

**Joint Convention on the Safety of Spent Fuel Management and on  
the Safety of Radioactive Waste Management**

**National Report**

**MADAGASCAR**

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## Initial and abbreviation used

ANPSR : Autorité Nationale de Protection et de Sûreté Radiologique

BSS : Basic Safety Standard

CAP-SRSN : Conseil Administratif Paritaire de Sûreté Radiologique et de Sécurité Nucléaire

CEA : Commissariat à l'Energie Atomique

CHU-HJRA : Centre Hospitalier Universitaire Joseph Ravoahangy Andrianavalona

DSRSN : Direction de Sûreté Radiologique et de Sécurité Nucléaire

GALANA: GALANA Refinery Oil Toamasina

IAEA: International Atomic Energy Agency

INSTN : Institut National des Sciences et Techniques Nucléaires-Madagascar

LPNPA : Laboratoire de Physique Nucléaire et de Physique Appliquée

LRI : Laboratoire des Radio Isotopes

NORM : Naturally Occurring Radioactive Material

OCGDR : Office Central de Gestion des Déchets Radioactifs

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## Section A : Introduction

Madagascar is among the latest countries that has signed and ratified the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management. This Joint Convention was entered into force on June 2007.

Since then, Madagascar has made an important effort to state institutional framework and general legislation governing all aspects of the implementation of the joint convention and its obligations.

This report, which is the first national report, is written in accordance with article 32 of the Joint Convention and presents the measures taken by Madagascar to meet each of the obligations set out in the Convention ; it is structured according to the guidelines concerning the form and structure of national reports, “IAEA Information Circular INFCIRC/604 Rev.3 of January 2015”.

Madagascar is a signatory to a number of international conventions relating to nuclear and radioactivity matters.

- Nuclear Treaty of Non Proliferation Weapons (NPT)
- Convention on the Physical Protection of Nuclear Material and Amendment (CPPMN)
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
- International Convention for the Suppression of Acts of Nuclear Terrorism
- Convention on Early Notification of a Nuclear Accident
- Convention on Nuclear Safety
  
- Resolution 1540
- Code of Conduct

This report deals with the following topics :

- Section A: Introduction;
- Section B: Policy and practices in the field of the Convention (article 32-1);
- Section C: Scope of application (article 3);
- Section D: Inventories and lists (article 32-2);
- Section E: Legislative and regulatory framework (articles 18 to 20);
- Section F: Other general safety provisions (articles 21 to 26);
- Section G: Safety of spent fuel management (articles 4 to 10);
- Section H: 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 activities to improve safety.
- Section L: Appendices.

## **Section B : Policy and practice**

### *Article 32. REPORTING*

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

- (i) spent fuel management policy;*
- (ii) spent fuel management practices;*
- (iii) radioactive waste management policy;*
- (iv) radioactive waste management practices;*
- (v) criteria used to define and categorize radioactive waste.*

### **B1 : radioactive waste management policy and strategy**

Policy and strategy for radioactive waste management are being developed.

### **B2 : Radioactive waste management practice**

Until now all radioactive wastes generated in Madagascar are arising from the use of radioactive materials in the form of sealed and unsealed sources in industry, medical, education and research fields.

There is also some waste generated in the open sky mines that contains only naturally occurring radioactive materials (Ilmenite, heavy sands...). This kind of waste is not declared as waste for the purpose of this Convention.

### **B3 : Categorisation of radioactive waste** WASTE CLASSIFICATION (By the Decree n°1199/2002)

#### *Article 6:*

The residues of a process of production, processing or use of radioactive materials with a mass activity greater than 74 kBq / h are considered as radioactive waste and can not be discharged directly into the environment or with conventional refuse. kg and whose daily activity rejected is greater than:

- 3.7 kBq, very high radioisotoxicity of radioelements (Group I),
- 37 kBq, high radio-toxicity radioactivity (Group II),
- 370 kBq, radiotoxicity of moderate radioelements (Group III),
- 3700 kBq, radiotoxicity of low radionuclides (Group IV).

The different groups mentioned are determined by the regulations in force.

#### *Article 7:*

The disposal and storage of radioactive waste shall comply with the classification defined in Articles 8 and 9 below, depending on the activity and period of the radioelements contained in the waste and on the physical form and composition of the waste.

