SECOND SOUTH AFRICAN NATIONAL REPORT ON COMPLIANCE TO OBLIGATIONS UNDER THE JOINT CONVENTION ON SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

SECOND SOUTH AFRICAN NATIONAL REPORT ON COMPLIANCE TO OBLIGATIONS UNDER THE JOINT CONVENTION ON SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

SEPTEMBER 2011

ACKNOWLEDGEMENT

The South African National Nuclear Regulator (NNR) acknowledges the support and cooperation of the South African Department of Energy (DoE), South African Department of Health (Directorate Radiation Control), South African Nuclear Energy Corporation (Necsa), Eskom and South African mining sector in the preparation of this report.

Table of Contents

TABLE OF FIGURES

EXECUTIVE SUMMARY

The Republic of South Africa acceded to the *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (Joint Convention) on 15 November 2006, and South Africa's obligations under the convention entered into force on 13 February 2007.

The Joint Convention establishes an international peer review process among Contracting Parties and provides incentives for nations to take appropriate steps to bring their nuclear activities into compliance with general safety standards and practices.

The first South African National Report was presented at the third Review Meeting of the Contracting Parties under the Joint Convention in May 2009 in Vienna, Austria.

This second South African National Report updates the first report, which documented spent fuel and radioactive waste management safety in the Republic of South Africa under the terms of the Joint Convention. It also incorporates additional information and responses to questions raised at the third review meeting of the Contracting Parties.

The Republic of South Africa is in compliance with the terms of the Joint Convention. A comprehensive national legal and regulatory structure ensures the safety of used fuel and radioactive waste management. The report describes used fuel and radioactive waste management in the Republic of South Africa, providing annexes with information on used fuel and radioactive waste management facilities, inventories, and ongoing decommissioning projects. Information is provided on used fuel and radioactive waste management safety, as well as imports/exports (transboundary movements) and disused sealed sources, as required by the Joint Convention.

SECTION A: INTRODUCTION

A-1. BACKGROUND

Recognizing the importance of the safe management of spent nuclear fuel and radioactive waste, the international community agreed upon the necessity of adopting a convention with the objective of achieving and maintaining a high level of safety worldwide in spent fuel and radioactive waste management: this was the origin of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (the "Joint Convention").

The Joint Convention was adopted on 5 September 1997 at a Diplomatic Conference convened by the IAEA at its headquarters from 1-5 September 1997. It was opened for signature at the IAEA General Conference on 29 September 1997. Pursuant to Article 40, the Joint Convention entered into force on 18 June 2001, 90 days after the date of deposit with the IAEA of the 25th instrument of ratification, acceptance or approval, including the instruments of 15 States possessing operational nuclear power plants.

Since the entry into force of the Joint Convention, there have been three review meetings held at the IAEA Headquarters in Vienna over the following periods:

(i)	First Review Meeting	3-14 November 2003;
(ii)	Second review Meeting	15-24 May 2006;
(iii)	Third Review Meeting	11-20 May 2009

The fourth review meeting is scheduled for the period 14-23 May 2012.

South Africa is a contracting party to the Joint Convention on the Safety of Spent Nuclear Fuel Management and Safety of Radioactive Waste Management. South Africa acceded to the convention on 15 November 2006 and its obligations under the convention entered into force on 13 February 2007. South Africa participated in the Third Review Meeting of the Joint Convention.

Provisions of the Joint Convention

The Joint Convention is the first international instrument that deals with the safety of management and storage of spent fuel and radioactive waste in countries with and without nuclear programs. It also considerably elaborates on and expands the existing IAEA nuclear safety regime and promotes international standards in this area. The Joint Convention is aimed at achieving and maintaining a high level of safety in spent fuel and radioactive waste management, ensuring that there are effective defences against potential hazards during all stages of management of such materials, and preventing accidents with radiological consequences.

The Joint Convention covers the safety of spent fuel and radioactive waste management from civilian applications. It also applies to the management of military or defence-originated spent fuel and radioactive waste if and when such materials are transferred permanently to and managed within exclusively civilian programs.

The Joint Convention calls on the contracting parties to review safety requirements and conduct environmental assessments both at existing and proposed spent fuel and radioactive waste management facilities. It provides for the establishment and maintenance of a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.

The Joint Convention establishes rules and conditions for the transboundary movement of spent fuel and radioactive waste that *inter alia* require a State of destination to have adequate administrative and technical capacity and regulatory structure to manage spent fuel or radioactive waste in a manner consistent with the Joint Convention. It obligates a State of origin to take appropriate steps to permit re-entry into its territory of such material if a transboundary movement cannot be completed in conformity with the Joint Convention.

A-2. PURPOSE

This report summarises South Africa's approach to the safety of used fuel management and the safety of radioactive waste management and demonstrates how South Africa fulfils its obligations under the Joint Convention. This is South Africa's second report on compliance to obligations under the Joint Convention. The first report was produced in October 2008.

A-3. STRUCTURE OF THE REPORT

In developing the report South Africa has drawn from the experience acquired from the last review meeting of the contracting parties of the Joint Convention and the five national reports under the Convention on Nuclear Safety. The report constitutes a self-supporting report, based on existing documentation, and reflects the viewpoints of the different regulatory authorities and operators.

This report is structured according to the "guidelines regarding national reports" for the Joint Convention – i.e., an "article-by-article" format, with each one being addressed in a dedicated chapter bearing the corresponding text of the relevant article of the Joint Convention on a shaded background at the top of the chapter. After the Introduction (Section A), the various sections deal successively with the following topics in the specific order prescribed by the guidelines:

- Section B: Policy and practices under the Joint Convention (Article 32-1);
- Section C: Scope (Article 3);
- Section D: Spent-fuel and radioactive-waste Inventories (Article 32-2);
- Section E: Legislative and regulatory system in force (Articles 18 to 20);

- Section F: Other general safety provisions (Articles 21 to 26);
- Section G: The safety of spent-fuel management (Articles 4 to 10);
- Section H: The safety of radioactive-waste management (Articles 11 to 17);
- Section I: Transboundary movements (Article 27);
- Section J: Disused sealed sources (Article 28),
- Section K: Planned safety-improvement actions; and
- Section L: Annexes in support of Section D.

SECTION B: POLICIES AND PRACTICES

Article 32: Reporting

1. In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

   (i) spent fuel management policy;

   (ii) spent fuel management practices;

   (iii) radioactive waste management policy;

   (iv) radioactive waste management practices;

   (v) criteria used to define and categorize radioactive waste.

B-1. RADIOACTIVE WASTE MANAGEMENT POLICY FRAMEWORK OF SOUTH AFRICA


DEPARTMENT OF MINERALS AND ENERGY

RADIOACTIVE WASTE MANAGEMENT POLICY AND STRATEGY FOR THE REPUBLIC OF SOUTH AFRICA
2005

the dme
Department:
Minerals and Energy
REPUBLIC OF SOUTH AFRICA

Figure 1: Radioactive Waste Management Policy and Strategy for The Republic of South Africa

In May 2000, the Department of Minerals & Energy initiated a process to develop a national policy for the management of radioactive waste. Following a process of national public consultation the Radioactive Waste Management Policy and Strategy for the Republic of South Africa, see Figure 1, was published in 2005.

The radioactive waste management policy and strategy serves as the national commitment to address radioactive waste management in a coordinated and cooperative manner and represents a comprehensive radioactive waste governance framework by formulating, additional to nuclear and other applicable legislation, a policy and implementation strategy in consultation with all stakeholders.

The Policy and Strategy outlines the main policy principles that the Republic of South Africa will endeavor to implement through its institutions in order to achieve the overall policy objectives and is founded on the belief that all nuclear resources of the Republic of South Africa are a national asset and the heritage of its entire people, and should be managed and developed for the benefit of present and future generations in the country as a whole.

The scope of the policy relates to all radioactive wastes and potential radioactive wastes (including used fuel), except operational radioactive liquid and gaseous effluent discharges, which are permitted to be released to the environment routinely under the authority of the relevant regulators (National Nuclear Regulator (NNR) or the Directorate Radiation Control (RADCON) under the Department of Health).

B-2. RADIOACTIVE WASTE MANAGEMENT PRACTICE

Within the South African regulatory framework, radioactive waste, for legal and regulatory purposes, is defined as material that contains or is contaminated with radio-nuclides at concentrations or activities greater than clearance levels as established by the regulatory body and for which no use is foreseen.

It should be recognised that this definition is purely for regulatory purposes, and that material with activity concentrations equal to or less than clearance levels is radioactive from a physical viewpoint, although the associated radiological hazards are negligible.

In accordance with the Radioactive Waste Management Policy and Strategy for the Republic of South Africa, final disposal is regarded as the ultimate step in the radioactive waste management process, although a stepwise waste management process is acceptable. Long term storage of certain types of waste e.g. high level waste, long lived waste and spent sources may be regarded as one of the steps in the management process.

In practice the following hierarchy of waste management options shall be followed were practicable:

- waste avoidance and minimisation;
- reuse, reprocessing and recycling;
- storage;
- conditioning and final disposal.

Radioactive material which could satisfy requirements for clearance, reuse, reprocessing or recycling is considered as Potential Radioactive Waste, for example contaminated metal and used nuclear fuel. The disposal and waste management options for the various classes of radioactive waste are detailed in Table B-1.

As part of the South African strategy for long term radioactive waste management it is envisaged that one site shall be developed for disposal of each of the waste classes indicated in Table B.1, except in the case of NORM waste, which is disposed of in bulk, on the waste generator's site. This is to maximise benefits from economies of scale of all activities associated with disposal waste management.

At present the following disposal options are implemented in South Africa:

- above ground disposal in engineered facilities for the bulk of mining waste;
- near surface disposal for Low and Intermediate Level Waste at the Vaalputs National Radioactive Waste Disposal Facility in the Northern Cape Province.

B-3. SPENT FUEL MANAGEMENT POLICY

In the South African context, the term "used fuel" is used instead of "spent fuel". Pending the outcome of current investigations into possible reprocessing of the used fuel to extract radioactive isotopes for further use, used fuel is not classified as radioactive waste. Rather than being in its final form for disposal used fuel is considered to still have useful material.

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa prescribes the domain within which used fuel shall be managed in South Africa. Used fuel is currently stored in authorised facilities within the generator's sites. Two mechanisms, i.e., dry and wet storage, are currently in use in South Africa. The Policy and Strategy dictates that investigations shall be conducted within set time frames to consider the various options for safe management of used fuel and high level waste and states that the following options shall be investigated:

- long-term above ground storage in an off-site facility licensed for this purpose;
- reprocessing, conditioning and recycling;
- Deep geological disposal; and
- Transmutation.

It is required that the choice of the most suitable option must take due cognisance of policy principles and objectives. All conclusions on investigations shall be subject to public scrutiny.

B-4. SPENT FUEL MANAGEMENT PRACTICES

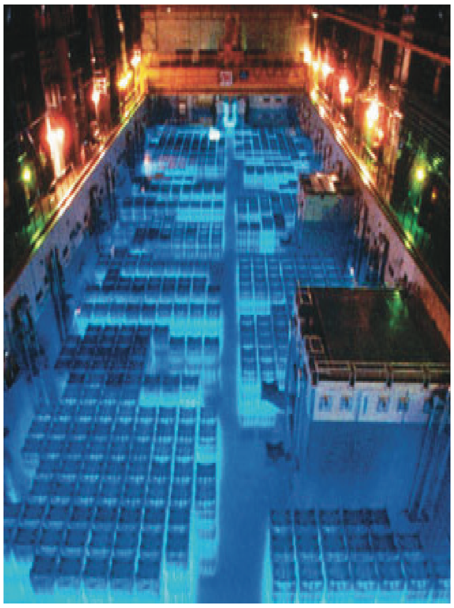


Figure 2: Koeberg Used Fuel Pool

In South Africa, two mechanisms (Dry and Wet storage) are currently in use for the management of used fuel.

Used fuel from the Koeberg Nuclear Power Station is currently stored in authorised used fuel pools on the site as well as in casks designed and constructed for storage of used fuel. The Koeberg site has enough storage capacity for the used fuel that will be generated during the current operational lifetime of Koeberg Nuclear Power Station.

The used fuel from the SAFARI-1 Research Reactor is initially stored in the reactor pool for at least two years to facilitate cooling of the used fuel prior to it being transferred to an authorised dry storage facility on the Pelindaba site.

It is recognised that the current storage capacity at the Koeberg and Pelindaba sites are finite and the practice of storing used fuel on a reactor site is not sustainable indefinitely.

B-5. CRITERIA USED TO DEFINE AND CATEGORISE RADIOACTIVE WASTE

The National Radioactive Waste Classification Scheme (Table B-1) defines the criteria used to define and categorise radioactive waste as well as the generic waste treatment/conditioning requirements and possible disposal/management options.

Table B-1: National Radioactive Waste Classification Scheme

Waste Class	Waste Description	Waste type/Origin	Waste Criteria	Generic waste treatment/ Conditioning requirements[*]	Disposal/Management Options
1 HLW	Heat generating radioactive waste with high long and short-lived radionuclide concentrations	1 Used fuel declared as waste or used fuel recycling products 2 Sealed sources	1 Thermal power > 2 kW/m³ OR 2 Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels > levels specified for LILW-LL OR 3 Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in inherent intrusion dose (the intrusion dose assuming the radioactive waste is spread on the surface) above 100 mSv per annum	Waste package suitable for handling, transport and storage (storage period in order of 100 years). The waste form shall be solid with additional characteristics as prescribed for a specific repository	1. (a) Regulated Deep Disposal (100's of meters) (b) Reprocessing, Conditioning and Recycling (C) Long Term above ground storage
2 LILW-LL	Radioactive waste with low or intermediate short-lived radionuclide and intermediate long-lived radionuclide concentrations.	1 Irradiated uranium (isotope production). 2 Un-irradiated uranium (nuclear fuel production). 3 Fission and activation products (nuclear power generation and isotope production) 4 Sealed sources	1. Thermal power (mainly due to shortlived radio nuclides (T ½ < 31 y) <2 kW/m³) AND 2. Long-lived alpha radio nuclides (T ½ > 31 y) concentrations. ❖ Alpha: < 4000 Bq/g ❖ Beta and gamma: <40000 Bq/g (Maximum per waste package up to 10x the concentration levels specified above). OR 3 Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in inherent intrusion dose (the intrusion dose assuming the radioactive waste is spread on the surface) between 10 and 100 mSv per annum	Waste package suitable for handling, transport and storage (storage period in order of 50 years). The waste form shall be solid with additional characteristics as prescribed for a specific repository	1. Regulated medium depth disposal (10's of meters) 2. Managed as NORM-E-Waste (unirradiated uranium)

Waste Class	Waste Description	Waste type/Origin	Waste Criteria	Generic waste treatment/ Conditioning requirements(*)	Disposal/Management Options
3 LILW-SL	Radioactive waste with low or intermediate short-lived radionuclide and/or low long-lived radionuclide concentrations.	1 Un-irradiated uranium (nuclear fuel production). 2 Fission and activation products (nuclear power generation and isotope production). 3 Sealed sources.	1. Thermal power (mainly due to short-lived radio nuclides (T ½ < 31 y) <2 kW/m^3) AND 2. Long-lived alpha radio nuclides(T ½ > 31 y) concentrations. ❖ Alpha: < 400 Bq/g ❖ Beta and gamma: <4000 Bq/g (Maximum per waste package up to 10x the concentration levels specified above). OR 3. Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in inherent intrusion dose (the intrusion dose assuming the radioactive waste is spread on the surface) below 10 mSv per annum	Waste package suitable for handling, transport and storage (storage period in order of 10 years). The waste form shall be solid with additional characteristics as prescribed for a specific repository	1. Regulated near surface disposal 2. Managed as NORM-E-Waste (unirradiated uranium)
4 VLLW	Radioactive waste containing very low concentration of radioactivity.	1 Contaminated or slightly radioactive material originating from operation and decommissioning activities.	1. Concentration or authorised discharge or reuse criteria and levels approved by the relevant regulator.	Waste stream specific requirements and conditions	1. Clearance 2. Authorized disposal discharge or reuse
5 NORM-L (low activity)	Potential Radioactive waste containing low concentrations of NORM.	1 Mining and minerals processing. 2 Fossil fuel electricity generation. 3 Bulk waste – unirradiated uranium (Nuclear fuel production).	1. Long-lived radio nuclide concentration: <100 Bq/g.	Unpackaged waste in a miscible form	1. Reuse as underground backfill material in an underground area 2. Extraction of any economically recoverable minerals followed by disposal in any mine tailings dam or other sufficiently confined surface impoundment 3. Authorised disposal 4. Clearance

Waste Class	Waste Description	Waste type/Origin	Waste Criteria	Generic waste treatment/ Conditioning requirements(*)	Disposal/Management Options
6 NORM-E (enhanced activity)	Radioactive waste containing enhanced concentrations of NORM.	1 Scales 2 Soils contaminated with scales	1. Long-lived radio nuclide concentration > 100 Bq/g.	Packaged or Unpackaged waste in a miscible or solid form with additional characteristics for a specific repository	1. Reuse as underground backfill material in an identified underground area 2. Extraction of any economically recoverable minerals followed by disposal in any mine tailings dam or other sufficiently confined surface impoundment 3. Regulated deep or medium depth disposal

(*)Treatment and conditioning requirements are mainly dependent on specific waste type in a waste class

SECTION C: SCOPE OF APPLICATION

Article 3. Scope of Application

1. This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.
2. This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.
3. This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.
4. This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.

C-1. USED FUEL AND REPROCESSING

The reprocessing, conditioning and recycling of used fuel are options currently being investigated as part of the South African long-term management strategy for used fuel. These activities are not presently being undertaken in South Africa.

Further, whilst South Africa is not currently investigating options for possible transmutation of used fuel, South Africa continues to monitor international developments in this regard.

The used fuel arising from both the Koeberg Nuclear Power Station and the SAFARI-1 Research Reactor falls under the scope of application of this National Report.

C-2. THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

The scope of the South African policy and strategy on radioactive waste management relates to all radioactive wastes, except operational radioactive liquid and gaseous effluent discharges, which are permitted to be released to the environment routinely under the authority of the relevant regulators (NNR or RADCON).

The safety of radioactive waste management is considered during all commissioning, operational and decommissioning phases of regulated nuclear actions in South Africa. This includes:

- the operation of nuclear reactors and other facilities within the nuclear fuel cycle;
- the production and use of radioactive materials in the fields of research, medicine, industry, agriculture, commerce, and education;
- the extraction, processing and combustion of raw materials containing naturally occurring radioactive materials (NORM);
- environmental restoration programmes associated with any of the above.

As such, South Africa's reporting under the Joint Convention relates to all radioactive wastes, including radioactive waste that contains only naturally occurring radioactive material (NORM), irrespective of whether such wastes arise from within the fuel cycle or not.

C-3. MILITARY OR DEFENCE PROGRAMMES

The Republic of South Africa has no active military or defence nuclear programmes. The Republic of South Africa voluntarily discarded its former nuclear weapons programme and acceded to the Treaty on the Non-Proliferation of Nuclear Weapons on 10 July 1991. The objectives of the treaty are to prevent the spread of nuclear weapons, facilitate peaceful nuclear cooperation between treaty members and provide a foundation for nuclear disarmament.

Further, the Pelindaba Treaty (also called the African Nuclear Weapons Free Zone Treaty) prohibits the production of nuclear weapons in the African region. The Pelindaba Treaty was opened for signature on 11 April 1996 and all 53 African Union members (including the Republic of South Africa) have signed the treaty.

C-4. DISCHARGES

Radioactive liquid and gaseous effluent discharges, which are permitted to be released to the environment routinely under the authority of the relevant regulators (NNR or RADCON), are reported on under the Joint Convention.

SECTION D: LISTS OF FACILITIES AND INVENTORIES

Article 32. Reporting, paragraph 2

1. This report shall also include:

   (i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

   (ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

   (iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

   (iv) an inventory of radioactive waste that is subject to this Convention that:

   (a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

   (b) has been disposed of; or

   (c) has resulted from past practices.

   This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

   (v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

D-1 LIST OF THE USED FUEL MANAGEMENT FACILITIES

A list of used fuel management facilities, their location, main purpose, and essential features are listed in Section L: Annex 1.

D-2 USED FUEL INVENTORIES

The inventory of used fuel from the Koeberg Nuclear Power Station and SAFARI-1 Research Reactor is currently stored on the Koeberg and Pelindaba sites respectively and is detailed in Section L: Annex 2.

D-3 LIST OF THE RADIOACTIVE WASTE MANAGEMENT FACILITIES

A list of Necsa radioactive waste management facilities (disposal and storage), their location, main purpose, and essential features are indicated in Section L: Annex 3.

D-4 INVENTORY OF RADIOACTIVE WASTE

The inventories of radioactive waste arising from Koeberg intermediate- and low-level waste currently on site up to 31 March 2011 is indicated in Section L: Annex 4.

The volume of radioactive waste in Necsa storage and disposal facilities is indicated in Section L: Annex 5.

Radioactive Waste arising from typical actions involving NORM material is indicated in Section L: Annex 6.

D-5 LIST OF NUCLEAR FACILITIES IN THE PROCESS OF BEING DECOMMISSIONED

A list of Necsa nuclear facilities in the process of being decommissioned and the status of decommissioning activities are detailed in Section L: Annex 7.

SECTION E: LEGISLATIVE AND REGULATORY SYSTEMS

E-1 IMPLEMENTING MEASURES

Article 18: Implementing Measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

In conformance to Article 18 of the Joint Convention, the Republic of South Africa has undertaken the necessary legislative, regulatory and administrative measures to fulfil its obligations under the Joint Convention and these are reported on in this report.

E-2 LEGISLATIVE AND REGULATORY FRAMEWORK

Article 19: Legislative and Regulatory Framework

1. Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.
2. This legislative and regulatory framework shall provide for:
   - (i) the establishment of applicable national safety requirements and regulations for radiation safety;
   - (ii) a system of licensing of spent fuel and radioactive waste management activities;
   - (iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;
   - (iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;
   - (v) the enforcement of applicable regulations and of the terms of the licences;
   - (vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.
3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

E-2.1. LEGISLATIVE FRAMEWORK

The South African legislative framework on nuclear energy dates back to 1948 when the predecessor of the present South African Nuclear Energy Corporation (Necsa), namely the Atomic Energy Board (AEB), was created in terms of the provisions of the Atomic Energy Act. This Act was amended over the years to keep pace with developments in nuclear energy. The establishment of the Nuclear Installations Act, which came into force in 1963, made provision for the licensing of Nuclear Installations by the Atomic Energy Board.

The Uranium Enrichment Corporation (UCOR) was created in 1970 in terms of the provisions of the Uranium Enrichment Act, Act 33 of 1970. This allowed the enrichment of uranium by a State Corporation separate from the AEB and subject to licensing by the latter.

A major change took place in 1982 when the Atomic Energy Corporation (AEC) was created and made responsible for all nuclear matters, including uranium enrichment. This change was mandated by the provisions of the Nuclear Energy Act, Act 92 of 1982. In 1988, a major amendment to the Nuclear Energy Act (Nuclear Energy Amendment Act, Act 56 of 1988) created the autonomous Council for Nuclear Safety (CNS), responsible for nuclear licensing and separate from the AEC.

The old Nuclear Energy Act was replaced by a new Act in 1993 (Nuclear Energy Act, Act 131 of 1993). This maintained the autonomous character of the CNS but made provision for the implementation of the Safeguards Agreement with the IAEA pursuant to the requirements of the Nuclear Non-Proliferation Treaty to which South Africa acceded in June 1991.

At present the nuclear sector in South Africa is mainly governed by the Nuclear Energy Act, Act 46 of 1999 (NEA) and the National Nuclear Regulator Act, Act 47 of 1999 (NNRA), which superseded the previous Nuclear Energy Act (Act 131 of 1993). Additionally the Hazardous Substances Act, Act 15 of 1973 (HSA), provides for control of Group III hazardous substances (involving exposure to ionising radiation emitted from equipment) and Group IV hazardous substances (radioactive material not at nuclear installations or part of the nuclear fuel cycle, for example fabricated radioactive sources and medical isotopes).

