Kingdom of Morocco

Head of the Government

Seventh National Report

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

Jointly Prepared by:

The National Centre for Nuclear Energy, Science and Technology
'CNESTEN'

The Moroccan Agency for Nuclear and Radiological Safety & Security
'AMSSNuR'

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ABBREVIATIONS USED

ADR	European agreement on the International Carriage of Dangerous goods by Road
AMSSNuR	Moroccan Agency for Nuclear and Radiological Safety and Security
AFRA	African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology
BSS	Basic Safety Standard
CENM	Nuclear Research Centre of Maamora
CNESTEN	The National Centre for Nuclear Energy, Science and Technology
CNEI	National Committee of Environmental Impact Assessment
CNRP	National Centre of Radioprotection
CNSN	National Commission of Nuclear Safety
COGEMA	Compagnie Générale des Matières Nucléaires
DGPC	Direction Générale de la Protection Civile
DSRS	Disused Sealed Radioactive Sources
EPR	Emergency Preparedness and Response
EU	European Union
EC	European Commission
EW	Exempt waste
FNRBA	Forum of Nuclear Regulatory Bodies in Africa
GICNT	Global Initiative to Combat Nuclear Terrorism
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICRP	International Commission on Radiological Protection
INFCIR	Information Circular
LILW	Low and Intermediate Level Waste
LILW-SL	Low and Intermediate Level Waste Short Lived
LILW-LL	Low and Intermediate Level Waste Long Lived
HLW	High Level Waste
ICAO	International Civil Aviation Organization
MEME	Ministry of Energy, Mines and Environment
NORM	Naturally Occurring Radioactive Material
NPP	Nuclear Power Plant
OCP	Office Chérifien du Phosphate
ORSEC	Organization de Secours
ORSEC RAD	Organisation de Secours en cas d'accident Radiologique
REMEX	REsponse and Mitigation Exercice
RID	Regulations concerning the International carriage of Dangerous goods by rail
SONASID	National Company of Metallurgy
TCC	Technical Crisis Center
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TLD	Thermoluminescent Dosimeter
SNF	Spent Nuclear Fuel
RW	Radioactive waste
RWM	Radioactive Waste Management
SAR	Safety analysis report
NORM	Naturally occurring radioactive materials
WAC	Waste acceptance criteria

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Section A: INTRODUCTION

As a Member State of the IAEA and Party to the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the Kingdom of Morocco is committed to managing radioactive waste in a safe, secure and sustainable manner in accordance with internationally recognized principles and good practices related to nuclear and radiation safety.

The application of those principles aims at ensuring adequate and sustainable protection of workers, the public and the environment from the harmful effects of ionizing radiation. Therefore, the Kingdom of Morocco was among the first countries to sign and ratify the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management (Joint Convention), which entered into force on 18 June 2001, and is committed to establishing a beneficial, responsible and sustainable radioactive waste management (RWM) system consistent with the IAEA Nuclear Energy Basic Principles, Fundamental Safety Principles.

In this regard, the Kingdom of Morocco has established a national centralized organization for radioactive waste management (CNESTEN created in 1986) and also an independent regulatory body (created in 2016) who, together, elaborated a national policy and strategy for radioactive waste and spent fuel management.

Since the first report till now, the Kingdom of Morocco has made an important effort towards establishing an adequate institutional and legislative framework governing all aspects of the implementation of the Joint Convention.

This seventh national report is written in accordance with article 32 of the Joint Convention and presents the measures taken by the Kingdom of Morocco to meet each of the obligations set out in the Convention.

This report is designed according to the guidelines concerning the form and structure of national reports, as presented in IAEA Information Circular INFCIRC/604 and takes into account comments and questions made regarding Morocco's previous national reports, as well as during countries' group sessions,

Thus, this report deals with the following topics:

- Section A: Introduction;
- Section B: Policy and Practices in the field of the Convention (article 31);
- 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.

The Kingdom of Morocco is a signatory to many international instruments, among which, the following treaty and conventions:

- Treaty on the Non-Proliferation of Nuclear Weapons entered into force in Morocco on November 27, 1970.
- Convention on Physical Protection of Nuclear Material entered into force in Morocco on September 22, 2002.
- Amendment to the Convention on the Physical Protection of Nuclear Material ratified by Morocco on 10 December 2015.
- Vienna Convention on Civil Liability for Nuclear Damage signed by Morocco on November 30, 1984.
- Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage entered into force in Morocco on October 4, 2003.
- Convention on Supplementary Compensation for Nuclear Damage entered into force in Morocco on April 15, 2015 ;
- Convention on Early Notification of a Nuclear Accident entered into force in Morocco on November 7, 1993.
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency entered into force in Morocco on October 7, 1993.
- Convention on Nuclear Safety entered into force in Morocco on August 19,2019.

In addition, the nuclear safety and security framework was reinforced in 2014 by the adoption of the law 142-12 on nuclear and radiological safety and nuclear security, by which a new independent regulatory body was created. This entity is named Moroccan Agency for Nuclear and Radiological Safety and Security (AMSSNuR). This regulatory body is an independent organization under the umbrella of the Head of Government.

AMSSNuR has taken over the regulatory missions and attributions of the former regulatory bodies (National Centre for Radiation Protection 'CNRP' and Minister of Energy, Mines and Environment 'MEME'). AMSSNuR is assigned to establish specific regulations dealing with radioactive waste management.

As to the present national operational infrastructure, the Kingdom of Morocco is operating the Nuclear Research Centre of Maamora (CENM) with a 2 Megawatts TRIGA MARK II research reactor and facility to treat radioactive waste generated at the national level.