#### *Article 8*

The radioactive waste classified according to the activity and the period of the radioelements are the following:

- (a) exempt waste:

It is the wastes whose very low level of activity allows their elimination by conventional techniques, without any particular consideration for their radioactive properties.

(b) low and medium-level waste:

Short-lived low-level and intermediate-level waste must be divided into three categories according to their radioactive period:

- . Type 1 waste, which contains only radionuclides with a period of less than 6 days;
- . type 2 waste, which contains radionuclides with a period of between 6 and 71 days;
- . type 3 waste, which contains radionuclides with a period of more than 71 days.

(c) Long-lived waste:

This refers to wastes whose average activity in long-lived alpha emitters exceeds that set for short-lived waste.

(d) High Activity Waste:

It is waste with a thermal capacity of more than 2 kW per cubic meter and a concentration of long-life emitters exceeding that set for short-lived waste.

#### *Article 9:*

The radioactive waste classified according to physical form and composition is as follows:

- non-putrescible solid waste,
- putrescible solid waste,
- liquid waste,
- waste gases,
- and sealed sources.

**NB : This classification must be updated.**

### **B4 : Detection of radioactive sources in metal scrap (See photo in annexe 2).**

Madagascar is equipped with mobile and fixed container scanners to detect materials containing radioactive material. These devices are managed by the Customs service through the GasyNet Company, in the four (04) main ports of Madagascar (Toamasina, Mahajanga,

Toliary, Antsiranana). In the event that it has radioactive material in the containers, the regulatory authority (DSRSN) will take the necessary measures to solve this problem.

## **Section C : 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 6.*

## **SECTION D : Inventories and lists**

*Article 32. Reporting, Paragraph 2*

*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.*

## Inventory of waste

In Madagascar, several disused radioactive sources were surveyed. Many of these sources have been characterized, packed, dismantled and returned to their country of origin. However, storage of these sources poses a big security problem because the national center for radioactive waste management and storage is not yet in place, even if this option is part of the priority countries. For now, the radioactive waste is stored in each user's storage rooms.

TABLE 1. : INVENTORY OF RW IN MADAGASCAR [1]

Location <sup>a</sup>	Radionuclide	Utilization	Nbr	Dmax <sup>b</sup>	Origine	Storage <sup>c</sup>
<b>RADIUM SOURCES</b>						
CHU-HJRA <sup>1</sup>	Ra-226	Brachytherapy	56	8.3	CEA France	Conditioned in stainless steel drum
<b>SHARS</b>						
CHU-HJRA <sup>1</sup>	Co-60		1		China	Teletherapy Room
	Co-60	Seed Irradiator	24		Norway / Russia	In room
LRI <sup>2</sup>						

TABLE 2 : INVENTORY OF RW IN MADAGASCAR (CONT') [1]

Location <sup>a</sup>	Radionuclide	Utilization	Nbr	Dmax <sup>b</sup>	Origine	Storage <sup>c</sup>
<b>NEUTRONS SOURCES</b>						
LRI <sup>1</sup>	Am-241/Be	Moisture gauge	20	Up to 200	CEA - France	In the room storage
LPNPA <sup>3</sup>	Am-241/Be	Analysis/ Moisture gauge	2	2730	Bitatron	In the room storage
<b>OTHER SOURCES</b>						
CHU-HJRA <sup>1</sup>	Sr-90	Standard	4	26	-	In lead pot
	Ra-Be	Unknown	6	70	-	
LRI <sup>2</sup>	Cs-137	Unknown	4	Up to 200	-	In the room storage
	Ir-192	Unknown	1	16	-	



	Ra-226	(Ores standard)	11	90	-	
	Unknown	Unknown	2	16	-	
	Am-241/Be (very low activity)		2	-	-	
SECREN <sup>4</sup>	Co-60	Level gauge	2	450	Danmark	Transferred to LPNPA site
GALANA <sup>5</sup>	Co-60	Level gauge	3	10	Berthold	
LPNPA <sup>3</sup>	Sealed sources, Ores samples	Research	110	10	IAEA	LPNPA site

<sup>1</sup> CHU-HJRA : CHU-HJRA Antananarivo

<sup>2</sup> LRI : Laboratoire des Radio Isotopes - Antananarivo

<sup>3</sup> LPNPA : Laboratoire de Physique nucléaires et physique appliquées, University of Antananarivo.

