PEER REVIEW REPORT

EMERGENCY RESPONSE REPORT

FOR NUCLEAR 1 ENVIRONMENTAL IMPACT ASSESSMENT

PREPARED BY: **CAIRNS A R BAIN**

VERSION 1 **DATE: NOVEMBER 2015**

CONTENTS

1 INTRODUCTION **1**

2 SCOPE OF WORK **1**

3 REVIEW FINDINGS **2**

4 CONCLUSIONS **5**

1 INTRODUCTION

Dr C A R Bain Pri. Sci. Nat. Consultant was appointed by Gibb (Pty) Ltd. To undertake a peer review of specialist report "Emergency Response Report November 2014" (referred to subsequently as the Report) compiled by J Slabbert for the proposed Nuclear 1 Power Station project which covers the three sites situated at Thyspunt in Eastern Cape Province and Bantamsklip and Duynefontein in the Western Cape Province of South Africa

2 SCOPE OF WORK

The scope of work as supplied by Gibb for this review study is the following:

1. Assess the document/ Report in terms of its fulfilment of its Terms of Reference set;
2. Consider whether the Report is entirely objective;
3. Consider whether the Report is technically, scientifically and professionally credible;
4. Consider whether the method and the study approach is defensible;
5. Identify whether there are any information gaps, omissions or errors;
6. Consider whether the recommendations presented are sensible and present the best options;
7. Consider whether there are alternative viewpoints around issues presented in the Report and if these are clearly stated;
8. Consider whether the style of the Report is written so as to make it accessible to non-specialists, technical jargon is explained and impacts are described using comparative analogies where necessary; and
9. Report on whether normal standards of professional practice and competence have been met.

3 REVIEW FINDINGS

3.1 Fulfilment of Terms of Reference

The terms of reference are given in the Report specific to Emergency Response and stated as “the qualitative assessment of the feasibility of a nuclear emergency plan for the sites”. Demonstration of feasibility is also a requirement of the National Nuclear Regulator (NNR). The many stages discussed towards feasibility and establishing the emergency plan are outlined in this review in section 3.4. All these stages and their respective discussions show complete fulfilment of the terms of reference. In fact the Report goes beyond this in that preliminary quantitative aspects for the sites for relevant reactors is included.

3.2 Report Objectivity

The Report is based on regulatory requirements, international guide lines, site and regional specific data and information and scientifically accepted methodology for the quantification of accident doses. The findings are based on objective information. The computer code COSYMA used for estimating dose from accidents is widely used in Europe’s nuclear industry. The three sites are not ranked for feasibility of emergency plan at this preliminary stage. However the special nature of Duynefontein being on an existing nuclear site with a much larger current emergency planning zone means its emergency plan feasibility is effectively assured. At the other sites any negative regional factors can be allowed for in planning actions and the Report justifiable concludes together with the other criteria, that effective emergency plans are feasible at these sites. The Report is considered to be wholly objective.

3.3 Technical, Scientific and Professional Credibility

The subject matter is of a high technical and scientific content and together with regulatory requirements is covered in a comprehensible well-structured manner. The Report is well supported with tabulations and extensive references. The fact that the Report has extended the terms of reference from qualitative to a preliminary quantitative assessment of the feasibility of the emergency plan shows a high level of professionalism and confirms the overall level of credibility.

3.4 Defensibility of Methodology and Study Approach

The emergency planning objectives and terms of reference are given in the Report. In essence the approach taken is to consider what emergency or accident are you planning for? Firstly the nuclear nature means all the relevant national and

international requirement need to be addressed. This is further answered by considering severe type accidents with frequency of occurrence of less than 1.0 E-06 (one in a million) and their characteristics. The design features of such accidents are then discussed in regard to source term of discharge (detailed in Appendix) i.e. which radionuclides and their magnitude. These are the design extension condition accident that include core melt. The technical basis of the emergency planning zones concerning interventions for evacuation, sheltering and consumption control with associated dose limits is considered. The objective is to mitigate stochastic dose effects and prevent deterministic effects. These in turn relate to various site and regional characteristics. Firstly those that effect the dose received via air dispersion of source term released i.e. the meteorology and air dispersion coefficients and then agricultural practice that affects dose from local food consumption. The physical planning aspects to make the plan work include; knowledge of physical features; population density; infrastructure of roads suitable for evacuation and for bringing help; communication infrastructure (radio and phones). Then the aspect that makes it practical is organisational at power plant, municipal provincial, national and international level. All the above aspects and their interrelations go together to establish the feasibility of the overall emergency plan. Lessons learnt from Fukushima nuclear accident are included. This approach and methodology described is eminently defensible on the grounds of thoroughly covering all aspects, meeting international norms and arriving at an outcome aimed for. Furthermore the preliminary quantitative analysis has two findings. Firstly that modelled air dispersion coefficients for the two new sites are shown to be orders of magnitude within the criteria set for dispersion potential for accident conditions. Secondly using the GEN III type reactor severe accident source terms the estimated dose mostly meets the distance objectives for Emergency Planning Zones for the different possible protection actions. This confirms the feasibility of the emergency plan related to new proposed reactor types. The quantitative results will be subject to refinement and confirmation at later nuclear licensing phase.

