

# Status of the Management of Disused Sealed Sources in Madagascar

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**Abstract:** In Madagascar, Nuclear applications can provide significant benefits in various fields of medicine, agriculture, industry, research or other. However, some of these applications generate radioactive waste that must be managed well to avoid potential risks to people and the environment.

On the legislative and regulatory framework, Madagascar has already a law on radioactive waste management (Law ° 97-041) and implementing regulations. These regulations will shortly be complemented by prescriptions and guides. If necessary, they will be updated to be consistent with GSR Part 3.

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.

Temporary solutions have therefore been taken in particular:

- The dismantling of devices containing sealed sources of the service (Case of brachytherapy machine)
- Conditioning of radium sources (56 sources of Ra-226 needles),
- Repatriation of sources of high activity (2 Sources of Cobat-60 used in radiotherapy) (SHARS)

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 chosen option.

**Key words:** Disused sources in Madagascar

## 1. Introduction

In Madagascar, Nuclear applications can provide significant benefits in various fields of medicine, agriculture, industry, research or other. However, some of these applications generate radioactive waste that must be managed well to avoid potential risks to people and the environment.

### **Legislative and regulatory framework**

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.

### **Policy and strategy**

Policy and strategy for radioactive waste management are being developed.

### **Joint Convention**

The law ratifying the Joint Convention on the safety of waste fuel and the safety of Radioactive Waste Management was adopted by the parliament and the senate in June, 2016.

### **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
	Sr-90	Applicator	5		France	In lead pot
LRI <sup>2</sup>	Co-60	Seed Irradiator	24		Norway / Russia	In room

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

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

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

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

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

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>						
CHU-HJRA <sup>1</sup>	Am-241/Be	Moisture gauge	20	Up to 200	CEA -France	
LPNPA <sup>3</sup>	Am-241/Be	Analysis/ Moisture gauge	2	2730	Unknown/ Bitatron	
<b>OTHER SOURCES</b>						
CHU-HJRA <sup>1</sup>	Sr-90	Standard	4	26		Unknown
	Ra-Be	Unknown	6	70	Unknown	
	Cs-137	Unknown	4	Up to 200		
LRI <sup>2</sup>	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	
GALANA <sup>5</sup>	Co-60	Level gauge	3	10	Berthold	
LPNPA <sup>3</sup>	Sealed sources, Ores samples	Research	110	10		

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

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

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

**Option for Storage**

Temporary solutions have therefore been taken in particular:

- The dismantling of devices containing disused sealed sources (Case of brachytherapy machine)

In October 2015, with the financial support of the European Commission, the IAEA conducted a mission in Madagascar to help national counterparts to implement the best strategies to manage Madagascar’s inventory of disused radioactive sources. Also during the mission, an IAEA technical officer (TO) dismantle a disused brachytherapy device containing Cs-137 sources, which are used in radiation therapy to treat cancer patients. The device had been declared inoperative, and had been placed in a hospital room under poor safety conditions. The room was closed, personnel access was prohibited, and the room could not be used for any other purpose. The expert transferred the disused sources into an appropriate container, which was then removed from the hospital and transferred to a safe storage facility. The room containing the brachytherapy device is now free of disused radioactive material, and can be used for other purposes.



Fig.1. The dismantling of brachytherapy devices



Fig.2. Conditioning of radium sources



Fig. 3.Repatriation of Cobat-60 source(SHARS) used in radiotherapy.

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.

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## **Reference**

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