10 CONCLUSIONS AND RECOMMENDATIONS (ENVIRONMENTAL IMPACT STATEMENT)

10.1 Need for the project

The need for additional base-load electricity capacity in South Africa is proven. The reserve margin (the difference between maximum generating capacity and demand) has been steadily declining over the last decade, and in spite of the current stable conditions after load shedding in late 2007 and early 2008, the country's reserve is still below the ideal. There has been an increase in demand in the latter part of 2009 and in the first two months of 2010. Continuing trends in electricity demand indicate that South Africa needs to an additional 40 000 MW of new generation capacity by 2025.

Of this 40 000 MW, 12 476 MW is already under construction in the form of the Medupi and Kusile coal fired power stations, the return to service of coal fired power stations and the Ingula pumped storage scheme. This leaves around 25 000 MW, which must be generated from additional sources. There are a number of sources available to Eskom, including demand side management, renewable energy and base-load power generation. However, the only generation alternatives that can provide a reliable and sufficient base load generating capacity are coal-fired and nuclear electricity generation.

South Africa is already heavily reliant on coal-fired electricity generation, and needs to limit its reliance on coal in order to reduce its greenhouse gas emissions. Eskom has indicated its intention is to reduce the utilities' relative CO_2 footprint until 2025, and thereafter to continually reduce absolute emissions in support of national and global targets. In life-cycle terms, nuclear power releases approximately the same amount of greenhouse gases as renewable power, such as wind and solar power. Nuclear power will therefore form an important part of Eskom's strategy to increase base load generation capacity and to reduce its greenhouse gas emissions. Eskom is proposing to construct a nuclear power station based on Pressurised Water Reactor (PWR) technology. Although its intention is to construct more than one nuclear power station in the future, this Environmental Impact Assessment (EIA) is for a single power station, of a maximum capacity of 4 000 MW at one of three alternative sites (Duynefontein, Bantamsklip and Thyspunt).

10.2 Key technical considerations

Eskom's Nuclear Site Investigation Programme (NSIP) in the mid-1980s investigated the technical feasibility of five alternative sites, namely Thyspunt (Eastern Cape), Bantamsklip and Duynefontein (Western Cape), Brazil and Schulpfontein (Northern Cape). All these alternative sites were found to be technically feasible for the construction, operation and decommissioning of a conventional nuclear power station. However, because of the difficulty to integrate with the transmission system (amongst other reasons) the Northern Cape sites were removed from further consideration at the end of the Scoping Phase of this EIA.

Studies regarding transmission issues have noted that the development of the Duynefontein site will result in an increased capacity of the generation pool in the Western Cape, which means a concentration of generation in one area at the expense of another. Strategically this exposes the transmission system to more risk as opposed to diversifying the generation closer to major load centres. This is the overriding strategic transmission advantage of the Thyspunt site, which will provide a new base load generation pool in a weak part of the Eskom transmission network and enable future potential load growth for the Eastern Cape.

10.3 Key environmental considerations and potential impacts

The development of a nuclear power station at all three alternative sites has the potential to result in significant environmental impacts (positive and negative) at the sites and beyond. The potential environmental impacts of highest significance at the Thyspunt, Bantamsklip and Duynefontein sites are as follows:

10.3.1 Geology and 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. Current information related to the sites, however, suggests that there is a low geological risk and no disqualifiers for any of the three alternative sites and surrounding natural environment.

10.3.2 Seismological risk

A key consideration with respect to seismic risk is the ability of the nuclear power plant to meet a design basis seismic event. The design basis seismic event is that event which will be used in the conservative design of the important to safety and safety critical structures, systems and components of the nuclear power station. For a standard export plant it is the seismic event against which the standard design is checked to ensure that the power station can be built on the specific site under consideration. The beyond design basis seismic event is that event which is used to ensure that no ‘cliff edge’ effects exist in the design which could endanger the fundamental safety functions.

