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

Third Report

September 2014

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CONTENTS

CONTENTS (continued)

TABLE OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

Recognising the importance of the safe management of spent nuclear fuel and radioactive waste, the international community agreed on the necessity of adopting a convention with the objective of achieving and maintaining a high level of safety in spent fuel and radioactive waste management worldwide.

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"), which was adopted on 5 September 1997 and entered into force on 18 June 2001.

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.

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

REVIEW MEETING	DATES
First Review Meeting	3-14 November 2003
Second review Meeting	15-24 May 2006
Third Review Meeting	11-20 May 2009
Fourth Review Meeting	14-23 May 2012

The fifth review meeting is scheduled for the period 11-22 May 2015.

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 first South African National Report was presented at the Third Review Meeting of the Contracting Parties under the Joint Convention in Vienna, Austria during May 2009. This third South African National Report is an update of the previous two National Reports, prepared in 2008 and 2011 respectively, and documents safety of used fuel and radioactive waste management safety in the Republic of South Africa. It also incorporates additional information and responses to questions raised at the Fourth Review Meeting of the Contracting Parties.

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

Section A

INTRODUCTION

A-1. BACKGROUND

Recognising 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 to 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, which was 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 each having an operational nuclear power plant.

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

REVIEW MEETING	DATES
First Review Meeting	3-14 November 2003
Second Review Meeting	15-24 May 2006
Third Review Meeting	11-20 May 2009
Fourth Review Meeting	14-23 May 2012

The Fifth Review Meeting is scheduled for the period 11 - 22 May 2015.

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 previously participated in the Third and Fourth Review Meetings 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 programmes. It also elaborates on, and expands the existing IAEA nuclear safety regime, while promoting 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 the 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. This 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 programmes.

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, requires the State of destination to have adequate administrative and technical capacity and a regulatory infrastructure 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 third report on compliance with obligations under the Joint Convention. The previous two reports were produced in October 2008 and September 2011 respectively.

A-3. STRUCTURE OF THE REPORT

In developing the report, South Africa has drawn from the experience acquired from the previous review meetings of the contracting parties of the Joint Convention and the six national reports under the Convention on Nuclear Safety. The report constitutes a self-supporting report, based on existing documentation, and reflects the viewpoints of government, the regulatory authorities and industry.

This report is structured in accordance with the "Guidelines regarding the Form and Structure of National Reports" for the Joint Convention – i.e., an "article-by-article" format, with each one being addressed in a dedicated chapter, carrying 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:

   (i) spent fuel management policy;

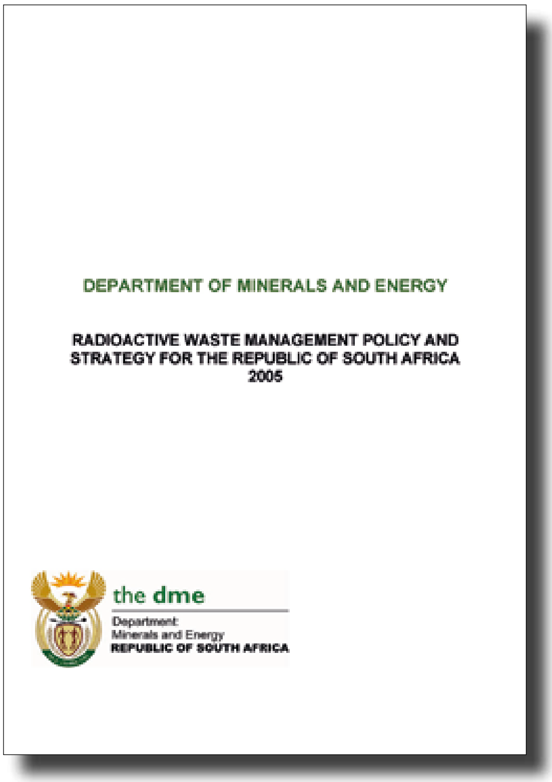
   (ii) spent fuel management practices;

   (iii) radioactive waste management policy;

   (iv) radioactive waste management practice;

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

B-1. RADIOACTIVE WASTE MANAGEMENT POLICY FRAMEWORK FOR 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 2005

The cornerstone of South Africa's approach to addressing radioactive waste management issues is the Radioactive Waste Management Policy and Strategy for the Republic of South Africa.

The strategic intent of this Policy and Strategy is to ensure a comprehensive radioactive waste governance framework by formulating, in addition to nuclear and other applicable legislation, a policy and implementation strategy in consultation with all role-players and stakeholders.

The development of the national policy and strategy was initiated by the Department of Minerals and Energy during May 2000. Following a process of national public consultation, the Radioactive Waste Management Policy and Strategy for the Republic of South Africa (Policy and Strategy) was published in November 2005.

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

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

The Policy and Strategy defines the respective roles of government, regulators, waste generators and operators. It furthermore provides for the development of institutional and financial arrangements to implement long-term waste management solutions in a safe, environmentally sound, comprehensive, cost-effective and integrated manner.

The scope of the Policy and Strategy relates to all radioactive waste and potential radioactive waste (including used fuel), with the exception of operational radioactive liquid and gaseous effluent discharges, which are permitted to be released into the environment routinely under the authority of the relevant regulators (National Nuclear Regulator (NNR) and the Directorate Radiation Control in the Department of Health).

The Policy and Strategy makes provision for the establishment of two management structures for radioactive waste management, in the form of the National Committee on Radioactive waste Management (NCRWM), and the National Radioactive Waste Disposal Institute (NRWDI).

The role of the NCRWM is to advise the Minister and oversee the effective implementation of policy, while the NRWDI will be the implementing body with the direct responsibility for the siting, construction and operation of radioactive waste disposal and related facilities. The policy also calls for the National Radioactive Waste Management Fund to be established via the statutes, in order to manage the radioactive waste disposal institute funds at national level.

B-2. RADIOACTIVE WASTE MANAGEMENT PRACTICES

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 further 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 considered negligible.

In accordance with the Policy and Strategy, 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 specific types of waste, such as high-level waste, long-lived waste and high activity disused radioactive 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; and
- 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 1.

As part of the South African Strategy for long-term radioactive waste management, it is envisaged that one site shall be developed for the disposal of each of the waste classes indicated in Table 1, with the exception of NORM waste, which is disposed of in bulk, on the waste generator's site. This is to maximise benefits from economies of scale, pertaining to all activities associated with disposal and 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 of Low and Intermediate Level Waste (LILW) at the Vaalputs National Radioactive Waste Disposal Facility in the Northern Cape Province.

B-3. USED FUEL MANAGEMENT POLICY

In the South African context, nuclear fuel that has been irradiated in a nuclear reactor is called "used fuel" 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 contain 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 on the generator's site. Two mechanisms, namely dry and wet storage, are currently in use in South Africa.

The Policy and Strategy dictates that various options for the safe management of used fuel and high-level waste shall be investigated. These investigations include:

- 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 will be subject to public consultation.

B-4. USED FUEL MANAGEMENT PRACTICES

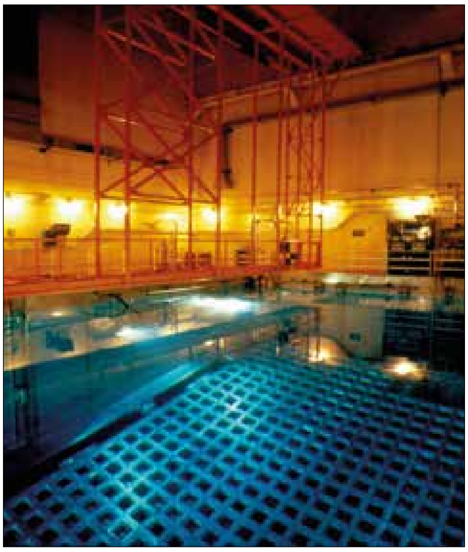


Figure 2: Used fuel pool at Koeberg nuclear power station

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 (KNPS) is currently stored in authorised used fuel pools on site, as well as in casks designed and constructed for dry storage of used fuel. It is recognised that the current storage capacity at KNPS is finite and limited.

Due to a need to increase the energy output at KNPS, the KNPS operating organisation, Eskom, implemented a revised fuel management strategy. The revised fuel management strategy has required that some used fuel be stored in a checkerboard configuration within the used fuel pool, thereby reducing the available storage capacity of the used fuel pools. Furthermore, Eskom is considering extending the operating lifetime of the two units at KNPS, beyond 40 years. Consequently Eskom is considering options to expand the used fuel storage capacity at KNPS.

The used fuel from the SAFARI-1 Research Reactor, at the Necsa Pelindaba site, is initially stored in the reactor pool for at least two years to facilitate cooling, prior to it being transferred to the Thabana Pipe Store – an authorised dry storage facility on the Pelindaba site. The Thabana Pipe Store is described in Annex A1-2.2.

The storage capacity of the Thabana Pipe Store was increased in 2007. Currently the facility has 60 storage pipes, rendering a total storage capacity of 1 200 fuel elements, which is deemed sufficient for the used fuel that is envisaged to be produced during the lifetime of the SAFARI-1 Research Reactor.

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

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

Table 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 an 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 (100s 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 short-lived 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 10 x the concentration levels specified above) **OR** 3 Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in an 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 (10s of meters) 2. Managed as NORM-E-Waste (unirradiated uranium)
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/m³) **AND** 2. Long-lived alpha radionuclides (T ½ > 31 y) concentrations - Alpha: < 400 Bq/g - Beta and gamma: <4000 Bq/g (Maximum per waste package up to 10 x the concentration levels specified above) **OR**	Waste package suitable for handling, transport and storage (storage period in order of 10 years). The waste form will be solid with additional characteristics as prescribed for a specific repository	1. Regulated near surface disposal 2. Managed as NORM-E-Waste (un-irradiated uranium)

Table 1: National Radioactive Waste Classification Scheme (continued)

WASTE CLASS	WASTE DESCRIPTION	WASTE TYPE/ ORIGIN	WASTE CRITERIA	GENERIC WASTE TREATMENT/ CONDITIONING REQUIREMENTS(*)	DISPOSAL/MANAGEMENT OPTIONS
			3 Long-lived alpha, beta and gamma emitting radionuclides at activity concentration levels that could result in an inherent intrusion dose (the intrusion dose assuming the radioactive waste is spread on the surface) below 10 mSv per annum		
4. VLLW	Radioactive waste containing a very low concentration of radioactivity	1 Contaminated or slightly radioactive material originating from operational 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 radionuclide 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
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 waste management strategy for used fuel. These activities are not presently being undertaken in South Africa.

Furthermore, while South Africa continues to monitor international developments with regard to the possible transmutation of used fuel, there is no current investigation or research into this option taking place in South Africa.

The used fuel, arising from both the KNPS 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 types of radioactive waste with the exception of operational radioactive liquid and gaseous effluent discharges, which are permitted to be routinely released into the environment under the authority of the relevant regulators (National Nuclear Regulator (NNR) or the Directorate Radiation Control (RADCON) in the Department of Health).

The safety of radioactive waste management is applied to all commissioning, operational and decommissioning phases of regulated nuclear actions in South Africa. These include the following:

- 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 types of radioactive waste, including radioactive waste that contains only natural occurring radioactive material (NORM), irrespective of whether such waste arises from within the fuel cycle or not.

C-3. SAFETY OF USED FUEL AND RADIOACTIVE WASTE FROM 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 objective of the treaty is to prevent the spread of nuclear weapons; facilitate peaceful nuclear cooperation between treaty members; and provide a foundation for nuclear disarmament.

Furthermore, the Pelindaba Treaty (also referred to as 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 routinely released into the environment under the authority of the relevant regulators (National Nuclear Regulator (NNR) or the Directorate Radiation Control (RADCON) in the Department of Health), are reported on under the Joint Convention.

Section D

INVENTORIES AND LISTS OF USED FUEL AND RADIOACTIVE WASTE MANAGEMENT FACILITIES

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 USED FUEL MANAGEMENT FACILITIES

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

D-2 USED FUEL INVENTORIES

The inventories of used fuel from the KNPS and the SAFARI-1 Research Reactor are currently stored at the Koeberg and Pelindaba sites respectively and are detailed in SECTION L: Annex 2.

D-3 LIST OF RADIOACTIVE WASTE MANAGEMENT FACILITIES

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

D-4 INVENTORY OF RADIOACTIVE WASTE

The inventories of radioactive waste in storage facilities at KNPS, are presented in Section L: Annex 4.

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

Radioactive waste, arising from actions involving NORM material, is presented in Section L: Annex 6.

Inventories of radioactive waste at iThemba Labs are presented in Section L: Annex 7.

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

A list of Necsa nuclear facilities in the process of being decommissioned, as well as the status of decommissioning activities, is detailed in SECTION L: Annex 8.

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.

The Republic of South Africa has implemented the necessary legislative, regulatory and administrative measures to fulfil its obligations under the Joint Convention, in conformance to Article 18 of the Joint Convention. 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) 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. ESTABLISHMENT AND MAINTENANCE OF A LEGISLATIVE AND REGULATORY FRAMEWORK TO GOVERN THE SAFETY OF USED FUEL AND RADIOACTIVE WASTE MANAGEMENT

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 established in terms of the provisions of the Atomic Energy Act. Over the years, this Act was amended 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 established in 1970, in terms of the provisions of the Uranium Enrichment Act, (Act No. 33 of 1970). This allowed the enrichment of uranium by a State Corporation separate from the Atomic Energy Board but subject to licensing by the latter.

A major change took place in 1982, when the Atomic Energy Corporation (AEC) was established and made responsible for all nuclear matters, including uranium enrichment. This change was mandated by the provisions of the Nuclear Energy Act, 1982 (Act No. 92 of 1982). In 1988, a major amendment to the Nuclear Energy Act (Nuclear Energy Amendment Act, 1988 (Act No. 56 of 1988)), mandated the establishment of 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, 1993 (Act No. 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, 1999 (Act No. 46 of 1999) (NEA) and the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) (NNRA), which superseded the previous Nuclear Energy Act 1993 (Act No. 131 of 1993). The Department of Energy administers these Acts. In addition, the Department of Health administers the Hazardous Substances Act, 1973 (Act No. 15 of 1973) (HSA), related to Group III and Group IV hazardous substances.

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

- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- Mine Health and Safety Act, 1996 (Act No. 29 of 1996) (MHSA);
- National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Water Services Act, 1997 (Act No. 108 of 1997) (WSA);
- Environment Conservation Act, 1998 (Act No. 73 of 1989) (ECA);
- Environment Conservation Amendment Act, 2003 (Act No. 50 of 2003) (ECAA);

- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); and
- National Environmental Management: Integrated Coastal Management Act 2008 (Act No. 24 of 2008) (NEM: ICMA)

In terms of section 46 of the Nuclear Energy Act, 1999 (Act No. 46 of 1999), the 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 of Energy, in concurrence with the Minister of Environmental Affairs and the Minister of Water and Sanitation, 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, 1999 (Act No. 47 of 1999).

E-2.2. LEGISLATIVE AND REGULATORY FRAMEWORK

E-2.2.1. THE ESTABLISHMENT OF APPLICABLE NATIONAL SAFETY REQUIREMENTS AND REGULATIONS FOR RADIATION SAFETY

The National Nuclear Regulator Act, 1999 (Act No. 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, 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 Energy. The Safety Standards and Regulatory Practices (SSRP), Regulation R 388 of 2006, was published on 28 April 2006 and these regulations are being enforced on all nuclear authorisation holders 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 of facilities and activities involving radioactive material.

Other regulations published by the Minister of Energy, 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 the Establishment of Public Safety Information Forums – Regulation 968 of 2008;
- The regulations on Cooperative 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; and
- The regulations on the Licensing of Sites for New Nuclear Installations – Regulation 927 of 2011.

The Hazardous Substances Act, 1973 (Act No. 15 of 1973), as amended, makes provision for the Minister of Health to establish the following 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 substances, the calling of meetings of any such committee, the quorum for and the procedure of such meeting.
- Regarding safety standards in connection with the importation into and exportation from the Republic; the manufacture, packing, disposal, dumping, sale, serving, applying, administering or the use of grouped hazardous substances; and the manner in which such standards shall be brought to the notice of persons concerned in any of the 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 published regulations relating to Group IV Hazardous Substances – Regulation GN.R.247 – dated 26 February 1993.

E-2.2.2. A SYSTEM OF LICENSING OF USED FUEL AND RADIOACTIVE WASTE MANAGEMENT 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, the Directorate Radiation Control in the Department of Health, or the Minister of Energy), in the prescribed format, detailing the intended activities and providing a demonstration of the safety and compliance with 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 a 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 combination of licensing stages needs to be established with a view to streamlining and scheduling 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 the 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 both normal operating conditions and 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 or closure. The conditions of authorisation also oblige the holder of the authorisation to provide a demonstration of compliance by 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 deemed appropriate;
- Maintenance testing and inspection requirements;
- Operational radiation protection programmes;
- Radioactive waste management programmes;
- Emergency planning and preparedness requirements as deemed appropriate;
- Physical security;
- The transport of radioactive material;
- Quality assurance; and
- Reporting.

In accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), an environmental assessment has to be conducted prior to the construction of a spent fuel management or radioactive waste management facility. Furthermore, the Environment Conservation Amendment Act, 2003 (Act No. 50 of 2003) (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. A SYSTEM OF PROHIBITION OF THE OPERATION OF A USED FUEL OR RADIOACTIVE WASTE MANAGEMENT FACILITY WITHOUT A LICENCE

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

The NNRA prohibits the following:

- The siting, construction, operation, decontamination or decommission of a nuclear installation, except under the authority of a Nuclear Installation Licence.
- The 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 a 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 Nuclear Energy Act, 1999 (Act No. 46 of 1999), 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.

Furthermore, NEMA requires that –

- all facilities, activities or processes involving radioactive material or nuclear fuel;
- the establishment of new or the expansion of existing facilities concerned with the production, enrichment, reprocessing, storage or disposal of nuclear fuels and wastes;

must be subjected to an Environmental Impact Assessment (EIA) and may not be constructed or operated without a permit issued by the Minister of Environmental Affairs.

E-2.2.4. A SYSTEM OF APPROPRIATE INSTITUTIONAL CONTROL, REGULATORY INSPECTIONS AND 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 the following:

- A detailed description of the plant and site;
- The scope of activities to be undertaken;
- Specifications of systems, structures and components that are important to safety;

- Onsite and off-site environmental factors or components that are relevant to nuclear and radiation safety;
- A plant operational safety assessment, including associated nuclear and radiation safety rules, criteria, standards and requirements relevant to the safety assessment; and
- Operational safety related programmes and limiting conditions of operations, including:
    - a programme for compliance with dose and risk limits as deemed appropriate;
    - a programme to ensure that nuclear installations are built and operated in accordance with good engineering practice and international norms and standards;
    - a programme for incident and accident management. including emergency planning, preparedness and response measures;
    - a quality management programme;
    - a system of records and reporting;
    - a radiation protection programme;
    - a radioactive waste management programme;
    - a programme for the transport of radioactive material;
    - an environmental monitoring and surveillance programme; and
    - a programme for decommissioning.

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

- reports on problem, incident and accident notification, investigation and closeout;
- quality assurance and audit reports, including closeout reports;
- environmental monitoring reports; and
- 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 is 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, a review of routine reports and a review of occurrence reports.

The NNR compiles an annual Compliance Assurance Plan (CAP), which specifies the facilities and aspects to be inspected. The CAP also specifies the frequency and the number of inspections to be conducted at each facility. In 2013, 56 inspections were conducted at the KNPS, 118 inspections were conducted at Necsa operated facilities and 190 inspections were conducted at NORM facilities. These inspections confirmed compliance with the regulatory provisions related to radioactive waste management and the safety of used fuel management at authorised facilities.

Similarly, with regard to facilities and activities regulated by the Directorate Radiation Control, the Directorate conducts independent compliance assurance activities to verify compliance to the conditions in the issued permits. The Directorate Radiation Control uses a graded approach in its compliance assurance activities. Higher risk facilities are inspected more frequently than those that pose a lower risk.

