ESKOM HOLDINGS LIMITED
GENERATION DIVISION

NUCLEAR 1 ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

SPECIALIST STUDY FOR SCOPING REPORT

SPECIALIST STUDY: EMERGENCY RESPONSE

NSIP-NSI-020564#P1-21

J27035

October 2007

NUCLEAR 1 ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

SPECIALIST STUDY FOR SCOPING REPORT

SPECIALIST STUDY: EMERGENCY RESPONSE

CONTENTS

LIST OF FIGURES

1 EXECUTIVE SUMMARY

For Nuclear Emergencies, two sets of requirements have to be fulfilled:

- Functional (response) requirements
- Infrastructure (preparedness) requirements

Many response requirements refer to the “capability” to perform an activity. The “capability” includes having in place the necessary authority and responsibility, organization, personnel, procedures, facilities, equipment and training to perform the task or function when needed during an emergency.

The functional or ‘response’ requirements apply in the event of a radiological or nuclear emergency. The ‘response’ requirements are the aims or objectives of the response and include among others:

1. Establishing emergency management and operations: The on-site emergency response must be promptly executed and managed without impairing the performance of the continuing operational safety functions. The off-site emergency response must be effectively managed and coordinated with the on-site response. The emergency response must be coordinated between all responding organizations.

2. Identifying, notifying and activating: When circumstances necessitate an emergency response, operators must determine the appropriate emergency class or level of emergency response and must promptly initiate the appropriate on-site actions and notify and keep informed the off-site notification point. Upon notification of an emergency, the off-site notification point must promptly notify all appropriate off-site response organizations. Upon notification the off-site response organizations must promptly initiate a pre-planned and coordinated response appropriate to the emergency class or level of emergency.

3. Performing mitigatory actions: First responders must take appropriate actions to minimise the consequences of emergencies involving events in threat category IV. The operator must promptly take the necessary actions to minimise the consequences of abnormal conditions or emergencies involving the sources or practices under their responsibility.

4. Taking urgent protective actions: All appropriate measures must be taken to save lives. Urgent protective actions must be taken that effectively limit the occurrence of severe deterministic health effects and to avert dose consistent with international standards. Urgent protective actions must be appropriately adjusted to take into account any new information that becomes available relating to the emergency. A protective action must be discontinued when it is no longer justified.

5. Providing information and issuing instructions and warnings to the public: Instructions on actions to be taken in response to an emergency must be provided to the public near a threat category I or II facility before an event. Upon declaration of an emergency the public must be promptly warned and informed of the actions they should take. There must be no undue delay that could jeopardise the effectiveness of the protective actions.

6. Protecting emergency workers: Measures must be taken protect emergency worker consistent with the relevant international standards.

Infrastructure requirements must be fulfilled to ensure that functional requirements of response can be performed when needed. The common infrastructure elements that must be in place to ensure that the critical response functions can be performed in the event of an emergency include the following:

1. Authority: Authority for developing and maintaining emergency preparedness and to take respond actions for a nuclear or radiological emergency must be established by means of Acts, legal codes or statutes. The emergency arrangements must include a clear allocation of responsibility, authority and coordination during all phases of the response.

2. Organisation: The organizational relationships and interfaces between all the major response organization must be established.

3. Co-ordination: Clear mechanisms for the co-ordination of emergency response between, and protocols for operational interfaces between, operators and local, regional and national governments must be developed, as applicable.

4. Plans and Procedures: A general plan must be developed for responding to the range of potential nuclear or radiological emergencies. This plan must clearly designate the organization responsible for development and maintenance of a coordinated.

5. Logistical Support and Facilities: Adequate tools, instruments, supplies, equipment, communication systems, emergency facilities and documentation to perform the critical functions identified must be provided.

6. Training, Drills and Exercises: The operator and response organizations must implement a means for selection and an on-going training program to ensure the personnel have required knowledge, skill and abilities to perform their assigned response functions.

2 INTRODUCTION

2.1 Description of Proposed Project

This EIA entails the construction and operation of a Conventional Nuclear Power Station and associated infrastructure in the Eastern, Northern or Western Cape areas. The sites, which will be investigated during this Environmental Impact Assessment, have been identified based on previous site investigations undertaken since the 1980s.

