# PROJECT INFORMATION

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| **Title:** | ***Revised*** Draft Environmental Impact Assessment Report for the Eskom Nuclear Power Station and Associated Infrastructure (Nuclear-1) |
| **Environmental Authority:** | Department of Environmental Affairs (DEA) |
| **DEA Reference No.:** | 12/12/20/944 |
| **Applicant:** | Eskom Holdings Limited |
| **Environmental Consultants:** | Arcus GIBB (Pty) Ltd |
| **Date:** | March 2011 |

*Afrikaans and Xhosa versions of this Executive Summary are available from the GIBB Public Participation Office (P.O. Box 3965, Cape Town, 8000; Tel: 021 4699180 Office Hours: Mon to Fri – 09h00 to 13h00 excl. public holidays; Fax: 021 424 5571 and Email: nuclear1@gibb.co.za). The English Version of this document is the Master Copy.*

# EXECUTIVE SUMMARY

## SUMMARY

*The key finding of this Revised Draft Environmental Impact Report is that it is recommended that the DEA consider authorising the Thyspunt site for the Eskom Nuclear-1 Power Station, with conditions.*

## INTRODUCTION

Eskom Holdings Limited (Eskom) proposes to construct, operate and decommission a conventional nuclear power station in South Africa in order to meet the total demand for electricity. Eskom is planning for the construction of additional base-load generation capacity in parallel with energy efficiency advancements and the development of renewable energy generation capacity. South Africa is currently experiencing increasing electricity demand in excess of 3 % percent per year. Based on projections, there is a requirement for more than 40 000 Megawatts (MW) of new electricity generating capacity over the next 20 years. The approved Integrated Resource Plan 2010, which outlines government's strategy for meeting the increasing energy needs, indicates government's commitment to the construction of 9 600 MW of nuclear power by 2030. It is Eskom's intention to investigate the feasibility of pursuing the nuclear power generating capacity required by South Africa.

The legislative requirements for nuclear facilities in South Africa are extensive. In the case of a nuclear power station, two key authorisations are needed from two regulatory authorities namely the Department of Environmental Affairs (DEA[1]) and the National Nuclear Regulator (NNR). These authorisations, and a number of others, are needed prior to the commencement of construction activities.

Environmental authorisation in terms of the National Environmental Management Act (NEMA, Act No. 107 of 1998) and the EIA Regulations (2006) is required before the proposed nuclear power station can be built, as it involves 'listed activities' (i.e. activities which may have potentially detrimental impacts on the environment), the primary ones being:

- *(1a) The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where the energy generation is greater than 20 Megawatts and the facility exceeds an area of one hectare; and*
- *(1b) The construction of facilities or infrastructure, including associated structures or infrastructure, for nuclear reaction including the production, enrichment, processing, reprocessing storage or disposal of nuclear fuels, radioactive products and waste.*

Arcus GIBB (Pty) Ltd (Arcus GIBB) was appointed by Eskom as the independent Environmental Assessment Practitioner (EAP), to undertake the Environmental Impact Assessment (EIA) process and compile an Environmental Impact Report (EIR) and Environmental Management Plan (EMP) for the proposed nuclear power station (hereafter referred to as Nuclear-1) and associated infrastructure. A number of specialists assisted with the EIA and compiled the necessary specialist reports.

The EIA process for Nuclear-1 comprised of two phases, the Scoping Phase and EIA Phase. An application was submitted to the DEA in May 2007 and then amended in July 2008 for a single nuclear power station of up to 4 000 MW. The Scoping Phase of the EIA is complete. The DEA received comments from the relevant provincial environmental authorities and approved the Scoping Report in November 2008. This approval included the recommendation that two of the original five alternative sites assessed during the Scoping Phase, namely Brazil and Schulpfontein in the Northern Cape, be excluded from further consideration in the EIA. The exclusion of these sites was based on limited local

[1] Previously the Department of Environmental Affairs and Tourism

demand and the lack of existing electricity transmission corridors associated with these sites. The DEA approved the Final Plan of Study for the EIA in January 2010.

Based on comments received on the Draft EIR that was provided for public and authority comment during 2010, the Draft EIR has been revised. This document is the Revised Draft EIR for Nuclear-1. It documents the EIA process that has been undertaken to assess the potential environmental impacts of the proposed nuclear power station at any one of the three alternative sites, namely Duynefontein and Bantamsklip in the Western Cape and Thyspunt in the Eastern Cape. It includes revisions to certain specialist reports and makes recommendations with regards to the siting and authorisation and recommended siting of Nuclear-1, based on the outcomes of the EIA.

**ROLES OF GOVERNMENT AUTHORITIES**

The National Nuclear Regulator (NNR) is mandated by the National Nuclear Regulator Act (NNRA, Act No. 47 of 1999) to provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices. In accordance with Section 21 of the NNRA, Eskom is required to submit a formal application to the NNR for a nuclear installation license for the siting, construction, operation, decontamination and decommissioning of the proposed nuclear power station. The NNRA makes provision for the NNR Board to arrange for public hearings pertaining to health, safety and environmental issues related to the specific application.

In terms of the Constitution of the Republic of South Africa (Act No. 108 of 1996) and the NEMA, the DEA is responsible for assessing the impacts of the power station on the environment. In recognition of the dual but distinct responsibility with respect to the assessment of radiation hazards, the NNR and the DEA signed a co-operative agreement. The DEA and NNR have agreed to work in close collaboration on the assessment of nuclear related matters.

**PROJECT DESCRIPTION**

Pressurised Water Reactor (PWR) technology, which uses water as a coolant and moderator, was chosen by Eskom for Nuclear-1. PWRs are the most commonly used nuclear reactors internationally. Eskom is familiar with this technology from a health and safety, as well as an operational perspective, having used it for the past 27 years at the Koeberg Nuclear Power Station (KNPS). A nuclear power station of standard Generation III design is favoured by Eskom due to the operational simplicity and rugged design, availability, reduced possibility of core melt accidents, minimal effect on the environment, optimal fuel use and minimal waste output.

Detailed descriptions of the proposed nuclear plant are not available, as a preferred supplier has not been selected.

The approach used in this EIA process has been to specify enveloping environmental and other relevant requirements, to which the power station design and placement on site must comply. The enveloping criteria have been developed to ensure that they represent the most conservative parameters associated with the various plant alternatives within the PWR technologies.

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 10 000 MW, should this be environmentally or technically feasible. It is estimated that the total footprint required for Nuclear-1 (4 000 MW) is 200 to 280 hectares. In addition to the footprint of the nuclear power station, there will be two categories of exclusion zone for emergency planning purposes, around the power station complex. Internationally accepted exclusion zones are being considered for Nuclear-1. Within the 800 m zone, restrictions on land development would be enforced. The NNR will make the final decision regarding the size of the exclusion zone, as per the NNRA.

The proposed power station complex will include *inter alia* the nuclear reactor, turbine halls, fuel storage facilities, waste handling facilities, intake and outfall structures required to obtain / release water used to cool the process, a desalinisation plant, power lines within the plant site, roads, the high voltage yard, and any other auxiliary service infrastructure. An Open Cycle Gas Turbine Plant (OCGT) will be used for emergency power generation at the Thyspunt site.