<sup>4</sup> SECREN : SECREN-Antsiranana

<sup>5</sup> GALANA : GALANA Refinery Oil Toamasina

<sup>a</sup> Location: Location, City or Town

<sup>b</sup> Dmax : Max dose rate at the surface in  $\mu\text{Sv.h}^{-1}$

<sup>c</sup> Storage: Type of device or facility housing the source

## Section E. Legislative and Regulatory System

Madagascar has already a law on radioactive waste management (Law No. 97-041 on the Protection against the Harmful Effects of Ionizing Radiation and Radioactive Waste Management in Madagascar was enacted on January 2, 1998.)

Following this law, 4 implementing regulations were adopted in 2002. Among which include the "- Decree No. 2002-1274 of 16 October 2002 on the basic principles of radioactive waste management.

In 2012, the decree n ° 2012-1112 on the reorganization of the National Authority for Radiological Protection and Safety (ANPSR), the Technical Body in Radiation Protection (OTR), and the Central Office of Radioactive Waste Management (OCGDR) has been adopted.

These regulations will shortly be complemented by prescriptions and guides. If necessary, they will be updated to be consistent with GSR Part 3.

## **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.*

## **E 2: Legislative and Regulatory Framework**

### *ARTICLE 19. LEGISLATIVE AND REGULATORY FRAMEWORK*

*Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.*

*2. This legislative and regulatory framework shall provide for:*

*(i) the establishment of applicable national safety requirements and regulations for radiation safety;*

*(ii) a system of licensing of spent fuel and radioactive waste management activities;*

*(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a licence;*

*(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;*

*(v) the enforcement of applicable regulations and of the terms of the licences;*

*(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.*

*3. When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.*

## **E 3: Regulatory body**

### *Article 20: Regulatory body*

*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.*

### **The Regulatory Body**

For Madagascar, by the law:

*Article 1.*

The National Authority for Radiological Protection and Safety (ANPSR), under responsible of the Prime Minister, is the supreme administrative authority for protection against the harmful effects of ionizing radiation and radioactive waste management in Madagascar.

In accordance with the provisions of Article 3 of Law n ° 97-041 of 02 January 1998 on protection against the dangers of ionizing radiation and radioactive waste management, ANPSR is delegated to the National Institute of Science and Technology Nuclear Techniques (INSTN), cumulatively to its usual mission defined by Decree n ° 92-869 of September 30, 1992 establishing the National Institute of Nuclear Sciences and Techniques and organization of this institute and the subsequent texts.

The ANPSR carries out the tasks, roles and functions of the regulatory body in the field of radiation protection, nuclear safety, safeguards and, in general, any question of the peaceful use of nuclear energy.

*Article 9.-*

The ANPSR is the only authority responsible for issuing the prior authorizations required by Law No. 97-041 of 02 January 1998, relating to:

- practices or activities involving to the exposure to ionizing radiation;
- transport of radioactive materials or radioactive waste;
- production and management of radioactive waste;
- releases or eliminations of liquid or gaseous radioactive waste of any origin.

**The Directorate of Radiological Safety and Nuclear Safety (DSRSN)**

Functions of DSRSN (by the decree n° 2012-1112)

*Article 15.-*

The Directorate of Radiological Safety and Nuclear Safety (DSRSN) is responsible for :

- instructing and prepare the ANPSR's decisions (through the ANPSR President, CAP-SRSN and the INSTN Board of Directors);

- implementing the decisions taken by the ANPSR;
- preparing ANPSR activity and intervention programs within the framework of the mission
- carrying out the approved programs for the ANPSR;
- defining the administrative procedures for the intervention of the technical bodies;
- preparing technical or administrative guides;
- preparing the draft budget to be used for the implementation of the ANPSR mission;
- managing appropriations and assets allocated to the ANPSR;
- recruiting and proposing to the nomination by the Director General of INSTN the members of the staff over whom he has authority;
- assisting and representing the President of ANPSR in the acts of civil life of the ANPSR and in the various remedies involving ANPSR, particularly in the context of repressive actions;
- drawing up the annual activity report of the ANPSR.

### **The Technical Organ in Radiation Protection (OTR)**

Functions of technical bodies (by the decree n° 2012-1112)

*Chapter 1 –*

*Article 24.*

The ANPSR shall be assisted in its mission by the Technical Organization for Radiation Protection (OTR) and the Central Office for the Management of Radioactive Waste (OCGDR) for carrying out all studies and technical operations relating to its mission.