Eskom proposes to construct a nuclear power station of the Pressurised Water Reactor type technology. In many ways the structure of the nuclear plant resembles that of a conventional thermal power plant. The difference between such plants is in the manner in which heat is produced. In a fossil plant, oil, gas or coal is fired in the boiler, which means that the chemical energy of the fuel is converted into heat. In a nuclear power plant, however, energy from the fission chain reaction is utilized. Cooling water for the nuclear power station will be utilised directly from the sea. Although detail design still needs to be completed, it is estimated that the entire development will require in the order of 31 ha, including all auxiliary infrastructure,. The proposed nuclear power station will include nuclear reactor, turbine complex, spent fuel, nuclear fuel storage facilities, waste handling facilities, intake and outfall basin and various auxiliary service infrastructure.

Should the proposed project be authorised, it is estimated that the construction of the nuclear power station could commence in 2009/10- with the first unit being commissioned in 2016.

2.2 Terms of Reference

The assessment of impacts should broadly be undertaken in accordance with the guidelines provided in the Guidelines Document: EIA Regulations (DEAT, 1998), the NEMA principles and Section 24(4) of NEMA (as amended), as appropriate to the specific field of study. In addition, the following General Terms of Reference would apply to each of the specialist studies:

- Describe the baseline conditions that exist in the study area and identify any sensitive areas that would need special consideration;
- Ensure that all issues and concerns and potential environmental impacts relevant to the specific specialist study are addressed and recommend the inclusion of any additional issues required in the Terms of Reference, based on professional expertise and experience. Also consider comments on the previous specialist studies undertaken for the Nuclear Siting Investigation Programme (NSIP) undertaken during the 1980s-1990s;
- Provide a brief outline of the approach used in the study. Assumptions, sources of information and the difficulties with predictive models must also be clearly stated;
- Indicate the reliability of information used in the assessment, as well as any constraints/limitations applicable to the report (e.g. any areas of insufficient information or uncertainty);

- Identify the potential sources of risk to the affected environment during the construction and operational phases of the proposed project;
- Identify and list relevant legislative and permit requirements applicable to the potential impacts of the proposed project;
- Include an assessment of the “no go” alternative and identified feasible alternatives;
- Assess and evaluate potential direct and indirect impacts during both the construction and operational phase of the proposed project;
- Identify and assess any cumulative effects arising from the proposed project;
- Undertake field surveys, as appropriate to the requirements of the particular specialist study;
- Identify areas where impacts could combine or interact with impacts likely to be covered by other specialists, resulting in agravated or enhanced impacts and assess potential effects;
- Apply the precautionary principle in the assessment of impacts, in particular where there is major uncertainty, low levels of confidence in predictions and poor data or information;
- Recommend practicable mitigation measures to minimise or eliminate negative impacts, enhance potential project benefits or to protect public and individual rights to compensation and indicate how these can be implemented in the final design, construction and operation of the proposed project;
- Provide a revised significance rating of assessed impacts after the implementation of mitigation measures;
- Identify ways to ensure that recommended mitigation measures would be implemented, as appropriate; and
- Recommend an appropriate monitoring and review programme in order to track the effectiveness of proposed mitigation measures.

The ToR for the specialist undertaking Emergency Services are:

The study must address all emergency procedures that will be put in place to address an emergency response both during construction and operational phases. The study must consider evacuation and resources required for such emergency responses.

The study will also have to consider any other emergency response services that are identified during the public participation and scoping processes.

3 BACKGROUND

3.1 Legislative Framework

At the outset of the EIA for Nuclear Installations, the Department of Environmental Affairs and Tourism (DEAT) as the lead authority on environmental matters, and the National Nuclear Regulator (NNR) agreed to work in close collaboration regarding the cross cutting issues related to the DEAT EIS process and the NNR licensing process. In order to give practical impetus to the process described above a cooperative governance agreement was entered into between the DEAT and the NNR.

Beside the normal decision-making structures for an EIA, several other acts, regulations and treaties apply to this particular proposed study. These include, *inter alia*:

Acts:

Name of Act	No and Date:	Relevance for the inclusion of the Act in the process
The Constitution of South Africa	Act 108 of 1996	**According to chapter 2 section 24 of the Constitution** Everyone has the right a. to an environment that is not harmful to their health or well-being; and b. to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that i. prevent pollution and ecological degradation; ii. promote conservation; and iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
National Environmental Management Act	Act 107 of 1998	Section 30(1)(a) of the Act provides for control of emergency incidents including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed.