In the event that the proposed project is authorised, it is anticipated that the construction will last for approximately 9 years. The first units will start producing electricity commercially 2023 / 2024[2].

**EIA PROCESS, PUBLIC PARTICIPATION AND IMPACT ASSESSMENT**

The EIA process which is being undertaken in accordance with the 2006 EIA Regulations, includes the Public Participation Process (PPP) and the technical specialist studies as well as the issues that have been identified and assessed.

The proposed project was announced mid 2007 when registration of Interested and Affected Parties (I&APs) commenced and which has continued throughout the EIA. Extensive Public Open Days, Key Focus Group Meetings and Key Stakeholder Workshops were held to enable I&APs to discuss the findings of the Draft Scoping Report (DSR) with the EIA Team. I&AP comments were integrated into an updated Issues and Response Report (IRR) and the Final Scoping Report.

The potential impacts associated with Nuclear-1 were identified in the Scoping Phase. A range of alternatives for the proposed project were highlighted and taken forward for further consideration in the EIA Phase.

The baseline environment at each of the alternative sites was investigated by the environmental specialists and described in terms of the physical, biophysical and social aspects. Additional potential impacts were identified through the various specialist studies (desktop and field-based studies) and through the ongoing consultation process with I&APs. Specialists then evaluated the significance of the identified potential impacts and proposed appropriate mitigation measures where necessary. During the EIA Phase the public also contributed relevant local information and knowledge to the EIA and ensured verification that issues had been considered in the environmental investigations. The specialist study findings have been integrated and evaluated in this Draft EIR.

A further key component of the EIA Phase is the public review of the findings presented in this Revised Draft EIR. All registered I&APs have been notified of the Report's availability and of the planned Public Meetings. Key Stakeholder Workshops are being held in the Western and Eastern Cape. The availability of the Revised Draft EIR and arrangements for the Public Meetings have been advertised in the newspapers.

The Revised Draft EIR and accompanying reports will be amended, where appropriate, following comment received from I&APs during the review period. The reports will then be submitted to the DEA for consideration and decision making.

**KEY CHANGES IN FINDINGS**

Key changes in this Revised Draft EIR since the publication of the Draft EIR for comment in 2010 are:

- The abandonment of the plans for the Pebble Bed Modular Reactor (PBMR) Demonstration Power Plant at the KNPS. This Revised Draft EIR therefore contains no mention of the PBMR plans.;
- The completion of the groundwater monitoring study undertaken in 2010 at all three alternative sites. The results of this study provide a higher degree of confidence to the Geohydrological Assessment. It also provides improved confidence that proposed mitigation measures for groundwater drawdown will be effective in preventing impacts on sensitive wetlands such as the Langefonteinvlei at the Thyspunt site;
- The completion of an assessment of debris flows, liquefaction and flooding of the R330 Road at the Thyspunt site. This confirmed that there is no evidence of debris flows at the site or that the conditions exist for debris flow. It also confirms that there is no risk of damage to the Nuclear-1 or to the access roads and minimal risk from the liquefaction of sands (or quicksands), provided that standard engineering practice is used for roads and associated structures;

[2] These dates may differ from dates included in other chapters of the EIR. However 2023 / 2024 is in line with the recently approved 2010 IRP.

- Completion of a waste specialist assessment covering general, hazardous and radioactive wastes. The assessment concluded that there is sufficient capacity for the disposal of all types of waste generated by Nuclear-1 at any of the alternative sites and that the potential impacts of these forms of waste should be minimal, provided that strict control over waste management is exercised, as per legal requirements.
- The Heritage Impact Assessment (HIA) found that the Thyspunt site is regarded as a "Cultural Landscape" as defined by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Convention. The HIA furthermore indicates that there is uncertainty about the nature of the impacts on heritage resources in the central portion of the site. In view of this an application to the South African Heritage Resource Agency (SAHRA) for a permit to perform test excavations at this site was made but is still pending. Such a permit is required in order to confirm the heritage impacts;
- Consideration of two cooling water disposal alternatives at Thyspunt: near-shore and off-shore. The assessment concluded that the near shore outfall is acceptable at Thyspunt from the point of view of marine organisms (e.g. chokka squid). A further chokka squid assessment confirmed that the impacts of the marine disposal of sediment, and warmed cooling water outflows would not result in significant impacts on chokka squid or fishing.
- Disposal of spoil on surf breaks at Thyspunt. The assessment concluded that, minimal impacts will occur as long the recommended deep marine disposal site is used. Whilst increased sediment at Seal Point may affect the manner in which the wave breaks, no increased sediment thickness at St. Francis Bay, Bruce's Beauties and Jeffrey's Bay would occur. The surf conditions at these locations will therefore not be affected.
- A key change to the transport of heavy loads to the Thyspunt site is that an access route for heavy vehicles around Humansdorp has been identified. Consequently heavy construction vehicles accessing the Thyspunt site will not have to travel through the centre of Humansdorp.

## ASSESSMENT OF PROJECT ALTERNATIVES

The consideration of alternatives is a key requirement of an EIA as it provides a basis for choice for the competent authority and I&APs. Alternatives that are considered must be reasonable and feasible. Alternatives considered during the EIA include the following:

- Location of the power station;
- Forms of power generation;
- 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 sites;
- Waste disposal; and
- The no-development alternative (i.e. 'No-Go').

The evaluation of alternatives is based on a combination of the documented specialist assessments, the results of the specialist integration workshop held in November 2009 and Arcus GIBB's integration and assessment of the studies' findings, including the revisions to the specialist reports in late 2010 and early 2011.

### LOCATION OF THE NUCLEAR POWER STATION

The three site alternatives assessed in the EIA Phase are:

- Duynefontein, which is situated adjacent and to the north of the KNPS on the Cape West Coast, approximately 35 km north of Cape Town. The site falls within the existing Eskom-owned property, which includes a nature reserve.

- Bantamsklip, which is situated on the Southern Cape coast, mid-way between Danger and Quoin Points. The site forms a part of the total Bantamsklip Eskom-owned property, and is primarily utilised for flower harvesting and fishing.
- Thyspunt, which is situated on the Eastern Cape coast between Oyster Bay and St. Francis Bay. The site for the proposed Nuclear-1 is currently Eskom-owned, but there are a number of houses on the adjacent properties, outside the proposed nuclear power station's Emergency Planning Zones (EPZs).

The comparative assessment of the three alternative sites was based on:

- Specialist studies: specialists have indicated the relative significance of potential impacts with mitigation at each of the three alternative sites;
- An integration workshop (November 2009), involving all specialists, where potential impacts and ranking of the sites was discussed;
- Costs; and
- Technical requirements (e.g. transmission integration, seismic suitability).

The 259 impacts were grouped into categories and then consolidated and filtered to provide the 16 most important impacts for decision-making. This involved the removal of impacts with low significance, impacts of equal significance across all sites as well as those not applicable to all sites.