Facilities and activities regulated by the Directorate Radiation Control are also required to submit prescribed reports to the Regulator.

E-2.2.5. ENFORCEMENT OF APPLICABLE REGULATIONS AND CONDITIONS OF AUTHORISATION

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. A CLEAR ALLOCATION OF RESPONSIBILITIES OF THE BODIES INVOLVED IN THE DIFFERENT STEPS OF USED FUEL AND OF RADIOACTIVE WASTE MANAGEMENT

The Radioactive Waste Management Policy and Strategy for the Republic of South Africa, clearly defines the responsibilities of government, regulatory bodies, as well those of generators of radioactive waste and operators of radioactive waste disposal facilities. Furthermore, 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, as well as the establishment of 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 Energy;
- The Department of Environmental Affairs;
- The Department of Health (Directorate Radiation Control);
- The Department of Water and Sanitation; and
- The Department of Mineral Resources.

In accordance with the provisions of section 6 of the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999), the NNR is required to enter into cooperative governance agreements with other organs of state that have overlapping functions or responsibilities. The purpose of these agreements is to:

- ensure the effective monitoring and control of nuclear hazards;
- coordinate and minimise the duplication and procedures for executing such functions; and
- promote consistency in the execution 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 NNR's primary function 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, comprises of a Board of Directors, a Chief Executive Officer and staff members. The NNR's mandate and authority are conferred through sections 5 and 7 of the NNRA, which detail the objects and functions of the NNR.

The powers of the NNR, in terms of the NNRA, embrace all actions aimed at providing 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 resulted in 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 therewith.

The competence of the NNR is ensured by 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.

E-3.1.1. ORGANISATION OF THE NNR

The structure of the Regulator is depicted in figure below:

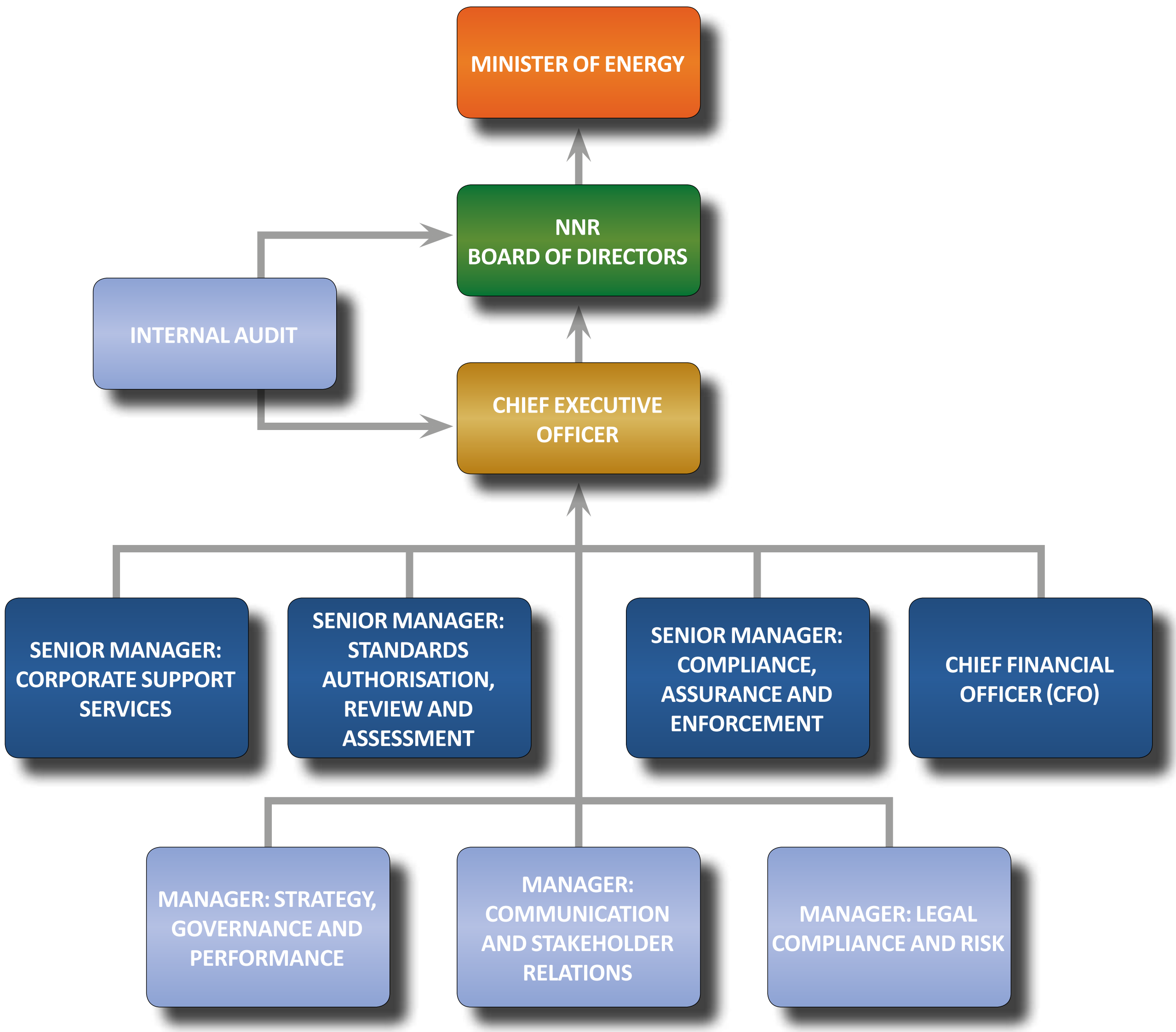


Figure 3: NNR Organisational Structure

(i) THE BOARD OF DIRECTORS

The Executive of the regulatory body reports to a Board of Directors, which is appointed by the Minister of Energy. The Board consists of twelve (12) directors, including an official from the Department of Energy, an official from the Department of Environmental Affairs, a representative of organised labour, a representative of organised business, a representative of communities who may be affected by nuclear activities, and up to seven (7) other directors who hold office for a period not exceeding three (3) years. The directors are eligible for re-appointment at the end of their term of office. The Chief Executive Officer of the NNR is a member of the Board of Directors.

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

- is a holder of a nuclear authorisation or an employee of such holder;
- becomes a Member of Parliament, a Member of the Provincial Legislature, as well as a member of 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 Director 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, 1999 (Act No. 1 of 1999) (PFMA) 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) Standards, Authorisation, Review and Assessment (SARA)

The SARA group renders technical assessment functions to all the divisions and comprises four (4) functional subgroups:

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

The functional responsibilities of the SARA Group include the following:

- Reviewing submissions from holders or applicants;
- Conducting related safety assessments;
- Assisting with enforcement/compliance assurance activities upon the request from the Compliance and Enforcement (CAE) group; and
- Performing independent assessments of the nuclear emergency preparedness and response arrangements at nuclear installations.

In addition, a Special Nuclear Projects Team coordinates the following activities:

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

(b) Management of Regulatory Programmes

Currently, the NNR has three regulatory Programme Managers:

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

who are responsible for the planning of assessment activities and liaison with authorisation holders.

The Programme Manager: NPP, is responsible for exercising regulatory control over Koeberg Nuclear Power Station (KNPS), including the 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 and nuclear technology applications) and for 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 materials, deriving primarily from the mining and mineral processing of radioactive ores.

(c) Compliance Assurance and Enforcement (CAE)

The CAE group is responsible for conducting compliance inspections and enforcement with regard to the holders of authorisations, currently comprising the following "programmes":

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

(d Support Services

Support Services includes Finance, Corporate Services, Strategic Planning, Communication and Stakeholder Relations, as well as Legal Counsel.

E-3.1.2. HUMAN RESOURCES

The NNR plays a pivotal role in overseeing the effective regulation of the nuclear industry and maintaining high safety standards. Recent developments in the South African nuclear sector, as well as the ensuing competition for skilled and experienced personnel, have crucial implications for the recruitment, retention and development of trained staff members for the nuclear regulatory function.

This situation, coupled with the realisation that Human Resources is central in supporting the NNR's overarching strategy, resulted in the positioning of Human Resources as a value-adding, mainstream business partner within the organisation, as well as in the development of a comprehensive Human Resources Strategy, which places greater focus on talent acquisition, development and retention.

Over the past three years, the NNR has been able to recruit staff in core technical areas, such as science and engineering – although, due to competition for scarce skills, both locally and abroad, skills retention is still considered a challenge.

In support of the capacity-building strategy, the NNR runs an internship programme and offers bursaries with the objective of addressing the inadequate supply of appropriate technical capacity to deliver on its core business. The NNR strives to maintain high competency levels for its technical employees, through continuous participation in local and international workshops and seminars, including those conducted by the IAEA, ICRP, IRPA and other international organisations.

The NNR will require additional skills to cope with upcoming projects, such as the planned steam generator replacement, thermal power upgrade expansion of the current used fuel dry storage capacity at KNPS; and the envisaged nuclear expansion programme. For this purpose, a staff expansion programme is presently being implemented with additional funding from licence fees. In some technical areas, where in-house expertise is not readily available, the NNR makes use of external technical support organisations (TSOs) – both locally and internationally.

Overall, the staff complement of the NNR comprises:

- Management (19);
- Technical/Professional staff (61); and
- Support staff (21).

The NNR plans to increase its overall staff complement by approximately 50 staff members, in preparation for the planned national nuclear expansion programme.

E-3.1.3. FINANCIAL RESOURCES

The capacity of the NNR continues to be supported through both its autonomous establishment and its funding provisions, which consist of monies appropriated from Parliament, fees paid to the NNR in respect of nuclear authorisations and donations or contributions received by the NNR with the approval of the minister.

E-3.2. DIRECTORATE RADIATION CONTROL

The Department of Health's Directorate Radiation Control (RADCON) administers the Hazardous Substances Act, 1973 (Act No. 15 of 1973), related to Group III hazardous substances (involving exposure to ionising radiation emitted from equipment) and Group IV hazardous substances (radioactive material that is not at nuclear installations or not part of the nuclear fuel cycle, for example fabricated radioactive sources and medical isotopes).

The Directorate applies regulatory requirements, for the control of radioactive sources, through a system of regulations, codes of standards and regulatory guides. The Directorate processes applications and issues authorisations to radionuclide users, such as laboratories, industry, hospitals, research institutions, etc., for the acquisition, production, possession, import, export, use, transport, sale and disposal of sealed and unsealed radioactive sources in terms of the Regulations.

The Directorate: Radiation Control forms an integral part of the National Department of Health (NDOH) and comprises four sub-directorates, dealing with the regulation of ionising radiation; radionuclides; non-ionising radiation and electro-medical devices; as well as an Inspectorate. The structure of the NDOH is as follows, indicating the position of the Directorate: Radiation Control.

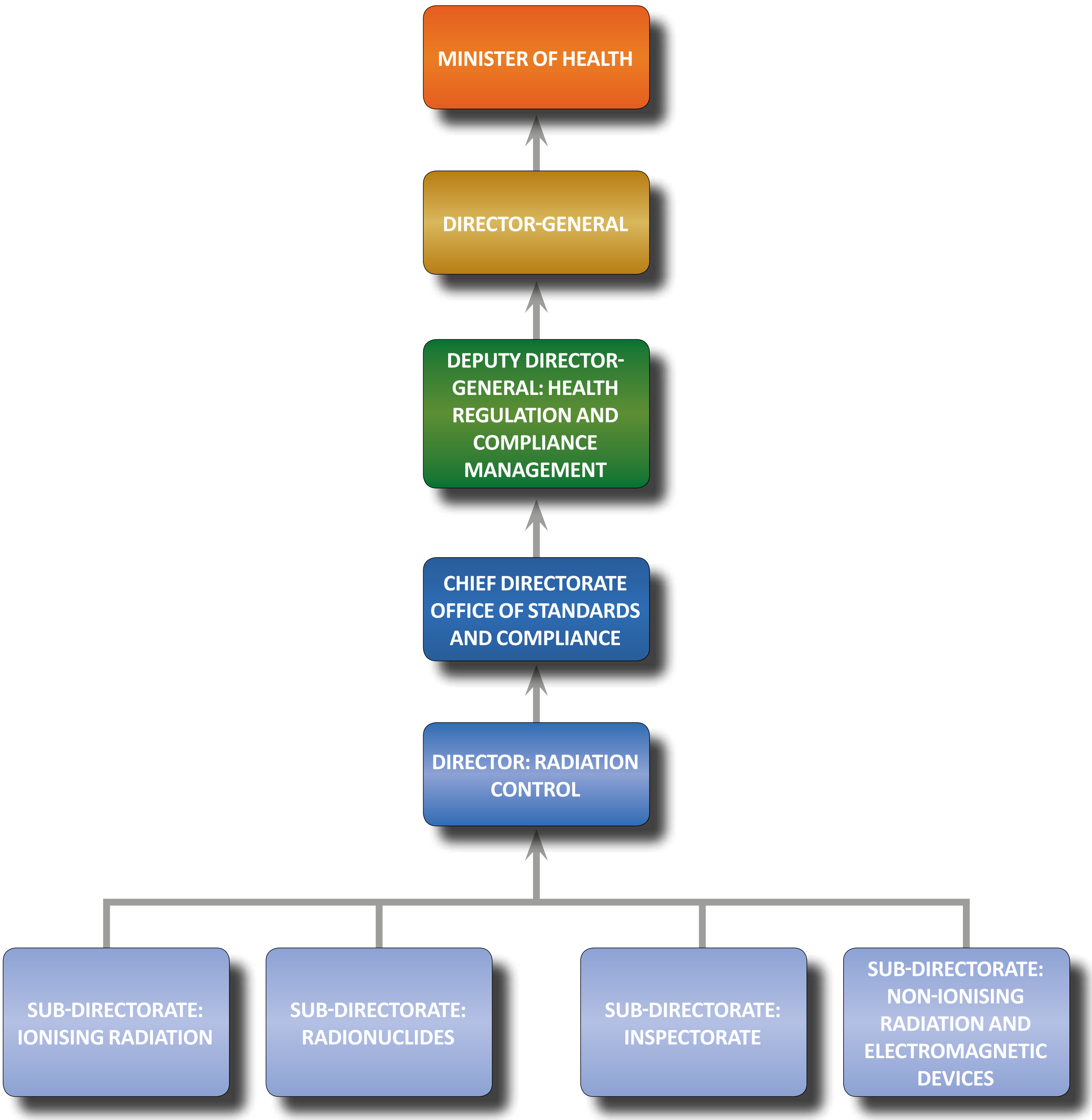


Figure 4: Organisational structure and reporting lines for Directorate Radiation Control

E-3.2.1. HUMAN RESOURCES

The Directorate Radiation Control currently has a staff compliment of 42 comprising:

- Management (5);
- Technical/Professional staff (19); and
- Support staff (18).

E-3.2.2. FINANCIAL RESOURCES

Financial resources for the Directorate are made provision for in the budget of the National Department of Health. Furthermore, the Directorate charges a nominal fee for permits or authorisations issued.

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 independently from government in terms of carrying out its mandate, which ensures that public health is assured for all South Africans who are exposed to the dangers of nuclear and radiation hazards. The purpose of this independence was established in order to ensure that regulatory decisions can be made free of other interests 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 as Chief Executive Officer.

With regard 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 a resolution to such disagreement the Minster has the power to make the final decision; no failure to resolve the disagreement has thus far emerged, regarding the relevant recommendations by the Board.

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

South Africa is satisfied that the regulatory body is effectively independent, consistent with the recommendations of the IAEA as published in GSR Part 1. The recent regulatory self-assessment, however, recommended aspects that could strengthen this regulatory independence. These include the following:

- Revising the current appeals process to reflect that appeals against a decision of the Board will be directed to the South African High Court and not the Minister.
- Strengthening the existing provision that the publication of regulations, related to safety standards and regulatory practices, must be on the recommendation of the NNR Board.

The process of revising the NNRA to give effect to these recommendations has been initiated.

Section F

GENERAL SAFETY PROVISIONS

F-1 RESPONSIBILITY OF THE AUTHORISATION 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.

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

F-1.1. RESPONSIBILITY FOR SAFETY

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 as protection of the environment, rests with the holder of, or applicant for a nuclear authorisation, and extends in an unbroken chain through the line management 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 recognised that regulation can bolster but never replace the commitment of line management and the workers to integrating proper health and safety practices into 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 authorisations and regulatory letters; and by a compliance assurance programme. The latter comprises inspections, surveillance and audits, as well as various forums for interaction with the authorisation holders.

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

Holders of, and applicants for, nuclear authorisations demonstrate their compliance with regulatory requirements; health, safety and environmental (HSE) legislation; permits; conditions of authorisation; national and international norms and standards; as well as via holder and applicant-specific policy and standards documents. The following aspects are generally covered in holder or applicant-specific documents:

- Safety policy and philosophy;
- Authorisation strategies;
- Integrated safety assessments;
- Identification of radioactive waste categories;
- Determination of radioactive 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;
- Authorisation holder inspections programmes;
- Non-compliance identification and reporting;
- Radiation protection programme and radiation dose limitation;
- Nuclear security arrangements;
- Emergency preparedness and response arrangements; and
- Management of radioactive effluents, including control of radioactive discharges to the environment.

F-1.2. RESPONSIBILITY FOR USED FUEL OR RADIOACTIVE WASTE

In accordance with the legislative requirements, the holder of a nuclear authorisation, whose operations generate or have 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 demonstrates the ability to safely manage all radioactive waste that may result from the proposed operations. Furthermore, 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 of the Republic of South Africa, ownerless radioactive waste (radioactive waste where the generator no longer exists or cannot be identified by reasonable means or does not have the resources to manage such waste) is the responsibility of government. At present, Necsa fulfils government's obligations in this regard.

In future, this responsibility will be vested with the recently 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:

1. qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;
2. 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;
3. 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, Regulation 388:

“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.”

Therefore, the holder of a nuclear authorisation has the primary responsibility for ensuring that the employees are qualified and authorised to do their jobs. Nuclear authorisation holders are required to report to the NNR on its staffing and competency levels. Holder employee training programmes include initial, complementary and refresher training programmes.

At KNPS, Eskom’s Nuclear Fuel Department is responsible for human resources planning to fulfil corporate responsibilities in accordance with Eskom’s requirements regarding resource management.

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

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

F-2.2. FINANCIAL RESOURCES

In general, the financing of decommissioning and waste management follows the principle of the "polluter pays". In accordance with this principle, all holders of nuclear authorisations are responsible for ensuring that sufficient resources are in place to meet their responsibilities with regard to decommissioning and radioactive waste management. It is furthermore a requirement of the SSRP, Regulation R.388, 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 (release from regulatory control).

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

- Low and intermediate-level waste from Koeberg and Necsa's Pelindaba site is disposed 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 of operational funds.
- Decommissioning of disused mine equipment (primarily in the gold, copper, phosphate and mineral sands operations) are currently being undertaken. The mining companies finance the decommissioning costs themselves and subcontract the operations out to specialised agencies.

Decommissioning of the Koeberg nuclear power station is currently scheduled for after 2035. Financial provision for the decommissioning and used fuel management has been accumulating on a monthly basis since commercial operations of the installation started in 1984.

Management at Eskom and Necsa is responsible for determining the financial resources necessary to meet 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.

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 regarding radioactive waste management; and
- Funding for other activities related to radioactive waste management.

Legislation for the establishment of a National Radioactive Waste Management Fund was developed and is currently undergoing legal review by the State Law Advisor. In keeping with the polluter pays principle, the contributions to the fund will come from the generators of radioactive waste. The contributions shall be managed in an equitable manner, without cross-subsidisation; and will *inter alia*, be based on classification of the waste and the volumes.

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

An "after-care" fund was established for the Vaalputs repository to finance activities during the institutional control period.

Financial provision for the closure and post-closure of mining and mineral processing operations is regulated by the Directorate Mineral Resources, in terms of the Minerals and Petroleum Resources Development Act, 2002 (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 SSRP's principle nuclear safety requirements, is 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 are verified by audits, surveillance, self-assessment and peer reviews. Staff members undertaking monitoring activities are independent of direct responsibility for the activity being monitored. The detection, correction of and the 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 non-conformance 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 as part of the Compliance Assurance Programme (CAP).