All the above are linked to international and national regulatory requirements and based on accepted computer codes used in European nuclear industry. The methodology is up to date and well supported with references and can generally be well defended.

3.5 Information Gaps, Omissions or Errors

Typographical: Generally small grammatical errors are not noted. The following few typographical, layout errors are noted.

P vii: in Glossary the item Accident in definition 3rd line “of potential” to read “or potential”

P vii: in Glossary the item Iodine in definition 2nd line “uptake or“to read “uptake of”

P viii: in Glossary the item Ground shine is misplaced alphabetically.

Error in page numbering: All main text pages are numbered as p 31.

Error in layout Table 4-1 just heading on blank page then appears in full next page. This occurs for several other Tables. Maybe a fault with PDF file conversion?

Possible Gaps

There is no reference in section 4.1 Technical Basis for planning guidelines of European Utility Requirements.

The reference [15] to air quality coefficient appears to be rather dated from 1982.

A list of abbreviations would be useful.

3.6 Sensibility of Recommendations and Presentation of Best Options

The main recommendations of the Report are that effective emergency plans for each of the new sites are feasible subject to some measure of infrastructure upgrade particularly for roads with allowance for flooding in some areas. The existing Koeberg nuclear power station site emergency plan will include the Duynefontein site with its feasibility findings. The air dispersion coefficients are found to be very favourable. These recommendations are all based on requirements of international criteria and national regulations and are eminently suitable. The extent of flooding upgrade will have to take in account long term climate change aspects. The preliminary quantitative dose findings for meeting the emergency planning zones distance objective of 800m show that the new GEN III type reactor, AP1000 does not achieve 10 mSv at that distance but can meet the dose objective at 2km distance. The Report recommends that in that case the exclusion zone can be shifted to 2km as that is on the designed boundary of the power plant site. This is a very practical suggestion but the caveat mentioned in the Report that more refined quantitative studies in future when reactor design is defined may not require it. The best option waits for the future. The other important conclusion is that although short-term emergency interventions are unlikely, some protective actions related to food may be required for a limited post-accident period. Three such actions are mentioned. Once more these actions are to meet international good practice.

3.7 Alternative Viewpoints Presentation and Clarity of Statement

There are no significant alternative viewpoints presented in the Report.

3.8 Accessibility of Style of Report to Non-specialists

The style of the report is generally effective in communicating the complexities of the subject to the non-specialist. A lot of good background is given to set the scene

for why and what needs to be done. The thoughtful reader should gain some measure of assurance in the thoroughness that the nuclear industry applies to designing for safety. The Executive Summary mentions a fundamental safety objective for a nuclear facility is to protect both people and the environment from harmful effects of ionizing radiation. The last step in the multiple Defence-in-Depth approach in designing a nuclear plant is in fact the emergency plan, which here has been thoroughly presented.

The use of Table 4-1 for Dose Estimates for Severe Accidents is very informative as it reveals how, for different reactor types, the emergency zones and protective actions are linked to objectives of the planning zones. It in fact acts as a summary of the whole process of assessing suitability of reactor options. For non-specialists however there may be confusion that the title of the table speaks of UPZ and LPZ zones but only EPZ is used in the columns. This should be better explained and linked to 1mSv dose value, or the glossary definition of EPZ can be expanded.

The lessons learnt from Fukushima are also assuring. Further background material is given in the Appendix for Reference Accident for EPZ assessment. The accessibility is supported with several diagrams, charts and tables, a helpful glossary, and detailed referencing.

3.9 Meeting of normal Standards of Professional Practice and Competence

The Report meets the normal standards of professional practice and competence and goes beyond these by furthering the terms of reference by providing preliminary quantitative dose data for accident conditions which puts the emergency plan feasibility findings on a firmer footing. The report is well structured and competently executed to cover the many stages to achieve its objective.

4 CONCLUSIONS

The review process has addressed all 9 points of the Scope of Work and is satisfied they have been met as indicated in each section.