The governance and regulation of radioactive waste management is also subject to the provisions of the following other acts:

- National Radioactive Waste Disposal Institute Act, Act No. 53 of 2008. (NRWDIA)
- Environment Conservation Amendment Act, Act 50 of 2003. (ECAA)
- Minerals and Petroleum Resources Development Act, Act No. 28 of 2002. (MPRDA)
- National Environmental Management Act, Act No. 107 of 1998. (NEMA)
- National Water Act, Act No. 36 of 1998. (NWA)

- Water Services Act, Act No. 108 of 1997. (WSA)
- Mine Health and Safety Act, Act No. 29 of 1996. (MHSA)
- Environment Conservation Act, Act 73 of 1989. (ECA)
- Dumping at Sea Control Act, Act No. 73 of 1980. (DSCA)

In terms of section 46 of the Nuclear Energy Act, Act 46 of 1999, discarding of radioactive waste and storage of irradiated nuclear fuel require the written permission of the Minister of Energy and are subject to any conditions that the Minister, in concurrence with the Minister of Environmental Affairs and the Minister of Water Affairs, deems fit to impose. The conditions so imposed will be additional to any conditions contained in a nuclear authorisation as defined in the National Nuclear Regulator Act, Act 47 of 1999.

E-2.2. REGULATORY FRAMEWORK

E-2.2.1. SAFETY REQUIREMENTS AND REGULATIONS FOR RADIATION SAFETY;

The National Nuclear Regulator Act, Act 47 of 1999 (NNRA), provides the South African National Nuclear Regulator (NNR) with a mandate to establish and enforce national standards in the areas of radiological health and safety and environmental protection.

In terms of the NNRA, the NNR formulated national safety standards and regulatory practices which were recommended by the NNR Board to the Minister of Minerals and Energy. The Safety Standards and Regulatory Practices (SSRP), Regulation R 388 of 2006, were published on 28 April 2006 and these regulations are being enforced on all holders of nuclear authorisations in the country. These regulations are based on international safety standards and regulatory practices and provide for criteria and requirements related to exclusion, exemption and regulation (authorisation by way of Certificate of Registration or Licensing) of actions involving radioactive material.

Other regulations which were published, in terms of the NNRA, include the following:

- The regulations on the keeping of a record of all persons in a nuclear accident defined area, Regulation R 778 of 2006.
- The regulations on the content of the annual report on the health and safety related to workers, the public and the environment, Regulation R 716 of 2006.

- The regulations on Establishment of Public Safety Information Forums, Regulation 968 of 2008.
- The regulations on Co-operative Governance in respect of the monitoring and control of radioactive material or exposure to ionising radiation, Regulation 709 of 2002.
- The regulations on the prescribed format for the application for a nuclear installation licence or a certificate of registration or a certificate of exemption, Regulation 1219 of 2007.

The Hazardous Substances Act, Act 15 of 1993 as amended, makes provision for the Minister of Health to establish regulations:

- Authorising, regulating, controlling, restricting or prohibiting the manufacture, modification, importation, storage, transportation or dumping and disposal of any grouped hazardous substance or class of grouped hazardous substance.
- Providing for the appointment of such committees as may be considered necessary for the purpose of advising the Director General on any matter concerning any Group III or Group IV hazardous substance, the calling of meetings of any such committee, the quorum for and procedure of such meeting.
- Regarding safety standards in connection with the importation into and exportation from the Republic, manufacture, packing, disposal, dumping, sale, serving, applying, administering or use of grouped hazardous substances and the manner in which such standards shall be brought to the notice of persons concerned in any of said activities in respect thereof, and in general with regard to any matter which the Minister considers necessary or expedient to prescribe or regulate in order to attain or further the objects of the Act.

In terms of the above provisions the Minister of Health has published regulations relating to Group IV hazardous substances Regulation GN.R.247 dated 26 February 1993.

E-2.2.2. LICENSING OF ACTIVITIES

The authorisation processes are defined in South African legislation (NNRA, NEA, HSA). Prior to the granting of an authorisation the applicant is required to apply to the relevant regulator (NNR or RADCON), in the prescribed format, detailing the intended activities and providing a demonstration of the safety and compliance to the requirements and regulations. The documentation submitted must address safety in the design of any facilities concerned and safety in the way the facility will be constructed, commissioned, operated, maintained and decommissioned or closed.

In accordance with the provisions of section 21 of the NNRA -

"Any *person wishing to site, construct, operate, decontaminate or decommission a nuclear installation may apply in the prescribed format to the chief executive officer for a nuclear installation licence and must furnish such information as the board requires*".

The above therefore represents the logical licensing stages that are applicable to any nuclear installation. The applicant may however choose to combine individual stages; such combination of stages may be approved by the regulator subject to the applicant ensuring that all the necessary safety documentation relevant to the combined stages has been submitted.

The combinations of licensing stages need to be established with a view to streamlining and scheduling of the licensing process. Allowance must be made for assessments that may prove to be time-consuming. The applicant must produce a safety case for each licensing stage or combination of licensing stages. Based on the applicant's proposal for combination of licensing stages, the NNR may impose hold and/or witness points. The applicant must not proceed beyond an imposed hold or witness point without prior NNR approval.

A safety case is a collection of safety arguments and evidence in support of the safety of a facility or action. The safety case provided must identify and characterise all sources of radiation associated with the facility and all possible exposure pathways that may arise from such sources, under normal operating conditions and under accident situations.

The NNR undertakes an evaluation of the submitted documentation to ensure that the action or facility will meet the standards and requirements. From the evaluation, conditions are identified for inclusion in the nuclear authorisation.

The authorisation conditions represent a framework within which the applicant or holder of the nuclear authorisation is obliged to adhere to particular requirements in respect of design, operation, maintenance and decommissioning and closure. The conditions of authorisation also oblige the holder of the authorisation to provide a demonstration of compliance through the submission of routine and non-routine reports.

Typical conditions included in a nuclear authorisation address:

- the description and configuration of the authorised facility or action;
- requirements in respect of modification to facilities;
- operational requirements in the form of operating technical specifications, procedures or programmes as appropriate;
- maintenance testing and inspection requirements;

- operational radiation protection programmes;
- radioactive waste management programmes;
- emergency planning and preparedness requirements as appropriate;
- physical security;
- transport of radioactive material;
- quality assurance; and
- reporting.

In accordance with the requirements of the NEMA, an environmental assessment has to be conducted prior to the construction of a spent fuel management or radioactive waste management facility. Further, the ECAA prescribes that no person may establish, provide or operate a disposal site without a permit issued by the Minister of Environmental Affairs.

E-2.2.3. PROHIBITION OF THE OPERATION WITHOUT AN AUTHORISATION

The legislative system prohibits the operation of a spent fuel or radioactive waste management facility without appropriate authorisation.

The NNRA prohibits:

- siting, construction, operation, decontamination or decommission of a nuclear installation, except under the authority of a nuclear installation licence;
- undertaking of any action not requiring a nuclear installation licence or a nuclear vessel licence except under the authority of a certificate of registration or certificate of exemption.

The HSA provides that no person shall produce, otherwise acquire, or dispose of, or import into the Republic or export from there, or be in possession of, or use or convey or cause to be conveyed, any Group IV Hazardous substance, except in terms of a written authority issued by the Director General of the Department of Health.

In accordance with the provisions of the NEA, the discarding of radioactive waste and storage of irradiated nuclear fuel require the written permission of the Minister of Energy and are subject to such conditions that the Minister in concurrence with the Minister of Environmental Affairs and the Minister of Water Affairs, deems fit to impose. The conditions so imposed will be additional to any conditions contained in a nuclear authorisation as defined in the NNRA.

Further, the ECAA prescribes that no person may establish, provide or operate a disposal site without a permit issued by the Minister of Environmental Affairs.

E-2.2.4. REGULATORY INSPECTIONS, SAFETY DOCUMENTATION AND REPORTING

The nuclear authorisation requires the holder to develop and maintain a documented safety case which demonstrates compliance with the requirements of the applicable act and regulations and which includes as a minimum:

- detailed description of the plant and site;
- scope of activities to be undertaken;
- specifications of systems, structures and components important to safety;
- onsite and off- site environmental factors or components relevant to nuclear and radiation safety;
- plant operational safety assessment, including associated nuclear and radiation safety rules, criteria, standards and requirements relevant to the safety assessment;
- operational safety related programmes and limiting conditions of operations including:
    - programme for compliance with dose and risk limits as appropriate;
    - programme to ensure that nuclear installations are built and operated according to good engineering practice and international norms and standards;
    - programme for incident and accident management including emergency planning, preparedness and response;
    - quality management programme;
    - system of records and reporting;
    - radiation protection programme;
    - radioactive waste management programme;
    - programme for transport of radioactive material;
    - environmental monitoring and surveillance programme;
    - programme for decommissioning.

The holder of a nuclear authorisation is responsible for ensuring that all operational safety related programmes are procedurised and implemented accordingly. Further, the holder of a nuclear authorisation is required in terms of the provisions of the NNRA to implement an inspection programme to ensure compliance with the requirements of the nuclear authorisation and provide any information or monthly return as required by the NNR. This includes:

- reports on problem, incident and accident notification, investigation and closeout;
- quality assurance and audit reports including closeout reports;
- environmental monitoring reports;
- reports on liquid and gaseous effluent discharges.

The NNR conducts independent compliance assurance activities to determine the extent to which holders of nuclear authorisations comply with the conditions of authorisation. The nature of the NNR's compliance assurance activities are commensurate with the nature of authorisation issued and the risk posed by the facility or action. The compliance assurance activities involve a combination of audits, routine inspections, non-routine inspections, review of routine reports and review of occurrence reports.

E-2.2.5. ENFORCEMENT

Offences and the appropriate sanction for the commission of such offences are contained in the NNRA. The NNR may, in terms of the NNRA, revoke a nuclear installation licence at any time. It is furthermore empowered to impose such conditions, as it deems necessary for preventing nuclear damage, upon the holder of the relevant nuclear installation licence, during his period of responsibility as defined.

E-2.2.6. ALLOCATION OF RESPONSIBILITIES

The Radioactive waste Management Policy and Strategy for the Republic of South Africa, clearly defines the responsibilities of Government, Regulatory Bodies as well a s generators of radioactive waste and operators of radioactive waste disposal facilities. Further, the policy makes provision for the establishment of a National Committee on Radioactive Waste Management, to oversee the implementation of the national policy and strategy on radioactive waste management, and a National Radioactive Waste Disposal Institute (NRWDI).

To give effect to Cooperative Governance as per the constitution of the Republic, the National Nuclear Regulator and the following Government Departments are represented on the National Committee on Radioactive Waste Management:

- The Department of Environmental Affairs;
- The Department of Health (RADCON);
- The Department of Water Affairs.

In accordance with the provisions of section 6 of the NNR Act, the NNR is required to enter into co-operative governance agreements with other organs of State that have overlapping functions or responsibilities. The purpose of the agreements is to:

- ensure the effective monitoring and control of nuclear hazards;
- co-ordinate and minimise the duplication and procedures for the exercise of such functions; and
- promote consistency in the exercise of such functions.

E-3 THE ESTABLISHMENT OF A REGULATORY BODY

Article 20: Regulatory Body

1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.
2. Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organizations are involved in both spent fuel or radioactive waste management and in their regulation.

E-3.1. NATIONAL NUCLEAR REGULATOR

The National Nuclear Regulator (NNR) is the national authority responsible for exercising regulatory control over the safety of nuclear installations, radioactive waste, irradiated nuclear fuel, and the mining and processing of radioactive ores and minerals. The primary function of the NNR is to protect workers and members of the public from the harmful effects (i.e. nuclear damage) arising from exposure to ionising radiation.

The NNR, established as an independent juristic person in terms of the provisions of the NNRA, is comprised of a Board, a Chief Executive Officer and staff. The mandate and authority of the NNR are conferred through sections 5 and 7 of the NNRA, which detail the objectives and functions of the NNR.

The powers of the NNR under the NNRA embrace all actions aimed at providing the public with confidence and assurance that the risks arising from the undertaking of actions involving radioactive material to which the NNRA applies, remain within acceptable safety limits. In practice this has led to the NNR establishing safety standards and regulatory practices including probabilistic risk limits and derived operational standards, conducting proactive safety assessments, determining conditions of authorisation and obtaining assurance of compliance thereto.

The competence of the NNR is ensured through both its autonomous establishment and its funding provisions which consist of monies appropriated from parliament, fees paid to the regulator in respect of nuclear authorisations and donations or contributions received by the regulator with the approval of the Minister of Energy.

E-3.2. ORGANISATION OF THE NNR

The organisational structure of the NNR is depicted in Figure 3 below

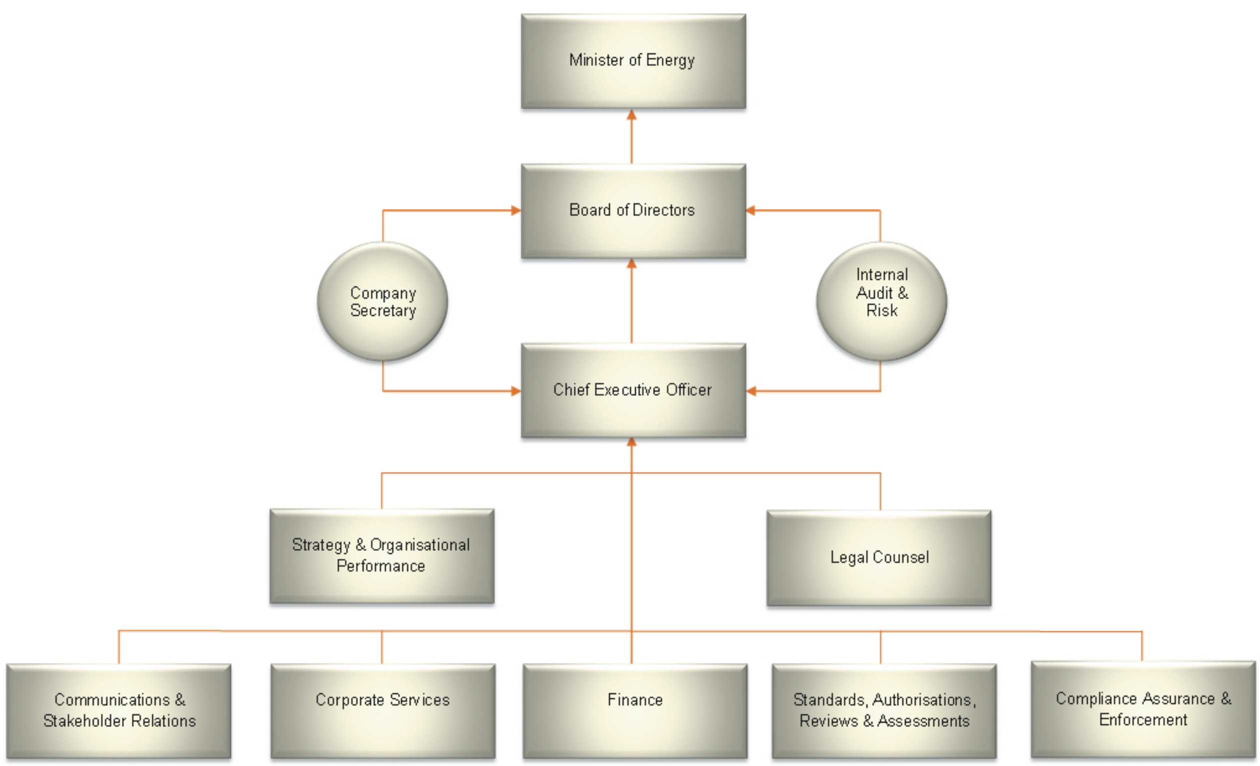


Figure 3: NNR Organisational Structure

(i) **THE BOARD OF DIRECTORS:**

The Executive of the regulatory body reports to a Board, which is appointed by the Minister of Energy. The Board consists of twelve Directors including an official from the Department of

Minerals and Energy, an official from the Department of Environmental Affairs, a representative of organised labour, a representative of organised business, a representative of communities which may be affected by nuclear activities and up to seven other Directors who hold office for a period not exceeding three years, although they are eligible for re-appointment.

A person is disqualified from being appointed to or remaining a director of the Board if he or she, inter alia, is:

- a holder of a nuclear authorisation or an employee of such holder;
- becomes a member of parliament, a provincial legislature, a municipal council, the Cabinet or the executive council of a province.

(ii) **THE CHIEF EXECUTIVE OFFICER:**

The Chief Executive Officer is appointed by the Minister of Energy and is also a member of the Board. The Chief Executive Officer is the accounting officer of the Board and has the responsibility to ensure that the functions of the Regulator are performed in accordance with the NNRA and the Public Finance Management Act. The Chief Executive Officer holds office for a period not exceeding three years as specified in the letter of appointment and may be reappointed upon expiry of that term of office.

(iii) **THE STAFF OF THE REGULATOR:**

The NNR's organisational structure is configured to perform the following core functions:

(a) **Compliance Assurance and Enforcement (CAE)**

The CAE group is responsible for conducting compliance inspections and enforcement on the holders of nuclear authorisations currently comprising the following "Programmes":

- Nuclear Power Plants (NPP)
- Nuclear Technology and Waste Products (NTWP)
- Naturally Occurring Radioactive Material (NORM)

(b) **Standards, Authorisation, Review and Assessment (SARA)**

Management of Regulatory Programmes

Currently the NNR has three Regulatory Programme Managers (NPP, NTWP, NORM) who are responsible for the planning of assessment activities and liaison with the authorisation holders.

The Programme Manager: NPP is responsible for exercising regulatory control over Koeberg Nuclear Power Station, including transport of radioactive material to and from Koeberg.

The Programme Manager: NTWP is responsible for exercising regulatory control over activities undertaken by Necsa at the Pelindaba Site (covering research reactors, nuclear fuel fabrication facilities, nuclear technology applications) and the disposal of low and intermediate level waste at the Vaalputs site.

The Programme Manager: NORM is responsible for exercising regulatory control over naturally occurring radioactive material arising primarily from the mining and mineral processing of radioactive ores.

Review and Assessment

The Review and Assessment Group renders technical assessment functions to all the divisions and consists of 4 functional subgroups:

- Design Safety
- Operational Safety
- Environmental and Radiation Protection
- Nuclear Security and Emergency Preparedness

The functional responsibilities of the Review and Assessment Group, include:

- Review of submissions from holders or applicants as requested by the Programme Managers (NPP, NTWP, NORM)
- Conduct related safety assessments
- Assist in Enforcement/compliance assurance on request from CAE.
- Perform independent assessment of nuclear emergency preparedness at nuclear installations

Special Nuclear Projects

The Special Projects Team coordinates the following activities:

- Regulatory Research

- Development of Regulatory Guidance Documents,
- Development of Safety Standards,
- Development of Position Papers,
- Review of international standards, trends and best practices.

(c) **Support Services**

The support services include Finance, Corporate Services, Strategic Planning, Communications and Stakeholder Relations and Legal Counsel.

E-3.3. INDEPENDENCE OF THE REGULATORY FUNCTION

The independent authority of the NNR is "de jure" entrenched in the NNRA, subject to the extent that powers are conferred on the Minister of Energy to appoint the governing, non-executive Board of Directors and the Chief Executive Officer.

The NNR operates independent from the government in terms of carrying out its mandate that ensures that public health is assured for all South Africans that are exposed to nuclear and radiation hazards. The purpose of this independence is established in order to ensure that regulatory decisions are made free of other interest that may conflict with safety.

The NNRA makes provision for a comprehensive appeals process and specifically forbids any representative of an authorisation holder or political structure from being appointed as a director of the Board or the Chief Executive Officer.

With regards to the "de facto" independence of the NNR the NNRA provides that if the Minister rejects a recommendation of the Board, on the contents of regulations to be published, the Minister and Board must endeavour to resolve their disagreement. Although in the absence of resolution of such disagreement, the Minster has the power to make the final decision. No failure to resolve disagreement has thus far emerged regarding the relevant recommendations from the Board.

The NNR is directly accountable to parliament, through the Minister of Energy, on nuclear and radiation safety issues and operates independent from Government, to the extent that it is able to carry out its mandate without undue influence being brought upon it

SECTION F: GENERAL SAFETY PROVISIONS

F-1 RESPONSIBILITY OF THE LICENCE HOLDER

Article 21: Responsibility of the licence holder

1. Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.
2. If there is no such licence holder or other responsible party, the responsibility rests with the Contracting Party, which has jurisdiction over the spent fuel or over the radioactive waste.

F-1.1. RESPONSIBILITY FOR SAFETY

As a principle the South African Regulatory framework requires that the primary responsibility for ensuring protection of the health and safety of the workers and members of the public as well protection of the environment rests with the holder or applicant for a nuclear authorisation and extends in an unbroken chain through the line managers to the workers in the facility.

As an external "action-forcing" agency, the Regulator influences the actions of the holder/applicant only to the extent necessary to ensure adequate protection of the public and worker health and safety. While the Regulator may identify current and potential safety problems and offer alternative strategies for addressing each issue, resolving these safety problems remains the sole responsibility of the holder/applicant. It is recognized that regulation can bolster but never replace the commitment of line management and the workers to integrating proper health and safety practices in work planning and performance.

The NNR ensures that the nuclear authorisation holder meets its primary responsibility with regard to safety essentially by the establishment of safety standards, the issuance of a nuclear authorisation and regulatory letters and by a compliance assurance programme, the latter comprising inspections, surveillances and audits as well as various forums for interaction with the nuclear authorisation holder.

These requirements include requirements for the nuclear authorisation holder to maintain effective safety related processes independent of production. Safe practices are achieved by ensuring that the nuclear authorisation holder complies with the conditions of the nuclear installation licence.

Holders of and applicants for nuclear authorisations demonstrate their compliance with regulatory requirements, Health, Safety and Environmental (HSE) legislation, permits, licence conditions, national and international norms and standards through holder and applicant specific policy and standards documents. The following aspects are generally covered in nuclear authorisation holder or applicant specific documents:

- safety policy and philosophy;
- licensing strategies;
- integrated safety assessments;
- identification of radioactive waste categories;
- determination of radioactivity content;
- classification of radioactive waste;
- processing and conditioning of radioactive waste;
- storage and material accounting;
- identification of waste management end points;
- receipt, disposal and transport guidelines;
- administrative guidelines;
- exclusions;
- holder inspections programmes;
- non-compliance identification and reporting;
- radiation protection programme and radiation dose limitation;
- facility security;
- management of radioactive effluents including control of radioactive discharges to the environment.

F-1.2. RESPONSIBILITY IN ABSENCE OF NUCLEAR AUTHORISATION HOLDER

In accordance with the legislative requirements, the nuclear authorisation holder whose operations generates or has generated used fuel or radioactive waste is responsible for all radioactive waste management measures and the associated costs, in accordance with the "polluter pays" principle.

It is a pre-condition to the granting of a nuclear authorisation that the applicant demonstrate the ability to safely manage all radioactive waste which may arise from the proposed operations.

Regulatory oversight of authorised nuclear facilities and actions is accomplished in cooperation with other national agencies and regulators, in compliance with the NNRA, and other applicable laws. The NNR requires a smooth transition as nuclear facilities and actions pass from one life cycle stage to the next (siting, construction, commissioning, operations, end of life, decontamination and decommissioning including clean-up, demolition, and environmental restoration activities).

In terms of the Radioactive Waste Management Policy and Strategy for the Republic of South Africa ownerless radioactive waste (radioactive waste where the generator no longer exists or cannot be identified through reasonable means or does not have the resources to manage such waste) is the responsibility of the Government. At present Necsa fulfils Government's obligations in this regard. In the future this responsibility will be vested with the soon to be established National Radioactive Waste Disposal Institute (NRWDI).

F-2 HUMAN AND FINANCIAL RESOURCES

Article 22: Human and financial resources

Each Contracting Party shall take the appropriate steps to ensure that:

(i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;

(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;

(iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

F-2.1. QUALIFIED STAFF

In accordance with the provisions of the SSRP:

"An *adequate number of competent, qualified and trained staff must be responsible for carrying out the functions associated with radiation protection and nuclear safety and for maintaining an appropriate safety culture.*"

Thus the nuclear authorisation holder has the primary responsibility for ensuring that the employees are qualified and authorised to undertake their jobs. Nuclear authorisation holders are required to report to the NNR on their staffing and competency level. Nuclear authorisation holder employee training programmes include initial, complementary and refresher training programmes

The Nuclear Fuel Department of Eskom is responsible for human resource planning to fulfil corporate responsibilities in accordance with Eskom requirements for resource management.