F-3.1. QUALITY ASSURANCE AT NECSA

The quality of activities and behavioural performance are managed by means of a Quality Management System (QMS). The Necsa Safety and Licensing Department is responsible for ensuring that the QMS is established, implemented and maintained.

The roles and responsibilities with regard to implementation and management of the quality processes, are defined in the QMS manual and the Necsa Quality Policy.

As part of the QMS, 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, so as to ensure that satisfactory results are obtained. 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 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 in the organisation. Skills are identified via the balance score-card and the individual development programme is implemented to ensure that 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:

- Control of documents;
- Control of records;
- Control of non-conformance;
- Internal audits;
- Corrective action; and
- 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 the internet, e-mail, notice boards, intranet, meetings, road shows, etc.

Quarterly and annual reports are compiled for top management to ensure effective controls. Staff members performing work affecting quality are adequately trained and authorised to perform specified tasks.

F-3.2. QUALITY ASSURANCE AT KNPS

The KNPS 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 the KNPS. This programme is based on the IAEA Safety Code 50-C/SG-Q, the NNR Licence Document LD-1023 and the Eskom Nuclear Division Safety and Quality Management Manual.

A comprehensive audit programme of planned, periodic monitoring of the nuclear installation is implemented by the licence holder in conformance with NNR's licensing requirements. This programme is informed by indicators, which include audit findings, inspection of non-compliance, 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.

Achievement and maintenance of quality is 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 check-lists. Staff members 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-conformance, deficiencies and deviations from quality requirements are specified in various authorised procedures. Non-conforming items are marked conspicuously and, where possible, separated 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 non-conformance 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-conformance of components is dispositioned as follows: Use-as-is, repair, rework or unfit-for-purpose-based on reviews and evaluations by responsible, competent engineers. Non-conformance dispositions are reviewed and accepted by the responsible management.

Conditions adverse to quality, include failures, malfunctions, deficiencies, deviations, defective material or equipment and 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 is determined and corrective action is taken to prevent a repetition. The appropriate management is informed.

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

F-3.3. QUALITY ASSURANCE AT NORM FACILITIES

Holders of nuclear authorisation (Certificate of Registration) are required to establish, implement and maintain a quality management programme. The quality management programme calls for an organisational structure, the identification of roles and responsibilities, levels of authority, as well as communication protocols of staff members to be clearly documented. The programme entails a quality policy and objectives to be met during all phases of the operation of the facility, including decommissioning. The programme is reviewed at defined intervals by the facility's Executive Management to assess the status and adequacy of the programme. During such a review, audit and surveillance findings, system deficiencies, document discrepancies, non-conformance reports, corrective action requests and any other performance-related reporting mechanisms are evaluated to determine the extent and consequences of the deviations and their effect on the programme.

The programme calls for the establishment, implementation and authorisation of the following mandatory procedures:

- Document control procedure;
- Records control procedure;
- Non-conformance control procedure;
- Internal audit procedure;
- Corrective action procedure; and
- Preventive action procedure.

The NORM facilities ensure effective implementation of the programme by conducting internal audits and self-inspections on various conditions of the nuclear authorisation, including radioactive waste management. Furthermore in accordance with the approved waste management programmes, the holders are required to submit quarterly and annual waste reports to the NNR.

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 that 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 below:

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.

- 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 aged 16 to 18 years, who are training for employment, involving exposure to radiation; and for students aged 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 applies for the remainder of the pregnancy.

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 occupationally exposed persons:

- for the purpose of saving a 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 that 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 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 from all authorised actions for members of the public, is 1 mSv. No action may be authorised that 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, as well as to assist in ensuring that the operational programmes are not compromised. The necessary principles are embodied in the nuclear authorisation and in the authorisation holders programme on radiological protection.

F-4.1.2. ALARA FOR WORKERS AND THE 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 and their associated risks are taken into account. During the design of a new facility or the modification of existing facilities, design objectives are set to optimise exposure protection of both workers and the public.

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

Doses to the 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 to 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; optimised design of facilities; establishing radiation and contamination control zones; a work permit system for non-standard tasks; registration of radiation workers – i.e. workers whose radiation risk profile indicates that, based on normal operations, they may receive an effective dose of 1 mSv/a or more are classified as radiation workers and will undergo the necessary dose monitoring, health evaluations and training.

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

In the mining industry, a limited number of shafts registered 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 a nuclear installation, in accordance with good engineering and international norms and practice. This includes prevention and mitigation of accidents and redundant measures to reduce the probability of discharges into the environment. The degree to which defence-in-depth is applied must take the magnitude of the hazard into account.

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 ongoing or anticipated releases of radionuclides arising from the normal operations of an authorised action/facility or a source within an authorised action/facility. It is a requirement that both discharges into the atmosphere and discharges into water bodies need to be addressed.

Any person applying for an authorisation for the discharge of radioactive effluents must submit the relevant information necessary to the NNR, 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 authorised 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 inter-dependencies. 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, so as to ensure that a discharge into the environment is an acceptable option.

Authorised discharge limits will be issued in the form of a “discharge authorisation”. A revised application for a discharge authorisation must be applied for in event of the following:

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

Authorisation holders are responsible for setting up and implementing the technical and organisational measures that are necessary for ensuring the protection of the public in relation to the radioactive discharges for which they are authorised.

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, due to higher than normal discharges in conditions of poor dispersion 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 due cognisance 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 and based on the model results, an appropriate set of environmental investigation/reporting levels must be developed. The site environmental monitoring programme must take due cognisance of the predicted discharge impact and this 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 Programme (CAP).

Koeberg

Radioactivity in liquid and gaseous discharges from Koeberg during the 2013 calendar year, contributed a projected total individual dose of 1.09 µSv to the hypothetically most exposed public group. The projected doses, as a result of gaseous and liquid discharges, were 0.31 µSv and 0.78 µSv respectively, which is well within the NNR dose constraint of 250 µSv per annum. The projected public doses, resulting from the Koeberg nuclear power station, for the six years between 2008 and 2013, is depicted in the graph below:

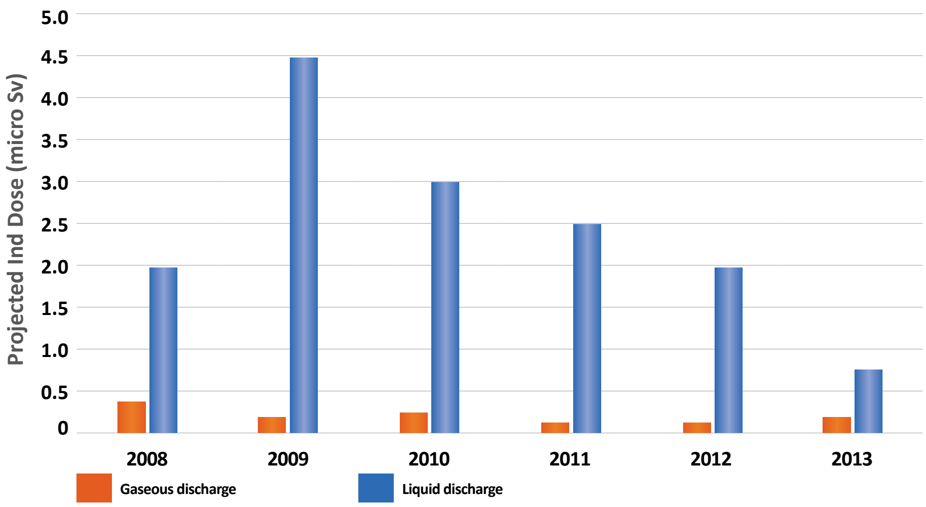


Figure 5: Koeberg projected public doses for the period 2008 to 2013

Necsa

Radioactivity in liquid and gaseous discharges from nuclear facilities at the Necsa Pelindaba site during the 2013 calendar year, contributed a projected total individual dose of 8.97 µSv to the hypothetically most exposed public group. The projected doses, as a result of gaseous and liquid discharges, were 4.07 µSv and 4.90 µSv respectively, which is well within the NNR dose constraint of 250 µSv per annum. The projected public doses, resulting from the nuclear facilities on the Necsa Pelindaba site for the period 2010-2013 is depicted in the graph below:

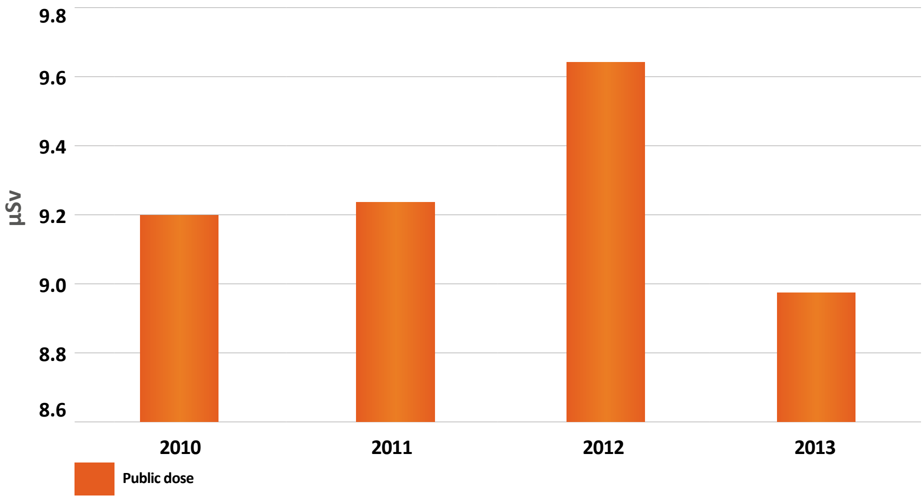


Figure 6: Projected public doses from the Necsa Pelindaba site for 2010 to 2013

Mines

At present, source-specific AADQs are not applied at mining and mineral processing facilities. The NNR is currently undertaking investigations in this regard and plans to introduce source-specific AADQs 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 materials into the environment is a reportable event in terms of the conditions of authorisation. In reporting the event, the holder of a nuclear authorisation is responsible for investigating the cause of the event and determining appropriate corrective and preventative actions to be undertaken. The NNRA further gives NNR the 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 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 take place. The Regulator must ensure that such emergency plans are effective for the protection of persons, should a nuclear accident take place. The emergency plan includes a description of facilities, training and exercising arrangements, liaison with off-site authorities as well as relevant international organisations, and emergency preparedness provisions.

Furthermore, the Minister may, on recommendation of the Board of Directors and in consultation with the relevant municipalities, make regulations pertaining to the development surrounding any nuclear installation, so as to ensure the effective implementation of any applicable emergency plan.

In addition, the conditions of licence require the following:

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 bodies 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.

In order to assess the effectiveness of the emergency preparedness and response arrangements, the NNR normally performs audits and arranges an 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.

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

In terms of other relevant legislation applicable to emergency planning, the Disaster Management Act, 2002 (Act No. 57 of 2002) was promulgated on 15 January 2003.

This Act 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; and
- matters relating to these issues.

The National Disaster Management Framework comprises six key performance areas (KPAs). 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 actions and monitor the effectiveness of efforts in this regard.

(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, 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 both the National Disaster Management Framework and the Act. These include performance audits; self-assessments; peer reviews; reviews of significant events and disasters; as well as rehearsals, simulations, exercises and drills.

F-5.1.1. IMPLEMENTATION OF EMERGENCY PLANS

Parties involved with emergency preparedness and response include the licensees, local authorities in the region, provincial authorities, national government and the NNR. According to section 38(1) of the NNRA, the licensee must enter into an agreement with the relevant municipalities and provincial authorities to establish an emergency plan.

When a nuclear accident occurs, the holder of the nuclear authorisation 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, 2002 (Act No. 57 of 2002), the off-site authorities are required to verify and implement off-site protective actions, as recommended by the authorisation holder in the event of a nuclear accident, in accordance with the procedures stipulated in the emergency plan.

In support of the emergency plan, an environmental monitoring plan has been implemented for the past few decades, which provides a baseline for background radiation and radiological concentrations in various environmental media in the surrounds of the Pelindaba, Vaalputs and Koeberg sites. 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.

Mining and minerals processing facilities: Although formal emergency preparedness is not required from mining and minerals processing operations, emergency preparedness and response plans are in place for all mine residue facilities and these plans are incorporated into the mine management plans.

F-5.2. INTERNATIONAL ARRANGEMENTS

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

- The Convention on Early Notification of a Nuclear Accident.
- The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

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

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 preparedness and response arrangements, are nuclear professionals and specially trained personnel. These include government representatives and technical advisors from the regulatory body.

For other staff members, 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 Regulator every 18 to 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 in the regulatory framework.

F-6.2. PROVISIONS WITH RESPECT TO OPERATIONAL RADIATION PROTECTION, DISCHARGES AND UNPLANNED AND UNCONTROLLED RELEASES

The SSRP prescribes the requirements for decommissioning of nuclear installations, plants or equipment that have an impact on radiation protection and nuclear safety. An applicant for, or a holder of a nuclear authorisation, is required to establish an initial decommissioning plan for the facility, based on the established decommissioning strategy commensurate with the type and status of the facility.

The initial decommissioning plan must –

- take into account major safety issues;
- support the fact that decommissioning can be safely conducted, using proven techniques or techniques being developed;
- include a generic study, indicating the feasibility of decommissioning;
- take cognisance of environmental aspects of decommissioning, such as the management of waste and radioactive effluents; and
- provide a basis to assess the costs of the decommissioning activities and the means of financing it.

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.

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 KNPS is currently scheduled for after 2035. Financial provision for the decommissioning (and also used fuel management) has continued to be accumulated on a monthly basis since commercial operations 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 financial provision amount for decommissioning and spent fuel management made each month is determined by present value calculations of the associated 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 Annex 8.

For each decommissioning phase or a combination of phases, an authorisation from the Regulator is required. It is required that safety of the workers and the public is demonstrated under normal operating conditions, as well as during emergencies. The conditions of approval also include, inter alia, radiation safety programmes, waste safety programmes, nuclear security, access egress control, fire safety, quality control, emergency plans, etc. to be in place before authorisation to decommission is granted.

The Regulation (R.388 of 2006), published in terms of the NNRA, requires that a site, used in the conducting of an authorised action, may be released for unrestricted use, provided that:

- it is demonstrated that radioactive contamination and radioactive materials, which can reasonably be attributed to the authorised action, have been removed from the site; or in the case of naturally occurring radioactive nuclides, have activity concentrations below the levels for exclusion; or
- where the provision above cannot reasonably be achieved, remedial measures have been implemented to achieve optimisation of protection, constrained in accordance with the annual effective dose received by the average member of the critical group for all feasible future situations arising from the residual radioactive contamination and radioactive materials, which can reasonably be attributed to the regulated action, does not exceed the dose constraint that was applicable during operations.

In the event that the release of a site in accordance with the conditions above can only be reasonably achieved by imposing restrictions on the use of the site, the Regulator may approve the release of that site for restricted use.

F-6.5. PROVISIONS WITH REGARD TO EMERGENCY PREPAREDNESS

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

F-6.6. RECORDS OF INFORMATION IMPORTANT TO DECOMMISSIONING ARE KEPT

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

- updated facility description;
- reference to past safety health and environmental assessments;
- normal operational discharge quantities and waste generated;
- radiological surveillance results;
- events registered and dose exposure records; as well as
- the prescribed decommissioning reports.

Section G

SAFETY OF USED 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 REMOVAL OF RESIDUAL HEAT GENERATED DURING USED FUEL MANAGEMENT AT KNPS

Koeberg only handles and stores used fuel generated from the two Koeberg reactor units. Used 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; and
- the high-density racks at Koeberg, which are all lined with boron carbide and the coolant that is mixed with boric acid to ensure sub-criticality during storage. The boron concentration in the spent fuel pool is maintained between 2 440 and 2 700 mg B/kg.

The used fuel pool cooling system (PTR) performs the following functions with regard to the used fuel:

- Maintaining the irradiated fuel in subcritical conditions.
- Biological protection of staff by:
  - o maintaining sufficient depth of water in the used fuel pool; and
  - o removing corrosion products, fission products and suspended particles present in the used fuel pool water by filtration, demineralisation and surface skimming.
- Cooling by:
  - o removing residual heat released by irradiated fuel assemblies stored in the used fuel pool (temperature in the spent fuel pool is maintained between 10 and 50°C); and
  - o backing up the residual heat removal system (RRA), in case the RRA becomes unavailable after opening the reactor coolant circuit.

The fresh fuel storage facility is used for the dry storage of the fresh fuel assemblies. These dry storage racks are designed in such a way that the facility remains sub-critical when filled with fresh fuel and that the effective multiplication factor K_{eff} does not exceed the value of 0,95, even in postulated accidents, although it is assumed that water or another possible moderator enters the storage facility.

Used fuel assemblies are always stored and handled under water in compliance with biological protection criteria. Criticality control during for the movement of fuel assemblies in the used fuel pools is achieved via an administrative procedure, KAF-023.

Four CASTOR X/28 F used fuel dry storage casks are currently located in the cask storage building on site. These casks, containing 112 spent fuel assemblies in total, were analysed to accommodate used fuel with enrichments up to 3,5 wt%. The casks do not require any active safety systems with regard to criticality and residual heat removal. However, the ambient air temperature is monitored by the ventilation system in the cask storage building. The ventilators open automatically upon the loss of electrical supplies or when the air temperature reaches 38°C; and they can also be opened manually.

G-1.2. CRITICALITY AND REMOVAL OF RESIDUAL HEAT GENERATED DURING USED FUEL MANAGEMENT AT NECSA

Irradiated uranium target plates, fuel assemblies and control rods from the SAFARI-1 Research Reactor 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; and
- 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/she must also monitor the status of the core nuclear instrumentation during these activities.

Requirements for the shipment of fuel: Special arrangements for the shipment of fuel out of the reactor building (e.g. the shipment of fresh fuel back to the manufacturer for some reason, or the shipment of used fuel for long-term storage) 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 piping 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 Thabana Pipestore, used fuel storage facility criticality was taken into consideration. The operating technical specification limits the acceptance of used fuel to the pipestore to fuel that has undergone a cooling period of at least two years. A subsurface pipestore/borehole design was selected for the dual purpose of shielding and heat transfer.

G-1.3. THE GENERATION OF RADIOACTIVE WASTE ASSOCIATED WITH USED FUEL MANAGEMENT IS KEPT TO THE MINIMUM PRACTICABLE, CONSISTENT WITH THE TYPE OF FUEL CYCLE POLICY ADOPTED

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

G-1.4. INTERDEPENDENCIES AMONG THE DIFFERENT STEPS IN USED 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 regard 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, disposal in particular, will be taken into account when any radioactive waste management activity is being considered.

G-1.5. EFFECTIVE PROTECTION OF INDIVIDUALS, SOCIETY AND THE ENVIRONMENT BY APPLICATION OF PROTECTIVE METHODS AS APPROVED BY THE REGULATORY BODY

The SSRP issued in terms of the NNRA, prescribed dose and risk criteria applicable to members of the public and the workforce, as well as general safety principles, such as defence-in-depth, ALARA and conformance to good engineering practice. The dose criteria, discussed in Section F-4 are applied in accordance with international practice (e.g. ICRP, IAEA). The risk criteria, established by the Regulator in the late 1970s, are based on analyses 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 the following:

- 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 processes of Koeberg and SAFARI-1. This implies that the protection of individuals, society and the environment is assessed in terms of the same criteria applicable to operating conditions.

G-1.6. BIOLOGICAL, CHEMICAL AND OTHER HAZARDS ASSOCIATED WITH USED FUEL MANAGEMENT

It is required that waste characterisation be conducted throughout the pre-disposal management steps. Waste category-specific characterisation requirements shall be specified and shall 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 the 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 while also monitoring for leaks). A risk assessment of the facility was carried out.

