porichthys myriaster	specklefin midshipman	-	-	-	-	-	0.3	-	-	-	**<0.1**
Clupeidae	herrings	-	-	-	-	-	-	0.3	-	-	**<0.1**
Nannobrachium spp.	lanternfishes	-	-	-	-	-	-	0.2	-	-	**<0.1**
Gobiesox rhessodon	California clingfish	-	-	-	-	-	0.2	-	-	-	**<0.1**
Sebastes spp.	rockfishes	-	-	-	-	-	-	0.2	-	-	**<0.1**
Citharichthys spp.	sanddabs	-	-	-	-	-	-	-	-	0.2	**<0.1**
	Station Total	**2,744.3**	**2,155.7**	**2,801.3**	**3,231.0**	**4,245.4**	**5,587.0**	**5,728.8**	**3,474.2**	**3,024.3**	

APPENDIX C. Estimates of CIQ goby larvae at South Bay Power Plant entrainment and source water stations from monthly surveys conducted from February 2001 through January 2002 used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 2,275,244 m^3, and the volume of the source water used in calculating the source water population estimates was 149,612,092 m^3. The number of days that the larvae were exposed to entrainment was estimated at 22.86 days.

Survey Date	Entrainment Concentration (#/m^3)	Estimated Number Entrained	Source Water Concentration (#/m^3)	Estimated Number in the Source Water	*PE* Estimate	Days in Survey Period	Estimate of Source Water Population for Period	Proportion of Source Population for Period (*f*)	$=f_i(1-PE_i)^d$
28-Feb-01	2.143	4,877,000	5.712	8.546E+08	0.0057	41	3.504E+10	0.2165	0.1900
29-Mar-01	1.069	2,433,000	3.643	5.451E+08	0.0045	29	1.581E+10	0.0977	0.0882
17-Apr-01	1.997	4,544,000	2.794	4.180E+08	0.0109	19	7.942E+09	0.0491	0.0382
16-May-01	2.036	4,633,000	1.770	2.649E+08	0.0175	29	7.682E+09	0.0475	0.0317
14-Jun-01	3.747	8,525,000	2.311	3.458E+08	0.0247	29	1.003E+10	0.0620	0.0350
26-Jul-01	4.047	9,208,000	2.740	4.100E+08	0.0225	42	1.722E+10	0.1064	0.0633
23-Aug-01	0.648	1,475,000	2.609	3.904E+08	0.0038	28	1.093E+10	0.0675	0.0619
25-Sep-01	1.057	2,406,000	2.307	3.452E+08	0.0070	33	1.139E+10	0.0704	0.0600
23-Oct-01	1.254	2,852,000	2.553	3.820E+08	0.0075	28	1.070E+10	0.0661	0.0557
27-Nov-01	1.655	3,764,000	2.390	3.576E+08	0.0105	35	1.252E+10	0.0773	0.0607
20-Dec-01	1.861	4,233,000	2.745	4.107E+08	0.0103	23	9.446E+09	0.0584	0.0461
17-Jan-02	3.554	8,087,000	3.132	4.686E+08	0.0173	28	1.312E+10	0.0811	0.0545
				Average =	0.0118			P_M=	0.2147

APPENDIX D. Estimates of KGB rockfish larvae at MBPP entrainment and source water stations from monthly surveys conducted from January 2000 through December 2000 used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) and annual estimate of proportional mortality (P_M). The daily cooling water intake volume used in calculating the entrainment estimates was 1,619,190 m^3, and the volume of the source water used in calculating the source water population estimates was 15,686,663 m^3. Bay volume = 20,915,551 m^3. The larval duration used in the calculations was 11.28 days.

Survey Date	Estimated Number Entrained	Estimated Number in the Bay	Bay *PE*	Estimated Number in the Offshore Area	Offshore *PE*	Total *PE*	Source Water Population for Period	Proportion of Source Population for Period (*f*)	$=f_i(1-PE_iP_S)^d$
17-Jan-00	5,500	17,800	0.3097	0	–	0.3097	17,800	0.0099	0.0073
28-Feb-00	2,180	20,700	0.1052	22,100	0.0988	0.0509	42,800	0.0239	0.0227
27-Mar-00	0	6,550	–	186,000	–	–	192,000	0.1076	0.1076
24-Apr-00	38,100	715,000	0.0533	576,000	0.0661	0.0295	1,291,000	0.7218	0.7010
15-May-00	4,460	11,800	0.3785	202,000	0.0220	0.0208	214,000	0.1197	0.1173
12-Jun-00	0	14,900	–	15,000	–	–	30,300	0.0169	0.0169
10-Jul-00	0	0	–	0	–	–	0	–	–
8-Aug-00	0	0	–	0	–	–	0	–	–
5-Sep-00	0	0	–	0	–	–	0	–	–
2-Oct-00	0	0	–	0	–	–	0	–	–
27-Nov-00	0	0	–	0	–	–	0	–	–
18-Dec-00	0	0	–	0	–	–	0	–	–
			$\bar{x}$ = 0.0705		$\bar{x}$ = 0.0156	$\bar{x}$ = 0.0342			P_M = 0.0271

APPENDIX E. Estimates used in calculating empirical transport model (*ETM*) estimates of proportional entrainment (*PE*) for kelp, gopher, and black-and-yellow (KGB) rockfish complex for Diablo Canyon Power Plant. Entrainment estimates and estimates from the nearshore sampling area from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999. The daily cooling water intake volume used in calculating the entrainment estimates was 9,312,114 m^3, and the volume of the sampled source water used in calculating the nearshore population estimates was 1,738,817,356 m^3. The larval duration used in the calculations was 16.4 days.

A) July 1997 – June 1998

Survey Date	Start Date Based on Larval Duration	Estimated Number Entrained	Entrainment Std. Error	Estimated Population in Nearshore Sampling Area	Nearshore Population Std. Error	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-97	5-Jul-97	2,770	2,770	258,000	255,000	0.0107	0.0151	0.0004	0.0004
25-Aug-97	9-Aug-97	0	–	0	–	–	–	–	–
29-Sep-97	13-Sep-97	0	–	0	–	–	–	–	–
20-Oct-97	4-Oct-97	0	–	0	–	–	–	–	–
17-Nov-97	1-Nov-97	0	–	0	–	–	–	–	–
10-Dec-97	24-Nov-97	0	–	216,000	216,000	–	–	0.0003	0.0003
22-Jan-98	6-Jan-98	6,280	6,280	7,775,000	3,345,000	0.0008	0.0009	0.0121	0.0053
26-Feb-98	10-Feb-98	23,900	13,900	11,534,000	2,267,000	0.0021	0.0013	0.0180	0.0038
18-Mar-98	2-Mar-98	1,051,000	503,000	17,903,000	2,903,000	0.0587	0.0297	0.0279	0.0050
15-Apr-98	30-Mar-98	847,000	376,000	111,247,000	12,360,000	0.0076	0.0035	0.1732	0.0214
18-May-98	2-May-98	1,468,000	288,000	409,996,000	51,937,000	0.0036	0.0008	0.6384	0.0334
8-Jun-98	23-May-98	2,940,000	622,000	83,336,000	9,213,000	0.0353	0.0084	0.1297	0.0165
					Mean =	0.0167	Sum =	1.0000	

B) July 1998 – June 1999

Survey Date	Start Date Based on Larval Duration	Estimated Number Entrained	Entrainment Std. Error	Estimated Population in Nearshore Sampling Area	Nearshore Population Std. Error	PE_i	PE_i Std. Error	f_i	f_i Std. Error
21-Jul-98	5-Jul-98	7,000	7,000	2,118,000	636,000	0.0033	0.0035	0.0035	0.0011
26-Aug-98	10-Aug-98	0	–	0	–	–	–	–	–
16-Sep-98	31-Aug-98	0	–	0	–	–	–	–	–
6-Oct-98	20-Sep-98	0	–	0	–	–	–	–	–
11-Nov-98	26-Oct-98	0	–	0	–	–	–	–	–
9-Dec-98	23-Nov-98	0	–	0	–	–	–	–	–
12-Jan-99	27-Dec-98	0	–	14,709,000	3,038,000	–	–	0.0240	0.0053
3-Feb-99	18-Jan-99	6,830	6,830	14,905,000	2,462,000	0.0005	0.0005	0.0243	0.0045
17-Mar-99	1-Mar-99	1,621,000	967,000	49,607,000	5,491,000	0.0327	0.0198	0.0809	0.0108
14-Apr-99	29-Mar-99	1,601,000	825,000	116,783,000	22,089,000	0.0137	0.0075	0.1906	0.0328
24-May-99	8-May-99	4,168,000	868,000	363,131,000	33,925,000	0.0115	0.0026	0.5926	0.0456
23-Jun-99	7-Jun-99	877,000	287,000	51,558,000	33,815,000	0.0170	0.0125	0.0841	0.0509
					Mean =	0.0131	Sum =	1.0000	

APPENDIX F. Regression estimates, onshore and alongshore current meter displacement, source water estimates, and estimates of the proportion of source water sampled (P_S) from monthly surveys conducted for two periods A) July 1997 through June 1998, and B) July 1998 through June 1999 for kelp, gopher, and black-and-yellow (KGB) rockfish complex at the Diablo Canyon Power Plant. The common slope used in calculating source water estimates was 0.000117 for the 1997-1998 period and -0.000367 for the 1998-1999 period. The ratio of the length of the nearshore sampling area (17,373 m) to the alongshore current displacement was used to calculate P_S for each survey (alongshore P_S). The regression coefficients and onshore and alongshore current displacement were used to calculate an estimate of the population in the source water for each survey. The ratio of the estimated population in the nearshore sampling area to the estimated population in the source water was used to calculate an estimate of P_S for each survey (offshore P_S).

A) July 1997 - June 1998

Survey Date	Y-Intercept	X-Intercept	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Extrapolated Number Beyond Nearshore Sampling Area	Total Extrapolated Offshore Source Population	Total Extrapolated Alongshore Source Population	Offshore P_S	Alongshore P_S
21-Jul-97	-0.171	1,460	31,300	4,820	4,820	16,382,000	16,848,234	466,000	0.0153	0.5545
25-Aug-97	–	–	–	–	–	–	0	0	–	–
29-Sep-97	–	–	–	–	–	–	0	0	–	–
20-Oct-97	–	–	–	–	–	–	0	0	–	–
17-Nov-97	–	–	–	–	–	–	0	0	–	–
10-Dec-97	-0.172	1,470	146,000	31,600	31,600	7,772,826,000	7,774,642,009	1,816,000	<0.0001	0.1189
22-Jan-98	-0.015	125	120,000	23,400	23,400	3,753,412,000	3,807,288,976	53,877,000	0.0020	0.1443
26-Feb-98	0.064	-545	33,700	8,710	8,710	144,140,000	166,528,437	22,388,000	0.0693	0.5152
18-Mar-98	0.165	-1,410	181,000	12,400	12,400	1,801,789,000	1,988,251,728	186,463,000	0.0090	0.0960
15-Apr-98	2.115	-18,000	76,100	12,800	12,800	2,264,580,000	2,752,044,506	487,464,000	0.0404	0.2282
18-May-98	8.127	-69,400	67,100	19,900	19,900	10,706,927,000	12,290,666,879	1,583,740,000	0.0334	0.2589
8-Jun-98	1.376	-11,700	111,000	5,670	5,670	559,792,000	1,094,442,999	534,651,000	0.0761	0.1559
								Mean =	0.0307	0.2590

B) July 1998 - June 1999

Survey Date	Y-Intercept	X-Intercept	Cumulative Alongshore Displacement (m)	Onshore Current Displacement (m)	Estimated Offshore Extent of Source Water (m)	Extrapolated Number Beyond Nearshore Sampling Area	Total Extrapolated Offshore Source Population	Total Extrapolated Alongshore Source Population	Offshore P_S	Alongshore P_S
21-Jul-98	0.596	1,620	76,300	11,100	3,010	0	9,299,000	9,299,000	0.2278	0.2278
26-Aug-98	–	–	–	–	–	–	0	0	–	–
16-Sep-98	–	–	–	–	–	–	0	0	–	–
6-Oct-98	–	–	–	–	–	–	0	0	–	–
11-Nov-98	–	–	–	–	–	–	0	0	–	–
9-Dec-98	–	–	–	–	–	–	0	0	–	–
12-Jan-99	0.859	2,340	46,200	24,100	3,010	0	39,166,000	39,166,000	0.3755	0.3755
3-Feb-99	0.859	2,340	81,900	19,700	3,010	0	70,254,000	70,254,000	0.2122	0.2122
17-Mar-99	1.529	4,169	36,900	8,540	4,170	9,113,397	114,452,000	105,339,000	0.4334	0.4709
14-Apr-99	2.936	8,003	163,000	10,200	8,000	744,108,728	1,837,168,000	1,093,059,000	0.0636	0.1068
24-May-99	7.716	21,036	180,000	21,800	21,000	10,709,111,477	14,464,376,000	3,755,264,000	0.0251	0.0967
23-Jun-99	1.605	4,376	158,000	5,970	4,380	54,169,916	522,822,000	468,652,000	0.0986	0.1100
								Mean =	0.2052	0.2286

05 August 2105

Tshwane

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Our Ref: J27035/ J31314

Your Ref: Email received 07 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE NUCLEAR 1

RESPONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT
APPENDIX E 10, Section 2.3.3, p.68 – 72 AIR QUALITY SPECIALIST REPORT

Response compiled by H.Thorpe and submitted on behalf of the St Francis Bay Residents'Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

1. Introduction
The direction and strength of the wind in the area around Thyspunt is one of the key factors in determining the viability or otherwise of the site. As such it should have been the subject of its own special report. The fact that it has been relegated to a mere four pages, in an obscure place in a report which is ostensibly on air quality, indicates how inadequately this issue has been addressed.

Whilst a decision on this is the responsibility of the National Nuclear Regulator, they will undoubtedly be influenced by the specialist reports which have been produced for the ROD in the EIA. It is therefore imperative that the Air Quality Report, which addresses these matters, is scrupulously accurate; is based on verifiable evidence; and draws the correct conclusions.

In the event, the quality of this section of the air quality report is so poor as to suggest that there is a deliberate conspiracy to camouflage what is in fact a threat to the whole project.

2. Wind direction & speed
Wind direction and speed are critical considerations. They affect the extent to which radio-nuclides released from the site, whether routinely or accidentally, travel overland or out to sea; the impact which this could have on the safety of persons and properties; and what the implications are in terms of viability of the site. It is a fundamental issue.

The Air Quality Report begins by repeating Eskom's confident assertion, based on a report from 1987, that "it is clear that the most dominant wind direction in this region is from the west northwest to northwest." No evidence is given for this view, which is pure fiction. If it were correct, it would mean

that most releases of radio-nuclides from Thyspunt, whether routine or accidental, would be blown out to sea.

The most conclusive evidence of the prevailing wind direction at Thyspunt is the by-pass headland dunefield (one of three in the area), from Thysbaai, next to Thyspunt. This runs overland from south west to north east and directly to Sea Vista Township and St Francis Bay. This is clearly visible from aerial photographs of the area, and in figures published in the report, such as fig 10.1a of the Transportation Specialist Study. It reflects a high-energy prevailing wind which has blown for centuries, if not millennia, and has blown sand overland for 12 kilometers before re-joining the sea at St Francis Bay, to the east of the headland.

The region surrounding Thyspunt has one of the highest wind energy capacities in the country, hence the proliferation of applications for wind farms in the immediate vicinity.

The reality at Thyspunt is that the prevailing wind is from the west to southwest; that it is frequently experienced in the area; that it is a high-energy wind; and that it blows directly towards either Cape St Francis or Sea Vista township and St Francis Bay, which are between 11 & 12 kilometers away. The implication of this is that, in the event of an accidental nuclear release while the prevailing wind was blowing at the claimed average of 5.8 m/sec (21 kph), the communities of Rebelsrus, Mostert's Hoek, Cape St Francis, Sea Vista Township and St Francis Bay, stretching over 10 kilometers of coastline would have 30 minutes to evacuate, down one escape route, which would in any case be cut by the nuclear cloud. At times the wind speed is anything up to five times this average. The wind direction & strength have a direct bearing on the viability of the Thyspunt site.

It is inexplicable that there is no reference whatsoever to the by-pass headland dunefields in the Air Quality Report, which depends instead for its conclusions on evidence supplied by Eskom, and short-term measurements conducted in the area. This despite the fact that it has been raised as an issue in every submission and at every stakeholder's & public meeting held to-date. The fact that it has not been considered at all by the specialist indicates either negligence, in the form of failure to consider issues raised by I&APs, or a deliberate attempt to mislead the responsible authority.

It is, of course, in Eskom's interest to state that the prevailing wind is north westerly, as this would safeguard the viability of the site.

3. The Air Quality Report

This crucial issue is dealt with in some four pages of the Air Quality Report (Report E10, p. 68 – 72).

We believe that it is deficient in a number of respects:

I. It begins with an acknowledgement that measurements taken on site are not sufficient for any long-term analysis, and mentions an attempt from December, 1986 to September 1989, which led to limited data recovery due to vandalism of equipment. According to the report, the best data was taken from the period January to September, 1987. This excluded the period October to December, which is locally acknowledged to be the windiest period of the year. This is clearly far too short a period of time to draw any conclusions.

II. Eskom's claim that the prevailing wind is north westerly is contradicted by the evidence of the by-pass headland dunefield in the area, and by all the evidence supplied. None of the wind roses displayed in figs 2-25 – 2-27 or Table 2-23 support this conclusion. Indeed the report itself conceded that the 21 month survey at Thyspunt indicated westerly, rather than north-westerly winds at Thyspunt.

III. Despite this, the report does nothing to refute the confident assertion regarding the predominant north westerly direction of the wind.

4. Conclusion

This report is typical of this EIA, in which everything is presented in a way which favours a successful application for an ROD. It is sufficiently misleading to justify a formal complaint to the DEA and even prosecution, and undermines confidence in the entire EIA process.

The most reliable recent data comes from a wind mast placed east of Oyster Bay by the CSIR as part of the current S.A.Wind Generation Programme. This has only been in operation for some 9 months, but details are available from the CSIR website, wasadata.csir.co.za. It is not known whether this is the information referred to in the Air Quality Report. It will clearly confirm that the prevailing wind is west to south west, and not west north west to north, as alleged by Eskom.

We request that this component of the Air Quality Report be rejected, and that the EAP be censured for allowing this inaccurate and fundamental information to remain in the report without being challenged.

We also demand an explanation from the EAP as to why the input from the local community has been completely ignored in this important component of the report.

Response 1:

Your comments as well as all other comments in this regard have been noted and documented (Please see the Issues and Response Report attached as Appendix E8 to the Revised Draft EIR). Please find an official response from the Air Quality specialist, Dr. Lucian Burger attached.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

1.1.1
1.1.2AIRSHED PLANNING PROFESSIONALS (Pty)
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Our Ref: AG/06/02_pn 11/01 Your Ref:

23 AUGUST 2011

ARCUS GIBB (Pty) Ltd
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Rivonia
2128

Attention: Ms J-M Ball

Subject: THYSPUNT ALLIANCE NUCLEAR 1: RESPONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT APPENDIX E 10

This memorandum provides comments to:

> THYSPUNT ALLIANCE NUCLEAR 1: RESPONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT APPENDIX E 10, Section 2.3.3, p.68 – 72 AIR QUALITY SPECIALIST REPORT by H.Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

The above-mentioned document has been referred to as the *RESPONSE* in the discussion below.

General Comment

It would appear that main contention in the *RESPONSE* is the reference and discussion in the Air Quality Report of the wind data collected and analysed by Eskom during an early monitoring campaign (1987). The *RESPONSE* claim that this data portrays a picture that is meant to mislead the reader into believing that the prevailing wind at the proposed site is from the west-north-western and the western sectors, which according to the *RESPONSE*, carries air pollutants over the ocean and away from residential areas such St. Francis Bay, Cape St Francis, Rebelsrus, Mostert's Hoek amd Sea Vista Township.

As a result and in conclusion, the *RESPONSE* request that "…*this component of the Air Quality Report be rejected, and that the EAP be censured for allowing this inaccurate and fundamental information to remain in the report without being challenged.*"

As will be shown below,

- the reference to the Eskom historical data was included as part of a summary of available wind data at the time of the investigation, which also included data from a weather station located on the proposed Thyspunt Site and the South African Weather Services' station located in Cape St. Francis;
- that the conclusion reached from the Eskom data, as far as that particular dataset is concerned, is correct; and supporting figures from their report was included in this response;
- that the conclusions reached in the discussions with regards to the Thyspunt data do not contradict the *RESPONSE*'s comments, and especially confirms the movement of the headland-bypass dune-fields;
- that the Eskom data was not used to quantify any of the predicted air pollution impacts;
- that the hourly-averaged data, collected over a 21-month period on the proposed Thyspunt site, was used to conduct the dispersion calculations, which were reported in the study; and
- that, unless it is still strongly felt to confuse the reader of the Air Quality Report, there should be no reason to remove the discussion of the old Eskom dataset.

Comments on the RESPONSE

In order to address all the concerns, more detailed comments have been below given for each paragraph of the *RESPONSE*, as numbered below.

Introduction

1) *The direction and strength of the wind in the area around Thyspunt is one of the key factors in determining the viability or otherwise of the site. As such it should have been the subject of its own special report. The fact that it has been relegated to a mere four pages, in an obscure place in a report which is ostensibly on air quality, indicates how inadequately this issue has been addressed.*

   The Air Quality Report states (Section 2.3.3) that the dispersion of air pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The influence of wind speed on the dispersion of air pollutants is significantly non-linear and is therefore best described through the use of dispersion models and not only through a qualitative description of the wind patterns as depicted by wind roses. An analysis of wind roses provides an indication of the area of most impact (i.e. likelihood), but not necessarily the magnitude. For instance, releases near ground level would result in high ground level concentrations during calm wind conditions at night, whereas the same atmospheric conditions in the case of elevated releases would result in the lowest ground level concentrations. It is therefore also important to consider the wind speed, atmospheric stability and release height together with the wind direction when qualitatively estimating the area of impact. These concepts were also discussed in the Air Quality Report (Section 2.3.2). So, although the *RESPONSE* indicates that only four pages were dedicated to the direction and the strength of the wind, a significant portion of the Air Quality Report discusses the more important result of the assessment, i.e. the predicted ground level concentration patterns, which take into account a number of

meteorological parameters in addition to wind speed and direction. A discussion of the latter two parameters alone cannot provide adequate information on the behaviour of the atmospheric dispersion.

2) *Whilst a decision on this is the responsibility of the National Nuclear Regulator, they will undoubtedly be influenced by the specialist reports which have been produced for the ROD in the EIA. It is therefore imperative that the Air Quality Report, which addresses these matters, is scrupulously accurate; is based on verifiable evidence; and draws the correct conclusions.*

It is important to source information that would be useful and essential for the prediction of air pollution impacts. The three sources of meteorological data available at the time of the assessment included

- Eskom meteorological stations located at four sites in the vicinity of Thyspunt, namely De Hoek, Thyspunt, Klippepunt, and Brakkeduine (December 1986 to September 1988).
- The South African Weather Services' weather station located at Cape St. Francis. Data collection started in 2004.
- Onsite station which consists of a 10 m mast, fully equipped with meteorological instrumentation to measure the wind vector, air temperature, relative humidity, barometric pressure and rainfall. Data have been collected since 10 January 2008.

The reference to the Eskom measurements was included merely to provide background discussion on the historical information. These measurements were not used in any of the calculations. The atmospheric dispersion modelling was done using the onsite data for the period January 2008 to September 2009. The results included the simulations for every hour of this period and therefore considered actual measurements of the meteorological parameters experienced on the site. The results included in the Air Quality Report therefore did not rely on speculation of impacts due to a discussion of specific wind directions based on wind roses, but were based on actual measurements of all meteorological parameters.

The results which the National Nuclear Regulator would be reviewing are therefore based on the onsite information available at the time of the assessment. In any event, the National Nuclear Regulator follows a very rigorous procedure, in line with the International Atomic Energy Agency, which requires continually updating onsite information and syntheses of these (including onsite meteorological data and dispersion modelling).

3) *In the event, the quality of this section of the air quality report is so poor as to suggest that there is a deliberate conspiracy to camouflage what is in fact a threat to the whole project.*

There is no deliberate conspiracy to camouflage the information as started in the *RESPONSE*. Subsection 2.3.3 contains a general description of al the meteorological parameters that influence atmospheric dispersion. As explained previously, wind speed and direction constitute only two components of the overall atmospheric dispersion process. The section was not meant to provide results on the ground level concentrations, but merely some significant meteorological observations. The actual predicted impact is described by the calculated dispersion patterns which are given elsewhere in the report.

The *RESPONSE* focuses on the description of the Eskom wind direction results, which were in any event not used in the dispersion calculations. In the same section (Subsection 2.3.3 (c)(i)), the results from the observations at Thyspunt are discussed. It clearly states that "….*westerly winds dominate, with approximately 20.5% occurrences during the period. This wind direction also experiences the highest frequency of strong winds, i.e. winds in excess 10 m/s occurring 1.5% of the year. Winds in excess of 15 m/s occur 0.1% of the period. Strong winds in excess of 15 m/s also occur from the west-south-west (~0.03%) and south-west (~0.02%). Winds from the north-north-east to northerly sector are on average the lowest (~3.9 m/s), compared to the average of 6.2 m/s from the east-north-east and eastern sector, and 5.8 m/s from the west-south-west to western sector.*"

It continues in the next paragraph with "*…the western wind component is prevalent during all four seasons (Figure 2-23). However, the eastern wind component is more prevalent during spring and summer. The frequency of strong westerly winds increases during winter months (July to August). Winter also witnesses an increased amount of wind from the west-north-west.*"

These observations were also compared to the Cape St. Francis measurements; and the similarities and differences shown in comparative wind roses and discussed accordingly.

Wind direction & speed

4) *Wind direction and speed are critical considerations. They affect the extent to which radio-nuclides released from the site, whether routinely or accidentally, travel overland or out to sea; the impact which this could have on the safety of persons and properties; and what the implications are in terms of viability of the site. It is a fundamental issue.*

We agree with this, as also discussed in the Air Quality Report. The dispersion calculations have to take all meteorological parameters into account.

5) *The Air Quality Report begins by repeating Eskom's confident assertion, based on a report from 1987, that "it is clear that the most dominant wind direction in this region is from the west northwest to northwest." No evidence is given for this view, which is pure fiction.*

The historical dataset produced by Eskom is given in Figure A (summer) and B (winter) below (originally contained in the *EIA Inception Report*). The figures indicate that the most dominant wind direction measured was from the west northwest to northwest.

The figures further illustrate the differences between the day and night-time conditions, with the latter observing increased winds from the northwest and north-northwest, indicating the land-sea breeze interactions expected at a coastal site.

6) *If it were correct, it would mean that most releases of radio-nuclides from Thyspunt, whether routine or accidental, would be blown out to sea.*

If the calculations were based on the Eskom measurements, the long-term patterns may well be towards the southeast. However, as stated before, the dispersion calculations were based on measurements at Thyspunt and not these observations.

7) *The most conclusive evidence of the prevailing wind direction at Thyspunt is the by-pass headland dunefield (one of three in the area), from Thysbaai, next to Thyspunt. This runs overland from south west to north east, and directly to Sea Vista Township and St Francis Bay. This is clearly visible from aerial photographs of the area, and in figures published in the report, such as fig 10.1a of the Transportation Specialist Study. It reflects a high-energy prevailing wind which has blown for centuries, if not millennia, and has*

blown sand overland for 12 kilometres before re-joining the sea at St Francis Bay, to the east of the headland.

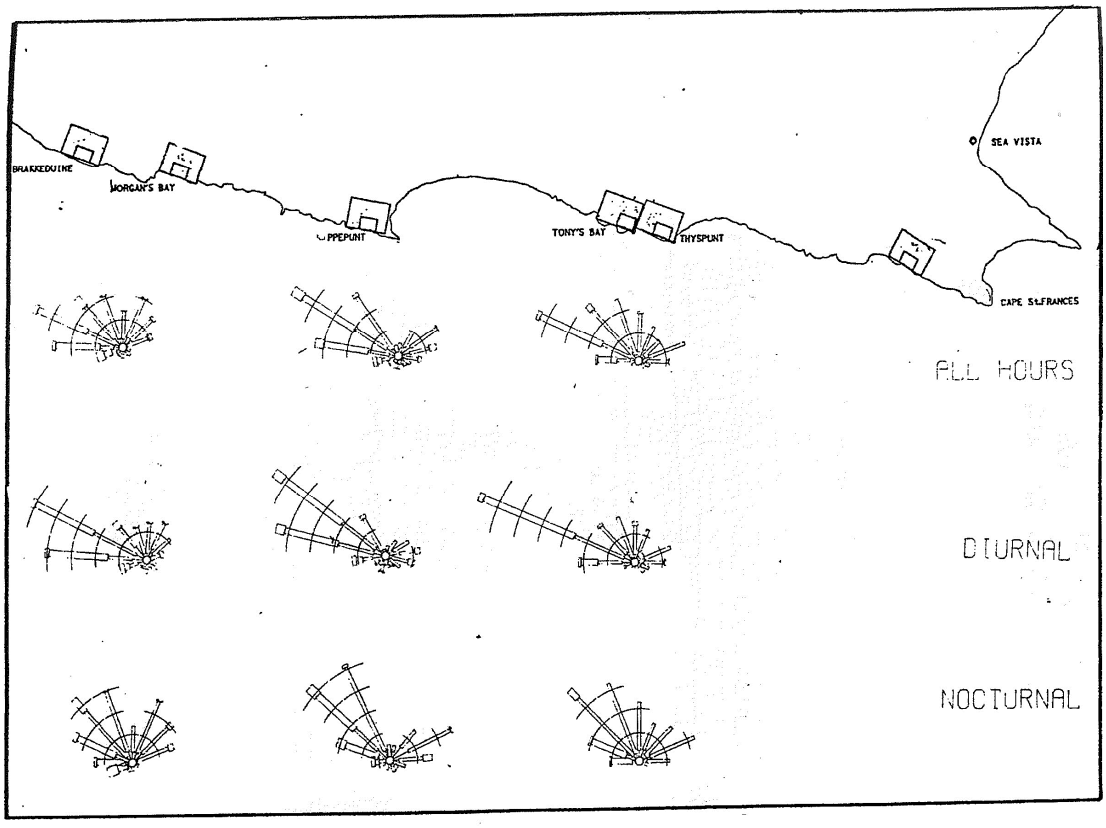

Figure A: Wind roses for summer conditions (Eskom January 1987)

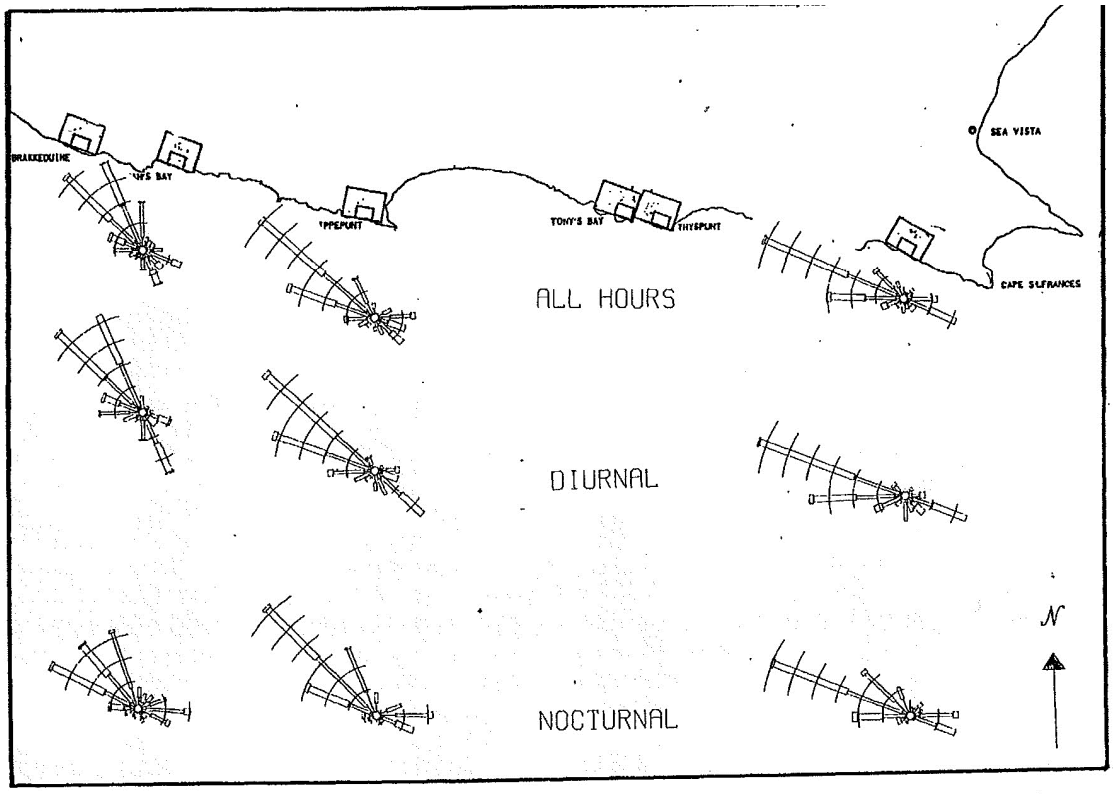

Figure B: Wind roses for summer conditions (Eskom, July 1987)

As shown in Figure C, the wind observations at Thyspunt indicate a dominant westerly wind, followed by a north-north-westerly. However, the dominant **strong** wind conditions occur mostly from the west, west-south-west, east and east-north-east. These are also reflected in the South African Weather Services' observations at Cape St. Francis. Dune movement are influenced by these strong winds (typically above 6 m/s) and supports the wind measurements at Thyspunt.

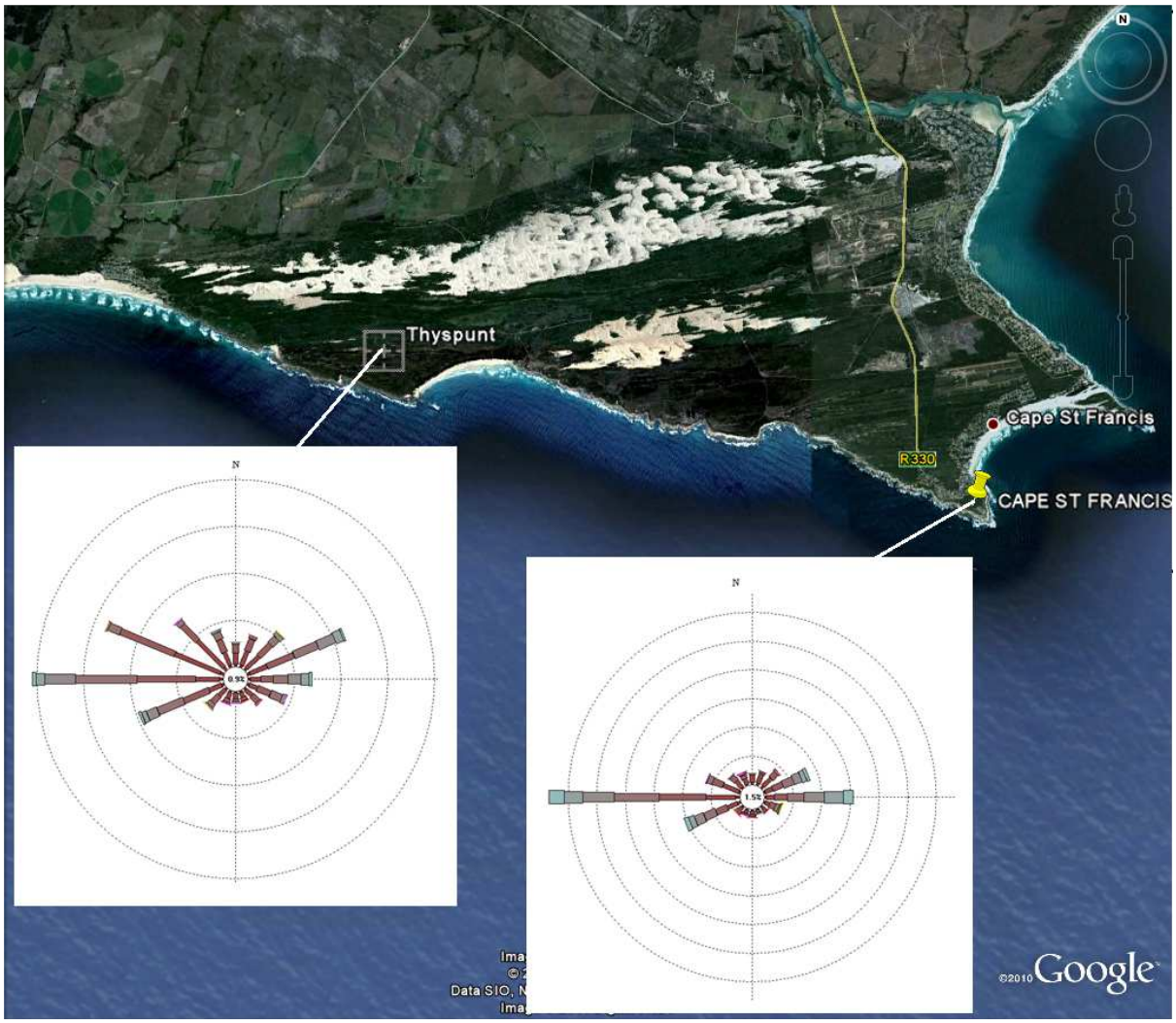

Figure C: Wind roses for Thyspunt and Cape St. Francis, also showing the headland-bypass dune-fields

8) *The region surrounding Thyspunt has one of the highest wind energy capacities in the country, hence the proliferation of applications for wind farms in the immediate vicinity.*

This is correct and the statement made in the *RESPONSE* is confirmed by the very low incidence of calm wind conditions, which is less than 1%.

9) *The reality at Thyspunt is that the prevailing wind is from the west to southwest; that it is frequently experienced in the area; that it is a high-energy wind; and that it blows directly towards either Cape St Francis or Sea Vista township and St Francis Bay, which are between 11 & 12 kilometres away. The implication of this is that, in the event of an accidental nuclear release while the prevailing wind was blowing at the claimed average*

of 5.8 m/sec (21 kph), the communities of Rebelsrus, Mostert's Hoek, Cape St Francis, Sea Vista Township and St Francis Bay, stretching over 10 kilometres of coastline would have 30 minutes to evacuate, down one escape route, which would in any case be cut by the nuclear cloud. At times the wind speed is anything up to five times this average. The wind direction & strength have a direct bearing on the viability of the Thyspunt site.

The predicted dispersion patterns, as shown in the Air Quality Report (Figures 3-30 to 3-23), were based on the observed hourly average meteorological measurements for a 21-month period at Thyspunt. It should be noted that improved dilution occurs under strong wind conditions. The calculations to determine the worst-case concentrations during accidental releases considered all meteorological combinations based on these measurements.