Managers at Necsa are responsible for human resource planning to fulfil corporate responsibilities in accordance with Necsa's requirements for resource management. This includes the identification and provision of personnel training and orientation requirements as prescribed in their management system. Necsa has also implemented a knowledge management program in order to involve all employees in identifying and solving problems to ensure that the workforce is suitably qualified and experienced.

All the mines have established a radiation protection function with sufficient staff responsible for all activities with regard to radiation safety.

F-2.2. FINANCIAL RESOURCES

In general, the financing for decommissioning and waste management follows the rule of "polluter pays". In accordance with this principle all nuclear authorisation holders are responsible for ensuring that sufficient resources are in place to meet their responsibilities with respect to decommissioning and radioactive waste management.

Further, it is a requirement of the SSRP, that it must be demonstrated to the regulator that sufficient resources will be available from the time of cessation of the operation to the termination of the period of responsibility.

Decommissioning and waste disposal is currently taking place in the following areas:

- low and intermediate level waste from Koeberg and Necsa Pelindaba site is disposed of in shallow land- fill trenches at Vaalputs, the National Radioactive Waste Repository operated by Necsa and situated about 600 km north of Cape Town. Although the State financed the initial development costs of the site, Eskom and Necsa pay fees based on the amount of radioactive material sent to Vaalputs.
- decommissioning and associated waste management of Necsa's two former enrichment plants (the Y and Z plants) as well as the former conversion plant (U plant) and associated facilities are undertaken by Necsa itself and the financing is carried by the State through the annual State allocation for operational funds;
- decommissioning of disused mine equipment (primarily in the gold, copper, phosphate and mineral sands operations) are currently undertaken. The mining companies finance the decommissioning costs themselves and subcontract the operations out to specialized agencies.

- Decommissioning of the Koeberg nuclear power station is currently scheduled for after 2035. Financial provision for the decommissioning and used fuel management has continued to be accumulated on a monthly basis since commercial operation of the installation began in 1984.

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa, makes provision for a national Radioactive Waste Management Fund that will be managed by the South African Government. Waste generators will contribute to the fund based on the radioactive waste classes and volumes produced. The fund is aimed at ensuring sufficient provision for the long term management of radioactive waste and includes the following:

- funding for disposal activities;
- funding for research and development activities including investigations into waste management/disposal options;
- funding of capacity building initiatives for radioactive waste management; and
- funding for other activities related to radioactive waste management.

Management at Eskom and Necsa are responsible for determining the financial resources necessary to achieve legal responsibilities through the budgeting programme, including adequate funding for the management of used fuel and the disposal of intermediate and low-level waste. Similar arrangements are in place for the mines.

F-2.3. FINANCIAL PROVISION FOR POST-CLOSURE MANAGEMENT OF FACILITIES

An "After-care" fund has been established for the Vaalputs repository to finance activities in the institutional control period.

Financial provision for closure and post closure of mining and mineral processing operations is regulated by Directorate Mineral Resources in terms of the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and is funded by the mines.

F-3 QUALITY ASSURANCE

> **Article 23: Quality assurance**
>
> Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

One of the principal nuclear safety requirements of the SSRP requires that a quality management programme must be established, implemented and maintained in order to ensure compliance with the conditions of the nuclear authorisation. The implementation of a quality management programme is required to provide adequate confidence in the validity of the operational safety assessment and safety assurance processes.

All holders of nuclear authorisations have a quality assurance program in place and the achievement and maintenance of quality is verified by audits, surveillances, self-assessments and peer reviews. Personnel undertaking monitoring activities are independent of direct responsibility for the activity being monitored. The detection, correction of and taking of future preventative actions related to non-conformances, deficiencies and deviations from quality requirements are specified in various authorised procedures.

Management reviews are conducted on an annual basis. The inputs for management reviews are obtained from monitoring activity reports, corrective action reports, quality deficiency reports and other reporting mechanisms. During these reviews an assessment of the current quality assurance programme is performed and the programme is amended as required.

The NNR audits the implementation thereof on a frequent basis.

F-3.1. QUALITY ASSURANCE AT NECSA

The quality activities and behavioural performance are managed by means of a Quality Management System. The quality department is responsible to ensure the quality management system is established, implemented and maintained.

The roles and responsibilities with regards to implementation and management of the quality processes are defined in the quality management systems manual. A quality policy is designed to set the overall direction.

A quality management system is developed to provide management with a comprehensive feedback on the overall performance of the plant. Regular audits and inspections are conducted to determine the extent of compliance.

The auditors assess compliance annually via internal audits. Audit reports are compiled and submitted to management and assistance is provided to rectify non-conformances/deficiencies.

Activities affecting quality performance are performed in accordance with documented instructions, procedures, drawings or appropriate qualitative acceptance criteria to ensure satisfactory results are attained. Each process is described to a level of detail, commensurate with its complexity and the need to ensure consistent and acceptable results.

Quality awareness training is conducted on a continuous basis to ensure sustainable operations and to foster a culture of continual improvement.

Annual management reviews are conducted to ensure continuing suitability, adequacy and effectiveness of the system. Measurable quality objectives are established at all levels within the organization. Skills are identified via the balance scorecard and the individual development programme is implemented to ensure the training needs are met.

The inspection measuring and test equipment are identified and calibrated at defined frequencies. The core management procedures that describe the quality management system are as follows, namely:

- control of documents;
- control of records;
- control of non-conformances;
- internal audits;
- corrective action;
- preventive action.

The work environment is controlled via the implementation of an environmental management system and an occupational, health and safety management system. Various methods of communication are applied, namely: internet, emails, notice boards, intranet, meetings, road shows etc.

A waste management plan is in place to ensure effective control of solid and liquid waste.

Quarterly and annual reports are compiled for Top Management to ensure effective controls. Personnel performing work affecting quality are adequately trained and authorized to perform specified tasks.

F-3.2. QUALITY ASSURANCE AT ESKOM

Eskom's Quality Assurance (QA) programme, including the Quality Policy Directive, is specified in the Safety and Quality Management Manual of its Nuclear Division. Oversight of the operations is provided by the QA programme of Koeberg Nuclear Power Station. This programme is based on the IAEA Safety Code 50-C/SG-Q, the NNR Licence Document LD-1023 and Eskom Nuclear Division Safety and Quality Management Manual.

The responsibility for the implementation of quality assurance policies on the operational plant is that of the Koeberg Power Station Manager being accountable to the Senior General Manager (Nuclear Division). The licence holder's quality management and operational QA programmes presently satisfy both the international standards and codes and those of the NNR.

A comprehensive audit programme of planned, periodic monitoring for the nuclear installation has been established by the licence holder in conformance with NNR's licensing requirements. This programme is informed by indicators which include audit findings, inspection non-compliances, operating experience and problem reports. The audit programme is discussed with the NNR and takes into account the NNR's planned audit and inspection programme to ensure an integrated monitoring programme is established.

Achievement and maintenance of quality are verified by audits, surveillances, self-assessments and peer reviews. These are conducted in accordance with authorised procedures and are performed by certificated auditors using approved checklists. Personnel performing monitoring activities are independent of direct responsibility for the activity being monitored.

Monitoring reports are issued and reviewed for comment by the monitored organisation. Follow up action is taken to verify that deficiencies or discrepancies have been corrected. The results of monitoring activities and management reviews are maintained as quality assurance records. The detection, reporting, disposition and correction of non-conformances, deficiencies and deviations from quality requirements are specified in various authorized procedures. Nonconforming items are conspicuously marked and where possible segregated from other items.

Management reviews are conducted on an annual basis. The base material for management reviews is obtained from monitoring activity reports, corrective action reports, quality deficiency reports and other reporting mechanisms. During these reviews an assessment of the adequacy of the current QA programme is performed and changes are made if deemed necessary.

Non-conformances for components are dispositioned as follows: use-as-is, repair, rework, or unfit-for-purpose based on review and evaluation by responsible, competent engineers. Non-conformance dispositions are reviewed and accepted by responsible management.

Conditions adverse to quality include failures, malfunctions, deficiencies, deviations, defective material or equipment, incorrect material or equipment. Significant conditions adverse to quality involve programmatic problems, as opposed to individual failures.

Conditions adverse to quality are identified and corrected. Significant conditions adverse to quality are identified, the root cause of the condition determined, and corrective action taken to prevent repetition. Appropriate management is informed.

Vendors are classified according to a 4-tier quality level system, based on the service/materials they provide and the safety classification of the plant which requires the vendor intervention.

Quality levels 1&2 vendors (highest quality classification) are assessed by the nuclear installation according to ISO 9001 and other pertinent criteria. Controls are in place to prevent inadvertent use of incorrectly classified vendors.

Permanent QA records are retained for the life of the item to which they refer. Record storage facilities have been constructed to prevent damage or deterioration of records due to fire, flooding, insects, rodents and adverse environmental conditions.

F-4 OPERATIONAL RADIATION PROTECTION

Article 24: Operational radiation protection

1. Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:

   (i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;

   (ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and

   (iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

2. Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:

   (i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and

   (ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.

3. Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.

F-4.1. OPERATIONAL RADIATION PROTECTION: LEGAL FRAMEWORK

The NNRA makes provision for the NNR to impose any condition in a nuclear authorisation, which is deemed necessary to ensure the protection of persons, property and the environment against the risk of nuclear damage. The fundamental radiation protection criteria are detailed in the SSRP, Regulation R.388. These include the prescribing of dose limits for workers and members of the public as well as the setting of dose constraints for public exposure.

F-4.1.1. DOSE LIMITS

In achieving the objectives for the control of occupational exposure, the NNR requires that no individual shall receive an annual dose in excess of the prescribed dose limits and that all exposures are as low as is reasonably achievable.

The NNR has prescribed dose limits for both members of the public and the occupationally exposed workforce. These limits are detailed as follows:

a) Occupational exposure

The occupational exposure of any worker shall be so controlled that the following limits are not exceeded:

- an (average) effective dose of 20 mSv per year averaged over five consecutive years;
- a (maximum) effective dose of 50 mSv in any single year;
- an equivalent dose to the lens of the eye of 150 mSv in a year; and
- an equivalent dose to the extremities (hands and feet) or the skin of 500 mSv in a year.
- in special circumstances, provided that radiation protection in the action has been optimised but occupational exposures still remain above the dose limit the Regulator may approve a temporary change in the dose limit subject to the agreement of the affected employees, through their representatives where appropriate, and provided that all reasonable efforts are being made to improve the working conditions to the point where compliance with the dose limits can be achieved. This temporary change shall not exceed 5 years and shall not be renewed.

b) Apprentices and students

For apprentices of 16 to 18 years of age who are training for employment involving exposure to radiation and for students of age 16 to 18 who are required to use sources in the course of their studies, the occupational exposure shall be so controlled that the following limits are not exceeded:

- an effective dose of 6 mSv in a year;
- an equivalent dose to the lens of the eye of 50 mSv in a year; and
- an equivalent dose to the extremities or the skin of 150 mSv in a year.

c) Women

The annual effective dose limit for women of reproductive capacity is the same as that which is generally specified for occupational exposure. Following declaration of pregnancy, a limit on the equivalent dose to the abdomen of 2 mSv for the remainder of the pregnancy applies.

d) Emergencies

In the event of an emergency or when responding to an accident, a worker who undertakes emergency measures may be exposed to a dose in excess of the annual dose limit for persons occupationally exposed:

- for the purpose of saving life or preventing serious injury;
- if undertaking actions intended to avert a large collective dose; or
- if undertaking actions to prevent the development of catastrophic conditions.

Under any of the above circumstances, all reasonable efforts must be made to keep doses to the worker below twice the maximum annual dose limit. In respect of life-saving interventions, every effort shall be made to keep doses below ten times the maximum annual dose limit. In addition, workers undertaking interventions which may result in their doses approaching or exceeding ten times the annual dose limit may only do so when the benefits to others clearly outweigh their own risk.

e) Exposure of visitors and non-occupationally exposed workers at sites

The annual effective dose limit for visitors to the sites and those not deemed to be occupationally exposed is 1 mSv. The annual dose equivalent limit for individual organs and tissues of such persons is 10 mSv.

f) Public exposure

The annual effective dose limit for members of the public from all authorised actions is 1 mSv. No action may be authorised which would give rise to any member of the public receiving a radiation dose from all authorised actions exceeding 1 mSv in a year. To ensure compliance with this limit a public dose constraint of 0.25 mSv per annum is applied at authorised sites.

Holders of nuclear authorisations are required to establish complementary operational programmes, which are sufficiently comprehensive to ensure compliance with those limits. These are augmented by operational verification programmes on aspects relating to radiation protection in design in order to ensure that the parameters of the safety assessment remain current and to aid in ensuring that the operational programmes are not compromised. The necessary principles are embodied in the nuclear licence and in licence holder's programme on Radiological Protection.

F-4.1.2. ALARA FOR WORKERS AND PUBLIC

The ALARA programmes at Eskom and Necsa are aimed at minimising radiation doses. A hazard-graded approach is used to determine safety requirements for radiation risks associated with facilities during normal operations as well as during abnormal or accident conditions. Interdependencies between related actions or their associated risks are taken into account. During the design of a new facility or modification of existing facilities, design objectives are set to optimise exposures of workers and the public.

Dose optimisation is used to limit doses associated with various activities, and dose limits are set to ensure that desired levels of safety are achieved.

Doses to public are kept ALARA with the application of optimisation for discharges to the environment and through implementation of a system of Annual Authorised Discharge Quantities (AADQ).

Workers at mining and mineral processing facilities are monitored at defined intervals and conditions are continuously reviewed to ensure that doses are kept in accordance with the requirements of the ALARA programme.

F-4.1.3. OCCUPATIONAL DOSE CONTROLS

All holders of nuclear authorisations undertake various radiation protection actions to limit the exposure of workers and ensure compliance with the dose limits. These include: establishing a radiation protection programme, optimising design of facilities, establishing radiation and contamination control zones, a work permit system for non-standard tasks and registering of radiation workers.

The nuclear authorisation holders maintain dose records for workers and projections of public doses, based on the quantities of effluent released. Doses that are above reference levels for individual workers are investigated and at higher values interventions occur to limit further exposure.

In the mining industry a limited number of shafts have registered worker doses above the annual effective dose limit of 50 mSv/a. In those shafts where the dose limit was exceeded workers were removed and relocated. The ventilation in these shafts was also improved to reduce the dose to below 50 mSv/a.

F-4.1.4. MEASURES TO PREVENT UNPLANNED/UNCONTROLLED RELEASES

The SSRP and conditions of authorisation stipulate that the principle of defence- in-depth must be applied in the design and operation of the nuclear installation in accordance with good engineering and international norms and practice. This includes prevention and mitigation of accidents, and redundant measures to reduce probability of discharges to the environment. The degree to which defence-in-depth is applied must take into account the scale of the hazard.

F-4.2. DISCHARGE CONTROL

In the SSRP provision is made for the control of discharges to the environment.

"The *Regulator may, for the purposes of controlling radioactive discharges from a single authorised action, determine a source-specific annual authorised discharge quantity (AADQ) in the nuclear authorisation, which must take into account the dose constraint and links to optimisation."*

The term 'discharge' is used to refer to the on-going or anticipated releases of radionuclides arising from the normal operation of an authorized action/facility or a source within an authorized action/facility. It is a requirement that both discharges to atmosphere and discharges to water bodies need to be addressed.

Any person applying for an authorisation for the discharge of radioactive effluents must submit to the NNR the relevant information necessary to support the application. The application must contain an assessment of the nature, magnitude and likelihood of the exposures attributed to the discharges and an appropriate safety assessment, including an explanation of how radiological protection has been optimised and the assessed dose/risk to members of the public from the discharge of radioactive effluents as a result of normal operations.

The effectiveness of radiation protection measures for each authorized discharge, together with the potential impact of this discharge on humans and the environment, must also be assessed.

The submission must also address the issues of waste generation and management interdependences. In this regard, the submission must demonstrate that the generation of radioactive wastes in terms of activity and volume is kept to the minimum practicable and that available options for waste disposal are taken into account to ensure that discharge to the environment is an acceptable option.

Authorised discharge limits will be issued in the form of a document referred to as a 'discharge authorisation'. A revised application for a discharge authorisation must be applied for:

- whenever an increase in discharges or the discharge of a new radionuclides are being considered; or
- whenever it is identified that a model assumption has been invalidated.

Nuclear authorisation holders are responsible for setting up and implementing the technical and organizational measures that are necessary for ensuring the protection of the public in relation to the radioactive discharges for which they are authorized.

F-4.2.1. DISCHARGE LIMITS AND REGULATORY REPORTING

Discharge authorisations are normally set in terms of annual limits. While these are the primary limits, shorter-term levels must be set in order to:

- trigger investigations; and
- ensure that the procedure used and the associated conditions and assumptions used to estimate doses remain valid, (e.g. to prevent significantly higher doses being received owing to higher than normal discharges in conditions of poor dispersal in the environment).

As an illustration, these levels could be set at 40% of the annual limit for a calendar quarter, 15% of the annual limit for a calendar month, or 5% of the annual limit for a week, with account taken of the nature and operation of the source. Although this is not be seen as a breach of the statutory discharge authorisation, the operator is required to

- notify the regulatory body if the shorter term levels are exceeded;
- state the reasons for their being exceeded; and
- propose mitigatory measures.

In addition to the above, based on the model results, an appropriate set of environmental investigation/reporting levels must be developed. The site environmental monitoring programme, must take due account of the predicted discharge impacts and, must serve as a means of verifying model predictions.

All licensees have NNR approved programmes implemented. Adherence to the requirements is verified by the NNR through the compliance assurance program.

Koeberg

Radioactivity in liquid and gaseous discharges from Koeberg during 2010 contributed a projected total individual dose of 3.54 µSv to the hypothetically most exposed public group. The projected doses as a result of gaseous and liquid discharges were 0.39 µSv and 3.15 µSv respectively, which is well within the NNR dose constraint of 250 µSv per annum, and meets the ALARA dose target of 10 µSv, which is applicable for an annual period in which there is one refuelling outage.

Necsa

At Necsa, discharges to both the atmosphere (via several facility stacks) and to a water body (Crocodile River) are controlled via a set of nuclear license and control documents, to ensure that the public exposure to radiation is kept as low as reasonably achievable. For the year 2010 the estimated dose to the maximum exposed member of the public was; 4.1 µSv for atmospheric discharges and 5.1 µSv for liquid effluent discharges. This resulted in a total public dose estimate of 9.2 µSv that is 3.47% of the dose constraint of 250 µSv/annum set by the NNR.

Mines

At present source specific AADQ's are not applied at mining and mineral processing facilities. The NNR is currently undertaking investigations in this regard and plans to introduce source specific AADQ's for mining and mineral processing facilities in the near future.

F-4.3. UNPLANNED RELEASE OF RADIOACTIVE MATERIALS INTO THE ENVIRONMENT

The unplanned release of radioactive material into the environment is a reportable event in terms of the conditions of authorisation. In reporting the event the nuclear authorisation holder is responsible for investigating the causes of the event and determining appropriate corrective and preventative actions to be undertaken. The NNRA further provides the NNR with authority to impose any condition necessary for the rehabilitation of the site or to ensure protection of persons, property and the environment from nuclear damage.

F-5 EMERGENCY PREPAREDNESS

Article 25: Emergency preparedness

1. Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.
2. Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.

F-5.1. EMERGENCY PLANS

The NNRA requires the establishment of an emergency plan, where the possibility of a nuclear accident affecting the public may occur. The regulator must ensure that such emergency plans are effective for the protection of persons should a nuclear accident occur. The emergency plan includes a description of facilities, training and exercising arrangements, and liaison with off- site authorities as well as relevant international organizations and emergency preparedness provisions.

Furthermore, the Minister may, on recommendation of the Board of Directors 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.

Additionally the conditions of licence require that

a. The licensee must ensure that emergency planning and preparedness processes include procedures to ensure that all persons, in the employ of the licensee, who have duties in connection with such processes, are properly trained and instructed in:

   (i) the performance of the processes;

   (ii) the use of any equipment that may be required; and

   (iii) the precautions to be observed.

b. Where emergency planning and preparedness processes require the assistance or cooperation of, or it is expedient to make use of the services of any person, local authority or any other body; the licensee must ensure that such persons, local authority or other body are consulted in the periodic review and update of such processes.

c. The licensee must ensure that all emergency planning and preparedness processes are exercised and tested at such intervals and at such times and to such extent as the NNR may specify or, where the NNR has not so specified, as the licensee considers necessary to ensure their continued viability.

All facilities have emergency plans to describe the emergency organization, emergency scenarios (including initiating event, source term and consequences) and actions to control an emergency (including data to be reported, mitigatory measures and personnel monitoring requirements).

In order to assess the effectiveness of the emergency preparedness and response arrangements the NNR normally performs audits and arranges a regulatory emergency exercise during which the response to a given scenario is tested. This testing of the licensee's emergency preparedness and response is additional to the self-testing required of licensees.

In terms of other relevant legislation applicable to emergency planning the Disaster Management Act, Act 57 of 2002 (DMA) was promulgated on 15 January 2003.

The DMA provides for:

- an integrated and coordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters, and post- disaster recovery
- the establishment of national, provincial and municipal disaster management centres
- disaster management volunteers
- matters relating to these issues.

The national disaster management framework comprises six key performance areas (KPA's). Each KPA is informed by specified objectives and, as required by the Act, key performance indicators (KPIs) to guide and monitor its implementation.

(i) KPA 1 focuses on establishing the necessary institutional arrangements for implementing disaster management within the national, provincial and municipal spheres of government and describes some of the mechanisms for funding disaster management.

(ii) KPA 2 addresses the need for disaster risk assessment and monitoring to set priorities, guide risk reduction action and monitor the effectiveness of our efforts.

(iii) KPA 3 introduces disaster management planning and implementation to inform developmentally-oriented approaches, plans, programmes and projects that reduce disaster risks.

(iv) KPA 4 presents implementing priorities concerned with disaster response and recovery and rehabilitation.

(v) KPA 5 describes mechanisms for the development of both non-accredited and accredited education and training for disaster management and associated professions and the incorporation of relevant aspects of disaster management in primary and secondary school curricula. It also addresses priorities and mechanisms for supporting and developing a coherent and collaborative disaster risk research agenda.

(vi) KPA 6 presents processes for evaluation, monitoring and improvement of disaster management as envisaged in the implementation of the Act. It introduces a range of mechanisms for measuring and evaluating compliance with the national disaster management framework and the Act. These include performance audits, self-assessments, peer reviews, reviews of significant events and disasters, and rehearsals, simulations, exercises and drills

When a nuclear accident occurs, the nuclear authorisation holder in question must implement the emergency plan as approved by the regulator. In terms of the decision-making arrangements regarding a nuclear accident, the authority to implement on-site protective actions rests with the nuclear installation emergency controller. In terms of the Disaster Management Act, the off-site authorities are required to verify and implement off-site protective actions as recommended by the nuclear authorisation holder in the event of a nuclear accident according to the procedures laid down in the emergency plan.

In support of the emergency plans, environmental monitoring plans, that provide a baseline for background radiation and radiological concentrations in various environmental media in the surrounds of the Pelindaba, Vaalputs and Koeberg sites, have been implemented for the past few decades. These include air, water (river, dam and borehole), sediment, soil, vegetation, fish, produce and milk as applicable to the sites. Quarterly and annual reports of the findings are presented to the NNR.

With regard to mining and minerals processing facilities, although emergency preparedness is not required from such operations, emergency plans and preparedness arrangements are in place for all residue disposal facilities and incorporated in the management plans.

F-5.2. INTERNATIONAL ARRANGEMENTS

South Africa has signed and ratified the following International Conventions that are pertinent to emergency preparedness:

- Convention on Early Notification of a Nuclear Accident; and
- Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency

No specific agreements have been signed with neighbouring countries on matters relating to notification in the case of a nuclear emergency or the provision of assistance in such a case.

F-5.3. PREPARATION AND TESTING OF EMERGENCY PLANS

Preparedness is achieved by training a specific group of professionals, with a view to enhancing efficiency in responding to an emergency situation. Those who develop and provide specialist support services in respect of the licence holder's emergency response are nuclear professionals and specially trained personnel. These include Government Technical Advisors from the regulatory body.