Name of Act	No and Date:	Relevance for the inclusion of the Act in the process
National Nuclear Regulator Act	Act 47 of 1999	In terms of section 38(2) of the Act, the Regulator must ensure that the emergency plan is established, in terms of section 38(1), by agreement between the holder of the nuclear authorisation and the relevant municipalities and provincial authorities. Such an emergency plan is effective for the protection of persons and the environment. Section 38(4) of the Act deals with the development surrounding a nuclear installation and provides that the Minister may, on recommendation of the Board of the Regulator and in consultation with the relevant municipalities, make regulations on the development surrounding any nuclear installation to ensure the effective implementation of any applicable emergency plan.
National Water Act	Act 36 of 1998	Section 20 of the Act deals with pollution of water resources following an emergency incident, such as an accident involving the spilling of harmful substance that finds or may find its way into a water resource.
Air Quality Act	Act 39 of 2004	The Act generally gives effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.
Disaster Management Act	Act 57 of 2002	In terms of section 7(1) the Minister must prescribe a national disaster management framework. The framework must reflect a proportionate emphasis on disasters of different kind, severity and magnitude that occur or may occur in South Africa.

Regulations:

- The EIA Regulations contained in Government Notice, 1183, as published in the Government Gazette of 5 September 1997 as amended.
- National Road Traffic Regulations as published in the Government Gazette of 17 March 2000
- Regulations for the safe transport of radioactive material (IAEA No. TS-R-1 (ST-1 revised)

- Government Notice No. 287 of March 2004 published under Government Gazette No.26121 provides for Regulations (herein referred to as “Regulation No. 287”), made by the Minister, on the development surrounding any nuclear installation to ensure the effective implementation of any nuclear emergency plan. Section 3 of Regulation No. 287 provides that the Regulator shall lay down, where appropriate, specific requirements relating to the control and / or monitoring of development within the formal emergency planning zone surrounding a specific nuclear installation, after consultation with the relevant provincial and /or municipal authorities.

Further to the national statutes (acts and regulations) a number of provincial and local authority regulations/ordinances must be satisfied, particularly those related to land-use planning, economics and service provision.

3.2 Assumptions & Limitations

(i) The current report concerns emergency preparedness and response for a nuclear or radiological emergency. The range of possible nuclear and radiological emergencies of concern is enormous, extending from a general emergency at a nuclear power plant to emergencies involving lost, stolen or found radioactive material. The scope of the current report is limited to emergencies concerned with the nuclear power plant.

(ii) As per the project brief from SRK, the current study is a desk top study, hence no site visits were conducted to evaluate or identify disaster management infrastructure currently in place in close proximity to the five sites.

(i) To take the study to the next level, the following should at least be taken into account:

a. The NSIP reports should take into consideration the full spectrum of emergency planning issues.

b. The NSIP reports should provide more detail on the land and waste bodies that may be used by the population or may serve as a habitat for organisms in the food chain.

c. Ambient radiation monitoring must be conducted before commissioning of the nuclear installation, and as a minimum this must cover ambient radioactivity of the atmosphere, hydrosphere, lithosphere and biota in the region. This will enable the holder of an nuclear authorisation to determine the impact of the installation and the data obtained could be used as a baseline in future investigations.

3.3 Review of NSIP Reports

In order to provide a technical view on the validity of the issues raised in the NSIP reports, the following reports were reviewed:

- o Nuclear Siting Investigation Programme (NSIP) Eastern Cape – Summary Report, Dec 1994, rev(1) – ACC 1166714

- o Nuclear Siting Investigation Programme (NSIP) Southern Cape – Summary Report, rev1 – ACC -

- o Nuclear Siting Investigation Programme (NSIP) West Coast – Summary Report, Dec 1994, rev(1) – ACC 1166717

- o Preliminary report on access routes to possible nuclear sites west of Port Elizabeth, Sep 1986, rev(0)

- o Metereological Monitoring Along the Cape S.E Coast during August 1987 – TRR/N87/026

- o Ekokonsult Inc, Van Wyk & Louw Inc - Nuclear Power Investigations: Eastern Cape, Feb 1988 – Nuclear 1164676.