10) *It is inexplicable that there is no reference whatsoever to the by-pass headland dunefields in the Air Quality Report, which depends instead for its conclusions on evidence supplied by Eskom, and short-term measurements conducted in the area. This despite the fact that it has been raised as an issue in every submission and at every stakeholders' & public meeting held to-date. The fact that it has not been considered at all by the specialist indicates either negligence, in the form of failure to consider issues raised by I&APs, or a deliberate attempt to mislead the responsible authority.*

The conclusions of the study were not based on the Eskom data. The conclusions were reached using onsite data. The predicted dispersion patterns, as shown in the report (Figures 3-30 to 3-23), were based on the observed hourly average meteorological measurements for a 21-month period at Thyspunt. It should be noted that improved dilution occurs under strong wind conditions. The calculations to determine the worst-case concentrations during accidental releases considered all meteorological combinations based on these measurements.

11) *It is, of course, in Eskom's interest to state that the prevailing wind is north westerly, as this would safeguard the viability of the site.*

Refer to item 3 above.

<u>The Air Quality Report</u>

12) *This crucial issue is dealt with in some four pages of the Air Quality Report (Report E10, p. 68 – 72). We believe that it is deficient in a number of respects: i) It begins with an acknowledgement that measurements taken on site are not sufficient for any long-term analysis, and mentions an attempt from December, 1986 to September 1989, which led to limited data recovery due to vandalism of equipment. According to the report, the best data was taken from the period January to September, 1987. This excluded the period October to December, which is locally acknowledged to be the windiest period of the year. This is clearly far too short a period of time to draw any conclusions. ii) Eskom's claim that the prevailing wind is north westerly is contradicted by the evidence of the by-pass headland dunefield in the area, and by all the evidence supplied. None of the wind roses displayed in figs 2-25 – 2-27 or Table 2-23 support this conclusion. Indeed the report itself conceded that the 21 month Survey at Thyspunt indicated westerly, rather than north-westerly winds at Thyspunt. iii) Despite this, the report does nothing to refute the confident assertion regarding the predominant north westerly direction of the wind.*

Refer to item 3 above.

<u>Conclusion</u>

13) *This report is typical of this EIA, in which everything is presented in a way which favours a successful application for an ROD. It is sufficiently misleading to justify a formal complaint to the DEA and even prosecution, and undermines confidence in the entire EIA process.*

The basis for claiming that the Air Quality Report is misleading is not correct. All calculations were done on the measured data at the proposed Thyspunt site. There was also no attempt made to "camouflage" any data or results, as implied by the *RESPONSE*.

14) *The most reliable recent data comes from a wind mast placed east of Oyster Bay by the CSIR as part of the current S.A.Wind Generation Programme. This has only been in operation for some 9 months, but details are available from the CSIR website, wasadata.csir.co.za. It is not known whether this is the information referred to in the Air Quality Report. It will clearly confirm that the prevailing wind is west to south west, and not west north west to north, as alleged by Eskom.to the DEA and even prosecution, and undermines confidence in the entire EIA process.*

The meteorological data recorded at the Thyspunt weather station is considered adequate for the purposes of the assessment. It is not clear why the data generated at the CSIR wind mast should be considered more reliable. The mast is located more than 6.5 km inland and approximately 20 km northwest of the site. In spite of this, the latter dataset was not available for any comparison since monitoring only commenced after the assessment was completed.

15) *We request that this component of the Air Quality Report be rejected, and that the EAP be censured for allowing this inaccurate and fundamental information to remain in the report without being challenged.*

It is with regret that the *RESPONSE* may have misinterpreted the information given in the Air Quality Report. The Eskom information was provided as background only and was not used in any of the calculations. The prevalence of north-north-westerly winds is clearly shown in the Eskom results, as provided in Figures A and B (Item 5, above). The Air Quality Report merely stated this observation from these set of results. Its inclusion or exclusion from the report does not change any of the results.

All calculations were based on onsite measurements at the proposed Thyspunt site. The Air Quality Report also illustrated and discussed the similarities and differences between the observations made the Thyspunt weather station and Cape St Francis.

I trust that the views expressed will be taken in good faith.

Yours sincerely,

Dr L W Burger

Managing Director

05 August 2015

Tshwane

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Our Ref: J27035/ J31314

Your Ref: Email received 07 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE NUCLEAR 1

RESPONSE TO SECOND DRAFT ENVIRONMENTAL IMPACT REPORT
APPENDIX E 10, Section 2.3.3, p.68 – 72 AIR QUALITY SPECIALIST REPORT

Response compiled by H.Thorpe and submitted on behalf of the St Francis Bay Residents'Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

1. Introduction
The direction and strength of the wind in the area around Thyspunt is one of the key factors in determining the viability or otherwise of the site. As such it should have been the subject of its own special report. The fact that it has been relegated to a mere four pages, in an obscure place in a report which is ostensibly on air quality, indicates how inadequately this issue has been addressed.

Whilst a decision on this is the responsibility of the National Nuclear Regulator, they will undoubtedly be influenced by the specialist reports which have been produced for the ROD in the EIA. It is therefore imperative that the Air Quality Report, which addresses these matters, is scrupulously accurate; is based on verifiable evidence; and draws the correct conclusions.

In the event, the quality of this section of the air quality report is so poor as to suggest that there is a deliberate conspiracy to camouflage what is in fact a threat to the whole project.

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Wind direction and speed are critical considerations. They affect the extent to which radio-nuclides released from the site, whether routinely or accidentally, travel overland or out to sea; the impact which this could have on the safety of persons and properties; and what the implications are in terms of viability of the site. It is a fundamental issue.

The Air Quality Report begins by repeating Eskom's confident assertion, based on a report from 1987, that "it is clear that the most dominant wind direction in this region is from the west northwest to northwest." No evidence is given for this view, which is pure fiction. If it were correct, it would mean

that most releases of radio-nuclides from Thyspunt, whether routine or accidental, would be blown out to sea.

The most conclusive evidence of the prevailing wind direction at Thyspunt is the by-pass headland dunefield (one of three in the area), from Thysbaai, next to Thyspunt. This runs overland from south west to north east and directly to Sea Vista Township and St Francis Bay. This is clearly visible from aerial photographs of the area, and in figures published in the report, such as fig 10.1a of the Transportation Specialist Study. It reflects a high-energy prevailing wind which has blown for centuries, if not millennia, and has blown sand overland for 12 kilometers before re-joining the sea at St Francis Bay, to the east of the headland.

The region surrounding Thyspunt has one of the highest wind energy capacities in the country, hence the proliferation of applications for wind farms in the immediate vicinity.

The reality at Thyspunt is that the prevailing wind is from the west to southwest; that it is frequently experienced in the area; that it is a high-energy wind; and that it blows directly towards either Cape St Francis or Sea Vista township and St Francis Bay, which are between 11 & 12 kilometers away. The implication of this is that, in the event of an accidental nuclear release while the prevailing wind was blowing at the claimed average of 5.8 m/sec (21 kph), the communities of Rebelsrus, Mostert's Hoek, Cape St Francis, Sea Vista Township and St Francis Bay, stretching over 10 kilometers of coastline would have 30 minutes to evacuate, down one escape route, which would in any case be cut by the nuclear cloud. At times the wind speed is anything up to five times this average. The wind direction & strength have a direct bearing on the viability of the Thyspunt site.

It is inexplicable that there is no reference whatsoever to the by-pass headland dunefields in the Air Quality Report, which depends instead for its conclusions on evidence supplied by Eskom, and short-term measurements conducted in the area. This despite the fact that it has been raised as an issue in every submission and at every stakeholder's & public meeting held to-date. The fact that it has not been considered at all by the specialist indicates either negligence, in the form of failure to consider issues raised by I&APs, or a deliberate attempt to mislead the responsible authority.

It is, of course, in Eskom's interest to state that the prevailing wind is north westerly, as this would safeguard the viability of the site.

3. The Air Quality Report
This crucial issue is dealt with in some four pages of the Air Quality Report (Report E10, p. 68 – 72).

We believe that it is deficient in a number of respects:

I. It begins with an acknowledgement that measurements taken on site are not sufficient for any long-term analysis, and mentions an attempt from December, 1986 to September 1989, which led to limited data recovery due to vandalism of equipment. According to the report, the best data was taken from the period January to September, 1987. This excluded the period October to December, which is locally acknowledged to be the windiest period of the year. This is clearly far too short a period of time to draw any conclusions.

II. Eskom's claim that the prevailing wind is north westerly is contradicted by the evidence of the by-pass headland dunefield in the area, and by all the evidence supplied. None of the wind roses displayed in figs 2-25 – 2-27 or Table 2-23 support this conclusion. Indeed the report itself conceded that the 21 month survey at Thyspunt indicated westerly, rather than north-westerly winds at Thyspunt.

III. Despite this, the report does nothing to refute the confident assertion regarding the predominant north westerly direction of the wind.

4. Conclusion
This report is typical of this EIA, in which everything is presented in a way which favours a successful application for an ROD. It is sufficiently misleading to justify a formal complaint to the DEA and even prosecution, and undermines confidence in the entire EIA process.

The most reliable recent data comes from a wind mast placed east of Oyster Bay by the CSIR as part of the current S.A.Wind Generation Programme. This has only been in operation for some 9 months, but details are available from the CSIR website, wasadata.csir.co.za. It is not known whether this is the information referred to in the Air Quality Report. It will clearly confirm that the prevailing wind is west to south west, and not west north west to north, as alleged by Eskom.

We request that this component of the Air Quality Report be rejected, and that the EAP be censured for allowing this inaccurate and fundamental information to remain in the report without being challenged.

We also demand an explanation from the EAP as to why the input from the local community has been completely ignored in this important component of the report.

Response 1:

Your comments as well as all other comments in this regard have been noted and documented (Please see the Issues and Response Report attached as Appendix E8 to the Revised Draft EIR). Please find an official response from the Air Quality specialist, Dr. Lucian Burger below:

The Air Quality Report states (Section 2.3.3) that the dispersion of air pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The influence of wind speed on the dispersion of air pollutants is significantly non-linear and is therefore best described through the use of dispersion models and not only through a qualitative description of the wind patterns as depicted by wind roses. An analysis of wind roses provides an indication of the area of most impact (i.e. likelihood), but not necessarily the magnitude. For instance, releases near ground level would result in high ground level concentrations during calm wind conditions at night, whereas the same atmospheric conditions in the case of elevated releases would result in the lowest ground level concentrations. It is therefore also important to consider the wind speed, atmospheric stability and release height together with the wind direction when qualitatively estimating the area of impact. These concepts were also discussed in the Air Quality Report (Section 2.3.2). A significant portion of the Air Quality Report discusses the important result of the assessment, i.e. the predicted ground level concentration patterns, which take into account a number of meteorological parameters in addition to wind speed and direction. A discussion of the latter two parameters alone cannot provide adequate information on the behaviour of the atmospheric dispersion.

The sources of the data used in the Air Quality report are indicated below. It is important to source information that would be useful and essential for the prediction of air pollution impacts. The three sources of meteorological data available at the time of the assessment included:

- *Eskom meteorological stations located at four sites in the vicinity of Thyspunt, namely De Hoek, Thyspunt, Klippepunt, and Brakkeduine (December 1986 to September 1988);*
- *The South African Weather Services' weather station located at Cape St. Francis. Data collection started in 2004; and*
- *Onsite station which consists of a 10 m mast, fully equipped with meteorological instrumentation to measure the wind vector, air temperature, relative humidity, barometric pressure and rainfall. Data have been collected since 10 January 2008.*

The reference to the Eskom measurements was included merely to provide background discussion on the historical information. These measurements were not used in any of the calculations. The atmospheric dispersion modelling was done using the onsite data for the period January 2008 to September 2009. The results included the simulations for every hour of this period and therefore

considered actual measurements of the meteorological parameters experienced on the site. The results included in the Air Quality Report therefore did not rely on speculation of impacts due to a discussion of specific wind directions based on wind roses, but were based on actual measurements of all meteorological parameters.

The results that the National Nuclear Regulator would be reviewing are therefore based on the onsite information available at the time of the assessment. In any event, the National Nuclear Regulator follows a very rigorous procedure, in line with the International Atomic Energy Agency, which requires continually updating onsite information and syntheses of these (including onsite meteorological data and dispersion modeling).

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

COMMENT ON THE BOTANY AND DUNE ECOLOGY, AND WETLAND ECOSYSTEMS IMPACT ASSESSMENTS: THYSPUNT NPS, 2nd Draft EIA REPORT.

Compiled by Prof RM Cowling BSc (Hons), PhD, ASSAf, NAS (USA), SACNAS and submitted on behalf of F.O.S.T.E.R. (Friends of St Francis Nature Areas), a member of the Thyspunt Alliance.

FOSTER is a Public Benefit Organisation, registered in terms of section 18A of the income tax act No 58 of 1962.

Botany and Dune Ecology Impact Assessment

(i) The Botany and Dune Ecology Impact Assessment fails to use Rouget et al. (2004) as a bioregional planning product. This assessment has been superseded by a more recent and finer-scale assessment, namely Vromans et al. (2010). This report includes finer-scale vegetation types and a more comprehensive and appropriate assessment of endangerment and recommendations for land use. Vromans et al (2010) must be incorporated in a substantive way in a revised draft of this report.

Response 1:

Rouget et al. has been considered in the Botany and Dune Ecology Assessment (Appendix E 11 of the Revised Draft EIR). The publication by Vromans *et al.* will be considered in EIR Version 2.

Comment 2:

(ii) There is no costing for implementing the mitigation measures.

Wetland Ecosystems Specialist Study

There is no costing for implementing the mitigation measures.

(i) The report makes reference to offsets as mitigation measures. As per my comments on the first draft, offsets are not mitigation measures and reference to this must be removed from the report.

Response 2:

Your comment is noted. The specialist stands by the recommendations and mitigation measures included in the report. Offsets are considered as valid mitigation measures by environmental authorities.

Comment 3:

References

Rouget, M, Reyers, B, Jonas, Z, Desmet, P, Driver, A, Maze, K, Egoh, B & Cowling, R M (2004). South African National Spatial Biodiversity Assessment 2004: Technical Report.Volume 1: Terrestrial Component. Pretoria: South African National Biodiversity Institute.

Vromans DC, Maree KS, Holness S, Job N and Brown AE. 2010. The Garden Route Biodiversity Sector Plan for the southern regions of the Kouga and Koukamma Municipalities. Supporting land-use planning and decision-making in Critical Biodiversity Areas and Ecological Support Areas for sustainabledevelopment. South African National Parks, Knysna.

Response 3:

Noted.

Yours faithfully

_____

For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

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RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Geohydrology Assessment Study 135 Final / March 2011

Quotes from the Geohydrology report surrounded by borders and relevant text highlighted in yellow.

S. Cowling's comments and questions are highlighted in turquoise

Comment 1:

Summary
The obvious bias throughout the report and especially in the conclusions, raises doubts about the integrity of the study. Methods of mitigation are vague. How can the report conclude with such confidence that impacts can be reduced with mitigation, lowering impacts from high to low, yet use language such as "This impact **may** be mitigated..." with dewatering schemes which the report states have "not yet been designed".

Furthermore, the purported methods of mitigation to protect the construction of the infrastructure (not the natural systems) pose a further threat to the natural systems. These cumulative threats are not included in the conclusions.

The report acknowledges severe threats eg depletion of local aquifers, degradation of wetlands, during construction but is unable to provide mitigation details, costs or efficacy, but is confident of success. This is a flaw in this report. Table 4.3 gives data for 7 sites analysed at Thuyspunt, of which 5 indicate scale-forming. However, the conclusion reads =Results indicate that corrosion is unlikely to be a problem at this site. The report fails to include the problems associated with scale forming in the conclusion. This scale forming is likely to cause great problems with infrastructure involving pipes, pumps etc. and cannot be ignored.

*"Quote "**4.4 No Go Option***
*In the event that the sites are not developed for NPSs, Eskom will sell the Bantamsklip and Thyspunt properties and non-essential parts of Duynefontein could also be sold. In this scenario the impact is seen to be of low intensity, neutral consequence and low significance for the Bantamsklip site but of medium intensity, negative consequence and high significance for the Thyspunt and Duynefontein sites as **it is unlikely that a similar level of site control and preservation of aquifers and ecological features could be enforced or afforded by private land owners/developers** as would have been the case with a nuclear site. The main mitigation measure for this scenario would be strict*

enforcement of conditions applicable to any approved future development of the sites, which would presumably cover preservation of these features."

The above text indicates the overwhelmingly strong bias of the specialist in favour of the client. Private owners or developers wishing to develop would have to undergo the stringent requirements of an EIA. Private developers are highly unlikely to propose a development of the same scale or of threat as the building of a nuclear power station. In the event of a No Go, because the land has been purchased with State funds, it could become a state asset such as a sustainably managed natural and cultural heritage site.

Response 1:

Depletion of aquifers is a worst case scenario impact, which assumes that groundwater will be abstracted. However, as indicated in the project description in Chapter 3 of the Revised Draft EIR and in Chapter 5 of the Revised Draft EIR, the project will make exclusive use of desalinated seawater for construction and drinking water during construction and operation.

An extensive programme of wetlands and groundwater monitoring undertaken at the all three alternative sites throughout 2010 (culminating in the Wetlands Monitoring Report – Appendix E12 of the Revised Draft EIR) found that the Langefonteinvlei wetland, the most critical and sensitive wetland on the Thyspunt site, is not geo-hydrologically linked to the footprint of the power station and that dewatering of the power station excavation would therefore not cause impacts on this wetland, particularly if the recommended mitigation of a hydrological cutoff wall around the excavation is implemented. The only wetland impacts that were found could not be mitigated are the impacts on the coastal seep wetlands.

Further a system of cut-off walls, boreholes and wellpoints was successfully used for dewatering/groundwater control for the excavation for the Koeberg Nuclear Power Station. This enabled the bedrock surface exposed in the base of the excavation to be mapped for geotechnical engineering purposes and for the foundations to be laid safely and in dry conditions. The thickness of saturated sands at this site was about 14 m and the base of the excavation was at an average of 10 m below sea level. The dewatering design is shown below figure and an aerial photograph of the excavation, showing the stable side walls and dry floor is also attached. Trucks can be seen on side ramps into the excavation.

A similar system was also successfully used for dewatering/groundwater control for excavations for Coega Harbour north of Port Elizabeth. This site was particularly demanding from a safety/design point of view as excavations took place in the tidal zone and below sea level. Men and machinery were working many metres below sea level with only a cut-off wall and some boreholes/wellpoints stopping the excavation from collapsing, which would have had disastrous consequences. SRK acted as review consultants for the National Ports Authority on this project and can vouch for the effectiveness of this type of integrated groundwater control design.

In the light of the above examples (and many more world-wide), SRK has full confidence in a) the feasibility of such a design and b) the effectiveness in practice of such a design.

Lastly your views regarding the alternative forms of land use being subjected to stringent EIA requirements are noted. However, unfortunately recent history of residential and golf estate developments in the St. Francis region contradict your statement. Even though these developments have been subjected to EIA processes, development of these sites has caused extensive destruction of heritage resources and portions of the mobile dune systems, without sufficient mitigation being undertaken. There is, therefore, reason to believe that other developments having a severe impact would be permitted. It must be borne in mind that developments are not always planned on a large scale. Small developments that individually have insignificant impacts can have highly significant impacts when their cumulative impact over time is considered. This is particularly the case with the development of urban areas along the coastline.

Comment 2:

If the actual mitigatory activities of building cut-off walls also pose a threat to the sensitive wetlands etc, why is this not mentioned in the Conclusions?

Response 2:

A cut-off wall would pose little or any threat to the wetlands as it is designed specifically with a view to **mitigating** the impacts on wetlands due to groundwater drawdown in the power station excavation. A cut-off wall would be placed parallel and directly adjacent to the power station excavation, as shown in Figure 4.7 of the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR).

Comment 3:

The specialist has referred to interconnectedness in the groundwater systems between the site and the east flowing Sand River. Why is the potential contamination of the latter groundwater (a vital past and potential water source for Greater St Francis Bay) by emissions (of any level) and of bacterial origin not mentioned in the Conclusions?

Response 3:

Interconnectivity is used here in the sense that there are no physical boundaries *per se*, e.g. an impermeable geological formation. However, there could be water divides and the groundwater in the Nuclear Power Station footprint/excavation area is not directly connected to the Sand River System. Liquid emissions will have no impact on the latter. Normal gaseous emissions are postulated to impact on this area but at levels well below any human health or ecological concern.

Comment 4:

How can the report state that the Thyspunt site has a low to medium sensitivity over most of the site in view of the fact that the Thyspunt site has all five criteria for sensitivity listed in the report viz major aquifers; existing supply boreholes/springs; wetlands/seeps; surface water features such as rivers and dams; and 500 m buffer zones around the fore-mentioned?

Response 4:

The Thyspunt site only has two of the above criteria present, i.e. a major aquifer and wetlands/seeps, plus the (arbitrary) 500 m buffer zones. The wetlands are shown as having a high sensitivity and have a 500 m buffer zone of medium sensitivity. In the light of the additional wetlands/ groundwater monitoring work, the high sensitivity of the Langefonteinvlei, or at least the southern parts, may be changed to medium.

Comment 5:

Why the phrase "these (water) bodies may (sic) sustain sensitive ecosystems" when the wetlands expert in the EI Assessment has stated emphatically that these are sensitive ecosystems of global and unique importance?

Response 5:

The wording will be changed, i.e. *may* will be deleted.

Comment 6:

"Quote pg 157 A groundwater monitoring programme is essential, as it will provide:
Baseline information on aquifer behaviour for at least a two-year period before construction commences;"

Why isn't this vital point of 2 years monitoring included in the report's conclusions?

Response 6:

An expanded groundwater monitoring programme commenced in early 2010 and the results thereof are documented in the Wetlands Monitoring Report (Appendix E12 of the Revised Draft EIR). This monitoring programme is ongoing and also includes wetlands, meteorology and oceanography. . A comprehensive recommended monitoring programme is recommended in Section 5.4.10 and Table 5.6 of the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR Version 1). The updated EIR (Version 2) will be amended accordingly.

Comment 7:

The report acknowledges severe threats in construction eg depletion of local aquifers, degradation of wetlands, but is unable to provide mitigation details, costs or efficacy, but is confident of success. This is a major flaw in this report.

Response 7:

The Geohydrological Assessment (Appendix E7 of the Revised Draft EIR Version 1) must be read in conjunction with the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR Version

1) as these studies both focus on assessing impacts (from different perspectives) on hydrological resources. As indicated in Response 1, a programme of groundwater and wetland monitoring has confirmed that the proposed mitigation measures are practical.

There are no 'severe threats' only the possibility of depletion of aquifers should inappropriate use of groundwater take place. The additional wetlands/groundwater investigation started in January 2010 has since shown that the wetlands are unlikely to be affected by controlled use of groundwater in the footprint area.

Comment 8:

"Cut off wall and Monitoring to prevent: Degradation of Ecologically Sensitive Wetlands / Seeps / Springs

This impact may be mitigated by constructing a cut-off or diaphragm wall, and by carrying out groundwater level monitoring. Groundwater monitoring is considered an essential mitigation measure so that timeous remediation measures can be taken, if required. The final design of dewatering schemes has not been established. However, based on results from this EIR study, the construction of such a barrier is considered to be an essential mitigation measure at the Duynefontein and Thyspunt sites. The siting of the NPS within the EIA Corridor should also take into account the optimal position from this point of view. Abstraction should preferably not take place from aquifers with direct links to freshwater ecosystems. Roads, cables, foundations and pipelines should all avoid passing through/intruding areas identified as important hydrological corridors and no roads, pipelines, cable routes or other structures should be passed through wetland areas."

Given the content of the box above –the unknowns, the sensitivity of the site, the further threats posed by mitigatory actions - the conclusions of this report should surely recommend this site as unsuitable for an NPS.

Response 8:

As indicated in Response 1, extensive groundwater and wetland monitoring has taken place (Refer Wetlands Monitoring Report, Appendix E12 of the Revised Draft EIR). Monitoring undertaken for this study has reduced the uncertainty sufficiently that geo-hydrological linkages between aquifers are well enough understood to prevent impacts on aquifers and critical wetlands. See also Response 1.

Comment 9:

"Executive summary Pg iv
The impact rating of the potential environmental impacts is summarised as follows for the construction and operational phases:

Flooding by groundwater: Medium at all three sites with out mitigation and Low with mitigation;"

Elaborate on this inexplicable point.

Response 9:

This has been addressed previously and was a typing error. The correct wording is as shown as below:

*Flooding by groundwater: Medium at all three sites **without** mitigation and Low with mitigation;"*

Comment 10:

"*Depletion of local aquifers: Medium at Thyspunt and Low-Medium at Bantamsklip and Duynefontein without mitigation and Low at all three sites with mitigation;"*

Provide details on mitigation and explain how intensity becomes low – Has this been assessed in the light of recent rainfall events, especially over the medium term (and not just after the recent events). Mention threat by mitigatory cut-walls.

Response 10:

Dewatering the construction area will result in lowering of the water table, which could deplete the local primary aquifer system. Potential impacts relating to a declining water table include the threat of decreased yields of existing production boreholes / wellpoints and drying up of wetlands/seeps. Without mitigation the intensity is assessed to be low as the natural processes (i.e. depth to groundwater, sustainable borehole yields, etc.) would be negligibly altered. The duration of this potential impact is assessed to be short-term, as once the excavation works have been completed, the water table will soon attain its pre-construction natural depth below ground level. Mitigation measures could include managed artificial recharge of the primary aquifer with pumped groundwater near to sensitive features and installing cut-off walls around the dewatered excavation areas. With mitigation, the intensity is assessed to be low.

The extent of the influence of dewatering on groundwater levels was determined by numerical modelling and shown to be of limited extent, especially with the installation of cut-off walls.

At the Thyspunt site there are no cumulative impacts relating to depletion of the aquifer systems as there are no other significant developments and / or large-scale groundwater abstraction areas within the indicated area of influence of dewatering/groundwater control.

Groundwater could be used for start-up water supply at the Thyspunt site based on aquifer potential and assessment of impacts on the aquifer/wetlands/seeps.

Comment 11:

"Degradation of wetlands / seeps / springs: Medium at Thyspunt and Duynefontein and Low-Medium at Bantamsklip without mitigation and Low at all three sites with mitigation."

3. Provide details on mitigation and explain how intensity becomes low and what the confidence limits are.

Response 11:

Potential impacts relating to a declining water table may include the drying up/degradation of coastal springs, seeps and / or wetlands in close proximity to the sites. These bodies sustain sensitive ecosystems and are mostly fed and sustained by groundwater from the primary aquifers. The survival of such ecosystems may be threatened due to dewatering activities and/or foundations or cut-off walls. The intensity is assessed to be medium, as the functioning of such coastal springs, seeps may be temporarily modified. The duration will be short-term during construction but could be long-term during operation. With mitigation, the intensity is assessed to be low. The additional wetlands/groundwater monitoring work has also shown that the Langefonteinvlei at Thyspunt is perched above the water table in its southern and western parts.

An assessment of impacts to these surface freshwater ecosystems has been carried out and includes identification and mapping of the wetlands in the vicinity of the sites, classification of the wetlands and an assessment of wetland sensitivity and importance. Modelling has shown that it will be possible to site the NPS within the EIA Corridor so that these impacts will be minimal to absent. Ongoing monitoring is taking place and additional modelling will be carried out if measured parameters exceed established trends.

Confidence levels are high in the light of the additional monitoring being carried out.

Comment 12:

Quote pg 9 from report Modelling scenarios: Alternative scenarios for a given area are then assessed. In order to develop a model of an aquifer system, certain assumptions have to be made, including the following

- *The system is initially in equilibrium and therefore in steady state.*
- *The available information on the geology and field tests is considered as acceptable and representative.*

Models done by Dr Ingrid Dennis and reviewed by Professor Gerrit van Tonder of UOFS who has a BSc Hons in geohydrology and MSc and PhD in geohydrological statistics and data analysis. The modelling was also reviewed by Peter Rosewarne and Richard Connelly."

Can we have written statements from these experts confirming that this system is in equilibrium and therefore in steady state. If they are unable to confirm this, how do the models hold up?

Response 12:

In all numerical flow modeling simulations, the accepted protocol is to first construct a steady state model. This is essential and unavoidable in order to first calibrate the model. Models are simplifications of the real world situation and certain assumptions have to be made in order for them to run properly. To reiterate this important point, this is the standard international procedure for constructing and running numerical groundwater flow models.

Comment 13:

"Quote pg 11 : The best way to improve the confidence in a groundwater model is to collect time series data. An extended groundwater/wetlands monitoring programme was thus initiated by Eskom at the site in February 2010, scheduled to run for at least one year. Additional boreholes/piezometers have been established and continuous data loggers installed."

Have these data been analysed and do they support or negate the earlier assumptions and findings.

Response 13:

Results of the groundwater / wetlands monitoring programme were analysed and the outcomes are documented in the Wetlands Monitoring Report (Appendix E12 of the revised Draft EIR). These outcomes support the finding that mitigation of wetland impacts is possible, as it was found that aquifers feeding critical wetlands such as the Langefonteinvlei wetland are not geohydrologically linked to the aquifer at the proposed power station position.

Comment 14:

"Quote pg 12: Thyspunt …. The nuclear footprint is likely to be located very close to the coastline."

How close is "very close" and how does this align with distances from the shoreline given in the other specialist reports.

Response 14:

A strip of 200 m will be kept clear of any development at all three alternative sites. Thus the power station will not be constructed less than 200 m from the coastline. All specialist reports were prepared on the assumption that there would be no development within this 200 m coastal strip.

Comment 15:

"Quote pg 94 The prevailing wind direction is south-westerly to north-easterly."

Why does this differ from the emissions report which states that the northwesterly is a prevailing wind."

Response 15:

The wind direction stated in the Geohydrological Assessment (Appendix E7 of the Revised Draft EIR) is incorrect and will be corrected to be consistent with the Air Quality Assessment (Appendix E10 of the Revised Draft EIR).

Comment 16:

"Quote pg 96 Groundwater flow direction is to the south / east with discharge along the beaches and rocky outcrop into the ocean, and to the south-east into the Sand River aquifer. Local groundwater flow also occurs in westerly and eastern directions, possibly along channels between the dunes and then enters streams or rivers with subsequent southerly flow towards the ocean; Also A high yielding significant intergranular aquifer occurs to the east of Thyspunt at Mostert's Hoek and St. Francis Bay, where a spring with an artesian yield of 8 L/s occurs."

Why does the report ignore the tremendous water resources of the Sand River system which has in the past, and potentially be a future source if sustainably managed?

Response 16:

It is not clear what is meant here by 'ignore', i.e. ignore these resources from a possible supply source point of view or from a possible impact point of view? In terms of the former, this system was not considered because of sensitivities regarding previous/existing/future use by St. Francis Bay, environmental concerns and accessibility. In terms of the latter, there will be no impacts from the nuclear power station excavation/dewatering/groundwater control. The only potential 'impact' is from gaseous emissions during normal operation of the nuclear power station.

Comment 17:

The intergranular aquifer is currently classified as a Major Aquifer system (Parsons 1995 and Parsons and Conrad 1998), as this aquifer produces high yielding boreholes with good water quality. The site is classified as being highly vulnerable to anthropogenic impacts.

Why if, as the report states, the groundwater flows into the Sand River aquifer, and this system with good quality water is highly vulnerable to human impacts, why is this not mentioned in the conclusions – or for that matter, more detailed in any of the impact analyses?

Table Mountain Group Aquifer
The TMG Aquifer is classified as a major aquifer system. The aquifer is classified as having a moderate vulnerability to anthropogenic impacts.

Response 17:

It is stated in the Revised Draft EIR Version 1 that, on a regional scale, groundwater flow is to the south and east and to the southeast, into the adjacent Sand River Aquifer system. It should not be inferred from this statement that groundwater generally flows from the site into the Sand River Aquifer. This could possibly apply to groundwater in the northeast parts of the site, away fro the potential Nuclear Power Station footprint. Groundwater in the vicinity of the proposed nuclear power station footprint flows into Thysbaai.

Comment 18:

10. Earlier, the report states that groundwater systems are interconnected and flows eastwards. Where is the detailed assessment of risk to the water system of the Sand River? The interconnectedness implies that activities at Thyspunt will affect the artesian well of St Francis Bay. Given the scarcity of water in the greater St Francis Bay and NMMetro region, no threat to artesian wells should be tolerated. (These wells have supported Greater St Francis Bay for many years).

Response 18:

Activities at Thyspunt, e.g. nuclear power station excavation dewatering or use of groundwater in the footprint area (which will all be associated with the Algoa Aquifer), will have no effect on the Sand River or wells/boreholes in the St. Francis Bay area.

Comment 19:

Hydraulic heads
The hydraulic head values as calculated during the steady simulations were specified in the model.

Scenario using regional model: Potential groundwater contamination due to air pollution from site –

Scenario 1: Deposition of tritium
In this scenario the movement of tritium is simulated from the deposition thereof on the ground, to the movement of it in the groundwater system. Tritium is modelled as though it is conservative. It is once again important to note that the nature of the subsurface (vegetation and soil types present) will also play a role in their movement. Therefore, this scenario can only serve as an indication of what can occur and must be seen as qualitative and not quantitative. Using average annual emissions assuming two EPR and three AP1000 units (to make up the 4 000 MWe) it is clear that most of the wetlands and the St. Francis Bay boreholes will be affected by emissions, but by low concentrations of ~2.5 TU. This is for a 20 year indicative simulation period.

All potential NPS contaminants of the groundwater system would migrate towards the sea and as such very little groundwater contamination is expected. This does not include potential contamination of groundwater due to air emissions. Why is the potential contamination of wetlands and groundwater by emissions (of any level) not mentioned in the Conclusions?

Response 19:

The Geohydrological Assessment is being updated and any pertinent omissions as pointed out will be addressed in the new version.

Comment 20:

"Quote from Report 2.4Site Sensitivity
Site sensitivity has been assessed according to the categories listed below. Category Description

High sensitivity
These are no go areas or severely prohibited areas for development; they may be protected by legislation

Medium sensitivity
These are areas that may have the potential for development, if adequate mitigation measures are prescribed Low sensitivity. These areas have no sensitivity to development.

The sensitivity of each of the sites is shown in Figure 2.67 (Duynefontein), Figure 2.68 (Bantamsklip) and Figure 2.69 (Thyspunt) for the defined site areas. Criteria used for defining site sensitivity were the presence of any of the following:

- *Major aquifers;*
- *Existing supply boreholes/springs;*
- *Wetlands/seeps;*
- *Surface water features such as rivers and dams; and*
- *500 m buffer zones around the above.*

Thyspunt Site sensitivity analysis indicates a low to medium sensitivity over most of the site with a high sensitivity for the wetland areas."

How can the report state that the Thyspunt site has a low to medium sensitivity over most of the site in view of the fact that the Thyspunt site has all five criteria for sensitivity listed above?

Response 20:

Your comment is noted however please read the text again. It states that criteria used for defining site sensitivity were the presence **of any** of the following The Thyspunt site only has **two** of the above criteria present, a major aquifer and wetlands/seeps, plus the 500 m buffer zones around these features.

Comment 21:

"Report states the following:
It is recommended that the system be further monitored and the model re-calibrated as further monitoring data are collected, especially in terms of groundwater/wetlands interactions. However, it is considered unlikely that widely differing results will be obtained."

On what basis it is it considered that widely differing results will be obtained?

Response 21:

The statement is that '...it is considered *unlikely* that widely differing results will be obtained.'

Comment 22:

Will the next final report describe the impacts – not only immediate but also the longer term records - of the July rainfall events, and what are the conclusions?

Response 22:

The Revised Draft EIR Version 2 will reflect the latest monitoring data and the implications thereof.

Comment 23:

"ENVIRONMENTAL ASSESSMENT
4.1 Construction Phase
Flooding by Groundwater – Direct Impact
As the natural groundwater levels at the sites are shallow, flooding will occur immediately when excavations extend below the water table. This potential impact refers to the natural effect of the environment on the construction works, whereby groundwater inflow into excavations will hinder and be a danger to construction activities. Without mitigation the *intensity* (i.e. the management of the impact in relation to the sensitivity of the receiving environment) is assessed to be *medium* because the natural geohydrological processes (i.e. movement of groundwater) will continue, albeit in a modified way. Localised flow directions may be altered as a result of the change in hydraulic gradient. However, the *duration* of this potential impact is assessed to be *short-term*, as once the excavation works have been completed, the environment will mostly recover to equilibrium with groundwater levels and flow directions achieving pre-construction conditions. With mitigation, the *intensity* is assessed to be *low*."

15. Describe mitigation in detail and also costs and explain how intensity becomes low – also explain the assumption with recovery to equilibrium. Explain how the redirected "modified" water flows will achieve re-construction conditions when a massive infrastructure has been built in the original path?

Response 23:

The costs associated with mitigation, such as a cut-off wall, pumping and return of pumped water to the upper aquifer, are likely to be significant on their own but not in relation to the overall site development/installation cost.. Such costs are impossible to estimate with any accuracy at this stage as site specific design details are not known to the specialist.

Comment 24:

"Degradation of Ecologically Sensitive Wetlands / Phreatophytes / Seeps / Springs – Indirect Impact

Potential impacts relating to a declining water table may also include the drying up/degradation of any coastal springs, seeps, phreatophytes and / or wetlands in close proximity to the sites. These bodies may sustain sensitive ecosystems and are mostly fed and sustained by groundwater from the primary aquifers. The survival of such ecosystems may be threatened due to dewatering activities and/or foundations or cut-off walls. The intensity is assessed to be medium, as the functioning of such coastal springs, seeps and / or wetlands may be temporarily modified. The duration will be short-term during construction but could be long-term during operation. With mitigation, the intensity is assessed to be low."

16. Why the phrase "these (water) bodies may sustain sensitive ecosystems" when the wetlands expert in the EI Assessment has stated these as being of global and unique importance"?

Response 24:

The wording will be changed.

Comment 25:

17. If the mitigatory activities of building cut-off walls also pose a threat to the sensitive wetlands etc, why is this not mentioned in the Conclusions?

Response 25:

A cut-off wall would pose no threat to the wetlands. This will be explained in the Revised Draft EIR Version 2.

Comment 26:

18. Why is there no proper justification for the confidence (or not) in low impacts?

We need more information that (sic) just an opinion. The EIA specialist reports state that this is a unique system in the world. Therefore there is a need for proper justification that these activities will have low impacts. Why is there no proper assessment of the impacts of the mitigation?

Response 26:

As indicated in several responses above, confidence in the assessment of impacts has been drastically improved through analysis of the data from a wetland and groundwater monitoring programme, as documented in the Wetlands Monitoring Report (Appendix E12 of the Revised Draft EIR).

Comment 27:

"An assessment of impacts to these surface freshwater ecosystems has been carried out and includes identification and mapping of the wetlands in the vicinity of the sites, classification of the wetlands and an assessment of wetland sensitivity and importance (Day, 2007a and Day, 2007b). Modelling has shown that it will be possible to site the NPS within the EIA Corridor so that these impacts will be minimal to absent. However, further investigation, monitoring and modelling is planned for these areas to firm-up predictions and mitigation measures."

19. The conclusions need to include the fact that the mitigation methods in themselves pose threats to the wetland, seep etc systems. Mitigation must be more fully described and report must explain how intensity becomes low.

Response 27:

The mitigation measures could have an impact on coastal seeps but not on the other wetlands. This will be addressed in the updated specialist study..