G-1.7. AVOIDANCE OF ACTIONS THAT IMPOSE REASONABLY PREDICTABLE IMPACTS ON FUTURE GENERATIONS GREATER THAN THOSE PERMITTED FOR THE CURRENT GENERATION

In accordance with the provisions of 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 high level waste (HLW) management shall involve a public participation process.

G-1.8. AIM TO AVOID IMPOSING 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, final disposal is regarded as the ultimate step in radioactive waste management, although a stepwise waste management process is acceptable. Long-term storage of certain types of waste, such as used fuel, may be regarded as one of the steps in the management process

Investigations shall be conducted by the National Radioactive Waste Disposal Institute (NRWDI), to consider the various options for the safe management of used fuel, and the following options will be investigated:

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

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: OVERVIEW AND 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 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 KNPS 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 KNPS.

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 team members' experience and good practices in 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 in 2006, but also identified performance gaps in the areas of plant status controls and situational awareness (i.e. conventional safety).
- While these gaps did not result in an unacceptable situation with regard to nuclear safety, it was 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) in these areas and to bring the station back in line with industry best practice. The utility has since developed action plans to address the areas for improvement.

Modifications Implemented at Koeberg

Some of the modifications relevant to this Convention, which resulted in safety improvements, include the following:

- 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;
- Upgrading of the used fuel pool crane;
- Upgrading of control room alarms; and
- 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 were initiated as a result of various factors, such as:

- a 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; and
- potential weaknesses in the design, identified during the safety re- assessment of the nuclear installation, or resulting from the activities reported under Section H.

G-2.3. PLANNED INCREASE IN USED FUEL DRY STORAGE CAPACITY

It is recognised that the current used fuel storage capacity at KNPS is finite and limited. Due to a need to increase the energy output at KNPS, the KNPS operating organisation, Eskom, implemented a revised fuel management strategy. The revised fuel management strategy has required that some used fuel be stored in a checkerboard configuration within the used fuel pool, thereby reducing the available storage capacity of the used fuel pools. Furthermore, Eskom is considering extending the operating lifetime of the two units at KNPS, beyond 40 years. Consequently Eskom is considering options to expand the used fuel storage capacity at KNPS.

Furthermore, Eskom is considering extending the operating lifetime of the two units at the KNPS from the current 40 years' to a possible 60 years' operating life. This proposed plant life extension will also require additional used fuel storage capacity.

To this end, the power utility Eskom is investigating options to expand the current dry storage capacity at the KNPS.

G-2.4. INCREASE IN STORAGE CAPACITY OF NECSA 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. The pipe was removed from the borehole. This assessment proved that the current design was safe and suitable and no improvements were required 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.

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 4.

G-3.1. RELEVANT SITE-RELATED FACTORS LIKELY TO AFFECT 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 and land-use;
- adjacent sea-usage;
- nearby transportation, civil and industrial facilities;

- meteorology;
- oceanography and cooling water supply;
- the impact of natural hazards;
- the impact of external man-made hazards;
- hydrology, geology and seismology;
- fresh water supply;
- site control measures;
- emergency services;
- radioactive effluents; and
- 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 so as 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. EVALUATION OF THE SAFETY IMPACT OF THE FACILITY ON INDIVIDUALS, SOCIETY AND THE ENVIRONMENT

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, due to normal operations and accident conditions of moderate frequency (1-10^{-2} per annum), complies with an average dose limit of 0.25 mSv per annum to the critical group.

With regard to accidents of a 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 licensee performs the dose and risk calculations.

The NNR furthermore stipulated limits on urban developments in the vicinity of the installation and holds regular meetings with the licence holder and 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 18-24 months (as reported under Section F-5).

G-3.3. AVAILABILITY OF INFORMATION ON THE SAFETY OF THE FACILITY TO MEMBERS OF THE PUBLIC

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 (PSIF) in order to inform the persons living in the municipal area on nuclear safety and radiation safety matters.

Public Safety Information Forums were established for both KNPS and the nuclear facilities at the Necsa Pelindaba site and quarterly 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 offered 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 Government Gazette, as well as in 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 required, the Board will arrange for such hearings.

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

G-3.4. CONSULTATION WITH CONTRACTING PARTIES NEAR A FACILITY AND PROVISION OF GENERAL DATA RELATING TO THE FACILITY TO ENABLE THEM TO EVALUATE THE LIKELY SAFETY IMPACT OF THE FACILITY UPON THEIR TERRITORY

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 consultations detailed under G-3.3.

G-3.5. STEPS TO ENSURE THAT FACILITIES SHALL NOT HAVE UNACCEPTABLE EFFECTS ON OTHER CONTRACTING PARTIES BY BEING SITED IN ACCORDANCE WITH THE GENERAL SAFETY REQUIREMENTS

When any new facility is being sited or when significant modifications to an existing license are made, which could have an effect on public safety, the public is consulted on 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 to the public and other affected parties, at the Public Safety Information Forums.

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

G-4.1. LEGISLATION AND LICENSING PROCESS ON 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.

With regard to 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, Environmental and Quality (SHEQ) requirements for both the internal and external approval of the project. The requirements include the interpretation of the regularly framework as applicable to all the project phases (design to decommissioning), which is then communicated to, and agreed with the Regulator.

G-4.2. CONCEPTUAL PLANS AND TECHNICAL PROVISIONS FOR THE DECOMMISSIONING OF A USED FUEL MANAGEMENT FACILITY 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 furthermore 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 during the design phase. The decommissioning strategy is required to be updated throughout the operation of the authorised action as a basis for a detailed decommissioning plan.

G-4.3. TECHNOLOGIES INCORPORATED IN THE DESIGN AND CONSTRUCTION OF A USED FUEL MANAGEMENT FACILITY ARE SUPPORTED BY EXPERIENCE, TESTING OR ANALYSIS

The SSRP requires that –

"Installations, equipment or plants requiring a 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."

Furthermore in accordance with the provisions of NNR Requirements document RD-0034, namely 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 that 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 it must be consistent with the reliability goals determined for the respective SSC.

(4) Where new or innovative designs or features are used, the licensee must provide the results of the investigation into the 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 of pre-determined requirements and/or design criteria. The licensee must ensure that the outputs are reviewed against inputs as part of a design review process, in order 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 the design and as a basis for the performance of design reviews.

(8) The verification or checking process must be performed by individuals, departments or organisational units other than those who have developed 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 demonstrate 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 the potential to result in verification, validation and approval processes. The requirements resulting from such deviations must be implemented in the selection and implementation process of the codes and standards and the qualifications of the suppliers and the SSC.

(11) Procedures must be established for 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 the 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 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 performed within their own organisations and Level 1 suppliers (suppliers assigned responsibility for products of high importance to nuclear safety or having 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, in order to provide sufficient data to validate analytical codes; and that the effects of systems interactions are acceptable. The test programme 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, namely *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 Environment Conservation Amendment Act, 2003 (Act No. 50 of 2003) (ECAA) and the National Environment Management Act, 1998 (Act No. 107 of 1998) (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 life cycle safety assessments and safety cases are detailed in Section E-2.2.2: A SYSTEM OF LICENSING OF SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT ACTIVITIES, 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 life cycle safety assessments and safety cases are detailed in section E-2.2.2: A SYSTEM OF LICENSING OF SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT ACTIVITIES, of this report.

The NNR is charged, by virtue of the provisions of the National Nuclear Regulator Act, (Act No. 47 of 1999), 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, as well as 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 holder 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. A Site Safety Report.
iv. A 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 license, 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 safety analysis report (SAR) as necessary, and the relevant inspections and tests have been conducted, confirming compliance with the approved 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, as well as modifications to the plant and safety-related procedures.

G-6.3. PROCEDURES FOR OPERATIONS, MAINTENANCE, MONITORING, INSPECTION AND TESTING

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 must 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 holders on an annual basis. Deficiency in engineering or technical support is directed to the licence holder for rectification.

As regard KNPS for example, the licence holder entered into technical cooperation 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 regulator 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, as well as corrective action.

With regard to KNPS, the process includes operating experience feedback 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 USED 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 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 the 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 DURING RADIOACTIVE WASTE MANAGEMENT

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 the 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 for a nuclear authorisation, should demonstrate that:

(1) an adequate organisation with responsibility to implement the criticality safety program is being established;

(2) an adequate criticality safety programme, to ensure safe operation of the facility, is being 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. The submitted safety case 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 programme.

(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 analyses can be reviewed and inspected by the NNR and the 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 the 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 is 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 by the preparation of a facility radioactive and hazardous waste management programme 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 end points and ensures that waste management and transport steps meet the 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 by integrated safety, health, environment and quality management practices, which aim to prevent harmful effects on current and future generations for the total life cycle of radioactive waste management.

H-1.4. EFFECTIVE PROTECTION OF INDIVIDUALS, SOCIETY AND THE ENVIRONMENT WITH DUE REGARD FOR INTERNATIONALLY ENDORSED STANDARDS AND CRITERIA

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

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, Finland, France, South Korea, Russia, the United Kingdom and the United States of America.

South Africa is also a member of the Network of Regulators of Countries with a Small Nuclear Programme (NERS), the Forum of Nuclear Regulatory Bodies in Africa (FNRBA) and the Southern African Development Community (SADC) Nuclear Regulatory Network (NRN) and, as such, shares experiences, safety standards, etc. with regulators of countries who are members of these networks.

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 they have a connection with radiological hazards. In addition, all facilities regulated by the NNR and the DOH have to comply with all other national legislation with regard to other types of hazards.

Necsa employs a radioactive waste characterisation process for the characterising of radiological, chemical, mechanical, thermal and biological properties of radioactive wastes. These characteristics are used to categorise the waste 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, furthermore 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., phyrophoric 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 principle, radioactive waste shall be managed in such a way that the predicted impact on future generations will not be greater than the 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 periods of time. It could be possible for some fraction of the waste inventory to 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 increases in future. 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. 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 it will not impose an undue burden on future generations. South Africa 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, such as 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 will be followed were practicable:

- Waste avoidance and minimisation;
- Reuse, reprocessing and recycling;
- Storage; and
- 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.

Furthermore, 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 with the conditions of authorisation.

As an integral part of the operational safety assessment, in addition to the ongoing 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 IN ORDER TO DETERMINE WHETHER ANY INTERVENTION IS NEEDED

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

- Compliance with a system of justification of facilities/actions;
- Compliance with dose and risk limits;
- Compliance with dose constraints and annual allowable discharge quantities;
- use of the ALARA principle; and
- 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 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, however, suggested that the operational safety of the disposal site can be improved by, for example, backfilling and covering disposal trenches more promptly and thereby limiting exposure of waste packages to environmental agents. These suggestions were incorporated into operational procedures and into 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 FACTORS LIKELY TO AFFECT THE SAFETY OF A FACILITY DURING ITS OPERATING LIFETIME, AS WELL AS THAT OF A DISPOSAL FACILITY AFTER CLOSURE

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 five years and submitted to the Department of Labour (DoL) in terms of the major hazard installation regulations of the Occupational Health and Safety Act, 1993 (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, Regulation 927 of 2011 on siting of new nuclear installations was published in November 2011.

Regulation 927 of 2011 establishes regulatory requirements pertaining to sites for new nuclear installations. In developing these Regulations, the NNR took cognisance of international standards and practices from sources such as the IAEA and also from relevant nuclear safety authorities of other countries.

Regulation 927 of 2011 requires that the applicant wishing to site a nuclear installation must submit a site safety report to the NNR, which will sufficiently characterise the site and 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; the impact of natural hazards; the impact of external man-made hazards; hydrology, geology and seismology; fresh water supply; site control; emergency services; radioactive effluents; and 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 have 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. EVALUATION OF THE SAFETY IMPACT OF A FACILITY ON INDIVIDUALS, SOCIETY AND THE ENVIRONMENT, 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 was undertaken. This assessment was based on the IAEA ISAM methodology and demonstrated that the post-closure impact would be acceptable in terms of the current dose limits.

The post-closure safety assessment identified that the operational safety of the disposal site can be improved by, for example, backfilling and covering disposal trenches more promptly and thereby limiting exposure of waste packages to environmental agents. The water content in waste disposed of at Vaalputs must be limited. These suggestions were incorporated into operational procedures and into the waste acceptance criteria to improve the safety of the facility.

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

H-3.3. AVAILABILITY OF INFORMATION ON SAFETY TO MEMBERS OF THE PUBLIC

Current regulations require that an environmental impact assessment (EIA) and a nuclear licence for nuclear-related projects be subjected to public participation in the decision-making phases, prior to the 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 facility building.

Information regarding the safe operation of nuclear facilities is communicated to interested and affected parties via Public Safety Information Forums. Also see Section G-3.3.

H-3.4. CONSULTATION WITH CONTRACTING PARTIES IN THE VICINITY OF A FACILITY AND PROVISION OF GENERAL DATA RELATING TO THE FACILITY TO ENABLE THEM TO EVALUATE THE LIKELY SAFETY IMPACT OF THE FACILITY UPON THEIR TERRITORY

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

H-3.5. STEPS TAKEN TO ENSURE THAT FACILITIES DO NOT HAVE UNACCEPTABLE EFFECTS ON OTHER CONTRACTING PARTIES, BY BEING SITED IN ACCORDANCE WITH THE GENERAL SAFETY REQUIREMENTS

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 to the public and other affected parties at Public Safety Information Forums.

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 is 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 the design and construction of nuclear installations.

All projects at the Necsa site follow the project approval process with specific requirements determined by the categorisation of the project in terms of risk level. 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 that contains the information prescribed in the construction regulations in terms of the Occupational Health and Safety Act 1993 (Act No. 85 of 1993) which includes a Necsa approved Health and Safety plan that addresses hazards that may impact on individuals, society or the environment; and
- must be in good standing with the government compensation fund or a licensed insurer.

Necsa's management system 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.

With regard to Koeberg, all storage facilities were designed to limit the release of radon and dust into the atmosphere and also to limit the amount of seepage and run-off from the source into the environment.

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

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

For all new projects that are undertaken, it is required that conceptual plans for decommissioning are developed during the design stage.

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

Continued monitoring and environmental surveillance of the Vaalputs site are 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 is required for the decommissioning of all nuclear facilities.

H-4.4. TECHNOLOGIES THAT ARE INCORPORATED IN DESIGN AND CONSTRUCTION ARE SUPPORTED BY EXPERIENCE, ANALYSIS AND TESTING

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

With regard to 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 the possible impact of the waste disposal operations on the environment.

At Koeberg, experienced staff members from various disciplines are in place to provide technical support for the application of new technologies with regard to 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 ASSESSMENT AND AN ENVIRONMENTAL ASSESSMENT BEFORE CONSTRUCTION

In accordance with environmental legislation, any authorisation granted for a nuclear installation by the Department of Environmental Affairs would be conditional to 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, constitute key elements of the safety case of the waste management facility.

The Vaalputs repository was granted a nuclear license (NL28) 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 2013 respectively. The operational safety assessment was updated in 2012.

With regard to Koeberg, a public safety assessment and an environmental impact assessment (EIA) were 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, 2007 and again in 2013, by means of the post-closure radiological safety assessments. These assessments indicated 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 2013 post-closure radiological safety assessment of Vaalputs demonstrated that the repository isolation concept, comprising near-surface trenches located in the region above the groundwater table, provided 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 300 years for the Vaalputs repository, given the current operational constraints and source term.

Safety assessments of Vaalputs demonstrate 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 an excessive financial burden on the current and future generations;
- prevents or substantially delays movement of water or radio-nuclides towards the accessible environment; and
- provides for the safe closure of the facility once all operations have ceased, given that the necessary after-care measures are taken in 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.)

With regard to 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 National Radioactive Waste Disposal Facility, operate in terms of a nuclear installation licence, issued by the NNR under the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999). The repository nuclear license (NIL-28) includes requirements pertaining to the following:

- Risk assessment and compliance with safety criteria;
- Modifications and license change requests;
- Reporting nuclear occurrences;
- Probabilistic safety assessment;
- Waste acceptance criteria;
- A quality and environmental management system;
- A radiological environmental surveillance programme;
- Radiological control programmes;
- Control over radioactive effluents;
- Technical design specifications;
- Emergency planning;
- A maintenance programme;
- Security requirements;
- A meteorological programme;
- An in-service inspection and testing programme; and
- Operational procedures.

In terms of commissioning, at Koeberg inspections are done by both the operator and the regulator during commissioning, in order to ensure that the facility is performing in accordance with design parameters and also that the safety requirements are being met.

H-6.2. OPERATIONAL LIMITS AND CONDITIONS

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

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 specific safety related 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 that the necessary technical and engineering support is available to facility managers.

With regard to the facilities at Koeberg, each operation has a Senior Manager: Engineering, who is responsible for the inspection and maintenance of critical safety components of storage facilities. Furthermore, technical support is obtained from a competent team of engineers from the Eskom Corporate Office, for operations of the radioactive waste management facility.

H-6.5. PROCEDURES FOR CHARACTERISATION AND SEGREGATION OF RADIOACTIVE WASTE

Waste is characterised in accordance with the National Waste Management Policy and Strategy. 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 into the environment from the Pelindaba site (SHEQ-INS-8240);
- Management of radioactive emissions at 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);
- A solid radioactive waste classification scheme (SHEQ-INS-8380); and
- Radioactive waste categorisation (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 KNPS, a waste management procedure is in place for the characterisation and segregation of waste. Characterisation of waste at KNPS includes the determination of the physical, chemical and radiological properties of the waste, so as to establish the need for further adjustment, treatment, conditioning or its suitability for further handling, processing, storage or disposal. The method employed at KNPS to group various types of radioactive waste according to their physical characteristics is aligned with the national classification systems. Low and intermediate level short-lived waste (LILW-SL) includes active spent resin, spent resins from APG demineralisers, evaporator concentrates, miscellaneous waste, low-active water filters, high-active water filters, metallic objects, sludge, wood and miscellaneous waste, which are categorised according to the activity and dose rate.

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

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 notifications and assistance in the case of nuclear accidents and radiological emergencies (SHEQ-INS-4143);
- Event-rating scale (SHEQ-INS-4145);
- Categorisation 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); and
- 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 time-frames. All incidents relating to radioactive waste management are reported, classified, investigated and recorded in accordance with the Koeberg Incident Reporting and Investigation Procedure. Incidents relating to radioactive waste management are assigned Problem Notification Numbers and the classification of the incident is performed in accordance with an Eskom incident classification system and the International Nuclear Event Scale as required. A Lead Investigator is assigned and the investigation is recorded and reported in a format that addresses the following aspects:

- The title or description of the incident;
- The plant state before the occurrence;
- A chronological sequence of events;

- The investigation and assessment;
- The technical causes, direct causes and root causes identified;
- Previous operating experience relating to the incident;
- Conclusion, recommendations and corrective actions; and
- Reporting to key stakeholders.

H-6.7. ANALYSIS OF OPERATING EXPERIENCES

The detail reported under section G-6.6 is also of relevance here.

In addition, the licensee management systems provide for the following:

- **ALARA reviews:** Detail is provided in Section F-4.1.2 in response to Article 24.
- **Safety Reviews:** Safety reviews are conducted routinely at facilities with a frequency depending on the associated risk and when modifications are made. The purpose of facility safety reviews is to keep facility staff members alert to process hazards; a review of operating procedures; identification of equipment or process modifications that could have introduced new hazards; the application of new technology to existing hazards; a review the adequacy of inspections and safety instructions; and ensuring periodic reviews of the safety assessment.

H-6.8. DECOMMISSIONING PLANS

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

With regard to the radioactive waste management facilities, decommissioning strategies and plans were prepared for each operation and they are reviewed and updated every two years, so as 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 the following:

- 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 were followed in the operation and closure of the facility and that they are aimed at optimising the site and disposal operations with regard to the radiological impact 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.

Furthermore, the conditions of authorisation require that licensees must implement and maintain a document management system, in order 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.

All records and documentation pertaining to radioactive waste management and test results; and checks and inspections carried out on waste for disposal at Vaalputs are kept as quality records at Koeberg for 50 years in accordance with the approved Records Management System.