The main objective of this step was to identify any potential major flaws (related to emergency response) in the NSIP reports when judged against current standards and conditions. The following significant flaws were identified:

(i) Threat analysis has not been done or at least referred to in the NSIP reports, such an analysis could be used to implement a graded approach to emergency response arrangements commensurate with the potential magnitude and nature of the hazard. For instance, threat categories I, II and III represent decreasing stringency of requirements for emergency preparedness and response. Facilities in threat categories I and II warrant extensive on site and off site arrangement for emergency preparedness.

(ii) The responsibilities for emergency response are typically assigned at three levels: operator, off-site and international. With respect to off-site level, the NSIP reports made no mention of organizations (or availability of infrastructure and or resources) that will perform the response actions carried out off the site, these could include the police, fire-fighting and civil emergency services or medical personnel, and they may be the first to learn about the emergency. Inadequate responses to emergencies can often be traced back to inadequacy in one or more of these infrastructural elements.

(iii) The NSIP reports neither attempted to identify what disaster management infrastructures are currently in place in close proximity to the sites nor elaborated on the various types of disaster management that will be associated with such a project. The planning and preparations for response to a nuclear or radiological emergency should be integrated with the planning for response to hazards of all types and should fully involve the national or local organizations responsible for response to conventional emergencies such as those due to fires, floods, earthquakes, tsunamis or storms.

(iv) A projection of the present population in the region should be made for:

- the expected year of commissioning of the plant;
- selected years (e.g. every tenth year) over the lifetime of the plant.

(v) Projections should also be made on the basis of population growth rate, migration trends and plans for possible development in the region. Data should be analysed to give both the current and the projected population distribution in terms of direction and distance from the plant.

4 DESCRIPTION OF THE SITE AND SURROUNDING ENVIRONMENT

The sites being investigated as part of the EIA were reportedly identified based on previous site investigations undertaken since the 1980s (see Figure 4.1). They include Thyspunt, in the Eastern Cape, located west of Port Elizabeth near Cape St Francis; Bantamsklip, in the Western Cape, located 10 km south-east of Pearly Beach; Duynefontein, within the existing Koeberg nuclear power station site in the Western Cape; Brazil, in the Northern Cape, located in the Kleinsee/Port Nolloth area; and Skulpfontein, also in the Northern Cape, located in the Hondeklipbaai/Kleinsee area.

4.1 Thyspunt

Thyspunt is located on the Kouga Coast of the Eastern Cape Province, approximately 80 kilometers west of Port Elizabeth. The Kouga Coast is located within the jurisdiction of the Humansdorp Transitional Representative Council. The planning area, for which a Structure Plan has been undertaken, extends 155km along the coast between the Tsitsikamma Forest and Coastal National Park in the west and the Kabeljous River mouth in the east, and inland to the Suuranysberge, some 1700km^2 in extent.

The Kouga Coast is a transition zone between various geological formations, and experiences winter and summer rainfall climates. The resulting range of landscapes and ecological niches, with their diverse flora and fauna, results in a rich and interesting landscape. It is this natural environment that forms the basis for a number of the region's economic activities, including agriculture, forestry and tourism. The Kouga Coast has a distinct cultural and ecological character, with great potential for the development of tourism [8].