*Article 25.*

In addition to the above bodies, ANPSR may call upon the contribution of any public or private body, whether national or foreign, if it deems it necessary

### **The Technical Organ in Radioactive Waste Management (OCGDR)**

Functions of technical bodies (by the decree n° 2012-1112)

*Article 27.-*

The OCGDR is responsible for:

- inventory all types of radioactive waste throughout the territory of Madagascar;
- study the requirements relating to the production, generation and management of radioactive

waste, as well as risk prevention measures, to ensure compliance with their implementation to be approved by ANPSR;

- monitoring and control of radioactive waste management at national level;
- managing radioactive waste whose producer is recognized as being unable to manage it, or has forfeited its authorizations or no longer exists or is unknown;
- issue specifications for technical conditions and practical arrangements for the treatment and packaging, transport and storage of radioactive waste;
- propose to ANPSR any regulation concerning the treatment, pre-disposal or disposal and management and control of radioactive waste and effluent;
- carry out independent investigations in the event of an accident;
- establish and maintain specific contingency plans in the event of accidents or emergencies and to coordinate their implementation;
- organize trainings in the field of radioactive waste management or give advice on the content and effectiveness of such training,
- conduct analyzes and studies relevant to the management of radioactive waste;
- examine the applications submitted by any body for the subcontracting of the management of radioactive waste produced by third parties;
- ensure the necessary contacts with national or international bodies concerned with the management of radioactive waste;
- co-ordinate the interventions of the local intervention committees set up

#### **Responsabilities (By the decree n°1274-2002)**

- Decree N° 2002-1274 on 16th October 2002 dealing the general principles of the Radioactive Waste Management

##### *Article 10:*

The responsibility for waste management is entrusted to the Central Office for Radioactive Waste Management(O.C.G.D.R.).

##### *Article 11:*

The primary responsibility for the safety of radioactive waste management lies with the waste producers, even if this management has been entrusted to another person or body authorized by the National Authority for Radiation Protection and Safety (ANPSR) on a proposal from the O.C.G.D.R.

## Section F: Other general safety provisions

### F1 : Responsibility of the license 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.*

By the decree n°1274-2002 on Radioactive waste management):

#### *Article 12:*

All radioactive waste which can not benefit from the decay procedure must be transferred in accordance with procedures defined by the National Radiological Protection and Safety Authority to the Central Office for Radioactive Waste Management for processing, packaging, storage and optionally storage.

#### Article 13:

Any person or organization can store long-lived or high-level waste.

The storage of this waste can only be carried out in a center designed and constructed for this purpose by the Central Office for Radioactive Waste Management and authorized by the National Authority for Radiological Protection and Safety.

#### Article 14:

The National Authority for Radiological Protection and Safety acting on behalf of the State shall entrust to the Central Office for the Management of Radioactive Waste the management of radioactive waste in cases where the producer of such waste is recognized as being in the " inability to manage them, has been stripped of its authorizations, or no longer exists, or is unknown.

*Article 15:*

Each radioactive waste producer is required to designate a person named "Waste Manager" who is responsible for managing the radioactive waste.

This person shall have the authority and independence to ensure safe and efficient management in the facilities subject to the authorization.

*Article 16:*

The tasks of this responsible are:

- to establish and update the inventory of radioactive materials and waste generated,
- to establish contact and collaborate with people working on radioactive materials,
- to liaise with the Central Office for Radioactive Waste Management,
- to establish a system for the archiving of data to facilitate the identification, characterization, collection and storage of radioactive material transformed into waste,
- to ensure that the transport of radioactive waste to the site is carried out in accordance with the written safety,
- to guarantee before their transport to the Central Office of Management that the waste conforms the transport and acceptance specifications of the Office,
- to ensure the presence of appropriate shielding, marking, physical protection and integrity packages,
- to ensure that the release of waste and effluents is carried out in compliance with the control thresholds and the discharge authorizations,
- to report to the management of the installation any accident or incident concerning the management of the waste in the installation,
- to maintain and keep up-to-date data on wastewater systems installation, municipal landfills around the site, non-radioactive waste incinerators and any other waste management facilities.