An analysis of the impacts showed that Duynefontein could be the preferred site. However it was necessary to consider the relative importance of each of the impact categories between sites and within a site. To this end a weighted numerical comparison of the alternative sites was undertaken in an attempt to identify the most suitable site for Nuclear-1. Technical and environmental factors, including negative and positive impacts, were considered in this comparison. The following nine decision factors were applied in this weighted ranking exercise:

- Transmission integration;
- 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.

The weighted comparison of alternative sites, undertaken in terms of the above-mentioned environmental and technical factors, and the weighting thereof, results in the following scores for the respective alternative sites:

- Duynefontein: -8
- Bantamsklip: -8
- Thyspunt: +5

This result indicates a higher score for Thyspunt, followed by Bantamsklip and Duynefontein. This suggests that Thyspunt is the preferred site from an environmental and technical perspective. The above conclusion has also been tested by applying a non-numerical comparison to the alternative sites and the conclusion with regards to a preferred site remains the same.

Thyspunt is more sensitive from a biophysical and heritage perspective than either Duynefontein or Bantamsklip, primarily due to the quality and number of heritage sites at Thyspunt and its value as a Cultural Landscape. However, there are no issues that would disqualify Thyspunt site from being considered for the establishment of a nuclear power station. This is dependent on confirmation that archaeological sites in the central portion of the power station footprint are not as numerous or of the same importance as the archaeological sites along the coast.

The relative differences between the alternative sites (resulting from the numerical and non-numerical comparison) are material enough to choose Thyspunt above either Bantamsklip or Duynefontein.

## CONCLUSIONS AND RECOMMENDATIONS

**Location of the power station**
The EIA has identified Thyspunt as the preferred site. It is recommended that this site be considered for authorisation by DEA, subject to the confirmation and resolution of the outstanding heritage issues, as well as the conditions and mitigation measures identified in the Revised Draft EIR.

**Forms of power generation**
As far as power generation technologies are concerned, nuclear generation and coal-fired power generation are the only proven base-load technologies. It is preferable to build coal fire power stations closer to the resource for efficiency and cost reasons. The life cycle contributions of nuclear electricity generation to greenhouse gas emissions is small compared to coal-fired electricity generation. This points to nuclear generated electricity being a necessary part of South Africa's strategy to generate an additional 40 000 MW of electricity by 2025. Renewable energy sources such as solar and wind energy do not provide the guaranteed base-load generation capacity that is required. However, this does not preclude the development of renewable energy technologies, which needs to occur in parallel with nuclear energy generation.

**Nuclear plant types**
Pressurised Water Reactors are internationally the most commonly used nuclear reactors. The KNPS uses Pressurised Water Reactor technology and it is therefore a tested form of power generation that has been operating safely for the past 27 years. Eskom is familiar with the technology from a health and safety, as well as from an operational perspective.

**Modes of transport**
Road transport is accepted as the only solution for the transport of heavy loads from the harbours for Duynefontein and Thyspunt. However, at Bantamsklip, due to the extensive infrastructure upgrades that will be required for the transport of heavy equipment from Cape Town harbour, transport by barge from Cape Town harbour has been suggested as an alternative to road transport.

From an environmental point of view, this alternative is regarded as unacceptable, due to the expected significant impacts that would result from the construction of landing facilities for the barge. Although no specific assessment of potential landing points has been conducted, the vertebrate fauna and heritage assessments both identified the coastal strip along the Bantamsklip site as being highly sensitive to disturbance. In any event, the construction of a landing facility for a barge would require a separate EIA process.

Barging of exceptionally heavy loads to Bantamsklip is therefore rejected as an alternative in this EIA**.**

**Positions of the nuclear power station on the sites**
Preliminary site 'envelope' layouts of the power station footprint were developed by Eskom for each alternative site. These layouts were provided to the specialists and were subsequently refined to address some of the issues and concerns that the specialists raised. The specialists' sensitivity maps were integrated and composite sensitivity maps were produced to indicate areas of highest environmental suitability for the proposed nuclear power station. Finalisation of the site layouts, should the power station be authorised, will require detailed investigations, in conjunction with the relevant qualified and experienced specialists, once the preferred site and power plant type is confirmed.

Based on the sizes of the areas that are environmentally suitable for a nuclear power station on the alternative sites (between 172 ha and 293 ha), and the proposed size of the Nuclear-1 footprint (200 to 280 ha), it will not be possible to construct additional power stations, beyond Nuclear-1, at any one of the alternative sites.

In spite of the above-mentioned broad recommendations regarding the number of power stations that could potentially be constructed at each site, it must be emphasized that the current application is for a single nuclear power station of a maximum of 4 000 MW. The cumulative impacts of any additional

nuclear power stations on a particular site (if authorised) would have to be confirmed in a new EIA process prior to any further development.

**Utilisation of abstracted groundwater**
Groundwater will have to be abstracted from deep excavations at all three sites in order to allow for the construction of a Nuclear Island. The preferred alternative with regards to abstraction of groundwater is the storage and utilisation of the water on site. However, due to the volume of water likely to be abstracted, particularly at Thyspunt, some water may also have to be discharged into the sea. Transfer to the municipal water supply system is not regarded as feasible at any of the alternative sites, due to distance from the nearest serviced urban area. Therefore, a combination of storage and discharge to the sea is recommended.

**Fresh water supply**
At all sites desalination provides a guaranteed source of fresh water supply for the lifespan of the proposed nuclear power station without jeopardising the availability of fresh water to other users. A desalinisation plant is therefore the preferred alternative for the provision of fresh water at all alternative sites.

**Management of brine**
Either the disposal of brine into the sea or the co-disposal of brine and cooling water into the sea is environmentally acceptable. Disposal of brine directly into the sea should be utilised only during construction, and brine should be mixed with cooling water that is discharged into the sea during the operational phase.

**Intake of sea water**
The installation of intake and outlet tunnels which entails the installation of undersea pipelines, that obtain water from the ocean and feed cooling water into a storage area (intake basin) located adjacent to the cooling water pump houses is the only feasible alternative for all three alternative sites.

**Outlet of water and chemical effluent**
Outlet structures for cooling water and chemical effluent must be offshore. All releases need to occur at the appropriate distances as described by the relevant specialists. Provided that the specific mitigation measures identified in the marine biology report are adhered to, offshore effluent release is therefore the recommended alternative.

**Management of spoil material**
Based on the findings of the oceanographic modelling and the marine impact assessment, it is recommended that fine spoil be disposed of in the marine environment. The remainder, which cannot be pumped to sea, must be disposed of on land and used for activities like levelling of the HV yard, to minimise the footprint. A landscape architect should be engaged to assist in the appropriate design of the spoil dumps in order to minimise the visual impact.

The only feasible and reasonable alternative for the disposal of Low-Level and Intermediate Level radioactive waste is disposal at the Vaalputs Nuclear Waste Disposal Site. It is the only authorised facility for this form of waste in South Africa and it has sufficient capacity for the waste that will be generated by Nuclear-1.