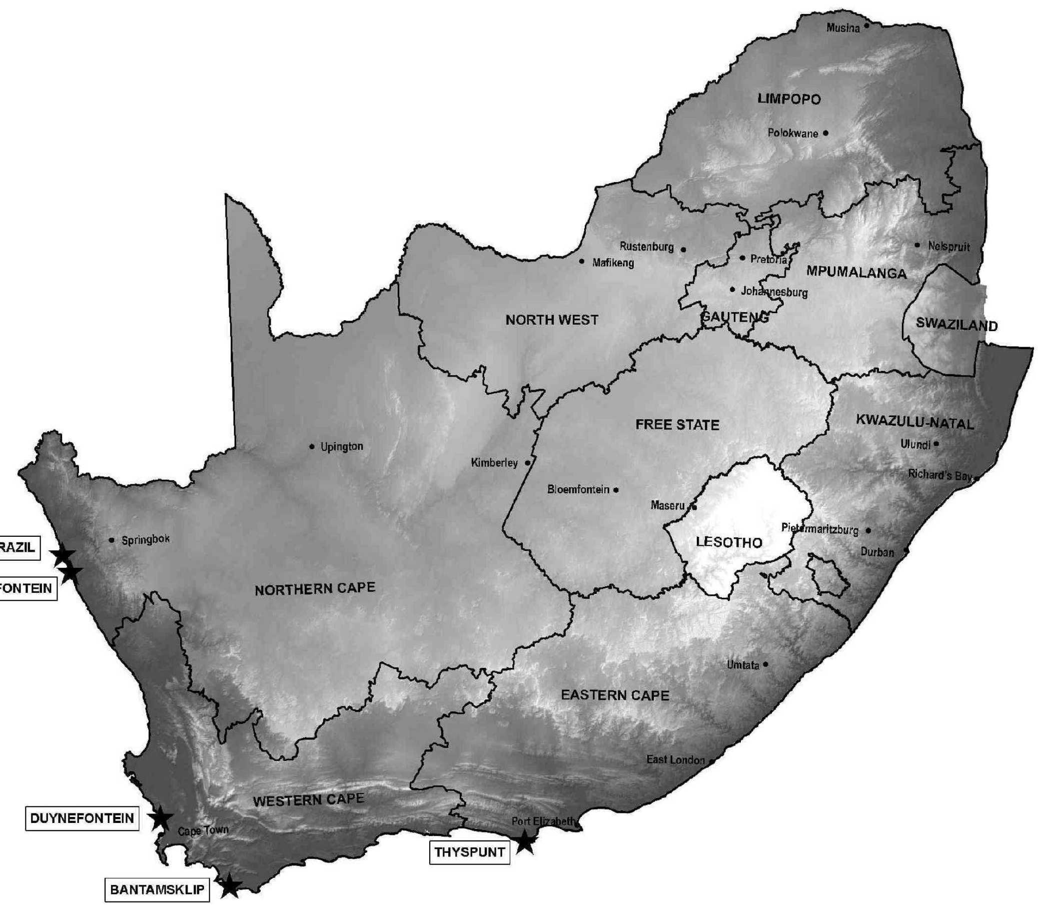
4.2 Bantamsklip

The Overberg Region is the southern-most region in the Western Cape and incorporates Cape Agulhas, the southern tip of Africa. The Southern Overberg Sub-Regional Structure Plan area includes portions of the Hermanus and Bredasdorp magisterial districts and is 2300km^2 in extent.

The region has a Mediterranean type climate with most of its rainfall occurring in winter. As part of the Cape Floristic Kingdom, the area has many unique and vulnerable Fynbos species. There are also several archaeological sites, mostly along the coastline, as well as well-known shipwrecks.

Agriculture is the primary activity of the Overberg. With the exception of a few farming and holiday resort towns, the region is relatively undeveloped. However, the Southern Overberg is currently experiencing growth in development as a result of its increased popularity as a holiday and tourist destination. Infrastructure and services are close to capacity during peak tourist seasons but under-utilised for the remainder of the year [8].

SRK Consulting
Engineers and Scientists



PROJECT NO.	COORDINATE SYTEM			DATE	SCALE
378677	Geographic		**PROPOSED NUCLEAR POWER STATION EIA & EMP: GROUNDWATER ASSESSMENT**	20/08/2007	1:9,000,000
	SPHEROID: WGS 84	CENTRAL MERIDIAN: LO25	LOCATION OF PROPOSED NUCLEAR POWER STATION SITES	COMPILED BY: GOES	FIG NO. 1

Path: J:\NewProj\378677_NuclearSites\4_ProjectWork\GIS\mxd\Location_AllSites_17082007_BW.mxd

Figure 4.1: Location of the Proposed Nuclear Power Station Sites

4.3 Duynefontein (existing Koeberg Power Station)

The Koeberg power station site is located north of Ouskip, Van Riebeeckstrand and Melkbosstrand and to the east of the R27 on the farm Duynefontein 34. The site is located about 2.0 km from the Duynefontein residential area, 30 km north of Cape Town and 10 km south of Atlantis. The Koeberg power station site is surrounded on three sides by a proclaimed nature reserve of 3 000 ha. The site and surrounding nature reserve are managed according to a formal Integrated Environmental Management System (IEMS).

Duynefontein (farm number 34). Eskom owns Duynefontain (farm number 34), which stretches 4.4km along the coast and 3.5km inland, comprising 1 257ha. The West Coast Road passes over the farm giving excellent access to the site. The adjoining farm, Kleine Springfontein (farm number 33) also belongs to Eskom. This property includes 3.6km of coast to the north of Duinefontein and stretches 3.75km inland measuring 1 590ha. South of Duynefontein, Eskom also owns land that has been developed as a housing estate, originally for Koeberg employees. The housing development utilizes about 87.5ha of the local area of 309ha owned by Eskom. This housing development area is now private property and part of Melkbosstrand.

