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 Pressurised 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?

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 islimited 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?

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 licence? 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)

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.

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

Introduction

An estimate of the cost of the intake tunnels will be approximate in that costs will be estimated at a concept level.

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 13.11.2 "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 $42m^2$ 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.

Costs

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)

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 is1500 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

Intake tower on sea bed

This tower will stand about 10 m above the sea bed. Estimated cost **R 30** million

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

Total cost of the intake tunnels and related infrastructure.

Summing the rand values in bold comes to a value of **R 477** Million

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

Appendix 1

Excerpt from file: Revised DEIR 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.