For the other personnel, training courses are developed at a level appropriate to the function required of the individual. The efficiency of these plans at Koeberg and Necsa is tested by the NNR every 18-24 months.

F-6 DECOMMISSIONING

Article 26. Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available;

(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied;

(iii) the provisions of Article 25 with respect to emergency preparedness are applied; and

(iv) records of information important to decommissioning are kept

F-6.1. QUALIFIED STAFF AND ADEQUATE FINANCIAL RESOURCES

Decommissioning is regarded as a phase in the life cycle of authorised facilities. Specific requirements applicable to decommissioning, such as early decommissioning planning, arrangements to ensure appropriate information management, staffing and financial resources are covered in regulations and the regulatory framework.

F-6.2. REQUIREMENTS DURING DECOMMISSIONING

The SSRP prescribes the requirements for decommissioning of nuclear installations, plants or equipment having an impact on radiation protection and nuclear safety. The development of a decommissioning plan must be initiated as part of the prior safety assessment and must proceed throughout the period of operation of the authorised action. The decommissioning plan must be submitted to the regulator at its various stages of development and must specify all institutional controls necessary after termination of the period of responsibility of the holder. The need for institutional controls must be minimized.

It must be demonstrated to the regulator that sufficient financial resources will be available from the time of cessation of the operation to the termination of the period of responsibility.

F-6.3. DECOMMISSIONING AT KOEBERG

Decommissioning of the nuclear installation is currently scheduled for after 2035. Financial provision for the decommissioning (and also spent fuel management) has continued to be accumulated on a monthly basis since commercial operation of the installation began in 1984. The financial provision is reflected in the annual financial statements of the licence holder. These financial statements are audited in accordance with South African national legislation.

The amount of decommissioning and used fuel provision made each month is determined by present value future estimation for cash flows in terms of decommissioning financial plans. These financial plans are reviewed regularly and annually adjusted with the South African inflation rate.

Financial and human resources for the management of low and intermediate level radioactive waste are part of the normal operations of the nuclear installation and hence included in the business and financial plans.

F-6.4. DECOMMISSIONING AT NECSA:

A decommissioning strategy is required for all operational and new facilities. The ability to decommission a facility is a design parameter. Prior to termination of operations, a final decommissioning strategy is selected and motivated and a decommissioning plan is submitted to the NNR for approval. The decommissioning plan shall, as a minimum requirement cover phase

1 decommissioning activities. Continued decommissioning (phase 2 and 3) shall be determined depending on the circumstances of each case. An explanation of the decommissioning phases is provided in Section L Annex7.

The operational requirements for example ventilation and radiation protection programmes approved in the preceding phase of the project shall be maintained until replaced by an approved program.

F-6.5. PROVISIONS WITH RESPECT TO EMERGENCY PREPAREDNESS

Decommissioning is regarded as a phase of authorisation and all the main requirements applicable to the operational phase are applicable for decommissioning.

F-6.6. RECORDS OF INFORMATION IMPORTANT TO DECOMMISSIONING

The nuclear authorisation holder is required to maintain a record of the facility history. This record must include:

- facility description,
- SHE assessments,
- raw material, product quantities, quantities of normal operational liquid and gaseous discharges and waste generated
- prevailing radiological condition of the facility and surrounding environment,
- events registers and dose exposure records, and
- the prescribed decommissioning reports.

SECTION G: SAFETY OF SPENT FUEL MANAGEMENT

G-1 GENERAL SAFETY REQUIREMENTS

Article 4: General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management; individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed;

(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted;

(iii) take into account interdependencies among the different steps in spent fuel management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

G-1.1. CRITICALITY AND RESIDUAL HEAT REMOVAL

G-1.1.1. KOEBERG:

Koeberg only handles and stores spent fuel generated from the two Koeberg reactor units. Irradiated fuel assemblies and control rods are stored only in designated racks in the storage pool. These are:

- high and low density storage racks in the storage pool for standard and cropped fuel assemblies;
- the control rod rack in the storage pool for burned control rods;
- the high-density racks at koeberg are all lined with boron carbide and the coolant is mixed with boric acid to ensure sub criticality during storage.

G-1.1.2. Necsa:

SAFARI-1 Irradiated uranium target plates, fuel assemblies and control rods are stored only in designated racks in the storage pool. These are:

- Standard and cropped fuel assemblies
- The control rod rack in the storage pool for intact control rods
- The cool-off rack in the reactor pool for Molybdenum target plates.

Special arrangements are made for irradiated fuel that is located in other areas during transfer or for inspection, testing, and cropping. All fuel transfers are carried out in accordance with the designated fuel transfer permit procedures and forms.

Safety Precautions for handling Fuel Assemblies: Fuel is handled only under the supervision of a licensed shift supervisor, assisted by at least two reactor operators, one of which is a licensed reactor operator. A licensed reactor operator must be in the control room to record every fuel movement in the control room log book and when fuel is being loaded into or unloaded from the reactor core. He must also monitor the status of the core nuclear instrumentation during these activities.

Requirements for Shipment of Fuel: Special arrangements for the shipment of fuel out of the reactor building (e.g. Shipment of fresh fuel back to the manufacturer for any reason, or shipment of used fuel for long term storage or final disposal) shall be made only in accordance with the designated fuel transfer permit procedures and forms. Used fuel is shipped only in a properly designed and licensed used fuel cask.

Criticality of Fuel in Transit: In order to prevent accidental criticality while handling fuel, no more than six fuel units, i.e. fuel elements and/or control rods, may be present in any location not included in the description of designated storage locations.

The Thabana Pipestore is a dry storage facility for used fuel from the SAFARI-1 research reactor. This facility comprises subsurface sealed stainless steel storage pipes. These pipes are positioned in boreholes that are lined with normal borehole lining and cement pipe for possible acid neutralisation. The pipe openings are shielded with a lead plug and are sealed with an airtight flange. The pipes are kept under pressure of an inert gas. For security and safety purposes the facility is enclosed in a shed like structure.

During the design of the Pipestore, used fuel storage facility criticality was taken into consideration. The operating technical specification limits the acceptance of used fuel at the Pipestore to fuel that has undergone a cooling period of at least 2 years. A subsurface borehole design was selected for the dual purpose of shielding and heat transfer

G-1.2. RADIOACTIVE WASTE MINIMISATION

No waste that is associated with used fuel management is generated at facilities, except for the components such as end adaptors, cadmium section, lower member end adaptors that are removed at the SAFARI-1 reactor. These are handled as LILW waste.

G-1.3. INTERDEPENDENCIES IN SPENT FUEL MANAGEMENT

Used fuel is currently kept in interim storage at the generator's facilities. The facilities have been designed so as to retrieve elements at a later stage. No decisions have been made with respect to processing or disposal. The Radioactive Waste Management Policy and Strategy for the Republic of South Africa outlines a framework within which these decisions will be made. As far as reasonably practicable, the effects of future radioactive waste management activities, particularly disposal, will be taken into account when any one radioactive waste management activity is being considered.

G-1.4. PROTECTION OF INDIVIDUALS, SOCIETY AND THE ENVIRONMENT

The SSRP prescribes dose and risk criteria applicable to members of the public and workforce, as well as general safety principles such as defence-in-depth, ALARA, and conformance to good engineering practice. The dose criteria, discussed in Article 24, are applied in accordance with international practice (e.g. ICRP, IAEA). The risk criteria, established by the regulator in the 1970s, are based on analysis of risk to society imposed by industry and various natural disasters.

These standards refer directly to the primary concerns of nuclear safety, namely radiological risk to the public and plant personnel, and are intended to ensure protection of the environment against radiological hazards.

The applicant is required to submit a safety case which must include documentation relevant to the demonstration of compliance with the SSRP. The safety case typically includes:

- A Safety Analysis Report (SAR);
- Risk and dose assessment;
- General Operating Rules (GOR);
- SAR/GOR supporting documentation;
- Other licence binding documents;
- Changes to the SAR/GOR and supporting documentation relevant to the particular application;
- Project management documentation; and
- Safety related programmes applicable during a given licensing stage.

In terms of the NNRA, the NNR issues a nuclear installation licence which holds the licensee responsible to the above standards as well as to the safety case, which for nuclear installations includes the plant specific Safety Analysis Report.

Used fuel management is managed as part of the operational process of Koeberg and SAFARI-1. This implies that the protection of individuals, society and the environment is assessed under the same criteria applicable to operating conditions.

G-1.5. BIOLOGICAL, CHEMICAL AND OTHER HAZARDS

It is required that waste characterisation be conducted throughout pre-disposal management steps. Waste category specific characterisation requirements are specified and cover the establishment of physical, chemical, biological and radiological properties to determine waste processing needs and the ultimate suitability of the waste package for storage and disposal. Waste characterisation data and records are used for verification and quality assurance purposes.

Biological, chemical and other hazards associated with used fuel, are considered in relation to radiological hazards. In addition, all facilities regulated by the NNR and RADCON have to comply with all other relevant legislation.

The storage pipes of the Necsa Pipestore are sealed (kept under pressure of an inert gas to avoid degradation and monitor for leaks). A risk assessment of the facility was carried out.

G-1.6. PROTECTION OF FUTURE GENERATIONS

According to the Radioactive Waste Management Policy and Strategy for the Republic of South Africa, the government will initiate investigations into the best long-term solutions for the management of used fuel. The process of selecting a site for long-term (HLW) waste management shall involve a public participation process. The principle of protection of future generations is embodied in the Radioactive Waste Management Policy and Strategy for the Republic of South Africa and this principle is discussed in Section H-1.6.

G-1.7. NO UNDUE BURDENS ON FUTURE GENERATIONS

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa embodies the principle of no undue burden on future generations. In line with this principle the policy and strategy regards final disposal as the ultimate step in radioactive waste management, although a stepwise waste management process is acceptable. Long term storage of certain types of waste e.g. used fuel, may be regarded as one of the steps in the management process

Investigations shall be conducted within set time frames to consider the various options for safe management of used fuel and the following options shall be investigated:

- long-term above ground storage in an off-site facility licensed for this purpose;
- reprocessing, conditioning and recycling;
- deep geological disposal; and
- transmutation.

G-2 EXISTING FACILITIES

Article 5: Existing facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

G-2.1. LEGISLATIVE FRAMEWORK:

The conditions of authorisation require the holder of a nuclear installation licence to provide a safety assessment, including a risk assessment, and to keep the assessment up to date. The assessment must take into account experience feedback (local and international) in terms of incidents or emergent safety issues.

G-2.2. KOEBERG: MAIN RESULTS OF SAFETY ASSESSMENTS PERFORMED

The holder is required by conditions of licence to maintain an up to date plant specific safety assessment. Koeberg completed a periodic safety re-assessment in 1998. A subsequent periodic safety review was commenced in 2008 and was completed at the end of 2010.

A World Association of Nuclear Operators (WANO) team, comprising experienced nuclear professionals from three WANO regions, conducted a peer review at the Koeberg Nuclear Power Station in November 2008. The purpose of the review was to determine strengths and areas in which improvements could be made in the operation, maintenance, and support of the nuclear units at the Koeberg Nuclear Power Station.

As a basis for the review, the team used the Performance Objectives and Criteria for WANO Peer Reviews; Revision 3 dated January 2005. These were applied and evaluated in light of the experience of team members and good practices within the industry.

The team spent two weeks in the field observing selected evolutions, including surveillance testing and normal plant activities.

The following was noted:

- WANO credited Koeberg for the progress that had been made since the last WANO review of 2006 but also identified gaps in performance in several areas, specifically in the areas of

Plant Status Controls and Situational Awareness (i.e. conventional safety).

- Whilst these gaps have not resulted in an unacceptable situation as regards nuclear safety, it has been recognised by Koeberg that a step change in management actions and in the focus on their resolution is required in order to avoid a repeat Area For Improvement (AFI) finding in these areas and to bring the station back in line with industry best practice. The utility has developed action plans to address the areas for improvement.

Modifications implemented at Koeberg

Some of the modifications relevant to this convention, which have resulted in safety improvements, are:

- re-racking of the used fuel pools with high density fuel storage racks;
- castor x/28 f dry storage casks for interim spent fuel storage;
- re-racking of the used fuel pools with super high density fuel storage racks to accommodate the full design life of the plant;
- increased used fuel pool cooling;
- upgrade of used fuel pool crane;
- upgrade of control room alarms;
- code repair of stress corrosion cracking on the refuelling water storage tank and pipe work of the spent fuel pool, containment spray and low head safety injection systems.

Generally modifications have been initiated as a result of various factors such as:

- need for additional used fuel storage capacity;
- international operating experience feedback e.g. TMI initiatives;
- other international sources to improve nuclear safety or the installation's cost effectiveness;
- potential weaknesses in the design, identified during the safety re- assessment of the nuclear installation, or resulting from the activities reported under Article 14.

A suite of modifications identified as safety re-alignment projects (CP1) has been identified (EdF was used as a benchmark). These modifications will be completed by 2011/12 by utilising a phased approach in terms of implementation.

G-2.3. NECSA: INCREASE IN STORAGE CAPACITY OF PIPESTORE

The storage capacity of the Necsa Pipestore used fuel storage facility had to be extended. Before the design was done, a full review was performed on the existing facility. This included a detailed assessment on a used storage pipe. This assessment proved that current design was safe and suitable and no improvements were needed to upgrade the safety of the facility.

G-3 SITING OF PROPOSED FACILITIES

Article 6: Siting of proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:
   - (i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime;
   - (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment;
   - (iii) to make information on the safety of such a facility available to members of the public;
   - (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.
1. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.

G-3.1. SITE-RELATED FACTORS LIKELY TO AFFECT THE SAFETY

In terms of the NNRA, nuclear authorisation applications are required for the siting of nuclear installations. The conditions of authorisation require the holder of a nuclear installation licence to provide a safety assessment, including a risk assessment, and to keep the assessment up to date. The assessment must take into account experience feedback (local and international) in terms of incidents or emergent safety issues.

In terms of reviewing the suitability of a specific site, the applicant must submit to the regulator a site safety report which will sufficiently characterise the site so as to demonstrate that the safety standards laid down by the regulatory body could be met in respect of the plant design. Typically the site safety report should address the following topics: description of site and environs, population growth and distribution, land-use, adjacent sea–usage, nearby transportation, civil and industrial facilities, meteorology, oceanography and cooling water supply, impact of natural hazards, impact of external man made hazards, hydrology, geology and seismology, fresh water supply, site control measures, emergency services, radioactive effluents, and the ecology of the surroundings.

Although all these topics need to be supported by up to date validated data, one important factor in determining the suitability of the site is that the projected population growth and distribution around the site has to be such to provide the assurance that emergency planning and preparedness arrangements for the site could be maintained viable throughout the lifetime of the nuclear installation.

Should the regulatory body conclude that the proposed site is not viable or suitable; an authorisation will not be granted.

G-3.2. SAFETY IMPACT OF THE FACILITY

Holders of nuclear authorisations must comply with the requirements of the SSRP. The NNR requires the holder of an authorisation to provide adequate source term data to demonstrate that the projected dose to the critical group owing to normal operations and accident conditions of moderate frequency (1-10^{-2} per annum) comply with an annual average dose limit of 0.25 mSv per annum to the critical group.

For accidents of frequency lower than 10^{-2} per annum, the licence holder is required to calculate the projected accident source terms in order to demonstrate compliance with the risk criteria laid down by the regulatory body in terms of maximum individual risk, average population risk and societal risk.

The NNR has further stipulated limits on urban developments in the vicinity of the installation and holds regular meetings with the licence holder and the local authorities in this regard. The licence holder is required to maintain an effective emergency plan. The emergency plan is regularly exercised by the licence holder and independently by the Regulator (every 18 months to two years) (as reported under Article 25).

G-3.3. PUBLIC ACCESS TO SAFETY RELATED INFORMATION

All used fuel management facilities are considered nuclear installations and in terms of the NNRA, the holders of nuclear installation licences must establish a public safety information forum in order to inform the persons living in the municipal area on nuclear safety and radiation safety matters.

Public Safety Information Forums have been established and frequent meetings are held with the public living in the area of the nuclear installation in order to inform them on current safety issues. The public and other interested parties are invited to NNR emergency exercises as observers, during which time opportunities are given to evaluate the state of emergency preparedness.

In terms of the NNRA, the applicant for a new nuclear installation licence must:

- serve a copy of the application upon every municipality affected by the application and such other body or person as the chief executive officer determines; and
- publish a copy of the application in the Gazette *and* two newspapers circulating in the area of every such municipality.

Any person who may be directly affected by the granting of a nuclear installation or vessel licence pursuant to an application may make representations to the board, relating to health, safety and environmental issues connected with the application, within 30 days of the date of publication. Should the NNR Board be of the view that further public hearings are needed, the Board shall arrange for such hearings.

Further, in terms of the South African environmental legislation an environmental impact assessment, which is subject to public participation, must also be performed for all radioactive waste management facilities.

G-3.4. CONSULTATION WITH CONTRACTING PARTIES

At present South Africa does not undertake any specific consultation with other contracting parties regarding new facilities; however any contracting party that may be affected will be included in the consultation detailed under G-3.3.

G-3.5. NO UNACCEPTABLE EFFECTS ON OTHER CONTRACTING PARTIES

When any new project is initiated or when modifications to an existing license is made, which could have an effect on public safety, the public is invited to participate in the new or revised application for a license. The potential effect from the project on the public is assessed in terms of the basic safety requirements specified in the SSRP. After authorisation, the NNR implements a compliance assurance programme. Feedback is given at the public information forums to the public and other affected parties.

G-4 DESIGN AND CONSTRUCTION OF FACILITIES

Article 7: Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account;

(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

G-4.1. LEGISLATION AND LICENSING PROCESS DURING DESIGN AND CONSTRUCTION

The requirements of the NNRA and the principal safety requirements formulated in the SSRP form the basis for the stipulation of the regulatory requirements for design and construction of nuclear installations. These requirements are applicable to all existing and new facilities. Authorisation to operate a facility is only given after it has been verified by the NNR that the construction was in accordance with the design.

For Koeberg, where appropriate, the requirements of the vendor country are taken into consideration and safety and engineering standards, including those relating to design, manufacturing and construction, are required to be those of countries with acceptable records of safety.

At Necsa management processes are in place to ensure that all projects, which include the modification and the establishment of new facilities, are assessed to determine the Safety, Health, Environment and Quality (SHEQ) requirements for the internal and external approval of the project. The requirements include the interpretation of the regulatory framework as applicable to all the project phases (design to decommissioning) that is then communicated and agreed with the Regulator.

G-4.2. DECOMMISSIONING AT THE DESIGN STAGE

In accordance with the provisions of the SSRP, a decommissioning strategy must be submitted as part of the prior safety assessment for any new facility. NNR requirement document RD-0026 further requires that a decommissioning strategy, consistent with the SSRP and Radioactive Waste Management Policy and Strategy for the Republic of South Africa, must be submitted as part of the conceptual decommissioning plan from the design phase and must be updated throughout the operation of the authorised action as a basis for a detailed decommissioning plan.

G-4.3. EXPERIENCE, TESTING AND ANALYSIS

The SSRP requires that

"Installations, equipment or plant requiring nuclear installation licence, nuclear vessel licence or a certificate of registration and having an impact on radiation or nuclear safety must be designed, built and operated in accordance with good engineering practice."

Further, in accordance with the provisions of NNR requirement document RD-0034, *Quality and Safety Management Requirements for Nuclear Installations*, the following requirements must be complied with:

(1) The conditions for application of the selected codes and standards as prescribed by the authority which released the code / standard must be fulfilled by the organisations involved in the process. Any deviations must be justified and presented to the NNR for acceptance.

(2) QA measures must be defined and must be compatible with the technical requirements of the selected codes and standards. The involvement of the licensee in the QA measures must be commensurate with the safety and quality classification of the SSC.

(3) All SSC important to nuclear safety must be designed according to the latest or applicable approved standards as at the time of licensing of the nuclear installation and must be accepted by the relevant South African authorities. If no approved standards are available for a specific application, internationally recognised codes or standards must be proposed for acceptance. The licensee may also request NNR acceptance of a specific edition of a code or standard. If possible the SSC should be of a design proven in previous equivalent applications, and must be consistent with the reliability goals determined for the respective SSC.

(4) Where new or innovative design or features are used, the licensee must provide the results of the investigations on applicability of the codes and standards to the NNR. It must be demonstrated that the selected codes and standards are fully applicable to the SSC. In any other case a revised code, standard or specification must be developed and approved.

(5) Design and development outputs must contain the information necessary for verification and validation to pre-determined requirements and/or design criteria. The licensee must ensure that the outputs must be reviewed against inputs as part of a design review process to provide objective evidence that the requirements /or design criteria have been met.

(6) Validation of the output of the design and development processes must be performed in a controlled manner to ensure that the resulting product is capable of meeting the requirements for the specified use.

(7) Design control procedures must be established for verifying or checking the adequacy of design and as a basis for the performance of design reviews.

(8) The verification or checking process must be performed by individuals, departments or organizational units other than those who have performed the original design.

(9) The licensee must establish a process for the selection and acceptance of the codes and standards which must be based on the classification of the SSC and graded quality assurance measures. The selected codes and standards have to be determined and justified by the licensee. The justification of a code or standard for an intended application must be acceptable to the NNR.

(10) The licensee must show to the NNR how the deviations will be incorporated and covered during the design and licensing process in case of deviations from an existing code or standard with a potential to result in verification, validation and approval process. The requirements resulting from such deviations must be implemented in the selection and implementation process of the codes and standards and the qualification of the suppliers and the SSC.

(11) Procedures must be established at suppliers for selecting, and reviewing the suitability of materials, parts, equipment and processes that are essential to the safety functions of SSC.

(12) Provisions must be implemented to ensure that quality assurance measures are included in design specifications and that responsibilities are determined to ensure that compliance with these measures is controlled and achieved. The requirements that are essential to quality and to procedural processes must be specified prior to commencing with the activity to which they relate.

(13) The licensee must ensure that design verification procedures are implemented and measures are performed within their own organisations and level 1 suppliers (suppliers assigned responsibility for products of high importance to nuclear safety or having a direct influence on the safety performance of the nuclear installation) if:

- New safety features for nuclear installations are considered that differ significantly from proven technology or that use simplified, inherent, passive, or other innovative means to accomplish their safety functions
- Design changes occur for components of existing nuclear installations

(14) In case of design changes the design verification measures must be commensurate with those applied to the original design and must be performed based on processes agreed with the NNR.

(15) Design changes must be controlled as part of a configuration management system. Design changes affecting the safety functions and occurring after the submission of a safety case must be submitted to and accepted by the NNR in accordance with agreed processes.

(16) A test programme must be implemented by the licensee or its suppliers to demonstrate the safe performance of new safety features. It must be ensured that the safety features will perform as predicted, to provide sufficient data to validate analytical codes, and that the effects of systems interactions are acceptable. The test program must include suitable qualification testing of a prototype simulating the most adverse design conditions. The test programme must be defined in writing and make provision for sign-offs as the test programme conditions are met.

Additional guidance in this regard is included in NNR position Paper PP-008, *Design Authorisation Framework.*

G-5 ASSESSMENT OF SAFETY OF FACILITIES

Article 8: Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

G-5.1. PRIOR SAFETY ASSESSMENT AND ENVIRONMENTAL ASSESSMENT

In accordance with the regulations published in terms of the ECAA and the NEMA an environmental impact assessment is required for all proposed spent fuel management facilities.

The SSRP requires that:

"Measures to control the risk of nuclear damage to individuals must be determined on the basis of a prior safety assessment which is suitable and sufficient to identify all significant radiation hazards and to evaluate the nature and magnitude of the associated risks, with due regard to the dose and risk limits"

G-5.2. OPERATION SAFETY ASSESSMENTS AND ENVIRONMENTAL ASSESSMENTS

The requirements for lifecycle safety assessments and safety cases are detailed in Section E-2.2.2 of this report.

G-6 OPERATION OF FACILITIES

Article 9: Operation of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the licence to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility;

(v) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body

G-6.1. SAFETY ASSESSMENTS AND SAFETY CASES

The requirements for lifecycle safety assessments and safety cases are detailed in Section E-2.2.2 of this report.