*Article 17:*

The waste producer must annually establish an inventory of existing waste as well as the estimate of future waste generated by its installation.

This inventory will be sent to the Central Office for Radioactive Waste Management. (OCGDR).

In the event of a significant change in the inventory, the Office will be informed.

The OCGDR may at any time request an up-to-date inventory from the producer.

This inventory should indicate the types of waste, according to the specified classification,

physical, chemical and radiological characteristics and quantities.

Article 18:

A national inventory is drawn up annually by the OCGDR (Central Office for the Management of Radioactive Waste) and is available to administrations and the public. (See SECTION D: Inventories and lists)

#### CHAPTER 4: REPORT TO THE NATIONAL AUTHORITY

Article 19:

Any radioactive waste producer and manager must submit an annual report to the National Radiological Protection and Safety Authority.

The quantities and types will be specified in this report

- waste having reached the threshold of decontrol and having been released into the environment and conditioned waste stored.

## **F2: Human and financial resources**

### *Article 22. HUMAN AND FINANCIAL RESOURCES*

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

- (i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility;*
- (ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning;*
- (iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.*

FINANCING WASTE MANAGEMENT By the decree n°1274-2002 on Radioactive waste management):

Article 20:

Any natural or legal person who generates radioactive waste is obliged to manage it and finance it.

Article 21:



All expenses generated by the waste management operations falling within the public service remit of the Central Office for the Management of Radioactive Waste are the responsibility of the State regardless of the own revenue generated by the Management Office.

types of waste, according to the specified classification, physical, chemical and radiological characteristics and quantities.

### **F3: 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.*

As mentioned in Article 49 and 50 (QUALITY ASSURANCE) (**decree n°1274-2002 on Radioactive waste management**):

#### *Article 49:*

Waste generators and the Central Office for Radioactive Waste Management must set up a written quality assurance program for all waste management operations approved by the National Authority for Radiological Protection and Safety.

#### *Article 50:*

This program should be designed to minimize the risk of accidental release of radionuclides into the environment and to ensure that the packages produced are in compliance with the required criteria and that all data concerning the waste generator packages, the radionuclides contained, the physical form of the waste and the dose rate are correctly archived.

types of waste, according to the specified classification, physical, chemical and radiological characteristics and quantities.

### **F4 : 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 ;*

*(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.**

The decree number 2002-1199 of 07 october 2002 currently in force fixes the general principles of radiation protection against hazards resulting from the use of ionizing radiation to protect workers and the members of the public from the risks deriving from ionizing radiations.

Consequently, these principles are applicable to facilities at which the waste are managed.

This regulations contains 6 Titles which the most important are :

## TITLE I: SCOPE

### *Article 3:*

Any practice or activity involving exposure to ionizing radiation referred to in the first article, including the possession, handling, use, processing, storage, processing, trade, transport and elimination of any radioactive substance or any electrical generator of ionizing radiation is subject to prior authorization by ANPSR

### *Article 6:*

In general, where the laws and regulations of Madagascar do not otherwise provide, or where they have not yet been defined, or in the absence of such texts, any practice or activity ipplying ionizing radiation exposure shall conform to the standards and requirements specified in the "INTERNATIONAL BASIC STANDARDS FOR THE PROTECTION AGAINST IONIZING RADIATION AND THE SAFETY OF RADIATION SOURCES"

("NAMES STANDARDS AS FOLLOWS" ) published by the INTERNATIONAL ATOMIC ENERGY AGENCY.

## **F 4.1: Protection of the workers**

As it's reported in the decree related to radiation protection :

### **CHAPTER 2 : DOSE LIMITATION SYSTEM**

#### *Article 9:*

No practice involving exposure to ionizing radiation may be permitted if the application of the practice does not produce a positive net benefit.

#### *Article 10:*

Irradiation of persons and the number of persons exposed to ionizing radiation shall be reduced as reasonably possible.

#### *Article 11:*

In all cases, the exposure doses received must be less than the limits laid down in the following Title III.

### **TITLE III : DOSE LIMITS FOR NORMAL EXPOSURE**

#### **FIRST CHAPTER: DOSE LIMITS FOR WORKERS**

#### *Article 13:*

No worker under the age of 18 years must be assigned to a workstation in a controlled area.