Based on work completed to date none of the alternative sites are considered to have any seismic disqualifiers. Future information which will be developed from the Senior Seismic Hazard Advisory Committee (SSHAC) process, which will only be completed within the next 2 to 3 years, could result in the seismic risk rating of the respective sites either increasing or decreasing.

The design basis for standard nuclear power stations is considered to be based on a seismic risk of 0.3 g, a rating beyond such a parameter would necessitate the re-evaluation and design of a standard plant, resulting in potentially significant financial additions to the overall construction and operational cost of the plant.

The seismic risks at the alternative sites vary considerably. Seismic studies completed to date indicate that the design basis for the respective sites are as follows:

- Duynefontein - PGA (~0.3 g)
- Bantamsklip - PGA (~0.23 g)
- Thyspunt - PGA (~0.16 g)

Peak ground acceleration (PGA) values associated with the alternative sites are provided above. Thyspunt demonstrates considerably lower risk with respect to any future variations arising from the SSHAC process, which is in the process of being completed for the three alternative sites. Depending on the outcome of the process, possible subsequent deviations from a standard nuclear power station design, which is more likely to be the case for the Bantamsklip and Duynefontein sites, will result in potentially significant cost and time delays to Nuclear-1 should it be authorised.

10.3.3 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. The potential impacts associated with larger volume excavations in sands will however be significant to varying degrees on all of the alternative sites, depending on the final footprints chosen.

10.3.4 Hydrological conditions

The hydrological assessment investigated the suitability of the alternative sites in terms of the hydrological conditions and features streams, rivers and other forms of watercourses. The potential impacts in terms of the hydrological environment relate to potential flood hazard at low points along the coastal frontage of the EIA corridor and increased surface run-off volumes and peaks. However, the major characteristics that differentiate the potential impacts on the environment at the three alternative sites mainly relate to rainfall, the presence of seasonal wetlands and non-perennial watercourses. The potential direct hydrological impacts at all three alternative sites are low in significance.

10.3.5 Freshwater supply

There are no rivers or perennial streams at any of the three alternative sites and as the nuclear power station will be constructed at a coastal site, where groundwater is near the end of the flow path. The only existing groundwater use that could be directly affected is that from coastal springs. Desalination of sea water is thus the most viable alternative for an assured water supply with least potential environmental impact. This alternative source of water would not be affected by climate change.

10.3.6 Impacts on dune geomorphology

Groundwater does not “daylight” 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 lines can be built across the mobile dunes at the Duynefontein and Bantamsklip, with potential operational impacts ranging from medium to low. Access roads and transmission lines at Duynefontein can be built across the artificially vegetated dunefield and vegetated parabolic dune fields with low potential operational impacts after rehabilitation. In both cases, mobile dunes in the vicinity of infrastructure would need to be artificially stabilised.

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 dunefield to form wetlands. The dune dynamics interacts 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, haul roads and conveyor belts between the nuclear power station in the south and the HV yard in the north, the potential impacts on dune geomorphology at Thyspunt are potentially much more extensive than at the other two alternative sites. The considered final positioning of the proposed nuclear power station (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 the stringing thereof, rehabilitation of damaged areas, minimisation of construction roads etc.) will be need to ensure the mitigation of potential impacts on the dunes.

10.3.7 Air quality impacts

Owing to the uniformity of the nuclear power station power generation process at all alternative sites, the nature of the emissions will be very similar at all alternative 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 potential impacts will have a high significance if no or limited mitigation measures are applied, but with mitigation can be reduced to low significance by tarring of roads.

The operational phase potential impacts of non-radiological pollutants are predicted to be very low. 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. The potential impacts are very similar at all three alternative sites and there is no preferred site as far as the impacts on air quality is concerned.

10.1 Impact 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 the nuclear power station is situated on the eastern half of the EIA corridor, away from the limestone fynbos. With respect to the Thyspunt and Duynefontein sites, Thyspunt has by far the greatest diversity of vegetation communities. This includes extensive and highly sensitive wetlands, particularly the Langefontein wetland complex 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.