Comment 28:

"Quote from report pg150 Degradation of Infrastructure – Direct Impact
In scale forming water, a precipitate or coating of calcium or magnesium carbonate can form on the inside of the piping. This coating can inhibit the corrosion of the pipe, because it acts as a barrier, but it can also cause the pipe to clog. Water with high levels of sodium, chloride, or other ions will increase the conductivity of the water and promote corrosion.

Corrosion can also be accelerated by:

- *・low pH (acidic water) and high pH (alkaline water),*
- *・high flow rate within the piping,*
- *・high water temperature,*
- *・oxygen and dissolved CO2*
- *・high dissolved solids, such as: salts, sulphates,*
- *corrosion related bacteria and electrochemical corrosion, and*
- *presence of suspended solids, such as sand, sediment, corrosion by-products, and rust.*

The Langelier index indicates the corrosivity of water (Langelier Saturation index). If its value is lower than - 0.5, then water is corrosive, if it is higher than + 0.5 then the water has a high scaling potential, and it can form deposits in piping.

Table 4.3: Langelier Indices for the Thyspunt site with degradation indication (corrosion or scaling)'

This table gives data for 7 sites analysed at Thuyspunt (sic) , of which 5 indicate scale-forming. However, the conclusion reads = Results indicate that corrosion is unlikely to be a problem at this site. Explain why the conclusion makes no mention of the earlier problems associated with scale forming. This scale forming is likely to cause great problems with infrastructure involving pipes, pumps etc. and cannot be ignored.

Response 28:

Scaling will be addressed in the Revised Draft EIR Version 2 and the need for this possible effect to be taken into account in plant design and maintenance.

Comment 29:

"Table 4.6: Impact assessment table for the Thyspunt site during the construction phase

Fig 2.69 Sensitivity zones.
The well point area as well as western access roads are shown very close to these highly sensitive zones."

Given the high sensitivity of the zones of Fig 2.69, justify the close positioning of the well points as well as the western access road to these sensitive sites. Why does this proposal ignore the precautionary principle?

Response 29:

It is unclear to which 'well point area' you refer.

Comment 30:

Refer to Tables.

22. Provide details on how Impact 1 will be mitigated and explain how this mitigation can justify the significance from medium to low, given the high probability.

Response 30:

The impact will be mitigated by installation of a cut-off wall, boreholes, well points and sumps for groundwater control/dewatering. These methods are tried and tested for this type of application and are known to be effective in creating dry, stable excavations.

Comment 31:

Refer to tables.

23. Explain how the consequences of Impact 3 will only be medium, given the national legislation regarding the shoreline and wetlands. Provide details on how will this be mitigated and explain how this mitigation can justify the significance from medium to low, given the high probability.

Response 31:

Your reference to national legislation regarding the shoreline and wetlands is presumably a reference to the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008). It is furthermore assumed that your reference to Impact 3 refers to Impact 3 for the construction phase (Drying up of coastal springs) and not to Impact 3 for the operational phase (Organic and bacteriological contamination of groundwater).

In this regard, please refer to Tables 9-8 to 9-13 in Chapter 9 of the Revised Draft EIR. Although the impact on coastal seeps has been assessed in the Geohydrological Assessment (Appendix E7 of the Revised Draft EIR), this impact has been assessed in more detail in the Freshwater Ecology Report (Appendix E12 of the Revised Draft EIR) from the perspective of the affected resource. Section 9.12 of the EIR has, therefore, referred to the findings of the latter specialist study.

The Freshwater Ecology Report assesses the impacts on coastal seep wetlands to be high without mitigation and medium with mitigation. The significance of these impacts is reflected as such in Table 9-32 of the Revised Draft EIR. The potential loss of these coastal seep wetlands cannot be avoided, and the recommended mitigation is therefore the extension of the conserved area of wetlands, thereby creating a potential net positive impact for wetlands.

Comment 32:

Refer to tables.

24. Explain how the consequences of Impact 4 will only be medium, particularly given that the wetlands expert in this EIReport has identified the wetlands of being unique and of global importance.

Provide details on how this will be mitigated and explain how this mitigation can justify the significance of the impact from medium to low, given the high probability.

Response 32:

It is assumed that your reference to Impact 4 refers to Impact 4 for the construction phase (Degradation of wetlands) and not to Impact 4 for the operational phase (Decreased yields of existing production boreholes).

In this regard, please refer to Table 9-8 in Chapter 9 of the Revised Draft EIR. Although the impact of wetland degradation has been assessed in the Geohydrological Assessment (Appendix E7 of the Revised Draft EIR), this impact has been assessed in more detail in the Freshwater Ecology Report (Appendix E12 of the Revised Draft EIR) from the perspective of the affected resource. Section 9.12 of the EIR has, therefore, referred to the findings of the latter specialist study.

In this regard, please refer to Tables 9-8 to 9-13 in Chapter 9 of the Revised Draft EIR. Although the degradation impact on wetlands has been assessed in the Geohydrological Assessment (Appendix E7 of the Revised Draft EIR Version 1), this impact has been assessed in more detail in the Freshwater Ecology Report (Appendix E12 of the Revised Draft EIR Version 1) from the perspective of the affected resource. Section 9.12 of the EIR has, therefore, referred to the findings of the latter specialist study.

The Freshwater Ecology Report assesses the degradation impacts of a number of different types of wetland. With the exception of the degradation of coastal seep wetlands (see Response 36), the degradation impacts on wetlands are generally assessed to be medium without mitigation and low with mitigation and in some cases low-medium without mitigation and low with mitigation. The significance of these impacts is reflected as such in Table 9-32 of the Revised Draft EIR. In general the probability of these impacts reduces to low after mitigation and hence the significance also reduces.

Comment 33:

"*Quote from report Pg 150 "Leaks of any radioactivity into the subsurface and ultimately into the Underlying aquifers (both the primary and secondary aquifers) will not directly affect existing groundwater users (but will affect the receiving environment), but air emissions from the sites could be transported inland by prevailing winds and contaminate groundwater by being incorporated into rainfall recharge."*

25. In view of the problems of reliable water supply for the greater St. Francis area (the recent drought conditions led to water restrictions for 18 months which raised the prospect of the towns once again relying on groundwater supplies from local boreholes) the above comment is of great concern.

Response 33:

Your comment is noted. The Air Quality Assessment (Appendix E10 of the Revised Draft EIR) concluded that normal operational releases of radionuclides and Design Basis Accidents (DBA) would be of low significance, as these releases would not exceed the acceptable limit. Even the highest whole body dose (1 km downwind from the nuclear power station) during a DBA would be 49 mSv, which remains below the maximum legally acceptable limit of 50 mSv for a single event.

Comment 34:

How does this report justify any threat of contamination of groundwater local water supply in the regions which is notorious for droughts and floods?

Response 34:

The report is does not attempt to justify contamination of local groundwater supplies, it merely assesses the likelihood and severity of any such effect. It should also be borne in mind that contamination does not necessarily imply that groundwater (or any water) supplies would not still be fit for purpose/beneficial use. According to the Department of Water Affairs', contamination is defined as:

'*The introduction of any substance into groundwater systems by the action of man.'*

Comment 35:

Refer to tables.

26. Provide details on how Impact 1 will be mitigated and explain how this mitigation can justify the significance from medium to low.

Response 35:

Please refer to Response 30.

Comment 36:

Refer to tables.

27. Provide details on how Impact 2 will be mitigated and explain how this mitigation can reduce the HIGH probability to low.

Response 36:

Mitigation measures are listed in the report and include good housekeeping, bunding/control of storage areas and immediate clean-up of any leaks/spills. Monitoring will detect any unobserved emissions to the groundwater.

Comment 37:

Refer to tables.

28. Provide details on how Impact 3 will be mitigated and explain how this mitigation can reduce the HIGH probability to low.

Response 37:

Impact 3 will be mitigated by the provision of proper on-site sanitation, lining of waste water ponds, monitoring and immediate remedial action if signs of unacceptable contamination are found.

Comment 38:

Refer to tables.

29. Provide details on how Impact 4 will be mitigated and explain how this mitigation can change the duration from HIGH to low.

Response 38:

Impact 4 is Low both without and with mitigation. This is because there are no existing boreholes whose yield could be affected by the mitigation measures.

Comment 39:

Refer to tables.

30. What is the justification for classifying the impact on the irreplaceable resources of wetlands of global significance as low?

Response 40:

The justification is that mitigating measures will ensure that impacts will be minimal. The additional wetlands/groundwater monitoring has provided further assurance in this respect.

Comment 41:

31. Question: It is requested that each of the cells in these tables be re-analysed in collaboration with the following critical people:

1) The wetlands expert
2) Dr Fred Ellery
3) An expert in local St Francis water supplies who will confirm that the Greater St Francis Area will need to become reliant on its water supplies from groundwater boreholes, just as it was in the past. The current supply from the Churchill Dam has been in operation for only a few years. This supply is in the form of a pipeline from the Churchill Dam to the Nelson Mandela Metro whose water demand is

becoming untenable. Furthermore, the water supply pipeline to St Francis is currently out of commission owing to the fall of the Sand River bridge. Until this bridge is properly rebuilt, this pipeline is under threat. The town is in the process of re-commissioning its groundwater boreholes.

Response 41:

As indicated in several of the above responses, in cases where the wetlands specialist has assessed similar or the same impacts to the geo-hydrological specialist, the wetland specialist's assessment has been carried forward into the Revised Draft EIR, as the wetland specialist's knowledge of the affected wetland resources is more detail than that of the geo-hydrological specialists.

The specialists for the Nuclear-1 EIA are qualified and experienced to assess the potential impacts of the proposed nuclear power station. In terms of the EIA legislation (The National Environmental Management Act, 1998 and the EIA regulations in Government Notices no. R 543 to 546 of 2010), the Environmental Assessment Practitioner may appoint particular specialists. It is only the relevant specialists who can, in terms of legislation, assess the impacts. GIBB, as the Environmental Assessment Practitioner, cannot agree to requests from individual interested and affected parties (of whom there are several thousand) to have an input into the assessment of impact significance. This responsibility lies with a single specialist or team of specialists.

Dr Ellery has taken part and submitted numerous comments on the Draft and Revised Draft Nuclear-1 EIRs and has also taken part in public meetings. In addition, he participated in a Key Stakeholder Workshop with relevant specialists in St. Francis on 25 May 2010, where he and other stakeholders had the opportunity to comment with and interact with both the Nuclear-1 geo-hydrological specialist and the freshwater ecology specialist. As such, Dr. Ellery has had ample opportunity to provide his opinion to the EIA Team. Therefore, GIBB cannot accede to a request for additional participation in the EIA by individuals such as Dr. Ellery. The final decision on assessment of the significance of potential environmental impacts remains with the relevant specialists.

Your comment on St. Francis having to become reliant on groundwater is noted. It is unclear how this relates to Nuclear-1, since it is proposed that Nuclear-1 will be entirely dependent on desalinated seawater during construction and operation. Nuclear-1 would therefore not affect groundwater volumes potentially used by St. Francis. Furthermore, should any potential pollution from Nuclear-1 enter the groundwater table, it will not enter St. Francis's water supply, since the proposed position of Nuclear-1 is 11km west of St. Francis and at the end of the groundwater flow pathway (i.e. virtually at sea level).

Comment 42:

"Quote "4.4 No Go Option
In the event that the sites are not developed for NPSs, Eskom will sell the Bantamsklip and Thyspunt properties and non-essential parts of Duynefontein could also be sold. In this scenario the impact is seen to be of low intensity, neutral consequence and low significance for the Bantamsklip site but of medium intensity, negative consequence and high significance for the Thyspunt and Duynefontein sites as it is unlikely that a similar level of site control and preservation of aquifers and ecological features could be enforced or afforded by private land owners/developers as would have been the case with a nuclear site. The main mitigation measure for this scenario would be strict enforcement of conditions applicable to any approved future development of the sites, which would presumably cover preservation of these features."

32. The above text indicates the overwhelmingly strong bias of the specialist in favour of the client. Private owners or developers wishing to develop would have to undergo the same stringent requirements for an EIA as this proposal. Furthermore, private developers are highly unlikely to have the funds to propose a development of the same scale, or size or hazardous threat as a nuclear power station. On the grounds of this opinion, this comment clearly indicates a serious bias. The land has been purchased with State funds and could become a state asset of a well managed water catchment which could provide a sustainable water supply to local communities, in such a way that the area becomes a natural and cultural heritage site.

Response 42:

Your views regarding the alternative forms of land use not being authorised are noted. However, unfortunately recent history of residential and golf estate developments in the St. Francis region contradict your statement. Even though these developments have been subjected to EIA processes, development of these sites has caused extensive destruction of heritage resources, without sufficient mitigation having been undertaken. There is, therefore, reason to believe that other developments having a severe impact would be permitted. It must be borne in mind that developments are not always planned on a large scale. Small developments that individually have insignificant impacts can eventually have highly significant impacts when their cumulative impact is considered. This is especially the case with the development of urban areas, particularly along the coastline.

Comment 43:

"Quote 155 All industrial wastewater that will be generated at the sites from various operations must be safely and effectively processed and disposed of (essential mitigation measure)."

33. Report must provide details on such a facility, its siting and how it will function.

Response 43:

There is no information yet as to the likely position, design or operation of a wastewater treatment plant. However, the waste water treatment will be designed and constructed to meet legal requirements. Such technology is available and is used in various applications. It will also be sited in ensuring that all the requirements the EMP and conditions of authorisation - if received.

The Revised Draft EIR 9Version 2), which will be provided for public comment, will include conceptual layout plans to show the sizes of all infrastructure elements like the waste water treatment plant that form part of the power station footprint.

Comment 44:

"Quote pg 157 A groundwater monitoring programme is essential, as it will provide: Baseline information on aquifer behaviour for at least a two-year period before construction commences;"

34. Why isn't this vital point included in the Report's conclusions?

Response 44:

The specialist report will be updated accordingly as part of the Revised Draft EIR Version 2.

Comment 45:

"Mitigation measures / management actions are recommended in order to aid with the following:

- *Minimising or eliminating negative impacts;*
- *Enhancing beneficial impacts; and*
- *For assistance with the project design to prevent or minimise negative impacts.*

5.2 Recommended Mitigation Measures
Dewatering to prevent: Flooding by Groundwater
To mitigate this, the construction area and subsequent excavated areas must be dewatered by constructing a cut-off / diaphragm wall and installing a series of wellpoints and boreholes. The design of a dewatering scheme is beyond the scope of this specialist study, but the dewatering activity and associated groundwater monitoring programme are considered essential mitigation measures. A form of cutoff wall is considered to be the most suitable and reliable design to minimise the extent of drawdown. The siting of the NPS within the EIA Corridor should take this aspect / impact into account.

Mitigation Hierarchy: Avoidance"

35. This impact of flooding by groundwater is a threat to the construction of the infrastructure

But according to the report, the design of the mitigatory method is unknown. Furthermore, the mitigation poses another threat of its own. This further threat should be noted in the conclusions.

Response 45:

The specific design has still to be determined but the conceptual methodology is well documented and has been successfully employed for similar applications worldwide. Local applications include the construction of Koeberg Nuclear Power Station and Coega Harbour.

Comment 46:

"Cut off Wall and Monitoring to prevent: Depletion of Local Aquifers
This impact may be mitigated by constructing a cut-off or diaphragm wall, and by carrying out groundwater level monitoring to assess the efficiency of such a design. Monitoring is considered an essential mitigation measure so that remedial actions can be carried out timeously, if required. The final design of dewatering schemes has not been established. However, based on results from this EIR study, the construction of such a barrier is considered to be an essential mitigation measure at the Duynefontein and Thyspunt sites. The siting of the NPS within the EIA Corridor should take this aspect/impact into account. Mitigation Hierarchy: Avoidance"

36. How can the report conclude with such confidence that impacts can be reduced with mitigation, lowering impacts from high to low, yet use language such as "This impact **may** be mitigated…"

Response 47:

Your comment is noted. The wording will be changed to *can* in the Revised Draft EIR Version 2

Comment 48:

37. Given the last paragraph of the box above, the conclusions of this report should surely recommend this site as unsuitable.

Response 48:

The Revised EIR Version 2 will take all the revisions and new data into account and the conclusions will be adjusted as/if necessary. For example, the additional wetlands/groundwater monitoring has shown that the risk of impact on the wetlands is lower than previously attributed. Furthermore the revision to the report has positive implications such as:

- Additional investigation/monitoring of the Langefonteinvlei
- The better understanding of groundwater/wetlands processes so obtained
- Willingness to take cognisance of the numerous questions that have been raised by IAPs, which have added value to the report; and
- The time-span from first submission to this revision and the quest for continual improvement

Yours faithfully

_____
For GIBB (Pty) Ltd
The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 8 August 2011

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Dear Tania Lategan

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

COMMENTS ON 2ND DRAFT ENVIRONMENTAL IMPACT REPORT (DEIR): NUCLEAR 1 THYSPUNT

As we consider your reply to our submission to be inadequate and the second draft EIA even more so, we have chosen to resubmit our previous comments, with responses to your answers and a few additional comments.

The Supertubes Surfing Foundation (SSF) is a non-profit (Section 21 Company) organization dedicated to the preservation of the dunes and beaches of Jeffreys Bay. It has been operational since 1999 and initiated by the local surf clubs, J Bay Boardriders and JBU. The SSF is a partner of the Thyspunt Alliance, a coalition of community-based organizations that are opposing the location of the facility at Thyspunt. We object on the following grounds:

Comment 1:

Although this has not been discussed in the EIA and we have not been given the opportunity to debate the subject, our stance is that the government and Eskom should be investing heavily in renewable energy. We reject the assumption that the only choices for baseload power are either coal-fired or nuclear power stations. We believe that our country should make use of wind, solar, biogas and wave power and that these options haven't been explored adequately due to insufficient funding. It is frightening to note that between 1974 & 2007, 55% of all public research dollars (US 236 billion) were spent on Nuclear. This is six times more than the level of support to renewables. This trend is also apparent in South Africa. Between 2006/7 and 2009/10, the country allocated R7,2-billion for the development of the demonstration and fuel plants to prove the PBMR technology, while it allocated a further R1,73-billion in 2009/10 for the programme. This programme has now been shelved. Imagine if some of this money could have been channeled towards renewable research.

Your response (1):

The energy mix for South Africa is an important issue, it is being thoroughly investigated through the Integrated Resource Plan (2), which will hopefully be released by the Department of Energy before the end of this year. Documentation is available on the DOE website but for ease of reference the introductory document has been attached to this response. This describes the factors which will be considered when determining the energy mix of the country. Eskom aligns itself with the IRP process and its outcomes. In order to avoid a possible electricity crises resulting from initiating the projects too late Eskom has initiated the EIA's for Nuclear, Coal, pumped storage, Combined Cycle Gas Turbines

and wind. The outcomes of the IRP will determine which of these projects will be allocated to Eskom and IPP's and which technologies will be suitable to meet South Africa's needs.

Eskom has recognized the need for clean electricity in South Africa, more recently the Department of Energy reflected this through the development of the Refit tariff and allocation of renewable technologies in the Integrated Resource Plan (1). This is an important step for South Africa since it provides the beginning of a regulatory framework for the implementation of renewable technologies. All technologies are required to meet the current and future demand for electricity. Eskom obtained Environmental Authorisation for a 100MW solar thermal demonstration plant in Upington and 100MW wind facility in Vredendal, unfortunately these were delayed due to funding constraints. However, recently Eskom has been successful in sourcing funding for both of these projects and are confident that the construction of the wind facility will begin within the next year. Eskom recently initiated a process to investigate biomass co-firing, this will be largely dependent on the sustainability and availability of the resource. Eskom has been carrying out research on several other renewable technologies which are not yet commercially available such as ocean pumped storage, wave and current technology. Eskom has also initiated studies into cleaner coal technologies and is demonstrating Underground Coal Gasification near Volksrus.

Our response (1):

Government policy leans towards large projects with great potential for corruption and towards protection of the Eskom monopoly. If Eskom were not a parastatal, but a private company, it would not pursue this most expensive and potentially dangerous method of generating electricity. If it truly wanted what was best for the country, it would be actively advocating renewables, which would provide both cheaper electricity and more jobs. We refer you to www.energyblueprint.info information supplied by Greenpeace, which states that, by 2030, South Africa can generate 50% of its electricity from renewables, creating 150 000 new jobs.

To say that, of the projected 40,000MW additional energy required, authorization was given for 200MW (0,5%) in renewables is an insult.

Response 1:

The development of the Integrated Resource Plan (IRP) 2010, which provides the South Africa government's policy for security of electricity supply for the next 20 years, was driven by the Department of Energy **and not by Eskom**. The IRP provides for the development of 17,8 GW (17,800 MW) of renewable power supply. The above-mentioned reply indicated two of the renewable power supply projects that Eskom is involved with. A significant portion of renewable energy required by the IRP will be supplied by Independent Power Producers (IPPs). Large infrastructure projects are necessary for the growth of the South African economy, they will not only ensure security of supply of electricity but the provision of sustainable employment.

Comment 2:

We believe that the public of Jeffreys Bay has been completely ignored during the current Draft Environmental Impact Assessment public participation process. No Public Meetings were held in Jeffreys Bay. We find this completely unacceptable and consider this a serious flaw in the public participation process.

Your response (2):

The public participation process in terms of the Nuclear-1 EIA has been designed to reach as many directly impacted Interested and Affected Parties (I&APs) as possible. During the Scoping Phase of the EIA public meetings were held in Jeffrey's Bay but these were relatively poorly attended. The majority of registered I&APs are located within the St. Francis Bay area and many of the public participation initiatives during the EIA Phase of the EIA have thus been centred around this area.

Public meetings have taken place in other areas such as Oyster Bay, Sea Vista and Port Elizabeth amongst others and a meeting with the Kouga (Jeffreys Bay) municipality was also undertaken.

Our response (2):

The public meetings during the Scoping Phase of the EIA were held in 2007 – 4 years ago and information at the time was vague. More recent public meetings would have alerted the public in Jeffreys Bay that they will be severely affected by e.g. the social, transport and marine impacts of a NPS at Thyspunt. The information shared during the meeting with Kouga municipality certainly was not made available to the public

Response 2:

Minutes of all meetings held during the Nuclear-1 public participation process are publicly available in the hardcopies, which are placed at various public libraries (e.g. the St. Francis and Humansdorp libraries) and on the Nuclear-1 EIA website. The minutes of this particular meeting with the Kouga Municipality is available under Appendix D5 at the following website
http://projects.gibb.co.za/en-us/projects/eskomnuclear1reviseddrafteir.aspx

Jerffrey's bay communities have attended the meetings held at Humandorp.

As indicated in the Revised Draft EIR and in the relevant specialist reports (e.g. the Marine Ecology Assessment and the Addendum on Surf Breaks), the broader regions will experience negligible impacts on marine ecology and Jeffreys Bay will experience no impacts on surf conditions.

Comment 3:

The environmental impact assessment contains many inaccuracies, such as the prevalent wind being Northwest and Vaalputs waste disposal site being closer to Thyspunt than to Bantamsklip. Vital information was omitted, such as the costs of upgrading roads from Port Elizabeth and the construction of transmission lines. Many figures referred to in the EIA do not appear therein.

Your response (3):

Your comments are noted.

The wind direction, as used in the Draft EIR and described in the Air Quality and Climate Assessment Report (Appendix E10) is correct, and is consistent with the wind roses for the area.

The transport distances were reviewed and found to be incorrect and will be rectified in the revised Transportation Assessment.

The draft Environmental Impact Report (EIR) is currently being revised and a revised report will be made available for public review and comment. Any inaccuracies and omission in the first draft of the report will be rectified in the revised draft.

Our response (3):

We repeat, your information on wind direction is incorrect.

The transport distances obviously impact on the Economic Report, so this should also be adjusted.

Response 3:

We repeat that the information regarding wind direction is correct.

Inconsistencies in the Transport Assessment did not have an impact on the calculations in the Economic Impact Assessment. Correct distances were used in the latter study.

Comment 4:

E22 Tourism assessment: Negative perceptions ignored on the basis that Koeberg has not affected tourism in Cape Town. This is an unacceptable extrapolation. Surf tourists are very aware of their environment and the SSF have a petition signed by thousands to the effect that they oppose the construction of a NPS near Jeffreys Bay. We find this report completely inadequate and unacceptable. The comment: *"Owing to budgetary cuts and time constraints, comprehensive surveys were excluded."* All specialists' studies should be as comprehensive as possible and budgetary constraints should not just be affecting those studies that have more bearing on the affected communities and less on engineering solutions of a Nuclear Power Station.

Your response (4):

Your comments are noted. Please see Appendix E37 for peer review reports of all specialist studies. No studies were shown to be fatally flawed.

Comment 5:

E18 Social impact assessment: Kouga municipal area, and Jeffreys Bay in particular, does not have enough water, housing, jobs, clinics or sanitation to serve the current population. An influx of any number of jobseekers will have a serious, long-term negative impact.

Your response (5):

The concern raised regarding local infrastructure is very relevant. Eskom will be required to engage with the local authorities prior to construction to determine and document responsibilities for this. Furthermore, Eskom will use desalination units to supply the power station with fresh water in order not to use the existing resources of the community. Eskom will also build a sewer plant on site for the same reasons. If the project is approved, Eskom intends proceeding with a study to determine the current level of skills of the unemployed in the area to plan for training of these people, as far as possible Eskom intends to use as much local labour as possible, this will be achieved by working with local communities and the voters roll. These initiatives along with others are intended to minimise the influx of job seekers.

Our response (5):

A desalination plant on the NPS site will not prevent thousands of jobseekers flocking to the area from using our water resources. The same goes for a sewer plant on site. It is impossible to restrict desperate people from moving into the area if they perceive a possibility of employment. By constantly trying to gain favour for the NPS with the public and government on the basis of job creation, you have already caused an influx.

Neither EIA factors in the costs of possible infrastructure upgrades being paid for of partly paid for by Eskom.

Please specify what "other initiatives" will be used to discourage people from moving to Kouga.

Response 5:

It is accepted that Eskom must bear some of the financial responsibility for the upgrade of infrastructure that would be necessary for an influx of people into the area (although Eskom cannot be held responsible for assisting municipalities financially for current infrastructure backlogs). Thus, one of the key recommendations of the Revised Draft EIR is that "*Eskom must enter into negotiations with local authorities and other relevant authorities well before the start of construction to identify how it can be ensured that municipal services are capable of providing sufficient capacity for the expected influx of people into the affected area. Agreement must be reached between Eskom and these bodies on the apportionment of financial responsibility for infrastructure upgrades.*"

It is important to note that it is the right of people to move to seek employment and that people therefore cannot be prevented from moving to the Kouga region to better their economic circumstances. However, it is recognised that migration of people into the region will impact on existing residents' access to services and therefore the following measures are recommended to mitigate the impacts of the influx of job seekers:

- A proactive, broad-based information campaign (including site notices) to clarify the number of job opportunities that will be available. The objective is to dispel rumours and unrealistic expectations and thereby seek to curtail the inflow/settlement of job seekers;
- Proactive engagement by the appointed contractor(s)with local authorities/SAPS/Community Policing Forums PFs to ensure that job seekers do not settle in the vicinity of Construction Villages or the construction terrain;
- Follow a transparent public participation process with role-players and I&APs; Make use of local labour and local suppliers of material for the construction as far as possible; and
- Monitor the situation after the occupation of the Construction Village, Staff Village and housing projects, and involve the relevant role-players in such process.

The design of the housing, community participation and labour relations policies and practices could be modelled on that of the Port of Ncgura. The Coega Development Corporation, which is recognised as one of the more successful organisations with regards to mitigating the impacts of an influx of job seekers, has indicated that it is willing to share its experiences and provide advice to Eskom on the design of appropriate policies and procedures.

Comment 6:

E25 Transportation assessment: The additional traffic volumes in the area will have a further negative impact on tourism. We are also concerned by the increased risk of traffic accidents due to more vehicles on the road from Port Elizabeth. Many local surfers commute between Jeffreys Bay and Port Elizabeth daily.

Your response (6):

Growth in economic active areas is unavoidable. The same applies to Jeffreys Bay area. Development and increase in traffic flows steadily increased through the years without the existence of the power station. Traffic is directly related to the number of inhabitants in an area. The following information was obtained from the Koega Spatial Development Framework (December 2009):

- **847 houses was completed in Jeffrey's Bay during the year with a further 359 under construction**
- **According to the census of 2001, the population of Jeffrey's Bay was 16 178 people. The CDM survey of 2005 shown a population of 40 203. The population of Jeffrey's Bay is expected to be 62 434 in 2015. The totality of the Nuclear-1 project will at maximum be approximately 7000 in the entire area of Kouga (some of the 7000 jobs will be local people). It is estimated that approximately 2000 of these staff will reside in Jeffrey's Bay (out of the existing 62 434).**
- **The population in the entire Kouga municipality (2005) was estimated at 88 793**

Please note that these figures do not include the Nuclear-1 power station staff. There will of course be an additional increase in the traffic due to the construction activities. Traffic maximums will occur during the mornings and afternoons when construction staff goes to work (estimated at a maximum of 320 vehicles per hour). Eskom will use busses to reduce the number of individuals travelling to work on a daily basis. A revised transportation specialist report has been produced and will form part of this revised DEIR.

Our response (6):

We would argue that during the construction period of the proposed NPS, transport would not be directly related to the number of inhabitants in the area, since many of the construction vehicles transporting building materials would be making round trips, some types as many as 7,953 per year.

Even if you are able to minimize the influx to just two people for every one of the 7,000 jobs and fewer than half of those have a partner (and/or children) there could easily be an additional 20,000 people in the greater municipal area – equivalent to the projected growth of Jeffreys Bay over 10 years. Two thirds of these people would be unemployed or take jobs from the current residents, leaving them unemployed.

These 7,000 jobs are of course not available concurrently over the entire construction period, are temporary and will leave the Kouga municipality with an even greater burden after construction is completed.

Please note that our concern is not so much the 1,300 staff who would be permanently employed after completion of the proposed NPS. They would be able to pay rates and taxes which would hopefully contribute to upgrading of necessary infrastructure.

Response 6:

The Transportation Assessment specifically addresses the impact of additional traffic generated by the construction and staff transport, (home-work trips) and recommends mitigating interventions required. As stated, there will be a secondary increase in traffic volumes that can be attributed to the families of the staff / workers. This increase will predominantly be recreational, school and secondary employment trips. The growth of traffic related to this will not be evenly spread throughout the region, so it is impossible to calculate a general traffic growth. The traffic growth will be focussed predominantly in the vicinity of the new staff housing areas and separate Transport Impact Assessments will be undertaken to determine and mitigate these impacts. The extent of mitigation required can only be determined when the exact location of these areas is finalised.

Please note, with respect to construction traffic, that the Transport Impact Assessment has been substantively amended. The revised Transport specialist study therefore acknowledges that the Thyspunt site requires significant transport infrastructure upgrades. The R330 is now proposed to be used for light vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operations phases for staff access, light vehicle traffic, heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity. The Transport Impact Assessment will be made available for public comment with the Draft Revised EIR Version 2.The approximately number of jobs is an estimate of the employment at the peak of construction i.e. in approximately the sixth year of the nine year construction period. Seven thousand people would not be employed throughout the construction period.

As stated above the influx of people into the area will need to be carefully managed and additional services and infrastructure will be required. Eskom, local and provincial authorities will need to plan for the appropriately both financially and logistically.

Comment 7:

E15 Marine impact assessment: We are vehemently opposed to the discharge of 6,37 million tons of spoil into the ocean at any rate or with any mitigating measures. We believe that the sediment and the resulting turbidity would have a negative impact on the marine life and on the squid in particular. As many local surfers are also involved in the squid industry, this would affect their income and probably lead to job losses. It is inconceivable to us how, in a country with high unemployment rates, a very lucrative, 6,000-job industry can be put at risk.

Your response (7):

Your comments are noted. The Marine Assessment specialist found that the temporal and spatial limitations of the impacts associated with the disposal of spoil on the chokka squid at Thyspunt will have limited impact on the overall squid stock, when taken within the context of the extensive area over which the species spawns.

Our response (7):

According to SASMIA (the South African Squid Management Industry Association), between 28 and 37% of all squid catches in the squid industry occur within 10 nautical miles East and West of the proposed NPS. The construction of the cooling water uptake and release pipes, the disposal of 6,3 million cubic metres of spoil on the ocean floor and resulting increase in turbidity from and (sic) average of 3mg/l to 26mg/l will combine to do irreversible damage to thousands of square metres of prime squid breeding grounds. Although it is true that squid is found along almost the entire SA coastline, the area around Thyspunt is clearly very concentrated.

Response 7:

The figure of 28 to 37% catches (previously around 30%) quoted by SASMIA appears to have been calculated using only four selected vessels – a gross under-representation of the chokka squid fleet. Data from the commercial database of the Department of Agriculture Forestry and Fisheries for the same area provided to the marine specialist team show that 14.7% of total squid catches are taken in the **wider area** (two quarter degree squares of approximately 22 x 27 km each) around the Thyspunt site – itself a much larger area what will in fact be impacted in the immediate vicinity of the proposed power station. The 30% figure used by SASMIA is therefore not supported by independent information on the total chokka squid fishery provided by the DAFF and its advisory body, the Squid Working Group, which is .

The total area that will be affected by a temperature increase of 3ºC or more as a result of the release of warmed cooling water will be less than 1km^2 in the inshore area. In the current revision of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR) the area potentially lost to the fishery (based on the commercial info provided by DAFF) is presented. While still under review, this figure ranges from 2.86% (worst-case scenario) to 2.53% (least-case scenario) to the fishery in the **local area** under question, or between 0.42% and 0.37% for the fishery as a whole.

The Marine Ecology Assessment bases its assessment of the impacts on squid on all potential sources of impact, including the marine exclusion zone, the release of warmed cooling water, the increase in turbidity and the disposal of spoil on the seafloor. The recommendations of this report are that spoil must be released at a disposal site deeper than the relatively shallow spawning grounds of chokka squid, which extend to a depth of approximately 50 m. Thus, release of spoil will take place at a depth of around 80 m, up to 6 km from shore. The Marine Ecology Assessment accordingly found, based on these release depths, that the maximum suspended sediment concentration (based on a medium discharge rate of 2.06 m^3/s) is not expected to reach levels above the critical 80 mg/l (above which definite impacts can be expected) near the water surface at any time during or after spoil disposal. Furthermore the impacts will be confined to less than 1.4km² near the seafloor. Hence it is a key recommendation of the Environmental Impact Report that a medium discharge rate must be used and not a high discharge rate, since high discharge rate would result in unacceptably high turbidity that could impact on squid. In addition, the turbidity levels will be temporally limited outside the actual disposal site, occurring for a maximum of two days throughout the entire disposal period. Therefore, the impacts of increased turbidity on chokka squid are predicted to be very limited.

Comment 8:

Our comment (8) (sic):

E2 Dune geomorphology: We object to the building of roads across a mobile, soft dune system which behaves in unpredictable ways. We believe that this will damage the unique ecosystem and biodiversity of the area and therefore contravene the Biodiversity act of NEMA.

Your response (8) (sic):

Your comments are noted. The impact of the Nuclear Power Station on the mobile dune system has been assessed in the Dune Geomorphology Assessment (Appendix E2 of the Draft EIR) and the impacts are described in sections 5.3 and 6 of the report in more detail. It is recommended, irrespective of which site is chosen, that a team of specialists (including the botanical, wetlands, vertebrate and invertebrate fauna, heritage and visual specialists) must determine the detailed positioning of infrastructure on site prior to detailed design of the power station and associated infrastructure.

Our response:

Our concern referred to in this comment is not with the flora and fauna of the area, but with the building of roads to carry radioactive waste across a headland bypass dune system, which behaves in unpredictable ways, such as recently demonstrated by the washing away of the Sand River bridge (twice).

Response 8:

The issue of radioactive waste transport across the dune system was not identified as an issue of concern in your initial comment.

Waste transport will be carried out according to the appropriate provisions of the IAEA Regulations for the Safe Transport of Radioactive Material, subject to a graded approach. The objective of the Regulations is to protect persons, property, and the environment from the effects of radiation during the transport of radioactive material. In terms of the Regulations, the transport process is subject to radiation protection, emergency response, quality assurance, and compliance assurance programmes.

Appendix E30 assessed the risk of debris flow within the mobile dune system in detail and found that the a number of conditions necessary for the occurrence of debris flow do not exist within the dunes, primarily because the slopes of the dunes are not steep enough. The frequent flooding damage that has occurred to the road overpass over the Sand River can be mitigated by appropriate engineering design to cater for larger flood events. The revised Transport Assessment recommended that a Stormwater Assessment Plan be undertaken to evaluate the future flooding probability of the river. The design specification for the upgrade of the bridge should be reviewed in accordance with the results of the Stormwater Assessment Plan to ensure that the bridge is capable of accommodating a higher storm probability.

There are two route options for the transport of waste from the facility, the primary route being via the upgraded Oyster Bay road and the secondary route option via the R330. This allows for an alternative transport route should one become incapacitated in any way.

The current frequency of transport of LLW and ILW to Vaalputs is 6 times and 32 times per year, respectively, given that 120 metal LLW and five concrete ILW containers can be transported per shipment. This equates to a transport frequency of a maximum of one every week and a half. Similar frequencies will apply to Nuclear-1. Safe temporary storage space will be provided on the nuclear power station site for Low Level Waste (LLW) and Intermediate Level Waste (ILW). In the event of a road washing away, the power station would therefore have sufficient capacity to store LLW and ILW on site until such time as roads have been repaired.

LLW and ILQW will be transported in sealed drums (metal drums and concrete drums, respectively) that prevent the escape of radiation into the environment. This is an internationally acceptable practice that will be undertaken in terms of the conditions of the National Nuclear Regulator and the IAEA

Regulations for the Safe Transport of Radioactive Material, In terms of the Regulations, the transport process is subject to radiation protection, emergency response, quality assurance and compliance assurance programmes. Such waste transport to Vaalputs has taken continued to take place from Koeberg Nuclear Power Station without incident for several decades. The drums are transported in a normal road-going heavy delivery vehicle.

ADDITIONAL COMMENTS FROM INDEPENDENT NUCLEAR SPECIALIST

Agreed - the key factor in the safety of transport in accordance with IAEA regulations is that safety is built into the transport package (provided it is an approved design) and not specifically dependent on the transport route - as such transport packages are engineered to be deterministically safe for a range of potential transport incidents and consequences.

Comment 9:

E12 Wetlands: We live in a water-scarce area and having just experienced the worst drought in 132 years, we object to any disturbance of the Langefonteinvlei wetlands on the Thyspunt site.

Your response (9):

Your comments are noted. The Wetlands will be avoided, potential indirect impacts resulting during construction are being thoroughly investigated (continuous monitoring and assessment over the past 18 months by independent specialists) and will ensure that the wetlands are not impacted.

Our response (9):

Why then does Appendix E12 state:
"The zone of dewatering (0,1 m drawdown) could extend to a maximum of 1,8 km from the footprint boundary when dewatering the entire (approximately 27 ha) footprint. The dewatering would intersect flows in the mobile dune, affecting both wetlands in the Oyster Bay dunefield and the Langefonteinvlei itself. "

Response 9:

The above-mentioned text must be read in context of the entire report. Modelling of the impacts of groundwater drawdown was undertaken for a number of scenarios, including one scenario where dewatering would over the entire 27 ha footprint. This is not the only scenario that was assessed. As indicated by the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR, extensive groundwater and wetland monitoring took place during 2011 and the results of this monitoring confirmed that "that the southern portion of the Langefonteinvlei, and the western sections of both the southern and the northern portions of the wetland are perched above the groundwater table of the Algoa Aquifer[1], rather than being linked directly to it. Drawdown caused by abstraction or dewatering extending to below these parts of the wetland is therefore unlikely to have any effect on wetland hydrology or hydroperiod".