With regards to High-Level Waste (spent fuel), the only alternative currently available in South Africa is long-term storage of the spent fuel in the nuclear power station. Vaalputs is being considered as a disposal site for High-Level Waste, but the required authorisation processes for this will take several years, so currently the disposal of spent fuel at this facility is not a feasible option.

**No-Go alternative**
Given the urgent power demand based on economic growth in South Africa, the No-Go alternative is not considered to be a logical alternative, as Eskom's mandate is to provide power to the country. Eskom, would in all likelihood, apply to develop more coal-fired power stations if the current application is declined. The life-cycle environmental impacts of coal-fired power generation are much greater than nuclear-fuelled power generation. It would become increasingly difficult to develop more coal-fired power stations in the future, due to carbon tax that would be imposed on countries that continue to emit greenhouse gases. The No-Go alternative would imply that potential benefits that

emanate from the proposed project would not be realised. In this respect, it is important to balance the interest, needs and perceptions of neighbouring communities with the national interest for a secure electricity network that facilitates long-term sustained development of South Africa's economy. Although potential negative impacts of the proposed project would be avoided with the No-Go alternative, it is imperative that South Africa develops its power generation capacity, particularly in the Western and Eastern Cape.

**Key mitigation measures and conditions of authorisation**
The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding at any of the alternative sites, provided that the recommended mitigation and management measures are implemented.

It is imperative that the recommendations for mitigation contained in this EIR, the Environmental Management Plan (EMP) and in the specialist studies be strictly implemented. The mitigation measures for botanical impacts, vertebrate and invertebrate fauna, wetlands, dune geomorphology 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 six months to a year 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.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations (including the technical specialist's recommendations) from this EIA have been included within an EMP (in compliance with the NEMA Regulation 34) which has been included in Appendix F. This EMP should form part of the contract with the contractors appointed to construct the proposed nuclear power station and ancillary infrastructure. The EMP should be used to ensure compliance with environmental specifications and management measures during all phases of the project. The implementation of this EMP for all life cycle phases (i.e. construction, operation and decommissioning) is essential.

The EMP is a dynamic document and as new information becomes available over time, or as lessons are learnt in the implementation of the EMP's recommendations, the EMP must be updated over time.

## SUMMARY OF SPECIALISTS FINDINGS

The potential environmental impacts at the three alternative sites were assessed by the technical specialists[3], and a summary of their findings is provided below.

**Geotechnical suitability**
The potential impacts related to slope stability imposing safety risks without mitigation measures have low significance and consequences at all of the alternative sites, as slope stability design techniques will be employed to deal with these issues. This will principally involve the creation of flatter slope angles, which will require larger volumes of excavations and the need for disposal of greater volumes of spoil. The impacts associated with this (without mitigation) are however of low significance at all three alternative sites. With mitigation, which essentially involves locating the excavations near the sea at Bantamsklip and Thyspunt, the significance of the associated impacts remains low at all sites.

**Seismic risk**
Stress release in the earth's crust causes movement along faults at surface or at depth, resulting in earthquakes. Seismic shockwaves and aftershocks are transmitted with velocities and amplitudes dependent on the rock media through which they travel. It is generally accepted internationally that standard plant can sustain seismic criteria in the order of 0.3 g Peak Ground Acceleration (PGA) for intra-plate sites similar to South Africa. There is no physical upper limit for the seismic design of a

[3] The discussion in this section is restricted to EIA specialist studies. Studies related to the National Nuclear Regulator licensing process (the Human Health Risk Assessment, Site Control and Emergency Response reports) are included as appendices to the draft Environmental Impact Report for information only.

nuclear power stations, but increasing the specification to seismic criteria above 0.3 g increases both cost and time required for design of the power station.

No seismic disqualifiers were found at any of the sites, and they are all suitable for the construction of a nuclear power station. PGA values for the three sites are respectively 0.16 g, 0.23 g and 0.3 g at Thyspunt, Bantamsklip and Duynefontein. Based on the available data and work to date, the Thyspunt site has the highest seismic margin and the lowest seismic hazard in terms of PGAs of the three alternative sites. In addition, in the light of the uncertainty relating to the revised PSHA following the SSHAC procedure, it is recommended from a seismic perspective that the site with the biggest seismic margin (Thyspunt) be selected as the preferred site.

**Geological risk**
The assessment of potential impacts related to geological risk is not only significantly interrelated to the seismic hazard of the site but also to the water quality in the area. Geological hazards have been investigated within radii of 320 km, 40 km and 8 km around the proposed sites.

The three sites are exposed to similar geological conditions. Changes in the geological environment resulting from the mass movement of rock or soft sediment are considered improbable, especially as all three sites are situated on stable plains far away from potentially unstable slopes of higher gradient. Geologically there are no sensitive areas that need to be avoided at the Bantamsklip and Duynefontein sites. At Thyspunt the foundation of critical structures should not cross the contact between the Goudini and Skurweberg Formations. Furthermore, there is no evidence of any recent volcanic activity within the site region of any of the three proposed sites.

The current information related to the sites therefore suggests that there is a low geological risk and no disqualifiers for any of the three alternative sites and surrounding environment.

**Geo-hydrology**
The Geo-hydrological Assessment included a hydrocensus, surface geophysics, drilling, test pumping, packer tests, chemical analysis, numerical flow and transport modelling and monitoring. A groundwater / wetlands monitoring programme was undertaken for 12 months from February 2010 at all sites.

Potential impacts identified at all three coastal sites included flooding by groundwater, depletion of local aquifers, degradation of wetlands, contamination of groundwater, degradation of infrastructure by corrosion and contamination of the shore zone. The potential degradation of wetlands is assessed in the specialist wetland assessment.

The assessment concluded that all three sites are environmentally acceptable, with the majority of the impacts being rated as low before and after mitigation. Radioactive contamination was, however, identified as being of high significance before mitigation, reducing to medium after mitigation (use of nuclear reactor designs meeting the NNR's requirements for normal operational dose emissions and containment of accident emissions). The overall sensitivity of the sites to development, based on the geohydrological conditions, is as follows:

- Duynefontein: Low along the coast, increasing in sensitivity inland;
- Bantamsklip: Low; and
- Thyspunt: Low to medium, but high in wetland areas.

The low sensitivity of the sites is largely based on them being situated in coastal zones, with the groundwater being at or near the end of its flow path and minimal downstream receptors.

**Hydrological conditions**
At all sites there is a potential flood hazard at low points along the coastal frontage of the sites in the event of an unusually high water level. A flooding hazard also exists from ponding of open excavations during the construction phase. The assessment confirmed that potential sea level rises due to global warming would have little effect on the proposed nuclear power station. Climate change should also have a minor effect considering the absence of major watercourse on the sites. Due to hardening of surfaces at the sites the stormwater run-off volumes and peaks are expected to increase by about 25

to 40 times when compared to the pre-development conditions. All impacts can, however, be reduced with the implementation of mitigation measures.