The land-use pattern within a 20km radius of the Koeberg power station can be classified in the following categories: nature reserve, cultivated land; uncultivated land; residential development; industrial development; dune areas; vlei areas and river valleys. The Melkbosstrand urban strip, which lies along the coast, is the dominant land-use within a 5km radius of Koeberg power station. The area to the immediate east of Koeberg power station is largely uncultivated as it consists of sandy soil of low agricultural value.

The northern area consists of Standveld Coastal Shrublands. Poorly vegetated sands occur in the dune areas along the coast and further inland to the NNW of Koeberg power station. The soil quality generally improves outwards towards the 20km radius and this is reflected in the intensity and quality of the agricultural output. The farming is typically Swartland with wheat and fodder crop cultivation dominating agricultural activities. Dairy farming is also popular. Poultry farming occurs mainly in the NE sector, particularly in the area of smallholdings east of Atlantis.

The industrial and residential towns of Atlantis form the most significant urban development to the north of Koeberg power station. There is metropolitan growth in the area north of Milnerton (SSE and SE of Koeberg power station). The area immediately north of Table View is exhibiting rapid growth. Residential development in this area is still beyond the 10km radius from Koeberg power station. South of Koeberg power station, adjacent to the conservation area, lies the town Duynefontein.

Scattered industries in the form of brickfields and waste sites also occur in the SE and SSE sectors. Extensions of industrial areas south of the Diep River characterize the SE sector around the 20km radius. The Koeberg power station site and the Koeberg nature reserve is integrated with the Atlantis Growth Corridor Management Plan, Metropolitan Spatial Development Framework, Cape Metropolitan Council (2000) and the Cape Metropolitan Council (1996).

4.4 Brazil (Nama Khoi municipality)

This site is located in the Northern Cape Province, in the Kleinsee/Port Nolloth area of the Nama Khoi Municipality. Nama Khoi Municipality came into being after the local government elections on 5 December 2000. The new Municipality comprises the former Transitional Local Council areas of Springbok, Steinkopf, Okiep, Concordia and Komaggas and the transitional rural council areas of Buffelsrivier, Nababeep, Bulletrap, Vioolsdrif, Goodhouse and Carolusberg. Nama Khoi is the largest Municipality in Namakwa District, and covers an extensive rural area. Its municipal offices are situated in Springbok.

The population of Nama Khoi is estimated at 44 836, nearly half of whom (42.8%) are between the ages of 0 - 19 years. This demographic situation will place a heavy demand on education, health, training and recreational facilities in the Municipality, and will also mean an increasing demand for work creation as these young people grow up and enter the job market. At present, the unemployment figure for the economically active age group is 25.5%. Those of the local inhabitants who are employed work either in the mining industry or on farms. The tourism season offers limited job opportunities that usually last for only a short time. Another difficulty for job- seekers in the Municipality is that not only are work opportunities scarce, but the population is thinly scattered over a wide area, making access to work places difficult [1].

4.5 Schulpfontein (Kamiesberg Municipality)

This site is located in the Northern Cape Province, in the Kondeklipbaai/Kleinsee area of the Kamiesberg Municipality. Kamiesberg Municipality incorporates the former Transitional Local Council areas of Garies, Hondeklipbaai, Kamieskroon, Leliefontein / Kamiesberg and Rietpoort, and the transitional rural council area of Namakwa. The Municipality covers an extensive area that is bordered by the Atlantic Ocean on the west and includes the Kamies mountain range. Garies, the seat of the Municipality, is the fourth largest town in Namakwa District, and is situated on the N7 route between Cape Town and Namibia. Farming is the main economic activity in the area, which has a low rainfall. Stock farming (sheep, cattle and goats) and a limited amount of grain cultivation are the main land uses. The Municipality also has a limited tourist season, when the spring flowers are in bloom. The total population of Kamiesberg Municipality is about 11 031, of whom about 41% are in the 0 - 19 age group. Only 24.5% of the inhabitants are employed, mostly in poorly paid unskilled jobs. Poverty is severe, with 9.9% of households earning no income at all, and 55.02% earning less than R1 500 a month. This means that about two- thirds of the Kamiesberg population live below the poverty datum line [1].