Furthermore, it is recommended in this specialist report that a hydrological cut-off wall must be implemented around the power station excavation to prevent the drawdown of the water table far beyond the excavation. The comparative results of the implementation of such a cut-off wall are shown in Figure 4.7A (without a cut-off wall) and 4.7B (with a cut-off wall). Figure 4.7A shows the unmitigated impacts, indicating that groundwater drawdown would extend close to the western boundary of the Langefonteinvlei wetland. Figure 4.7B shows the mitigated impacts, where groundwater drawdown would extend only in a westerly direction but would be restricted to the excavation and would not extend in an easterly direction toward the Langefonteinvlei wetland.

[1] The aquifer immediately below the recommended power station footprint from where drawdown would take place

Our comment (10):

Minutes: We strongly object to the fact that the minutes of various recent meetings, such as the one held at the St. Francis Links on 25 May 2010, were only available nearly a month afterwards. We believe that the late publication of minutes is purposely frustrating our efforts to present our response to the Draft EIA. We therefore reserve our right to challenge the procedural fairness of this EIA process on the grounds that crucial and important information is supplied late and these actions do not allow us sufficient time to include the information which was presented at the meetings in our final comments.

Your response (10):

Your comments are noted. Interested and Affected Parties were given 14 days to comment on draft minutes. As previously stated you will be afforded with additional time to submit comments when the Revised Draft EIR is made available for public review.

Our response (10):

Our concern is not with the 14 days afforded to comment on the minutes, but the fact that the minutes were not made available sooner after various meetings. This is still a problem, eg. Minutes for the meeting held on 31 May 2011 were only sent out on 21 June 2011.

Response 10:

As you know, a series of five meetings was held around the Thyspunt site in the period 29 May to 2 June 2011 (one meeting per day). This included meetings in Oyster Bay, St. Francis, Sea Vista and Humansdorp. The same members of the EIA team presented at all these meetings. As such, although it was aimed to complete these minutes in the shortest possible time frame, it was not possible to transcribe the recordings of all these meetings and for quality control of the transcriptions to take place in a shorter time. GIBB was not prepared to make the draft minutes available without quality control (which had to be performed by two key resources who presented at these meetings), especially considering the fact that some interested and affected parties had complained about the quality of previous minutes.

New comments following publication of the Second Draft Environmental Impact Assessment and subsequent public meetings and open days

Comment 11:

1. We object to the fact that you have not agreed to have Key Focus Group Meetings with anyone but the Squid Industry and a dissident KhoiSan group. We consider this "Second Revised" DEIR to be a new document and as such require your specialists to be available to explain their findings to their peers if necessary.

Response 11:

Please provide a motivation for your objection to the involvement of SASMIA, the Gamtkwa KhoiSan Council and the 1st Nation. SASMIA is considered to be a key interested and affected party in the St. Francis region due to the importance of the squid industry in the area as a source of employment. The Gamtkwa KhoiSan Council and 1st Nation groups are considered as a key interested parties due to their claim that members of these groups have descent from Khoi and San people and the presence of KhoiSan archaeological sites on the Thyspunt site. It is the responsibility of the EAP objectively and independently consider all voices and to consult as broadly as possible.

A Key Stakeholder Workshop (with selected specialist being present) is under consideration after the release of the Draft EIR Version 1 in 2012. However, it is not common practice to have specialists

present in detail on each of their studies to the public. Comments from peers are encouraged and we ask that they are submitted so that the relevant specialist can respond to them. Where specific issues have been raised such as the concerns related to squid, heritage and debris flow specialist workshops have been held to facilitate discussion between specialists.

Comment 12:

2. We object to the fact that the technology for the proposed NPS has still not been identified and therefore the emergency planning zones cannot be specified by the National Nuclear Regulator.

Response 12:

The technology **has been decided** – nuclear power station, pressurized water reactor technology (reference Nuclear Energy Policy of South Africa). **The vendor**, and hence the specific design of PWR has not yet been decided. As indicated in the EIR, the assessment of the impacts of the proposed power station is based on a Consistent Dataset (Appendix C of the Revised Draft EIR), which represents a worst case scenario of potential inputs and outputs from a Generation III nuclear power station operating under normal conditions. This dataset has been based on the commercially available nuclear power station designs currently available.

Comment 13:

3. We object to the fact that the National Nuclear Regulator, according to them, has to date not been approached by Eskom.

Response 13:

Please provide substantiation for your statement that the National Nuclear Regulator (NNR) has not been approached by Eskom. Eskom has engaged with the NNR on a regular basis, although the official application for a nuclear license has not yet been submitted. The license application can only be submitted after the vendor is known and detailed designs and proposed operational data on the proposed power station are available. .

Comment 14:

4. We object to the fact that Eskom is continuing to purchase land in the area as if the project has already been approved. This has the effect of leading the public to believe that opposing the project would be a futile exercise and putting pressure on the government to give a positive Record of Decision because of the amount of money which has already been spent.

Response 14:

Eskom is buying land around the Thyspunt site at its own risk, pending the outcome of the EIA process. There is nothing in law that prevents Eskom from acquiring such land. In terms of NEMA, an applicant is prohibited from commencing with construction prior to receiving an authorisation. The development of a nuclear power station is dependent on long-term planning, which is why the potential sites for nuclear power stations were acquired as many as 20 years ago. It would indeed be unwise for Eskom to wait to the proverbial “last minute” before it bought the land.

Eskom’s acquisition of additional land around Thyspunt must also be viewed in context of the recommendations of the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR) that wetlands that fall outside the current Eskom owned land must also be secured for inclusion into a de facto nature reserve. The acquisition of these wetlands for conservation is regarded as one of the key “offset” mitigation measures at Thyspunt.

Comment 15:

5. We object to weightings given to various specialist reports in order to ensure that Thyspunt is declared the preferred site whilst being the most environmentally sensitive.

Response 15:

Your objection is noted. Please provide substantiation for your objection.

Comment 15:

6. We object to the fact that Eskom have completely ignored the South African Heritage Resource Agency (SAHRA)'s input on this proposed project.

Response 16:

A sensitivity analysis of each of the alternative nuclear power station sites was undertaken, based on the findings of the relevant specialists and their identification of sensitive areas on the sites. These sensitive areas have been overlapped to produce a composite sensitivity map and hence indicate an area that would affect the least sensitive features on the sites. The recommended position of the power station on each of the alternative sites, as with Thyspunt, is in the area of lowest environmental sensitivity. In the case of Thyspunt, the recommended position of the power station avoids sensitive environmental features such as the concentration of heritage sites along the western coastline, the mobile dunes in the northern portion of the site and the wetlands in the northern and eastern portions of the site. Thus, although the larger Eskom property as a whole contains many sensitive elements, the recommended position of the power station ensures that potential impacts on these features is either avoided or minimised.

Comment 17:

7. We object to European Utility Requirements being used to define emergency planning zones. These standards are not recognized by the International Atomic Energy Association not by the National Nuclear Regulator.

Response 17:

at the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs.

Please note that the Emergency Plan radii are defined by source terms that the plants are designed for, together with the potential accident scenarios modelled. Over the plant life several modifications are made to the plant, taking into account various experiences and risk study outputs. These allow for the reduction of public risk and may also inform the reduction of Emergency Plan radii. The new plant designs have taken into account the lessons learnt from the Operating Experience of plants in operation. These improvements have been incorporated on designs, and will also be reviewed by the NNR for soundness.

Comment 18:

Finally, as the Supertubes Surfing Foundation, we believe that the Thyspunt area is of immeasurable value to the human race and the planet as a whole. It should be declared a UNESCO World Heritage Site and preserved for future generations.

Response 18:

Your opinion is noted.

_____

Yours faithfully
for GIBB (Pty) Ltd

Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 08 August 2011

Email: dmarshall@uwc.ac.za

Dear Delia Marshall

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

EIA COMMENTS

I have several concerns regarding the EIA for Nuclear-1:

Unscientific ranking system used in the EIA

The ranking system used to demonstrate the preferred site for Nuclear-1 is amateurish and poorly substantiated. Such vague, unscientific reasoning would not be accepted in an undergraduate report!

Decisions about if and where to site a nuclear power station ought to made on a thorough, scientifically rigorous basis, not on the basis of an amateurish and opaque ranking system.

Response 1:

Your comment is noted. Every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts has developed over the last three decades and includes a number of criteria that are applied almost universally in EIAs by professional practitioners. These criteria typically include nature (is the impact negative or positive?), extent (or scale), duration, intensity (degree of change), consequence (seriousness), reversibility, probability (how certain is it that the impact will occur?) and significance (overall importance of the potential impact).

Although there is general agreement about the nature of the criteria for assessment and there are local and international guidelines on this, there is no single agreed method. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria, as well as any requirements that the environmental authority might have regarding the criteria. In the case of the Nuclear-1 EIA the EAP sought assistance from other senior EAPs, namely Mr. Neal Carter and Mr. Reuben Heydenrych, as well as an advisor on EIA process, Mr. Sean O'Beirne.

Furthermore, based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to

simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

Comment 2:

Spent fuel disposal

It is envisaged that the spent fuel in Nuclear-1 will be stored in the nuclear power station, as currently the case at Koeberg. However, one of the lessons learnt from Fukushima is that waste on site is not optimal. Currently no other options exist in South Africa.

In addition, the construction of high level waste facilities is extremely costly, as demonstrated in the USA, among other countries (see Economic impact, below)

Response 2:

The design of the Fukushima Daiichi nuclear power station dates from the late 1960s and does not incorporate the substantial lessons in nuclear power station design that have been learnt in the decades since its construction.

One of the major differences between the design of the Fukushima Daiichi power station and later power stations in terms of spent fuel storage is that the Fukushima Daiichi design includes the spent fuel pool outside the containment structure, housed in a steel structure whereas in later designs (e.g. at Koeberg Nuclear Power Station - KNPS), the spent fuel pool is within the steel enforced containment structure and contamination in the containment structure does not impact access to, and operation of, spent fuel cooling systems. Please see Appendix E32 and E33 of the Revised Draft EIR (Version 2) for a more detailed discussion.

The spent fuel pool storage is provided as part of the overall plant supply and is not differentiated. The decommissioning costs are inclusive of used fuel/spent fuel management/storage.

Comment 3:

Economic impact on South Africa

What is perhaps most concerning about this Nuclear-1 proposal is the potentially *adverse economic impact on the country.*

The assumption is made in the EIA is that nuclear energy remains a cost-effective mode of energy production for South Africa, but this is not adequately substantiated in the documentation. The comparative figures in the EIA are in fact different from those in the IRP2, which points to sloppiness in the EIA report-writing process.

I am concerned that the projected costs for nuclear energy seem to be based on outdated figures. In addition, the EIA doesn't adequately take into account decommissioning costs, nor the high costs of building permanent high-level waste facilities, nor the legislated insurance requirements.

All these costs need to be factored in *now* – they cannot be left for future generations to deal with.

An additional concern is that the actual end-of-project costs for Nuclear-1 are likely to be significantly higher than the projected costs. This is an international trend. For example, the newest EPR reactor being built in Finland is currently costing double the projected price.

Response 3:

The costs for nuclear generation are based on the costs in the IRP 2010. The projected costs in the Revised Draft EIR are based on 2008 figures. Inflationary increases would need to be applied to these costs to account for current construction costs.

There have indeed been significant cost overruns with regard to the construction of nuclear power stations. However, it must be borne in mind that the Finland site (Olkiluoto) was the first site where the new EPR unit was constructed. The French site (Flamanville) was the second and a considerable number of lessons learned at Finland site were implemented at Flamanville – hence much reduced delays were experienced. The Chinese plants used these lessons and are on time and within cost. Eskom never intended to build a first of a kind plant type, which obviously will reduce the risk of overruns in both construction time and cost.

With regard to cost, we refer you to the EPRI report carried out on behalf of the DOE to inform the Draft Integrated Resource Plan. Coal will be subject to carbon taxes and increasing fuel cost in the future, which will influence cost comparisons of nuclear, coal and renewable technologies.

Comment 4:

Argument based on increased base-load requirements

The EIA refers to a 4% average demand growth in electricity over the past few years. However, this is contested by researchers in energy studies, who argue that this value is inflated (eg. Winckler, 2009). The EIA refers to Eskom's projection of over 40 000 MW of new generating capacity required over the next 20 years, but this is not referenced or substantiated.

Should South Africa remain stuck in out-moded views of economic growth linked to heavy industry (including smelters), rather than to more sustainable models of growth? If the extra base-load requirement is in fact not required urgently, it seems unwise to invest so heavily in nuclear energy at this stage.

Furthermore, there is no analysis in the EIA of ways to meet energy demand in other ways (eg demand side management options). The 'no go' option is poorly motivated.

Response 4:

With regards to the motivation for the need for additional electricity generation capacity, please refer to Chapter 4 of the Revised Draft EIR, which is based (amongst other sources) on several Eskom annual reports showing the increase in electricity demand, as well as sources like the Department of Energy and the International Energy Agency and the Accelerated and Shared Growth Initiative for South Africa (AsgiSA). In addition, you are referred to the National Planning Commission, which states in the National Development Plan that one of the key objectives with respect to Economic Infrastructure is that "*The country would need an additional 29 000MW of electricity by 2030. About 10,900 MW of existing capacity is to be retired, implying new build of more than 40,000 MW*".

It is not within the mandate of an EIA process to make recommendations regarding the economic growth model for South Africa and whether the economy continues to rely on large-scale energy-intensive industries.

It is pointed out in the Revised Draft EIR that Eskom is not pursuing nuclear electricity generation exclusively and to the detriment of renewable electricity generation. A range of different generation alternatives need to be pursued in parallel in order to meet South Africa's electricity generation challenges. It is not within the mandate of a project-specific REIA process such as that for Nuclear-1 to question the strategic decisions that have been taken in the Integrated Resource Plan for the proportions that different generation technologies should contribute to South Africa's electricity generation mix. The IRP has examined these technologies and come to the conclusion that renewable energy sources must make up around 17,800 MW of future power supply and that demand-side management can achieve a maximum saving of around 3,420 MW by 2017.

Comment 5:

Safety standards

The EIA fails to consider the perceptions of the safely culture that exists in the South African nuclear industry. It is well-known that the safety culture at Koeberg has been a concern. With heightened public awareness of safety issues in the wake Fukushima (as well as 'near misses' like the Forsmark Swedish nuclear power station incident in 2006), it would be imperative to address this issue.

Response 5:

Your comments regarding the perception of safety culture in the South African nuclear industry are noted and it is agreed that a culture strict safety with regards to nuclear technology is an absolute necessity. It is also to be noted that the Koeberg Nuclear Power Station's radiation emissions have been consistently far below legal limits set by the National Nuclear Regulator (as reported publicly in the National Nuclear Regulator's annual reports) in all the years of this power station's operation.

The Fukushima Daiichi incident has indeed focused attention on issues of nuclear safety. An analysis of this incident and the implications it holds for the design and operation of nuclear power stations will be included in a revision of the Nuclear-1 EIR, which will be made available for public comment. It is to be noted, as indicated in Response 2, that nuclear power station design has advanced considerably since the late 1960s Fukushima designs and that current Generation III designs are inherently much safer than the Fukushima Daiichi design.

RESPONSE FROM THE INDEPENDENT NUCLEAR SPECIALIST

The adoption and demonstration of a "nuclear safety culture" is a fundamental tenet of modern nuclear safety management systems - the effective on-going demonstration of which would be expected to be a key part of the NNR licensing conditions

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 07 August 2011

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Dear Andre Von Holdt

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

RE: ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (DEA REF. NO.: 12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE - REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: REMINDER CLOSURE OF REVIEW PERIOD

Comment 1:

We would like to register our opposition to the possible siting of a nuclear power plant at the proposed Bantamsklip site.

As the recent natural catastrophes in Japan have illustrated, nuclear power can never be considered 100% safe. Natural disasters, mechanical breakdowns and human error are factors that are unpredictable and inevitable in the long-term. This is of relevance to both active nuclear reactors as well as to the extremely long-term hazards of nuclear waste that will become the burden of future generations.

Response 1:

Your comment is noted. It is acknowledged that the incident at Fukushima as a result of this natural disaster has highlighted many important safety factors in terms of the future of nuclear energy and is indeed a stark reminder of the unpredictability of the natural environment. However it is also well known that South Africa is located on a vastly more stable tectonic environment that that of Japan which is situated close to a major subduction zone within the Pacific Ocean and the two cannot, in all fairness, be compared to one another.

South Africa will not build its nuclear power stations on fault lines or on coasts susceptible to tsunamis, and it has already reviewed its regulatory system. We therefore stand by our assessment that serious incidents in South Africa are unlikely. Please see Appendix E32 and E33 attached for a more detailed discussion.

It is also acknowledged that the issues of radioactive waste management is important and integral to debate surrounding nuclear energy and as stated the only alternative currently available in South Africa is long-term storage of the spent fuel in the nuclear power station. However please note that radioactive waste management practices envisaged for Nuclear-1 are consistent with the IAEA guidelines for a Radioactive Waste Management Programme for nuclear power stations, from generation to disposal. Nuclear Power Station strives to minimise production of all solid, liquid and

gaseous radioactive waste, both in terms of volume and activity content, as required for new reactor designs. This is being done through appropriate processing, conditioning, handling and storage systems. In addition, production of radioactive waste is minimised by applying latest technology and best practices for radiological zoning, provision of active drainage and ventilation, appropriate finishes and handling of solid radioactive waste. Where possible, the Nuclear-1 power station will reuse or recycle materials.

All forms of radioactive wastes are strictly controlled and numerous specialised systems and management practices are in place to prevent uncontrolled contact with these substances. These controls and practices differ for the different forms of radioactive waste. South Africa still has to formally release a strategy for the long-term management of HLW, including spent fuel. Until such time, all spent fuel is stored temporarily either in spent fuel pools (wet storage), or in dry cask storage facilities (dry storage). This allows the shorter-lived isotopes to decay before further handling, a management strategy that is acceptable from a safety perspective. It must be noted however that as per the Department of Energy's Media Statement on Nuclear Procurement Process Update as released on 14 July 2015 strategies are complete to develop an approach for South Africa to deal with Spent Fuel/High Level Waste disposal.

Comment 2:

The development of alternative energy solutions has not been taken up or promoted by government adequately. This must be done so with urgency.

Response 2:

This EIA and Application for Environmental Authorisation is not a strategic assessment of South Africa's energy requirements and the future energy mix proposed to address these requirements or an investigation into the pros and cons of the use of Nuclear Power versus Renewable/Alternative Energy. It is a tool used to assess the possible positive or negative impact which the proposed project may have on a specific receiving environment, which in this case are the Duynefontein, Bantamsklip and Thyspunt sites. As you rightly point out these issues fall within the ambit of strategic government initiatives such as the Integrated Resources Plan 2010.

Comment 3:

In terms of the specific proposed siting at Bantamsklip, this seems extremely inappropriate. This is a highly prized area of the coast in terms of both tourism and biodiversity - and an area in which the local economy relies on its many visitors / tourist trade.

Response 3:

Your comment is noted however a team of in excess of 30 independent specialists (including tourism, socio-economic and biodiversity specialists) have found no fatal flaws at any of the three sites under investigation. In the event that the Thyspunt site is approved by the Department of Environmental Affairs for the construction and operation of Nuclear-1 Eskom would need to re-apply for Environmental Authorisation if Bantamsklip is put forward as a site alternative for Nuclear-2.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 07 August 2011

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Dear Michael & Cecelia Ravenscroft

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

COMMENT ON NUCLEAR – 1 REVISED DRAFT

We have studied revised draft and attended public meetings in connection with Nuclear 1. We align ourselves with the Save Bantamsklip campaign and agree with their comments. In particular we would like to make the following comments:

1. Nuclear safety

   In the Mail & Guardian of the 29/07/2011 a report on nuclear plant safety, the nuclear regulator informs us that Koeberg has established a team that identified areas for improvement.

   We were told that is *was* perfectly safe. Will Nuclear -1 also be reassessed down the line for possible improvements, if nothing goes wrong in the meantime?

   Experience has shown that human error and natural disasters are impossible to predict.

   All systems are at risk from accident and breakdown and we must suffer the resulting inconvenience. A nuclear disaster, with loss of life and long lasting effects on humans and the environment, goes way beyond inconvenience, and is unacceptable.

   No decision makers should be expected to carry this responsibility as part of their job.

Response 1:

Your comments are noted.

The principle of continuous improvement is an intrinsic part of the operational philosophy of nuclear power stations. The fact that improvements have been identified does not mean that there have been significant deficiencies that endangered public safety. Nuclear power station operators are informed on an on-going basis by the International Atomic Energy Agency (IAEA) of possible improvements

that are identified in nuclear facilities so that these can be replicated in other facilities to improve nuclear safety globally.

For instance, even though no tsunami has ever been recorded on the Cape west coast, the Koeberg Nuclear Power Station (KNPS) is constructed on a platform 8 m above sea level to minimise the risk of a tsunami impacting the power station. In the wake of the events at Fukushima Daiichi power station in Japan, lessons learnt from that incident are also being applied at the KNPS to reduce this risk even further. Although there are a number existing back-up power supply options, new diesel generators are being installed at a height of 12m above sea level to provide an additional power supply in the event that all the other options fail.

Risk is inherent in almost all human activity. Whilst it is true that there are (managed and well-controlled) risks associated with nuclear power generation, there are many other common risks (that have a far greater potential to lead to fatalities or serious and debilitating injuries) that the public is happy to accept on a daily basis. Such common risks include travelling in vehicles (around 15,000 South Africans are killed on our roads each year – this does not include the number of serious injuries and incidents of paralysis) and common household chemicals like chlorine that can be used to make explosives, but over which there is no control. In spite of the comparatively low risk of sickness or death from nuclear incidents (bearing in mind that there has been not a single fatality or incidence of radiation sickness recorded from the release of radioactivity from Fukushima Daiichi but more than 20,000 combined deaths and missing persons recorded as a result of the tsunami), there remains a perception that nuclear technology results in an inherently greater risk of death or injury than other commonplace risks. In spite of 20,000 deaths from the tsunami, there does not seem to be an equal perception of risk associated with living in low-lying coastal cities, living in areas prone to earthquakes or other commonplace risks that people have come to take for granted.

Comment 2:

2. Energy crisis

   Having neglected [even opposed] developing alternative systems for the past 30 years because "we have the cheapest electricity in the world" we are now struggling to have other safe, environmentally friendly systems developed and accepted by a poorly motivated public.

   Another nuclear plant may be necessary to tide us over the slow development of alternatives and closing of old coal fired plants.

Response 2:

Your comment is noted.

It is not in the mandate of this EIA process to compare the costs and benefits of nuclear generation technology to renewable forms of electricity generation, since the EIA process is, by its very nature, a project-specific tool that focuses on a particular form of technology. However, it is to be noted that the Integrated Resource Plan (government's strategy for security of energy supply over the next two decades) requires a balanced mix of generation technologies, including 9,600 MW of nuclear and 18,700 MW of renewables. It is also pointed out in the Revised Draft EIR that a mixture of generation technologies, including base-load power supply (of which nuclear is an example) and peaking power supply are required. It is, therefore, not a simple matter of closing all coal-fired power plants over time, replacing them with renewable technologies and using nuclear as a "stop-gap" in the meantime. As indicated in the Revised Draft EIR, the expected operational life span of Nuclear-1 is 60 years. It is also to be noted that the South African government has committed itself to a fleet of nuclear power stations in future.

Comment 3:

3. Siting of plant

To alienate portion of our magnificent south west coastline for a nuclear power plant is unthinkable. Over and above the safety factor for the people who live and visit these areas, the negative impact on the environment, both physically and visually on a permanent basis is irresponsible.

All the mitigating responses that are proposed in the report confirm the unsuitability of our eastern coastline. Environmental experts such as Dr Richard Cowling give far higher ratings to Bantamsklip than what is shown in the Draft. The actual area occupied by the proposed plant and the supports to the radiating transmission lines is insignificant compared to the extent of the area negatively affected and the impact it will have on this important part of our small but rich Floral Kingdom.

Abandoning of the two west coast sites before the public had an opportunity to comment on their suitability, is suspicious. Their remote siting, sparse population and proximity to the hazard storage site at Vaalputs made them the preferred sites. Cost of transmission was cited as the factor that disqualified these sites. The extra cost involved, compared to the lines over the terrain from Bantamsklip for instance, may well be acceptable when the public, who will ultimately bear the cost, are made aware of the benefits.

To summarize: First preference is no nuclear but if unavoidable on one of the west coast sites.

Response 3:

Your comments are noted.

It is also noted in the Revised Draft EIR Version 1 that the potential cumulative impacts of the Bantamsklip site together with the impacts of the transmission lines will be significant.

The exclusion of the Brazil and Schulpfontein (Northern Cape) sites at the end of the scoping phase was accepted by the then Department of Environmental Affairs and Tourism (now the Department of Environmental Affairs – DEA). Your comment is based on the assumption that placing Nuclear-1 in the Northern Cape would necessarily lead to lesser degradation of the environment than the other alternatives. This assumption can be challenged. The Northern Cape (not only the location of the power station but also the areas that the transmission lines will traverse) is home to some of the most endangered and endemic succulent plant species on earth, since the Succulent Karoo Centre of Endemism, with critical biodiversity areas like the Knersvlakte lies between the proposed Northern Cape sites and the Western Cape. Furthermore, the transmission lines would have to traverse the Namaqua National Park. On the other hand the Cape Metropole is already largely developed, and the areas that would be affected by the development of the Duynefontein site are therefore already degraded from a biodiversity perspective.

It is not factually correct to state that the public had no opportunity to comment on the exclusion of the Brazil and Schulpfontein sites, which you refer to as the “west coast” sites. The scoping process included extensive public participation and the Nuclear-1 Scoping Report and Plan of Study for EIA were provided for public comment in terms of the requirements of the EIA regulations. Additionally, the Revised Plan of Study for EIA was also provided for public comment.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035/ J31314
Your Ref: Email received 05 August 2011

Email: adrod@mweb.co.za

Dear Dr A E Marshall

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

RE: ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (DEA REF. NO.: 12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE - REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT: REMINDER CLOSURE OF REVIEW PERIOD

I wish to register my strong opposition to the proposed nuclear power station. Apart from all the valid objections already advanced by experts in this field, I wish to state the following:

Comment 1:

1. French nuclear power experts have admitted that no nuclear power station could withstand the impact of a terrorist attack in the form of a bomb or other explosive means. Thus, natural disasters such as earthquakes and tsunamis are not the only potentially deadly hazard to contend with. In a highly volatile society such as ours, the possibility of such acts of sabotage cannot be ruled out.

Response 1:

Your comments are noted. A new nuclear plant as is the case with Koeberg will be classified as a National Key Point facility with controlled access. The National Intelligence Agency will perform a detailed threat analysis for the proposed power station prior to construction and will put in place an appropriate security exclusion zone and requirements for security at the power station, based on the findings of its analysis, these will not be made public for security reasons. This zone is specified to protect the power station from unauthorised access by the public. Currently, there is a security exclusion zone of 2 km offshore from the high water mark specified for Koeberg. Security aspects are also factored into the design of the plant. All potential risks are factored into the final design of the plant.

Comment 2:

2. The human error factor: if this was an important cause of the disaster in a highly advanced first-world country such as Japan, surely it would be an even more significant risk in South Africa which is relatively less developed technologically and in virtually every other way. One need only recall the potentially disastrous incident at Koeberg recently when the carelessness and ineptitude of an employee literally "threw a spanner in the works".

Response 2:

Thank you for your comment. It is well known that the main cause of the disaster at the Fukushima Plant was caused by a tsunami triggered by a magnitude 8.9 earthquake centred offshore of the city of Sendai on the eastern cost of Honshu island. It is acknowledged that the incident at Fukushima as a result of this natural disaster has highlighted many important safety factors in terms of the future of nuclear energy and is indeed a stark reminder of the unpredictability of the natural environment. However it is well known that South Africa is located on a vastly more stable tectonic environment that that of Japan which is situated close to a major subduction zone within the Pacific Ocean. The descriptions and facts reported in the Geological Hazard and Seismic Risk Assessment stem from published data and work undertaken by the CGS and others. In terms of the identification of faults and seismic risk the information represents the current knowledge and understanding based on a regional picture. It is acknowledged that new evidence of neotectonic movements may be discovered I n the more detailed investigations that still have to be undertaken to look for evidence of palaeo-seismicity and can alter the understanding of the tectonics and geology of the respective study areas. Please see Appendix E32 and E33 of the Revised EIR (Volume 2) for a more detailed discussion.

Lastly, \the “incident with the bolt at Koeberg” affected only the generator and had no impact on the nuclear reactor, nuclear fuel and any radioactive material. Nuclear safety was maintained at the highest level throughout the incident. Nobody was injured, and there was no risk to people or the environment as a result of the incident.

Comment 3:

3. As far as the selection of a nuclear power provider is concerned, there is a high probability that we have the makings of another Arms Deal scandal here. Who exactly will benefit from the selection of the nuclear provider? Will the tenderpreneurs be identified? .In view of the governments' determination to push through the highly contentious Protection of Information Bill, how much transparency will there be surrounding the decisions taken on the Nuclear Power Deal?

Is it conceivable that reassurance could be provided on all these issues? Without this, the proposed construction of any nuclear power station is completely unacceptable.

Response 3:

Your comments are noted. A preferred vendor for the supply and installation of PWR technology has not yet been chosen. A consistent dataset has been compiled for Nuclear-1 based on the specifications of all possible PWR III generation vendors and represents a conservative set of criteria that provides a “worst case scenario” in terms of the specifications of the proposed plant. Any vendor appointed will be done so in terms of this envelope. A credible commercial process will need to be followed.

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

5 August 2015

Our Ref: J31314

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Dear Mr. Baxter

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

General Comment

COMMENTS ON THE REVISED DRAFT EIR, DEA REFERENCE NO. 12/12/20/944 BY JIM BAXTER

The main concern that I have as an IAP are the proposed transmission lines from Bantamsklip.

I understand that the transmission lines have been put "on hold", but this draft EIR still includes Batamsklip as a candidate. As such, I am submitting comment and should the transmission lines ever be released from "on hold", then would ask that my comments below are taken into account and I am again requested for comment.

Attention is drawn to the Eskom report, GP Report_08/61, Public Version dated October 2008. This document is imbedded to save you looking for it:-

Grid-Report.pdf

Also attention is brought to the statement on the Draft EIR itself:-

General Response

Your comment is noted. GIBB confirms that the Environmental Impact Assessment (EIA) for the proposed Bantamsklip Transmission lines has been put on hold and GIBB has had no further instruction from Eskom in terms of proceeding with the EIA.

Comment 1:

A power station at Bantamsklip will be less advantageous, as 765 kV transmission lines will be required through difficult terrain, which would result in substantial additional cost at the Bantamsklip site. Quite clearly the Eskom report from 2008 recommends Thyspunt to better improve the health of the national power grid.

After some effort in gaining access to the detailed maps of the proposed transmission line routes, maps 10 and 11 (which had to be collected at the Arcus Gibb offices) as they were not generally available on the web and were too large to email out to me, I can very much agree with the statements made from the two sources indicated above with respect to the transmission lines from Bantamsklip.

Response 1:

Your comments are noted but please also note that not only were transmission integration factors considered as a key to the selection of a preferred site but also a number of other factors as listed below. GIBB made use of the findings of a specialist integration workshop, which was conducted in November 2009, to determine which impact categories (both environmental and technical) have more relative importance than others. This led to the ranking of impact categories and determination of the key "decision factors" to be used in site selection which is

- Transmission integration factors;
- Seismic suitability of the sites;
- Impacts on dune geomorphology;
- Impacts on wetlands;
- Potential conservation benefits;
- Impacts on heritage resources;
- Economic impacts;
- Impacts on invertebrate fauna; and
- Impacts on vertebrate fauna.

Comment 2:

I live in the Uilenkraals river valley, and can further point out a few more issues with building transmission lines from Bantamsklip, notably the following:-

Map 10 – Batamsklip Bacchus Alt 2, at the point where the transmission lines will cross the Uilenkraals river, the transmission lines themselves have been placed directly over the farmhouse Goedvertrouw, a thriving dairy farm owed and lived in by Philip DeVilliers.

This same transmission line then proceeds directly over the top of Grootkop, again which is very difficult terrain to cross, especially in winter. Note also that the Uilenkraals river bed becomes a wetland in winter.

Where this particular proposed transmission line will cross the Uilenkraals, I am concerned with the effect that it may have on wildlife, such as fish eagles, marshal eagles, owls, a variety of geese and

bird life that fly up and down the Uilenkraals valley morning and night and would have to negotiate these transmission lines if it were built.

There is also two or three troupes of baboons which are resident in Uilenkraals river bed and the terrain surrounding Grootkop, which is not developed, or is used to harvest protea. I am concerned that the disturbance made in creating the transmission lines will cause them to leave this area.

Salmonsdam Nature Reserve is a popular nature destination and if this Tx line was built, it would be visible from the reserve.

Response 2:

Your comments are noted and have been forwarded to the Bantamsklip Transmission Line EIA Team for their response, if and when the EIA is resumed.

Yours faithfully
For GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

5 August 2015

Our Ref: J31314
Your Ref: Email received 07 August 2011

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Dear Andrew Stuart Marshall

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

BOKSPRUIT FAMILY TRUST: OBJECTION TO NUCLEAR-1 REVISED DRAFT EIA REPORT

Comment 1:

We refer to the above. Please take note of the following objection.

1 Introduction

1.1. This submission is made on behalf of the Trustees for the time being of the Bokspruit Family Trust, who in that capacity own portion 25 (Portion of portion 7) of the Farm Ongegunde Vryheid Number 746, Division of Humansdorp. The property lies on the coast at Thysbaai, approximately 3 km from the proposed site of Nuclear 1 at Thyspunt.

1.2. The writer will comment on the Revised Draft Environmental Impact Assessment Report (the "EIA") for the Eskom Nuclear Power Station and Associated Infrastructure ("Nuclear 1") produced by Arcus GIBB (Pty) Ltd ("the Consultant") and dated March 2011 insofar as it relates to the Thyspunt site ("Thyspunt").

1.3. The objection will deal with the site selection process followed, the methodology followed in reaching a conclusion as to the preferred site, and finally certain selected aspects of the specialists' findings.

Response 1:

Your comment is noted.

Comment 2:

2. Assumptions

2.1. The writer assumes that the statements set out in this paragraph are not disputed by the Consultant, and are accordingly common cause.

2.2. Thyspunt is a valuable heritage site, both as a result of the wealth of archaeological material that is known to be extant at the site, and also due to the cultural significance of the site for

the local Khoi people. While steps may be taken to mitigate any loss of such material, and to minimise damage to the site from a cultural perspective, such damage as occurs would be irreversible.

Response 2:

Your comment is noted. Where GIBB and the Heritage Specialist differs from the writer of the comment, this will be pointed out.

Your statement regarding the heritage value of the Thyspunt site refers. There is a dense concentration of heritage sites in a good state of preservation along the western coastline of the site, and to a more limited extent along the eastern coastline. However, the recommended footprint area within which the power station is proposed to be placed has very few heritage sites and is situated in an inland area within the vegetated dunes, within which very few heritage sites are found. This finding is based on extensive trial excavations (under a permit issued by the South African Heritage Resource Agency) undertaken in late 2011.

Any damage to archaeological sites is essentially, by its very nature, irreversible, since heritage resources are non-renewable resources. However, mitigation measures such as responsible excavation, research and housing of the heritage resources in a museum can increase knowledge about the value of the Khoi heritage on the site. Whilst the heritage resources on the site are undoubtedly left by Khoi people, direct links between KhoiSan people who lived on the site and groups of present-day people who claim Khoi descent cannot be demonstrated beyond doubt, due to the poor written history for the Khoi people.

Comment 3:

2.3. Thyspunt is a biodiversity hotspot, particularly insofar as the richness of the flora at the site is concerned. This richness is to a large degree dependent upon the unique dune / wetland combination at the site. The interaction of the dune system with the wetlands is not well understood by experts. Once again, while steps may well be attempted to mitigate any damage, any damage that did result from construction of Nuclear 1 may well be irreversible.

2.4. The Thyspunt site includes and / or is profoundly linked with the only remaining dune headland bypass system in the country.

2.5. The Thyspunt site has significant wilderness qualities, as noted in the EIA.

2.6. The coastal waters near Thyspunt support a chokka fishery that is of great importance to the economy of the surrounding district.

Response 3:

The Thyspunt site in itself cannot be said to be a biodiversity hotspot. The Thyspunt site does possess a diversity of habitats (e.g. mobile dune fields, wetlands, vegetated dunes, forest and scrub) but cannot be said to qualify as a centre of endemism.

The interactions between the dune systems, water tables and wetlands are in fact well understood. several years' worth of monitoring data of groundwater levels and wetlands was used to model the interaction between these systems and the results are interpreted in an Addendum to the freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR), based on monitoring carried out since 2010. This monitoring is still ongoing at present and confirms the findings in the Revised Draft EIR Version 1 that critical wetlands such as Langefonteinvlei are not geo-hydrologically linked to the

groundwater table in the portion of the site where groundwater will be extracted from the excavation for the "nuclear island".

Your comment regarding the rarity of the headland bypass dune system is noted. The headland bypass dune system at Thyspunt is not the only one in South Africa. Other examples are found at Cape Agulhas, Waenhuiskrans, Buffelsbaai and Cape Recife (Port Elizabeth). Please refer in this regard to the Dune Geomorphology Assessment (Appendix E2 of the Revised Draft EIR Version 1).

Your statement regarding the wilderness qualities of the Thyspunt site are noted.

Your statement regarding the importance of the chokka industry to the local economy is noted. This and the fact that chokka is caught (amongst other locations) in areas immediately offshore of the Thyspunt site is not disputed. However, analysis of independent commercial chokka fishery data provided by the Department of Agriculture Forest and Fisheries and its scientific advisory group (the Squid Working Group), shows that claims of a negative impact of up to 30% on the chokka fishery is not substantiated. Data provided by these bodies shows that 14.7% of total catches are taken in the wider area (two quarter degree squares of approximately 22 x 27 km each) around the Thyspunt site – itself a much larger area what will in fact be impacted. In this regard, it must also be noted that the total area affected by a temperature increase of 3ºC or more will be less than 1km^2. In the current revision of the Marine Ecology Report the area potentially lost to the fishery (based on the commercial info provided by DAFF) is presented. While still under review, this figure ranges from 2.86% (worst-case scenario) to 2.53% (least-case scenario) to the fishery in the **local area** under question, and between 0.42% and 0.37% for the fishery as a whole.

Comment 4:

3. Site of nuclear power station

3.1. The proposed sites for Nuclear 1 are derived from a study conducted during the 1980s (the "NSIP Report")[1]. At the time, policy requirements dictated that a nuclear power station could not be built within 100 km of the Ciskei or Transkei. Accordingly, the site selection process at that stage did not take account of a large stretch of the South African coastline.