#### *Article 14:*

Occupational exposure of any worker shall not exceed the following limits:

- (a) effective dose of 20 mSv per year on average over 5 consecutive years;
- (b) effective dose of 50 mSv in a single year;

- (c) equivalent dose to the 150 mSv crystalline lens in one year;
- (d) equivalent dose to the extremities (hands and feet) or to the skin of 500 mSv in one year.

*Article 15:*

Any pregnant woman must inform her employer.

The employer must adapt the working conditions of the woman who has declared pregnancy so that the effective dose at the embryo or fetus does not exceed that provided for the public.

## CHAPTER 2 :DOSE LIMITS FOR STUDENTS AND APPRENTICE

*Article 16:*

In the case of students and apprentices attending special education for ionizing radiation and their applications occupational exposure shall not exceed:

- (a) effective dose of 6 mSv in one year;
- (b) dose equivalent to the 50 mSv crystalline lens in one year;
- (c) equivalent dose to the extremities or skin of 150 mSv in one year.

*Article 17:*

The protection of the students and apprentices referred to in the preceding Article shall be secured in the same manner as for work.

In addition, individual radiological surveillance and medical surveillance should be established in all cases.

## **F 4.2: Protection of the public**

### CHAPTER 4: LIMITS OF DOSE FOR PERSONS OF THE PUBLIC

*Article 20:*

Exposure to the public attributable to the use of ionizing radiation sources shall not exceed the following limits:

- (a) effective dose of 1 mSv per year;
- (b) dose equivalent to the lens of 15 mSv per year;

- (c) skin equivalent dose of 50 mSv per year;
- (d) in specially licensed special circumstances, the effective dose may be up to 5 mSv in a single year provided that the average dose over the 5 consecutive years does not exceed 1 mSv per year.

These limits apply to the relevant critical groups.

## CHAPTER 5: VERIFICATIONS OF COMPLIANCE WITH DOSE LIMITS

### *Article 21:*

The dose limits laid down in Articles 14 to 20 shall apply to the sum of the doses resulting from the external exposures during the specified period and the doses incurred as a result of the absorption of radionuclides during the same period. The duration of this evaluation is 50 years for adults and 70 years for children.

### *Article 22:*

In the case of absorption of radionuclides, compliance with the limits laid down in Articles 14 to 20 should be verified by the application of the actual dose values incurred by the incorporation unit for ingestion and inhalation, specified in the STANDARDS laid down in Article 6 of this Decree.

## **F 4.3: unplanned or uncontrolled release of radioactive materia**

## **F 5: Emergency preparedness**

### *Article 25. EMERGENCY PREPAREDNESS*

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

## **F5.1 : National emergency preparedness plan**

There is a national emergency plan named PLAN ORSEC the all the type of emergency except radiological emergency and lead by the « Bureau National de la Gestion des Risques et Catastrophes (BNGRC) at National level.

The implementation of this plan for radioogical emmergence is ongoing with BNGRC, Civil Protection Corps and INSTN.

## **F6: 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.*

There are no nuclear facilities planned to be dismantled in Madagascar.

## **Section G : Safety of spent fuel management**

### **G1: 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.*

Madagascar has any research reactor and there is no spent fuel for the moment.

### **G3: Sitting of proposed facilities**

### **G 4 : Design and construction of facilities**

#### *ARTICLE 7. DESIGN AND CONSTRUCTION OF FACILITIES*

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

- (i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases ;*  
*(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account ; (iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.*

After the various missions carried out by the IAEA experts, partner countries and the local counterpart of the projects. The interim storage of these sources in a dedicated container in a secure location was the chosen option.

It consists of 2 containers of 40 feet:

1 for storage of used sealed sources

1 for characterization, conditioning.

All sealed radioactive sources used in the country will be stored in this facility.

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It consists of 2 containers of 40 feet: 1 for storage of used sealed sources 1 for characterization, conditioning. All sealed radioactive sources used in the country will be stored in this facility.

### **Establishment of the Centralized Radioactive Waste Management Facility**

Actually, the priority for Madagascar is the establishment of the Centralized Radioactive Waste Management Facility. The realization of this project is under the RAF9062 Project.