The NNR is charged, by virtue of the provisions of NNRA, to consider all relevant aspects of an application for a nuclear licence which it may receive and may direct the applicant to furnish it with such information as may assist it in reaching a decision on the granting or refusal of a nuclear licence, and the conditions under which such a licence ought to be granted.

The licensing process covers several stages including siting, early site works, construction, commissioning and operation.

The applicant is required to submit the relevant supporting safety documentation for each phase which would cover the following:

i. Credentials as an applicant (e.g. legal, financial and organisational aspects);

ii. Licensing and construction schedules;

iii. Site Safety Report;

iv. Safety Analysis Report (including plant design);

v. General Operating Rules covering all operational safety related programmes, covering commissioning, plant operations, quality assurance, radiation protection, waste management, maintenance, inspection and testing, emergency planning and physical security.

A site licence followed by a construction licenses may be issued or optionally a combined construction licence covering siting may be issued. The construction licence would not be issued until the first four items listed above have been submitted and reviewed by the regulator, and relevant inspections conducted. Provisional submissions of general operating rules will generally be required at this stage as well.

The operating licence will generally constitute a phased process involving several licences issued in stages. Again these would only be issued once the regulator is satisfied with the submissions covering the relevant aspects of the general operating rules and additional aspects of the SAR as necessary, and the relevant inspections and tests have been conducted confirming compliance to the design.

G-6.2. OPERATIONAL LIMITS AND CONDITIONS

The conditions of authorisation stipulate that the plant must be operated in accordance with limits and conditions consistent with the overall safety case, which includes the outcome of the testing and commissioning programmes.

Further to this, the operating licence holds the applicant to the safety case and relevant operating rules, which include the processes for maintaining the safety case valid and current, incorporating experience feedback, and modifications to the plant and the safety related procedures.

G-6.3. OPERATIONAL PROCEDURES

The conditions of authorisation stipulate that all activities relating to nuclear safety shall be conducted in accordance with procedures and in accordance with a quality management system accepted by the regulator. As referred to in G-6.1 these include operations, maintenance, monitoring, inspection and testing.

G-6.4. ENGINEERING AND TECHNICAL SUPPORT

To comply with the conditions of the nuclear authorisation the licence holder needs to have sufficient resources in order to address the full scope of requirements imposed by the regulatory body. These are covered by the Quality Assurance requirements referred to in G-6.1. The Regulator monitors and reports on the organisational aspects including competence and staffing levels of the nuclear authorisation holders, on an annual basis. Deficiency in engineering or technical support is directed to the nuclear authorisation holder for rectification.

As regards Koeberg Nuclear Power Station for example, the licence holder has entered into technical co-operation agreements with Electricité de France to provide additional technical support as necessary.

G-6.5. INCIDENT REPORTING

Requirements on incident reporting and corrective actions are specified in the conditions of licence. The licence holder is also required to maintain a problem management and reporting system to the satisfaction of the regulatory body.

Koeberg reports nuclear safety significant events to WANO, and the regulatory body reports events to the IAEA-IRS (Incident Reporting System) and INES reporting systems.

G-6.6. OPERATING EXPERIENCE FEEDBACK SYSTEM

The holder is required by condition of licence to implement an operating experience feedback system. The licence requires implementation of the relevant processes for analysis of experience feedback from the plant and relevant international experience feedback, and corrective action.

For Koeberg the process includes operational experience from Electricité de France, WANO, INPO and manufacturers.

G-6.7. DECOMMISSIONING PLANS

In accordance with the regulations on safety standards and regulatory practices (SSRP), decommissioning plans are required for all facilities from the design stage through to decommissioning. The plans must be updated periodically and submitted to the regulator for approval before actual decommissioning commences.

G-7 DISPOSAL OF SPENT FUEL

Article 10: Disposal of spent fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

In the South African context, the term "used fuel" is used instead of "spent fuel". Pending the outcome of current investigations into possible reprocessing of the used fuel to extract radioactive isotopes for further use, used fuel is not classified as radioactive waste. In view of the above there are currently no immediate plans for disposal of used fuel.

SECTION H: SAFETY OF RADIOACTIVE WASTE MANAGEMENT

H-1 GENERAL SAFETY REQUIREMENTS

Article 11: General safety requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed;

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable;

(iii) take into account interdependencies among the different steps in radioactive waste management;

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards;

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation;

(vii) aim to avoid imposing undue burdens on future generations.

H-1.1. CRITICALITY AND RESIDUAL HEAT REMOVAL

In accordance with the legislation and conditions of authorisation a safety case must be submitted by an applicant to the NNR to obtain a nuclear authorisation. The authorisation is granted when the NNR has satisfied itself that the applicant has addressed all aspects of safety satisfactorily and that appropriate control programmes are implemented to deal with issues of concern. The applicant is required to have a criticality safety program in place for all operations involving uranium and plutonium (except in instances where the isotopic mass fraction is less than that of natural uranium) including analysis, verification, and implementation thereof. Effective implementation of this programme is verified by the NNR.

NNR guidance related to criticality safety requires that the applicant, in the authorisation application, should demonstrate that:

(1) An adequate organization with which to implement the criticality safety program is established;

(2) An adequate criticality safety program to ensure safe operation of the facility is established including an adequate criticality accident alarm system (CAAS);

(3) Adequate controls and limits on parameters relied on to prevent nuclear criticality are implemented; and

(4) Accident sequences identified in the Criticality Safety Evaluations (CSEs) and documented in the safety analysis leading to nuclear criticality have been assessed.

The applicant's implementation of criticality safety technical practices to ensure the safe operation of the facility are required to be described as part of the submitted safety case. This should include:

(1) The commitment to implement criticality safety controls and limits in accordance with technical practices as described in the application, by incorporating them into the applicant's criticality safety program.

(2) Technical practices, including a description of the management measures that ensure operability of the CAAS and emergency response procedures.

(3) The technical practices to ensure that limits on controlled parameters have an adequate safety margin. These practices should include those to ensure that the methods used to develop criticality safety limits are properly validated.

(4) The technical practices to ensure that sufficient criticality safety controls developed in the CSEs, and taken up in the safety analysis, are identified for each process.

(5) The areas of review as they relate to criticality safety, with specific reference to-

    i. Potential accident sequences that could result in nuclear criticality;

    ii. Specific controls relied on to provide reasonable assurance that an inadvertent criticality will not occur; and

    iii. A demonstration that the likelihood of failure is sufficiently low so as to demonstrate compliance with the double contingency principle.

(6) A commitment to prepare and maintain applicable safety basis documentation, which will be in sufficient detail so that criticality controls and contingency analysis can be reviewed and inspected by the NNR and applicant.

H-1.2. MINIMISATION OF RADIOACTIVE WASTE

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa embodies waste minimisation as a principle and requires that generation of radioactive waste shall be kept to the minimum practicable.

Generation of waste must be kept to a minimum in terms of activity and volume by application of design, operating and decommissioning measures. Wastes are segregated by physical, chemical, radiological and biological characteristics in order to reduce volumes and facilitate good practice in radioactive waste management.

The waste management process is regarded as an integrated process that includes waste generation, predisposal waste processing (pre-treatment, treatment and conditioning), waste storage, waste transport and waste disposal.

Effective implementation is verified by the NNR.

H-1.3. INTERDEPENDENCIES IN RADIOACTIVE WASTE MANAGEMENT

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa embodies the principle that interdependencies among all steps in radioactive waste generation and management shall be appropriately taken into account.

Interdependencies in the generation and management steps are managed through the preparation of a facility radioactive and hazardous waste management program and waste management plans. Requirements are identified during the facility hazard assessment and included in the integrated safety assessment of the facility. The facility waste management programme identifies waste streams and endpoints and ensures that waste management and transport steps meet requirements of the NNR.

Non-conformities in earlier processes (e.g., the predisposal processes) may impact on later processes (e.g., final disposal). It may not always be possible or effective to rectify such non-conformities in a retrospective manner. In such a case, an integrated waste management approach is endorsed through integrated safety, health, environment and quality management practice, which aims to prevent harmful effects on current and future generations for the total life cycle of radioactive waste management.

H-1.4. PROTECTION OF INDIVIDUALS, SOCIETY AND THE ENVIRONMENT

The NNRA mandates that the NNR provide for protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices. The NNR has published regulations on safety standards and regulatory practices on 26 April 2006 (SSRP).

In developing its regulations, standards and guidance the NNR takes due account of international standards and criteria, in particular the safety standards of the IAEA, recommendations from the ICRP and reports from UNSCEAR.

The NNR also tracks regulatory practices at other regulators and has signed bilateral agreements for the sharing of information, standards and regulatory practices with a number of international nuclear regulators including nuclear regulatory bodies in Argentina, Canada, France, Korea, United Kingdom and United States of America.

South Africa is also a member of the Network of Regulators of Countries with a Small Nuclear Programme (NERS) and as such, shares experiences, etc. associated with regulators of such countries.

H-1.5. BIOLOGICAL, CHEMICAL AND OTHER HAZARDS

The NNR has no specific requirements regarding biological, chemical and other hazards. However, these are considered in as far as they have a connection with radiological hazards. In addition, all facilities regulated by the NNR and DOH have to comply with all other legislation with regard to other types of hazards.

Necsa employs a radioactive waste characterisation process for radiological, chemical, mechanical, thermal and biological properties of radioactive wastes. These characteristics are used to categorise the wastes in order to determine the applicable processing technology that will be used to render the final waste matrix acceptable for packaging, storage and final disposal.

The waste acceptance criteria of the Vaalputs low and intermediate level waste repository further impose requirements on predisposal operators to record and report all radioactive as well as hazardous chemical and biological waste constituents. It further prescribes a list of prohibited waste (e.g. pyrophoric material, hazardous chemicals, gas generating constituents, etc.) that will not be accepted for final disposal.

H-1.6. PROTECTION OF FUTURE GENERATIONS

The protection of future generations is a principle embodied in the Radioactive Waste Management Policy and Strategy for the Republic of South Africa. In accordance with the policy principles, radioactive waste shall be managed in such a way that predicted impacts on future generations will not be greater than relevant levels of impact that are acceptable today.

The SSRP prescribes the NNR dose and risk criteria and applicants for and holders of nuclear authorisations are required, by means of their submitted safety case documentation, to demonstrate compliance with the prescribed dose and risk criteria.

In the case of waste disposal, permanent containment and isolation in a repository cannot always be guaranteed over long time periods. It may be possible that some fraction of the waste inventory could migrate to the biosphere, potentially giving rise to exposures in future years. Doses to individuals and populations over long time-scales can only be estimated and the reliability of these estimates decrease as the time period into the future increases. The Post-Closure Radiological Safety Assessment for Vaalputs Radioactive Waste Disposal Facility considered various long and short term intrusion and exposure scenarios and concluded that the dose to the most exposed individual (inadvertent intrusion) would still be within prescribed limits.

H-1.7. NO UNDUE BURDEN ON FUTURE GENERATIONS

In accordance with the Radioactive Waste Management Policy and Strategy for the Republic of South Africa, radioactive waste shall be managed in such a way that will not impose undue burdens on future generations. South Africa has also adopted the "*Polluter Pays Principle*", in that the financial burden for the management of radioactive waste shall be borne by the generator of the waste.

In the Republic of South Africa, final disposal is regarded as the ultimate step in the radioactive waste management process, although a stepwise waste management process is acceptable. Long term storage of certain types of waste e.g. high level waste, long lived waste and spent sources may be regarded as one of the steps in the management process.

In practice the following hierarchy of waste management options shall be followed where practicable:

- waste avoidance and minimisation;
- reuse, reprocessing and recycling;

- storage;
- conditioning and final disposal.

To provide future generations with freedom of choice and to build confidence, all radioactive waste disposal options shall provide for a defined period during which retrievability will be possible.

Further, to minimise the burden on future generations, decommissioning and closure of facilities should be implemented as soon as practicable.

H-2 EXISTING FACILITIES AND PAST PRACTICES

Article 12: Existing facilities and past practices

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility;

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

H-2.1. SAFETY OF EXISTING RADIOACTIVE WASTE MANAGEMENT FACILITIES

In terms of the NNRA, the applicant is required to submit a safety case, which must include documentation relevant to the demonstration of compliance with the SSRP. Approved, existing safety cases reflect the current situation of the waste management facility.

In accordance with the SSRP, an operational safety assessment must be performed and submitted to the Regulator at intervals specified in the nuclear authorisation and which must be commensurate with the nature of operation and the radiation risk involved. The compliance assurance programmes of the NNR are established to monitor compliance to the conditions of authorisation.

As an integral part of the operational safety assessment in addition to the on-going assessment, which focuses on immediate aspects of installation and procedural modification, a requirement to undertake a periodic safety re- assessment is also in place. The conditions of authorisation for nuclear installations require that the licensee establish and implement processes for the periodic and systematic review and reassessment of safety cases submitted to the regulator.

H-2.2. REVIEWING THE RESULTS OF PAST PRACTICES

The waste management facilities at Koeberg, Necsa and Vaalputs comply with safety requirements laid down by the NNR. The requirements prescribe:

- compliance with a system of justification of facilities/actions;
- compliance with dose and risk limits;
- compliance with dose constraints and annual allowable discharge quantities;
- mandate the use of the ALARA principle;
- require application of the "defence in depth" principle and good engineering practice.

When the Vaalputs facility was developed more than two decades ago, the emphasis was placed on the performance of natural barriers (e.g., low permeability geo-sphere) rather than engineered barriers. The initial safety report, the probabilistic safety assessment and the post closure safety assessment for Vaalputs, have not shown that any optimisation/ improvement of the disposal concept are required in order to enhance the long term safety performance of the site.

The post closure safety assessment has, however, suggested that the operational safety of the disposal site can be improved by:

- backfilling and covering disposal trenches more promptly and thereby limiting exposure of waste packages to environmental agents.
- Limiting the water content in disposed waste packages

These suggestions have been incorporated into operational procedures and the waste acceptance criteria to improve the safety of the facility.

H-3 SITING OF PROPOSED FACILITIES

Article 13: Siting of proposed facilities

1. Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:

    (i) to evaluate the safety of all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure;

    (ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure;

    (iii) to make information on the safety of such a facility available to members of the public;

    (iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.

2. In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.

H-3.1. SITE-RELATED SAFETY FACTORS

At this stage, there are no new radioactive waste management facilities proposed for development and siting in South Africa.

The Department of Environmental Affairs and the NNR require holders of nuclear authorisations to evaluate all relevant site related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after its closure. Where a major hazard installation is located on-site outside of a nuclear installation, a risk assessment has to be conducted every 5 years and submitted to the Department of Labour (DOL) in terms of the major hazard installation regulations of the Occupational Health and Safety Act, Act No. 85 of 1993.

In terms of the NNRA, nuclear authorisations are required for the siting of nuclear installations. In anticipation of applications for new nuclear sites, regulations on siting of new nuclear installations were published in July 2009, for stakeholders comment.

The purpose of these Regulations is to establish regulatory requirements pertaining to sites for new nuclear installations. In developing these regulations the NNR took cognizance on international standards and practices from sources such as the IAEA and also from relevant nuclear safety authorities of other countries. The standards and processes applied to the current site of the nuclear installations, reported below, have to a large extent been taken into account in the proposed Regulations.

In terms of reviewing the suitability of a specific site, the applicant must submit to the NNR a site safety report which will sufficiently characterise the site such as to demonstrate that the safety standards of the NNR could be met in respect of the plant design. Typically the site safety report would address the following topics: description of site and environs, population growth and distribution, land-use, adjacent sea–usage (if applicable), nearby transportation, civil and industrial facilities, meteorology, oceanography and cooling water supply, impact of natural hazards, impact of external man made hazards, hydrology, geology and seismology, fresh water supply, site control, emergency services, radioactive effluents, ecology.

Although all these topics need to be supported by up to date validated data, one important factor in determining the suitability of the site is that the projected population growth and distribution around the site has to be such as to provide the assurance that emergency planning and preparedness arrangements for the site could be kept viable throughout the lifetime of the nuclear installation. Should the NNR conclude that the proposed site is not viable and suitable for licensing; the applicant will need to consider other alternative sites.

H-3.2. SAFETY IMPACT AFTER CLOSURE

The Vaalputs National radioactive waste disposal facility is the sole disposal facility in the country. A post closure safety assessment of the disposal facility has been undertaken. This assessment was based on the IAEA ISAM methodology and demonstrates that the post closure impacts will be acceptable in terms of the current dose limits.

A conceptual plan is also in place for the care and maintenance of the Vaalputs site up to 300 years post closure. See also Sections H-5.2 and H-6.9.

H-3.3. PUBLIC ACCESS TO INFORMATION

Current regulations require that an environmental impact assessment and a nuclear licence for nuclear related projects, be subjected to public participation in the decision-making phases prior to establishment and operation of the nuclear facility. Detail on this process is provided in Section G-3.3.

Nuclear installation licenses are made available to the public or anybody visiting a nuclear facility by displaying the licenses in three languages within accessible areas of the facility building.

Information regarding the safe operation of nuclear facilities is communicated to interested and affected parties on Safety Information Forums. See also Section G-3.3.

H-3.4. CONSULTATION WITH CONTRACTING PARTIES

The current radioactive waste management facilities pose no impact beyond the borders of the Republic and therefore neighbouring contracting parties have not been engaged on the likely impact of radioactive waste facility. Any contracting party that may be affected by the granting of a new nuclear authorisation for radioactive waste management facility will be included in the consultation detailed under Section G-3.3.

H-3.5. NO UNACCEPTABLE EFFECTS ON OTHER CONTRACTING PARTIES

When any new project is initiated or when modifications to an existing license are made, which could have an effect on public safety, the public is invited to participate in the new or revised application for a license. The potential effect from the project on the public is assessed in terms of the safety requirements specified in the SSRP. After authorisation, the NNR implements a compliance assurance programme. Feedback is given at the public information forums to the public and other affected parties.

H-4 DESIGN AND CONSTRUCTION OF FACILITIES

Article 14: Design and construction of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a radioactive waste management facility provides for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

H-4.1. CONTROL MEASURES FOR DESIGN AND CONSTRUCTION

The requirements of the NNRA and the principal safety requirements formulated in the SSRP form the basis for the stipulation of the regulatory requirements for design and construction of nuclear installations.

All projects on the Necsa site follow the project approval process with specific requirements determined by the categorization of the project in terms of nuclear risk. Before construction of a nuclear facility, a safety assessment report and an environmental assessment are required. In the event of construction, the contractor must:

- have a health and safety file which contains the information prescribed in the construction regulations in terms of the OHS Act, Act No. 85 of 1993 that includes; a Necsa approved Health and Safety plan that addresses hazards which may impact on individuals, society or the environment
- must be in good standing with the government compensation fund or a licensed insurer.

The management system of Necsa prescribes the requirements and aspects to be considered in the safety assessment of each nuclear facility at Necsa, including all waste management, storage and conditioning facilities.

For Koeberg, all storage facilities have been designed to limit release of radon and dust into the atmosphere and also to limit the amount of seepage and runoff from the source to the environment.

H-4.2. CONCEPTUAL PLANS FOR DECOMMISSIONING AT THE DESIGN STAGE

The SSRP requires that a decommissioning strategy must be submitted as part of the prior safety assessment and must be updated throughout the operation of the nuclear installation as a basis for detailed decommissioning planning.

All new projects that are undertaken require that conceptual plans for decommissioning are taken into account during the design stage.

For nuclear power plants, where appropriate, the requirements of the vendor country are taken into consideration and safety standards are made reference to in terms of those of the country with an acceptable safety record.

H-4.3. TECHNICAL PROVISIONS FOR CLOSURE AT THE DESIGN STAGE

Continued monitoring and environmental surveillance of the Vaalputs site is ensured through the decommissioning and after care strategy, which is a nuclear license requirement and represents additional safety control measures that contribute to building confidence in the safe operation of the repository. A strategy for the decommissioning of all nuclear facilities is required.

H-4.4. EXPERIENCE, ANALYSIS AND TESTING

The same set of requirements applicable to spent fuel facilities applies to facilities discussed in this section. (See Section G, and Section E)

For the Vaalputs disposal site, technical and scientific data obtained from monitoring and measurement results are used to improve mathematical models for safety assessments and also for confirming the disposal system performance and possible impacts of the waste disposal operations on the environment.

At Koeberg experienced personnel coming from various disciplines are in place to provide technical support for the application of new technologies for design and construction.

H-5 ASSESSMENT OF SAFETY OF FACILITIES

Article 15: Assessment of safety of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out;

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body;

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

H-5.1. SAFETY AND ENVIRONMENTAL ASSESSMENT BEFORE CONSTRUCTION

In accordance with the environmental legislation any authorisation granted for a nuclear installation by the Department of Environment Affairs would be conditional on the necessary nuclear authorisation from the NNR being in place. No authorisation (Record of Decision) is required for facilities commissioned before September 1997 unless the operational status of the facility changes.

The NNR requirements for safety assessment are stipulated in the SSRP. The same set of requirements applicable to spent fuel facilities applies to facilities discussed in this section. (See Section G, and Section E)

At Necsa, the safety assessment report, the facility operating instructions and the environmental impact assessment requirements of the facility identified during the project review process constitutes key elements of the safety case of the waste management facility.

The Vaalputs repository was granted a nuclear license to commence operations in 1986 based on the Vaalputs National Radioactive Waste Disposal Safety Report. A probabilistic safety assessment of the Vaalputs operations was conducted in 1996 to assess the probabilities of different event sequences and failure scenarios and this assessment was incorporated into the nuclear license. The Post-closure Radiological safety Assessment was reviewed in 2007 and the Operational Safety Assessment was updated in 2010.

For Koeberg, a safety assessment and environmental impact assessment has been developed and submitted for approval by the respective regulators. These are reviewed and revised at defined intervals.

H-5.2. POST-CLOSURE SAFETY ASSESSMENT OF A DISPOSAL FACILITY

In accordance with NNR requirements, the post-closure safety performance of the Vaalputs repository system has subsequently been assessed in 2000 and again in 2007 by means of the post-closure radiological safety assessments. These assessments showed that the natural barrier component of the multi- barrier system provided sufficient isolation of the waste disposed of in the Vaalputs repository. The predicted radiation exposure of the public (critical group) is at levels considered to be acceptable as required by the national regulatory authorities.

The 2007 post-closure radiological safety assessment of Vaalputs showed that the repository isolation concept, comprising near surface trenches located in the region above the groundwater table, provides effective isolation from the biosphere for the duration of the operational and institutional control period. The institutional control period commences after repository closure and is envisaged to be three hundred years, given the current operational constraints and source term.

Safety assessments of Vaalputs have shown that the repository system has characteristics that:

- provide a high level of operational and long-term safety;
- demonstrate compliance with performance standards, thus enhancing public confidence in the disposal system;
- ensure safety without placing excessive financial burdens on the current and future generations;
- prevents or substantially delays movement of water or radio-nuclides toward the accessible environment;
- provides for the safe closure of the facility once all operations have ceased, given that the necessary after care measures are taken within the institutional control period.

H-6 OPERATION OF FACILITIES

Article 16: Operation of facilities

Each Contracting Party shall take the appropriate steps to ensure that:

(i) the licence to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements;

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary;

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure;

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility;

(v) procedures for characterization and segregation of radioactive waste are applied;

(vi) incidents significant to safety are reported in a timely manner by the holder of the licence to the regulatory body;

(vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate;

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body;

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

H-6.1. ASSESSMENTS AND COMMISSIONING PROGRAMME

The same set of requirements applicable to spent fuel facilities applies to facilities discussed in this section. (See Section G, and Section E).

For facilities in operation at Necsa facility-specific project commissioning requirements are documented in the pre-planning phase in accordance with the requirements of the approved SHEQ system.

All nuclear facilities, including Vaalputs operate under a nuclear installation licence issued by the NNR in terms of the NNRA. The repository nuclear installation license (NIL-28) includes requirements regarding the following:

- risk assessment and compliance with safety criteria;
- modifications and license change requests;
- reporting nuclear occurrences;
- probabilistic safety assessment;
- waste acceptance criteria;
- quality and environmental management system;
- radiological environmental surveillance program;
- radiological control programs;
- control over radioactive effluents;
- design technical specifications;
- emergency planning;
- maintenance program;
- security requirements;
- meteorological program;
- in service inspection and testing program; and
- operational procedures.