10.3.8 Impact on wetlands

The development of a nuclear power station at Duynefontein is unlikely to result in any unmitigable, highly significant impacts on wetlands. Development of the proposed nuclear power station at Bantamsklip would not be associated with any unmitigable impacts to wetland systems. Once mitigated, impacts on this site would be of low significance.

At Thyspunt issues to be considered in terms of potential impacts to wetland systems is more complex. It is suspected that there is a high degree of interaction between the dune systems and the wetlands. Thus, from a wetlands perspective, by far most serious potential impacts would occur at Thyspunt, with the impacts at both Bantamsklip and Duynefontein being of lesser (medium) significance. Mitigation measures recommended by the specialist to either avoid impacting the wetlands by infrastructure or minimise their potential impact (e.g. additional monitoring, leaving a buffer zone around wetlands, use of conveyor belts for sand transfer across the site etc.) must be implemented to minimise potential impacts.

10.3.9 Terrestrial vertebrate impacts

Most of the predicted 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 not of high faunal sensitivity between the coastal and R43 available for development, is more than sufficient to allow for the nuclear power station. The portion of the property inland of the R43 is highly sensitive and should not be developed at all.

At Bantamsklip the nuclear power station would have significant negative potential impacts because of the direct impacts on faunal habitats within the footprint areas. However, highly significant potential offsets are possible at Bantamsklip if undeveloped land is declared a nature reserve and is effectively managed as such. At Thyspunt a nuclear power station would have significant potential negative impacts because of the direct impacts on faunal habitats within the footprint areas, the development of two major new access roads, and the need for a development corridor across a large field of mobile dunes. Mitigation measures recommended by the specialist to either avoid impacting the terrestrial vertebrate fauna habitats by infrastructure or minimise their potential impact (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 to minimise potential impacts.

10.3.10 Terrestrial invertebrate impacts

The potential impacts of the proposed Nuclear-1 power station on the terrestrial invertebrate communities are very similar for all three alternative sites, but there are site-specific differences based on the species found here. 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 of very low and low sensitivity respectively. The undescribed species of ant found at Duynefontein is regarded as a generalist and is most likely to be found on other areas of the site.

Thyspunt has in all probability the highest butterfly diversity and conservation value of the three sites studied. Thyspunt is identified as higher sensitivity than Duynefontein, and only marginally lower than Bantamsklip. The sites in order of increasing sensitivity and suitability are Duynefontein (lowest overall significance potential impact), then Thyspunt and lastly Bantamsklip (highest significance overall potential impact). From the viewpoint of potential positive impacts of the nuclear power station, 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. .

10.3.11 Impacts on marine biology

The nature of the potential marine biology impacts is fairly similar at all the sites. The most significant potential 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 discarding of spoil. This potential impact will have a highly significant long-term negative affect on the marine environment.

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.

10.3.12 Oceanographic impacts

Although the major infrastructure for the nuclear power station 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 disposal of spoil and sediment in the sea, may have an impact of 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 suitable for the construction of the nuclear power station. 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. 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. The most efficient dispersal of the thermal plume will occur at Duynefontein. However, the dispersion of the thermal plume is considered to be acceptable at all sites.

10.3.13 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 if located at Duynefontein than at either of the other two alternative sites. Macroeconomic indicators 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 differences between the alternative sites are slight, and all the sites would have large positive economic impacts both on the local area and the province in which they are situated.

The economic impact assessment gives greater weight to the cost-effectiveness analysis. This favours Thyspunt as the preferred site, followed by Duynefontein and Bantamsklip.

10.3.14 Social impacts

At a social level, the most significant potential negative impacts that may result from the nuclear power station relates to accommodation for temporary workers, particularly during the construction phase. The possibility of an influx of job seekers is also a reality. Temporary workers, combined with influx of unsuccessful job seekers, can have a number of potential social impacts. This includes*, inter alia,* conflict with local communities, apparent competition for employment and the possibility of single men engaging in relations with local women (possibly increasing the risk of STDs, HIV and AIDS 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 the proposed nuclear power station 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 all three alternative 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.