## **Steps and activities already performed**

### **Previous case:**

- Meeting with the relevant ministries (Industry, Health, Higher Education and Scientific Research, National Defence ...)
- Council of Ministers (August 14, 2018).
- Governmental verbal communication related to the establishment of a temporary radioactive waste storage centre in a safe and secure place (August 14, 2018).
- Recognition of land in Arivonimamo (50 km from Antananarivo, area more than 2500 m<sup>2</sup>) (August 22, 2018)
- Because of the no continuity of State in our country, at the beginning the new minister did not accept the obtaining of land in Arivonimamo and He promised to give us another land after another verbal communication which will be promulgated soon.

### **Actual case:**

The current Minister of National Defence has accepted our request but this request is currently at the level of the Prime Minister. So, actually, we are waiting for the decision of the Prime Minister.

**Conclusion:** The construction of the National Radioactive Waste Storage Centre will be started only after the decision of the Prime Minister and the promulgation of the new verbal communication.

## **- Equipments already obtained from IAEA for the Centralized Radioactive Waste Management Facility:**

### **First shipment**

- 1- Two (02) Capsule P60, Assembly (empty capsule, non-radioactive)  
P60 special form vessel for Cs-137 or Am/Be sources
- 2- Tool Set for P60 capsule
- 3- Transportation Container LB100W (8038)
- 4- Wooden box
- 5- One (01) 200 litre standard steel drum



## Second shipment

- 6- Lead Bricks (Qty 150 standard brick with corner brick to form 5 sides shielded cavity
- 7- Caution radiation area barricade tape 80mm,
- 8- Radiation Caution Radioactive Materials Sign 200x300mm
- 9- 2M X 50M Thick (white )Heavy Duty Polythene Sheeting Roll
- 10- Karcher Tool Box 57 Piece Tool Set Including Hammer
- 11- Handcart Hand Trolley Maximum Load 300/500 kg Extra Large with Pneumatic Tyres
- 12- Lead glass 300\*200\*10 mm Pb Eq, Density: 5.2 10mm Pb Eq for Radium 226
- 13- TONG FOR SOURCE MANIPULATION
- 14- Teezers, specialized, compliant,
- 15- RADIAGEM-2000 PERSONAL PORTABLE GAMMA (DOSE RATE AND SURVEY METER
- 16- TELE-STTC WIDE RANGE GAMMA DOSE TELESCOPIC PROBE FOR RADIAGEM-2000
- 17- Surface Contamination Meter
- 18- Spectrometer Radionuclide identifier and dosimeter
- 19- DOSIMAN/S, manual electronic Dosimeter
- 20- Medical masks
- 21- TYVEK®-overall
- 22- Overshoes, PE eco overshoes pack of 110
- 23- Sempercare®-latex gloves type 5 size M

**Total 43,727.80 Euro**

## G5 : Assessment of the safety of the 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).*

*The authorization of operation of a nuclear installation is granted only after it was verified that the conditions fixed by the authorization of the commissioning were respected In order to get the authorization of operation, a final safety analysis report must be submitted to the corresponding regulatory body. The report will be evaluated by a commission where all the concerned ministries are represented. The report includes:*

- The results of commissioning of the nuclear installation*
- The limits and the conditions of operation, which have to take into account final Characteristics as well as results of commissioning*
- The programmes of operation and the detailed procedures of the management of the installation*

*Each safety analysis must contain the responses to demonstrate compliance with the safety functions and design criteria of the installations under normal and accident conditions, accompanied by a study of radiological impact*

## **G6 Operation of facilities**

### **ARTICLE 9.**

*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.*

## **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 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.*

In Madagascar, there are some abandoned open mine operated by a French company (CEA).

No security measures have been taken so far for the rehabilitation of these old uranium mines.

(See figure XX)

## **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 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 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 provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases;*
- (ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account;*
- (iii) at the design stage, technical provisions for the closure of a disposal facility are prepared;*
- (iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.*

## **H 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 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; 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.*

Before the construction of the national central facility, there is no operation in waste management in the country because all disused radioactive sources are stored at the user's storage room.

## **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*

## **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.*

## **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 re-entry 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.*

All disused radioactive sources are stored at the user's storage room.(See SECTION D: Inventories and lists)

## **Section K : Planned activities to improve safety**

Madagascar is preparing to complete the legislation and regulation covering all aspects of radiation protection, nuclear safety and nuclear security. At this subject a main law was already drafted.

The construction of one centralized facility with 2 containers of 40 feet is planned.  
All sealed radioactive sources used in the country will be stored in this facility.