5 IMPACTS AND MITIGATION MEASURES

5.1 Project Impacts and Mitigation Measures

The main objective of the National Regulator is to ensure that the government is in a position to implement the necessary measures to protect the population in the site surrounding areas from the radiological consequences of any releases before occurrence of these releases. These measures may be somewhat unwieldy, and require several hours to be implemented. Therefore, the operator and the regulatory authority must monitor the accident from the moment it is detected and assess the future behaviour of the reactor in order to propose protective measures to the government which could be implemented in sufficient time to control the risk to the public.

5.1.1 Potential sources of risk – construction and operational phases

(Note: all other factors mentioned in section 6 must also be considered)

Plant operating conditions

Plant operating conditions must be considered in combination with the postulated initiating events (PIEs). An event which might be of little consequence under one operating condition may be of much greater significance if it occurs with the plant in a different state. Operating conditions that should be considered may include:

- Normal operation, including:
  - approach to criticality.
  - startup and power ascension.
  - power operation.
  - power changes, including load following.
  - shutdown from power operation.
  - operation with various systems undergoing maintenance.
- Shutdown:
  - hot standby.
  - cold standby.
- Refueling or maintenance mode:
  - containment closed.
  - containment open.
- Fuel handling and spent fuel storage.

Accidents during shutdown conditions and maintenance modes have recently received considerable attention from regulatory authorities.

Transport accidents

The TS-R-1 Regulations [9] have a requirement for the provision of emergency response capability for transport accidents or incidents involving radioactive material. Although until now, there have been no reported transport accidents with serious radiological consequences. Therefore, an accident resulting in a significant release of radioactive material or loss of shielding during operational phase of the plant could have considerable consequences. The consequences can be controlled or mitigated by proper emergency response actions.

Population distribution

The distribution of population within the region shall be determined, including existing, and projected, transient and resident. Special attention shall be given to the population in the intermediate vicinity of the plant, to the densely populated areas and population centers in the region and to special institutions such as hospitals, prisons, etc. The data shall be analyzed to give the population distribution in terms of direction and distance from the plant.

Feasibility of emergency plans

An evaluation shall be performed of the radioactive releases associated with accidents including severe accidents to a reasonable extent, using specific parameters as appropriate. The feasibility of the emergency plans shall be evaluated taking into account site related aspects such as the following:

- Population density and distribution, distances from population centers, groups of population difficult to shelter or to evacuate in the event of an emergency.
- Special geographical features, such as islands, mountains terrains, rivers, capabilities of local transport and communication network;
- Economic, industrial, agricultural, ecological and environmental features of the external zone and region, for a rapid assessment of the problems associated with fallout of radioactive materials for medium and long term post-accident measures.

5.1.2 The National Emergency Organisation - mitigation

The main purpose of the national emergency organization is to limit, as far as possible, consequences of an accident occurring on a nuclear installation, by ensuring that the installation is in a controlled and safe state and, if necessary, take proper steps to protect population and environment before the occurrence of releases.

Depending on the role assigned to the different parties, the national crisis organization should be defined based on the following:

- A decision network associating the Central Command Stations (CCS) of the installation concerned, of operator headquarters, of the National Nuclear Regulator and of the local Government Office concerned.
- The advisory network provides the decision network with necessary expert appraisal which must make it possible for the relevant authorities to make decisions with regard to protecting the public, action to be taken in the field of food stuffs consumption.

6 SITE SENSITIVITY ANALYSIS

The acceptability of a site is closely related to the design of the proposed nuclear power plant. From the safety point of view, a site is 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. For the evaluation and ranking of the different sites in terms of emergency response, the following factors can be considered:

(i) Sheltering and evacuation

There should be no adverse site conditions which could hinder sheltering or evacuation of the population in the region or the ingress or egress of external services needed to deal with the emergency.

(ii) Natural and infrastructural conditions

Historical records of the occurrences and severity of those important natural phenomena shall be collected for the region and carefully analyzed for reliability, accuracy and completeness. Evaluation of Design Basis for External Natural Events shall consider site specific data, or data sufficiently relevant for the region, including but not limited to the following:

Earthquakes

The seismology and the geology of the region and the engineering geology of a proposed site shall be evaluated. Information on historical and instrumentally recorded earthquakes which have occurred in the region shall be collected and documented. The intensity of the maximum historical earthquake shall be assessed. The design basis earthquakes shall be determined from the seismotectonic evaluation of the region.