The major characteristics that differentiate the potential impacts at the three alternative sites mainly relate to rainfall, the presence of seasonal wetlands and non-perennial watercourses. Thyspunt has the highest rainfall as well as seasonal wetlands and a non-perennial watercourse. At Duynefontein the potential impact on the seasonal wetlands is less since the rainfall is the lowest of the three sites. Rainfall at Bantamsklip is higher than Duynefontein, but there are no directly affected sensitive hydrological features or any ecologically sensitive wetlands within the footprint area. The direct hydrological impacts at all three sites are therefore considered to be of low to low-medium significance.

**Fresh water supply**
There are no rivers or perennial streams at any of the three alternative sites. Construction and operation of Nuclear-1 will thus not have any direct impacts on surface water supply schemes or catchments. Furthermore, as Nuclear-1 will be developed at coastal sites where groundwater is near the end of the flow path, the only existing groundwater use that could be directly affected is the coastal springs. Any impacts on these springs will be of a localised extent.

Desalination of sea water is identified as the most viable alternative for an assured water supply at all three alternative sites. Desalination has the least potential environmental impacts and it would not be affected by climate change.

**Impacts on dune geomorphology**
The dunes at the Duynefontein site comprise mobile transverse dunes, artificially vegetated transverse dunes and naturally vegetated parabolic dunes. There are no mobile dunes at Bantamsklip but transgressive dunefields and some parabolic dunes. These comprise transverse dunes mostly artificially stabilised with alien vegetation. Groundwater does not “daylight” in the dunes at the Duynefontein or Bantamsklip sites. Thus, there are no potential impacts related to the interaction between groundwater and dune dynamics at these sites.

Access roads and transmission power lines can be built across the mobile dunes at the Duynefontein and Bantamsklip, with potential operational impacts ranging from medium to low significance. Access roads and transmission power lines at Duynefontein can also be built across the artificially vegetated dunefield and vegetated parabolic dunefields with low significant potential operational impacts after rehabilitation. In both cases, mobile dunes in the vicinity of infrastructure would need to be artificially stabilised. Topsoil and stockpiles located on the mobile dunes at Duynefontein will have operational impacts of medium significance. Such stockpiles located on the artificially vegetated dunefields, naturally vegetated parabolic dunefield at Duynefontein or the vegetation dunefields or parabolic dunes at Bantamsklip will have low significant operational impacts.

The interaction between dunes systems and wetlands is complex at the Thyspunt site, since groundwater “daylights” in many inter-dune areas within the Oyster Bay mobile dunefield to form wetlands. The dune dynamics interact with wetland, groundwater and surface water. Thus, any disturbance of the Oyster Bay dunefield may cause significant secondary impacts on wetlands. Furthermore, as a result of the location of the proposed construction of transmission lines and possible haul roads between the nuclear power station in the south and the High Voltage Yard in the north, the potential impacts on dune geomorphology at Thyspunt are potentially more extensive than at the other two alternative sites. Whilst the majority of the impacts will be of low to medium significance, some impacts of high significance (without mitigation) could arise as a result of the construction of the eastern and western access roads across the vegetated dunefield, transmission lines and spoil stockpiles. The considered final positioning of Nuclear-1 (including access roads and power lines), as well as the use of appropriate construction methodology (e.g. use of helicopters for the power line pylon construction and stringing, rehabilitation of damaged areas, minimisation of construction road impacts etc.) will need to be undertaken in close collaboration with a dune geomorphology and wetland specialists to ensure mitigation of the potential impacts on the dunes.

**The risk of debris flow, liquefaction and damage to roads at the Thyspunt Site**
In response to comments from a number of stakeholders, an assessment of the risk of debris flow at the Thyspunt site was undertaken. Debris flows occur on steep slopes and are often started by water.

The assessment concluded that there is no significant risk of debris flow damage to the Nuclear-1 site or to the access roads, because the slopes of the area are not conducive (i.e. steep enough) to debris flows. The preferred footprint for Nuclear-1 is to the south of the mobile dunefields at the site and therefore there is minimal risk from the liquefaction of sands (or quicksands). A detailed investigation into the flooding of the R330 Road concluded that the culverts underneath this road have been sufficient to handle most flooding events in recent history, although there is occasional overtopping of the road. The wing walls of the culverts were damaged during a flood in November 2006 and it is recommended that these be repaired.

**Impacts on air quality**
Owing to the uniformity of the Nuclear-1 power generation process at all alternative sites, the nature of the emissions will be very similar at all sites. The most significant potential air quality impacts would be felt during construction, due to fugitive dust emissions from general construction activities (clearance, excavation, scraping, road surfaces, etc.) and emissions from vehicles and equipment. Construction phase impacts will have a high significance if no or limited mitigation measures are applied, but with mitigation these can be reduced to low significance by tarring of roads and implementation of an air quality management plan.

The operational phase impacts of non-radiological pollutants are predicted to be of low significance. Furthermore, based on the predicted impacts of both non-radioactive and radionuclide emissions, the operational impacts at all the alternative sites would fall safely within legal and guideline limits. Given that the potential impacts are very similar at all three alternative sites, in terms of air quality impacts, there is no preferred site.

**Impacts on flora**
Of the three alternative sites, Bantamsklip will experience the least potential impact on plant communities and species, as the ecosystems on this site are fairly common along this section of coastline, provided that the power station is situated on the eastern half of the site, away from the limestone fynbos. With respect to the Thyspunt and Duynefontein sites, Thyspunt has by far the greatest diversity of vegetation communities, including extensive and highly sensitive wetlands, particularly the Langefonteinvlei in the eastern portion of the site. Thus, of the three alternative sites, Thyspunt will experience potentially the highest level of impact (i.e. is least preferred), followed by Duynefontein (intermediate) and Bantamsklip (most preferred). Mitigation measures proposed by the specialist, such as search and rescue and relocation of rare plant species, rehabilitation of disturbed areas, invasive alien plant control, construction techniques etc. are recommended to reduce the significance of identified potential impacts.

**Impacts on wetlands**
The preferred development footprints at Duynefontein lie well away from the most sensitive wetlands located in the south western portion of the site. Groundwater modelling has confirmed that dewatering activities would have a low risk to these and the natural and artificial wetlands on the site. Without mitigation, the impacts are considered to be of medium negative significance. Similarly, due to the preferred footprint of the development at Bantamsklip, Nuclear-1 would not directly affect the critically important Groot Hagelkraal River and its associated hillslope seeps and valley bottom wetland tributaries. The resulting impacts have been identified to be of medium significance.

At Thyspunt, without mitigation the development could result in profound degradation of relatively unimpacted wetland systems. However, the additional groundwater monitoring and numerical modelling undertaken has confirmed that the effects on the important Langefonteinvlei can be mitigated through the use of appropriate cut-off walls during groundwater drawdown for construction. In addition, should Nuclear-1 be built at this site, the conserved area of wetlands should be extended, which could result in positive impacts. Thus, from a wetlands perspective, the most significant impacts would occur at Thyspunt, with the impacts at both Bantamsklip and Duynefontein being of lesser significance. Mitigation measures recommended by the specialist to either avoid impacting the wetlands or minimise their potential impact (e.g. additional monitoring, implementation of a dewatering design allowing for the controlled redistribution of extracted groundwater back into the aquifer, use of cutoff walls around all sides of the drawdown area, and bridging of wetlands that are unavoidably crossed by access routes) must be implemented.