The Radwaste Management Section at Koeberg keeps records of equipment, as well as shipping containers stored at the Low Level Waste Building. KNPS employs a Radwaste Tracking Programme, which contains electronic data relating to the processing and management of LILW-SL radioactive waste.

In addition, the NNR maintains a document management system that is 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 includes 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 the disposal site security fences;
- Deterring animal, plant and human intrusion;
- Maintaining a cover over the waste;
- Monitoring of the performance of structures to confirm compliance with the design; and
- Ensuring proper rehabilitation and plant growth of 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; and
- Use of markers.

H-7.3. INTERVENTION MEASURES DURING INSTITUTIONAL CONTROL

Where non-conformities with regard 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."

The Directorate Radiation Control in the Department of Health is mandated for the purposes of the Hazardous Substances Act, 1999 (Act No. 15 of 1973) (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 in terms of the HSA as Group IV hazardous substances, requires prior authorisation from the Directorate Radiation Control.

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 materials, 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 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.

I-1. REVIEW OF CONTROLS AT PORTS OF ENTRY

In 2009, the IAEA was requested to conduct a fact-finding mission to review South Africa's needs with regard to detection at Ports of Entry. A task team was established as a response to address the challenges identified.

The following stakeholders are participating in the Task Team: Key stakeholders with a major role to play at Ports of Entry; the South African Revenue Service (SARS); the Department of Public Works (DPW); the Department of Public Enterprises (DPE); the Department of Transport (DoT); the National Department of Health (NDOH); the South African Police Service (SAPS); the State Security Agency (SSA); the South African Nuclear Energy Corporation (NECSA); National Nuclear Regulator (NNR) and the Department of Home Affairs.

The task team took into consideration the challenges, risks and lessons learned from the previous project. Several meetings were held by the task team, and progress made by the team includes, inter alia, the development of a Project Charter; which is a key document to assist in obtaining stakeholder buy-in, and *Standard Operating Procedures*, a document that forms the basis of response in a situation where the material is detected.

The current measures that are in place include the Commodity Identification Training delivered to SARS customs front-line officials (FLOs) at different Ports of Entry on a quarterly basis, to enable the physical identification of trucks, cargo and vans carrying nuclear material (placarding, labelling), as well as doing follow-ups with the relevant department involved.

The medium-term plan is to deploy the handheld portable monitors and the Department of Energy is also working on a plan to train the FLO in the operation of the portable monitors.

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 OF THE NATIONAL LAW TO ENSURE THAT THE POSSESSION, REMANUFACTURING OR DISPOSAL OF DISUSED SEALED SOURCES TAKE PLACE IN A SAFE MANNER

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 the Hazardous Substances Act, 1973 (Act No. 15 of 1973) and are regulated by the Directorate Radiation Control in the Department of Health.

J-1.2. APPLICATION OF CONTROL

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

- 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; and
- Transport and transfer requirements.

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

J-2. MANAGEMENT OF DISUSED SEALED SOURCES

The management 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 the 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 being applied for appears under the particular authority. If they are satisfied that everything is in order, a separate authority for disposal is issued. The holder is advised to contact Necsa with regard to transport and delivery arrangements. The Nuclear Liabilities Management (NLM) 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) Necsa charges a fee for this service. The tariffs are reviewed and updated annually and cover the full cost, including storage, possible conditioning and eventual disposal. Once the source is transferred to Necsa, the former owner is relieved of all further liability in respect of the source.

J-3. RE-ENTRY OF DISUSED SEALED SOURCES

South Africa implements the Code of Conduct on the Safety and Security of Radioactive Sources. South Africa does accept the return to suppliers of sources that were manufactured in South Africa. Regulatory approval is required for all imports and exports of sources. The Directorate Radiation Control requires that Form RN781 be submitted for all imports of sources into South Africa and Form RN782 needs to be completed for all exports of sources from South Africa. Such authority is issued if the Directorate Radiation Control is satisfied that everything is in order and the applicant can then make the necessary arrangements for exports/imports. Upon confirmation of export, the particular source is removed from the old authority and a new one is issued.

In the case of Category 1 and Category 2 sources, a four-party agreement (seller, buyer, regulatory body in seller state and regulatory body in buyer state) is employed for all transboundary movements of sealed sources.

Section K

GENERAL EFFORTS 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 the 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; and the entire nuclear fuel cycle, and also focuses on all applications of nuclear technology for energy generation.

The long-term vision of the policy is for South Africa to become globally competitive in the use of innovative technology for the design, manufacture and deployment of state-of-the-art nuclear energy systems and power reactors, as well as nuclear fuel cycle systems.

The objectives of the policy are the following:

- The promotion of nuclear energy as an important electricity supply option via the establishment of a national industrial capability for the design, manufacture and construction of nuclear energy systems.
- The establishment of the necessary governance structures for an extended nuclear energy programme.
- The creation of a framework for safe and secure utilisation of nuclear energy with minimal environmental impact.
- A contribution to the country's National Programme of Social and Economic Transformation, Growth and Development.
- Guiding actions to develop, promote, support, enhance, sustain and monitor the nuclear energy sector in South Africa.
- A long-term attainment of global leadership and self-sufficiency in the nuclear energy sector.
- Exercising control over unprocessed uranium ore for export purposes for the benefit of the South African economy.
- Establishing mechanisms to ensure the availability of land (nuclear sites) for future nuclear power generation.
- Allowing for the participation of public entities in the uranium value chain.
- Promoting energy security in South Africa.
- Improvement of the quality of human life and supporting the advancement of science and technology.
- A reduction in greenhouse gas emissions.
- Skills development related to nuclear energy.

The following institutional arrangements are considered necessary for the implementation of this policy:

- A National Nuclear Energy Executive Coordination Committee: This Cabinet-level committee was established in November 2011. It has been reconfigured and is chaired by the President. Recently, an Energy Security Committee (a sub-committee of Cabinet) was established.

- An organisation for National Nuclear Research, Development and Innovation: The South African Nuclear Energy Corporation (Necsa) fulfils this role.
- An organisation for electricity generation from nuclear power: Eskom shall be the main owner and operator of nuclear power plants in South Africa.
- A national nuclear safety regulator: The National Nuclear Regulator (NNR) fulfils this role.
- A national nuclear architectural engineering, component manufacturing and construction capability. This institution needs to be established as part of the phased decision -making approach.
- A national radioactive waste management agency, the Disposal Institute, is to be established in terms of the National Radioactive Waste Disposal Institute Act, 2008 (Act No. 53 of 2008) and will, as soon as it is operational, be responsible for the disposal of radioactive waste on a national basis. The generators of radioactive waste remain responsible for the predisposal management of their waste.

K-1.2. NATIONAL RADIOACTIVE WASTE DISPOSAL INSTITUTE

The National Radioactive Waste Disposal Institute Act 2008 (Act No. 53 of 2008) was promulgated in 2008 and applies to all radioactive waste in the Republic of South Africa, destined to be disposed of in an authorised 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, 1999 (Act No. 1 of 1999) (PFMA). The NRWDI will be regulated by NNR.

K-1.2.1. PROVISIONS OF THE ACT

The Act assigns the following functions to the NRWDI:

(i) Performing 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) Maintaining a national radioactive waste database and publishing a report on the inventory and location of all radioactive waste in the Republic at a frequency determined by the Board.

(v) Managing 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 pertaining to 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) Cooperate with any person or institution on matters related to the performance of any duty.

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

The Institute is governed and controlled by a Board of Directors that comprises:

- an official from 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; 2000 (Act No. 3 of 2000); 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 to whom the radioactive waste disposal certificate was issued in writing 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 on 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; and
   (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 were 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-1.2.2. ESTABLISHMENT OF THE NATIONAL RADIOACTIVE WASTE DISPOSAL INSTITUTE

The National Radioactive Waste Disposal Institute (NRWDI), established by the promulgation of the National Radioactive Waste Disposal Institute Act, 2008 (Act No. 53 of 2008) (NRWDI Act), is responsible for the management and disposal of radioactive waste on a national basis. The Institute was formally launched at the First Meeting of the Inaugural Board, convened by the Minister, on 31 March 2014. The Board commenced its fiduciary duties and assumed the general management and control responsibilities of the Institute as from this date.

K-1.2.3. FUNDING TO SECURE AND SUSTAIN WASTE MANAGEMENT AND DISPOSAL OPERATIONS

Figure 7 presents the various income streams for funding the waste management and disposal operations of the NRWDI, which must be taken into account when estimating the revenue that needs to be generated.

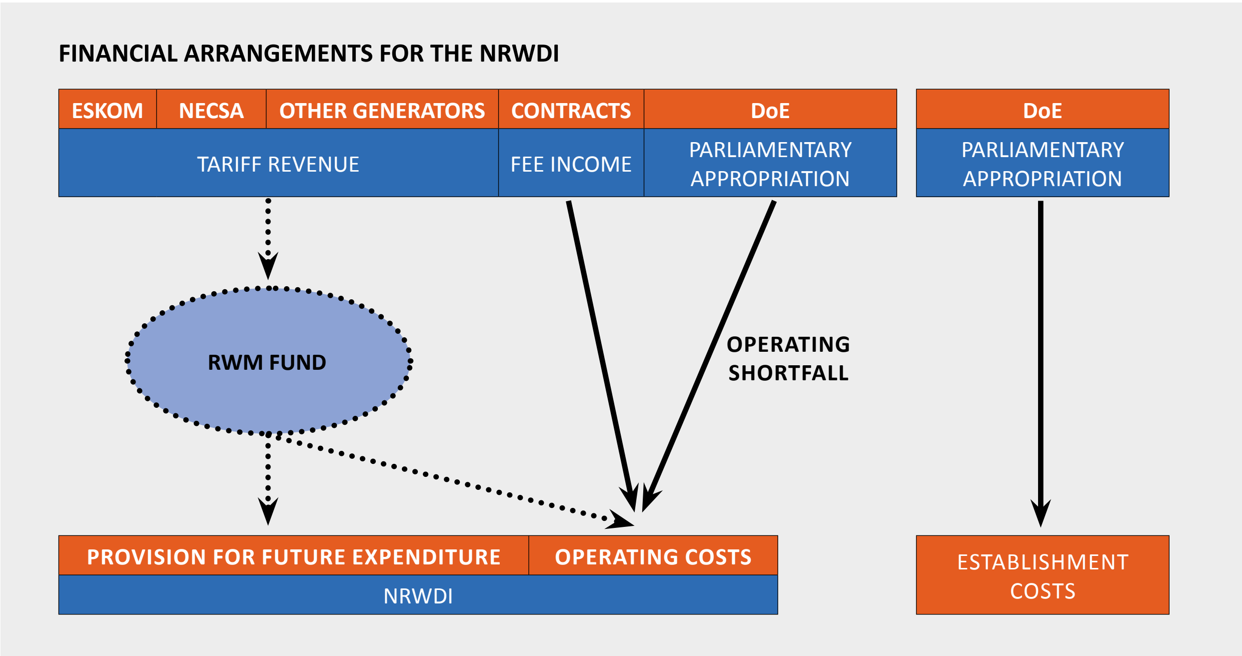


Figure 7: The various income streams for NRWDI

The Institute's financial year starts on 1 April in any year and ends on 31 March of the following year, and it is audited annually by the Auditor-General. In terms of section 21(1) of the NRWDI Act, the Institute receives its funds from the following sources:

- Fees received from waste generators on a cost recovery basis for services rendered (polluter pays principle);
- Money appropriated by Parliament;
- Money transferred to the Institute from the Radioactive Waste Management Fund (RWMF), which is still to be established by passing legislation;
- Money received for services rendered or derived from the sale or exploitation of the Institute's products, technology or other assets;

- Income or interest earned on the Institute's cash balance or on money invested;
- Loans raised by the Institute in accordance with the PFMA; and
- Donations or contributions received from any source, subject to approval by the Minister of Energy.

K-1.2.4. NATIONAL RADIOACTIVE WASTE MANAGEMENT FUND

The Radioactive Waste Management Policy and Strategy of 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 -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.

Legislation for the establishment of a National Radioactive Waste Management Fund was developed and is currently undergoing legal review by the State Law Advisor. In keeping with the polluter pays principle, the contributions to the fund will be the generators of radioactive waste. The contributions shall be managed in an equitable manner, without cross-subsidisation and, inter alia, be based on the classification of the waste, as well as the volumes.

Figure 8 on page 112 presents the schematic framework for the operation of the National Radioactive Waste Management Fund.

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 was initiated to develop and sustain national regulatory infrastructure for nuclear and radiation safety on the African continent.

The NNR and the Directorate Radiation Control in the Department of Health completed the Response, Analysis and Action Planning for Life cycle 1 of the Self-Assessment under IAEA Project RAF/9/038: *Promoting Self-Assessment of Regulatory Infrastructure for Safety and Networking of Regulatory Bodies in Africa*, in December 2010. Lifecycle 1 included the assessment of core modules and one thematic module in the Self-Assessment Tool (SAT), and national actions, related to non-compliance with IAEA standards, were completed by the NNR. The same actions have not yet been addressed by the Directorate Radiation Control, due to capacity constraints.

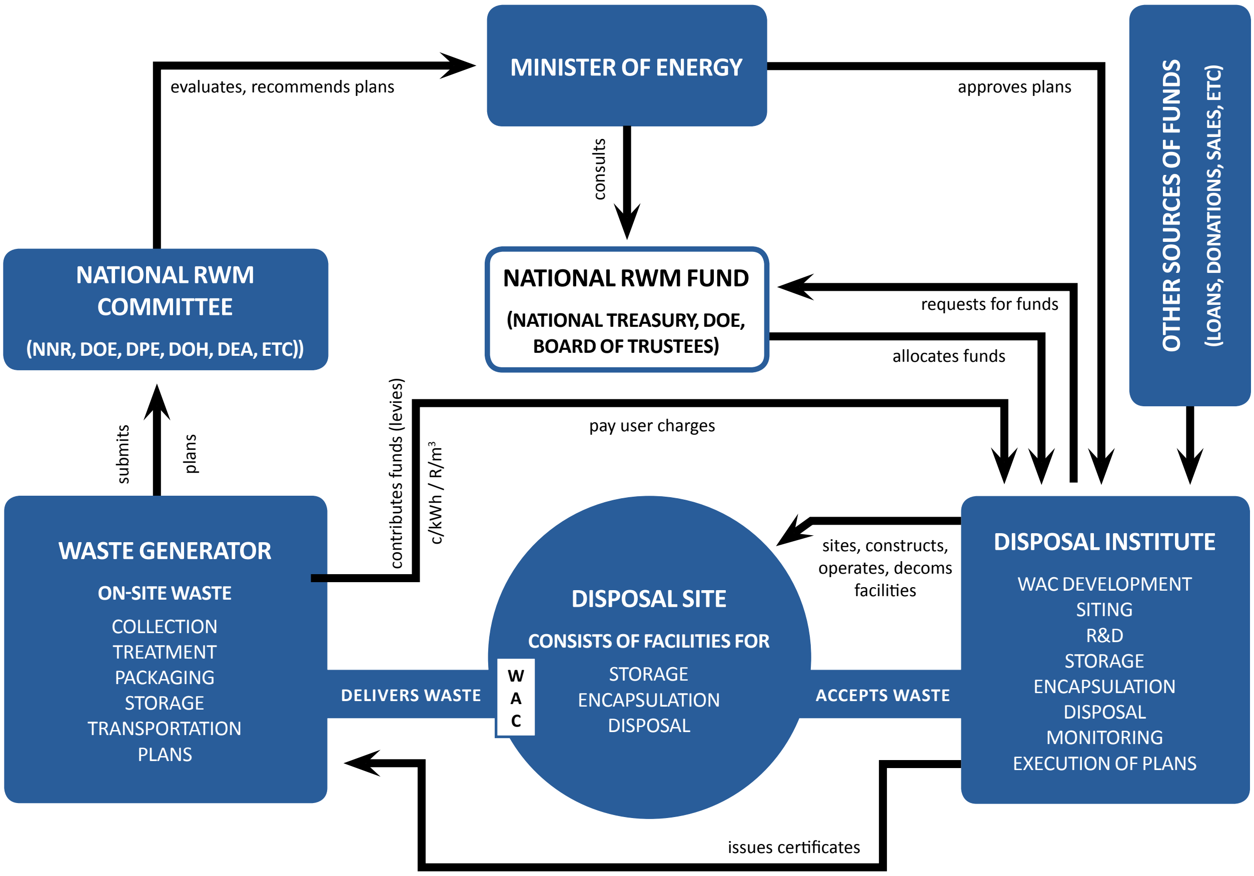


Figure 8: Schematic framework for the operation of the National Radioactive Waste Management Fund

IAEA project RAF/9/049: *Sustaining the Regulatory Infrastructure for the Control of Radiation Sources* is a continuation of RAF/9/038 and both NNR and the Directorate Radiation Control in the Department of Health are participating through the conducting of Life cycle 2 of the self-assessment. The scope of the Life cycle 2 includes the core modules and the thematic modules in the Self-Assessment of Regulatory Infrastructure for Safety (SARIS) tool. The IAEA self-assessment methodology is being utilised for Life cycle 2.

The NNR completed the Response, Analysis and Action Planning for the SARIS core modules in 2013/14. The Directorate Radiation Control is expected to complete the self-assessment of the core modules in SARIS In 2014/15.

In 2014/15, the NNR will complete the assessment of two of the thematic modules. Both the NNR and Directorate Radiation Control will conduct the self-assessment for the remaining thematic modules over the next few years, as preparation for an IAEA Integrated Regulatory Review Service (IRRS) Mission, which is scheduled for December 2016.

K-2. UPDATE OF LEGISLATIVE FRAMEWORK

Noting that the primary legislation governing regulation of the nuclear sector was last updated in 1999, South Africa has embarked on a review and update of both the Nuclear Energy Act, 1999 (Act No. 46 of 1999) and the National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).

Furthermore, stemming from the conclusions of the National Regulatory Self-Assessment undertaken, a need to update the NNR Regulations on Safety Standards and Regulatory Practices was identified. An Action Plan to address the findings from the self-assessment, as they relate to the Regulatory Framework (PLN-SARA-11-002 Rev 0a) was approved on 19 December 2011 The major milestones in the action plan included the following:

- The development of the Regulatory Philosophy document that describes the regulatory philosophy of the NNR that underpins and provides the overall basis of its safety standards and regulatory practices.
- A review of Regulatory Standards, including the review of the NNR risk criteria.
- An update of Business Processes.
- The development of an Internal Technical Guidance Document

K-2.1. REGULATORY PHILOSOPHY DOCUMENT

The Regulatory Philosophy Document describes the regulatory philosophy of the NNR that underpins and provides the overall basis of its safety standards and regulatory practices. The document also provides principles as they relate to safety standards and regulatory practices and, in essence, defines the regulatory document hierarchy. The Act provides the regulatory tools that enable the Regulator to fulfil its mandate. The regulatory tools include the setting of safety standards, as well as regulatory practices.

The Regulatory Philosophy Document also defines the hierarchy of regulatory documents, using a four-tier system:

Level 0: Legislation and Regulations.

Level 1: Nuclear Authorisations, Regulatory Policies and Directives.

Level 2: Guidance Documents and Position Papers.

Level 3: Technical Reports, Compliance Assurance Reports, Letters to Holders and Safety Evaluation Reports.

The system is depicted in the figure on the following page.