H-6.2. OPERATIONAL LIMITS AND CONDITIONS

Facility specific operating technical specifications (OTS) ensure that safety related systems, structures and components required for normal operation and emergencies are identified during risk and safety assessments. The conditions for any abnormal operation allowed must be clearly understood and documented.

The OTS includes safety limits, limiting safety settings, limiting conditions for operation, surveillance and maintenance requirements and the administrative controls involved in compliance with these requirements.

H-6.3. THE USE OF ESTABLISHED PROCEDURES

Facility specific in-service inspection and maintenance procedures (ISIP) are intended to ensure that systems, structures and components required for normal operations or emergencies function properly. The process is limited to the physical systems, structures and components identified in the risk assessment as items relied upon for safe operation.

Procedures for operation, maintenance, monitoring, inspection/auditing and testing have been established and are being implemented by the operator and results thereof are provided to the regulator during inspections and audits.

H-6.4. ENGINEERING AND TECHNICAL SUPPORT

The same set of requirements applicable to spent fuel facilities applies to facilities discussed in this section. (See Section G, and Section E)

The Necsa organisation is structured to ensure the necessary technical and engineering support is available to facility managers.

For the facilities at Koeberg, each operation has a Senior Manager: Engineering who is responsible for inspection and maintenance of critical safety components of storage facilities. Further, technical support is obtained from a competent team of engineers from the Eskom corporate office for operation of the radioactive waste management facility.

H-6.5. CHARACTERISATION AND SEGREGATION OF RADIOACTIVE WASTE

Waste is characterised according to the Radioactive Waste Management Policy and Strategy for the Republic of South Africa. Necsa management system documents provide guidance on the following topics:

- removal of material from radiological areas (SHEQ-INS-8040);
- clearance of materials from authorised facilities (SHEQ-INS-8110);
- off-site transport of radioactive material or contaminated equipment (SHE-INS-8170);
- quantities for the control of radioactive discharges to the environment from the Pelindaba site (SHEQ-INS-8240);

- management of radioactive emissions on the Pelindaba site (SHEQ-INS-8230);
- radiological environmental surveillance requirements for the Pelindaba site and vicinity (SHEQ-INS-8340);
- management of solid radioactive waste (SHEQ-INS-8360);
- solid radioactive waste classification scheme(SHEQ-INS-8380);
- radioactive waste categorization(SHEQ-INS-8390);

Waste acceptance requirements and criteria and discharge requirements are specified in facility specific procedures. Facility managers are responsible for waste characterisation. The necessity for detailed radionuclide characterisation depends in part on the projected dose to the critical group.

At Koeberg, a waste management procedure is in place for the characterisation and segregation of waste

NNR requirements document RD-004, *Radioactive Waste Management: Mining and Minerals Processing* specifies requirements for facilities dealing with NORM material.

H-6.6. REPORTING OF INCIDENTS

Necsa's incident reporting is addressed through the following management system documents:

- implementation of the conventions on the early notification and assistance in the case of nuclear accidents and radiological emergencies (SHEQ-INS-4143);
- event rating scale (SHEQ-INS-4145);
- categorization and notification of SHEQ related events (SHEQ-INS-4140);
- the Necsa emergency plan (SHEQ-INS-3500);
- notification and reporting to all relevant authorities (SHEQ-INS-4144);
- emergency plan for Necsa, Madibeng and Tshwane to control the off-site impact of Necsa emergencies (SHEQ-PLN-3500);
- requirements for SHEQ related event investigation (SHEQ-INS-4150);

At Koeberg, an occurrence reporting procedure is in place, which provides for detection, classification and reporting of reportable incidents within prescribed timeframes.

H-6.7. ANALYSIS OF OPERATING EXPERIENCES

The detail reported under Section G-6.6 is also relevant here.

Additionally the licensee management systems provide for:

- ALARA reviews: Detail is provided in Section F-4.12 in response to Article 24.
- Safety Reviews: Safety reviews are conducted routinely on facilities with a frequency depending on the associated risk and when modifications are made. The purpose of facility safety reviews are to keep facility personnel alert to process hazards, review operating procedures, identify equipment or process modifications that could have introduced new hazards, apply new technology to existing hazards, review the adequacy of inspections and safety instructions and ensure periodic review of the safety assessment.

H-6.8. DECOMMISSIONING PLANS

Requirements related to decommissioning are reported in Section F-6.

For the radioactive waste management facilities, decommissioning strategies and plans have been prepared for each operation and are reviewed and updated every 2 years to take into account any changes and events that might have occurred.

H-6.9. CLOSURE PLANS

The Vaalputs post closure engineering design incorporates information obtained during the operating lifetime of the facility. It forms part of the post-closure assessment of the repository and provides for:

- a detailed description of the Vaalputs repository as envisaged at the time of closure
- a basis for the assessment of potential closure system performance
- an indication that an integrated decommissioning and closure design has been developed
- evidence that good engineering principles and practises have been followed in the operation and the closure of the facility and are aimed at optimising the site and disposal operations with regards to radiological impacts arising from historical disposals.

H-7 INSTITUTIONAL MEASURES AFTER CLOSURE

Article 17: Institutional measures after closure

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved;

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required; and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

H-7.1. PRESERVATION OF RECORDS

To date no radioactive waste disposal facilities have been closed in the Republic of South Africa.

The SSRP makes provision for a system of record keeping to be implemented by holders of nuclear authorisations.

Further, the conditions of authorisation require that licensees must:

implement and maintain a document management system to ensure that every document required, every record made, every authority, consent or approval granted and every directive or certificate issued in pursuance of these conditions of licence is preserved for 30 years or such other period as the NNR may approve.

Additionally the NNR maintains a document management system aligned with the requirements of the National Archives and Records Services.

H-7.2. INSTITUTIONAL CONTROLS

The institutional control period for the Vaalputs installation commences after repository closure and is assumed to be 300 years (100 years for active institutional control followed by 200 years passive institutional control) given the current operational constraints.

The active institutional control measures after closure of the site include the following:

- measures to ensure that records of the location, design and inventory of the facility are preserved;
- radiological monitoring of environmental performance;
- patrolling and maintenance of disposal site security fences;
- deterring animal, plant and human intrusion;
- maintaining cover over the waste;
- monitoring of the performance of structures to confirm compliance with the design;
- ensuring proper rehabilitation and plant growth over previously disturbed areas.

In the passive institutional control phase it would clearly be preferable to put in place further regulatory measures to minimise the likelihood of intrusion into the site that was used for radioactive waste disposal. The following is regarded as means to achieve this:

- site location on official maps;
- land use restrictions/control;
- use of records;
- use of markers.

H-7.3. INTERVENTION MEASURES DURING INSTITUTIONAL CONTROL

Where non-conformities with regards to safety performance of the disposal site are detected within the institutional control period, it is foreseen that these will be corrected on a case-by-case basis in accordance with the best practise at the time. A ground stability unit is responsible for monitoring the geological stability of the site.

SECTION I: TRANSBOUNDARY MOVEMENT

ARTICLE 27.TRANSBOUNDARY MOVEMENT

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments. In so doing:

   (i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

   (ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilized;

   (iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention;

   (iv) a Contracting Party which is a State of origin shall authorize a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement;

   (v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not licence the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

   (i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international law;

   (ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin;

   (iii) the right of a Contracting Party to export its spent fuel for reprocessing;

   (iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

The National Radioactive Waste Management Policy and Strategy for the Republic of South Africa prescribes that:

"***No Import or Export of Radioactive Waste:*** *In principle South Africa will neither import nor export radioactive waste."*

RADCON is mandated for the purposes of the HSA to act as the national competent authority in connection with the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Material.

Transport of sealed sources classified as Group IV hazardous substances in terms of the HSA requires prior authorisation from the Directorate Radiation Control under the Department of Health.

The NNR is mandated for the purposes of the NNRA to act as the national competent authority in connection with the International Atomic Energy Agency's Regulations for the Safe Transport of Radioactive Material

Transport of radioactive material, including radioactive waste, that has activity concentrations above the exclusion levels specified in the SSRP requires prior authorisation from the NNR.

In accordance with the provisions of section 20(2) of the NNRA:

No vessel which is propelled by nuclear power or which has on board any radioactive material capable of causing nuclear damage may –

(a) *Anchor or sojourn in the territorial waters of the Republic; or*

(b) *Enter any port of the Republic, except under the authority of a nuclear vessel licence.*

The NNR has adopted the IAEA Regulations for the Safe Transport of Radioactive Material (TS-R-1) and this is referenced in the conditions of authorisation issued by the NNR. All transport of radioactive material must comply with the requirements of the IAEA regulations.

SECTION J: DISUSED SEALED SOURCES

Article 28: Disused sealed sources

1. Each Contracting Party shall, in the framework of its national law, take the appropriate steps to ensure that the possession, remanufacturing or disposal of disused sealed sources takes place in a safe manner.
2. A Contracting Party shall allow for reentry into its territory of disused sealed sources if, in the framework of its national law, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

J-1 FRAMEWORK FOR MANAGEMENT OF DISUSED SEALED SOURCES

J-1.1. AUTHORISATION OF WORK WITH SEALED SOURCES

All sealed sources inside a nuclear installation fall under the regulatory control of the NNR and are authorised in terms of the conditions of the Nuclear Installation Licence.

Outside a nuclear installation, sources are controlled as Group IV Hazardous Substances in terms of regulations under the HSA and are regulated by RADCON.

J-1.2. APPLICATION OF CONTROL

Control over the possession, remanufacturing and disposal of sealed sources is effected through a procedure which includes:

- approval of activities by the regulator;
- responsibilities;
- control over production;
- source registers;
- work procedures;
- use of sources at other sites;
- industrial radiography requirements;

- storage conditions and control;
- labelling of sources and source containers;
- smoke detector control;
- pre-disposal management;
- leak test requirements;
- transport and transfer requirements.

The relevant regulatory authority (NNR or RADCON) is required to be notified in advance of the production, subdivision, procurement, import, export, transfer and pre-disposal management of sources.

J-2 RE-ENTRY OF DISUSED SEALED SOURCES

The disposal procedure for sealed sources forms an inherent part of the regulatory procedures. Each time a sealed source is to be disposed of, a written permission must be obtained from RADCON. Disused sealed sources are held at the Necsa temporary waste storage site at Pelindaba or, as is the case with some imported sources, are re-exported to their country of origin.

The procedure for the disposal of sealed sources is as follows:

(i) authorisation holders who wish to dispose of redundant sealed sources have to apply to RADCON on the prescribed application form, namely RN525.

(ii) upon receipt of the application, the applicant's existing Authority to possess and use radioactive nuclides is checked to ensure that the source that is applied for appears on the particular authority. If RADCON is satisfied that everything is in order a separate Authority for disposal is issued. The authority holder is advised to contact Necsa regarding transport and delivery arrangements. The Nuclear Liabilities Division at Necsa is then contacted and provided with the full details of the specific application. After Necsa has taken possession of the source, RADCON is advised and the holder's Authority is amended by the removal of the source from the old Authority and a new one issued.

(iii) if the source is to be exported to the country of origin (typical for high activity medical sources) the holder must apply for an export Authority on the prescribed form RN781. Such Authority is issued if RADCON is satisfied that everything is in order and the authority holder can then make the necessary arrangements for export.

(iv) upon confirmation of the export, the particular source is removed from the old Authority and a new one is issued.

SECTION K: PLANNED ACTIVITIES TO IMPROVE SAFETY

K-1 NATIONAL MEASURES

K-1.1. NUCLEAR ENERGY POLICY

The Nuclear Energy Policy for the Republic of South Africa, published in June 2008, presents a policy framework within which prospecting, mining, milling and use of nuclear materials as well as the development and utilisation of nuclear energy for peaceful purposes by South Africa shall take place. The policy covers the prospecting and mining of uranium ore and any other ores containing nuclear materials, as well as the entire nuclear fuel cycle as well as focusing on all applications of nuclear technology for energy generation.

K-1.2. NATIONAL RADIOACTIVE WASTE DISPOSAL INSTITUTE ACT

The National Radioactive Waste Disposal Institute Act (Act No 53 of 2008) of South Africa was promulgated in 2008 and applies to all radioactive waste in the Republic of South Africa destined to be disposed of in an authorized waste disposal facility. The Act further establishes the National Radioactive Waste Disposal Institute (NRWDI), to be a schedule 3 public entity in terms of the Public Finance Management Act.

K-1.2.1. PROVISIONS OF THE ACT

The Act assigns the following functions to the NRWDI:

(i) perform any function that may be assigned to it by the Minister in terms of section 55(2) of the Nuclear Energy Act, 1999, (Act No. 46 of 1999), in relation to radioactive waste disposal;

(ii) design and implement disposal solutions for all classes of radioactive waste;

(iii) develop radioactive waste acceptance and disposal criteria in compliance with applicable regulatory, health, safety and environmental requirements and any other technical and operational requirements;

(iv) maintain a national radioactive waste database and publish a report on the inventory and location of all radioactive waste in the Republic at a frequency determined by the board;

(v) manage the disposal of any ownerless radioactive waste on behalf of the State, including the development of radioactive waste management plans for such waste;

(vi) assist generators of small quantities of radioactive waste in all technical aspects related to the disposal of such waste;

(vii) implement any assignments or directives from the Minister regarding radioactive waste disposal;

(viii) provide information on all aspects of radioactive waste disposal to the public in general, living in the vicinity of radioactive waste disposal facilities;

(ix) co-operate with any person or institution on matters related to the performance of any duty contemplated in this section falling within the functions; and

(x) perform any other function necessary to achieve the objects of this Act.

The Institute is governed and controlled by a board of directors that consists of:

- an official of the Department designated by the Minister;
- an official nominated by the Department of Environmental Affairs and Tourism and appointed by the Minister;
- an official nominated by the Department of Water Affairs and Forestry and appointed by the Minister;
- an official nominated by the Department of Health and appointed by the Minister;
- not more than five other directors;
- the Chief Executive Officer of the Institute; and
- the Chief Financial Officer of the Institute.

In terms of the provisions of section 23 of the Act:

(1) Any person who has to dispose of radioactive waste must apply to the chief executive officer for a radioactive waste disposal certificate in the prescribed format and must furnish such information as the board may require.

(2) The Chief Executive Officer must assess the information for compliance with the radioactive waste acceptance and disposal criteria contemplated in section 5(c) and, subject to the board's approval, must-

(a) refuse an application for a radioactive waste disposal certificate and furnish the applicant in writing with the reasons for the refusal, in accordance with the Promotion of Administrative Justice Act; or;

(b) grant an application for a radioactive waste disposal certificate subject to such conditions as may be determined in terms of section 24 of the Act.

In terms of the provisions of section 24 of the Act:

(1) The Chief Executive Officer may, subject to subsection (2), impose any condition in any radioactive waste disposal certificate which is necessary to ensure compliance with the radioactive waste acceptance and disposal criteria contemplated in section 5(c).

(2) The Chief Executive Officer-

(a) may, subject to paragraph (c), amend any condition in an existing radioactive waste disposal certificate;

(b) must notify the person in writing to whom the radioactive waste disposal certificate was issued of such amendment and the reasons therefore; and

(c) must submit to the board any amendments made to a radioactive waste disposal certificate in terms of paragraph (a) for ratification at the first meeting of the board following submission of the amendments.

Section 25 of the Act confers the following responsibilities to Waste Generators:

(1) The generators of radioactive waste are responsible for technical, financial and administrative management of such waste within the national regulatory framework at their premises and when such waste is transported to an authorised waste disposal facility.

(2) The generators of radioactive waste must-

(a) develop and implement site-specific waste management plans based on national policy;

(b) provide all relevant information on radioactive waste as required by the chief executive officer;

(c) demonstrate compliance with any conditions of a radioactive waste disposal certificate;

(d) provide site access to staff of the Institute for inspection against any conditions of the radioactive waste disposal certificate.

(3) The generators of radioactive waste remain responsible for all liabilities in connection with such radioactive waste under their control until such time as the radioactive waste has been received and accepted in writing by the Institution, following an inspection, at which time liability shall pass to the Institution.

In terms of section 30 of the Act, with effect from the specified date:

(1) all assets, rights, liabilities, obligations, licences and authorisations of the South African Nuclear Energy Corporation regarding the Vaalputs National Radioactive Waste Disposal Facility vest in the Institute; and

(2) the persons who immediately before the specified date were employees of the South African Nuclear Energy Corporation at the Vaalputs National Radioactive Waste Disposal Facility, appointed in terms of section 25 of the Nuclear Energy Act, 1999 (Act No. 46 of 1999), must be deemed to be employees of the Institute appointed in terms of section 19(2)

Noting that as a new entity the NRWDI will not immediately comply with all regulatory requirements of the NNR, the following transitional arrangements are established by the Act:

the South African Nuclear Energy Corporation must continue to maintain the nuclear installation licence of the Vaalputs National Radioactive Waste Disposal Facility by providing where necessary services to the Institute using the existing government budget allocations until such time as the Institute is in a position to take over the functions to the satisfaction of the National Nuclear Regulator.

K-1.3. NATIONAL REGULATORY SELF-ASSESSMENT – IAEA PROJECT

The AFRA Project on Self-Assessment of Regulatory Infrastructure for Radiation Safety and Networking of Regulatory Bodies has been initiated by the IAEA to develop and sustain national regulatory infrastructures for nuclear and radiation safety on the African continent.

In South Africa, both regulatory bodies, (NNR and RADCON) agreed to participate in the IAEA AFRA project RAF/9/038 "Promoting Self-Assessment of Regulatory Infrastructures for Safety and Networking of Regulatory Bodies in Africa". The South African response, analysis and report writing phases were conducted over one year, and were completed in December 2010. The outcome of the Self-Assessment was used to inform the organizational and, particularly the technical division strategy of the NNR.

The scope of the self-assessment matched the organisational functions. It considered the NNR goals and objectives, size and scope, competency to conduct self-assessment, weaknesses already identified during previous self-assessment(s), suggestions and recommendations from external review or appraisal events, areas of improvement identified during the QMS improvement or implementation, changes in the NNR's organisation, activities, management governmental framework, and stakeholder feedback. IAEA GS-R-1 requirements were used as the first level of Self-Assessment questions and criteria. The IAEA electronic Self-Assessment Tool (SAT) was used to facilitate the self-assessment process. The main aspects/modules to be considered for the self-assessment included:

- legislative and Government Responsibilities;
- responsibilities and functions of the Regulatory Body;
- organisation of the Regulatory Body;
- authorisation by the Regulatory Body;
- review and Assessment by the Regulatory Body;
- inspection and Enforcement by the Regulatory Body;
- development of Regulation and Guides of the Regulatory Body;
- management System for the Regulatory Body;
- radioactive Waste management and Decommissioning.

Officials participating in the project were selected to ensure that the preselected focus areas for self-assessment were represented across the regulatory body. A national train-the-trainer course on the self-assessment methodology was presented by the IAEA and additional in-house training workshops were conducted. The three phases of the Self-Assessment project included:

(i) Answering Phase where descriptive responses to an agreed self-assessment questionnaire along with all relevant documentary evidence are provided by a Respondent Team.

(ii) Analysis of Responses Phase documented comparison of how the answers given correspond to the criteria used as measures of excellence or compliance, and will identify the strengths and weaknesses of the regulatory body and its current performance relative to the assessment criteria.

(iii) Action Planning Phase, upon completion of the self-assessment analysis phase, a national action plan was developed by the Senior Management to improve the performance, effectiveness and efficiency of the regulatory bodies.

K-2 REGULATORS FORUMS

The NNR is a member of NERS (Network of Regulators of Countries with Small Nuclear Programmes) and as such, shares experiences, etc. associated with regulators of countries having a small nuclear programme.

The NNR has been actively involved in the establishment of the Forum of Nuclear Regulatory Bodies in Africa (FNRBA), which was launched in South Africa in March 2009. The main purpose of the FNRBA is to strengthen the regulatory oversight of nuclear and radiation safety on the African continent through increased cooperation amongst regulatory bodies.

Further, the NNR has bi-lateral agreements with nuclear safety authorities internationally such as the French ASN, the US NRC, the UK Health and Safety Executive Nuclear Directorate, the Argentinean (NBNR) and Korea(KINS). The bilateral agreements serve as a legal mechanism for information sharing and technical cooperation amongst the parties concerned.

The NNR is represented in the IAEA Commission on Safety Standards (CSS) and the IAEA Safety Committees (NUSSC, WASSC, TRANSSC and RASSC).

K-3 INTERNATIONAL NUCLEAR REGULATORY CONFERENCE

On behalf of the Government of South Africa, the NNR hosted the 2nd International Conference on Effective Regulatory Systems, as a follow up to the Moscow conference, which was held in Cape Town from 14-18 December 2009. The purpose of this conference was to emphasise the importance of a strong, effective global nuclear safety and security regime and the responsibility that all nuclear regulators, operating organizations and vendors have in maintaining it. Conferences of this nature play a vital role in ensuring that senior nuclear safety and security regulators review issues important to the global nuclear regulatory regime and to focus on the important role regulators play in safety and security. A regulatory system is effective when it ensures that a high level of safety, security and safeguards is maintained by licence holders/operating organizations; when it takes appropriate actions to prevent the degradation of safety and security; when it takes actions to promote safety and security improvements; when it performs its regulatory functions in an independent, transparent, timely and efficient way and it strives for the continuous improvement of itself and the industry.

The Conference was attended by 345 delegates, of whom more than 75% were international attendees, and was widely acknowledged as being very successful in achieving the objectives set for the Conference by the IAEA Programme Committee.

K-4 QUALITY MANAGEMENT SYSTEM

The NNR has initiated a project to review and strengthen its current internal processes with the objective of implementing a state of the art Integrated Management System (IMS). In conducting this Project the NNR has taken cognizance of the IAEA guidelines for management systems, International Management System Standards (e.g. ISO 9001) as well as investigating the approaches and experiences of nuclear regulatory authorities of other countries such as those from the NERS regulators network.

As part of this development the NNR has finalized its Management System Manual and mandatory ISO 9001 procedures. This includes important documented processes for the Development, Review, Approval, Issuance, Control and Revision of NNR Administrative and Technical Documents, Records Management, Internal Auditing, Corrective Action, Preventive Action and Management Review.

Core and support processes were identified, mapped, process owners identified and an approval matrix established. All required process documentation (Policies and Procedures) have been identified, some have been established and implemented. Although some policies and procedures still need to be developed, the Management System (MS) in general has therefore been established.

The NNR has initiated a project to strengthen its current Records Management and Knowledge Management processes through the implementation of an Electronic Document Management System (SharePoint Intranet). The Intranet systems design has been completed and the various Departmental Intranet sites established. Upon completion of the Validation and testing of the system, data migration and publication of existing / historic documents will be conducted.

Awareness, buy-in and implementation of the MS requirements and processes are not satisfactory at all levels of the organisation. A Change Management project will be initiated to ensure effective implementation and buy in of staff at all levels of the organisation.

K-5 REASSESSMENT FOLLOWING EVENTS AT FUKUSHIMA DAIICHI PLANT

The nuclear accident at the Fukushima Daiichi Nuclear Power Plant has highlighted potential weaknesses of nuclear plants to withstand extreme scenarios which may not have been initially analysed in their design. The NNR has in response to the event established a task team in April 2011 with the main objectives to identify the lessons from the accident and to conduct a comprehensive review of regulatory processes and regulations to determine whether the NNR should strengthen its regulatory oversight system to ensure continuous safety of operating nuclear installations in the country.

In this regard, the NNR has directed the Nuclear Operators in South Africa namely Eskom and the South African Nuclear Energy Corporation (Necsa) to perform safety reassessments on the Koeberg and Safari nuclear installations respectively. The aim of the safety reassessments is to identify vulnerabilities in the design basis of the facilities, to evaluate the safety margins for beyond design events, and to identify necessary modifications, measures and technical features to be implemented where needed to strengthen defence-in-depth and improve safety of operating facilities. The safety re-assessments reports from the operators are expected by November 2011, with the NNR review report expected by March 2012.

The NNR will further review and update, as may be required, its current regulatory standards and requirements incorporating the lessons learnt from the Fukushima event in line with its principal nuclear and radiation safety requirements as stipulated in the Safety Standards and Regulatory Practices, including risk and the principle of ALARA. and will direct, where necessary, the operators to implement these requirements as well as appropriate measures and/or design features to improve the safety of existing nuclear installations.