**Impacts on terrestrial vertebrate fauna**
Most of the potential impacts on vertebrate fauna are common to all three alternative sites, although the severity and significance of those potential impacts may differ between sites.

At Duynefontein the amount of land that is available for development that is not of high faunal sensitivity if limited, but sufficient to allow for Nuclear-1. Nevertheless, the development would have direct negative impacts on faunal habitat within its footprint area. Opportunities for on-site conservation offsets are limited because the land is already managed as part of a nature reserve.

At Bantamsklip, the amount of land that is not of high faunal sensitivity between the coast and the R43 Road available for development is more than sufficient to allow for the development of Nuclear-1. The portion of the property inland of the R43 Road is highly sensitive and should not be developed at all. Highly significant potential conservation offsets are possible at Bantamsklip if the undeveloped land is declared a nature reserve and effectively managed as such.

At Thyspunt, Nuclear-1 would have significant potential negative impacts because of the direct impacts on faunal habitats within the footprint areas, the development of two new access roads, and the need for a development corridor across a large field of mobile dunes. Mitigation measures recommended to either avoid impacts or minimise their significance (e.g. search and rescue operations before commencement of construction, fitting of bird 'flappers' on power lines, use of appropriate external lighting, suitable fence designs, use of appropriate construction and operational methodologies etc.) must be implemented. As for Bantamsklip, highly significant potential conservation offsets are possible at Thyspunt if the undeveloped land is declared a nature reserve and effectively managed as such.

**Impacts on terrestrial invertebrate fauna**
The potential impacts of the proposed Nuclear-1 power station on the terrestrial invertebrate communities are very similar for all three alternative sites and principally relate to the direct destruction of habitats and local populations, the impact of artificial lighting and the potential spread of alien invasive species. There are, however, site-specific differences based on the species found at each site.

None of the butterflies likely to occur in the Cape Flats Dune Fynbos area around Duynefontein are endangered or endemic. The non-vegetated and partially vegetated portions of the site were ranked as being of very low and low sensitivity to development, respectively. Duynefontein is considered to have the lowest sensitivity of all three alternative sites. Although an undescribed species of ant was found on this site, it is a generalist species that is likely to occur in a number of different areas.

Bantamsklip has the lowest overall species richness but is considered to have the highest potential for rare, endemic and relictual invertebrate species. In addition, the discovery of a new mygalomorph spider species and new ant species (although it is considered that this is most likely a generalist), means that Bantamsklip is considered to have the highest sensitivity to development of all three alternative sites.

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.

The sites in order of increasing sensitivity and suitability for development are Duynefontein, then Thyspunt and lastly Bantamsklip. From the viewpoint of potential positive impacts, Duynefontein already enjoys substantial benefits under the management of Eskom, which means that it would experience the least improvement in conservation status. Bantamsklip and Thyspunt on the other hand would benefit substantially from getting more formal protected status. Thus the proposed project would have a potential net positive impact on invertebrate communities at Bantamsklip or Thyspunt.

**Impacts on marine biology**
The nature of the potential marine biology impacts is fairly similar at all the alternative sites. Potentially the most significant impacts are the disruption of the marine environment through the offshore disposal of sediment, and the release of warmed cooling water. Disturbance will also be associated

with the marine disposal of spoil. To minimise the ecological impacts on abalone at Bantamsklip and chokka squid at Thyspunt, it is recommended that spoil only be discarded at deep offshore locations. A medium pumping rate should also be used at Thyspunt. The disposal of spoil will have little potential impact on the chokka squid at Thyspunt when taken in the context of the extensive area over which this species spawns. In addition, only a small proportion of the squid catches are taken in the area expected to be affected by marine spoil disposal.

Heating of seawater will be mitigated by a tunnelled design of the release system through multiple points of release to aid dissipation of excess heat. Water will be released above the sea bottom to minimise effects on the benthic environment and by utilising a very high flow rate at the point of release to maximise mixing with cool surrounding water. Considering chokka squid which are likely to avoid water temperatures elevated above their thermal tolerance range, the area predicted to be affected by an increase in water temperature represents less than a percent of the coastal spawning ground.

From a marine biology perspective, there is no clear preferred site. All sites would have similar levels of negative impacts, and the impacts on all sites could be mitigated sufficiently if the proposed designs are implemented as planned.

**Oceanographic impacts and surf breaks**

Although the major infrastructure for Nuclear-1 will be built at least 10 m above sea level, associated infrastructure such as the intake and outflow channels for cooling water, as well as the possible marine disposal of spoil, may have impacts on physical oceanographic conditions.

Potential construction related oceanographic impacts are likely to be similar at each of the alternative sites and all three of the sites are considered suitable for the construction of Nuclear-1. However, the potential for suspended sediment plumes to impact upon tourism (in particular shark cage diving at Dyer Island) should be considered if Bantamsklip is selected. Analysis has confirmed that sediment plumes may occasionally be visible at Dyer Island. The impacts of the disposal of spoil on surf breaks at Thyspunt will be minimal, assuming that a deep marine disposal site is used, as recommended (as opposed to the alternative shallow site). The modelling of sand movement indicates that spoil will not reach as far north as Jeffreys Bay and will therefore not impact surf conditions there. There will also be very limited impacts on surf conditions close to St. Francis.

Analysis of the thermal plume dispersion at each site indicates that relatively unfavourable dispersion of the thermal plume takes place at Thyspunt, where the plume is seen to hug the coastline and shallow near shore areas. At Bantamsklip, the use of a near shore channel outfall will result in a significantly larger thermal plume than offshore channel tunnel outfalls and consequently the latter is considered the preferred option. The most efficient dispersal of the thermal plume will occur at Duynefontein. However, the dispersion of the plume is considered to be acceptable at all alternative sites.

In terms of impacts on Nuclear-1 itself, these could arise from flooding from the sea and interruption of the cooling water supply. Due to the depth and design of the intakes, interruption of the cooling water supply is not considered a potential impact at any of the sites. Should a tsunami coincide with extreme meteorological conditions (a meteo-tsunami event), water levels could exceed the proposed elevation. However the occurrence of a tsunami is considered improbable given the low risk of seismic activity in the surrounding ocean.

**Economic impacts**

The overall positive macro-economic impacts will be greatest at Bantamsklip and Duynefontein, and less at Thyspunt, as the first two sites are situated in a province with a larger, more diversified economy. Nuclear-1 would result in less dislocation of economic activities (provision of inputs required to operate Nuclear-1 and retention of household income spend within the province) if located at Duynefontein than at either of the other two sites. Macro-economic indicators therefore favour Duynefontein and Bantamsklip.

However, the cost-effectiveness analysis indicates that Thyspunt has a very slight edge over Duynefontein and a somewhat larger edge over Bantamsklip.

The economic impact assessment gives greater weight to the cost-effectiveness analysis, which slightly favours Thyspunt, followed by Duynefontein and Bantamsklip. However, the economic differences between the alternative sites are slight (percentage-wise), and all the sites would have positive economic impacts on national, local and provincial levels. There is very little costs difference between Thyspunt and Duynefontein. However, Bantamsklip would be R6.38 billion more expensive to develop than Thyspunt, and R5.8 billion more expensive to develop than Duynefontein.