A maximum design basis vibratory ground motion for earthquake shall be defined for protecting the public from radiological consequences. Another vibratory ground motion is generally specified, above which the plant shall be inspected to the extent necessary. These motions should be expressed by appropriate parameters such as envelopes of frequency response spectra for various damping factors, duration of shaking and time histories.

Water waves induced by earthquakes

The region shall be evaluated to determine the potential for tsunamis or seiches. On the basis of the available historical data for the region and by comparison with similar regions that have been well studied, the frequency of occurrence, magnitude and height of regional tsunamis and seiches shall be estimated and shall be used to determine design basis tsunamis or seiches, taking into account amplification phenomena due to the coastal configuration at the site.

Slope instability

The site and its vicinity shall be evaluated to determine the potential for slope instability (such as land and rock slides and snow avalanches).

Tornadoes

If tornadoes have occurred in the region, detailed historical data shall be collected and analyzed. If historical data are not sufficient, they should be supplemented with data from other regions for which tornado statistics are available and which have similar characteristics.

Tropical cyclones

If the evaluation shows that there is a tropical cyclone potential, its design basis shall be developed relating to the site, on the basis of available data and the appropriate physical models. The design basis includes factors such as extreme wind speed, pressure and precipitation.

Soil Liquefaction

The potential for liquefaction of the subsurface materials of the site shall be evaluated. If evaluation results are not acceptable, the site shall be deemed unsuitable unless engineering, solutions are practicable.

Surface faulting

The investigation of a site and its vicinity for surface faulting shall include:

- Examination for faulting at the site or for fault trends towards the site;
- Thorough evaluation of the activity of any faults by the use of appropriate and accepted techniques and methods;
- Evaluation of the fault size, including possible secondary faulting.

If the site is within a zone of surface faulting that has a significant potential for relative displacement at or near the ground surface, the site should be deemed unsuitable.

Floods due to precipitation and other causes

The region shall be evaluated to determine the potential for flooding due to precipitation, high water and high tide. The design basis flood shall include the height of the water (including waves), the duration of the flood and flow conditions.

(iii) Demography

The protection of populations in an accidental situation involves knowledge of a set of factors that may influence the implementation of emergency plans. These are, in particular, the following points:

- Density and distribution of populations;
- Characteristics that may affect public health (farm and dairy production, water supply, sanitary equipment, etc.).

There must be a clear census of all factors relevant to the effective implementation of emergency plans.

7 CONCLUSIONS

The study on the emergency plan and assessment of impact on the proposed five sites should be based on the functional and infrastructure requirements and more importantly to determine or establish as to whether there is capability to perform emergency response.

The "capability" will then be assessed by means of conducting a technical and systems audit to verify that the necessary authority and responsibility, organization, personnel, procedures, facilities, equipment and training to perform the task or function when needed during an emergency is in place.

8 REFERENCES

1) Local Government in South Africa 2004-2006, official yearbook, researched and published by Gaffney Group

2) The National Nuclear Regulator Act, Act 47 of 1999

3) Government Notice No. 287 of 5 March 2004 published under Government Gazette No. 26121: Regulations in terms of section 38(4) read with section 47, of the National Nuclear Regulator Act, Act 47 of 1999 on the development surrounding any nuclear installation to ensure the effective implementation of any nuclear emergency plan.

4) Plan of Study for Scoping for a proposed PBMR DPP, rev 2 24 October 2005, Mawatsan

5) Plan of Study (PoS) for EIA for the proposed PBMR DPP Reactor at Koeberg Nuclear Power Station (KNPS) site, Western Cape January 2002, rev 3 – PBMR EIA Consortium

6) Results of the Assessment of Alternative Sites Thyspunt and Batamsklip (Extract from Draft Scoping Report for the Proposed Demonstration Module PBMR, dated March 2001, rev 0)

7) Arrangements for Preparedness for a Nuclear or Radiological Emergency, IAEA Safety Guide GS-G-2.1

8) www.eskom.co.za/nuclear_energy

9) International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Material, 1996 Edition (Revised), Safety Standards Series No. TS-R-1 (ST-1, Revised) IAEA, Vienna (2000).