3.2. The political environment during the 1980s severely restricted the ambit of public participation in any such process, particularly one as sensitive from a national security perspective as a nuclear power station. The process was accordingly not conducted in an open and transparent manner.

3.3. The statutory framework relating to the environment was radically different in the 1980s, so much so that there is a strong possibility that the findings of the NSIP report would be rejected if it were submitted today; nonetheless, the site selection for Nuclear 1 is based upon that report.

3.4. An example of the current process' weakness in respect of site selection is the manner in which the proposed inclusion of the Coega industrial area near Port Elizabeth was dealt with. The NSIP Report excluded the area as a possible site. Subsequent to that report, the Coega area was developed, and now not only has appropriate infrastructure to support the construction and operation of Nuclear 1, but is also located near an existing industrial hub where electricity generation capacity is required.

3.5. When it was suggested that Nuclear 1 be sited at Coega, the Consultant noted that seismic studies would be required before Coega could be approved as a nuclear power station site,

[1] Nuclear Siting Investigation Programme (NSIP) Eastern Cape Summary Report" of December 1994

and that such studies would take approximately 5 years. This, however, cannot be used as a justification for building the nuclear power station in an environmentally sensitive area when a site such as Coega is available, which is not environmentally sensitive and has existing infrastructure. The copy of the NSIP Report available to the writer was produced in December 1994, which is a year of no small significance in the Republic's history. It would have been clear to all persons involved in the site selection process after 1994 that the political environment had changed radically, as had the restrictions upon site selection. Nonetheless, in the 17 years since, no effort has been made to re-assess the findings of the NSIP Report.

3.6. "While the writer is aware that the Consultant was not given the option of exploring other possible sites, it is nonetheless submitted that it is a fatal flaw in the process to approve the construction of a nuclear facility on an environmentally sensitive site where a proper site selection process has not been carried out."

3.7. It would appear that the two proposed sites located in the Northern Cape, "Brazil" and "Schulpfontein", were excluded from the current EIA process due to political pressure being placed on the parties to reach a decision quickly. The writer submits that given the environmental and financial implications of building a nuclear power station, the decision cannot be rushed.

Response 4:

3.1 Your comment is noted.

3.2 Your comment is noted.

3.3 The environmental governance framework has indeed changed completely since the NSIP was completed. Environmental considerations have become mainstream issues in project development since the first EIA regulations were implemented in South Africa in 1997. However, apart from environmental management frameworks (EMFs), EIA remains the only legislated tool of environmental management in South Africa. EIA, in terms of legislated requirements, has always been and continues to be a project-specific tool of environmental management i.e. it is applied once a specific project has been identified on a specific site. As such, public participation, which forms an integral part of EIA processes, would not be applicable to strategic planning or feasibility study such as the NSIP. Thus, it cannot be said that site a feasibility investigation such as the NSIP would be rejected today based on a lack of public participation. Consequently, even under the current legislative regime, stakeholder engagement processes for pre-feasibility or feasibility studies are typically undertaken at a very strategic level and include high-level stakeholders such as authorities, but do not include broad-based public participation.

3.4 and 3.5 Your comments regarding the consideration of the Coega Industrial Development Zone as an alternative site for Nuclear-1 are noted. Section 5.2.5 of the Revised Draft EIR deals with the reasons why Coega could not be considered as an alternative for the Nuclear-1 EIA. A delay of a further five years for consideration of seismic information from Coega may well result in further electricity generation capacity being developed too late to ensure that current and likely future electricity backlogs are addressed. Coega may well be considered as a feasible and reasonable alternative in future EIA processes.

3.6 Your comment is noted.

3.7 Your comment regarding political pressure having been brought to bear on the exclusion of the Northern Cape sites is noted. Should you have substantiation for this statement, it would be appreciated if you could provide it. The reasons for the rejection of the Northern Cape sites in the scoping phase of the Nuclear-1 EIA process were clearly set out in the Nuclear-1 Scoping Report, which report has been accepted by the Department of Environmental

Affairs. The decision is certainly not being rushed - the Nuclear-1 EIA process has already taken more than seven years.

Comment 5:

4. Conservation benefit: a red herring

4.1. Eskom currently owns the property on which the proposed site is located. The EIA makes much of the conservation benefits of locating Nuclear 1 at Thyspunt. In particular the Consultant states that should the plant be built at the site, a conservation area would be established, and that the wetlands at Thyspunt, as well as the vertebrate and invertebrate fauna, would benefit from protection that they would otherwise not receive.

Response 5:

Your comment is noted.

As indicated in the Revised Draft EIR Version 1, a maximum area of approximately 280 ha is required for the power station. Thus, only a small portion of the site will be developed. The land currently owned by Eskom at Thyspunt is 1638 ha. Thus, if 280 ha is used for development, it would leave approximately 83% of the site undeveloped. At Duynefontein, where the Eskom owned property is 2849 ha, even a larger proportion of the site is undeveloped and dedicated to nature conservation. Development of the nuclear power station is proposed to be focused on a specific concentrated footprint, which has been defined for its low environmental sensitivity, leaving more than 80% of the property free for conservation. In the absence of any significant efforts to establish conservation areas along the affected stretch of coastline (with the exception of the Rebelrus conservancy) and the vigorous alien vegetation encroachment throughout the St. Francis region, the possibility of the development of a *de facto* nature reserve is indeed considered to be a significant offset benefit for conservation.

Comment 6:

4.2. This argument is based upon an unknown: while it is possible that Eskom will sell Thyspunt property if the EIA is not approved, there is no indication as to what the fate of the site would be in such an instance. If the site were subsequently developed as a high-density holiday resort the environmental impact would doubtless be severe indeed, perhaps more severe than construction of a nuclear power station. This scenario is possible but unlikely, given the property's environmental sensitivity and current zoning, as well as the environmental and heritage sensitivities of surrounding communities. Even if the site were sold to a private party, it is more likely that low-density development would result, in a similar fashion to the current land usage between Oyster Bay and Cape St Francis.

4.3. Because significant environmental degradation cannot be shown to be a likely outcome should Eskom not build a nuclear powers station at Thyspunt, the conservation benefit factor cannot be presented as a positive factor for locating Nuclear 1 at Thyspunt.

Response 6:

4.2 Your comment is noted. However, the history of recent development in the St. Francis area indicates that residential and golf estate developments in the St. Francis region, even though they are subjected to EIA process, contradicts your opinion. Even though these developments have been subjected to EIA processes, such developments have caused extensive destruction of heritage resources and lead to the stabilisation of a portion of the eastern part of the sensitive Oyster Bay Bypass Dune System. There is, therefore, reason to believe that other developments having a severe impact would be permitted. It must be borne in mind that developments are not always planned on a large scale. Small developments that individually have insignificant impacts can eventually have highly significant impacts when their cumulative impact is considered. This is especially the case with the development of urban areas along the coastline.

4.3. Your comment is noted. For the reasons given in Response 5, conservation benefits are contended to be a significant positive impact.

Comment 7:

5. The EIA has been prejudiced by site selection

5.1. The Consultant has for various reasons taken the approach of combining an EIA in respect of three potential sites for Nuclear 1 with a comparative assessment of these three sites to determine the site most suitable for construction of Nuclear 1.

Response 7:

5.1 Thank you for your comment. Based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

Comment 8:

5.2. The decision as to site location necessarily involves two enquiries. Firstly, is a particular site suitable for construction of a nuclear plant at all, from an environmental perspective? Secondly, if a number of sites are suitable, which site is to be preferred?

Response 8:

5.2 Your comment is noted. The EIA and specialist studies have concluded that both sites (Thyspunt and Duynefontein) are environmentally acceptable for a nuclear power station. The Thyspunt site is considered the preferred site and it is recommended that it be authorised by the DEA (with conditions) for Nuclear-1. Eskom must ensure that the required

mitigation measures are effectively implemented. It is important to remember that none of the specialist assessments identified fatal flaws at any of the remaining sites, and both the proposed sites remain viable sites for nuclear power station development, either for Nuclear 1, which is now proposed, or for some future power station. As such, the site selected is the one that provides the greatest immediate return from an electricity supply point of view. Thyspunt will strengthen the eastern grid and help create a generation centre along the east coast.

Comment 9:

5.3. These two enquiries would necessarily turn on different sets of factors. The first enquiry would place a greater emphasis on such environmental factors as impacts on dune geomorphology, impacts on heritage resources, impacts on flora and fauna, local economic impacts, and social impacts.

5.4. The second enquiry would place a greater emphasis on technical factors that are internal to Eskom, such as transmission integration and any factors impacting on the final cost of constructing and operating the plant[2]

Response 9:

5.3 & 5.4 Your comments are noted. Owing to the fact that none of the specialists identified fatal flaws at any of the sites, the answer to the "first enquiry" would be that all three of the alternative sites are potentially suitable. The "second enquiry" is discussed in Section 9.32 of the Revised Draft EIR Version 1.

Comment 10:

5.5. The Consultant, however, has not separated the two enquiries, and has conflated the decision as to whether a particular site is environmentally suitable at all with the question as to whether that site is to be preferred to other sites.

[2] Factors that would have weight is such a second enquiry include the following factors set out in the EIA:

- Geotechnical suitability: the impacts described here relate to technical challenges in constructing Nuclear 1, which are an internal Eskom consideration.
- Geo-hydrology: while several factors identified here are external to Eskom, the danger of flooding by groundwater and degradation of infrastructure by corrosion is internal to Eskom.
- Economic Impacts: "cost effectiveness" is identified as a factor, and a positive one at that. The report indicates that this factor gave Thyspunt an edge over the other two sites considered. However, it is not valid to give an internal Eskom cost such significance in this EIA.
- Impact on transportation systems: the EIA notes that transportation system upgrades would be required for certain sites, and that these costs would make one of the alternative sites to Thyspunt unfeasible; however, as these upgrades would be costs internal to Eskom, they should not be accorded great weight at EIA stage.
- Impacts of nuclear and non-nuclear waste: while potential harm caused by such waste is clearly an environmental concern, the Consultant seems to have assumed that the risk of such harm occurring is equal at each site, and examines the various possibilities in dealing with such waste. Again, this factor is internal to Eskom.
- Transmission integration: this factor relates wholly to Eskom's internal technical considerations. While the Consultant has made out a case for economic and social benefits by securing a secure supply of electricity, such factor would apply to the whole of the Eastern Cape Province, and not the immediate area of Thyspunt. Accordingly, while the factor is certainly noteworthy, it cannot be given high significance in an EIA. It would doubtless be decisive if an EIA had been approved in respect of one site in the Eastern Cape and one in the Western Cape, but it cannot be a significant factor in the EIA itself.

Response 10:

Your comment is noted. As indicated in Response 9, “Enquiry 1” has been answered since the specialists did not identify fatal flaws at any of the sites.

Comment 11:

5.6 The effect of this approach is that in deciding whether the Thyspunt site is to be recommended as the site of Nuclear 1, the recognised heritage and biodiversity sensitivities of Thyspunt are weighed directly against technical factors and economic factors particular to Eskom, particularly transmission integration, transportation infrastructure and seismic suitability. This approach in effect compares factors that do not bear comparison. The Consultant should first have determined whether the site was suitable from an environmental perspective at all before making a site comparison.

Response 11:

Your comment is noted. As indicated in the responses above, it has been determined that all of the sites are potentially suitable, and the Revised Draft EIR Version 1 therefore focused on determining the most suitable site from the three alternatives considered. Your comment is noted that technical factors and environmental impacts can in effect not be compared. The same could potentially be said for different categories of environmental impact e.g. impacts on the natural environment vs. impacts on the social environment, or even of impacts on one natural resource vs. impacts on another natural resource. This would imply that none of the categories of environmental impact could be compared to each other and no comparison of alternative sites could be done at all.

There are, however, several techniques such as multi-criteria analysis that compare apparently very disparate sets of data to identify a preferred alternative amongst options for which a wide variety of dataset are available.

Comment 12:

5.7. That is not to say that Eskom’s cost factors should not play a role in deciding upon an appropriate site for Nuclear 1, merely that these factors should play a significant role only after environmentally acceptable sites have been finalised.

Response 12:

5.7 Whilst your opinion is noted, the EIA process in South Africa is defined to consider all forms of environmental impact, which include both biophysical and social factors. Economic impacts are one of the categories of social impact. There is no policy or principle in South African environmental legislation that prioritises biophysical impacts over social and economic impacts. Your opinion that economic impacts should be considered only after biophysical impacts are considered is therefore not supported.

Comment 13:

5.8. Even then however, the recognised biodiversity and heritage value of the Thyspunt site cannot be outweighed by any but the direst economic need, and only then when no other suitable sites are available. While power generation is doubtless of great national

importance, it is not sufficiently important to risk damaging the unique biodiversity and heritage artefacts located at Thyspunt.

5.9 Consequently the writer is of the view that the Consultant's general approach in arriving at a decision was flawed in that it mixed the requirement for an EIA with the requirement for site selection.

Response 13:

Your comments are noted. Even through the Thyspunt site as a whole can be regarded as sensitive in terms of the occurrence and quality of heritage sites, the Oyster Bay Headland Bypass Dune System, wetlands and other factors, these sensitive features are not distributed evenly all over the site. They are concentrated in specific areas of the site. For instance, the highest quality heritage sites are concentrated by and large in a narrow strip 200m from the coastline. Similarly, the Headland Bypass Dune System occurs across the northern portion of the site but is missing from the southern portion of the site. Accordingly, the power station can be positioned to avoid impacts on scarce and valuable resources. The area that has been recommended for placement of the power station is therefore in the last sensitive portion of the site.

Comment 14:

6. Weighting Allocation was Flawed

6.1. The EIA does not follow any internationally recognised methodology when arriving at the weighting to be given to the various environmental and technical factors taken into account in selecting a site for Nuclear 1. Indeed, no reference was made to international best practice. The Consultant admits on page 314 of the EIA that the weighting methodology was decided upon at a workshop of specialists. In other words, the weighting methodology was developed "in-house" by the Consultant and the specialists that contributed to the EIA.

6.2. It is clear from the report that the weighting applied in respect of each of the factors was decided upon only after the specialist reports had been completed. Consequently, the weightings can have no objective basis, but were decided upon with the knowledge of the specialists' findings.

6.3. It would be difficult indeed for the Consultant to rebut the allegation that the weightings were deliberately allocated in such a way as to skew the choice of site towards Thyspunt. This allegation is given further force by the fact that the Duynefontein site is a clear favourite from a purely environmental perspective, while the weightings applied shift the results conclusively in favour of Thyspunt.

6.4. Accordingly the weighting allocation and consequent numerical comparison in the EIA are fatally flawed. Given that the Consultant has been tainted by the subjective manner in which it conducted this process, any new comparison would require the appointment of a new Consultant.

Response 14:

6.1 Your comments with respect to the weighting system are noted. It is questioned why "in-house" development of a weighting system would necessarily imply that the weighting system is flawed. As indicated, the principles of the weighting were agreed during a specialist integration meeting, where a total of 25 specialist teams (and even more individuals, as some teams consisted of more than 1 person) contributed to the discussion about the principles. Such a large number of participants ensured that a variety of viewpoints

on the weighting principles were heard and that no one team's viewpoints overruled the decisions on weighting.

6.2 Your statement that the weightings that have been applied have no objective basis refers. The EIA regulations (Government Notice No. R 543 of 2010) requires in Regulation 31(2)(n) that the Environmental Assessment Practitioner must provide "*a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation*". Clearly, from the content of this regulation, the EAP can provide an opinion, provided that it is reasoned. Accordingly, the rationale behind the weighting criteria has been fully explained in Section 9.35 of the Revised Draft EIR Version 1.

6.3 Your comment is noted. The reasons for the weightings are clearly articulated in section 9.32 of the Revised Draft EIR Version 1. Should you have any substantive motivation for rejecting the weightings, GIBB can consider this.

6.4 Your opinion in this regard is noted.

Comment 15:

7. Weighted Numerical Comparison

7.1. Without prejudice to the arguments set out in paragraphs 5 and 6, the writer takes issue with the weightings given to the factors described in this paragraph.

7.2. "Transmission integration factors" and "seismic suitability" are both factors that are of high significance to Eskom internally, but there is no clear justification to give these factors a higher weighting than any other factor. While there is certainly a place for economic and technical factors, these cannot have the effect of crowding out environmental factors. These factors certainly do not warrant a higher weighting than for example "impacts on heritage resources".

7.3. "Potential conservation benefits" are entirely speculative as pointed out in paragraph 4. They should not be included as a factor at all, let alone given a weighting as high as 3 out of 5.

7.4. "Economic Impacts" largely relate to Eskom's internal costs, and should not be given a weighting as high as "impacts on heritage resources" for example.

7.5. "Floral impact" is given the lowest possible weighting, despite Thyspunt having an acknowledged high biodiversity in flora. This is justified by the Consultant on the basis that mitigation would reduce the risk of damage to flora, but given the uniqueness of the resource at Thyspunt, mitigation is no reason to reduce its significance.

7.6 "Marine ecology impact" is given the lowest possible weighting. The chokka fishery is an important aspect of the economy of the region around Thyspunt, and damage to this fishery would have severe consequences for local communities. The low rating is not justified. See paragraph 10 below.

7.7. Certain factors were removed from consideration due to the fact that they were insignificant, equal across all three sites, or not applicable to all sites compared. Such an approach in (sic) interferes with the EIA process by imposing the requirements of site selection on the EIA.

7.8. The inappropriate weightings to various factors as set out above all appear to favour Thyspunt as a preferred site for Nuclear 1, which adds force to the contention that the Consultant deliberately allocated weightings so as to skew the results, given that Duynefontein was the favoured site on environmental grounds alone.

Response 15:

7.1 Your comment is noted.

7.2 Seismic factors, as explained in the Revised Draft EIR Version 1, are one of the most critical factors for the location of a nuclear power station as it affects the safety of the power station as well as the feasibility, cost and timing of construction. The importance of this factor is underscored by the large difference in the seismic values of the three alternative sites.

7.3 Your comment is noted. Please refer to Response 5 regarding the reason why conservation benefits are regarded as important.

7.4 Economic impacts do not in fact relate to Eskom's internal costs, but to the cost to the country, since Eskom is a publicly owned institution and money spent on the power station would therefore be taxpayers' money. Furthermore, the Revised Draft EIR Version 1 deals not only with economic costs but also with benefits to the regional economies in the respective provinces in which the alternative sites are located.

7.5 Your comment is noted. Although the Thyspunt site has high habitat diversity, the particular habitat within which the power station is proposed to be placed is vegetated dunes. This is one of the least sensitive ecological communities on the Thyspunt site.

7.6 Your comment is noted. The Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR Version 1) indicated that the impacts on the chokka fishery will be small. Please refer to Response 3 in this regard. These impacts can be effectively mitigated by the recommended measures to disperse warmed cooling water and to pump spoil offshore to a deep disposal site, beyond the depths at which it would have an impact on the relatively shallow chokka spawning grounds.

7.7 Your comment is noted. It is the duty of the Environmental Assessment Practitioner to interpret the data and information provided in the EIR and to make a reasoned recommendation with respect to the preferred site, since the application for Nuclear-1 is for a single nuclear power station that can only be constructed on a single site.

7.8 Your comment is noted. Please refer to our responses above regarding the rationale for weighting of the decision factors. Furthermore, subsequent to the RDEIR version 1 being available for public comment, the DEA requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site.

Comment 16:

8. Non-numerical comparison

8.1. The arguments applied in paragraph 7 apply equally to the non-numerical comparison, in that technical factors have trumped environmental ones. Moreover, the importance given to the conservation benefits at Thyspunt is misplaced, as discussed above.

Response 16:

Your comment is noted. Please refer to Response 5 above regarding the conservation benefits.

Comment 17:

9. Lack of Peer-review

9.1. The methodology used to assign weightings to the various factors was arbitrary and not subject to peer review.

Response 17:

Thank you, your comment is noted. Please note that every discipline has different method and approaches to evaluating data and information. In the field of environmental management, the assessment and evaluation of environmental impacts has developed over the last three decades and includes a number of criteria that are applied almost universally in EIAs. These criteria typically include nature (is the impact negative or positive?), extent (or scale), duration, intensity (degree of change), consequence (seriousness), reversibility, probability (how certain is it that the impact will occur?) and significance (overall importance of the potential impact). Although there is general agreement about the nature of the criteria for assessment and there are local and international guidelines on this, there is no single agreed method. It is up to the discretion of the environmental assessment practitioner (EAP) to apply his or her mind to determine the most appropriate combination of criteria, as well as any requirements that the environmental authority might have regarding the criteria. In the case of the Nuclear-1 EIA the EAP sought assistance from other senior EAPs, namely Mr. Neal Carter and Mr. Reuben Heydenrych, as well as an advisor on EIA process, Mr. Sean O'Beirne.

Furthermore, based on comments received from the DEA during the review of the RDEIR Version 1, The National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. This updated assessment no longer utilises the ranking / scoring system for the sites, but rather considers the residual risks associated with the proposed Nuclear power station at the proposed sites. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site. Please refer to Chapter 10 for the updated assessment approach.

Comment 18:

10. Impacts on marine biology

10.1. The following paragraph appears at page 51 of the Specialist's report on impacts on marine biology:

10.2. The following appears at page 43 of the same report:

10.3. The above paragraphs support the temperature and chlorine changes on the West coast (based on the Koeberg NPS experience), and describe increased chlorine toxicity in the warmer waters of the South coast, but then rely on potential sea temperature cooling as a result of climate change to mitigate that temperature increase.

10.4. This may be possible to extrapolate for the Duynefontein site but the other two potential NPS sites are on the Southern Cape coast. Both marine conditions (average water temperature) and the marine ecosystems are significantly different to that at the Duynefontein site, and thus and this conclusion is invalid.

10.5. Moreover, reference to climate change as an ameliorating factor is at best speculative, and cannot be used to support any conclusion in this regard.

10.6. Even in worst case scenarios those temperature changes are predicted to be only a few degrees, and nothing like the measured 4.1 degree sea water temperature difference between Duynefontein and Thyspunt. What the term "long term" means in the paper's reference is unclear. The NPS building period is anticipated to be 8-10 years, and thereafter the water temperature differential will start. This is not long-term at all and does not apply unless the predicted cooling of seawater secondary to climate change is predicted to occur in the next 10-20 years.

Response 18:

10.3 – 10.6 The ambient seawater temperatures at the respective sites are indeed very different. Your comment seems to assume that the only basis for the marine specialist team's conclusion about the impacts of warmed cooling water is their professional judgement and reference to the KNPS experience. However, their prediction of the impact in this respect is based on very detailed oceanographic modelling, which takes account of seawater temperatures and movement patterns. The results of the oceanographic modelling, which has been referred to in the Marine Ecology Assessment (Appendix E15) is contained in Appendix E16 of the Revised Draft EIR Version 1. The Marine Ecology Assessment considers the site-specific conditions at each site and to this end makes reference to a number of academic sources of information about each of the alternative sites.

Mitigation is not dependent on potential climate-change induced seawater changes. Mitigation measures for warmed cooling water (multiple release points, release above the ocean floor to prevent impact on the benthic environment and a very high flow rate at the point of release to maximise mixing with cool surrounding water) are well-documented in the Marine Ecology Assessment.

"Long-term" with reference to climate-induced changes in seawater temperature refers to a time scale of several decades. As stated above, the Marine Ecology Assessment does not rely on long-term climate-change induced changes in seawater temperature to offset the impacts of warmed cooling water. Thus, the issue of the time scale is largely academic as it does not materially affect the mitigation of the impact. Furthermore, the area that will be affected by the release of warmed cooling water at Thyspunt is very limited in extent. The Marine Ecology Assessment indicates that "*if a nearshore outfall is used a mean increase of 3ºC near the seabed will be limited to an area of roughly 0.2 km² (2 ha) around the outlets of a 4 000 MW plant and an area of 0.7 km² will experience a maximum increase of 3ºC or more at any time*".

Comment 19:

10.7. The conclusions reached on page 24 of the report are questionable: there is no evidence that meeting the DWAF Water Quality Guidelines will result in no impact on the marine environment. There are certainly marine changes in sites such as Mouille Point in Cape Town and Cape Recife near Port Elizabeth where waste water is released into the marine environment, so there would need to be some monitoring and assessment around the Thyspunt site. It cannot simply be stated that there will be "no impact on the marine environment".

10.8. Moreover, DWAF's water quality guidelines for marine coastal waters clearly state how increases in seawater temperature (the primary environmental impact in this case) can have an effect on primary producers (plants) and secondary consumers (animals) in the natural marine environment – refer to pages 105 and 188 thereof.

Temperature is the main reason why the South African Coastline in divided into 'West Coast, South Coast and East Coast'. Consequently, comparisons between Duynefontein and the other two sites have little standing.

Response 19:

Your comments regarding the impact of an increase in seawater temperature are noted. However, the increase in seawater temperature will be of very small spatial extent and concentrated near the surface, as warm water rises. The assessment of the significance of impact is based on oceanographic modelling and on the marine ecology specialist team's collective expertise and experience in this matter, including their monitoring of the marine environment at the KNPS.

Comment 20:

10.9. The following paragraph appears on page 32:

. The invalidity of an argument depending upon speculative effects of global warming have been highlighted above.

Response 20:

Your comment is noted. Please refer to Response 18, where it is pointed out that the predictions of seawater temperate are based on detailed site-specific oceanographic assessments.

Comment 21:

10.11. The following appears on page 44 of the report:

10.12. The report states that there is no marine conservation benefit for Duynefontein and Thyspunt, but there would be a benefit for Bantamsklip because of the resident abalone population. However near-shore disposal near Bantamsklip poses a significant threat to the juvenile abalone population in this critical area for the species. Consequently the conservation benefit for Bantamsklip is dependent on successful far off-shore dumping of spoil, and this is not guaranteed. Should this not be successful then the high allocation of points awarded to this site in the final chapter is not valid.

Response 21:

Our comment is noted. Successful mitigation of the impact on abalone at the Bantamsklip site is dependent on offshore release of both spoil and warmed cooling water. Should such release not be possible at Bantamsklip, it would influence the environmental acceptability of the Bantamsklip site, since abalone is a species of great conservation concern at this site.

Comment 22:

10.13. The report deals with disposal of spoil at sea at page 32. Thyspunt is located on a particularly rough stretch of coastline. The report appears to assume that no technical difficulties would exist in disposing of spoil a significant distance from the shore so as to mitigate negative effects. The nature of the coastline however renders any such assumption invalid, and a proper study would have to be conducted before any conclusions could be made in this regard.

10.14. Moreover, the impact on the marine environment of the spoil would depend to a large extent upon the nature of the spoil itself – a small particle size would remain suspended in the water column for a longer period than a larger particle size, with greatly differing effects. A proper study of this aspect would have to be conducted before any conclusions as to the impact of the spoil on the squid spawning grounds or any other aspect of the marine environment could be reached.

10.15. The inclusion of a mitigating strategy that is not feasible, could result in an EIA approval based on an incorrect premise, and if a site is chosen in that flawed process, inadequate mitigation could occur if the development proceeded incorrectly.

10.16 Thus the feasibility study for a 5km off-shore disposal at Thyspunt needs to be concluded, and included in the EIA, before the document can be assessed in a holistic fashion.

10.17. Moreover, the report clearly describes the planned dumping of 6.37 million cubic metres (Thyspunt and Duinefontein) and over 10 million cubic metres (Bantamsklip) of spoil, the environmental consequences of this, and need the need to mitigate this by dumping this spoil 5km or more out to sea (Thyspunt), and yet in the final analysis of points for the consideration of various sites the consequences on the marine environment are entirely omitted.

10.18. Report states that “no sites of special biological significance occur within the designated area”. The writer submits that Thyspunt lies within an unspoilt area which is subjected to limited fishing activity. It consequently has a high conservation potential that would be ruined by construction of a nuclear power station at the site.

10.19. Moreover, the writer is aware from personal experience as well as from anecdotal sources that Thyspunt supports a large and diverse shark population. The sensitivity of this population and the possible impact upon it, especially by spoil pumping and temperature change, has not been explored in the impact analysis.

Response 22:

10.13 – 10.16 Your comment is noted. Indeed the mitigation of the marine impacts at this site are dependent on pumping the spoil 5-6 km offshore. Should this, or any of the other key assumptions of the EIA prove not to be feasible, the EIR has stated that it would no longer be valid. In the event that an environmental authorisation is issued, it would be conditional on the implementation of the recommended mitigation measures.

The oceanographic modelling that was used in the Marine Ecology Assessment’s prediction of impacts considers the particle size of the spoil and turbidity that results from suspension of spoil in the water column. It is for this very reason that a medium pumping rate is recommended for spoil disposal at the Thyspunt site, since a high pumping rate would have resulted in unacceptably high turbidity.

10.17 Feasibility of the proposed offshore spoil disposal pipeline is based on international experience with the construction of nuclear power stations, and liaison with construction and marine engineering companies.

10.18 Your comment is noted. Your statement that the site is subjected to limited fishing activity seems to contrast with the statement of the high importance of the area for the chokka fishery.

10.19 Your comment is noted. Should the respondent be able to provide substantiated evidence of the claimed large shark population, this claim could be considered.

Comment 23:

11. Oceanographic impacts and surf breaks

11.1. No conclusions can be drawn as to the potential impact of dumping spoil at sea until a study has been done of the physical makeup of the spoil, as this would impact on the distance which the spoil spreads after being disposed of, and the nature of the spoil deposits when it eventually settles.

Response 23:

Your comment is noted. A sediment grading analysis has been performed individually for all three sites and the modeling of sediment movement is based on this analysis.

Comment 24:

12. Decommissioning factors

12.1. While the EIA has addressed the environmental impacts associated with constructing and operating a nuclear power station, it has not properly dealt with the decommissioning of the nuclear power station. Given the scale of the task of decommissioning a nuclear power station, which would include dismantling an extraordinarily large construction, as well as removing and storing radioactive materials from the site, this oversight is fatal to the EIA.

Response 24:

Your comment is noted. Decommissioning is addressed in the Revised Draft EIR Version 1 commensurate with the level of information available on the proposed decommissioning strategy.

Yours faithfully
For GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 07 August 2011

Email: Mohamed.Bhabha@standardbank.co.za

Dear Mohamed Bhabha

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

RE: ESKOM ENVIRONMENTAL IMPACT ASSESSMENT (DEA REF. NO.: 12/12/20/944) FOR A PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE - REVISED DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT COMMENT

Comment 1:

Standard Bank must first declare an interest in the ongoing nuclear EIA process. Alongside ICBC (China), Standard Bank is currently advising China Guangdong Nuclear Power Corporation (CGNPC) on its prospective bid to build/own/operate (as applicable) new nuclear power stations in South Africa.

Response 1:

Your comments are noted and we acknowledge your declaration of interest in the EIA process.

Comment 2:

As to the Revised Draft EIR, Standard Bank believes it is important to clearly distinguish between matters that have been assumed for drafting/submission purposes by Eskom/Arcus Gibb (to DEA) and matters which are in the decision-making domain of other entities within South Africa, for example, Department of Energy or the National Nuclear Regulator (NNR). For example, the Revised Draft EIR contains several references to:

- Generation III technology as being the basis of submission
  - We understand technology decisions (as to Generation 2, 2G+ and / or 3G) to be within the purview of Department of Energy and / or other policy-makers, with NNR responsible for the licensing of any individual technology source post a policy decision. Thus, the EIA should not be the final position.

Response 2:

The EIA, as a decision making tool, is not tasked with making recommendations in terms of technology use in this instance and indeed does not give a position on it. The main purpose of the EIA is to assess the significance of the impacts of the construction and operation of the proposed Nuclear-1 Power Station specifically on the Duynefontein, Bantamsklip and Thyspunt sites. As such

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A list of divisional directors is available from the company secretary.

the EIA has used a conservative envelope of criteria (Consistent Dataset), provided by Eskom, to which the technology used must comply, in its assessment of impacts.

Assuming that an authorisation is granted by the Department of Environmental Affairs, a power station design that deviates significantly from that specified in the Consistent Dataset in the Nuclear-1 EIR (Appendix C of the Revised Draft EIR Version 1) would render the design incapable of meeting the requirements of the EIR and the authorisation. Hence such a non-confirming design could not be considered for construction.

Comment 2:

- European Utility Requirements (EUR) on Emergency Planning Zones (EPZs)
  - We understand the EUR currently envisages a significant reduction in the extent of EPZs around its new nuclear plants, which the Revised Draft EIR has followed. As understood by Standard Bank, EURs (a trade body view) is not reflected within South African Law and the position found satisfactory on Koeberg is a somewhat larger evacuation zone. We further understand the scale of the relevant EPZ will be determined by the NNR.

Response 2:

Your comments are noted. The size of the Emergency Planning Zones (EPZs) is not yet certain, as it will be a function of the NNR's nuclear licensing process (as stated by yourselves above). It is an assumption, as stated in the Revised Draft EIR Version 1, that the EPZs will be based on EUR requirements. Should the EPZs determined by the NNR deviate significantly from those assumed in the EIR, then a re-assessment of the environmental impacts may be required.

Comment 3:

From our perspective, our chief concern is that the EIA should be an enabling document such as to allow DOE (or other policymakers) to determine the nuclear technology they deem most appropriate for South Africa; and to allow NNR to license the technology they deem suitable.

Accordingly, in finalising the Revised Draft EIR, we would suggest Eskom/Arcus Gibb submits positions that provide appropriate scope for South Africa's policy-makers to finalise the appropriate technology/tendering solution; and NNR appropriate scope to carry out their licensing/safety duties, without being unduly bound by drafting assumptions.

Response 3:

Your comment is noted. Please see our Response 2 in terms of the role of the EIA process.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Response 3:

Your comment is noted. Please see our Response 2 in terms of the role of the EIA process.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
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Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

COMMENT ON THE AGRICULTURAL IMPACT ASSESSMENT
THYSPUNT NUCLEAR 1 -DRAFT ENVIRONMENTAL 2nd DRAFT IMPACT ASSESSMENT REPORT

Prepared by: Trudi Malan & Cliff Harrington on behalf of the Thyspunt Alliance.

Comment 1:

We would like to request a copy of the written review of the Agricultural Impact Assessment as we are of the opinion that the study is fatally flawed.

Response 1:

Your comments and request are noted. All initial specialist studies (in 2008/9) were indeed reviewed by peer reviewers, who are recognized specialists in their fields. The peer reviewer for the agricultural specialist study was Garry Paterson of the Agricultural Research Council, who has extensive experience of agricultural impact assessments. The methodology for agricultural assessment and Terms of Reference (ToR) were reviewed and deemed to be acceptable by the reviewer, at this stage of the EIA process. No additional peer reviews were conducted for the agricultural specialist study.

Consideration needs to be taken that there have been some changes to the agricultural specialist's original ToR during the study. The initial ToR for the agricultural specialist study emphasized the environmental impact on the actual site (footprint) of the proposed nuclear plant and on a land survey/ audit of 16 km radius and an agricultural infrastructure audit in a 20 km radius. These aspects have been extensively detailed in the Agricultural Specialist Report (Appendix E21 of the Revised Draft EIR version 2). The regional impacts on agriculture have been covered in the economic impact report.

Comment 2:

We would like a scientific and factual explanation from the practitioner as to how he reaches the conclusion that there will be a 10% - 15% increase in production at the Thyspunt site. He states:

"This potential economic benefit is based on the potential of a region to increase its agricultural production as a result of the potential increased demand within the region."

To merely state that there will be more people therefore farmers will be able to sell more produce is not based on facts but rather on perception.

The AIA practioner provides the following explanation for his startling conclusion:

"***Dairy farmers have a number of options available to increase production other than expansion. These include an improvement in management and an improvement in the nutrient value of planted pastures, which would result in an increase in milk produced per milking cow. Other market opportunities potentially could open, including the selling of raw milk or maas directly to consumers.***

Alternatively, farmers may also switch production as has been done in the past (the region has moved from a predominantly wheat growing area to a dairy region mainly as a result of market forces). Therefore, for example, some farmers may switch to vegetable production if they believe this will be more profitable. Given the above it is estimated that the potential increase in the market for agricultural produce could be 10-15%."

Considering the above explanation we have the following questions:

Please list the possible management improvements that can be implemented as well as the cost implications of implementing these improvements?

Response 2:

In regard to the conclusion that there is the potential for agricultural production to increase by between 10 – 15 % in the Thyspunt area the reader is directed to the results given in the regional macro-economic model (Economic Impact Report – Appendix E17 of the Revised Draft EIR Version-1) where the total impact on agricultural production for the region (Eastern Cape) is estimated. The results are summarised in the following Table.

	Total - Impact on Production per Annum			
Type of Farming	Direct impact	Indirect impact	Induced impact	Total impact
		(R millions)		
Citrus farming	R 0.0	R 0.7	R 8.6	R 9.3
Sub-tropical fruit farming	R 0.0	R 0.0	R 1.3	R 1.4
Livestock farming	R 0.0	R 0.8	R 29.5	R 30.3
Dairy farming	R 0.0	R 1.7	R 22.1	R 23.8
Game farming	R 0.0	R 0.0	R 1.4	R 1.4
Forestry (Plantations)	R 0.0	R 5.3	R 1.7	R 7.0
Other agriculture	R 0.0	R 3.9	R 36.7	R 40.6
Agriculture - Subsistence	R 0.0	R 0.2	R 4.5	R 4.8
TOTAL AGRICULTURE	**R 0.0**	**R 12.7**	**R 105.8**	**R 118.5**

From the above Table it can be seen that as a result of the proposed development of Nuclear-1 it is estimated that agricultural production in the region (Eastern Cape) will increase by R118.5 million in total. The breakdown of the increase in demand and hence the increase in agricultural production of the different types of farming have been given in the Table. Given the main agricultural activities in the Thyspunt area if only livestock farming, dairy farming and other agricultural production is taken into account, the total increase in production is R98 million. It is reasonable to assume that given the production potential (especially in respect to dairy) of the area around Thyspunt that a conservative estimate of 20% of this increase in production could be taken up by farms in the Thyspunt region as they would have a comparative advantage (e.g. in regard to location, as their transport costs would be lower). This would give an estimated potential increase in production of R18 million per annum. It has been estimated that the total agricultural production of the region around Thyspunt is R150 million per annum and therefore this potential increase is within the 10 – 15% estimated.

An example of better management practices would be better record keeping that would lead to better cow selection which will ultimately result in an increase in milk yields. It should be noted that it is

stated in the specialist report that there is the potential for a 10 - 15% increase in production and not a 10 - 15% increase in profit.

Comment 3:

Provide the methods to be used to improve the nutrient value of the planted pastures and the cost related to these improvements?

Response 3:

Like all other businesses, farmers are continually looking for improving their efficiency and profitability in production. There are many references that show that improved pasture nutrition could increase production. An example of a reference is Tainton NM (1988) Veld and Pasture Management in South Africa. University of Natal Press, Pietermaritzburg, South Africa.

It needs to be stressed that this is an estimated potential increase in production and it would be up to the farmers in the region whether they are willing and able to take advantage of this potential opportunity.

Comment 4:

Indicate which areas in the study area would be suitable for vegetable production and provide the costs for the change from a dairy farm to a vegetable farm? Indicate which vegetables would be suitable to grow.