**Social impacts**
At a social level, the most significant potential negative impact that may result from the power station relates to accommodation for temporary workers during the construction period. The possibility of an influx of job seekers is also a reality. Temporary workers, combined with the influx of unsuccessful job seekers, can have a number of social impacts. This includes*, inter alia,* conflict with local communities, apparent competition for employment and the possibility of increasing risks of sexually transmitted diseases and unwanted pregnancies resulting in fatherless children. A potential increase in criminal and other illegal activities cannot be excluded.

The most significant potential positive social impact that may be associated with Nuclear-1 is the provision of electricity and its related linkages to the broader national and regional economies in terms of temporary employment, local business opportunities (SMMEs) and possible skills development during construction. The significance and consequence is high in the context of high levels of poverty and unemployment characterising the social environment around all three sites. The extent to which local employment creation during construction can truly be considered positive, depends on the extent to which local labour is utilised and capacitated during the construction process, as well as on ensuring optimal working conditions for labourers.

The most controversial potential impact relates to the perceived risks associated with nuclear incidents. From a social point of view, risk is a "subjective experience" which is felt by, and is different, for everyone. Perceived risks could lead to a change in attitude which, in turn, could change behavior. It is therefore important to ensure a reliable flow of relevant and correct information in order for communities to differentiate between perceived and real risks.

**Visual impacts**
Due to the sheer size of a nuclear power station and its location in relatively open, treeless landscapes along the coast, where there is limited to negligible visual screening by landforms, potential visual impacts at all three sites may be significant. The power station will be visible from up to 5 km, the meteorological and radio masts from up to 10 km and red light on top of the meteorological mast from further than 10 km[4]. However, the visibility of the masts will depend on climatic conditions with cloudy / misty conditions obscuring the masts from view. Apart from the potential impacts on residents, visual impacts may also be experienced by visitors to the area. The impacts would be reduced through the adoption of the mitigation measures proposed by the specialist (e.g. colour of large structures, use of screens, use of appropriate lighting, appropriate positioning of spoil dumps etc.).

**Heritage impacts**
All three alternative sites contain significant heritage resources, being situated in areas which are known to be archaeologically and palaeontologically sensitive and in scenic areas with strong wilderness qualities.

The amount of Late Stone Age heritage that will be impacted at Duynefontein will be substantially less than that of Bantamsklip and Thyspunt. However, Duynefontein is palaeontologically more sensitive. A comprehensive mitigation (excavation) programme could have scientific benefit as it would allow the collection and study of Caenozoic fossils in the deep excavations for the proposed power station., .

At Thyspunt, both the archaeological and palaeontological heritage is prolific, representing a very wide range of material, much of which is very well preserved. Mitigation of impacts at Thyspunt is going to be the most difficult due to accessibility problems, which could impact upon the construction programme for Nuclear-1. Without lengthy and complex mitigation, a great deal of Pleistocene palaeontological and archaeological material will be lost during construction. In addition, the wilderness qualities of this portion of the coast are exceptional and make a substantial contribution to

[4] The EIR has recommended that SODAR technology, which does not require a mast, should be used.

the character of the region, which contributes to the conclusion that Thyspunt conforms to the definition of a 'Cultural Landscape' under the UNESCO World Heritage Convention.

Bantamsklip is almost as sensitive as Thyspunt in terms of heritage. However, mitigation measures will have a better chance of success at Bantamsklip, as heritage sites are more visible and accessible at this site. Nevertheless, although the preservation and volume of archaeological sites at Thyspunt is exceptional, mitigation will be lengthy, expensive and resource intensive, requiring up a year's lead time before construction.

The impacts on human cultural heritage and landscape will therefore be more significant at Thyspunt than at Bantamsklip or Duynefontein. For this reason, Thyspunt is considered to be the least preferred site from a heritage perspective.

**Agricultural impacts**
There is existing agricultural production around all three alternative sites. The types of agricultural production differ markedly, with the area around Duynefontein being characterised by mixed farming, including wheat and grape farming. Milk farming dominates around the Thyspunt site and fynbos flower farming predominates around Bantamsklip. The region around the latter site is also characterised by some dairy farming, beef, sheep and game farming.

The greatest benefit in terms of estimated boosting of agricultural production due to an increased demand for agricultural goods would be at Thyspunt, followed by Bantamsklip (with a smaller increase in production) and then Duynefontein (with zero increase in production). The other major potential impacts of a nuclear power station on agriculture would be the generation of dust during the construction phase (before the tarring of the access roads is completed) and possible agricultural labour shortages. These short term negative impacts are considered to be of lowest significance at Duynefontein, followed by Bantamsklip (low significance) and Thyspunt (medium significance). In consideration of the fact that the negative impacts are generally of a shorter duration than the positive impacts, Thyspunt is considered to be the preferred site (as it would potentially experience the highest increase in agricultural production), followed by Bantamsklip and then Duynefontein.

**Tourism impacts**
The Thyspunt and Bantamsklip communities have expressed opposition to the proposed nuclear power station. The Thyspunt community has expressly highlighted the premium nature of the top-end coastal vacation destination, and the Bantamsklip community has emphasised the new and fragile nature of the developing tourism product and the local dependence thereon. While some Duynefontein tourism stakeholders have personal objections to the construction and operation of another nuclear power station, they recognise the potential for increased business and promote a generally positive outlook for tourism.

The tourism impact assessment has predicted that there would be very little potential impact at Duynefontein during construction. Bantamsklip is predicted to experience a potential 5 % positive impact during construction and Thyspunt is predicted to experience a 7.86 % negative impact on tourism during construction (due to some of the current holiday market not being entirely offset by the growth of business tourism at Thyspunt). During operation, Duynefontein is predicted to experience a potential 1.43 % improvement in tourism, Bantamsklip is predicted to experience a potential 8.57 % improvement and Thyspunt is predicted to experience zero potential impact. All these figures take into account decline in nature-based tourism as well as an increase in business-related tourism associated with the proposed power station.

The rapid growth of the tourism sector in the area near the KNPS since its opening and the increase in business tourism at Lephalale (resulting from construction of the Medupi Power Station) suggests that tourism and a power station can co-exist. Similar experiences have resulted from the operation of nuclear power stations in Europe.

**Noise impacts**
The vast majority of the potential noise impacts associated with the proposed nuclear power station are of low or very low significance. Due to the long distances between the proposed power station and the boundary of Eskom property, there would be no potential noise impact on adjacent land surrounding any of the alternative sites during construction or operation of Nuclear-1. The Open Cycle

Gas Turbine (OCGT) is no longer proposed to be located within the HV Yard but rather inside the power station complex at Thyspunt (the only site where an OCGT is proposed) and as such no significant noise impacts associated with its operation will occur at the nearby farm residences. No specific noise mitigation measures would therefore be required.