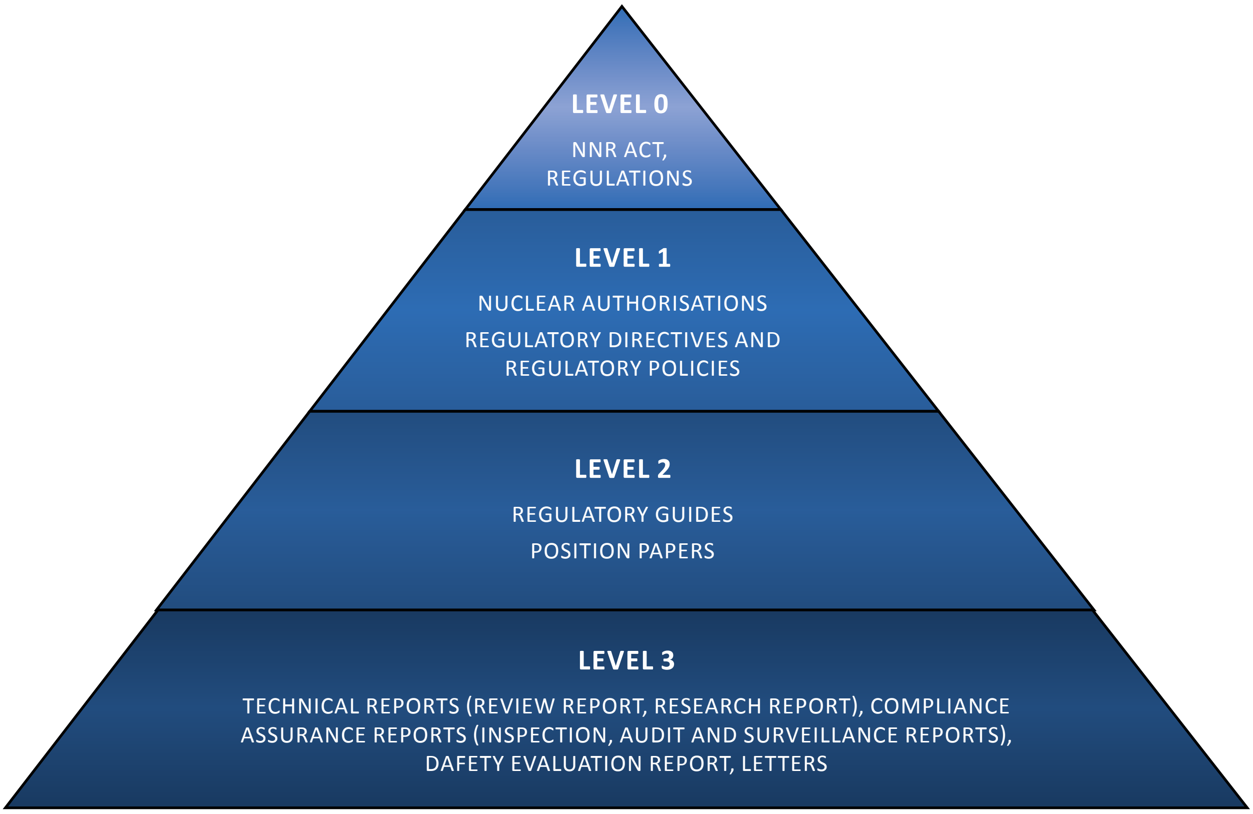


Figure 9: Hierarchy of Regulatory Documents

K-2.2. SUITE OF REGULATIONS

The suite of regulations comprises the General Nuclear Safety Regulations, integrating all thematic areas in a coherent and harmonised set of requirements, which will be complemented by a series of facilities and/or Action-Specific Safety Regulations. The General Nuclear Safety Regulations will address all radiation exposure situations (existing, planned and emergency) and will apply to all actions, whereas the Specific Safety Regulations apply to specific facilities and/or actions.

The General Nuclear Safety Regulations include the following parts:

(i) Scope of regulatory control;
(ii) Management of safety;
(iii) Nuclear authorisation;
(iv) Safety assessment;
(v) Radiation protection and waste safety;
(vi) Transport; and
(vii) Emergency planning.

The specific nuclear safety regulations include regulations on the following:

(i) Nuclear security and physical protection systems;

(ii) Nuclear installations; and

(iii) Waste disposal facilities.

These regulations were all developed in terms of Section 36 of the NNRA and will replace the current set of regulations, viz:

(i) Regulations and Safety Standards and Regulatory Practices (Regulation R.388 of 2006); and

(ii) Siting Regulations (Regulation R.927 of 2011).

In addition to the Regulations listed above, four more regulations were developed in terms of Section 47 of the NNRA. These are regulations pertain to the following:

(i) Financial liability in case of nuclear damage;

(ii) Enforcement;

(iii) Public safety information forum; and

(iv) Public participation.

K-3 EPREV MISSION

In response to a request from the Government of South Africa, the IAEA conducted an EPREV from 3 to 12 February 2014, to assess the country's emergency preparedness and response capabilities and arrangements to for nuclear and radiological accidents, against relevant IAEA standards.

The Department of Energy was the national counterpart for the EPREV. The mission took place at counterpart organisations in and around Pretoria and Cape Town. Site visits and interviews were conducted at the Department of Cooperative Governance and Traditional Affairs (CoGTA), the Department of Energy (DOE), the Department of Health (NDOH), the National Disaster Management Centre, the National Nuclear Regulator (NNR), Koeberg Nuclear Power Station (KNPS), the South African Nuclear Energy Corporation (Necsa), the iThemba Laboratory for Accelerator-based Sciences, Madibeng Municipality Disaster Management Centre, the City of Cape Town Disaster Risk Management Centre, as well as the Synergy Health Facility.

A pre-EPREV mission by the IAEA was conducted from 27 to 28 November 2013. In preparation for the EPREV, South Africa performed a Self-Assessment of its arrangements and capabilities against IAEA standards, which was facilitated by the NNR. Prior to the EPREV mission, South Africa provided the IAEA team with Advanced Reference Material regarding emergency preparedness and response arrangements, as well as capabilities available in the country.

The IAEA EPREV team identified a number of recommendations and suggestions to improve arrangements for emergency preparedness and response. A number of good practices in South Africa's emergency planning and response arrangements were also noted. South Africa is developing an action plan to address the findings from the EPREV, which will be verified by the IAEA during a follow-up mission.

K-4 INIR MISSION

South Africa is the first nuclear country to host an IAEA Integrated Nuclear Infrastructure Review Mission (INIR). This was done in 2013, through the Department of Energy. The mission resulted in recommendations, suggestions and good practices. An action plan to address the gaps identified was developed and it culminated into the various strategies and plans being developed, in preparation for rollout of the new nuclear build.

K-5 QUALITY MANAGEMENT SYSTEM FOR THE NNR

The NNR 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 took cognisance of the IAEA guidelines for management systems and, more in particular, the GS-R-03 Guideline, as well as relevant International Management System Standards (e.g. ISO 9001). The NNR investigated the approaches and experiences of nuclear regulatory authorities of other countries, such as those from the NERS regulators network, and a move towards integrated systems is a prevailing trend.

As part of this development, the NNR is in the process of reviewing its Quality Manual. This manual includes important documented processes for the development, review, approval, issuance, control and revision of NNR technical documents, records management, internal auditing, corrective action, preventive action and management review.

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

The NNR initiated a project to strengthen its current Records Management and Knowledge Management Processes via the implementation of an Electronic Document Management System (SharePoint Intranet). The intranet systems design was completed and the various departmental intranet sites were established. Upon completion of the validation and testing of the system, data migration and the publication of existing/ historic documents will take place.

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 by staff members at all levels of the organisation. It must be noted that integrating does not mean that all systems or processes will be aligned to one particular standard, such as ISO 9001. The NNR verification laboratories, for instance, adopted the ISO 17025: the ICT under the COBBIT standard, while management processes are under the banner of the EFQM Framework for business excellence and as other governance requirements stipulated in King III. Financial processes are regulated by the South African PFMA for state-owned organisations, while the technical processes will continue with the ISO 9001:2008 standards. Therefore, the integrated management system will endeavour seamlessness between and among these, to the ultimate delivery of quality management by the organisation for its stakeholders.

K-6 REGULATORS FORUMS

South Africa is a member of the Network of Regulators of Countries with a Small Nuclear Programme (NERS), the Forum of Nuclear Regulatory Bodies in Africa (FNRBA) and the Southern African Development Community (SADC) Nuclear Regulatory Network (NRN) and, as such, shares experiences, safety standards, etc. with regulators of countries who are members of these networks.

The NNR has bilateral agreements with nuclear safety authorities internationally, including nuclear regulatory bodies in Argentina, Canada, Finland, France, South Korea, Russia, the United Kingdom and the United States of America The bilateral agreements serve as a legal mechanism for information sharing and technical cooperation among 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-7 REASSESSMENT FOLLOWING EVENTS AT FUKUSHIMA DI ICHI PLANT

The nuclear accident at the Fukushima Daiichi nuclear power plant highlighted the potential weaknesses of nuclear plants to withstand extreme scenarios, which may not have been initially analysed in their design process. In response to the event, the NNR established a task team in April 2011, with the main objective 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 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-1 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, as well as to identify necessary modifications, measures and technical features to be implemented where needed, in order to strengthen defence-in-depth and improve the safety of operating facilities.

The safety reassessments did not yield any major findings, on the safety of Koeberg, SAFARI-1, or on the South African nuclear regulatory framework. In particular there were no immediate safety concerns related to the safety of used fuel management or the safety of radioactive waste management.

In the case of Koeberg, it was confirmed that the plant conformed to the design basis, which addresses external events with a return period of at least 10 000 years. Eskom implemented modifications and accident procedures at Koeberg to prevent or mitigate severe accidents beyond the design basis, thereby largely addressing one of the main post-Fukushima recommendations.

Nevertheless, the safety reassessments reports from the operators highlighted certain vulnerabilities against extreme external events and combinations of events.

Various proposals were made to make the respective facilities and designs more robust against external events, not considered in the design and that are beyond the design basis. The NNR instructed the respective operators to evaluate the improvement proposals made 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 them to implement improvement actions where deemed necessary.

Section L

ANNEXES

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

Annex 1
USED FUEL MANAGEMENT FACILITIES

A1-1 LIST OF USED FUEL MANAGEMENT FACILITIES AT KOEBERG NUCLEAR POWER STATION

Used fuel at KNPS 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 KNPS

Koeberg Nuclear Power Station (KNPS) (see Figure 10), comprises two 900 MW reactors. Each of the KNPS reactor units is served by a used fuel pool (UFP) with a capacity of 1 507 used fuel assembly (UFA) storage spaces. Some 157 of these spaces are reserved for emergency core offloads. That makes 1 350 spaces available for used fuel storage in each pool.

The KNPS stores UFAs in the used fuel pools (UFPs) on site. The interim wet management facility at KNPS comprises boronated pools at both reactor units, which are designed for temporary waste management of fresh fuel, just delivered and for the 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 for used fuel storage.

Figure 10: Koeberg Nuclear Power Plant

A1-1.2. INTERIM DRY FUEL MANAGEMENT FACILITY AT KNPS

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 KNPS. Figures 11 and 12 show pictures of the used fuel assembly (UFA) casks in storage.

Figure 11: UFA casks in storage at KNPS

Figure 12: A side view of the Castor X28 UFA casks at KNPS

A1-2 USED FUEL MANAGEMENT FACILITIES AT NECSA

Used fuel at Necsa is stored in two waste storage facilities. The wet waste storage facility, namely the reactor pool, is located in the reactor and the dry waste storage facility, namely the Thabana Pipestore, is located outside the reactor on the Necsa site. A description of the two waste storage facilities is provided below:

A1-2.1. THE REACTOR POOL

The facility is the storage racks available within the storage part of the pool area and consists of the following:

- Twelve high-density storage racks that can host 24 fuel elements per rack;
- Control racks that can host ten control rods; and
- The low-density storage racks are currently not in use, but are kept as a backup in case of capacity problems in the pool.

These storage racks are described below:

- **High Density Storage Rack**

  The main storage facility for spent and partially spent fuel elements is the high density rack (HDR) unit, which consists of six modules each, with a capacity of 24 elements. The modules are locked onto a base-frame that stands on the storage pool floor. Sub-criticality is maintained by the presence of cadmium sheets between the rows of fuel elements. The high density storage is criticality safe, even when the racks are filled with fresh fuel elements (see Table 2 for a summary of calculations performed). Each module is equipped with a hinged cover, which is secured in the closed position by means of a cam-lock. The function of the covers is to protect the fuel elements from falling objects and to maintain the subcritical geometry, should the rack (or individual modules) accidentally be tipped over.

- **Low Density Storage Racks**

  Spent and partially spent fuel elements can also be stored in so-called low density storage racks (to distinguish them from the high density storage racks). These form part of the original "standard" equipment of SAFARI-1 and each has a capacity of 16 elements in two parallel rows of 8 each. The rows are far enough apart to avoid criticality. Bars around the racks maintain this spacing between rows of elements in adjacent racks. Hinged covers are fitted to these racks to protect the elements from falling objects and to prevent them from falling out if the racks fall over.

  Following the installation of the high density rack in early 1994, the low density racks have largely been out of service, although a number of low density racks are kept in the storage pool for the storage of cropped fuel elements and control rods. The rest of them have been maintained in a commissioned condition in storage outside the pools. Eleven low density racks are available, with a total capacity of 176 elements. At times, when the high density racks are full, one or more low density racks are reinstalled in the storage pool to store additional fuel elements. (See Table 2 for a summary of criticality calculation results.)

- **Control Rod Storage Rack**

  Two control rod storage racks are attached to the rail on the eastern side of the storage pool. Each of these holds five (5)complete control rods, effectively making up ten (10) control rods in a single row at a pitch of 86 mm. The criticality analysis shows this arrangement to be criticality safe, even when loaded with fresh control rods. (See Table 2 for a summary of calculations performed.)

Table 2: Criticality calculations results summary for SAFARI-1 used fuel wet storage

POSITION AND DESCRIPTION	K_{eff} with HEU	K_{eff} with LEU
Low density fuel storage racks	0.778	0.767
Cropped fuel storage rack	0.805	Not calculated
Control rod storage racks	0.645	0.636
High density fuel storage racks (worst case)	0.890	0.878
Fuel vault (fresh fuel storage with mixture of 168 fuel assemblies, 20 control rods and 21 wooden boxes each containing 92 Mo-plates)	0.584	0.597

Note pertaining to Table 2: Optimum moderation (water with a density of 1.0 g.cm-3) was modelled between the fuel plates and between the assemblies elements. In the case of the in-pool storage racks, an annulus of 300mm water around the rack was modelled.

The heat produced in the reactor pool by gamma deposition, fast neutrons and convective heat transfer from the outside surface of the reactor vessel, is removed by the reactor pool coolant system.

A1-2.2. THABANA PIPESTORE

The Thabana Pipestore facility is located at Necsa's Pelindaba East site. 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.

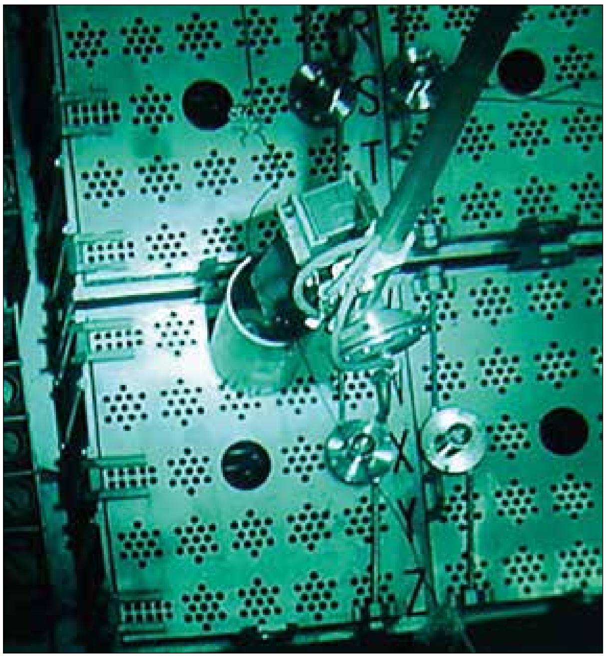


Figure 13: SAFARI-1 Fuel rack from the top

Figure 14: Handling of irradiated fuel assembly

Figure 15: A frontal view of the Thabana Pipestore

The storage pipes in the Thabana 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 1 200 fuel elements.

Figure 16: Thabana Pipestore

Annex 2

INVENTORIES OF USED FUEL

A2-1 INVENTORY OF USED FUEL AT KOEBERG NUCLEAR POWER STATION

Table 3: Inventory of used fuel in wet storage at Koeberg

STORAGE	LOCATION	USED FUEL ASSEMBLIES
Unit 1	Region 1	42
	Region 2	967
	Sub-total	**1009**
Unit 2	Region 1	53
	Region 2	943
	Sub-total	**996**
Dry Storage	Castor X/28F casks	112
Total		**2005**

A2-2 INVENTORY OF USED FUEL AT NECSA, PELINDABA

Table 4: Inventories of used fuel at the Necsa Pelindaba site

STORAGE	LOCATION	SPENT FUEL ELEMENTS	USED CONTROL RODS
Wet storage	Safari-1: High Density Rack Storage	175	5
	Safari-1: Low Density Storage Rack	0	26
	Sub-total	**175**	**31**
Dry storage	Thabana pipe storage facility	867	134
Total		**1042**	**165**

Annex 3

RADIOACTIVE WASTE MANAGEMENT FACILITIES

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

Necsa is a diverse nuclear installation (see Figure 17), 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 17: View of the Pelindaba site

Table 5: Listing of radioactive waste management facilities at the Pelindaba site

PURPOSE	NAME	LOCATION
Decontamination of uranium contaminated metals	Decontamination services	V-A8
	Area 26 Decontamination	Area 26
De-heeling of UF6 containing cylinders	UF6 cylinder De-heeling facility	Area 27
Liquid Effluent Treatment	LEMS	P-2400
	Uranium-bearing liquid effluent treatment facility	A8
Predisposal operations	Volume Reduction Facility	Area 14 Pelstore
Historic liquid waste evaporation facilities. (Under evaluation for rehabilitation)	Pelindaba 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 containerised 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
	Decontamination services	V-A8
	Pelindaba East Bus Shed Waste Drum Store	Pelindaba East
	Building 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 a disposal site	Thabana Radioactive Waste Storage Facility (Trenches)	Thabana
	Historic disposal trenches	P-5100
Metal smelter & cutting room	Test smelter	Area 26
Storage of confiscated radiological material	Illicit Material Store	Beva-E1

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

A3-1.1. PELSTORE

Pelstore forms part of the Area 14 Waste Management Complex, which is located at Necsa's Pelindaba East site. The building previously housed the Z Plant Uranium Enrichment Facility. During the decommissioning of the enrichment facility, all 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 600m². The purpose of the Pelstore facility is to store containers with solid waste, prior to, and after treatment and conditioning. The storage facility comprises:

- a drum repacking and inspection area
- the elevated grid floor storage area
- the 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 programme. Waste originating from industry, the SAFARI-1 research reactor and the medical isotope programme, is also stored in the facility. The waste is stored in dedicated marked 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 and traceability. Information for each waste container in any of the storage facilities is kept on a central database, referred to as the Waste Tracking System. It includes content description, drum/waste container origin, characterisation results, external dose rate, movements and the current position of waste packages.

The Volume Reduction Facility (VRF) is located in Pelstore. The facility consists of two sub-systems, which are the Drum Press and the Filter Press. The VRF was considered to condition the waste for disposal, by compacting the waste into pucks and the packing of the pucks into 210ℓ drums. The compaction pressure is between 10 000 and 15 000kN.

The Pelstore (see Figure 18) may store up to 104 000 waste containers. The current inventory is about 56 099 waste containers. The reduction in inventory, compared to the previous report, is due to the fact that, since May 2011, shipments have been made to the Vaalputs waste disposal facility.

Figure 18: Section of the Pelstore at the Pelindaba site

Figure 19: Section of VRF drum feed area in Pelstore at the Pelindaba site

A3-1.2. THABANA STORES 1 – 5

This facility (see Figures 20 and 21) consists of five (5) naturally ventilated, corrugated iron sheds (walls and roofs), each with a concrete floor. The Thabana stores were built in the late 1970s as waste stores in support of the former Y and Z Enrichment Plants. Waste contained in plastic or metal drums is stored in this facility. These stores are controlled as radiological areas.