Response 4:

The scope and budget of the study does not allow for a detailed soil survey. However given the generalized soil survey presented in the Agricultural Impact Assessment (Appendix E21 of the Revised Draft EIR), it is reasonable to assume that a relatively small area of land would be suitable for vegetable production if the farmer of that specific land that is suitable would want to switch to vegetable production. Intensive vegetable production requires relatively small areas of land.

Comment 5:

Please indicate how you reached a figure of 10% to 15% in increased production.

Response 5:

Kindly refer to the response 2 provided above.

Comment 6:

With reference to the selling of maas and raw milk (unpasteurised milk), please note that it is against the law to sell maas and raw (unpasteurised milk) to the public due to the health risk.

These products can spread brucellosis and some herds in the area are not brucellosis free.

Response 6:

It is correct to say that it is illegal to sell unpasteurised milk and the wording in the text should read maas and fresh milk. The essence of the statement in the report is that the farmers could sell their produce direct to the consumer (i.e. they could establish a small dairy factory and sell maas and pasteurised milk direct to the consumer). This is a trend throughout South Africa where individual farmers are grouping together and establishing a dairy factory and selling their milk directly to retail outlets and consumers.

Comment 7:

We have consulted with all the major dairy farmers in the area and they are of the opinion that the report is utter nonsense. The area is a dairy producing area; most of the milk produced in the area is purchased and distributed by major milk processors who sell into the national chain, the positive influence is thus not relevant.

Response 7:

The potential increase in demand (see response to comment 2) for dairy products will be a regional (Eastern Cape) impact for the farmers that could potentially supply to the local markets (St. Francis, Oyster Bay, Humansdorp and Jeffreys Bay). Therefore, it remains the agricultural and economic specialist's expert opinion, that the increase will filter down to the Thyspunt producers even if they supply a national dairy factory that produces pasteurised milk and sells nationally.

Comment 8:

Climate Data:

The prevailing wind direction as indicated in this report is wrong. (Please see Addendum 1). We find this mistake very disconcerting. As an Agricultural expert the specialist should understand that wind conditions could play a major role in the production of agricultural produce.

Response 8:

The information on the wind direction given in the agricultural impact report has been taken from the Air Quality Report. The wind direction, as used in the Draft EIR and described in the Air Quality and Climate Assessment Report (Appendix E10) is correct, and is consistent with the wind roses for the area. Wind direction data is explained in details in Issues and Response Report 82.

Comment 9:

Impact Assessment:

"(4) Possibility of Nuclear Incident
The actual risk of an accidental release of radionuclides over and above normal operations will need to be verified in the overall risk assessment report. Given that the probability of an incident happening is very low, the discussion below must be seen in this context."

We are all in agreement that the risk of a nuclear accident is low but the precautionary principle would hold that placing a nuclear facility in an area that produces 25% of the national dairy supply is still a risk, no matter how low the risk of a nuclear incident, there is still a risk and the impacts should be discussed.

Response 9:

The emergency evacuation zone is given as 3 km radius from the plant site and therefore this will have a minimal effect on agricultural production. This will need to be re-evaluated if the emergency evacuation zone is increased.

Comment 10:

The AIA does acknowledge the following:

"Therefore, in the event of a nuclear disaster with consequent nuclear fallout, the main concern is that milk will immediately be contaminated and within 24 hours enter the human food chain. Beef cattle, sheep and game that feed on contaminated grazing"

The mitigation method suggested “in the event of an accident dairy cattle will have to be removed from the area immediately” would not be possible if the number of dairy producing cattle in the area is considered.

Response 10:

In event of an emergency warning been given the dairy cattle can walk out of the 3 km evacuation zone. It is an assumption of the EIR that the evacuation zone will be no larger than 3km. Again, if the 3 km radius evacuation zone is increased, then this will need to be reassessed.

Comment 11:

The AIA suggests that the possibility of stock theft should be discussed in the Social Impact Assessment. We disagree with this statement. Stock theft is an integral part of farm management and should be addressed as part of the AIA.

Response 11:

The potential for stock theft as a result of the proposed development is rather a social issue and not an agricultural issue. If it is agreed by the social specialist that there would potentially be an increase in stock theft then this needs to be mitigated against by increasing security in the local area.

Yours faithfully
for GIBB (Pty) Ltd

The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

Tshwane

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Thyspunt Alliance
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RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE

NUCLEAR 1 **REVISED DRAFT ENVIRONMENTAL REPORT**
APP. E23 **NOISE ASSESSMENT**

Response compiled by H.Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

This assessment, together with the Transportation Assessment, feed into the Social Impact Assessment. It is principally concerned with the noise impact of construction on site, and of the construction of new roads. It does briefly, but totally inadequately, mentions the impact on local communities of transportation of materials to site.

This has to be one of the most complacent of all the specialist reports.

Response 1:

The calculation and prediction of road traffic noise is conducted in accordance with South African National Standard (SANS) 10210. It is highly complex taking into account numerous factors including: mean traffic flow, percentage heavy-duty vehicles, mean speed, road gradient, road texture, distance of receptor from the road, ground conditions, screening effects of topography and structures. It is in use for many decades and its accuracy has been validated internationally, locally and by this noise specialist every time, that he has conducted road noise measurements (close on 100 measurements)

throughout South Africa and applied the prediction model, including this project. Up to 200 m the correlation between measured and predicted $L_{Aeq,T}$ has been within 1 dB!

In terms of SANS 10328 the prediction and assessment of noise from road traffic is to be conducted in accordance with SANS 10210 because of its accuracy and specifically not based on short term measurements (whether one, two or more days duration).

All applicable information regarding existing and predicted future road traffic noise and the associated impact along the R330 south of Humansdorp on surrounding land is concisely contained in Tables 11 and 12 of the noise specialist report. Table 11 considered the worst case scenario, namely, the nearest residences located 10 m from the R330, which happened to be the informal settlement. The same would apply to any other residence at the same distance anywhere along the R330. On inspection it was observed that the majority of the residences were located 70 m or further from the R330. Table 12 in the Noise Impact Assessment (Appendix E23) considers the impact on the nearest of these residences.

The Tables form a small part of a page. Padding the report with many additional paragraphs would not add any further value.

Comment 2:

The reality is that the construction of a nuclear plant at Thyspunt, whose main access road is the R330, will involve hundreds of thousands of heavy to exceptionally heavy loads passing right past a large section of the Kromme River community and St Francis Bay, possibly 24 hours-a-day if a shift system is used, over an already busy and noisy bridge, then up a long and relatively steep hill, which runs from the current town entrance to Homestead Road, past a retirement complex and The Links golf estate, for a period of nine years . The noise impact of this would be massive, continuous, highly disruptive and unmitigable. Despite this, the Executive Summary contains the following statement, which is repeated in the conclusions on p. 38:

> *"the noise impact (of transportation of materials and equipment to site) on a small number of residences in the nearest informal settlements along the R330 at Sea Vista . . . would be medium."*

Questions arising from this breath-takingly complacent comment are whether the specialist is aware of the existence of St Francis Bay, or has ever been there, or has deliberately chosen to ignore it.

Response 2:

Response by the Noise Specialist:

The future predicted relative and cumulative impact of noise from road traffic on the R330 for each year of construction were based on the assumptions that construction traffic would not take place 24 hours a day but 8-hours per day. This is stated in the report and specifically excludes "…possibly 24 hours-a-day if a shift system is used…".

South of the traffic circle the R330 passes through a cutting with a maximum gradient of 8% over approximately 100 m at the base of the incline, decreasing steadily beyond each end of this segment of road. The effect of the gradient will be the same for existing traffic noise as it would be for any future traffic. This is irrespective of the effect due to the number of vehicles and percentage of heavy-duty traffic that forms part of the calculations.

A worst case scenario would be for a receptor located 10 m from the edge of the road in the middle of this 100 m segment of road. At this distance the angle-of-view of the road is close to 180 degrees and the sound Intensity Level at the receptor would be almost 100% be due to noise emanating from that segment. The sound Intensity Level at that receptor would be 2,4 dB higher than a receptor located 10 m from the road with no gradient for the same number of vehicles with same percentage heavy-duty vehicles. With reference to the Addendum a level difference of 3 dB or less is insignificant.

With increasing distance from the road the angle-of-view and exposure to noise from this segment of road decreases and the receptor is exposed to an increasing angle-of-view and increasing exposure of noise from other segments of the road. For example, at a distance of approximately 30 m from the road the angle of view of that 100 m segment would be approximately 90 degrees. The effect of only the reduced angle of view, excluding the reduction due to increased distance or intervening topography, would be a reduction in Intensity Level of 3 dB.

The previous paragraphs try to clarify one of many factors that are taken into account in calculating and predicting road traffic noise (SANS 10210). It cannot be expected to dissect each and every step.

Comment 3:

A second question is whether the categorization of the impact as “medium” is based on the Impact Assessment Criteria contained in Chapter 7 of the Revised Draft EIR, Table 3-16.

Response 3:

Response by the Noise Specialist:

Refer to attached Addendum.

Response by GIBB:

Since the publication of the Revised Draft EIR, the Transport Impact Assessment (Appendix E25 of the Revised Draft EIR) has been substantively revised. The outcome of the revision is that heavy delivery vehicles will make use of a bypass to the west of Humansdorp and will use only the Oyster Bay road, and no longer use the R330 through St. Francis. Only passenger vehicles and buses and occasional abnormal heavy haulage will use the R330 and access the Thyspunt site via the proposed eastern access road.

Comment 4:

A third question would be whether the specialist placed a sound monitor on the hill going up from the traffic circle towards Sea Vista. This would be serious low-gear work for heavy vehicles going up, and probably air brakes going down. To claim that this would have a low impact is nonsense.

Response 4:

Response by the Noise Specialist:

It was one of the locations considered. However, nowhere along the incline could the sound level meter be located 10 m from the road and 1,4m above road level and without interference of shrubbery, as required by the above-mentioned SANS standard. With reference to Response 1, calculations based on different measuring points to those used in the Noise Impact Assessment would not have resulted in substantively different results.

With regards to the excessive noise produced by “air brakes”, this type of breaking system has been outlawed in Europe (and possibly other countries). They are illegal in these countries and no new heavy-duty vehicle may be manufactured or fitted with this type of braking system. Outside of this study, the noise specialist has previously had discussions with the Department of the Environment and Development Planning of the Western Cape regarding legislating the phasing out of these types of vehicles, with it becoming illegal after a particular date. The specialist was left to understand that this would need to be considered at national level.

Local authorities have the power to legislate by-laws such as prohibiting “air brakes” being activated within their area of jurisdiction. This has been enacted in certain areas. The noise specialist recommends that this prohibition be included in Eskom’s tender and that the representative(s) of the residents make a parallel application to their local authority.

Response by GIBB:

Since the publication of the Revised Draft EIR, the Transport Impact Assessment (Appendix E25 of the Revised Draft EIR) has been substantively revised. The outcome of the revision is that heavy delivery vehicles will make use of a bypass to the west of Humansdorp and will use only the Oyster Bay road, and no longer use the R330 through St. Francis. Only passenger vehicles and buses and occasional abnormal heavy haulage will use the R330 and access the Thyspunt site via the proposed eastern access road.

Comment 5:

St Francis Bay is a highly successful and indeed unique resort town, with a world-wide reputation. It is a testimony to the vision and energy of a South African entrepreneur, who has set in place a very desirable amenity for the potential benefit of the entire country. A significant portion of the permanent population comprises retirees, who have worked their entire lives to enable them to live in what they regard as an incomparable environment. To impose a transportation system of the type envisaged on such a community would be unjust and unreasonable. **Despite this, the specialist does not even mention it.**

Response 5:

Response by the Noise Specialist:

The assessment of noise (on humans) makes no distinction of whatever regarding the demographic or socio-economic standing or age of people affected by noise.

Comment 6:

Attention is drawn to the Nuclear Site Investigation Programme (NSIP), a specific recommendation of which was that the small holiday resorts along the coast be left unaffected. Either the specialist did not study these reports, or Arcus Gibb failed to brief him on this, or it has been deliberately ignored.

Response 6:

Response by the Noise Specialist:

Kindly refer to Response 5 above.

Comment 7:

Impact Assessment Criteria
Attention is drawn to the revised impact assessment criteria contained in Ch 7, Table 7-16, p. 7-32 ff. It would appear that the specialist has not used these new criteria with regard to the noise impact of transportation in the vicinity of the Kromme River and St Francis Bay.

Even here, a problem arises, in that the duration figures given in the table are immediately contradicted by the explanatory notes. The notes seem to follow the original ratings, and have not been revised. Table 7-16 seeks to address an objection raised in the first draft, that nine years was far too long a period for the rating of a duration impact as low. In this particular case, the construction period is expected to be nine years, and this being the case, in terms of Table 7 – 16, any impact arising would be of high duration.

Below is our version of a table for the noise impact of traffic across the Kromme River and past St Francis Bay, based on Table 7 -16 in the revised draft.

Response 7:

Response by the Noise Specialist:

Kindly refer to the attached addendum.

Comment 8:

Kromme River & St Francis Bay

Traffic Noise Impact Assessment
(see similar exercise in comment on Impact Assessment & Revised Draft EIR Table 7 – 16)

Assumptions:	9 year construction period
	R330 regarded as site
	Loss of "sense of place" regarded as irreplaceable resource.
Nature	Negative
Extent	Medium (beyond immediate surrounds)
Duration	High (9 years to permanent)
Intensity	High (thousands of heavy-duty vehicles climbing hill, possibly 24 hours per day/night)
Consequence	(Duration, extent, intensity & irreplaceable resource) High
Probability	Definite (unless road re-directed from Kromme & St Francis)
Significance	High (high consequence and high probability).
Reversibility	Medium (Traffic impact reduced, but not removed after construction phase)
Irreplaceable	Yes (sense of place)
Confidence	High
Cumulative	Medium (roads only)

High significance indicates that mitigation measures are required.

Proposed mitigation measures
The only mitigation measures proposed relate to construction on site, road construction and ultra-heavy loads. There is no mention of the impact of heavy to abnormal loads, or of commuter traffic on the surrounding communities. In consequence, the above ratings are not mitigated in any way, nor can they be In fact the situation is worse than shown in the report, since no attention is paid to the huge increase in traffic over peak holiday periods. This could be 400% over normal traffic.

Response 8:

Response by the Noise Specialist:

The noise assessment was based on quantitative information available. The effect of abnormal loads is included in the report.

Comment 9:

Conclusions
This report is typical of those produced for this EIA. It deliberately or negligently disregards real problem issues, and ends with recommendations which favour the developer. It calls into question the integrity of the entire EIA.

We would argue that a “high significance” overall rating should be given to traffic noise in the St Francis area, and that this should strongly influence the decision to proceed with this aspect of the project.

This being the case, we demand that no access road to Thyspunt should pass within one kilometer of an urban edge. If no suitable road access is possible on this basis, this will be yet another flaw in a flawed site selection.

Response 9:

Response by the Noise Specialist:

It is hoped that with more factual understanding of the response of humans’ to noise and of the objective standardised procedures obliged to be conducted, a more balanced view can be formed.

Response by GIBB:

Since the publication of the Revised Draft EIR, the Transport Impact Assessment (Appendix E25 of the Revised Draft EIR) has been substantively revised. The outcome of the revision is that heavy delivery vehicles will make use of a bypass to the west of Humansdorp and will use only the Oyster Bay road, and no longer use the R330 through St. Francis. Only passenger vehicles and buses and occasional abnormal heavy haulage will use the R330 and access the Thyspunt site via the proposed eastern access road.

Comment 10:

Additional note
This response is based only on the impact on St Francis Bay and the Kromme River. It makes no mention of the Transportation Specialist’s proposal that all the heavy traffic should use a small residential road called Saffery Street in Humansdorp. If that does not illustrate the naïveté of the transportation report, nothing will. When announced at a public meeting in St Francis Bay, attended by some 200 people, the whole hall simply collapsed in mirth. Since there is no mention of it in the Noise Impact Report, we have to assume that the specialist was either not aware of this proposal, or chose to ignore it. From a noise perspective it is completely unacceptable.

Response 10:

Since the publication of the Revised Draft EIR, the Transport Impact Assessment (Appendix E25 of the Revised Draft EIR) has been substantively revised. The outcome of the revision is that heavy delivery vehicles will make use of a bypass to the west of Humansdorp and will use only the Oyster Bay road, and no longer use the R330 through St. Francis or Saffery Street through Humansdorp. Only passenger vehicles and buses and occasional abnormal heavy haulage will use the R330 and access the Thyspunt site via the proposed eastern access road.

Yours faithfully
for GIBB (Pty) Ltd

_____
Nuclear-1 EIA Team

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Architectural Acoustics Noise & Vibration Control Environmental Noise Traffic Noise Acoustical Material Research Underwater Sound Nonlinear Acoustics

HUMANS AND THEIR ACOUSTICAL ENVIRONMENT

The methodology used in the Noise Impact Assessment is dictated by SANS 10103, which is based on how humans perceive sound/noise. An attempt is made here to explain two of the numerous aspects of humans' perception of sound.

We perceive the physical world around us by means of our senses: vision, touch, smell, taste and hearing. Our acoustical environment invokes the least tangible of these senses. This may explain the lack of awareness and comprehension by many people of the degree to which sound affects their lives.

A fundamental aspect is that our sensory responses are not linearly related to physical stimuli. An illustrative example is provided below:

Place two loudspeakers closely side-by-side and feed the identical (mono) sound signal first to one loudspeaker and then both. So that your judgement is not influenced, shut your eyes and have someone else connect or disconnect one of the loudspeakers (quietly pull out or put in one of the loudspeaker plugs). Do you hear any difference?

Even with knowledge of what to expect, most of us would have difficulty in perceiving the difference in what we subjectively describe as "loudness" during this experiment. Yet the physical quantity (acoustical power in watts) radiated by two loudspeakers is <u>double</u> that of one loudspeaker. During our daily activities this difference would go unnoticed.

Our sense of hearing follows a logarithmic response to changes in the Intensity of sound at our ears defined as watts per square meter (W/m^2). Hence a different scale is used, namely, the decibel (dB).

Decibel = 10 × Logarithm of the ratio of two powers (W) or of two intensities (W/m^2)

$$\text{Power Level} = 10 \times \text{Log} \frac{Power}{Power_{reference}} \text{ dB}$$

$$\text{Intensity Level} = 10 \times \text{Log} \frac{Intensity}{Intensity_{reference}} \text{ dB}$$

It is not an absolute scale but a relative scale. To distinguish the latter one refers to sound Intensity Level that is referenced to the threshold Intensity of hearing. Refer to the Glossary in the noise specialist's report.

The relative difference between 2 acoustic watts radiated by two loudspeakers compared to 1 acoustic watt radiated by one loudspeaker on a decibel scale is,

$$10 \times \text{Log } \frac{2}{1} = 10 \times 0.301 \approx 3 \text{ dB}.$$

Here we have used the power radiated by one loudspeaker as reference. Thus, doubling the sound power equals a 3 dB increase in Sound Power Level and we would be exposed to a 3 dB increase in Intensity Level.

Because humans are not capable of perceiving a difference in Intensity Level of 3 dB or less, this difference in level is considered to be insignificant when assessing sound.

A fourfold increase in sound Intensity is equivalent to a 6 dB increase in sound Intensity Level. This difference is perceived and considered to be a significant difference in terms of humans' response. Only when the acoustical power, whence Intensity is increased tenfold i.e. 10 loudspeakers resulting in a 10 dB increase in level, would the average human perceive this as "twice as loud" compared to that from a single loudspeaker.

A second aspect is that human response to environmental sound/noise is dependent on the average sound energy received over a period of time, T, and not to the instantaneously varying sounds. The Rating Level, $L_{Req,T}$, is used for assessment of sound/noise. This includes the average sound level with adjustments for tonality and impulsivity of the sound. Refer to the Glossary in the noise specialist's report.

Moving from loudspeakers to road traffic noise. If the $L_{Req,T}$ due to, say, 300 vehicles per time period T at a receptor is 60 dBA then doubling the number to 600 vehicles during the same period will cause a 3 dB increase to 63 dBA due to the doubling of the average sound power emitted by twice the number of vehicles during the same time period. In this example the increase would be insignificant. There would be no detectable increase in "loudness". Notwithstanding this, the increase would fall in the 0 dB to 5 dB excess range and the associated noise impact would be assessed to be **Low**. Refer to 1.2.2 Impact qualifiers in the noise specialist report.

The illustration is based on the same mix of light and heavy-duty vehicles. The road noise prediction calculations applied to the noise study took into account the percentage of heavy-duty vehicles that emit a higher sound power level, road gradient, speed, plus other factors.

Combining the above knowledge one is ready to apply this to understanding the assessment of the impact of noise emanating from road traffic on the average human (receptor) within a residential community.

Refer to Table 11 of the noise specialist report regarding the impact of noise of receptors 10 m from the edge of the R330 south of Humansdorp. This forms two parts:

a) The existing measured or predicted $L_{Req,T}$ is compared with the typical $L_{Req,T}$ for the particular district (refer SANS 10103 Table 2). If the typical $L_{Req,T}$ is not exceeded the impact of noise is negligible. If the $L_{Req,T}$ due to road traffic exceeds the typical level the level of excess is assessed in 5 dB steps from **Low**, through **Medium**, to **High**.

   Based on sound measurements the $L_{Req,d}$ due to existing (Non-Eskom) traffic was found to be 63 dBA. This is 8 dB in excess of the typical level of 55 dBA and falls between the 5 dB and 10 dB excess range with an associated **Medium** intensity of noise impact. Remember, 6 dB increase is significant and 10 dB represents a doubling of "loudness".

   Thus, in the absence of any Eskom traffic there already exists a noise impact of **Medium** intensity for receptors located 10 m from the road edge.

   During the 1st year of construction the existing traffic plus the Eskom light and heavy-duty traffic combined will result in a predicted level of 69 dBA with an excees in $L_{Req,T}$ of 14 dB. The predicted noise impact of the <u>combined</u> traffic will be **High** (2nd last row of table). It would remain high during subsequent years even with reduced Eskom traffic.

b) The second part identifies and assesses the <u>relative</u> contribution of Eskom traffic noise to the total $L_{Req,T}$ of the combined non-Eskom traffic plus Eskom traffic. Eskom's relative impact would represent a **Medium** noise impact (last row of table). It would remain Medium for 2nd and 3rd years of construction and reduce to Low during all subsequent years.

It is hoped that this has provided some insight into human hearing and greater understanding of the noise impact assessments.

A.W.D. Jongens August 2011

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

Thyspunt Alliance
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Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

THYSPUNT ALLIANCE
NUCLEAR 1 REVISED ENVIRONMENTAL IMPACT REPORT
APP. H PEER REVIEW

Response compiled by H.Thorpe and submitted on behalf of the St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

On the whole, this is a balanced and well-researched review, within the limitations outlined at the outset. A strong point is made regarding the national priority of provision of power both to South Africa and to the Eastern Cape, and the relevance of this in assessing the pros and cons of the Thyspunt site. This is not disputed. However, the use of national interest as a ground for overlooking environmental and regulatory requirements would be setting a dangerous precedent.

There are a number of comments which are relevant to the position adopted by the Thyspunt Alliance and by the specialist's review.

These are the following:

1. Limitations in the review
   It is acknowledged in the opening paragraph, under "Terms of Reference", that this is "principally a process review, and is not intended as a means of verifying the scientific accuracy or completeness of the special studies that were prepared for the investigation Specialist reviews have been undertaken for that purpose." It has been confirmed verbally in

private conversation with the EAP that peer review of specialist reports is not conducted by the Peer review specialist. This leaves the way open for abuse.

One of our objections to the EIA process as conducted is the number of weak specialist reports, notably the Transportation, Noise and Social Impact reports. There has been minimal change to the reports mentioned between the first and revised reports, despite their blatant shortcomings.

Response 1:

Thank you for your comment. Please noted that the Transportation Assessment Report has been extensively revised and that all specialist studies were peer reviewed. From the peer reviews conducted on the specialist studies, it was found that the assessment and associated information provided is adequate and not fatally flawed. Kindly refer to Appendix E37 for all specialist peer review reports.

Comment 2:

2. Fragmentation of the process
   There is no discussion of the legality or appropriateness of excluding the NNR from the EIA process, or indeed of the fragmentation of the process into two separate EIAs, one for the plant itself and the other for the transmission lines. All of these are integral to the overall Record of Decision, and the cumulative effect of all three is not addressed. We view this as a shortcoming in the peer review.

Response 2:

Section 1.1 of the Revised Draft EIR contains a discussion of the authorisation process, the process driven by the National Nuclear Regulator (NNR) and the separation between the mandates of the NNR and the Department of Environment Affairs (DEA). Furthermore, the content of the co-operative governance agreement between the NNR and the DEA and a further explanatory letter on this agreement from the DEA is provided in full in Appendix B4 of the Revised Draft EIR.

South African legislation mandates nuclear and radiological safety considerations to the National Nuclear Regulator and environmental considerations to the relevant Environmental Authorities. There is some overlap in responsibilities and hence the NNR and the Environmental Authorities signed this cooperative agreement to govern integration of their respective responsibilities with regard to radiological impacts on the environment. The exclusion of the detailed assessment of nuclear safety aspects from the EIA is thus in keeping with South African legislation, and this co-operative governance. The NNR licensing process, during which nuclear safety aspects will be considered in detail, will be undertaken as it is necessary.

It is common practice in South Africa for the EIAs of power stations and electricity transmission lines to be completed separately. This is a practice accepted by the Department of Environmental Affairs and Tourism. The impacts associated with the Transmission lines have been considered as far as possible

during this EIA process. Whilst it might be ideal to consider the potential impacts of the power station and all three transmission corridors in a single document, this is not practically possible and would result in an unmanageable process and in all likelihood a set of documentation that would make understanding of the key issues impossible. At this stage, the EIR for the power station includes 28 different specialist studies and is a very lengthy document (six volumes). This amount of information is already difficult to manage and digest by the public and quadrupling the volume of this documentation by including all three power line corridors (most of which include a number of different corridors in widely dispersed areas) is not practical. It is in recognition of these facts that the DEA has approved the approach of one EIA process for the nuclear power station site and three separate EIA processes for the transmission power lines.

Comment 3:

3. Viability of the Thyspunt site
   A key issue in the process should have been the question of the viability of the site in terms of internationally recognized requirements for emergency planning. This is a matter for the NNR, who have been completely excluded because no licence application has yet been made. It would be reasonable to expect that this omission would be mentioned by the reviewer, since it is such a fundamental issue in the context of a Record of Decision on the suitability of Thyspunt as a nuclear site at all. This has not been forthcoming.

Response 3:

As clearly indicated in the EIR, the emergency planning zones (EPZs) on which the application is based are 800 m for the PAZ and 3 km for the UPZ. However, even if the larger EPZs currently applicable to the Koeberg Nuclear Power Station were to be applied to Nuclear-1, it would still remain viable and would not affect the technical viability of the project. Furthermore, also refer to response 2 above regarding the NNR.

Comment 4:

4. Generation –III & EURs

   Relevant in this context is the total dependence of this EIA on the use of Generation III technology, which is still in the developmental stage, and, arising from that, the proposal to reduce emergency planning zones in terms of so-called “EUR”s. Eskom is skating on very thin ice here, since both Eskom and the EAP have acknowledged that, if Generation III is not used, the entIre EIA will be null and void, and will have to start from scratch. Government announced some time ago that Generation III was not affordable. There is no discussion as to whether this decision has been reviewed, or whether EURs can be regarded as suitable regulatory requirements.

   The EURs are a product of the European Nuclear industry, to suit its own agenda, and has not been recognized, either by the IAEA or by any national nuclear regulator anywhere in the

world. Were South Africa to adopt these “requirements”, which are not even guidelines, let alone regulations, it would be the first country in the world to do so.

Surely this should have been included in the EIA process, and in this review. It should have been resolved before such an expensive process was ever entered into. This EIA has therefore been undertaken at risk. It is issues such as this which cause us to question the legality of proceeding with an EIA when the fundamental issue of the specific technology has not been resolved. In view of the extreme significance of these two considerations, it would be reasonable to expect some discussion of this in terms of the process being followed. There is no mention of it.

Response 4:

Your comment is noted. It is acknowledged that this is a key assumption of the EIA process.

The basis for adopting the EUR by Eskom is that the EUR aims at ensuring that the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs. The current plants being constructed, AP1000 and EPR, are compliant with the EUR emergency zoning.

However, in all the public participation interventions, Eskom has made it clear that the decision regarding the nuclear emergency plan rests with the National Nuclear Regulator (NNR) –refer to response 2 above. The technology has been decided – nuclear power station, pressurized water reactor technology (reference Nuclear Energy Policy of South Africa). The vendor, and hence the specific design of PWR has not yet been decided

Comment 5:

5. The Nuclear Siting Investigation Programme (NSIP)
   According to the reviewer, the EAP did review the NSIP. It would seem to us that she did so in a very selective manner. Our comment is based on Revision 1, ref ACC 1166714, dated December, 1994. In this there are several key points which seem to have been overlooked. These are:
   - The incomplete nature of the NSIP. The only criteria which were explored in any detail were the seismic, geology and demographic aspects, which led to the favourable report on Thyspunt. No attention was paid to infra-structural requirements, environmental impacts, emergency planning, costs, etc. These are only being investigated in any depth now in the EIA process.

- There is reference on p. 3 of the NSIP to the 50km demographic requirements from Port Elizabeth, and the 100km requirement from the Ciskei. This is repeated in Box 1 on p. 11 of the peer review, which refers to a 200km requirement from the (then) Ciskei. Whichever is correct, it reflects the security concerns of the then apartheid government. This fell away completely with the constitutional changes which occurred in the mid-nineties. There is a reference in the NSIP to a possible site closer to the Ciskei which, if suitable, could have placed the NPS between Port Elizabeth and East London. The failure by Eskom to investigate this further is inexplicable, and has contributed to the sense of urgency which is now so apparent throughout this EIA process. It would be reasonable to expect some reference to this in the peer review, but it is not mentioned.
- The implication of these limitations is that Eskom has, in fact, no confirmed sites for any NPS. They are all provisional, and based on an incomplete process. Eskom is proceeding as if all five sites have been confirmed as suitable, and are available for development. This is incorrect, and should have been acknowledged in the review.
- Item 3.2.2, p.11 states that "the eastern part of the Oyster Bay area is unsuited to development because of the proximity of several holiday centres". This led to the recommendation in 3.3.3, p.12, that "the small holiday resorts along the coast be left unaffected".

  It is difficult to see how using the R330 as a main access road for heavy traffic is consistent with this recommendation. Yet this is not discussed in the peer review

Response 5:

Relevance of NSIP planning

Project planning for large construction projects typically includes a pre-feasibility and feasibility assessment prior to detail planning and environmental impact assessment. Considering that the NSIP was focused on initial identification of potential nuclear power station sites, it should be regarded as an initial feasibility or even pre-feasibility study. It therefore stands to reason that not all impacts would have been investigated in detail and that these impacts can only be investigated in the EIA process or in other processes such as the nuclear licensing process. The socio-economic realities have not changed to such an extent since the NSIP was undertaken that the major load centres in the Eastern and Western Cape (Port Elizabeth and the Cape Metropole) have changed, and therefore the location of power station sites in each of these regions (close to the Cape Metropole and close to Port Elizabeth) therefore remains as valid today as it was when the NSIP was undertaken.

Your argument regarding review of the NSIP after the 1994 Constitutional changes is noted. Such an approach would imply that all planning undertaken prior to 1994 should have to be frozen pending review – a situation that is untenable as all planning and delivery processes would necessarily have been in limbo for the time it took to review planning priorities in view of the new political dispensation. In the case of the NSIP, planning would have been delayed by many years, since the NSIP process took in excess of a decade. It can be questioned whether the freezing of all power supply planning for a full review of planning conducted over a period of two decades (and the resultant delay in rolling out of power supply) would be of benefit to South African society. Apartheid era planning did not serve all the people of South Africa, yet planning for the development of a power station does in fact serve the entire population, no matter where it is planned, as it provides for security of supply across the

country, whilst a power station specifically developed in the Eastern Cape helps to balance power supply and demand across the national grid.

Construction traffic on the R330

The Transport Impact Assessment Report has been substantively amended, the study therefore acknowledges that the Thyspunt site requires significant transport infrastructure upgrades. The R330 is now proposed to be used for light vehicle traffic and abnormal load transport, and sections will require upgrading for this purpose. The Oyster Bay Road is now proposed to be upgraded to a surfaced road to be used during the construction and operations phases for staff access, light vehicle traffic, heavy vehicle traffic and as an emergency evacuation route for areas such as Oyster Bay. DR1762, which links the R330 and Oyster Bay Road is now proposed to be surfaced to provide improved east-west connectivity. The Transport Impact Assessment Report will form part of the Revised Draft EIR which will be made available for public review.

Comment 6:

6. Pressure on decision-making authority

   The point is well made in section 2.3.3, p. 16 of the report, that the possibility of conflict in RODs between the site EIA and the Transmission-line EIA, could force the authorities to approve the transmission lines by virtue of the approval of the power station. This would be a problem if the authorities are forced to approve the transmission lines in the face of a potentially intolerable impact.

   The same argument should be applied to the NNR's process. The NNR will only become involved once a licence application is submitted by Eskom. Should Eskom apply for, and obtain a favourable ROD prior to the licencing application, and prior to a decision on viability and other radiological issues by the NNR, this could place the NNR in the same sort of predicament as is mooted for transmission lines. It is unfortunate that these issues are not addressed at all in the peer review.

   Our request would be that no ROD be given until such time as the NNR has decided on a licence application.

Response 6:

Your comment is noted. As is the case with many other development projects, there are a number of different authorisations (estimated in excess of 30 for Nuclear-1) that have to be obtained from a number of authorities with widely differing legal mandates, including national, provincial and local authorities. It is practically not possible for these authorisations to be aligned and for the processes required by the relevant legislation to be run in parallel, or for certain authorisations to be dependent on other authorisations. Each authority has a unique legal mandate and each authorisation process has its own programme.

Comment 7:

7. Final Plan of Study issues (Issue 8, p.7)
   The argument that it is reasonable to begin study prior to the release of the Final Plan of Study is accepted. What is not acceptable is that several of the specialist studies were completed and dated prior to release of the POS. This meant that the POS and its requirements were not consulted before submission. This cannot be correct.

Response 7:

Your comment is noted. In many cases, especially with regards to biological studies, seasonality is critical, and the fieldwork for some specialist studies was therefore undertaken in the appropriate season. Thus, although it is preferable to wait for approval of the Plan of Study for EIA before conducting any specialist studies, some of these studies were completed prior to this approval.

Yours faithfully
for GIBB (Pty) Ltd

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The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Thyspunt Alliance
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St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St. Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE

NUCLEAR 1 RESPONSE TO REVISED DEIR

GENERAL COMMENTS

Response compiled by H.Thorpe and submitted on behalf of the St. Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance

Comment 1:

1. **No confidence in the EIA process**

The process has shown up weaknesses in the NEMA legislation. Wherever a consultant is selected and paid by the developer, there is inevitably a conflict of interest. NEMA requires strict impartiality on the part of the EAP, who will vehemently protest at any allegation of partiality.

NEMA allows considerable discretion to the EAP on the weighting of the various impacts. Thus, an arbitrary decision as to which impact should be weighted as of high importance, and which low, is left to the EAP, in a totally non-transparent process. Similarly, the impact rating criteria are determined by the EAP. These significantly increase the risk of bias. Decision-making factors are arbitrarily disregarded, with difficult ones, such as social impact, being relegated to insignifance (sic), or eliminated totally.

The DEA is therefore requested to scrutinize the specialist reports, and the comments passed on them by I&APs with great care.

This EIA has been characterized by extreme bias towards Eskom, with inaccurate, superficial, and misleading information being disseminated. Serious issues which could influence the ROD have been either swept aside, or played down, or quietly forgotten. Errors have been constantly repeated in each successive document. Minutes have frequently not reflected important contributions. Answers given to questions have not appeared in the minutes. Some of the "Specialists" have acted with a serious lack of professionalism, and there is no peer group monitoring to ensure that their reports are factually correct and comprehensive. Proposals for mitigation are frequently so naive as to lack all credibility. Requests for focus meetings to question specialists on the basis of their findings have been refused.

Unless there is evidence that that has changed, there is a prima facie case for a formal request to DEA to remove Arcus Gibb from this EIA, or even for prosecution of the guilty parties.

Furthermore, it is our contention that the Department of the Environment contravened its own NEMA Regulations by approving the Scoping Report in the absence of material information required for a decision. This included specific technology to be used, associated infra-structure, including road access and transmission lines, failure to investigate alternative sites, waste disposal etc. By permitting the EIA to proceed despite this, the DEA tacitly encouraged the consultants to believe that the DEA would take a soft line.

If a favourable ROD is given on the basis of the reports contained in the Revised DEIR, and of manipulative processes, such as the weighting and Impact Rating Criteria, it can only lead to an appeal, and ultimately to court action.

Response 1:

The EIA regulatory regime under (the National Environmental Management Act, 1998 and the EIA regulations thereunder - Government Notice Numbers R 543 to 546 of 2010) NEMA provides for the fair remuneration of environmental assessment practitioners (EAPs) involved in compiling or reviewing an EIA. Payment for work performed is implicit in any EIA work, as it is for any other form of work.

In this regard, Government Notice No. R 543 of 2010 provides the following definition:
"'*independent*', in relation to an EAP or a person compiling a specialist report or undertaking a specialised process or appointed as a member of an appeal panel, means—

(a) that such EAP or person has no business, financial, personal or other interest in the activity, application or appeal in respect of which that EAP or person is appointed in terms of these Regulations other than fair remuneration for work performed in connection with that activity, application or appeal; or

(b) that there are no circumstances that may compromise the objectivity of that EAP or person in performing such work".

Should you have an in-principle objection to the concept of payment for services performed in compiling an environmental impact assessment, it would be advisable to approach the Department of Environmental Affairs, since the prevailing legislation provides for fair compensation of EAPs by the applicant.

The EIA legislation prescribes broadly what criteria should be used in assessing the significance of potential environmental impacts, but does not prescribe how an EAP should reach a decision, as each

application for environmental authorisation has be judged on its own merits. Thus no universal set of criteria can be defined to deal with choices amongst alternatives.

Contrary to your claim of lack of transparency, the choice of criteria and the weighting of the criteria have been made abundantly transparent. Explanations are provided in Section 9.32 of the revised Draft EIR for the weightings, based on which key decision factors have been identified. Decision-making factors were not arbitrarily disregarded. Rationales for the inclusion of certain decision factors and the exclusion of others are provided in the Revised Draft EIR. GIBB employed three experienced external EIA process reviewers to review and comments on the criteria and assessment methodology, namely Messrs. Mark Wood, Sean O'bierne and Neal Carter.

Selection of impact rating criteria by the EAP is common throughout EIA practice and the selection of these criteria by the Nuclear-1 EAP is no different to the practice in any other EIA in South Africa.
Your comments regarding inaccuracy of information and misleading information are noted. The EAP and the EIA specialists stand by the information contained in their reports. Where errors have been found, these have been admitted and corrected. Parties are invited to continue to submit comment on the technical reports and process and these will be reviewed and corrections made, if relevant.

Minutes of all public, key focus group and key stakeholder meetings were provided to participants in attendance at the meetings for a period of two weeks (14 days) in order for the participants to review the minutes for accuracy. Meeting minutes have attempted to capture the essence of the discourse at meetings, but minutes are not verbatim minutes. Minutes were compiled from recordings of the meetings. If meeting participants have questioned the content of the minutes, recordings of the meetings have been provided to them on request to verify the accuracy of the minutes.