No noise impact associated with the construction of new roads to the alternative sites is anticipated, with the exception of the western access road to the Thyspunt, where it would pass within 230 m of the Umzamowethu Township. Mitigation measures include using construction processes and machinery with low noise emission levels, implementation of a fast track procedure to complete the construction process in the shortest possible time and construction work near residences only takes place during normal daytime working hours. Although the transport of materials and equipment to the sites would generate noise at the nearest residences along the access roads, the noise levels would not be high enough to require noise mitigation measures. The transport of heavy machinery by vehicles travelling very slowly on the other hand would result in a noise impact of medium intensity but short duration at residences within 1 km of roads. It is recommended that the residents are given notification prior to any such transportation taking place.

**Impact on transportation systems**
The Duynefontein site does not require significant upgrades to transport systems during the construction and operational phases of Nuclear-1 with regard to road intersections and heavy load road transport. Bantamsklip has a significant impact on the transport network with upgrades required to the public transport system, heavy load routes and road upgrades required for emergency evacuation purposes. Due to the Bantamsklip site's isolated location, transporting heavy loads by road will require significant infrastructure upgrades, which will have a high financial cost. From a biophysical perspective, the construction of marine landing facilities for barging heavy loads to site is dismissed as an alternative. Thyspunt requires significant transport upgrades with regard to public transport and access during the construction phase. These upgrades also contribute to financial cost of construction of the power station at this site. It should be noted that a key change since the publication of the Draft EIR is that an access route for heavy vehicles around Humansdorp has been identified. Consequently heavy construction vehicles accessing the Thyspunt site will not have to travel through the centre of Humansdorp.

**Impacts of nuclear and non-nuclear waste**
The management of construction waste (general and hazardous but not radio-active) and the mitigation of impacts will follow standard practices which will be detailed in the Construction Environmental Management Plan.

A review of the waste sites in proximity to the Duynefontein, Bantamsklip and Thyspunt sites have revealed that there is sufficient disposal capacity in the vicinity of these sites. Long-term agreements should be entered into with the managers of these sites to secure disposal space. The potential for recycling construction and operational waste (non-radioactive) will need to be closely examined as radioactive and non-radioactive wastes must be kept separate. At this stage it is considered that the separation of the radioactive fraction is a challenge and may make recycling inefficient and expensive.

The management of radioactive waste must be undertaken according to standards as laid down by the International Atomic Energy Agency, which follow international best practice. The Vaalputs Nuclear Waste Site has the capacity to handle the additional low-level and intermediate-level radioactive waste that will be produced by Nuclear-1 and is regarded as a safe and well-managed site. High-level radioactive waste will be stored on site (as has been the practice at the KNPS) until an authorised facility for the disposal of high-level waste is available in South Africa. This holds no significant risks, provided that the spent fuel waste is contained within a protected area according to management practices approved by the NNR.

**Risks to human health**
Provided that the NNR's statutory limits are adhered to, and that Eskom can demonstrate to the NNR that the design of the proposed Nuclear-1 will not exceed these statutory constraints as part of the NNR application process, then there should be no impact on human health during normal operations. This finding is supported by the air quality assessment, which found that airborne radionuclide levels would be so low that there would be no effect on human health.

**Impacts on emergency response**
From a safety point of view, a site is considered acceptable if there are technical solutions to site problems which give assurance that the proposed plant can be built and operated with an acceptably low risk to the population of the region. The assessment indicates that all three sites will experience impacts of equal significance and all three sites are regarded as acceptable. In spite of this, Duynefontein site may be considered marginally less suitable than the other two sites due to the large surrounding population. In line with the newly adopted European Utility Requirements (in terms of which the proposed nuclear power station will be constructed), there should be no or minimal need for emergency interventions (e.g. evacuation) beyond 800 m from the reactor. The 800 m emergency planning zone can be provided within Eskom property at all the alternative sites.

**Site control and access**
In general, the impacts that will be experienced at all three sites, to varying degrees, are restriction of public access and improved protection of the environment within the fenced boundary.

The overall impact of restricted access to the site during construction and operation is considered to be of low – medium negative significance without mitigation at all three sites. This is because:

- Access to Duynefontein is already largely controlled because the site is within the existing boundary of the KNPS. Due to its proximity to the KNPS, the site is not known to be an important access point to the coast for the public at present.
- The Bantamsklip site is currently fenced and not legally accessible to the general public as it is Eskom-owned private property. It is assumed that access to and along the R43 Road located within the site will be maintained for the public.
- The Thyspunt site is currently fenced and not legally accessible to the general public as it is Eskom-owned private property.

The development of the Bantamsklip site would have a potential beneficial impact in terms of providing stricter control over poachers of abalone.

**Transmission Integration**
For the electricity generated by the proposed nuclear power station to be made available to end-use customers, it needs to be transmitted from the High Voltage Yard at the power station through a network of high voltage transmission lines and then through a series of distribution lines. The Eskom transmission system design philosophy is to connect new base load generation to the closest load wherever possible. After considering a number of integration factors (e.g. system reliability and quality of supply, future potential for generation in each province, line length required and infrastructure cost) it was concluded that:

- The development of a power station in the Eastern Cape will result in a substantial improvement in system adequacy and supply security in the local area, as it has no base-load generating capacity;
- 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; and
- Development of the Duynefontein site will result in a concentration of the generation in one area as opposed to diversifying the generation closer to major load centres.

Therefore, from a transmission integration perspective, the preferred site is Thyspunt.

**WAY FORWARD**
The NNR is mandated by the NNRA to provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices. In accordance with Section 21 of the NNRA, Eskom is required to submit a formal application to the NNR for a nuclear installation license for the siting, construction, operation, decontamination and decommissioning of a nuclear power station. The Act makes provision for the NNR Board to arrange for public hearings pertaining to health, safety and environmental issues related to the specific application.

In terms of the Constitution of the Republic of South Africa (Act No. 108 of 1996) and the National Environmental Management Act, the DEA is responsible for assessing the impacts of the power station on the environment. In recognition of the dual but distinct responsibility with respect to the assessment of radiation hazards, the NNR and the DEA have signed a co-operative agreement in which it is agreed that the DEA, the lead authority on environmental matters, and NNR will work in close collaboration on the assessment of nuclear-related matters. With respect to this EIA, specialist studies relating to radiological issues have been included for information which will support the DEA decision making.

This Revised Draft EIR has been distributed for comment to all registered I&APs. A number of public interactions will be held during the comment period on this Revised Draft EIR. All comments on the document will be considered by Arcus GIBB and a response thereto will be provided in a revised Issues and Response Report (IRR), prior to submission of the Final EIR to the DEA for decision-making.

It is anticipated that Eastern Cape DEAET and the Western Cape DEA&DP, as well as the NNR (amongst other Government Departments), would provide comment to the DEA on the adequacy of the Final EIR. The DEA will consider these comments prior to making a decision on the acceptability of the proposed Nuclear-1 project. All I&APs will be notified of the availability of the Final EIR for information purposes, as well as of the DEA's decision.

Should the DEA authorise the proposed nuclear power station, it must be authorised strictly according to the conditions indicated in the Revised Draft EIR. 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.

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.