SECTION L: ANNEXES

The following Annexes are included in the South African National Report:

ANNEX 1:	Used Fuel Management Facilities
ANNEX 2:	Inventory of Used Fuel
ANNEX 3:	Radioactive Waste Management Facilities
ANNEX 4:	Inventory of Koeberg Radioactive Waste
ANNEX 5:	Inventory of Radioactive Waste at Necsa Facilities
ANNEX 6:	Typical Inventories of Radioactive Waste at NORM Facilities
ANNEX 7:	Necsa Facilities Being Decommissioned
ANNEX 8:	Reference to National Laws, Regulations, Requirements and Guides

ANNEX 1: USED FUEL MANAGEMENT FACILITIES

A1-1 USED FUEL MANAGEMENT FACILITIES AT KOEBERG NUCLEAR POWER PLANT:

Used fuel at Koeberg is stored in two interim waste management facilities, namely the interim wet waste management facility and the interim dry waste management facility. These are detailed below:

A1-1.1. INTERIM WET MANAGEMENT FACILITY AT KNPP

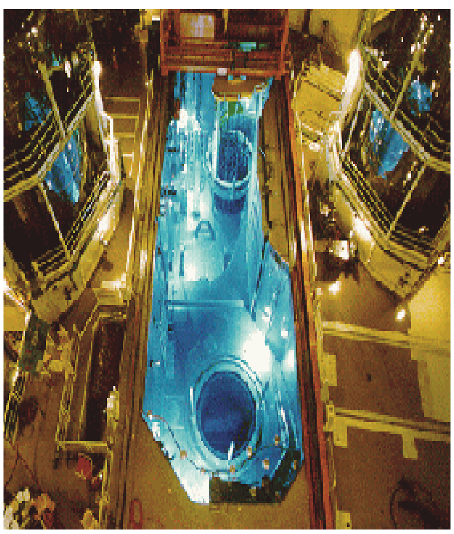


Figure 4: Koeberg Nuclear Power Plant

Koeberg Nuclear Power Plant (KNPP), see Figure 4, consists of two 900 MW reactors. Each of the reactor units of KNPP is served by a used fuel pool (UFP) with a capacity of 1 507 used fuel assembly (UFA) storage spaces. 157 of these spaces are reserved for emergency core offloads. That makes 1 350 spaces available for spent fuel storage in each pool.

The KNPP stores UFAs in the used fuel pools (UFPs) on site. Interim wet management facility at KNPP is made up of boronated pools at both reactor units, which are designed for temporary waste management of fresh fuel just delivered and for cooling and storage of irradiated or used fuel discharged from the reactor core. Each pool consists of two regions, namely region 1 for fresh fuel storage and region 2 used fuel storage.

A1-1.2. INTERIM DRY FUEL MANAGEMENT FACILITY AT KNPP

There are older UFAs with low enrichment (<3%) and low burn-up (<30GWd/t) that were removed from the pools and transferred to four dry-storage Castor X/28F casks. These casks are stored in the low level waste building at KNPP. Figure 5 and Figure 6 show pictures of the UFA casks in storage.

A1-1

Figure 5: UFA casks in storage at KNPP

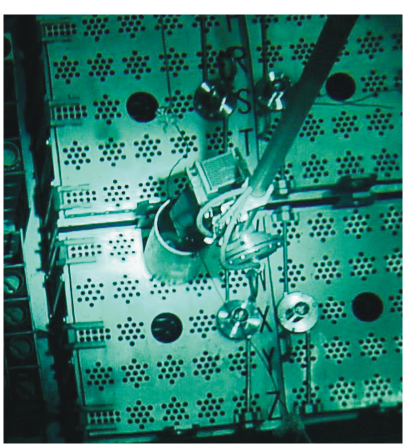
Figure 6: A side view of the Castor X/28UFA casks

A1-2 USED FUEL MANAGEMENT FACILITIES AT NECSA:

Used fuel at the Necsa is stored in two waste storage facilities. The wet waste storage facility, the reactor pool, is found in the reactor and the dry waste storage facility, the pipestore, is found outside the reactor on the Necsa Pelindaba site. These facilities are described below:

A1-2.1. THE REACTOR POOL

Storage racks, see Figure 7, are available within part of the reactor pool area and this facility consists of the following:



12 high density storage racks that can host 24 fuel elements per rack

control rod racks can host 10 control rods and

low density storage racks (currently not in use but are kept for back-up in case of capacity problems in the pool).

A1-2.2. THABANA PIPESTORE

The Thabana Pipestore facility is located on the Pelindaba East site of Necsa. It was built in 1994 for the dry storage of used fuel from the SAFARI-1 research reactor. The facility has a planned design lifetime of 50 years.

The storage pipes in the Pipestore are subsurface, inert atmosphere, sealed pipes. Access to the top of the pipes is limited by the enclosed structure built over the pipes.

In 2007 the storage capacity of the facility was increased. The original design was used when expanding the facility. The facility currently has 60 storage pipes, giving a total storage capacity of 1200 fuel elements.

Figure 8: A frontal view of the Thabana Pipestore

ANNEX 2: INVENTORIES OF USED FUEL

A2-1 INVENTORY OF USED FUEL AT KOEBERG NUCLEAR POWER PLANT:

Table 2: Inventory of used fuel in wet storage at Koeberg

STORAGE	LOCATION	USED FUEL ASSEMBLIES
Unit 1	Region 1	12
	Region 2	872
	Sub-total	***884***
Unit 2	Region 1	51
	Region 2	815
	Sub-total	***866***
Dry Storage	Castor X/28F casks	112
Total		***1882***

A2-2 INVENTORY OF USED FUEL AT NECSA, PELINDABA:

Table 3: Inventories of used fuel at Necsa Pelindaba site

STORAGE	LOCATION	SPENT FUEL ELEMENTS	USED CONTROL RODS
Wet storage	Safari-1: High Density Rack Storage	199	6
	Safari-1: Low Density Storage Rack	1	28
	Sub-total	***200***	***34***
Dry storage	Thabana pipe storage facility	662	114
Total		***862***	***148***

ANNEX 3: RADIOACTIVE WASTE MANAGEMENT FACILITIES

A3-1 SOUTH AFICAN NUCLEAR ENERGY CORPORATION (NECSA) PELINDABA SITE

Necsa is a diverse nuclear installation; see Figure 9, with various research and commercial programmes. It is therefore has a variety of radioactive waste storage facilities in operation. The radioactive waste generated needs to be isolated from the environment and therefore it is containerised, characterised, immobilised, treated, conditioned and stored before disposal can be considered. These waste management actions require the waste to be segregated and therefore the waste is handled in various locations and stores.

Figure 9: View of the Pelindaba site

Table 4: Listing of radioactive waste management facilities on the Pelindaba site

PURPOSE	NAME	LOCATION
Decontamination of uranium contaminated metals	Decontamination services	V-A8
	Area 27 Decontamination	Area 27
Future decontamination of UF6 containing cylinders	UF6 cylinder decontamination facility	Area 27
Liquid Effluent Treatment	LEMS	P-2400
	Oil purification plant	Sub area 40
	Uranium bearing liquid effluent treatment facility	A8
Predisposal operations	Volume Reduction Facility	Area 14 Pelstore
Historic liquid waste evaporation facilities. (Under evaluation for rehabilitation)	Pel East Pans 1-7	Pelindaba East
	CaF2 pans	Thabana
	Beva pans A, B, C & 1-14	Pelindaba west
Storage of post reactor test fuel pin related waste	Cell 3: NTP hotcell complex;	P1701
LILW and VLLW drummed and containerized solid waste storage facilities (conditioned and un-conditioned waste)	Pelstore	Area 14
	Thabana stores 1-5	Thabana
	UF6 cylinder and drum store	Area 21
	UF6 Cylinder store	Area 16
	Pelindaba East Bus Shed waste drum store	Pelindaba East
	A-west drum store	A west
Storage of non-clearable decontaminated metals	Quarantine store	Quarantine camp
Historic disposal trenches. Evaluated for possible retrieval, or approve as disposal site	Thabana radioactive waste storage facility (Trenches)	Thabana
	Historic disposal trenches	P-5100
Metal smelter & cutting room	Test smelter	Area 26

Below is a short description of some of the radioactive waste management facilities on the Necsa Pelindaba site.

A3-1.1. PELSTORE

Pelstore forms part of the Area 14 Waste Management Complex, which is located on the Pelindaba East site of Necsa. The building previously housed the Z Plant Uranium Enrichment Facility. During the decommissioning of the enrichment facility, all the equipment was removed and the building was cleaned to remove loose contamination. The facility has been used as a storage area since 2001.

The Pelstore consists of a concrete building and is utilised for the storage of containerised solid radioactive waste. The facility consists of a smooth concrete floor surface of about 15 600m^2.

The purpose of the Pelstore facility is to store containers with solid waste, prior to and after treatment and conditioning. The storage facility comprises:

- drum repacking and inspection area
- the elevated grid floor storage area
- main container storage area
- various adjacent, separate, smaller and enclosed storage rooms

Waste types of various origins are stored in the facility before being processed or disposed of. The majority of the waste originated from the previous Necsa nuclear fuel cycle program. Waste originating from industry, SAFARI-1 research reactor and the medical isotope program are also stored in the facility. The waste is stored, in dedicated blocks, in such a way that easy access to the containers can be obtained with the applicable handling equipment and for the purpose of inspections. Information for each waste container in any of the storage facilities is kept on a central database. This includes content description, origin, characterisation results, movements and current position

The Pelstore, see Figure 10, may store up to 104 000 waste containers. The current inventory is about 75 000 waste containers.

Figure 10: Section of the Pelstore on Pelindaba site

A3-1.2. THABANA STORES 1-5

This facility, see Figures 11 and 12, consists of five (5) naturally ventilated, corrugated iron sheds (walls and roofs) each with a concrete floor. The five Thabana stores were built as waste stores in support of the former Y and Z Enrichment Plants, in the late 1970's. Waste contained in plastic or metal drums are stored in this facility. These stores are controlled as radiological areas.

Figure 11: Side view of Thabana Store 1

Since their establishment they were only used for the storage of drums containing radioactive waste. Details of these stores are as follows:

Store 1: The floor area is 300m^2; the height is 3.6m and it has a storage capacity of about 2000 drums.

Stores 2 and 3: Stores 2 and 3 are two adjacent stores with no separating wall in between. Store 2 has a total floor area of 400m^2, height of 3.6m and Store 3 has a floor area of 500m^2, height of 3.6m and both stores have a storage capacity of about 8000 drums each.

Store 4: The total floor area is 975m^2 and the height is 3.6m and it has a storage capacity of about 4500 drums.

Store 5: The total floor area is 110m^2 and the height is 3.6m and it has a storage capacity of about 400 drums.

Figure 12: Thabana Stores 2 and 3

A3-1.3. PELINDABA EAST BUS SHED

This storage facility is situated on the east side of the Pelindaba site next to the Necsa Emergency Control Centre. The facility was built in the 1980's for the parking of the then used personnel transport busses. The bus shed became defunct in the early 1990's. The facility then was an open structure with no side walls and only the southern side as a brick wall. The facility was upgraded by closing all the sides with IBR sheeting. The floor of the facility consists partially of concrete and partially of tarmac. The roof of the facility comprises IBR sheeting. This area is used as a waste drum storage facility.

The facility is a naturally ventilated, enclosed structure with overall dimensions of 65m x 29m. The majority of the facility is used as storage area, but the south eastern corner is utilized for the Segmented Drum Scanner (SDS) used for waste characterization.

The Bus Shed is used for the storage of medical waste from hospitals, compressed waste historically treated in the Volume Reduction Facility contained in the 200 ℓ metal drums and other untreated waste drums.

A3-1.4. BUILDING A-WEST DRUM STORE

The Building A-West Drum Storage Facility is situated in the south western corner of the A-building complex of the Necsa site. The store has a concrete floor of area 2120m^2 and an IBR roof and is used for the storage of uranium contaminated waste contained in drums. It has a storage capacity for about 5000 drums.

During the operation of the Y Enrichment Plant, this facility served as a Y Plant compressor rebuilding, maintenance and testing facility that became redundant together with Y Plant in the early 1990's. Since about 1996 it was used as a waste drum store for uranium contaminated alumina gel and other waste originating from the Y and the Z Enrichment Plants.

A3-1.5. AREA 21 STORAGE FACILITY

The Area 21 Storage Facility is a storage facility located on the Pelindaba East site of Necsa. The facility has a concrete floor which is higher than the outside ground level. The storage facility is a barn type construction, comprising three rows of concrete pillars where each row supports a concrete beam. The purpose of the concrete beams is to support the long-travel of two 25 t overhead cranes

This facility is used for the storage of UF_6 cylinders containing UF_6 heels from the previous enrichment and conversion processes, ISO shipping containers filled with contaminated metal destined for a smelter, and 4 ton concrete drums containing solidified liquids from the isotope production facility.

A3-2 VAALPUTS NATIONAL RADIOACTIVE WASTE DISPOSAL FACILITY

The Vaalputs National Radioactive Waste Disposal Facility, see Figure 13, is located in the district of Kamiesberg in the Northern Cape Province.

Figure 13: An aerial view of the Vaalputs site showing disposal trenches

The introduction of nuclear power in South Africa called for the establishment of a national site for the disposal of LLW. In 1977, the state mandated a specialist study group to look at waste management alternatives for the intended commercial nuclear program. The study group recommended, in 1978, that the state proceed with a program to locate a suitable site for the disposal of radioactive waste in South Africa.

During 1979 to 1982 a comprehensive site selection program was undertaken in accordance with criteria that were regarded as internationally acceptable. The Vaalputs site emerged as the preferred option from the candidate sites and was subsequently acquired in 1983.

Detailed site suitability studies commenced in 1983. A preliminary safety report was compiled and submitted to the regulatory authority in 1984. The report was approved for building operations to commence. An intermediate safety report was issued to the regulatory authority in October 1986 according to which Vaalputs was granted a nuclear authorisation to operate. The method of disposal of radioactive waste at Vaalputs was approved to be shallow land disposal in near surface trenches a few meters deep.

The Vaalputs buildings include the administrative, operational and maintenance areas. The administrative area consists of a reception/display area, offices, canteen, conference room, controlled and uncontrolled area change rooms, toilet facilities and a records room. The operational area consists of a laundry, sample counting room, a waste reception area, a decontamination area, shielded storage area and a liquid waste solidification area. The maintenance area consists of a mechanical workshop/vehicle service area, store facilities for components, spares, equipment and flammable liquids, a store facility for site maintenance equipment and utility sections comprising of a standby generator, compressed air facility, ventilation facility, fire extinguishing pumps, electrical sub-station and liquid effluent containment area.

The first revision of the Vaalputs waste acceptance criteria was issued early 1986 and the first waste shipments from KNPS arrived in November that same year.

Vaalputs is currently authorised for the receipt and shallow land disposal of solid low level waste originating from Koeberg Nuclear Power Station (KNPS) and the South African Nuclear Energy Corporation (Necsa).

The waste disposal site comprises the following:

- a securely fenced area 900 m x 1 120 m;
- a 700 m x 500 m area for the disposal trenches;
- an exclusion area, or buffer zone, between the trench area and the fence;
- meteorological monitoring station; and
- covered car ports and storage areas for waste handling machinery and equipment

The operational phase that commenced in November 1986 and, under the current nuclear programme, is estimated to extend for 50 years up to 2036, which is also the estimated end of the operational period for the Koeberg Nuclear Power Station. It is also envisaged that Necsa's waste and other smaller waste producers' waste will have been successfully disposed of during this period. The 50 years expected operational lifetime of the Vaalputs repository is based on current knowledge and information. Any expansion in the South African nuclear programme resulting in more waste being sent to Vaalputs over longer time periods would require that the operational lifetime and post-closure arrangements of Vaalputs be reassessed and redefined accordingly.

The institutional control period commences after repository closure and is assumed to be three hundred years for the Vaalputs near surface repository given the current operational constraints. It is envisaged that this phase will be maintained until such time that the results of the final safety case confirm that the residual impact no longer requires further control of the site. During the institutional control period, it is possible that the Vaalputs site may continue to be subjected to regulation, including nuclear licensing. It is also assumed that ownership of the site will remain with a South African governmental organisation for the duration of this period.

At the end of the institutional control phase (300 years post-closure) it is envisaged that a final safety assessment would show that no further monitoring and measuring would be required, that no further corrective action would be necessary and that the site could be declared safe to the extent that all controls applicable to a radioactive waste disposal site could be lifted.

ANNEX 4: INVENTORIES OF KOEBERG RADIOACTIVE WASTE

Table 5: Inventory of processed low-level waste at Koeberg low level storage building

Drum Type	Volume (m^3)	Capacity (m^3)	WANO Volume (m^3)
Concrete Drums	144 784	360 024	1 288 400
Steel Drums	171 920	228 270	244 575
Total	***316 704***	***588 294***	***1 532 975***

Volume — this is the volume that these wastes occupy in the drum, i.e. resin and cement combined.

Capacity — this is the actual volume of the waste collected.

WANO volume — this is the total volume occupied by the drum, i.e. based on outside dimensions of drum.

Table 6: Inventory of solid radioactive waste at Koeberg low level storage building

Drum Type	Concentrates (C)	Resins (R)	Filters (F)	Trash (NCW)	Sludge
C1	125	205	-	39	5
C2	-	250	-	1	-
C2F	-	-	55	-	-
C4	-	-	22	-	-
210ℓ metal drum	-	273	-	805	-
Total	**125**	**728**	**77**	**845**	**5**

Table 7: Drumming guidelines at Koeberg Power Station

Filter	Contact Dose Rate	Radionuclide	Drum Type
	< 2 mSv/h	Various	210ℓ metal drum
	2 - < 15 mSv/h		C1
	15 - < 500 mSv/h		C4
	> 500		C2F
Resins	**Contact Dose Rate**	**Radionuclide**	**Drum Type**
	< 2 mSv/h	Various	210ℓ metal drum
	2 ≤ 200 mSv/h		C1
	> 200 ≤ 3500 mSv/h		C2
	> 3500 mSv/h		C3
Concentrates	**Activity (MBq/litre)**	**Radionuclide**	**Drum Type**
	< 92.5	Various	C1
	> 92.5 MBq/litre		C2

ANNEX 5: INVENTORIES OF RADIOACTIVE WASTE AT NECSA FACILITIES

Table 8: Inventory of radioactive waste at storage facilities on Necsa Pelindaba site

WASTE CLASSIFICATION	LOCATION	VOLUME IN STORAGE (M^3)*
HLW	Cell 3 P-1700	~0.25
LILW-LL	See Annex 3	~ 870
LILW-SL		~ 8895
VLLW		~ 1522
NORM-L		
NORM-E		

* Volumes are based on waste currently registered at Predisposal operations (Necsa central waste storage facilities), and exclude waste accumulated at waste generator facilities.

Table 9: Inventory of radioactive waste in Necsa old evaporation pans

WASTE CLASSIFICATION	LOCATION	ESTIMATED VOLUME IN STORAGE (M^3)
VLLW	Pel East Pans 1-5 Beva Ponds	5500
LILW-SL	Pel East Pan 6 CaF_2 ponds	7800

Table 10: Inventory of radioactive waste in Necsa disposal facilities

WASTE CLASSIFICATION	LOCATION	VOLUME IN DISPOSAL (M^3)*
Spent fuel		None
HLW		None
LILW-LL		None
LILW-SL	Vaalputs	11579
VLLW		None
NORM-L		None
NORM-E		None

Table 11: Inventory of redundant sealed sources

WASTE CLASSIFICATION / SOURCE CATEGORY	LOCATION	RADIONUCLIDE	QUANTITY
1	SAFARI-1 pool	Co-60	157
	Area-24 source store	Co-60 Cs-137	10 1
2 - 5	Area-24 source store	Various	4439
	Building P-2400	Unknown	2 containers

ANNEX 6: TYPICAL INVENTORIES OF RADIOACTIVE WASTE AT NORM FACILITIES

KLOOF GOLD MINE WASTE INVENTORY

Scrap Metal

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Kloof 1#	Main Salvage Yard	Operational	Surface	342
2	Kloof 3#	Main Salvage Yard	Operational	Surface	290
3	Kloof 4#	Main Salvage Yard	Operational	Surface	571
4	Kloof 7#	Main Salvage Yard	Operational	Surface	239
5	Kloof 8#	Main Salvage Yard	Operational	Surface	191
Total				**1633**	

Tailings Dams

	SITE		STATUS	METHOD OF STORAGE	m^3
1	Plant 1	Tailings Dam	Operational	Surface	54812300
2	Plant 2	# 1 Tailings Dam	Operational	Surface	9121347
3	Plant 2	# 2 Tailings Dam	Operational	Surface	15756410
Total				**79690057**	

Waste Rock Dump

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Kloof 1#	Kloof 1#	Operational	Surface	22073426
2	Kloof 2#	Kloof 2#	Not Operational	Surface	3542129
3	Kloof 4#	Kloof 4#	Operational	Surface	3571652
4	Kloof 7#	Kloof 7#	Operational	Surface	1099539
5	Kloof 8#	Kloof 8#	Operational	Surface	1216842
6	Kloof 10#	Kloof 10#	Not Operational	Surface	3380846
7	Kloof 5#	Kloof 5#	Not Operational	Surface	2293326
Total				**37177760**	

Timber					
	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Kloof 1#	Main Salvage Yard	Operational	Surface	51
2	Kloof 3#	Main Salvage Yard	Operational	Surface	42
3	Kloof 4#	Main Salvage Yard	Operational	Surface	33
4	Kloof 7#	Main Salvage Yard	Operational	Surface	69
5	Kloof 8#	Main Salvage Yard	Operational	Surface	23
Total				**218**	

All other types of waste (Plastic, etc)					
	SITE			METHOD OF STOR-AGE	QUANTITY TONNES
1	Kloof 1#	Main Sal-vage Yard	Operational	Surface	4
2	Kloof 3#	Main Sal-vage Yard	Operational	Surface	5
3	Kloof 4#	Main Sal-vage Yard	Operational	Surface	3
4	Kloof 7#	Main Sal-vage Yard	Operational	Surface	8
5	Kloof 8#	Main Sal-vage Yard	Operational	Surface	3
Total			***23***		

NB: All scrap originating from the respective underground shafts is immediately transported to the main salvage yard to be sorted and classified. Timber is sorted at the main salvage yard and if it is re-usable it is sent to the stapling plant for re-stapling prior to being returned underground for re-use for support purposes.

BEATRIX GOLD MINE WASTE

SCRAP Metal

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Beatrix 1, 2 & 3 Shaft	3 Shaft	Operational	Surface	8
2	Beatrix 1, 2 & 3 Shaft	Salvage Yard	Operational	Surface	107
3	Beatrix 4 Shaft	Salvage Yard	Operational	Surface	11
Total				***126***	

Tailings Dams

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Beatrix 1, 2 & 3 Shaft	# 1 Tailings Dam	Operational	Surface	67881069
2	Beatrix 1, 2 & 3 Shaft	# 2 Tailings Dam	Operational	Surface	34287567
3	Beatrix 4 Shaft	# 1&2 Tailings Dam	Operational	Surface	25156591
Total				***127325227***	

Waste Rock Dump

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Beatrix 1, 2 & 3 Shaft	# 1 Dump	Non-operational	Surface	5395819
2	Beatrix 1, 2 & 3 Shaft	# 2 Dump	Operational	Surface	3164096
3	Beatrix 1, 2 & 3 Shaft	# 3 Dump	Operational	Surface	2995238
4	Beatrix 4 Shaft	# 1 Dump	Non-operational	Surface	4010967
5	Beatrix 4 Shaft	# 2 Dump	Operational	Surface	5210817
Total				***20776937686***	

Timber

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Beatrix 1, 2 & 3 Shaft	Salvage Yard	Operational	Surface	339
2	Beatrix 4 Shaft	Salvage Yard	Operational	Surface	88
Total				***427***	

All other types of waste (Plastic, etc)					
	SITE		**STATUS**	**METHOD OF STORAGE**	**QUANTITY TONNES**
1	Beatrix 1, 2 & 3 Shaft	3 Shaft		Surface	9
2	Beatrix 1, 2 & 3 Shaft	Salvage Yard		Surface	64
3	Beatrix 4 Shaft	Salvage Yard		Surface	2
Total					***75***

NB: All scrap originating from the respective underground shafts are immediately transported to the salvage yards to be sorted and classified, except for 3 Shaft where some of the scrap is temporarily stored before being moved to the salvage yard. Timber reported above is mainly old wooden sleepers from underground not yet monitored and or decontaminated. Uncontaminated pipes, kibbles, etc. used during the shaft sinking process are stored at 3 Shaft but are not classified as radioactive waste.