Should you question the accuracy of any of the contributions of the specialists, you are welcome to comment directly on the findings of the specialist reports. Complete responses to comments on specialist reports have been provided under separate cover.

Requests for focus group meetings with specialists have been granted. A Key Stakeholder Workshop (KSW), requested by the Thyspunt Alliance, was held on 25 May 2010 and was attended by relevant specialists from the EIA Team during the review period for the Draft EIR.

With regards to this KSW it must be pointed out that direct engagement between interested and affected parties and EIA specialists is unusual in South African EIA practice. Much planning went into the arrangement of this Key Stakeholder Workshop, which was attended by specialists from seven different fields of specialisation. The list of specialists that was required to attend this KSW was determined in consultation with the Thyspunt Alliance.

Your comment regarding the DEA's contravention of its own regulations is noted and is best dealt with by the DEA itself. GIBB cannot comment on behalf of the DEA, except to say that the DEA has a decision-making mandate in terms of the NEMA and the EIA regulations thereunder and that it issued an approval of the Nuclear-1 Scoping Report and Plan of Study for EIA in terms of this mandate.

Comment 2:

2. Site selection

We are talking here of placing a huge industrial plant on a piece of coastline which has been identified as a potential World Heritage site. Furthermore this will be a nuclear site, which is in a category of its own in terms of site selection. Such a decision should only be contemplated when all negative impacts have been properly addressed, and all other possibilities have been excluded.

The problem goes right back to the original Site Selection Process. It was clearly stated in the Site Investigation Documents that the site selection was subject to very clear limitations. This included not going within 100 kilometres of Ciskei, for security reasons, (A potentially suitable site was identified within the 100 km zone); and limiting the investigation to seismic, geological and demographic factors only.

Furthermore, one of the recommendations of the Nuclear Siting Investigation Programme at the time was that the "small coastal resorts be left undisturbed". This has been completely ignored by Eskom, with its plan to take the heavy-duty traffic across the bridge over the Kromme River, and right past St Francis Bay.

In the original investigation no attention was paid to associated infra-structure, environmental impacts, emergency planning, economic considerations, etc. These were left for later investigation. The site selection was therefore incomplete on two fronts, and the five selected sites were therefore only provisional. No attempt has been made by Eskom to complete its site investigation in the light of political and other changes in the interim, and only now are the unexplored factors ebbing (sic) considered.

Despite this, Eskom has approached the EIA on the basis that it has the five sites, all of which are to be developed, and that the only question is which should be developed first.

Response 2:

Your comments regarding the site selection process are noted. Planning cycles for nuclear power stations are known world-wide to be long-term processes, due to the long time frames for construction and the long life spans of these power stations. Typically, the life cycle of a nuclear power station from start of planning to decommissioning can take up to 100 years. Early identification of potential sites for a nuclear power station is therefore an essential part of the planning process.

Whilst the political limitations of the Nuclear Site Investigation Programme (NSIP) that was undertaken during the last two decades of the 20th century are acknowledged, seismic and geological factors that were used in the identification of the sites have not changed since the publication of the NSIP. Furthermore, the distribution of the main population centres in the Eastern Cape and Western Cape that act as load centres (centres of electricity demand) have also not changed.

Your comment regarding traffic impacts on St. Francis bay are noted. The traffic impact assessment is being substantively revised, such that heavy construction traffic will completely bypass St. Francis and Humansdorp. A new interchange with the N2 is proposed to the west of Humansdorp to direct traffic

along the Oyster Bay Road to the western access road to the Thyspunt site. Details of this traffic proposal will be included in the Draft EIR Version 2.

Project planning for large construction projects typically includes a pre-feasibility and feasibility assessment prior to detail planning and environmental impact assessment. Considering that the NSIP was focused on initial identification of potential nuclear power station sites, it should be regarded as an initial feasibility or even pre-feasibility study. Given this focus of the NSIP, it is reasonable that it would not have addressed associated infrastructure, environmental impacts, emergency planning and economic considerations. As indicated above, the socio-economic realities today have not changed to such an extent that the major load centres in the Eastern and Western Cape (Port Elizabeth and the Cape Metropole) have changed, and the location of power station sites in each of these regions therefore remains as valid today as it was when the NSIP was undertaken.

It is not factually correct to state that Eskom intends to develop all five sites. Eskom does intend to develop more nuclear power stations than Nuclear-1. However, the Integrated Resource Plan 2010 recommends the development of 9,600 MW of nuclear electricity generation over the next 20 years. This would require the development of no more than two to three nuclear power stations.

Comment 3:

3. **The No-go option**

   It can be argued that South Africa has to go nuclear, and that the "no-go" option in this regard does not apply. However, this does not apply at all to specific sites, especially where they have been selected on the basis of politically determined and partial criteria. If a site is unsuitable, it is unsuitable, no matter how strong the motivation to go ahead.

   This EIA has proceeded on the assumption that all five sites are suitable, and that all will be developed. This is based on untested assumptions which are now being challenged. In reality, Eskom has no nuclear sites at all. All it has is five provisional sites. The "No-go" option is clearly a possibility in relation to site selection.

Response 3:

As indicated in Response 2, the technical criteria that were applied for the selection of the sites identified in the NSIP remain valid, irrespective of the political agenda at the time that the NSIP was initiated. All of the sites were found suitable from an environmental point of view, provided that the recommended positioning of the power station on the sites and other mitigation measures are implemented.

The scoping phase of the Nuclear-1 EIA process found that only the Eastern and Western Cape sites can be regarded as reasonable and feasible. It is therefore not correct to state that the EIA assumes that all five sites are feasible. As indicated in Response 2, it is furthermore not an assumption that all five sites will be developed. Eskom has indeed embarked upon a process, similar to the NSIP, to identify other sites suitable for a nuclear power station, in future.

Comment 4:

4. Site alternatives

In terms of the NEMA Regulations, the applicant has to investigate alternative sites. Eskom's argument is that it has five sites; that they are only investigating Nuclear 1, namely the first site to be developed, and that Duynefontein and Bantamsklip are therefore alternative sites.

What Eskom fails to state is that they plan to develop all three sites, so the other two are only alternatives in terms of Nuclear 1, 2 & 3? They are not ultimately alternatives at all, and certainly do not address the limitations of the site selection process in the Eastern Cape. This is a gross technical manipulation of the NEMA requirement. What should have happened as soon as the constitutional changes took place in South Africa was a full site review process, and a proper investigation of alternatives for the most suitable site in the Eastern Cape.

As the EIA has progressed, and the issues left unaddressed in the original site investigation have been investigated, it has become increasingly clear that Thyspunt is far from being a suitable site for such a purpose.

Response 4:

As indicated in Response 2, it is not a foregone conclusion that all sites considered in the Nuclear-1 EIA will be developed. Additional sites may be considered in future EIA processes. For instance, Coega may be considered as a site alternative in a future EIA process. As stated in Section 5.2.5 of the Revised Draft EIR, Coega was suggested as an alternative but not investigated, amongst other factors due to information constraints.

Your argument regarding review of the NSIP after the 1994 Constitutional changes is noted. Such an approach would imply that all planning undertaken prior to 1994 would have to be frozen pending review – a situation that is untenable as all planning and delivery processes would necessarily have been in limbo for the time it took to review planning priorities in view of the new political dispensation. In the case of the NSIP, planning would have been delayed by many years, since the NSIP process took in excess of a decade.

The findings of the Nuclear-1 EIA process, to date, indicate that Thyspunt is a suitable site for a nuclear power station, provided that all applicable mitigation measures recommended by the specialists and GIBB are applied.

Comment 5:

5. Viability

Here is the classic example of the devious manner in which the entire process is being conducted. Eskom has been aware for years that a question mark hung over the viability of the Thyspunt site, on the grounds of emergency planning, and of population levels within the sixteen kilometer emergency planning zones. This is a particularly sensitive issue at Thyspunt in view of the direction of the prevailing wind, the growth of population in the Greater St Francis area, and the single escape road for the entire community in the event of an emergency. This is a matter for the National Nuclear Regulator (NNR).

This being the case, it would have been appropriate to have cleared up this point before any EIA was embarked upon. As it is, Eskom has still not identified the specific PWR technology to be used, or applied for a licence for this technology. **As a result, the NNR has been completely excluded from the process to-date.**

What Eskom has stated is that it "favours" & "plans to use" Generation 111 technology. This is state-of-the art technology, which has a number of safety features built into it. However, it is still in the developmental stage, and government has stated that it is not affordable.

On the strength of the claims made for Generation 111, Eskom states that it will apply for a reduction of emergency planning zones from 16 to 3 kilometres, thus avoiding the demographic problem associated with the 16 kilometre zoning. This would be in terms of the so-called "European Utility Requirements" (EURs) (not to be confused with European Union Regulations, which do not exist). These "requirements" are a product of the European nuclear industry, in support of their own agenda. They have not been recognized by the IAEA or by any national nuclear regulator. If South Africa were to go ahead in terms of these, it would be the first country in the world to do so, and a major change in policy. This is a matter for the National Nuclear Regulator (NNR). Without a licence from the NNR, the Thyspunt site cannot be used.

Eskom and Arcus Gibb have stated publicly on several occasions that if "Generation 111" is not to be used, the entire EIA will be null and void, and will have to start from scratch.

The whole process to-date has been done at risk, on the assumption that Generation 111 will be used, and that the NNR will accept the EU Requirements for regulatory purposes.

Meanwhile Eskom is forging ahead, buying up land around Thyspunt, using public money to do so, before any ROD from either the Department of the Environment or the NNR has been forthcoming. Eskom appears to have the policy that, if it spends enough money, it will be impossible to retract, and the authorities will be compelled to give approval to the site. It would be difficult to imagine a more irresponsible way of dealing with public money.

Our view is that Eskom is acting in bad faith, and that those responsible should be prosecuted for unauthorised, wasteful and fruitless expenditure, and for contravening the requirements of the Promotion of Administrative Justice Act, which requires that administration be just, reasonable and fair.

Response 5:

It has been indicated repeatedly in public forums and in EIA documentation, the separation between the EIA process and the NNR licensing process is based on the legislative provisions of the relevant Acts, namely the National Environmental Management Act, 1998 and the National Regulatory Act, 1999, as well as the DEA/NNR co-operative agreement that governs the consideration of radiological issues in the EIA process.

As indicated in the Revised Draft EIR, one of the assumptions of the Nuclear-1 EIA process is that the Emergency Planning Zones of the European Utility Requirements (EUR) will apply to the Nuclear-1 power station. These zones are a maximum of 3 km and hence, no restrictions would apply on St. Francis, which is situated more than 10 km from the proposed nuclear power station site at Thyspunt.

However, even if a 16 km Urgent Protective Zone (UPZ) were to be applied to a nuclear power station at Thyspunt, it would not rule out development of a power station at this site. Private development is only restricted within the inner (smaller) Protective Action Zone (PAZ), which in the case of Koeberg Nuclear Power Station (KNPS) is 5km. The 16 km UPZ imposes evacuation planning restrictions but does not prevent private development.

Initial indications provided by the NNR are that it is likely that the EPZ will be reduced, even for the Koeberg Nuclear Power Station. For instance, in a presentation to the Parliamentary Select Committee on Economic Development on 1 June 2010, the Chief Executive Officer of the NNR stated the following: "*One major outcome of these new designs is that the emergency planning zones, specifically the Urgent Planning Zone, which is the zone within which evacuation of the public has to be catered for, would in all likelihood be reduced from 16 km in the case of Koeberg, to a much smaller radius which could fall within the property owned by the holder* …".

With regards to the issue of wind direction, it is important to consider the wind speed, atmospheric stability and release height together with the wind direction when qualitatively estimating the area of impact. These concepts are discussed in Section 2.3.2 of the Air Quality Assessment (Appendix E10 of the Revised Draft EIR). Predicted ground level concentration patterns take into account a number of meteorological parameters in addition to wind speed and direction. Wind speed and direction alone do not provide adequate information on the behaviour of atmospheric dispersion.

As indicated in the Revised Draft EIR, the assessment of the impacts of the proposed power station is based on a Consistent Dataset (Appendix C of the Revised Draft EIR), which represents a worst case scenario of potential inputs and outputs from a Generation III nuclear power station operating under normal conditions. This dataset has been compiled from the commercially available nuclear power station designs currently on the market. Generation III power stations are no longer in the developmental stages. .There are approximately 8 Generation III power stations currently under construction worldwide. Please note the EUR is a utility requirements document and not prescribed by nuclear regulators. The EUR aims at ensuring that the design that is adopted has minimal impact on the man and environment. This has been developed by utilities who will, in any case, have their design studied and endorsed by the relevant regulatory body. If the final design does not conform to the assertions made, the design will not be accepted and might have to be modified accordingly until it conforms to these requirements. Thus, the key emphasis of this requirement is to minimise the impact on man and environment. Eskom has chosen the EUR as this specification is sound and robust. It also allows for alignment with the international nuclear community. The Emergency Plan boundary allow for minimal restrictions around the site, while also providing for safer designs.

Eskom is buying land around the Thyspunt site at its own risk, pending the outcome of the EIA process. There is nothing in law that prevents Eskom from acquiring such land. In terms of NEMA, an applicant is prohibited from commencing with construction prior to receiving an authorisation. The development of a nuclear power station is dependent on long-term planning, which is why the potential sites for nuclear power stations were acquired as many as 20 years ago. It would indeed be unwise for Eskom to wait to the proverbial "last minute" before it bought the land.

Eskom's acquisition of additional land around Thyspunt must be viewed in context of the recommendations of the Freshwater Ecology Assessment (Appendix E12 of the Revised Draft EIR) that wetlands that fall outside the current Eskom owned land must also be secured for inclusion into a de facto nature reserve. The acquisition of these wetlands for conservation is regarded as one of the key "offset" mitigation measures at Thyspunt. Should Eskom not be able to use land at the

Bantamsklip or Thyspunt sites for power generation (e.g. in the event of an authorisation being refused), it would be obliged to sell the land.

Comment 6:

6. **Fatal flaws**

This concept is completely subjective, and subject to interpretation by those who have adopted a particular position. The specialists have all accepted that there are no fatal flaws in the Thyspunt site, on the basis of impact Assessment criteria devised by the EAP, in several cases on the basis of incorrect or incomplete information. How this is possible is not clear.

In the view of the Alliance, there are fatal flaws in the EIA process itself, in the viability of the site in terms of emergency planning, in the Heritage impact, in the environmental impact, in the social impact, and in the failure to address waste disposal.

Much depends on steps proposed in mitigation –whether they are realistic and whether they will be applied. In many cases the proposed steps in mitigation are little more than derisory, and will have little or no impact on the problems which have been identified.

Response 6:

The identification of fatal flaws was left to the discretion of each of the specialists on the EIA team. A fatal flaw is regarded to be a highly significant issue that cannot be mitigated and that could hence result in a project becoming unviable. None of the negative impacts identified at the Thyspunt site were regarded to be of such significance that they could not be mitigated. Most of the potentially significant negative impacts can be successfully mitigated by prudent placement of the project components such that they do not impact on sensitive features on the site.

The issue of viability in terms of emergency planning is addressed in Response 5. Waste management is addressed in detail in the Nuclear Waste Assessment (Appendix E30 of the Revised Draft EIR) and in Chapter 9 of the Revised Draft EIR. As for flaws in the EIA process itself, we have responded to these claims under separate cover. With regards to heritage issues, additional test excavations at Thyspunt that were approved by the SA Heritage Resource Agency and conducted in 2011 (after the release of the Revised Draft EIR), have confirmed that the heritage sites in the recommended footprint of the power station at Thyspunt are few in number and of low quality. This implies that direct impacts on heritage resources can be mitigated.

Mitigations measures that have been proposed have been identified on the basis of the experience of the EIA specialist team with similar large construction projects or other developments in similar environments. Certain of these mitigation measures at Thyspunt (e.g. the acquisition of additional land for conservation purposes and the excavation of heritage sites prior to development) have been identified as key mitigation measures. Thus it is recommended that the implementation of these mitigation measures must start prior to the commencement of construction to ensure their effective implementation.

Comment 7:

7. **Cumulative impacts**

Leaving aside the failure to determine the viability of the site, through exclusion of the NNR, no attempt has been made to assess the cumulative effect of these combined flaws. The approach adopted by the EAP is to consider each impact in isolation, and to conclude that there are no fatal flaws. However, the combined impacts which have been identified cumulatively amount to massive criticism of Thyspunt as a site for any kind of industrial plant. This includes the following:

- Effectively unmitigable destruction of a heritage site which has been identified as justifying World Heritage status;

- Major environmental impacts , such as interference with the by-pass headland dune system, which has been described by the dune specialist as follows:
  The geomorphologic conservation value of the headland-bypass dunefields at Thyspunt is high, as they are the only remaining large dunefields of this type that are still active in South Africa. The headland-bypass dunefields at Cape St Francis are unique on a local, regional and probably global scale. The vegetated dunefield is a classic, almost pristine example of a suite of Holocene and Pleistocene dune ridges with a variety of origins: parabolic dunes, hairpin parabolic dunes, and sidewalls of previously mobile headland-bypass dunefields, including fairly unique examples of such sidewalls. Overall, the dunefields at Thyspunt has high interpretive value for elucidating coastal dune dynamics.

  Numerous other examples can be quoted, identified by experts who are authorities in their fields. Only the less problematic of these receive detailed attention.

- The probable destruction of the chokka industry in the area, which is valued at between R500 & R700 million per annum, and employs 4000 people, as a consequence of depositing over 6 million tons of spoil on the sea bed.

- The social impact on adjacent communities, and the total change of sense of space which this will involve, in direct disregard on recommendation 2 in the NSIP that the coastal resorts should be left unaffected.

- The massive cost of associated infra-structure such as road up-grade and construction, transmission lines, pipelines under the sea bed, amounting to tens of billions of rands. Many of these appear to have been disregarded by the economic specialist in assessing the relative cost of the three sites.

Response 7:

- Impacts on the cultural landscape are indeed difficult to mitigate. Whilst the Heritage Impact Assessment (Appendix E20 of the Revised Draft EIR) indicates that the Thyspunt site could potentially qualify as a World Heritage Site, this is purely speculative and no motivation for World Heritage status has been submitted by the South African Department of Environmental Affairs to the United Nations Educational Scientific and Cultural Organisation, which

administers the World Heritage Convention. Furthermore, as indicated in Response 6, test excavations at Thyspunt have established that the heritage sites in the recommended power station position are low in number and quality. This confirms that the 200 m strip along the coastline that will be kept free of development, will effectively conserve the vast majority of the heritage sites on the Thyspunt site.

- The Headland Bypass Dune System is no longer functioning due to the establishment of Oyster Bay and St Francis Bay which have stopped the movement of sand. The Headland Bypass Dune System at the Thyspunt site has been kept completely free of development, with the exception of one set of electricity pylons between the power station and the High Voltage yard. The value of this system is indeed high, which is why the northern portion of the site where the system occurs is kept free of development.

- The scale of the potential impact on the chokka industry does not support a conclusion that this industry would be destroyed. The Economic Impact Assessment (Appendix E17 of the Revised Draft EIR) has estimated the economic value of the impacts on the squid fishery, based on the findings of the Marine Ecology Assessment (Appendix E15 of the Revised Draft EIR). The Marine Ecology Report bases its assessment of the significance of the impacts on all potential sources of impact, including the marine security exclusion zone, the release of warmed cooling water, the increase in turbidity in seawater and the disposal of spoil on the seafloor. The recommendations of this report are that spoil must be released at a disposal site deeper than the relatively shallow spawning grounds of chokka squid. This report found that the maximum suspended sediment concentration (based on a medium discharge rate of 2.06 m^3/s) is not expected to reach levels above the critical 80 mg/l (above which definite impacts can be expected) near the water surface at any time during or after spoil disposal and will be confined to less than 1.4km² near the seafloor. In addition, these turbidity levels will be temporally limited outside the actual disposal site, occurring for a maximum of two days throughout the entire disposal period. Therefore, the impacts of increased turbidity on chokka squid are predicted to be very limited. Furthermore, the Marine Ecology Report concluded, based on oceanographic modelling, that a nearshore outfall for warmed cooling water would result in an average increase of 3ºC near the seabed over an area of roughly 0.2 km² (2 ha) around the outlets and an area of 0.7 km² will experience a maximum increase of 3ºC or more at any time. Given this limited spatial extent of impact, it is reasonable to conclude that the significance of the potential impact on chokka squid would be insignificant.

  The claim that 30 % of the total chokka catch is taken within the Thyspunt area appears to have been calculated using only four selected vessels – a gross under-representation of the chokka squid fleet. However, data for the same area provided by the Department of Agriculture Forestry and Fisheries (i.e. the commercial database) showed that 14.7 % of total catches are taken in the wider area (two quarter degree squares of approximately 22 x 27 km each) around the proposed site – itself a much larger area than what may in fact be impacted.

- As indicated in previous responses, the Traffic Impact Assessment has been revised in totality to ensure that no construction traffic passes through St. Francis. This should, in large measure, mitigate the impact on the sense of place of this coastal resort town.

- Road upgrades that would be required for the construction of the proposed power stations have been considered in the Economic Impact Assessment. With respect to upgrades of other infrastructure (e.g. sewerage) due to the influx of people, it is clearly indicated in the Revised

Draft EIR that Eskom needs to agree with local authorities on the apportionment of financial responsibility well before the start of construction. The costs of catching up on existing service backlogs will, however, have to be borne by the authorities themselves, as it is unlikely given Eskom's mandate that it would be held responsible for such backlogs.

Comment 8:

8. **CONCLUSION**

The litany of short-comings listed above makes it clear that this EIA is little more than a charade. Eskom is relying on political support from the government on the grounds of "national interest". Nobody denies that we need to increase our power generation capacity and reduce dependence on fossil fuels. It is also accepted that there is a need for a power station in the Eastern Cape. However, this does not justify over-riding every piece of environmental and social justice legislation that has been introduced in terms of our Constitution. We believe that the manner in which the EIA has been conducted is a travesty of the EIA process, and the Revised Report should be treated in the same way as the fist report, until such time as the process is conducted comprehensively, impartially, transparently, reasonably and fairly.

Response 8:

Your comment is noted. The Nuclear-1 EIA process and its deliverables have been reviewed by independent peer reviewers (Appendix H of the Revised Draft EIR) and the finding of this peer review is that the process substantively complies with constitutional, environmental and administrative justice legislation.

Yours faithfully
for GIBB (Pty) Ltd

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The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Dear Patrick Dowling

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

Comment 1:

WESSA COMMENT ON THE NUCLEAR 1 REVISED DRAFT ENVIRONMENTAL IMPACT REPORT

Thank you for the detailed responses to some of our earlier comments. Notwithstanding those and the usefulness of the exchange we still have several concerns, understandable for any development of the scale being considered. We summarise these below.

The report makes several references to the fact that it covers the specifics of potential impacts on the three sites studied and does not consider the broader policy issues related to an energy plan for South Africa. Yet the supporting documents offered include “opening and closing remarks” by the NERSA chairperson on the total energy situation in South Africa.

In this address there is a call for “a national ‘compact’” between all South Africans working together at overcoming our challenges. We suggest that achieving such a compact will require even more and deeper levels of public participation than have been evident to date.

Unless we have missed it in the extensive number of documents comprising the report there seems to be no overall conclusion and evaluation regarding the general public sentiment towards the proposals to date. This could have been provided by the social impact specialist whose report generally seems to have been somewhat superficial.

Response 1:

Your comment is noted. The next revision of the EIR (Revised Draft EIR Version 2) will contain a summary of the comments received during the Nuclear-1 EIR. Due to the volume of comments received this summary will of necessity focus on broad categories of issues.

Comment 2:

It is reassuring that the report drafters make it clear that this assessment can be associated only with one power station despite Eskom’s stated intention to build more. However, even with this one, there are several shortcomings which require elaboration.

The report states that “Catastrophic incidents were not part of the plan of study for the assessment.” Considering two such incidents globally in less than 25 years, surely it would have been better to make such scenarios part of the plan of study. In terms of the National Environmental Management Act (NEMA) the approach to development must be risk averse and cautious taking into account the limitations of present knowledge. The National Nuclear Regulator Act (NNRA) does not remove this high order legislative requirement.

Response 2:

Thank you, your comment is noted. Kindly note that in terms of the recommendations of the approved Integrated Resource Plan, it is required that 9,600 MW of nuclear power should be developed, together with other sources of supply, to provide electricity in South Africa. Nuclear-1, being only 4,000 MW will therefore not provide the full complement of nuclear power required and additional nuclear power stations would need to be constructed. Such power stations would be subject to their own EIA processes.

Furthermore the EIA process must take cognisance of the range of government mandates, including those of the Department of Environmental Affairs (DEA) under the National Environmental Management Act, 1998 and the National Nuclear Regulator (NNR) under the National Nuclear Regulator Act, 1999. The roles of the DEA and NNR are further defined in their co-operative agreement, which governs the consideration of radiological issues in EIA processes and the interaction between the DEA and the NNR in terms of their respective mandates for environmental and radiological safety (See Appendix B4 of the Revised Draft EIR Version 1). The agreement clearly stipulates that issues of radiological safety are within the mandate of the NNR. Furthermore, it is not within the mandate of the Environmental Assessment Practitioner to question the legal mandates of either of these statutory bodies or the validity of their agreement. We must, therefore, conduct the EIA based on their mandates and their agreement. However, the public should gain comfort in the fact that the project cannot proceed without the Environmental Authorisation and NNR phased license approvals.

Comment 3:

Future casting seems to have been limited to 75 years for flood line calculations. In our view this time horizon is too short considering some sea-level rise predictions and associated surges along with the most recent evidence of the sort of damage this kind of event can cause. This threat has been acknowledged in the report which concludes that without mitigation none of the sites is suitable from a geohydrological point of view. It is WESSA’s experience that once development approval is granted the detail of mitigation plans is often lost. In the case of a NPS the results such neglect could be catastrophically hazardous.

Response 3:

Your comment is noted. The projected life span of the proposed power station is 60 years. Given this time span, it is reasonable for the time span of the flood line calculations to be based on a horizon of 75 years.

Your reference to recent evidence of the sort of damage that a storm surge can cause is presumably in reference to the Fukushima Daiichi nuclear incident. An analysis of the causes of this accident and

the lessons for future nuclear power station planning will be included in the next revision of the Environmental Impact Report. However, a condensed analysis of the events is provided here.

The design of all nuclear power stations must take cognisance of the risks of seismic events. In the case of the Fukushima Daiichi nuclear power station, the power station was designed for a high magnitude earthquake, evidenced by the fact that the power station suffered no significant structural damage as a result of the earthquake. However, the assumptions of tsunami heights and the design of the power station did not consider the heights of tsunamis that could be experienced in a country that is prone to frequent and severe earthquakes. The Fukushima Daiichi design and construction catered for a tsunami height of 6.5m. However, in this instance tsunamis of up to 8m were experienced along some parts of the Japanese coastline.

In contrast, emergency planning for the Koeberg Nuclear Power Station (KNPS) assumed a tsunami of 4 m, even though no tsunami has ever been recorded on the West Coast, and in spite of the fact that Southern Africa is seismically stable. In addition to planning for a tsunami, planning for the KNPS assumes that a tsunami may coincide with a spring tide and major storm surges (a so-called meteo-tsunami event), and thus the terrace for the KNPS is built at a height of 8m above sea level. Backup generators to supply power to the cooling systems has also been placed at heights of 12m above sea level, besides the backup power that can be supplied from two gas-fired peaking power stations in proximity to the KNPS. Similar planning is in place for Nuclear-1, in that a combined tsunami and an exceptional storm surge has been assumed in determining the height of the nuclear island and the location of backup power supplies.

Comment 4:

By not including a design for Nuclear-1 that is site-specific it is difficult to evaluate any potential risks that could arise in combination of a specific technology model at a particular site.

Response 4:

Your comment is noted. Whilst no specific technology supplier has been identified, the generic characteristics of a Generation III nuclear power station have been identified in the Consistent Dataset (Appendix C of the Revised Draft EIR Version 1).
It is common practice in EIA processes, especially for installation of industrial plants, to consider the performance of the systems and type of technology proposed to be installed, without referring to specific suppliers or manufacturers of this technology, of which there may be a range available in the market. As long as the inputs and outputs of the proposed technology are known and the environmental impacts can be predicted or deduced from these inputs and outputs with reasonable certainty, it is not necessary to know the brand name of the technology.

As has been done in other issues and response reports, it may be appropriate to explain the envelope of criteria in colloquial terms, as has been done in public meetings during the Nuclear-1 EIA process. If the envelope of criteria is compared to the specifications for buying a vehicle, this envelope may contain requirements with respect to top speed, fuel type, fuel efficiency, catalytic convertor performance, type of tyres and wheels, fuel tank size, effective range, CO_2 emission limits, cruise control, numbers and positions of airbags and a number of other safety systems such as ABS and EBD. The only thing that isn't specified is the brand of vehicle. Providing such a list of criteria would ensure that only a luxury vehicle with certain characteristics could qualify, but that a base model (entry-level vehicle) would not qualify. Similarly, if a vendor proposes a power station design that fails

to comply with the criteria established in the Consistent Dataset, that design will not qualify for consideration.

Comment 5:

We note with appreciation the candour of some of the specialist reports and second some of their concerns notably:

- That there are insufficient surface water or groundwater resources for construction and operation of the power station any of the three alternative sites and use of such resources by the power station would compromise other existing users of such resources.

- All of the site alternatives include in their boundaries and immediate surroundings wetland systems that are of high ecological importance, relatively un-impacted and considered to be either among the last remnants of particular wetland habitats or unique systems

- The limitations of the invertebrate studies because of short duration and inappropriate timing

- The potential for contaminated air emissions to be transported inland by prevailing winds and affect groundwater

- Significant negative impacts on fauna mainly because of the direct impacts on faunal habitats within the footprint areas. The same can be said for the footprints of any new grid extensions.

- The potential impact that the geological environment may have on the proposed Nuclear Power Station rather than *visa* (sic) *versa.*

Response 5:

Your comment is noted. Please note our additional input on some of the statements above.

The invertebrate study has been supplemented with further fieldwork. The results therefore will be included in the next version of the Nuclear-1 EIA, which will be provided for public comment.

The "*potential for contaminated air emissions to be transported inland by prevailing winds and affect groundwater*" is an opinion expresses in one of the specialist reports but not in the Air Quality Assessment (Appendix E10 of the Revised Draft EIR Version 1). As such, the opinion on inland transport of contaminated air emissions must be interpreted in the context of the Air Quality Assessment, which concluded that normal operational emissions would carry no risk of significant impacts and that the effective doses to the public would be far below statutory limits.

Thank you for your comment regarding the geological environment. The necessary changes will be implemented accordingly.

Comment 6:

Before any final decision is made it is essential that these real or potential problems be investigated further.

As suggested earlier we feel that the social impact of such a large development deserves more detailed attention and should go further than a survey of immediate or short-term effects on people of the biophysical nature of a NPS near them. Ideally such a study should be intergenerational in scope and include such considerations as long lead time and contrast this to potential effects of alternative development scenarios on broader South African society.

Response 6:

Your comment is noted.

The EIA process is project-specific in nature and has a specific mandate in terms of the applicable South African legislation, namely the National Environmental Management Act, 1998 and the EIA Regulations (Government Notices no. R 543 to 546 of 2010). It is therefore unclear how an analysis of alternative development scenarios on broader South African society would contribute to the purpose of the EIA process i.e. to predict the impacts of a proposed power station within specific identified geographical areas. Further detail on this issue from yourselves would be appreciated.

Yours faithfully
for GIBB (Pty) Ltd

_____
The Nuclear-1 EIA Team

5 August 2015

Our Ref: J27035 / J31314
Your Ref: Email received 07 August 2011

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Thyspunt Alliance
St Francis Bay Resident's Association
St Francis Kromme Trust

Dear Mr Thorpe, Thyspunt Alliance and its members, the St Francis Bay Resident's Association and the St Francis Kromme Trust

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

THYSPUNT ALLIANCE

NUCLEAR 1 REVISED DRAFT ENVIRONMENTAL REPORT

COMMENT ON APPENDIX 18: SOCIAL IMPACT ASSESSMENT

Response compiled by T. Malan & H.Thorpe, and submitted on behalf of the Cape St Francis Civics, St Francis Bay Residents' Association, the St Francis Kromme Trust and the Thyspunt Alliance.

General Comment:

If anything illustrates the partisan stance and amateurish approach of the EIA, it is this report. It is so bad that it calls into question the independence and competence, not only of the specialist, but also that of the EAP.

General Response:

Your comment is noted.

Comment 1:

Our major objections are the following:

1. The Assessment remains purely philosophical, with little reference to facts.

Response 1:

Your comment is noted. The Social Impact Assessment (Appendix E18 of the Revised Draft EIR Version1) makes extensive reference to available socio-economic data for the affected areas.

Comment 2:

2. The Assessment totally disregards Recommendation 2 in the Nuclear Site Investigation Programme, that "the small coastal resorts be left unaffected".

Response 2:

Your comment is noted. As indicated in separate Issues and Response Reports, the Nuclear Site Investigation Programme (NSIP) was a pre-feasibility study for the development of nuclear power stations. It is interesting to note that the Thyspunt Alliance completely discredits the site selection process in the NSIP due to it having been commissioned during the Apartheid era, with the notable exception of this particular recommendation.

Comment 3:

3. The social impact of the current proposal has been arbitrarily excluded from the list of nine decision-making factors identified on page 6 of the Executive Summary.

Response 3:

Contrary to your comment, the choice of decision factors used in the selection of the preferred site are made clear in Section 9.32 of the Revised Draft EIR Version 1.

Comment 4:

4. The revised impact assessment criteria found in Chapter 7, Table 7 – 16 have been ignored, with major implications for significance ratings.

Response 4:

The revised criteria have been applied in the Social Impact Assessment Tables (Appendix E18 of the Revised Draft EIR Version 1).

Comment 5:

5. Objections raised in the first draft have been completely ignored. No material changes have been made. The report remains entirely theoretical, playing down serious social impact issues as if they were pure speculation or simply perceptions. No serious attempt is made to address these issues.

Response 5:

Serious attention was given to each and every objection. Human behavior is difficult to predict and therefore provision must be made for the role of perceptions and sometimes speculation on what may happen in the future. The report is clear on the practical implications of the identified impacts with clear mitigation measures identified. Changes were made were facts supported the required change in the report.

Comment 6:

6. The Assessment feeds directly from the Transportation & Noise Assessments. These are equally inadequate. Our more detailed comments on these should be read in conjunction with this submission.

Response 6:

Your comment is noted. Responses to your comments on the Transportation and Noise Assessments are contained in separate Issues and Response Reports. It is also to be noted that the Transportation Assessment has been significantly revised so that heavy construction vehicles have been re-routed to the Oyster Bay road so that construction traffic through St. Francis along the R330 are avoided. The revised report will be made available for public comment and review as part of the Revised EIR Version 2.

Comment 7:

7. The demographics used in the assessment are out-dated.

Response 7:

Your comment is noted. The most up to date data available from various sources were used at the time of producing the report.

Comment 8:

8. Total failure to address the uncontrollable and unmitigable impact of increased unskilled and unemployed job-seekers arriving from elsewhere in the country; growth in informal settlements, and consequent social pathologies which will inevitably arise.

Response 8:

Your comment is noted. The influx of job seekers is a reality of most large construction projects and cannot be completely avoided, although it can be managed. It must also be noted, as indicated in the Social Impact Assessment, that people have a right to free movement in order to pursue economic opportunities. However, the need to mitigate this impact is recognised. Institutions such as the Coega Development Corporation have indicated their willingness to share their experience in this regard, as

they implemented what are widely regarded to be successful social and labour policies and procedures that restricted the inflow of people and prioritised employment for local residents.

Comment 9:

9. Completely inadequate assessment of the infra-structural and social services implications and costs for the Kouga Municipality

Response 9:

Your comment is noted. It is noted in the Revised Draft EIR Version 1, as well as in the Social Impact Assessment, that the Kouga Municipality has existing service backlogs and that infrastructure would not be able to cope with the additional influx of people that can be expected as a result of the construction of Nuclear-1 at Thyspunt. For this reason, it has been emphasised in the Revised Draft EIR Version 1 that infrastructure must be upgraded and that Eskom and the responsible authorities must agree on the apportionment of financial responsibility for such upgrades.

Eskom cannot, however, be expected to be solely responsible for infrastructure upgrades, as current infrastructure backlogs are the responsibility of the municipality. It is for this reason that it has been recommended that agreement must be reached between Eskom and the other role players regarding apportionment of financial responsibility for infrastructure upgrades.

Comment 10:

10. Mitigation measures proposed by the specialist are so naïve as to lack all credibility.

Response 10:

Your comment is noted.

Comment 11:

DETAILED DISCUSSION

1. Theoretical and non-factual nature of assessment

The SIA makes the following statement:

"Different people tend to view the realities of life differently and therefore the impact that may be perceived negatively by one individual or community could be perceived as the best and most positive impact by the next individual;"

To avoid this confusion about the realities of life it is necessary that the studies conducted as part of this EIA should be based on fact. The department will base their response not on perceptions and the specialist therefore has the responsibility to provide the department as well as I&AP's with a clear and

truthful description of the social situation as it is currently reflected in the affected environment. Whether people perceive Nuclear as good or bad has a very small role to play in the social impact assessment and although these perceptions can be recorded the social impact assessment should focus on the actual impact of a development of this size on the society at present.

Response 11:

Your comment is noted. The Social Impact Assessment deals with a reality fundamentally different to most of the other specialist studies, in that it deals with people's perceptions. Factual information has been provided on the socio-economic conditions of the affected environment. However, the impact that the development will have on the social environment is as much a function of the how the development will change access to social infrastructure as it is a function of how people perceive changes in their environment. Perceptions are therefore an important consideration in the Social Impact Assessment.

Comment 12:

Furthermore, where facts are given, they are contradictory. For example the background information in the SIA states:

Thyspunt site is located in the Eastern Cape, between Oyster Bay and Cape St. Francis, 20 km south of the town of Humansdorp, and approximately 50 km west of Port Elizabeth, as shown in Figure 1.02.

In the Transport Impact Assessment, Thyspunt is 80km west of Port Elizabeth, Humansdorp is 15km north of Thyspunt and 7km west of Oyster Bay. These inconsistencies are present throughout the DEIR. They highlight yet again one of the constant issues that we have been raising from the start. The most elementary facts are contradictory, and in each case, St Francis Bay and Sea Vista are ignored.

The section on Assumptions and limitations goes out of its way to dismiss input by the local community.

Response 12:

Your comment is noted. The discrepancies in distances between specialist studies are regrettable but do not affect the assessment of impacts. Each specialist study assesses the impacts on the potentially affected environment, which may differ from study to study, but which in most instances includes all the surrounding settlements. For the Thyspunt site, these settlements include Oyster Bay, Umzamuwethu, St, Cape St. Francis, St. Francis Bay, Sea Vista, Humandorp and Jeffrey's Bay.

Cape St. Francis, St. Francis Bay and Sea Vista are effectively a single settlement, and it would therefore serve no purpose to mention each of these components every time that the St. Francis area is discussed. Most people (including specialists) mention the names Cape St. Francis and St. Francis Bay interchangeably.