10.3.15 Visual impacts

Due to the sheer size of a nuclear power station and its location in relative open, treeless landscapes along the coast, where there is limited to negligible visual screening by landforms. Potential visual impacts at all three alternative sites may be significant. Apart from the potential impacts on residents, visual impacts may also be experienced by visitors to the area. Mitigation proposed by the specialist (e.g. colour of large structures, use of screens, use of appropriate lighting, appropriate positioning of spoil dumps etc.) need to be implemented to reduce potential negative impacts should the proposed power station be authorised.

10.3.16 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 potentially impacted at Duynefontein will be substantially less than that of Bantamsklip and Thyspunt. However, Duynefontein is palaeontologically highly sensitive. Bantamsklip is almost as sensitive as Thyspunt in terms of its heritage richness. However, mitigation measures will have a better chance of success at Bantamsklip, as heritage sites are more visible and accessible at Bantamsklip. Mitigation of impacts at Thyspunt is going to be the most difficult due to accessibility problems but will potentially positively benefit the research community.

10.3.17 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 area 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 would be at Thyspunt, followed by Bantamsklip 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, possible agricultural labour shortages and positive market effects. Although the significance of potential impacts is similar for all three alternative sites, from an agricultural production perspective Thyspunt is the preferred site, as agricultural production has the potential to increase the most at this site.

10.3.18 Tourism impacts

The Thyspunt and Bantamsklip communities have expressed the most adamant 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. 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 nuclear power station.

10.3.19 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 stations and the boundaries of the Eskom properties, there would be no potential noise impact on adjacent land surrounding any of the three alternative sites during construction or operation of Nuclear-1. No specific noise mitigation measures would therefore be required.

However, it is predicted that the Open Cycle Gas Turbine (OCGT) peaking power plant proposed for Thyspunt would result in a potential noise impact on residences situated within 1 000 m of the plant. It is recommended that this be confirmed by a noise prediction study once quantitative noise emission data of the actual plant to be installed is available. 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.

10.3.20 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 very high financial cost. 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.

10.4 Assessment of alternatives

Alternatives were not only assessed in terms of the requirements of the NEMA and its associated legislation, but also to provide a means of reaching the same need and purpose as the originally proposed project in a way that minimises its negative and maximises its positive potential impacts. The alternatives considered within the categories below are considered to be reasonable and feasible:

- Location of the power station;
- Forms of power generation;
- Nuclear plant types;
- Layout of the nuclear plant;
- Fresh water supply;
- Management of brine;
- Intake of sea water;
- Outlet of water and chemical effluent;
- Management of spoil material;
- Access roads to the sites;
- Waste disposal; and
- The no-development alternative (i.e. 'No-Go').

10.5 Conclusions and recommendations

(a) Location of the proposed power station

The comparative assessment of the three alternative sites by Arcus GIBB was based on the following:

- Results of the specialist studies: specialists have indicated the relative significance of potential impacts with mitigation at each of the three alternative sites;
- An integration workshop, involving all specialists, on 24 and 25 November 2009, where potential impacts and ranking of the alternative sites was discussed;
- Costs; and
- Transmission integration requirements.

Although there are obvious differences between the significance of the potential impacts of the three alternative sites, all specialists agreed that there are no fatal flaws at any of the sites (provided appropriate mitigation is implemented). The specialist further collectively agreed that all three alternative sites are suitable for development of a nuclear power station in time, given sufficient mitigation of impacts. Although the current application is only for a single nuclear power station, the assessment confirmed that all sites are suitable for the construction, operation and decommissioning of a nuclear power station(s).

The impacts of high and medium significance after mitigation were considered important for decision-making. These impacts were further filtered to a manageable number of key impacts for the purpose of decision-making. The following decision factors were selected as most important for decision-making:

- Transmission integration factors;
- Seismic suitability of the sites;
- Impacts on dune geomorphology;

- Impacts on wetlands;
- Impacts on vertebrate fauna;
- Impacts on invertebrate fauna; and
- Economic impacts.