Figure 20: 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 has a storage capacity of about 2 000 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, with a height of 3.6m and Store 3 has a floor area of 500m^2, with a height of 3.6m and both stores have a storage capacity of about 8 000 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 4 500 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 21: 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 1980s for the parking of the busses used as staff transport. The bus shed became defunct in the early 1990s. The facility was then an open structure with no side walls and only the southern side had 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 and has an enclosed structure with overall dimensions of 65m x 29m. The largest part of the facility is used as a storage area, but the south eastern corner houses the Segmented Drum Scanner (SDS), used for waste characterisation.

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 200ℓ 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 area of 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 5 000 drums.

During the operation of the Y Enrichment Plant, this facility served as a Y Plant compressor rebuilding, maintenance and testing facility that became defunct together with Y Plant in the early 1990s. Since about 1996, it has been 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. DORBYL CAMP

The Dorbyl Camp store is situated at the eastern side of the Pelindaba site, adjacent to Area 18, which houses the defunct cooling towers of the decommissioned Z Enrichment Plant. The facility consists of one large corrugated iron store, approximately 1120 m^2, and a smaller store of approximately 735 m^2, divided into three smaller stores. The three smaller stores are next to each other under one roof. These stores are also constructed of corrugated iron sheets, except for the northern storage area, which is closed off on two sides with wire fencing. The southern part of the combined store is currently used by the Flosep Department to store equipment. Also inside the Dorbyl camp are 6m shipping containers, used for the storage of contaminated equipment, zircon sand and NORM samples from various mines.

A3-1.6. LIQUID EFFLUENT MANAGEMENT SERVICES

The Liquid Effluent Treatment Facility Complex is situated on the Pelindaba East side at the Pelindaba site. This facility was constructed in 1963 for the handling of all liquid effluent generated on the Pelindaba site.

The Liquid Effluent Treatment Facility Complex consists of the following facilities or sub-processes:

(i) Industrial Effluent Treatment Facility;

(ii) Low Active Effluent Treatment Facility;

(iii) Medium Active Effluent Treatment Facility;

(iv) Solidification Facility;

(v) Laundry;

(vi) Hot Yard; and

(vii) Decontamination Hall.

A3-1.7. AREA 24 DISUSED SEALED RADIOACTIVE SOURCE STORAGE FACILITY

Figure 22: Disused Sealed Sources in Storage

The Area 24 Disused Sealed Radioactive Source Storage Facility is located at Necsa's Pelindaba East site. The building was previously used as a chemical facility, where non-radioactive chemicals were stored for the defunct plating plant. The Directorate Radiation Control (RADCON) is the current Regulator of the facility.

The facility has three storage rooms (Stores 1-3), a workshop, a lead shield cell and a bunker, comprising 20 small bunkers and one large bunker. Store 2 has a large high-density bunker that is used for source containers with high external radiation levels.

Sources of various origins are stored in the facility before being processed or disposed of. The conditioning process is concerned with the receiving, temporary storage, characterisation, conditioning and long-term storage of the sources.

Furthermore, the facility is used to store the conditioned disused radioactive sources in the bunkers for a period of about 50 years. The current inventory of the disused sealed radioactive sources (DSRS) in the facility is 7 790.

Necsa has an arrangement with the Department of Health to collect confiscated and orphaned sources around the country. For each collection, a team comprising the driver, the RPO and an operator is deployed with all the necessary equipment to different areas as requested by Department of Health.

A3-1.8. AREA 21 STORAGE FACILITY

The Area 21 storage facility is a storage facility located at 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 four-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 is located in the district of Kamiesberg in the Northern Cape Province.

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

Figure 23: Concrete waste packages being placed into a disposal trench

alternatives for the intended commercial nuclear programme. In 1978, the study group recommended that the state proceeded with a programme to locate a suitable site for the disposal of radioactive waste in South Africa.

From 1979 to 1982, a comprehensive site selection programme was undertaken in accordance with criteria that were regarded as internationally acceptable. The Vaalputs site emerged as the preferred option from three 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, a canteen, a conference room, controlled and uncontrolled area change rooms, toilet facilities and a records room. The operational area consists of a laundry, a sample counting room, a waste reception area, a decontamination area, a 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 a standby generator, a compressed air facility, a ventilation facility, fire extinguishing pumps, an electrical sub-station and a liquid effluent containment area.

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

Vaalputs is currently authorised for the receipt and shallow land disposal of solid low level waste, originating from KNPS and the Necsa.

The waste disposal site comprises the following:

- A securely fenced-in area of 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;
- A meteorological monitoring station; and
- Covered carports and storage areas for waste-handling machinery and equipment.

The operational phase commenced in November 1986 and, under the current nuclear programme, is estimated to extend for 50 years up to 2036. 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 for the operational lifetime and post-closure arrangements of Vaalputs to be reassessed and redefined accordingly.

The institutional control period commences after repository closure and is assumed to be three hundred (300) years for the Vaalputs near surface repository, given the current operational constraints. It is envisaged that this phase will be maintained until such time as 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 regulations, including nuclear licensing.

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.

Figure 24: An aerial view of the Vaalputs site, showing disposal trenches

Annex 4

INVENTORIES OF KOEBERG RADIOACTIVE WASTE

Table 6: Inventory of processed low-level waste at the 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 waste products 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 the outside dimensions of the drum.

Table 7: Inventory of solid radioactive waste at the Koeberg low-level storage building

DRUM TYPE	CONCENTRATES (C)	RESINS (R)	FILTERS (F)	TRASH (NCW)	SLUDGE
C1	119	236	-	50	5
C2	-	284	-	1	-
C2F	-	-	68	-	-
C4	-	-	43	-	-
210ℓ metal drum	-	305	-	1554	-
Total	119	825	111	1605	5

Table 8: Drumming guidelines at Koeberg Power Station

CONTACT DOSE RATE	RADIONUCLIDE	DRUM TYPE
FILTER		
< 2 mSv/h	Various	210ℓ metal drum
2 - < 15 mSv/h		C1
15 - < 500 mSv/h		C4
>500 mSv/h		C2F
RESINS		
< 2 mSv/h	Various	210ℓ metal drum
2 < 200 mSv/h		C1
> 200 < 3500 mSv/h		C2
> 3500 mSv/h		C3
CONCENTRATES		
< 92.5	Various	C1
> 92.5 MBq/litre		C2

Annex 5

INVENTORIES OF RADIOACTIVE WASTE AT NECSA FACILITIES

Table 9: Inventory of radioactive waste at storage facilities at the 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		~ 10944.4
VLLW		~ 1559.83
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 10: Inventory of radioactive waste in Necsa's old evaporation pans

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

Table 11: 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	13882
VLLW		None
NORM-L		None
NORM-E		None

Table 12: Inventory of redundant sealed sources

WASTE CLASSIFICATION	LOCATION	RADIONUCLIDE	QUANTITY
1	SAFARI-1 pool	Co-60	67*
	Area-24 source store	Co-60	13
		Cs-137	1
2 - 5	Area-24 source store	Various	7790
	Building P-2400	Unknown	2 containers

Annex 6

INVENTORY OF RADIOACTIVE WASTE FROM NORM FACILITIES

Tailings account for most of the residues from the mining industry. Most of the mine tailings containing elevated concentrations of natural radionuclides originate from the gold mining industry. The elevated radioactivity concentrations arise from elements in the uranium decay chain and vary over the same range as those in the ore body. Where uranium was extracted as a by-product of the gold recovery process, the uranium content has become depleted in relation to the other decay chain elements, resulting in a moderate reduction in total activity. The activity concentrations of mine tailings typically range from <0.1Bq/g to a maximum of around 100 Bq/g with a mean activity concentration of around 6 Bq/g. The mean activity concentrations for uranium-238 and radium-226 are 1.06 Bq/g and 1.40 Bq/g respectively. The lower mean value for uranium-238 is the result of uranium extraction.

Mineral sands operations also produce large quantities of tailings, which may vary in activity concentration from background levels up to two orders of magnitude higher. Thorium is the main contributor to the elevated activity concentration. Activity concentration of mineral sands on the East Coast typically range from 0.1Bq/g to 50Bq/g, while mineral sands on the West coast have higher activity concentrations from 0.1 to 200Bq/g.

Residues from the phosphate industry have an average alpha activity concentration of 10 Bq/g.

Waste rock accounts for the next largest category of mining residues, and again originates mostly from the gold mining industry. It contains the full uranium decay chain, but at lower activity concentrations than in tailings.

Mines and minerals processing facilities generate large quantities of steel scrap, both during operations and during decommissioning. Some of this is radioactively contaminated. Usually, the radioactivity arises mostly from uranium, but in certain components, particularly those from acid plants, it arises predominantly from radium in the form of radium sulphate scale. Almost all the steel is normal mild steel on which the contamination resides only as a surface layer, which can often be fully or partially removed by high-pressure washing. A few components from certain mineral processing operations are made of stainless steel, into which the contamination tends to penetrate and is therefore hard to remove.

Contaminated timber scrap originates from the salvaging of damaged underground support timber and underground railway sleepers. The contamination on support timber is essentially ore dust and occurs over short periods and penetrates the timber only moderately. The contamination on sleepers takes place under wet conditions, in which uranium can become concentrated above the levels in the ore body. It occurs over long periods and penetrates more deeply into the timber.

Management Options

The majority of mine tailings, waste rock and phosphate residues are stored in above-ground impoundments or dumps. Many of these are, or will be, stabilised in situ and will ultimately become final disposal sites.

Residues from uranium and acid plant maintenance and decommissioning that cannot, at present, be reprocessed or dispersed directly into tailings, are stored in controlled storage buildings at mines.

A few scrap-handling facilities possess nuclear authorisations, allowing them to handle contaminated steel scrap from mines. One such facility possesses a nuclear authorisation, allowing it to melt contaminated scrap steel originating from mines.

Table 13: Inventory of high-activity NORM radioactive waste

HOLDER	TYPE	ESTIMATED TONNAGE *
	STEEL	**500**
Vaal River	All steel removed from yards and segregated into two piles on concrete slabs in the plant area	
	One pile ≥ category III; second pile ≤ Category II	
	SADDLES	**80**
	≥ Category III saddles to be packed in bulk bags and placed in brick Category III store	
	≤ Category II saddles to be placed in a 6m steel container, reserved for plastics	
	PLASTICS	**40**
	≥ Category III plastics to be stored in a 6m steel container	
	≤ Category II plastics to be stockpiled and stored on concrete slabs in the plant area for later dis-posal	
	RUBBER AND REINFORCED PLASTICS	**40**
	All rubber & reinforced plastics to be stored in containers reserved for plastics	
	BRICKS	**150**
	≥ Category III bricks to be bagged and stored in containers reserved for bricks	
	≤ Category II bricks to be stockpiled on concrete slabs in the plant area	
	SAND BLAST GRIT (BLACK)	**5**
	≥ Category III grit to be bagged and stored in containers reserved for bricks	
	≤ Category II grit to be stockpiled on concrete slabs in the plant area	
	SAND (WHITE)	**100**
	Two sand piles to be levelled on site	
	ASBESTOS	**10**
	Sheeting to be bagged and disposed of legally – disposal certificate to be provided	
	SCALED RUBBER	**20**
	≥ category III; ADU scaled contaminated con-veyer belts	
	SCALED RUBBER	**5**
	≥ category III; ADU scaled contaminated con-veyer belts to be moved to the Central Store	
	BRICKS	**500**
	≥ Category III; SO2 tower bricks	

Table 13: Inventory of high-activity NORM radioactive waste (continued)

HOLDER	TYPE	ESTIMATED TONNAGE *
	CONCRETE AND OTHER STRUCTURAL MATERIAL	**500**
	Various waste to be cleaned up as part of demo-lition Category II & Category III	
	STEEL	**4000**
	Mixed Category I, II & III steel / metal material to be decontaminated as part of demolition	
	RUBBER LINING	**100**
	Category II & III; rubber lining & rubber-lined steel	
	SADDLES	**0.1**
Crown Gold Recoveries	Saddles waste from old Acid Plant	
	SADDLES	**1.2**
Buffelsfontein Gold Mines Limited	Plastic saddles from old Acid Plant	
NUFCOR	**PAPER, RUBBER, WOOD AND STEEL**	**0.25**

Category 1: 0.5-100 Bq/g Category 2: 100-1000 Bq/g Category 3: >1000 Bq/g

Table 14: Inventory of radioactive waste at mining and mineral processing facilities

WASTE TYPE	METHOD OF STORAGE	QUANTITY (TONNES)
1. Scrap Metal	Salvage yard (surface)	6. 76E+06
2. Tailings Material	Tailings storage facility (surface)	2. 16E+08
3. Waste Rock	Waste rock dumps (surface)	5. 12E+07
4. Other Waste	Salvage yard (surface)	1. 78E+08

Table 15: Inventory of radioactive waste at scrap dealers and smelters

WASTE TYPE	METHOD OF STORAGE	QUANTITY (TONNES)
1. Scrap Metal	Salvage yard (surface)	1. 04E+05
2. Tailings Material	Tailings storage facility (surface)	2. 22E+02
3. Waste Rock	Waste rock dumps (surface)	2. 04E+01
4. Other Waste	Salvage yard (surface)	3. 55E+04

Table 16: Inventory of radioactive waste at small users (e.g. laboratories, refurbishers)

WASTE TYPE	METHOD OF STORAGE	QUANTITY (TONNES)
1. Scrap Metal	Salvage yard (surface)	1. 00E+03
2. Tailings Material	Tailings storage facility (surface)	0. 00E+00
3. Waste Rock	Waste rock dump (surface)	1. 35E+05
4. Other waste	Salvage yard (surface)	6. 99E+02

Annex 7

INVENTORIES OF RADIOACTIVE WASTE AT ITHEMBA LABS

iThemba LABS is a laboratory for accelerator-based sciences. The facility has a cyclotron that can accelerate protons and heavy particles to energies of 200MeV. iThemba LABS brings together scientists working in the physical, medical and biological sciences. The facilities provide opportunities for modern research, advanced education, the treatment of cancer and the production of unique radioisotopes. In the production of radioisotopes and the operation of the cyclotron, radioactive waste is generated. The longest radioisotope produce is Na-22 with a half-life of two (2) years. Radioactive waste at iThemba LABS consists of metal, paper, plastic, glass and rubber.

Components from the cyclotron and other units used in the production of radioisotopes form part of the metal radioactive waste. These are stored in concrete drums.

Other waste is created from the labs and consists of paper towels, vials, bottles, contaminated clothes and plastic (used as overshoes, rubber boots and gloves). These are classified as compactable waste. They are compacted (see Figure 25) and stored in yellow drums with vermiculite to absorb any moisture.

Figure 25: Compacting unit for compacting radioactive waste

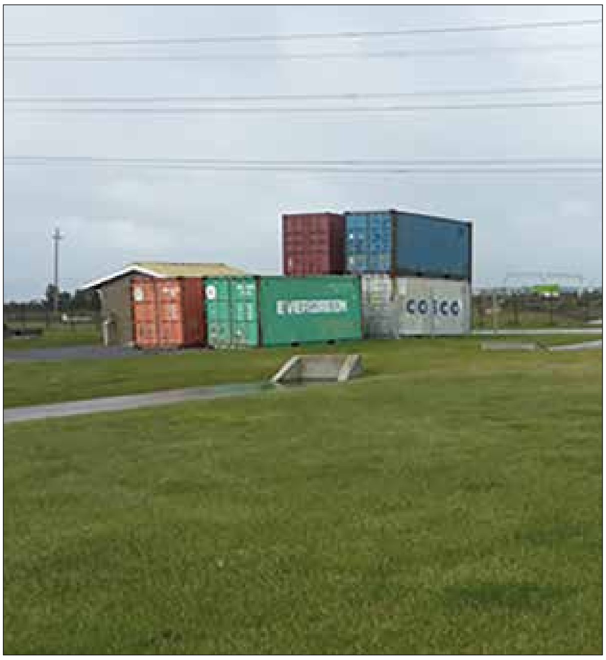


Figure 26: Containers where the yellow drums are stored

Table 17: Inventory of radioactive waste at scrap dealers and smelters

DRUM TYPE	CONTENTS	NUMBER OF DRUMS
Steel	Compactable waste	360 drums
Concrete	Non-compactable	3

Annex 8

LIST OF NUCLEAR FACILITIES AT NECSA IN THE PROCESS OF BEING DECOMMISSIONED

Table 18: 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 Fa-cility	Phase 2
P2900	Redundant Conversion Development Facility	Phase 2
E-building	Redundant Enrichment plant	Phase 2

Definitions

Phase 1: Phase 1 decommissioning covers the facility, Termination of Operation, and the minimum decommissioning activities, such as the removal from 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 clearance facilities. Activities may range from the final decontamination of facilities to clearance levels or from the 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 9

REFERENCE TO NATIONAL LAWS, REGULATIONS, REQUIREMENTS AND GUIDES

Table 19: National laws, regulations, requirements and guides

ACT NUMBER	DEPARTMENT	ACT
GENERAL		
130/1993	DOL	Compensation for Occupational Injuries and Dis-eases Act
29/1996	DMR	Mine Health and Safety Act
28/2002	DMR	Mineral and Petroleum Resources Development Act
103/1977	DTI	National Building Regulations and Building Standards Act
40/2004	DOE	National Energy Regulator Act
39/2004	DEA	National Environmental Management: Air Quality Act
24/2008	DEA	National Environmental Management: Coastal Management Act
59/2008	DEA	National Environmental Management: Waste Act • B33/2/121/9/P151: Class H:h disposal site (CaF2 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 the 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
3/2000	DOJ&CD	Promotion of Administrative Justice Act
33/2004	SAPS	Protection of Constitutional Democracy Against Terrorist and Related Activities Act
11/1999	National Treasury	Public Finance Management Act
SPECIFIC		
57/2002	COGTA	Disaster Management Act • Manual: joint management of incidents in-volving chemical or biological agents or ra-dioactive chemicals GG 28437 NN 143 February 2006
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

Table 19: National laws, regulations, requirements and guides (continued)

ACT NUMBER	DEPARTMENT	ACT
		• 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	NDOH: Radiation Control	Hazardous Substances 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 ionising 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. • Regulations in terms of s 29 (1;2), read in conjunction with s47 of the Act on the categorisation 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
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

Annex 10

LISTS OF NUCLEAR AUTHORISATIONS GRANTED BY NNR

Table 20: List of Nuclear Installation Licences granted by NNR

AUTHORISATION	NUCLEAR INSTALLATIONS
NIL 01	Koeberg Nuclear Power Station
NIL 02	SAFARI 1 Research Reactor
NIL 03	P2700 Complex
NIL 04	Thabana Complex comprising the following facilities: • Thabana Pipe Store; • Thabana Radioactive Waste Storage facility; Thabana Containerised Radioactive Waste Storage facility; • CaF2 Ponds.
NIL 05	HEU Vault - K0090
NIL 06	A 8 Decontamination Facility
NIL 07	Building A West Drum Store
NIL 08	ELPROD in Building P 2500
NIL 09	UMET in Building P 2600
NIL 10	Conversion Plant Complex
NIL 11	Area 14 waste management Complex
NIL 12	Quarantine Storage Facility
NIL 13	V YB Pelindaba East Bus Shed Complex
NIL 14	Pelindaba East Evaporation Ponds Complex
NIL 15	Oil Purification Facility
NIL 16	Area 21 Storage Facility
NIL 17	BEVA K3 Storage Complex
NIL 18	Area 16 Complex
NIL 19	Area 40 Complex
NIL 20	Area 27 De Heeling Facility
NIL 21	J Building
NIL 22	D Building
NIL 23	C Building
NIL 24	Building P 2900
NIL 25	Building XB
NIL 26	BEVA Evaporation Ponds
NIL 27	Building P 2800
NIL 28	Vaalputs National Radioactive Waste Disposal Facility
NIL 29	Area 26
NIL 30	E Building
NIL 31	Dorbyl Camp
NIL 32	X Building
NIL 33	Building P 1500
NIL 34	YM Vacuum Workshop
NIL 35	V H Building Laboratories
NIL 36	P 1900 Laboratories

Table 20: List of Nuclear Installation Licences granted by NNR (continued)