However, in cases where some components of the St, Francis area such as Sea Vista could be expected to experience more severe impacts than others (e.g. noise impacts due to the proximity of Sea Vista to the R330), impacts on the different components of an area like St. Francis have been treated separately.

Comment 13:

The DEA is requested to take note of this in considering any application for a ROD.

2. Recommendation 2

Recommendation 2 stated clearly that the coastal holiday resorts should be left unaffected by the development.

This was a clear recommendation, of which the Social Impact Specialist should be aware, and has been completely ignored. If he believes that having thousands of heavy-load trucks passing through St Francis Bay daily for nine years, together with a potential massive influx of unemployed job-seekers is leaving the resort “unaffected”, then words have no meaning.

The DEA is requested to ask the EAP for reasons why Recommendation 2 of the Nuclear Siting Investigation Programme has been disregarded, and to consider whether this does not constitute a fatal flaw.

Response 13:

Your comment is noted. As indicated in Response 3, the NSIP was a preliminary pre-feasibility study for nuclear power station placement. The Nuclear-1 EIA is a project-specific and more detailed assessment of Nuclear-1 using current information and as such, the Nuclear-1 EIA provides a more current perspective on social and environmental conditions and some of the findings and recommendations of the NSIP may, based on current information and socio-economic realities, no longer be considered valid.

The Nuclear-1 EIA has not stated that St. Francis will be unaffected, but has found, for instance, with regards to tourism, that an initial negative impact on tourism will over the longer term change to zero net impact.

Comment 14:

3. Exclusion of the Social Impact from the nine decision factors used in weighting the various impacts

It is completely unacceptable that the Social Impact has been excluded from the nine “decision factors”. The Social disruption caused by the selection of the R330 as the main access road will be massive, as will any expansion of the informal settlements which is inevitable if this route is selected.

One of the objections to this entire EIA is the arbitrary and secretive manner in which weightings have been given to different impacts. This is left to the EAP in conjunction with the various specialists. It is not a reliable process, since the specialists are only familiar with their own disciplines, and are not in a good position to evaluate impacts from other areas. It leaves the way open to the EAP to influence the process.

No minutes of the weighting meeting held prior to the First Draft have been made available, and no I & APs were present at that meeting. It appears to have been a brief and superficial meeting, at which major decision affecting the final outcome were taken.

It is our view that serious and unmitigable impacts are being deliberately relegated to insignificant weightings, or ignored completely, whilst less serious objections, which can be mitigated with some confidence, are promoted to high weightings.

The DEA is asked to require the EAP to give written reasons for the weightings which have been given; what the process was to determine these weightings; why social impact is not included; whether the process used is a credible one, or is open to manipulation; and whether the entire weighting process should not be re-done in a transpsarent, fair and reasonable manner. The responses to be made available immediately to I & APs.

Response 14:

Your comment is noted. Based largely on the concern of local residents about traffic impacts through Humansdorp and St. Francis, the traffic impact assessment is being substantively revised, such that heavy construction traffic will completely bypass St. Francis and Humansdorp. A new interchange with the N2 is proposed to the west of Humansdorp to direct traffic along the Oyster Bay Road to the western access road to the Thyspunt site. Details of this traffic proposal will be included in the Draft EIR Version 2

Contrary to your comment, clear motivations have been provided for the way that weightings have been allocated to different decision criteria. Please refer to section 9.32 of the Revised Draft EIR Version 1 in this respect.

Your comments about the “weighting meetings” are noted. Minutes of the specialist integration meeting held in November 2009 were provided to the Thyspunt Alliance although this meeting was an internal team meeting and was never intended to be a public meeting. It is not the intention, neither is it a legal requirement, for all proceedings of an Environmental Impact Assessment to be subject to participation by interested and affected parties (I&APs). It is not practical to involve I&APs in all EIA activities such as site visits for field investigations, internal team meetings, authority meetings, etc. in the process of conducting an EIA. There are elements of the process that are open to the public and other elements where the Environmental Assessment Practitioner (EAP) and associated specialists must apply their minds in the investigation or potential impacts and preparation of an Environmental Impact Report.

Your comment about specialists only being familiar with their own disciplines is noted. That is the very reason why integration meetings are held during EIA processes: so that specialists can become familiar with the findings and recommendations of other disciplines and understand their own findings in the context of the findings of other studies.

Comment 15:

4. Changes in impact rating criteria

The criteria have been revised in response to comment in the Peer Review in Appendix H. These are outlined in Chapter 7 "Methodology". Table 7 – 16 in section 7.8.1 on p.7 -32 outlines very specifically the new criteria to be applied. The revisions are discussed in detail in our response to Impact Assessment Criteria, Ch 7. In our view there have been some improvements, but overall the criticisms remain.

Typically of this EIA, the criteria outlined are immediately contradicted by the accompanying notes below it, which revert to those used in the first draft. We have assumed that Table 7 – 16 is correct, and should be used by all the specialists in determining the significance of different impacts. This has clearly not been done in this particular case.

The DEA is requested to seek confirmation from the EAP that the impact rating criteria contained in Table 7-16 of Chapter 7 are correct, and to explain why the explanatory notes which follow have not been altered to conform with the Table.

The EAP should also be requested to confirm that all impact significance assessments have been done in terms of Table 7-16, and not in terms of Table 7 – 10 in the First Draft Impact Report. Should this not be the case, then all non-conforming specialist reports to be reviewed in terms of these criteria, and no ROD considered prior to this.

Section 3 of the Social Impact Report, from p.139 – 212 presents a number of impact analyses. In every single case the impact is clearly assessed in terms of the earlier criteria, and not those proposed in Table 7 – 16 of Chapter 7.

The DEA is requested to check that impacts in the Social Impact Report have been assessed in terms of the criteria outlined in Table 7 – 16 of the revised draft, and not in terms of table 7 -10 in the first draft, and to demand that impacts be re-assessed in terms of the revised criteria.

Response 15:

As you correctly state, impact assessment criteria were substantially revised in line with the recommendations of the independent peer review team and the results of this revision are indicated in Table -16. These revised criteria as per this table were also provided to all the Nuclear-1 EIA specialists. It is unfortunate that some of the text below Table 7-16 contradicts the table. However, the format in which the criteria were supplied to the specialists is strictly according to the table. Examination of the specialist studies will confirm that the criteria in the table were applied.

Your comment on Chapter 3 of the Social Impact Assessment (SIA) is noted, The Social Impact Assessment Tables were added as a separate document to the SIA, with a note that the significance values in these tables supersede the significance values in the report.

Furthermore, please note that the National Department of Environmental Affairs requested the EAP to review the impact assessment methodology used in the Revised Draft Environmental Impact Report (Version 1), so as to simplify the criteria for assessment of significance and identification of a preferred site. In response, an approach has been developed that identifies and describes key decision-making issues contained in the individual specialist studies. These decision-making issues apply to both the acceptability of the proposed Nuclear Power Station as well as to the preferred site.

Comment 16:

5. Failure to address objections raised in the First Draft

The Social Impact Assessment was severely criticized in the First Draft on the grounds of being highly theoretical, backed by an almost complete absence of relevant fact, and blatantly designed to play down the social impact of placing a nuclear plant at Thyspunt.

The original Social Impact Assessment has not changed in any way.

Response 16:

Your comment is noted.

Comment 17:

6. Transportation and noise assessments

The social impact is strongly influenced by the Transportation and Noise impacts. Unfortunately the Noise and Transportation Assessments are as weak as the Social Impact Assessment, and fail completely to indicate the impact on the Kromme River and St Francis Bay communities. This has given the Social Impact specialist a further opportunity to play down the real impacts.

It is clear from the Transport Impact Assessment that the impact on the communities of Humansdorp, St. Francis and Oyster Bay will be large. We fail to understand how the SIA can come to the startling conclusion that the impacts at Bantamsklip and Thyspunt would be similar.

The specialist appears to be blissfully unaware or unconcerned that, if the present plans to use the R330 for the main road access are approved, this would lead to a total, permanent and unmitigable change of sense of place for both Humansdorp and the Greater St Francis area. The impacts at Humansdorp, St Francis Bay & Sea Vista will be HIGH.

This contravenes the requirements of both Section 33 (1)of the Constitution, and the requirements of the Promotion of Administrative Justice Act that administrative actions must be fair and reasonable.

Apart from the ludicrous proposal to take all the heavy & ultra-heavy loads down Saffery Street in Humansdorp, none of these reports have been revised in any way in the second draft, despite the criticisms made in the response to the first draft.

The DEA is requested to consider whether any of these reports pay adequate attention to the disruption which will be caused to the local communities by the volumes, size and noise of the proposed vehicle trips, or of the impact of the influx of unemployed job seekers into the area; and whether these should not be included in the list of decision factors and given a high significance rating in terms of the impact
rating criteria set out in Table 7-16.

The same applies to road access. Every time a public meeting is held in connection with Thyspunt, a new road access plan is presented. The reality is that the Oyster Bay by-pass headland dune system makes access to Thyspunt extremely problematic.

Whichever way the access roads go, in the light of the volume of traffic expected, it will have massive environmental, social and impacts. Table 3-14 in Chapter 3 predicts over 400000 2-way (i.e.over 800000 single) trips during year 6. Even at this late stage, it has not been possible to ascertain what proportion and type of traffic will use the R330 and what the Oyster Bay road. This despite several requests for clarification (See appendix to Transportation Assessment). Nor is it clear whether all transport will be during daylight hours, or whether a shift system will operate 24 hours per day for 30 days per month. The public has been assured that all traffic will be during daylight hours, but Table C 12 of The Transport Assessment indicates that a shift system will be the case, which is directly contrary to what the public has been told. What is clear is that hundreds of thousands of trips will be involved, incorporating both commuter and heavy load traffic, over a period of nine or more years. The estimated traffic figures for the construction period, found in Table 3-14 of Chapter 3 (Project Description), which is itself riddled with errors, imply that traffic will continue for 30 days per month without break. Depending on the routes to be taken, all of this has massive potential social impact. This appears to have no significance to the specialist, who dismisses it all as speculation and perception.

The DEA is requested to refuse any application for an ROD until such time as a final decision has been taken on the access roads, and the full environmental impacts of this, and cost implications, have been determined and evaluated.

Response 17:

Your comments on the noise impact assessment and traffic impact assessment are noted.

As stated in responses above, the traffic impact assessment is being substantively revised, such that heavy construction traffic will completely bypass St. Francis and Humansdorp. Thus effect on St. Francis in terms of impacts such as traffics safety and noise would be greatly reduced,

Your comment regarding the problematic assess across the bypass dune system is noted. Please be aware that no road is proposed to pass through the bypass dune system, and that all roads proposed to be built for Nuclear-1 have been routed over stable vegetated dunes.

Comment 18:

7. Out-dated demographics

The International Atomic Energy Association (IAEA), to which South Africa is a signatory states in the Safety Standards Series No. NS-R-3 that:

"4.12. the most recent census data for the region, or information obtained by extrapolation of the most recent census data, shall be used in obtaining the population distribution. In the absence of reliable data, a special study shall be carried out."

It is clear that the data provided as part of this SIA is outdated and therefore a special study should be conducted to determine more exact figures. The use of 2001 census figures is not acceptable and more recent data should be used.

The biggest problem with the use of outdated data is that the decision-making authorities would never be able to get a clear picture of the current situation on the ground. As I&AP's residing in the described environment we are fully aware that the numbers are not just slightly skew, they are wrong to such an extent that it would be laughable if the situation was not so serious.

For example:

Table 2.61: population Gender per Suburb within 16 km from the Thyspunt Site (2001)			
Town	**Male**	**Female**	**Total**
Cape St. Francis	83	85	168
Kouga	2104	2001	4105
Oyster Bay	172	170	342
St. Francis Bay	1065	1133	2198
Source - Statistics South Africa: Census 2001			

We would assume that the figure for St Francis Bay includes Sea Vista. The Eastern Cape Socio-Economic Consultative Council (ECSECC) reflected a total male population for the Kouga area in 2009 as 36 133 a discrepancy of 32 709 when compared with the figures above.

No attention is paid to the peak holiday influx, which can quadruple the normal resident population.

The DEA is requested not to grant an ROD until a thorough assessment of population figures in the Greater St Francis area, including peak holiday periods, has been completed and approved.

Response 18:

The population figures are within 16km from the Thyspunt Site as provided by Census 2001. Only a small part of Kouga is included in these figures. Population figures are clearly explained under 2.4.1.4 and Tourism Population and influx under point 2.4.1.6.

The Tourism Impact Assessment Study indicated that: "The tourist season at St Francis is extremely short, being concentrated into a ten-day period in December-January and over the Easter week-end. The normal population of 4,000 rises to 30,000 over Christmas and New Year and perhaps to 8,000 over Easter."

Comment 19:

8. Job creation

It is stated that 25% of the construction workers will be sourced locally. Even this is not guaranteed. No final decision has yet been taken on the vendor. Eskom has stated publicly in Sea Vista that this could be as little as 5% or 10%. If the vendor were to be Chinese, which is possible, experience elsewhere is that no local labour will be used. Estimates of direct local jobs opportunities have been hugely exaggerated. Eskom has been spreading the word that up to 8000 jobs will be created. This includes Eskom & the vendor's professional staff. The construction component us (sic) estimated to be about 5000. 25% of this is 1250, so a more realistic figure is a maximum of 1250 jobs, and then only in years 6 & 7. Spread over the whole of Kouga, it represents a fairly small number for each community. Once the higher number gets around, it is an absolute given that our locally unemployed will support the project, and that large numbers of unemployed people will flock to the area in the hope of obtaining jobs. With our present level of infra-structure, this simply cannot be supported.

Job-seekers from outside will be competing with the genuine locals, and every job awarded to an outsider (who will present himself as local) will be at the expense of a genuine local. This can only lead to a xenophobic reaction. This is dismissed by the specialist as speculation – something which "could" happen.

On the other hand there is the distinct possibility of the chokka industry, based at St Francis Bay, moving to Port Elizabeth or Mossel Bay if Eskom persists with its plan to place 6 million cubic metres of spoil on the sea bed in the prime chokka spawning ground in the country. This established industry employs 4000 people on a permanent basis.

The very presence of a nuclear plant could have a major negative impact on the surfing world, which flocks to Jeffreys Bay, as one of the best surfing venues in the world, but which has shown itself to be highly sensitive to the perceived dangers of nuclear power. If this were to happen one of the Eastern

Cape's major tourism attractions would have gone, and with it one of the mainstays of tourism in Jeffreys Bay.

The entire job-creation scenario should be treated with great circumspection, and should certainly not be rated too highly in the weightings of pros and cons for Thyspunt. An analysis of the likely actual direct job creation potential for the Kouga area is given below. It indicates that the direct jobs at Thyspunt, whilst not insignificant, will be much smaller than Eskom has suggested to the local communities, and would be short-term.

Based on the assumption that the majority of direct job opportunities will be during the construction period; will be limited to construction staff of 5000; and will constitute a maximum (unconfirmed) 25% being recruited locally; the maximum number is 1250. These will be recruited from the whole of the Kouga region. However, these requirements will fluctuate from year to year and this will only apply to year 6.

An approximate estimate of plant construction jobs for the whole Kouga region will read as follows:

Year	1	2	3	4	5	6	7	8	9
	220	275	450	670	825	1250	900	750	600

Bearing in mind that this submission is concerned mainly with the social impact on the St Francis community, including Sea Vista, the fact that a maximum of 25%, and possibly much less than this, of construction staff will be recruited locally, and that "local" covers the entire Kouga area, based on population figures for PDIs contained in the current Kouga Spatial Development Framework, it can be predicted that the job opportunities for the Sea Vista community will amount to approximately the following:

Year	1	2	3	4	5	6	7	8	9
	10	13	23	33	45	56	46	38	31

Against this should be placed the likely competition from the influx of job-seekers from outside the area, whose identification is highly problematic, and the potential loss of jobs in the chokka industry, which is by far the leading employer in Sea Vista.

The optimization measures proposed for the securing of local labour are highly idealistic and probably optimistic, unless they are incorporated as a condition of approval. Even with this, they will be difficult to apply.

In view of all this, the positive rating of employment opportunities as "high" in Table 3.08 on p.152, and repeated in the Summary Table for Thyspunt, is optimistic. So far as Sea Vista is concerned, it is more likely to be highly negative.

There would, of course, be indirect job creation in the form of construction of the various accommodation villages & roads, and in ancillary business opportunities, and these are not to be

scoffed at, but they must be viewed in proportion to other impacts which will occur. To state that local labour should be used for the building of the vendors and construction staff village is easier said than done. For large construction projects like this it is very difficult for local operators to provide the necessary financing and guarantees for large scale projects like the proposed project.

The DEA is requested to demand a much more accurate picture of the direct job opportunities likely to be available to the local population in the event of Nuclear 1 going ahead at Thyspunt, with reasons given, and to evaluate this in relation to the negative impacts which will accompany a site at Thyspunt.

Response 19:

Your comments regarding construction labour are noted.

Whilst the makeup of the vendor's labour force cannot be guaranteed, Eskom has stated its commitment to including targets for the use of local labour in its construction contract. Requirements for the use of local labour for construction would, therefore, be enforced upon contractors. Such requirements for use of local labour would also be entrenched as conditions in the authorisation (assuming an authorisation is issued).

Your comments on the impact on the chokka industry are noted. Extensive response to the claims of a catastrophic impact on the chokka industry has been provided directly to the SA Squid Management Industry Association (SASMIA) and to yourselves. Only the salient points of this response are repeated here. SASMIA's claims of an impact of up to 30% or more on its catches around the Thyspunt site are poorly motivated. The EIA team has consulted extensively with the Squid Working Group, which advises the Department of Agriculture Forestry and Fisheries (DAFF) on matters relating to the commercial exploitation of squid. The 30% figure claimed by SASMIA appears to have been calculated using only four selected vessels – a gross under-representation of the chokka squid fleet. Independent data for the same area provided by DAFF (i.e. the commercial database) showed that 14.7% of total catches are taken in the wider area (two quarter degree squares of approximately 22 x 27 km each[1]) around the proposed site – itself a much larger area what will in fact be impacted. In this regard, it must also be noted that the total area affected by a temperature increase of 3ºC or more (the magnitude of temperate increase that is predicted to result in a reduction in squid activity) will be less than 1km^2. While still under review, the percentage impacts that have been calculated based on commercial figures provided by the DAFF range from 2.86% (worst-case scenario) to 2.53% (least-case scenario) to the fishery in the **local area** under question, and between 0.42% and 0.37% for the fishery as a whole.

Your comments on the impact on surfing are noted. An assessment of the impact on surf breaks (Appendix I of the Revised Draft EIR) concluded that, as long as a deep disposal site is used for the marine disposal of spoil, the impacts on surf breaks will be negligible and that, at most, the sea bottom could be raised by a few cm over time due to the movement of sand from its offshore disposal site.

[1] Two quarter degree squares amount to a total area of approximately 1188km^2.

Comment 20:

9. Influx of job-seekers and growth of illegal dwellings

How can the impact of job seekers be evaluated in the absence of any numbers? There is a vast difference between 100, 1000 & 5000 job seekers, but this is not even mentioned, nor is there any attempt to evaluate the possible impacts based on numbers. Nor is there any mitigation measure that can address this.

The SIA makes the following statement:

"These job seekers, including those from areas outside the "local" area, enter the area with the hope of securing employment. When they do not secure employment, the potential exists that they will add to the usual difficulties related to informal settlement, pressure on existing resources, services and infrastructure. The possibility also exist that "new" job seekers may contribute towards crime and other social problems such as alcohol abuse and prostitution. Even if particular instance of crime are not as a result of the job seekers, these may still be attributed to them by local communities."

The impact goes further than this. These "job seekers" have the right to services like housing, schooling, police and medical services as well. At present the local community is under-serviced in most of these departments. Development should be sustainable and therefore current backlogs should first be addressed before an added load is heaped onto the authorities.

The inescapable conclusion is that illegal dwellings will mushroom in proportion to the influx. This will lead to all the social pathologies identified in the report, but for which no effective mitigation measures exist.

The social impact of this will be worst for the population of Sea Vista, but almost as bad for the town as a whole. The complacency with which this is addressed in the Social Impact Assessment is breath-taking. No attempt is made to assess the intensity of this impact in terms of specific numbers, and proposed mitigation measures are completely inadequate. The local authority is incapable of catering for the needs of the existing informal settlement at Sea Vista. Competition for the limited number of jobs is bound to lead to xenophobic reaction.

The mitigation measures for the prevention of more illegal dwellings states:

"Cooperate with local authorities to ensure that all legislation preventing illegal settlement, is enforced at all times; and"

This is unbelievably complacent and impractical. We would like to see a more practical and workable solution to this problem. Thus far the local authority could not prevent the erection of illegal dwellings. It is therefore doubtful that they will now suddenly succeed. It must be clearly stated who must cooperate with the local authority and what this cooperation will entail. There will be a cost to the local authority to appoint more enforcement officers. These issues should be discussed in more detail.

To lower the impact in one pen stroke to a impact of low significance is not only unacceptable but the mitigation measures are untested. We believe that the SIA practitioner should provide examples of where these mitigation measures have been successfully implemented.

Nobody objects to a natural growth of job-seekers in proportion to the natural growth of a town, but this is a completely artificial growth, which will place huge strain on both the local authority and on the existing population. The Social Impact Specialist virtually ignores it.

It is our view that this is a fatal flaw. The only solution to it is to avoid bringing any access road through St Francis Bay.

The DEA is requested to require the specialist to determine the actual impacts of jobseekers from outside the municipal area, in terms of specific numbers (e.g. 100, 1000, 5000), and to assess the significance of each level; and to consider whether any road access should be permitted through St Francis Bay , in view of recommendation 2 of the NSIP that the coastal resorts should be left unaffected.

Response 20:

Your comment in the inability of Kouga Municipality to deal with the expected influx of people into the Kouga municipal area is noted. It is also acknowledged in the Revised Draft EIR there are severe service provision backlogs and that the Kouga Municipality does not have sufficient funds of its own for the necessary upgrades. Thus, the following is recommended in Section 10.3.1 of the revised Draft EIR:

“Eskom must enter into negotiations with local authorities and other relevant authorities well before the start of construction to identify how it can be ensured that municipal services are capable of providing sufficient capacity for the expected influx of people into the affected area. Agreement must be reached between Eskom and these bodies on the apportionment of financial responsibility for infrastructure upgrades.”

Eskom cannot, however, be expected to be solely responsible for infrastructure upgrades, as current infrastructure backlogs are the responsibility of the municipality. It is for this reason that it has been recommended that agreement must be reached between Eskom and the other role players regarding apportionment of responsibility for the necessary upgrades.

Your comment regarding the access road is noted. Please refer to the previous responses in this regard, which indicate that heavy vehicle construction traffic will no longer be routed along the R330.

Comment 21:

10. Social pathologies

These are listed in the assessment, but simply not addressed. They include crime &increased risk of HIV/AIDS. This in a community which is already seriously under-staffed in law-enforcement provision.

The community is not just concerned about the possibility of the increase in criminal activities. They are concerned about the level of service that they currently receive and the impacts of an increased population on the provision of these services. This impacts particularly strongly on Sea Vista Township.

The mitigation measures suggested are again all “nice to have” but do not address the practical implementation of service delivery on the ground. If the SAPS does not have the budget to provide a larger staff contingent, we can have as many Community Monitoring Committees as we want, it will not deal with the actual situation. No police vehicles, staff shortages, no lock-up facilitities – these are facts at present. No pie in the sky perceptions and paper based solutions. These impacts and cost implications must be addressed.

HIV/AIDS is not just a risk – it is a certainty, as is increased prostitution. As with everything else in the SIA, it is simply raised and then breezed over.

The mitigation measures are all aimed at the workers. The impact that this proven increase will have on the present population is not discussed. The workers will be dealt with most probably at an Eskom clinic. What will happen to the people not employed by Eskom? There are several on-going education campaigns on the prevention of HIV and AIDS and more campaigns would always be welcome. Unfortunately it again does not address the true situation on the ground. The impact of HIV & Aids on any community cannot be described as medium-term; those infected will have to go on lifelong treatment the impact is also not just local. The impact is National as most of these patients will become move on, as well as being reliant on social grants.

The DEA is requested to consider whether the impact of social pathologies arising from a major influx of outsiders has been adequately addressed in the SIA.

Response 21:

Your comments regarding the potential increase in social pathologies and on service delivery are noted. Please refer to Response 21 regarding this impact.

Further in order to ensure effective and efficient service delivery the better capacitation of the SAPS is needed to address the challenges that goes hand in hand with growth in population numbers.HIV/AIDS is a national challenge and all parties involved need to work together to address this challenge. It is also the responsibility of the individual to take responsibility for his/her lifestyle and choices made.

Comment 22:

11. Inadequate coverage of municipal infra-structural & social service requirements

The project description states that: “***The infrastructural requirements associated with the proposed nuclear power station will be similar to that of the Koeberg nuclear power station***

located in Duynefontein, Western Cape Province." This statement is simply not true as Nuclear 1 will be at least 3 times the size of the Koeberg plant. The two situations are entirely different.

The same applies for the SIA discussions about Municipal Infrastructure. The SIA is little more than a copy of the Kouga IDP 2009 – 2012 and the Kouga Spatial Development Framework. Although these documents can be used as a baseline for the SIA it is important that the specialist compares the documents with the reality on the ground. This has not been done for this SIA.

This is one of the biggest social impacts and yet again most of the information contained in this SIA is copied from the Kouga IDP. Nowhere in the SIA is a table or indication provided of the possible costs of this development to the Local Authority. We have requested that these possible cost implications for the Local Authority should be included to provide a full overview. At present a large amount of emphasis is placed on the positives. We find this unacceptable as the local ratepayers are in the end going to bear the brunt of these costs. No mention is made of the provision of Emergency Services as per the Disaster Management Act. Eskom is responsible for Disaster Management on the site but the Local Authority is required to have a standard level of service available in case of a disaster.

In the description of impact the SIA notes:

"*It is probable that the new nuclear power station and residential development will place strain on municipal services such as water, sanitation, roads, waste and refuse removal."*

It is not probable, it is a fact. Furthermore the SIA focuses all the attention on the residential development with little or no consideration of the added burden due to population influx. Although Eskom is willing to invest in the upgrade of infrastructure such as sewerage treatment facilities, this does not solve or alleviate the back log problems currently experienced in the area. The 2011 Green Drop Report gives the Kouga Municipality an overall Municipal Green Drop Score of only 36.3%. The maximum risk rating for Humansdorp, Jeffreys Bay and St. Francis indicates that all of these plants are already a high-critical or critical risk that warrants urgent attention.

The SIA reports that:

"When considering the backlog, the municipality has taken cognizance of an additional element, viz. the ability to maintain the existing infrastructure. Subsequently, operational budget to attain effective repairs and maintenance programmes has been allocated."

The current municipal budget does not reflect the operational budget to effect the repairs and maintenance programme. These issues should have been investigated by the practitioner and the impacts should have been recorded.

The mitigation measures suggested are again theoretical and do not provide detailed solutions to age-old problems. There are no specific actions listed, no responsible parties nominated and again no discussion of cost implications.

There is no discussion in the SIA about the current road conditions, again just a theoretical rehash of the Transport Impact Assessment.

Response 22:

Your statements regarding the infrastructural requirements for Nuclear-1 are noted. Koeberg Nuclear Power Station (KNPS) employs approximately 1,200 people[2], which is similar in number to the estimated 1,400 operational personnel for Nuclear-1, in spite of the difference in power generation capacity. It is not correct to state that Nuclear-1 will be at least three times the size of the KNPS. The KNPS had a capacity of 1,800 MW, and although the application for Nuclear-1 is nominally 4,000 MW, this is the theoretical maximum that would be developed. Depending on the chosen vendor, Nuclear-1 could be made up of a number of smaller units or two larger units, with the potential to generate up to approximately 3,700 MW (i.e. approximately double that of the KNPS).

Lastly special reference is made to point 3.8. Municipal Services: "It is generally accepted fact that local municipalities have limited capacity and resources to cope with the growing demand, and therefore additional support and investment is needed when large projects are initiated.

The costs of providing local services would be part of the costs associated with the normal incremental growth of a town. Municipalities are responsible for providing specific services, but these costs are covered by user charges (the monthly municipal bills to householders and firms. New houses would have to pay municipal rates which would result in an enhanced revenue stream to the municipality. In addition to this, Eskom is willing to invest in the upgrade of infrastructure such as sewerage treatment facilities."

Details of such nature can only be progressed with the specific municipality, once the EIA decision authorization for the specific site is obtained

Your comments on the current service backlogs are noted. Whilst this is noted, it also has to be stated that the purpose of an EIA is not to solve current problems, but to provide an indication of the impacts that can be expected due to a proposed development and to ensure that these (potential future) impacts can be mitigated to acceptable levels. An EIA, as an environmental planning tool, is unable to address current service backlogs. However, these existing backlogs must be acknowledged (as they have been) in order to understand the context in which expected future potential impacts will be experienced.

Since there is a dedicated Transport Impact Assessment that considers road conditions, the focus of the SIA was not on providing an independent assessment of road conditions.

[2] http://www.eskom.co.za/c/75/the-koeberg-experience/

Comment 23:

Accommodation of Staff and Construction workers:

Although the SIA makes it clear that the accommodation arrangements have not yet been finalised and that an exact location has not yet been established the practitioner states that : ***"Provision for future residential development has been made in the Kouga Spatial Development Plan (2009), in and around Sea Vista, Cape St. Francis, Oyster Bay and Humansdorp."***

Yet there is no discussion about the fact that these future plans were actually to serve the **current** population of the Kouga area. At present we are dealing with not only a backlog in the provision of housing but also with the problem of land and infra-structure available to add these developments. If the areas identified as future residential developments are now used for Nuclear 1, this will mean that people who have been residing in the area for years, will now have to step back. The current back-log in infrastructure provision in the Kouga has already delayed several housing projects in the area. Even if Eskom promises to provide their own sewerage treatment plant, the land actually earmarked for the community at present will be lost to this development.

This aspect is completely ignored in the SIA and the impacts on the community are not discussed at all.

This, of course, will involve major infra-structural factors such as water, electricity and sewerage, schools and clinics, etc., etc. all of which are operating at capacity at this stage. Quite how any social impact can be assessed in the absence of this information is not clear.

The DEA is requested to reject any application for an ROD until such time as the siting of the various accommodation villages has been determined, backlogs have been addressed; and the environmental impact and infra-structural requirements of these has been fully addressed in terms of Table 7 – 16.

Response 23:

Your comments the accommodation of staff and construction workers refers. The SIA does not state that the areas allocated for residential development in the Kouga Spatial Development Plan are allocated to Nuclear-1. It is a simple statement of fact that an allocation has been made for future residential development. There is no suggestion in the SIA that people on current waiting lists for housing would have to "step back" for Nuclear-1 employees.

Eskom has stated repeatedly that it will enter into detailed negotiations with the relevant local authorities once a decision has been taken on the location of Nuclear-1, and that its preference would be to integrate the housing requirements for Nuclear-1 as far as possible into existing development, thus making use of existing housing stock as well as new developments proposed by local developers. The DEA has accepted the approach of this EIA that housing developments for Nuclear-1 will be assessed through separate EIA processes, should these be required.

Comment 24:

Hospitals

The SIA states under the heading Hospitals that:

"Humansdorp:
Humansdorp Hospital is a Public Private Partnership Hospital with 33 private beds and 70 general bed facilities. There are about 35 nurses and 15 doctors on the staff. Humansdorp Hospital is about 20 kms from the proposed Thyspunt Nuclear Power Station. It is the only hospital for patients from Oyster Bay, Cape St. Francis, St. Francis Bay, Jeffrey's Bay and the rural areas."

The dream for Humansdorp Hospital may be to have 15 doctors on the staff, but this has not been true for a very, very long time. This illustrates the problem with desktopstudies, we can all access relevant government information and this SIA made full use of this information. It is however very unfortunate that the specialist did not verify this information to ensure that the real social impacts can be discussed and considered.

Response 24:

Your comment is noted. It is not possible for the Social Impact Assessment specialist to ground-truth all information for all educational, safety and security, health, utilities and other state-financed institutions in each of the study areas and reasonable reliance is therefore placed upon publicly published information.

Comment 25:

12. **Mitigation measures**

Much depends on mitigation measures which are proposed to deal with the multitude of social impacts and pathologies which would arise from a decision to proceed with Thyspunt. These completely fail to stand up to any kind of scrutiny. In general those proposed in this report are little more than talk shops, designed to address problem areas after they have arisen, and with no teeth. By this time it will be too late to correct anything meaningfully. These have to be anticipated and addressed at the decision making stage. Those proposed have no prospect of even reducing, let alone addressing the issues raised. Once again, these measures reflect the extreme complacency of the Social Impact Specialist, and place a question mark over his impartiality

The DEA is requested to look very critically at the proposed mitigation measures in connection with the social impact, and to determine whether these address the problem areas identified.

Response 25:

Your comment is noted. The mitigation measures in the Social Impact Assessment are only one set of a suite of mitigation measures proposed by the range of specialists. The mitigation measures have

been integrated into a comprehensive Environmental Management Plan (EMP) – Appendix F of the Revised Draft EIR Version 1). The EMP stresses the fact that many of the proposed mitigation measures will have to commence well before the start of construction. It is further emphasized in the this EMP that civil society involvement is key in the monitoring of the implementation of mitigation measures, through a proposed Environmental Management Committee - a body comprising authorities, Eskom, independent environmental monitors, representatives of local communities and non-governmental organisations.

Comment 26:

13. CONCLUSION

In the Impact Identification and Assessment section of the SIA most of the recommended mitigation measures cannot be accepted as they are too vague, there is no responsibility attached to the mitigation measure and the implementation of some of these measures is debatable.

The Social Impact Assessment is complacent, partial, lacking in factual content and totally inadequate. It should be rejected out of hand.

Response 26:

Your comment is noted. Responsibility for implementation of mitigation measures is allocated in the EMP (Appendix F of the Revised Draft EIR Version 1).

Yours faithfully
for GIBB (Pty) Ltd

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The Nuclear-1 EIA Team

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05 August 2015

Our Ref: J27035
Your Ref: Email received 06 August 2011

Email: laura.cloete@aexp.com

Dear Ms Nixon

RE: ESKOM EIA CONCERNS FOR THE PROPOSED NUCLEAR POWER STATION AND ASSOCIATED INFRASTRUCTURE (DEA Ref. No: 12/12/20/944)

OBJECTION TO THYSPUNT WESTERN ACCESS ALTERNATIVES

(SPECIFICALLY W1, W2 AND W3)

OBJECTION TO THE LOSS OF THE 10 KM PROTECTION ZONE

Comment 1:

I wish to lodge an objection to the W1, W2 and W3 access routes, each of which will pass directly between Umzamowethu and Oyster Bay, separating the two villages with devastating impact. Negative impacts include:

- the 'apartheid' implications of separating the two quiet villages so decisively by cutting access to work, shop, beaches, etc with a dangerously busy road;

- the very real problems of building an overpass (elderly cannot reach the one shop they need) and underpass (muggings and drug use)

- the equally real danger of people short-cutting across the road or falling out of pubs and stumbling across the road, which will be life-threatening;

- the noise and pollution of "hundreds of vehicles" (to quote your report) using a route that would pass very near to a crèche, churches, pubs, schools and houses;

- total destruction of the area's gentle other-world ambience wrought by a busy tarred access road through the heart of two quiet villages;

- likely economic ruin of our one local shop that relies largely on Umzamowethu support to survive and of the tourism industry that is so necessary to the community;

- a growth in squatting and other hazardous social issues (increased crime, overcrowding, fire hazards, pollution, health issues, etc) as outsiders looking for work squat in Umzamowethu, the nearest village to the gates of the site.

The stated aim to provide transport only from Humansdorp will surely fail as, if the nuclear project aims to hire local people, they will have to stop at Umzamowethu to collect workers who cannot be

expected to relocate to Humansdorp when they live virtually on-site. However our villages have absolutely no infrastructure to support this - insufficient sewage, no hospital or clinic, no fire station, no police station, water shortages, etc. So the area will grow unrestrictedly and dangerously and the calm, peaceful, harmonious lifestyle of those who choose to live there will be forever destroyed.

This route is particularly galling when you clearly have another route (W4, the blue route) nearby which would serve the nuclear site as well without destroying our villages so totally. And now that you have also radically reduced the 10 km protection zone so that our villages are no longer restricted from further growth, it is clear you have abandoned any attempt to protect or mitigate the destruction of our villages.

Please can you clarify:

a) why does your report not address the negative impact of any route that cuts between our two villages?

b) why does your report not address the negative impact on our villages if there is no protection zone?

c) does your report actually carry any weight and is Eskom bound to apply your recommendations or is it just window-dressing?

Please clarify your position on the above as a matter of urgency as our residents cannot understand the purpose of your research when it so blatantly excludes such necessary research.

Response 1:

Your comments and concerns are acknowledged and noted. As result of public meetings held in particular in Oyster Bay on 30 May 2011, Humansdorp on 02 June 2011 and St. Francis Bay on 31 May 2011; as well as comments received from Interested and Affected Parties such as yourselves both at the public meetings and as part of the Public Participation process for the Revised Draft EIR Version 1 it came to light that the alternatives for access roads past the town of Sea Vista/ St. Francis Bay and the settlements of Umzamawethu/ Oyster Bay to the Thyspunt site need to be re-investigated. A follow-up investigation has therefore been conducted by the following specialists in order to undertake a comparative assessment of road alternatives W1 to W4:

- Social Impact Assessment;
- Noise;
- Botany;
- Dune geomorphology;
- Freshwater ecology (wetlands);
- Vertebrate fauna;
- Invertebrate fauna; and
- Heritage.

A combined Addendum Report has been produced (Appendix E31 of the Revised Draft EIR Version 2) and is available to the public for comment and review. The conclusion of this report is that the Western Access Road must follow an alignment east of Umzamowethu.

As indicated in the Revised Draft EIR Version 1, one of the assumptions of the Nuclear-1 EIA process is that the Emergency Planning Zones of the European Utility Requirements (EUR) will apply to the Nuclear-1 power station. These zones are a maximum of 3 km and hence, no restrictions would apply to Oyster Bay (as you also indicated in your comments). Private development is only restricted within the inner (smaller) Protective Action Zone (PAZ), which in the case of Koeberg Nuclear Power Station (KNPS) is 5km. The 16 km UPZ imposes evacuation planning restrictions but does not prevent private development.

All impacts, whether they be on the social, economic or biophysical were assessed in terms of their significance in the context of these assumptions.

All recommendations of the Final EIR will be incorporated in the Environmental Management Plan, which is a document with legal standing and is required to be implemented by Eskom and its appointed contractors and staff on site during the construction, operation and decommissioning

phases of the nuclear power station. The recommendations will also be included as conditions of an Environmental Authorisation but this would be done at the discretion of the Competent Authority, the Department of Environmental Affairs.

RESPONSE FROM THE INDEPENDENT NUCLEAR SPECIALIST

This seems to be largely an environmental impact issue as opposed to nuclear or radiological save for the emergency planning assumptions which are the design base assumptions.

Yours faithfully
for GIBB (Pty) Ltd

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The Nuclear-1 EIA Team