The Bantamsklip alternative would be costly because its location would require longer and larger transmission lines than either of the other two sites (900 km of combined 765kV and 400kV transmission lines at Bantamsklip vs. 500 km and 190 km of 400 kV lines at Thyspunt and Duynefontein respectively). The road and bridge upgrades that would have to take place to transport extra heavy loads from Cape Town harbour to Bantamsklip also contribute to the high costs of this site. The Bantamsklip alternative would be R 8 billion less costs effective than either of the other two alternative sites. **Despite the positive benefits that could potentially be realised through conservation of the northern portion of the site, bearing the cost and integration factors in mind, the Bantamsklip site was regarded as the least preferred site alternative and was removed from further consideration for this application.** Only Thyspunt and Duynefontein were considered for selection of a recommended site and were compared using a numerical ranking model that takes only the weighted (filtered) decision factors into account. Thyspunt was identified as the preferred site for Nuclear-1.

The most important argument in favour of Thyspunt with regards to biophysical impacts is the conservation benefits that would be realised through access control and active management of the site in the event of a nuclear power station being constructed there. This benefit would not be realised at Duynefontein, as the Koeberg Private Nature Reserve already includes the Duynefontein site. In addition the Thyspunt site has a considerably lower seismic risk profile, as well as being more favourably located in terms of Eskom's requirements for integration with the transmission system. The Thyspunt site is therefore recommended for authorisation in terms of this application. It is acknowledged that the Thyspunt site would experience environmental impacts of higher significance (particularly biophysical impacts) than Duynefontein. However, the conservation of the remainder of the site through access control and responsible long-term conservation management are significant positive impacts associated with this site. Mitigation of identified potential negative impacts recommended by the specialists and in this EIR must be ensured.

(b) 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 for 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.

Further, if Eskom does not utilise the Bantamsklip and Thyspunt sites for nuclear development, it is likely to sell the properties, pending a decision by the Eskom Board. The sale of the properties will be to a willing buyer at the market-related price, which would probably result in an alternative form of land use that will in all probability be more damaging than a nuclear power station and would not involve managing the majority of the properties as nature reserves.

The no-go alternative is therefore not recommended.

(c) 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. Of these two, **coal-fired generation is not viable in the coastal regions of the Western Cape and Eastern Cape**. 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.

(c) Nuclear plant types

Pressurised Water Reactors (PWRs) are internationally the most commonly used nuclear reactors. The existing Koeberg nuclear power station uses PWR technology and it is therefore a tested form of power generation that has been operating safely for the past 24 years. Eskom is familiar with the technology from a health and safety, as well as from an operational perspective.

(d) Mode of transport

Road transport is accepted as the only solution for the transports of heavy loads from the harbours for Duynefontein and Thyspunt. However, at Bantamsklip, due to the extensive road and bridge 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.

The potential social impacts associated with transport by barge would be significantly less than road transport, since road transport would result in delays along the road route, particularly along mountain passes between Cape Town and Bantamsklip.

If a barge were used between Cape Town and Bantamsklip, suitable landing and loading / off-loading facilities would have to be constructed along the beach close to the Bantamsklip site. The load would then have to be transported via road from the barge's landing point to the Bantamsklip site. This alternative requires the heavy load to change modes of transport more often than if the load was transported directly via road and is therefore only considered as a last resort. 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 EIR. Should Eskom wish to pursue this alternative, a separate EIA process would have to be commissioned as landing facilities have not been considered in this EIA.

(e) Position of the nuclear plant on the site

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 specialist raised during several specialist integration workshops between August 2008 and November 2009. The sensitivity maps of all specialists were integrated and composite sensitivity maps were produced to indicate areas of highest environmental suitability for the proposed nuclear power station. These maps are shown in Section 9.28.13 of this report. If authorised, finalisation of the site layout plans will require detailed investigations, in conjunction with the relevant qualified and experienced specialists, once the preferred site and plant type are confirmed.

Based on the sizes of the areas that are suitable for a nuclear power station, (between 73.79 ha and 172 ha), and the proposed size of the Nuclear-1 footprint (31 ha), it will be possible to construct additional power stations, beyond Nuclear-1, on all 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.