AUTHORISATION	NUCLEAR INSTALLATIONS
NIL 37	P 1600 Laboratories
NIL 38	Fuel Development Laboratories Complex
NIL 39	NTP Radiochemicals Complex
NIL 40	Pelindaba Analytical Laboratories (PAL) in
NIL 41	Liquid Effluent Treatment Facility Complex
NIL 42	B1- Building Basement

Table 21: List of Certificates of Exemption granted by NNR

CERTIFICATES OF EXEMPTION (COE)		
COE NUMBER	NAME OF COE HOLDER	TYPE OF COE ISSUED
COE 02	Oranje Mynbou En Vervoer Maatskappy	Condition for reclaimation of gypsum
COE 03	Nitrogen Products (Pty) Limited	Condition for reclaimation of gypsum
COE 04	Oranje Mynbou En Vervoer Maatskappy	Conditions for reclaimation and release of waste rocks
COE 10	Dino Properties (Pty)Ltd	Conditions for clean up of land
COE 12	The Maretsel Property Trust Developers	Conditions for removal of Tailing footprint

Table 22: List of Certificates of Registration granted by NNR

	COR NUMBER	NAME OF COR HOLDER	TYPE OF COR ISSUED
1	COR-2	Anglogold Ashanti Limited: Vaal River Operations	Mining and Mineral Processing
2	COR-3	Anglogold Ashanti Limited - West Wits Operations	Mining and Mineral Processing
3	COR-4	Anglogold Ashanti Limited - Ergo Operations	Mining and Mineral Processing
4	COR-5	ARMgold/Harmony Freegold Joint Venture Company (Pty) Ltd (Tshepong, Matjhabeng & Bambani Operations)	Mining and Mineral Processing
5	COR-6	ARMgold/Harmony Freegold Joint Venture Company (Pty) Ltd (Joel operation)	Mining and Mineral Processing
6	COR-7	African Rainbow Minerals Gold Limited (Welkom Operations)	Mining and Mineral Processing
7	COR-10	Avgold Limited - Target Division	Mining and Mineral Processing
8	COR-11	Gravelotte Mines Limited	Mining and Mineral Processing
9	COR-13	MTC Demolition	Scrap Processor
10	COR-16	Nuclear Fuels Corporation of SA (Pty) Limited	Mining and Mineral Processing
11	COR-18	South Deep Join Venture	Mining and Mineral Processing
12	COR-19	Palabora Mining Company (Pty) Limited	Mining and Mineral Processing
13	COR-20	Foskor Limited (Phalaborwa)	Mining and Mineral Processing
14	COR-22	Fer-Min-Ore (Pty) Limited (Zirtile Milling)	Mining and Mineral Processing
15	COR-23	Steenkampskraal Monazite Mine (Pty) Limited	Mining and Mineral Processing
16	COR-25	Eggerding SA (Pty) Limited	Mining and Mineral Processing
17	COR-26	Richards Bay Iron and Titanium (Pty) Limited	Mining and Mineral Processing

Table 22: List of Certificates of Registration granted by NNR(continued)

	COR NUMBER	NAME OF COR HOLDER	TYPE OF COR ISSUED
18	COR-27	Foskor Limited (Richards Bay)	Fertilizer Manufacturer
19	COR-28	Randfontein Estates Limited-(Kusasaletheu)	Mining and Mineral Processing
20	COR-30	Mine Waste Solutions (Pty) Limited	Mining and Mineral Processing
21	COR-31	Ya-Rona Scrap Metals	Scrap Processor
22	COR-32	CJN Scrap	Scrap Processor
23	COR-33	Rampete Metal Processors (Pty) Ltd	Scrap Processor
24	COR-34	DMC Energy (Pty) Limited	Mining and Mineral Processing
25	COR-37	Harmony Gold Mining Company Limited (Free State Operations)	Mining and Mineral Processing
26	COR-38	Omnia Phosphates (Pty) Ltd	Fertilizer Manufacturer
27	COR-40	ARMgold/Harmony Freegold Joint Venture Company (Pty) Ltd (St Helena Operations)	Mining and Mineral Processing
28	COR-41	Blyvooruitzicht Gold Mining Company Limited	Mining and Mineral Processing
29	COR-43	Tronox KZN Sands	Mining and Mineral Processing
30	COR-46	Evander Gold Mines Limited	Mining and Mineral Processing
31	COR-47	Grootvlei Properties Mines Ltd	Mining and Mineral Processing
32	COR-48	DRDGOLD Limited	Mining and Mineral Processing
33	COR-50	Rappa Resources (Pty) Limited	Mining and Mineral Processing
34	COR-51	Consolidated Modderfontein (Pty) Limited	Mining and Mineral Processing
35	COR-52	Nigel Gold Mining Company Limited	Mining and Mineral Processing
36	COR-53	East Rand Proprietary Mines Limited	Mining and Mineral Processing
37	COR-57	Crown Gold Recoveries Pty) Limited	Mining and Mineral Processing
38	COR-58	Harmony Gold Mining Company Limited - Randfontein Operations	Mining and Mineral Processing
39	COR-59	Industrial Zone Limited	Mining and Mineral Processing
40	COR-61	Sedex Minerals	Mining and Mineral Processing
41	COR-64	Potchefstroom Plastiek Herwinning BK	Scrap Processor
42	COR-66	Mintek	Small User
43	COR-69	Sibanye Gold Limited (Driefontein Operations)	Mining and Mineral Processing
44	COR-70	Sibanye Gold Limited (Kloof Operation)	Mining and Mineral Processing
45	COR-71	Sibanye Gold Limited (Beatrix Operation)	Mining and Mineral Processing
46	COR-76	Blastrite (Pty) Limited	Mining and Mineral Processing
47	COR-77	Anglo American Research Laboratories (Pty) Limited	Small User
48	COR-74	Durban Roodepoort Deep Mine	Mining and Mineral Processing
49	COR-79	Durban Roodepoort Deep Limited	Mining and Mineral Processing
50	COR-80	Mogale Gold (Pty) Ltd	Mining and Mineral Processing
51	COR-81	Metrec	Mining and Mineral Processing
52	COR-84	The Big Bin CC	Scrap Processor
53	COR-86	Glenover Phosphate Limited (Mining Site) Operation)	Mining and Mineral Processing
54	COR-87	Rand Refinery Limited	Mining and Mineral Processing
55	COR-92	The Forensic Science Laboratory, SA Police	Small User
56	COR-95	Microzone Trading 69 cc	Scrap Processor

Table 22: List of Certificates of Registration granted by NNR(continued)

	COR NUMBER	NAME OF COR HOLDER	TYPE OF COR ISSUED
57	COR-97	Geratech Zirconium Beneficiation (Ltd)	Mining and Mineral Processing
58	COR-98	B G Scrap Metals (Pty) Ltd	Scrap Processor
59	COR-99	Roode Heuwel Sand Limited	Mining and Mineral Processing
60	COR-100	South African Airforce (SAAF),Department of Defence (DoD), RSA	Mining and Mineral Processing
61	COR-101	The Reclamation Group (Pty) Ltd (Richards Bay)	Scrap Processor
62	COR-103	Linbeck Metal Trading (Pty) Ltd	Scrap Processor
63	COR-104	South African Port Operations (Dry Bulk Terminal - Richards Bay a Division of Transnet Limited)	Mining and Mineral Processing
64	COR-105	Tantilite Resources	Mining and Mineral Processing
65	COR-106	Mineral Sands Resources Pty Ltd	Mining and Mineral Processing
66	COR-107	Vesuvius South Africa (Pty) Ltd	Mining and Mineral Processing
67	COR-109	SM Mining Construction Pty Ltd	Mining and Mineral Processing
68	COR-110	Geotron Systems (Pty) Limited	Small User
69	COR-111	Bosveld Phosphate	Fertiler manufacturer
70	COR-112	Scaw Metals Group	Scrap Processor
71	COR-114	Interwaste Pty Ltd	Scrap Processor
72	COR-117	Vic Ramos CC	Scrap Processor
73	COR-118	GoldPlats Recovery Ltd	Mining and Mineral Processing
74	COR-119	Huntrex 196 Pty Ltd (trading as Ceracast)	Mining and Mineral Processing
75	COR-131	East Rand Beneficiation (Pty) Ltd	Mining and Mineral Processing
76	COR-132	Grifo Engineering (Pty) Ltd	Service provider
77	COR-135	Tioxide SA (Pty) Ltd	Mining and Mineral Processing
78	COR156	Necsa Calibration	Small User
79	COR-159	North West Reclaiming	Scrap Processor
80	COR-160	Shiva Uranium One	Mining and Mineral Processing
81	COR-164	Sulzer Pumps (SA) Limited	Service provider
82	COR-165	Uramin Mago Lukisa	Mining and Mineral Processing
83	COR-166	Weston Scrap Metal	Scrap Processor
84	COR-167	Western Uranium (Pty) Ltd	Mining and Mineral Processing
85	COR-178	Durban Container Terminal - Business Unit of SA Port Operations	Mining and Mineral Processing
86	COR-180	SA Port Operations - Container Terminal Cape Town	Mining and Mineral Processing
87	COR-181	Transnet Limited (SA Port Operations -Multipurpose Termi-nal,Saldanha bay)	Mining and Mineral Processing
88	COR-182	Buffelsfontein Gold Mine Limited	Mining and Mineral Processing
89	COR-183	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
90	COR-184	HVH Gold (Pty) Limited	Mining and Mineral Processing
91	COR-186	AfriSam (Pty) Limited	Mining and Mineral Processing
92	COR-190	Ezulwini Mining Company Ltd	Mining and Mineral Processing
93	COR-194	Exxaro Resources	Mining and Mineral Processing
94	COR-195	Houlgon Uranium & Power (Pty) Ltd	Mining and Mineral Processing

Table 22: List of Certificates of Registration granted by NNR(continued)

	COR NUMBER	NAME OF COR HOLDER	TYPE OF COR ISSUED
95	COR-197	Gold Reef City Theme Park	Mining and Mineral Processing
96	COR-198	Set Point Industrial Technologies (Pty) Ltd (Isando)	Small User
97	COR-199	Uramin Mago Lukisa	Mining and Mineral Processing
98	COR-200	Uramin Mago Lukisa	Mining and Mineral Processing
99	COR-201	A&S Mining Supplies	Service Provider
100	COR-203	Cemo Pumps (Pty) Ltd	Service Provider
101	COR-204	Holgoun Energy (Pty) Ltd	Mining and Mineral Processing
102	COR-206	Uranium One and Micawber 397 (Proprietary) Limited	Mining and Mineral Processing
103	COR-207	Set Point Industrial Technologies (Pty) Ltd (Mokopane)	Small User
104	COR-210	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
105	COR-211	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
106	COR-215	Margaret Water Company	Mining and Mineral Processing
107	COR-216	Paddy's Pad 1183 (Pty) Ltd	Mining and Mineral Processing
108	COR-217	Cango Caves Oudtshoorn Municipality	Mining and Mineral Processing
109	COR-218	Grindrod Terminals (Pty) Limited	Mining and Mineral Processing
110	COR-219	Southgold Exploration (Pty) Limited	Mining and Mineral Processing
111	COR-220	African Empowered Aggregates CC	Mining and Mineral Processing
112	COR-221	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
113	COR-222	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
114	COR-223	Tasman Pacific Minerals (Pty) Limited	Mining and Mineral Processing
115	COR-225	New Kleinfontein Goldmine (Pty) Limited	Mining and Mineral Processing
116	COR-226	Rand Uranium (Pty) Limited	Mining and Mineral Processing
117	COR-227	WG Wearne Limited	Mining and Mineral Processing
118	COR-228	Ergo Mining (Pty) Limited	Mining and Mineral Processing
119	COR-229	The New Reclamation Group (Pty) Limited	Scrap Processor
120	COR-230	ALS Chemex South Africa (Pty) Limited	Small User
121	COR-232	Central Rand Gold South Africa (Pty) Limited (West)	Mining and Mineral Processing
122	COR-233	Central Rand Gold South Africa (Pty) Limited (East)	Mining and Mineral Processing
123	COR-234	Pamodzi Gold Orkney (Pty) Limited	Mining and Mineral Processing
124	COR-235	IM Motlhabane Farming CC (T/A Motlhabane Recycle Scrap)	Scrap Processor
125	COR-236	Reclaim Invest 101 (Pty) Limited	Scrap Processor
126	COR-238	Tronox (Namakwa Sands Operations)	Mining and Mineral Processing
127	COR-239	Aflease Gold Limited	Mining and Mineral Processing
128	COR-240	Tantus Trading 180 (Pty) Ltd	Mining and Mineral Processing
129	COR-242	Enviro Mzingazi Gypsum (Pty) Limited	Mining and Mineral Processing
130	COR_245	Namakwa Uranium (Pty) Limited	Mining and Mineral Processing
131	COR_246	NTP Logistics (Pty) Limited	Mining and Mineral Processing
132	COR-247	SGS South Africa (Pty) Ltd	Small User
133	COR-248	Foskor Zirconia (Pty) Limited	Mining and Mineral Processing
134	COR-249	Pro Mass Transport (Pty) Ltd	Mining and Mineral Processing

Table 22: List of Certificates of Registration granted by NNR(continued)

	COR NUMBER	NAME OF COR HOLDER	TYPE OF COR ISSUED
135	COR-250	JCI Gold Limited	Mining and Mineral Processing
136	COR-252	Harmony Gold Mining Company Limited (South Operations)	Mining and Mineral Processing
137	COR-253	Avgold Limited (North Operations)	Mining and Mineral Processing
138	COR-254	WS Renovations Contractors	Service Provider
139	COR-255	Genalysis Laboratory Services (SA) (Pty) Limited	Small User
140	COR-256	Chifley Trading CC	Service Provider
141	COR-257	Samco Investments (Pty) Limited	Scrap Processor
142	COR-258	SA Metal and Machinery Co (Pty) Limited	Scrap Processor
143	COR-259	University of Pretoria	Mining and Mineral Processing
144	COR-260	African Mineral Standards (a division of Set Point Industrial Technology (Pty) Ltd)	Small User
145	COR-261	North West University	Mining and Mineral Processing
146	COR-262	UIS Analytical Services (Pty) Ltd	Small User
147	COR-263	Aklin Carbide (Pty) Ltd	Service Provider

DEFINITIONS

DEFINITIONS

Authorised discharge	Planned and controlled release of radioactive material into the environment in accordance with an authorisation from the Regulator.
Authorised dis-posal/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 the 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 a depth up to several hundred meters in a geologically stable formation.
High-level waste (HLW)	(a) 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 materi-al (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 the 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 an 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-utilisation 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 end point 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 due to 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 and change of composition. After treatment, waste may or may not be immobilised to achieve an appropriate waste form.
Unprocessed waste	As generated raw material requiring further characterisation and processing before being regarded as a waste stream.

ACRONYMS/ABBREVIATIONS

AADQ	Annual Authorised Discharge Quantities
AEB	Atomic Energy Board
AEC	Atomic Energy Corporation
AFI	Area for improvement
AFRA	African Regional Cooperative Agreement for Research, Development & Training related to Nuclear Science & Technology
ALARA	As Low as Reasonably Achievable, economic and social factors being taken into account
CAAS	Criticality accident alarm system
CAE	Compliance Assurance and Enforcement
CAP	Compliance Assurance Plan
CEO	Chief Executive Officer
CNS	Council for Nuclear Safety
CoGTA	Cooperative Governance and Traditional Affairs
COR	Certificate of Registration
CSE	Criticality Safety Evaluation
CSS	Commission on Safety Standards
DSCA	Dumping at Sea Control Act, Act No. 73 of 1980
DEA	Department of Environmental Affairs
DoE	Department of Energy
DMR	Department of Mineral Resources
DoL	Department of Labour
DoT	Department of Transport
DPE	Department of Public Enterprises
DPW	Department of Public Works
DSRS	Disused Sealed Radioactive Source
DTI	Department of Trade and Industry
ECAA	Environment Conservation Amendment Act, Act No. 50 of 2003
ECA	Environment Conservation Act, Act No. 73 of 1989
EFQM	European Foundation for Quality Management
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EPREV	Emergency Preparedness Review Service of the IAEA
FLO	Front-line official
FNRBA	Forum of Nuclear Regulatory Bodies in Africa
GOR	General Operating Rules
GSR Part 1	IAEA General Safety Standard Part 1 on Governmental, Legal and Regulatory Framework for Safety
HDR	High density rack
HLW	High-level waste
HSA	Hazardous Substances Act, Act No. 15 of 1973
HSE	Health Safety and Environment
IAEA	International Atomic Energy Agency

ACRONYMS/ABBREVIATIONS

ICRP	International Commission on Radiological Protection
ICT	Information and Communications Technology
INES	International Nuclear Event Scale
INIR	Integrated Nuclear Infrastructure Review Mission
INPO	Institute of Nuclear Power Operators
IRRS	IAEA Integrated Regulatory Review Service
ISO	International Organization for Standardization
IROFS	Items Relied on For Safety
IRPA	International Radiation Protection Association
IRS	Incident Reporting System
ISAM	IAEA Coordinated research program "Improvement of Safety Assessment Methodologies for Near Surface Disposal ”Facilities”
ISIP	In-service Inspection and maintenance Process
Joint Convention	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
KNPS	Koeberg Nuclear Power Station
KPA	key performance area
KPI	key performance indicator
LILW	Low and intermediate level radioactive waste
LILW (SL)	Low and intermediate level radioactive waste (Short lived)
LLW	Long-lived waste
MHSA	Mine Health and Safety Act, Act No. 29 of 1996
MPRDA	Minerals and Petroleum Resources Development Act, Act No. 28 of 2002
MS	Management System
NCRWM	National Committee on Radioactive Waste Management
NDoH	National Department of Health
NEA	Nuclear Energy Act, Act No. 46 of 1999
Necsa	South African Nuclear Energy Corporation
NEMA	National Environmental Management Act, Act No. 107 of 1998
NERS	Network of Regulators of Countries with a Small Nuclear Programme
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
NPP	Nuclear Power Plants
NRN	Nuclear Regulatory Network
NTWP	Nuclear Technology and Waste Projects
NORM	Natural Occurring Radioactive Material
NRWDI	National Radioactive Waste Disposal Institute
NUSSC	IAEA Nuclear Safety Standards Committee
NWA	National Water Act, Act No. 36 of 1998
OHS	Occupational Health and Safety

OTS	Operating Technical Specification
PFMA	Public Finance Management Act, Act No. 1 of 1999
Policy and Strategy	Radioactive Waste Management Policy and Strategy for the Republic of South Africa, 2005
PSIF	Public Safety Information Forum
PTR	Spent fuel pit cooling system
PWR	Pressure water reactor
QA	Quality Assurance
RADCON	Department of Health's Directorate Radiation Control
RASSC	Radiation Safety Standards Committee
RRA	Residual heat removal system
RWMF	Radioactive Waste Management Fund
SADC	Southern African Development Community
SAPS	South African Police Service
SAR	Safety Analysis Report
SARIS	Self Assessment of Regulatory Infrastructure for Safety
SARS	South African Revenue Service
SARA	Standards, Authorisation, Review and Assessment
SAT	Self Assessment Tool
SDS	Segmented Drum Scanner
SHEQ	Safety, health, environmental and quality
SSA	State Security Agency
SSC	Structures systems and components
SSRP	Safety Standards and Regulatory Practices in accordance with section 36 of the National Nuclear Regulator Act, 1999
TMI	Three Mile Island
TRANSSC	Transport Safety Standards Committee
TSO	Technical Support Organisation
UCOR	Uranium Enrichment Corporation
UFA	Used fuel assembly
UFP	Used fuel pool
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
VRF	Volume Reduction Facility
Vaalputs	Vaalputs National Radioactive Waste Disposal Facility
WASSC	Waste Safety Standards Committee
WANO	World Association of Nuclear Operators
WSA	Water Services Act, Act No. 108 of 1997

NOTES

prepared by the

NATIONAL NUCLEAR REGULATOR

For the protection of persons, property and the environment against nuclear damage.

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