SOUTH DEEP GOLD MINE WASTE INVENTORY

Scrap Metal

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	South Deep Gold Mine	Salvage Yard	Operational	Surface	0
2	South Deep Gold Mine	Gold Plant	Operational	Surface	0
Total					***0***

Tailings Dams

	SITE		STATUS	METHOD OF STORAGE	m^3
1	South Deep Gold Mine	Old Tailings Dam	Operational	Surface	22 450 000
2	South Deep Gold Mine	New Tailings Dam	Operational	Surface	33 425 000
Total					***55 875 000***

Waste Rock Dump

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	South Deep Gold Mine	South Shaft Rock Dump	Operational	Surface	3 816 060
2	South Deep Gold Mine	Twin Shaft Rock Dump	Operational	Surface	1 637 800
Total					***5 453 860***

All other types of waste (Plastic, Cement, Cement Bricks, Bags etc.):

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	South Deep Gold Mine	Industrial Waste Dump	Operational	Surface	0
Total					***0***

NB: No scrap metal is stored on site. Scrap metal generated is continuously released to the scrap recyclers in possession of Certificates of Registration issued by the NNR.

DRIEFONTEIN GOLD MINE WASTE INVENTORY

Scrap Metal

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Driefontein	Masakhane Shaft	Operational	Surface	10
2	Driefontein	Pitseng Shaft	Operational	Surface	5
3	Driefontein	Ya Rona Shaft	Operational	Surface	18
4	Driefontein	Hlanganani Shaft	Operational	Surface	10
5	Driefontein	Bambasinani Shaft	Non-operational	Surface	3
6	Driefontein	Rethabilie Shaft	Non-operational	Surface	2
7	Driefontein	Khomanane Shaft	Operational	Surface	8
8	Driefontein	Ithembalethu Shaft	Non-operational	Surface	8
9	Driefontein	Thabaleng Shaft	Operational	Surface	8
10	Driefontein	Salvage Yard	Operational	Surface	6
Total				***78***	

Tailings Dams

	SITE		STATUS	METHOD OF STORAGE	m^3
1	Driefontein	# 1 Tailings Dam	Operational	Surface	30430386
2	Driefontein	# 2 Tailings Dam	Operational	Surface	30997376
3	Driefontein	# 3 Tailings Dam	Non-operational	Surface	32653705
4	Driefontein	# 4 Tailings Dam	Operational	Surface	41904533
5	Driefontein	# 5 Tailings Dam	Non-operational	Surface	19043981
Total					**155029981**

Waste Rock Dump

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Driefontein	2 Dump	Operational	Surface	283622
2	Driefontein	4 Dump	Operational	Surface	368379
3	Driefontein	5 Dump	Operational	Surface	1036357
4	Driefontein	6 Dump	Operational	Surface	998775
5	Driefontein	7 Dump	Operational	Surface	131952
6	Driefontein	9 Dump	Operational	Surface	1281588
7	Driefontein	10 Dump	Operational	Surface	174826
8	Driefontein	11 Dump	Operational	Surface	3751337
9	Driefontein	12 Dump	Operational	Surface	7991869
10	Driefontein	13 Dump	Operational	Surface	474317
11	Driefontein	14 Dump	Operational	Surface	2266071
Total				***18759093***	

Timber

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Driefontein	Masakhane Shaft	Operational	Surface	33
2	Driefontein	Pitseng Shaft	Operational	Surface	9
3	Driefontein	Ya Rona Shaft	Operational	Surface	25
4	Driefontein	Hlanganani Shaft	Operational	Surface	38
5	Driefontein	Bambasinani Shaft	Non-operational	Surface	20
6	Driefontein	Rethabilie Shaft	Non-operational	Surface	4
7	Driefontein	Khomanane Shaft	Operational	Surface	26
8	Driefontein	Ithembalethu Shaft	Non-operational	Surface	12
9	Driefontein	Thabaleng Shaft	Operational	Surface	12
10	Driefontein	Salvage Yard	Operational	Surface	28
Total				***207***	
All other types of waste (Plastic, Cement, Cement Bricks, Bags etc.):					

	SITE		STATUS	METHOD OF STORAGE	QUANTITY TONNES
1	Driefontein	Masakhane Shaft	Operational	Surface	30
2	Driefontein	Pitseng Shaft	Operational	Surface	16
3	Driefontein	Ya Rona Shaft	Operational	Surface	51
4	Driefontein	Hlanganani Shaft	Operational	Surface	33
5	Driefontein	Bambasinani Shaft	Non-operational	Surface	70
6	Driefontein	Rethabilie Shaft	Non-operational	Surface	7
7	Driefontein	Khomanane Shaft	Operational	Surface	35
8	Driefontein	Ithembalethu Shaft	Non-operational	Surface	20
9	Driefontein	Thabaleng Shaft	Operational	Surface	18
10	Driefontein	Salvage Yard	Operational	Surface	9
Total				***289***	

ANGLOGOLD ASHANTI: ERGO OPERATIONS

TYPE OF WASTE / FACILITY NAME	QUANTITY (IN SITU)	UNIT
Semi solids waste (Tailings)		
Brakpan	5.58E+08	t
Daggafontein	2.00E+08	t
4L10	1.73E+05	t
4L11	3.10E+04	t
4L42	2.16E+05	t
4L43	8.60E+05	t
5L19	2.14E+05	t
5L21&22	1.08E+06	t
5L23	3.79E+06	t
5L24	1.33E+05	t
5L25	6.60E+05	t
5L26	5.65E+05	t
5L30	2.31E+05	t
5L5	2.12E+05	t
5L6&7	5.45E+05	t
5L9-12	6.00E+05	t
6L12	7.22E+05	t
6L13	2.02E+06	t
6L3	3.13E+05	t
Semi solids waste (Grit & Sand)		
4L8	2.37E+06	t
5L25	1.60E+05	t
5L27	3.50E+05	t
5L28	2.20E+05	t
5L32	2.20E+05	t
6L13	3.06E+04	t
7L14	2.36E+05	t
7L9	2.16E+05	t
CIL Grit	5.27E+05	t
Category III (Radiation Store)	2.06E+02	t

ANGLOGOLD ASHANTI: VAAL RIVER OPERATIONS

TYPE OF WASTE / FACILITY NAME	QUANTITY (IN SITU)	UNIT
Semi solids waste (Tailings)		
West Complex Grass Dam	3.04E+07	t
West Complex No.1	3.96E+07	t
West Complex No.2	1.73E+07	t
West Complex No.3	4.68E+05	t
West Complex No.4	7.32E+06	t
West emergency	1.54E+06	t
Ariston Gully	5.51E+06	t
West Extension	3.50E+07	t
West Complex Abandon	4.46E+06	t
East Complex Dam	7.79E+07	t
South East Extension Dam	2.48E+07	t
South Sulphur Paydam	5.52E+07	t
Mispah Dam + Kop U3O8	5.27E+07	t
Solid (Waste Rock)		
WRD 1	1.99E+07	t
WRD 2	9.25E+06	t
WRD 3	5.37E+06	t
WRD 4	5.12E+06	t
WRD5	4.63E+06	t
WRD Great Noligwa	5.93E+06	t
WRD Kopanang	1.53E+07	t
WRD Tau Lekoa	6.63E+06	t
WRD Moab Khotsong	5.99E+06	t
Category III (Radiation Store)	1.70E+02	t

ANGLOGOLD ASHANTI: WEST WITS OPERATIONS		
TYPE OF WASTE / FACILITY NAME	**QUANTITY (IN SITU)**	**UNIT**
Semi solids waste (Tailings)		
Mponeng	2.35E+07	t
Savuka No.7	5.92E+07	t
Savuka No.5	2.14E+07	t
No.1 (L17&L18)	6.38E+06	t
No.2 (L19)	4.85E+07	t
No.3 (L20)	1.44E+05	t
No.4 (L21)	1.52E+05	t
No.5 (L22)	2.56E+06	t
Solid (Waste Rock)		
WRD Savuka R11	5.52E+06	t
WRD Savuka R12	4.64E+05	t
WRD Mponeng	7.44E+06	t

Pamodzi Gold			
SITE	**STATUS**	**METHOD OF STOR-AGE**	**TONNES**
PGFS 9#	Non-operational	Tailings dam	52 110 800
PGFS 9#	Non-operational	Rock dump	4 311 872
PGFS 3#	Non-operational	Rock dump	171 035
PGFS 8#	Non-operational	Rock dump	77 154
PGFS 8#	Non-operational	Rock dump	3 266
PGFS 8#	Non-operational	Rock dump	34 952
PGFS 1#	Non-operational	Rock dump	31 396
PGFS 2#	Non-operational	Rock dump	203 027
TOTAL		***56943502***	

OTHER FACILITIES			
SITE	**STATUS**	**METHOD OF STOR-AGE**	**TONNES**
Richards Bay Minerals			
Roast tailings	Operational	Stockpile	5 315 612
MSP tailings	Operational	Stockpile	8 366 564
Paddy's Pad			
Paddy's Pad, Edenburg	Operational, exploration	210 litre drums	1 789 362
Deelkraal			
Deelkraal mine	Reclaiming rock dump	Rock dump	1 371 822
TOTAL		***16 483 360***	

ANNEX 7: NECSA FACILITIES BEING DECOMMISSIONED

Table 12: Necsa Facilities Being Decommissioned

FACILITY	DESCRIPTION	STATUS
Phase III decommissioning completed *Note: these facilities are not yet removed from regulatory control*		
Area 20	Redundant Hydrogen recovery facility	Phase 3
Area 28	Redundant development / testing facility	Phase 3
K3 Stores	Redundant SEA storage facility	Phase 3
X4 & X5 Labs	Redundant R & D laboratories	Phase 3
Building BEVA C3/C5	Redundant PWR fuel assembly facility	Phase 3
Building P1700 Contaminated labs	Redundant development laboratories	Phase 3
Building P1900 East	Process development facility	Phase 3
Building P3100	Instrument development facility	Phase 3
YG-Foundry	Redundant alloy development facility	Phase 3
Facilities being decommissioned		
Area 14 Oil basement	Redundant Enrichment plant service facility	Phase 2
Area 16	Redundant Enrichment plant service facility	Phase 2
C-building	Redundant Enrichment plant	Phase 2
D-building	Redundant Enrichment plant	Phase 2
J-building	Redundant Development / testing facility	Phase 2
P2900	Redundant Conversion development facility	Phase 2
E-building	Redundant Enrichment plant	Phase 2

FACILITY	DESCRIPTION	STATUS
P2800 building	Redundant Conversion development facility	Phase 2
P1500 Contaminated labs	Redundant R & D laboratories	Partial Phase 2
YM-vacuum workshop	Redundant pump servicing facility	Partial Phase 2
P2700A	Redundant Conversion development facility	Phase 2 decommissioning in progress
Conversion plant	Redundant Conversion facility	Phase 2 decommissioning scheduled
Area 74 Labs	Redundant conversion plant laboratories	Phase 2 Scheduled for 2013
P1900 West	Redundant R & D laboratories	Scheduled for reuse
XB-building	Redundant development/testing facility	Phase 2
Area 40	Redundant decontamination facility	Phase 2 scheduled for 2013

Definitions:

Phase 1: Phase 1 decommissioning covers the facility Termination of Operation and the minimum decommissioning activities such as the removal of inventory to obtain a state of passive safety. This phase is associated with a facility-specific care and maintenance programme which is developed to be commensurate with acceptable risk.

Phase 2: Phase 2 decommissioning covers continued decommissioning activities for the partial or complete removal and decontamination of process systems with the aim of restricted re-utilisation of facilities or reducing care and maintenance requirements. Care and maintenance programmes, which are commensurate with the remaining risk, are maintained.

Phase 3: Phase 3 decommissioning covers the activities required for the clearance facilities. Activities may range from final decontamination of facilities to clearance levels, or complete demolition of buildings and removal of all contaminated materials. Phase 3 is the ultimate end point of decommissioning after which a facility is released or removed from further regulatory control.

ANNEX 8: REFERENCE TO NATIONAL LAWS, REGULATIONS, REQUIREMENTS AND GUIDES

Act Number	Department	Act
General		
130/1993	DOL	Compensation for Occupational Injuries and Diseases Act
73/1980	DEA	Dumping at Sea Control Act
29/1996	DMR	Mine Health and Safety Act
28/2002	DMR	Mineral and Petroleum Resources Development Act
103/1977	Local Council: Hartbeespoort	National Building Regulations and Building Standards Act
40/2004	DOE	National Energy Regulator Act
39/2004	DEA	National Environmental Management: Air Quality Act
59/2008	DEA	National Environmental Management: Waste Act • B33/2/121/9/P151:Class H:h disposal site (CaF_2 pans) • Records of Decision • 12/9/11/L438/7 – Necsa H:H (sewage industrial and chemical effluent treatment facilities)
102/1980	SAPS	National Key Points Act
93/1996	DOT	National Road Traffic Act
36/1998	DWA	National Water Act
39/1994	SSA	National Strategic Intelligence Act
87/1993	South African Council for Non-Proliferation of Weapons of Mass Destruction	Non-Proliferation of Weapons of Mass Destruction Act
85/1993	DOL	Occupational Health and Safety Act • Major hazard installation Regulations. Government Gazette (GG) 22580 Notice Number (NN) 767 of 24 August 2001. • Construction Regulations. GG 25207 NN 1010 of 18 July 2003.
57/1978	DTI	Patent Act
33/2004	SAPS	Protection of Constitutional Democracy Against Terrorist and Related Activities Act
Specific:		
57/2002	DCG&TA	Disaster Management Act • Manual: Joint management of incidents involving chemical or biological agents or radioactive chemicals GG 28437 NN 143 February 2006

Act Number	Department	Act
107/1998	DEA	National Environmental Management Act • Environmental Impact Assessment Regulations GG 33306 NN543 18 June 2010 as amended. • Listing notice 1: List of activities and competent authorities identified in terms of section 24(2) and 24D GG 33308 NN 544 as amended • Listing notice 2:List of activities and competent authorities identified in terms of section 24(2) and 24D GG 33308 NN 545 as amended • Listing notice 3: List of activities and competent authorities identified in terms of section 24(2) and 24D GG 33308 NN 663 as amended • IEM Companion to the NEMA Environmental Assessment Regulations (Series 5); Public participation in the EIA process (Series 7); Environmental management framework (EMF) regulations for 2010 in terms of. NEMA (Series 6). GG 33308 NN 603. • Records of decision • A24/12/20/1294 Necsa - upgrade of the water and effluent collection and treatment infrastructure (2009) • 12/12/20/505 Necsa – extension of the Thabana Pipe Storage facility
15/1973	DOH: Radiation Control	Hazardous Substances Act

Act Number	Department	Act
47/1999	DOE	National Nuclear Regulator Act • Cooperative agreements concluded i.t.o s6 (2) and published i.t.o s6(4) of the Act on cooperative governance in respect of the monitoring and control of radioactive material or exposure to ionizing radiation. GG 31232 NN 759 18 July 2008. • Regulations in terms of section 7(1)(j) of the Act on the contents of the Annual Public Report on the Health and Safety related to workers, the public and the environment related to all sites on which a nuclear installation is situated or on which any action which is capable of causing nuclear damage is carried out. GG 29050 NN 716 of 28 July 2006. • NL27 Variation 25 in terms of s 21(1): South African Nuclear Energy Corporation (Necsa). • NL28 Variation 3 in terms of s 21(1): Vaalputs National Radioactive Waste Disposal Facility. • [Annexure other site licences here] • Regulations in terms of s 29 (1;2) read in conjunction with s47 of the Act on the categorization of the various nuclear installations in the republic, the level of financial security to be provided by holders of nuclear installation licenses in respect of each of those categories and the manner in which that financial security is to be provided. GG 26327 NN 581 of 7 May 2004. • Invitation for the public to comment on proposed draft regulations on the siting of new nuclear installations in terms of s 36. GG 32349 NN 914 3 July 2009. • Regulations in terms of s36, read with section 47 of the Act on safety standards and regulatory practices. GG 28755 NN 388 of 28 April 2006. • Regulations in terms of s37 (3) (a) of the Act on the keeping of a record of all persons in a nuclear accident defined area. GG 29078 NN 778 of 4 August 2006. • Regulations in terms of s38(4) read with s47, of the Act on the development surrounding any nuclear installation to ensure the effective implementation of any nuclear emergency plan. GG 26121 NN 287 5 March 2004. • Regulations in terms of s47 read in conjunction with section 26 (4) of the act on the establishment of a public safety information forum by the holder of a nuclear installation license to inform the persons living in the municipal area in respect of which an emergency plan has been established GG 31403 NN 968 12 September 2008. • Regulations in terms of s47, read with s21 and 22 of the Act, on the format for the application for a nuclear installation licence or a certificate of registration or a certificate of exemption. GG 30585 NN 1219 of 21 December 2007
53/2008	DOE	National Radioactive Waste Disposal Institute Act 2008

Act Number	Department	Act
46/1999	DOE	Nuclear Energy Act - Declaration [in terms of section 2] of certain substances, materials and equipment as restricted material, source material, special nuclear material and nuclear related equipment and material as indicated in government notice No. 740, Schedules 1,2,3,4 respectively GG 31954 NN 207 27 February 2009. - Invitation for nominations to the board of the South African Nuclear Energy Corporation (NECSA) [in terms of section 16 of the Act] GG 32212 NN 538

DEFINITIONS

Authorised discharge	Planned and controlled release of radioactive material to the environment in accordance with an authorisation from the regulator.
Authorised disposal/ recycling	Release of waste from nuclear regulatory control in terms of compliance with conditional clearance levels and specific disposal and recycling conditions.
Care and maintenance	Actions such as surveillance, inspection, testing and maintenance to ensure that facilities are maintained in a safe state between decommissioning phases.
Decommissioning	Actions taken at the end of useful life of a facility, other than a repository or disposal facility, in retiring it from service with adequate regard for the health and safety of workers and members of the public and protection of the environment. Actions include shutdown, dismantling and decontamination, care and maintenance.
Discharge	A planned and controlled release of radionuclides into the environment. Such releases should meet all restrictions imposed by the regulatory body.
Disposal	The emplacement of waste in an approved specified facility (for example, near surface or geological repository.
Geological disposal	Isolation of radioactive waste, using a system of engineered and natural barriers at depth up to several hundred meters in a geologically stable formation.
High level waste (HLW)	The radioactive liquid containing most of the fission products and actinides originally present in used fuel – which forms the residue from the first solvent extraction cycle in reprocessing – and some of the associated waste streams.
In-service inspection	A system of planned, usually periodic observations and/or tests performed on all items relied on for safety (IROFS) in order to detect, characterise and monitor (as appropriate) any defects and anomalies that could threaten pant safety. ISIP is part of the maintenance process and may be performed at any time that is considered appropriate, including after failure of IROFS.
Long lived waste (LLW)	Radioactive waste containing long-lived radionuclides having sufficient radiotoxicity in quantities and/or concentrations requiring long-term isolation from the biosphere. The term "long lived radionuclide" refers to half-lives usually greater than 31 years.
Long and intermediate level waste (LILW)	Radioactive waste in which the concentration of or quantity of radionuclides above clearance level established by the regulatory body, but with a radionuclide content and thermal power below those of HLW. Low and intermediate level wastes are often separated into short-lived and long-lived wastes. Short-lived wastes may be disposed of in near surface disposal facilities.
Natural occurring radioactive material (NORM)	Material containing no significant amounts of radionuclides other than naturally occurring radionuclides.

Near surface disposal	Disposal of waste, with or without engineered barriers, on or below the ground surface where the final protective covering is of the order of a few meters thick, or in caverns a few tens of meters below the Earth's surface.
Nuclear fuel cycle	All operations associated with the production of nuclear energy, including mining, milling, processing and enrichment of uranium or thorium; manufacture of nuclear fuel; operation of nuclear reactor; reprocessing of nuclear fuel; decommissioning; and any action for radioactive waste management and any research or development action related to any of the foregoing.
Phase 1 Decommissioning	Covers the facility termination of operation and the minimum decommissioning activities such as the removal of radioactive inventory to attain a state of passive safety. Care and maintenance programmes, which are commensurate with the remaining risk, are maintained.
Phase 2 Decommissioning	Covers continued decommissioning for the partial or complete removal and decontamination of process systems with the aim of restricted re-utilization of facilities or reducing care and maintenance requirements. Care and maintenance programmes, which are commensurate with the remaining risk, are maintained.
Phase 3 Decommissioning	Phase 3 decommissioning covers the activities that are necessary for the clearance of facilities. Activities may range from final decontamination of facilities to clearance levels, or complete demolition of buildings and removal of contaminated material. Phase 3 is the ultimate endpoint of decommissioning after which a facility is released or removed from further regulatory control.
Pre-treatment	Any or the entire operation prior to waste treatment, such as: Collection, segregation, chemical adjustment, and decontamination.
Regulated disposal	Disposal of radioactive waste in a facility licensed by the Regulator for disposal of a specific waste class.
Processed waste	Waste that undergoes any operation that changes the characteristics of the waste, including waste pre-treatment, treatment and conditioning.
Repository	A nuclear facility (for example, geological repository) where waste is emplaced for disposal. Future retrieval of the waste from the repository is not intended.
Reprocessing	A process or operation, the purpose of which is to extract radioactive isotopes from used fuel for further use.
Used fuel	Nuclear fuel removed from a reactor following irradiation, which is no longer usable in its present form because of depletion of fissile material, poison build-up or radiation damage.
Spent sources	Sources of which the useful lifetime have lapsed.
Storage	The placement of radioactive waste in a nuclear facility where isolation, environmental protection and human control (for example, monitoring) are provided with the intent that the waste will be retrieved.

Transportation	Operations and conditions associated with and involved in the movement of radioactive material by any mode on land, water or air. The terms ''transport" and "shipping" are also used.
Treatment	Operations intended to benefit safety and/or economy by changing the characteristics of the waste. Three basic treatment objectives are: volume reduction, removal of radionuclides from the waste, change of composition. After treatment, waste may or may not be immobilized to achieve an appropriate waste form.
Unprocessed waste	As-generated raw material requiring further characterisation and processing before being regarded as a waste stream.

ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
COR	Certificate of Registration
DEA	Department of Environmental Affairs
DOE	Department of Energy
DMR	Department of Mineral Resources
DOH	Department of Health
DOL	Department of Labour
EIA	Environmental Impact Assessment
HSE	Health Safety and Environment
IAEA	International Atomic Energy Agency
IROFS	Items Relied on For Safety
ISIP	In-service Inspection Process
Joint Conven-tion	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
KNPS	Koeberg Nuclear Power Station
LILW	Low and intermediate level radioactive waste
LILW (SL)	Low and intermediate level radioactive waste (Short lived)
Necsa	South African Nuclear Energy Corporation
NIL	Nuclear installation Licence
NLM	Nuclear Liabilities Management, a division of Necsa
NNR	National Nuclear Regulator
NNRA	National Nuclear Regulator Act, Act No 47 of 1999
NORM	Natural Occurring Radioactive Material
NRWDI	National Radioactive Waste Disposal Institute
OHS	Occupational Health and Safety
OTS	Operating Technical Specification

PMC	Spent fuel pool bridge Eskom
PSIF	Public Safety Information Forum
PWR	Pressure water reactor
QA	Quality Assurance
RCCA'S	Rod cluster control assembly
SSRP	Safety Standards and Regulatory Practices in accordance with section 36 of the National Nuclear Regulator Act, No 47 of 1999
VCF	Vaalputs Communication Forum
Vaalputs	Vaalputs National Radioactive Waste Disposal Facility located in the magisterial district of Namaqualand in the Northern Cape Province.
WANO	World Association of Nuclear Operators

Notes

Notes

Compiled on behalf of South Africa by the NNR