(f) Utilisation of abstracted groundwater

Groundwater will have to be abstracted at all three alternative sites in order to allow the excavation for the construction of a platform for the 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 (the only site with appreciable volumes of groundwater), some water may also have to be discharged into the sea. Transfer to the municipal water 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. Given the findings of the oceanographic assessment (Appendix E16) and marine biology assessment (Appendix E15) that discharge of spoil into the sea will not result in significant potential negative impacts, this combination of alternatives is regarded as environmentally acceptable.**

(g) 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.**

(h) 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.

(i) 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.

(j) 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 the recommended alternative.

(k) Management of spoil material

Based on the findings of the oceanographic modelling and the marine impact assessment (**Appendix E15**), it is recommended that fine spoil must be disposed of in the marine environment, according to the recommendations of the marine sediment study and the marine biology study, at all alternative sites. 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 on the terrestrial environment. The spoil dumps that need to be placed on land must be placed and shaped so that they fulfil a visual screening role as well and should be designed to minimise their visual impact. A landscape architect should be engaged to assist in the appropriate design of the spoil dumps, for this purpose. The transport of spoil to the panhandle at Thyspunt via conveyor belt is not recommended due to the sensitive and unique Oyster Bay mobile dune system across which such transport would have to take place.

(l) Access to the Thyspunt site

The Eastern Access Route is required by Eskom for heavy loads due to the gradient. There is no alternative to this route. The access route has been assessed by the specialists, and in majority found to be acceptable from an environmental perspective. Detailed studies will be required by qualified and experienced specialists, in the respective disciplines, before a final alignment for the road can be determined. In terms of the Northern and Western Access Routes to Thyspunt which were assessed as alternatives, the Northern Access Route is clearly less favoured than the Western Access Route, with respect to the potential impacts on agriculture, flora, wetlands and heritage resources. The Northern Access Route is favoured only in terms of visual impacts. The visual impacts associated with the Western Access Road (mostly related to a change in the sense of place) are minimal when compared to the overall change in the sense of place caused by the presence of the nuclear power station itself. Taking all relevant impacts into account, the Western Access Road is the preferred access road for the Thyspunt site.

(m) Waste

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, as it is the only authorised facility for this form of waste in South Africa. Vaalputs has more than 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 alternative.

(n) Key mitigation measures and conditions of authorisation

The findings of the technical 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. Collectively the specialists agreed that there are no environmental fatal flaws at any of the three alternative sites that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented.

Although the Thyspunt site is recommended as the preferred site for authorisation, there remain a number of key impacts of potentially high significance at this site. In order for the conservation benefits at this site to be realised, it is imperative that the recommendations for mitigation contained in this EIR, the specialist studies and the Environmental Management Plan (EMP) be strictly implemented. The mitigation measures for botanical impacts, vertebrate and invertebrate fauna, wetlands and heritage resources are particularly important. Mitigation of heritage impacts particularly will require the work of a site-specific team dedicated to excavations over a period of several years prior to the onset of construction. It will also be important to involve qualified and experienced botanical, wetlands, vertebrate, invertebrate, dune geomorphology and heritage specialists in finding an acceptable final route alignment for the access roads to Thyspunt.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the 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 document should be used to ensure compliance with environmental specifications and management measures during all phases of the proposed 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.

10.6 Way forward

As previously stated in this Draft EIR the 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 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 as the DEA will not consider radiological impacts in decision-making.

The Draft EIR has been distributed for comment to all registered I&APs for a period of 66 calendar days. A number of public interactions will be held during the comment period on the Draft EIR (see **Appendix D** for adverts and letters advising registered stakeholders of the Public Meetings, as well as invitations to the Key Stakeholder Meetings). 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 DEDEA and the Western Cape Department of Environmental Affairs and Development Planning, as well as the NNR (amongst other Government Departments), would provide comment to the DEA on the adequacy of the Final EIR and that 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.