So far, all radioactive wastes generated in Morocco are arising from the use of radioactive material in the form of sealed and unsealed radioactive sources in industry, medicine, education and research fields.

There is also waste generated by the phosphate mining industry that contains only naturally occurring radioactive materials. This kind of waste is not declared as waste for the purpose of this Convention. However, law 142-12 has foreseen a full section dealing with NORM and TENORM and assigned to AMSSNuR to quantify the risk associated with this kind of waste and to set up a specific regulation.

The present national report was developed by AMSSNuR jointly with CNESTEN, and underwent a large consultation with the following concerned parties:

1. Ministry of Foreign Affairs, African Cooperation and Moroccans Expatriates,
2. Ministry of Health,
3. Ministry of Energy, Mines, and Environment,
4. Ministry of Interior,
5. National Office of Electricity and Drinking Water,
6. General Directorate of National Security,
7. National Defense Administration,
8. General directorate of Civil protection.

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:
1-spent fuel management policy.
2-spent fuel management practices.
3-radioactive waste management policy.
4-radioactive waste management practices.
5-criteria used to define and categorize radioactive waste.

B-1: National Policy of Radioactive Waste & Spent Fuel Management

Until now, there is no approved document on the policy and strategy for radioactive waste management. The policy and strategy are laid down in the national legislation (mainly law142-12, and the law on the protection of environment).

The draft of the policy and strategy for radioactive waste management was prepared by AMSSNuR and CNESTEN in consultation with all relevant stakeholders. This draft was reviewed by the IAEA experts and the concerned parties. The final draft of this policy was submitted in 2018 to the head of government for approval.

Policy objectives

The safety and security objectives for the management of nuclear spent fuel and radioactive waste in Morocco are stated in Articles 84 and 85 of the Law 142-12, as follows, to:

- Achieve and maintain a high level of safety and security regarding the management of spent nuclear fuel and radioactive waste.
- Ensure adequate protection of workers, the public and the environment from the harmful effects of ionizing radiations, without compromising their ability to meet their expectations.
- Prevent accidents and mitigate their consequences.

Based on these objectives, the policy statement is expressed as follows:

1. The management of radioactive waste in Morocco adopts the *Fundamental Safety Principles* of the International Atomic Energy Agency (IAEA), and the safety requirements related to radioactive waste management.

2. Radioactive waste management in the Kingdom of Morocco shall ensure achievement of the fundamental safety objective to sustainably protect people and the environment from the harmful effects of ionizing radiation.
3. Radioactive waste management in the Kingdom of Morocco is subject to strategic planning and objectives that are consistent with this policy, so that safety is not compromised now or in the future.
4. All concerned organizations shall clearly identify any roles and responsibilities associated with radioactive waste management, including oversight of all related operations.
5. All concerned organizations shall establish funding mechanisms that ensure the long-term sustainability of radioactive waste management, including liability.
6. Radioactive waste shall be managed with consideration being given to the interdependency between all the steps of predisposal, and between predisposal and the eventual disposal activity.
7. Radioactive waste management shall follow the principles of waste avoidance, minimization, reuse, and recycling. Dilution of radioactive waste to reach the clearance limits is prohibited unless expressly authorized by AMSSNuR.
8. Decision-making related to radioactive waste management shall be based on scientific information, sound safety-case, and resource optimization.
9. Radioactive waste shall be managed according to a graded approach.
10. Radioactive waste management shall be conducted in such a manner as to avoid the existence or production of unregulated radioactive waste within the Kingdom of Morocco.
11. Involved organizations shall ensure that the resources and competencies required for appropriate radioactive waste management are available all the time.
12. Eventual disposal facilities shall ensure that coherent waste radioactive waste management practices are in place at all times, based on a comprehensive set of generic waste acceptance criteria.
13. This policy and associated national radioactive waste and spent fuel strategies are public documents.

In addition to that, AMSSNuR has developed a nuclear safety policy, in consultation with all relevant stakeholders, and submitted it in February 2020 to the head of government for approval.

Based on the governmental declaration and a justification note, this policy aims to protect, through its effective implementation, the current and future generations and environment from harmful effects of ionizing radiations, resulting from nuclear and radioactive activities.

In this declaration note, the government of the Kingdom of Morocco commits, through its consistent and long-term engagement in oversight and support to the relevant processes in the field of Nuclear and radiological safety, the following:

1. Strengthening and implementing the legislative and regulatory framework.
2. Abiding by the IAEA fundamental safety principles in accordance with a graded approach.
3. Ensuring that the use of radiation sources in facilities and activities is justified with respect to socioeconomic benefits for the society and by application of safety requirements.
4. Supporting a regulatory decision-making process to ensure safety.
5. Ensuring provisions of human and financial resources for building and maintaining competencies and safety measures by all parties having responsibilities in relation to the safety of facilities and activities, including provisions and a framework for Research and Development for safety.
6. Promoting transparency and openness attitudes among all stakeholders in accordance with the legal and regulatory framework.
7. Facilitating public involvement (consultation and information) regarding the radiation risks in facilities and activities according to the legislative and regulatory framework.
8. Ensuring an effective coordination mechanism among relevant parties involved in the decision making process related to facilities and activities.
9. Contributing to the global nuclear safety regime, through, e.g., active participation in peer reviews and sharing of experience at the international level.

10. Fostering international cooperation, including regional cooperation, in the field of nuclear and radiological safety.

B-2: Radioactive Waste and Spent Fuel Management Practices

So far, Morocco hasn't got any spent fuel generated by the TRIGA reactor, therefore only low and intermediate level radioactive waste (LILW) will be discussed in this section. The radioactive waste shall be managed safely and securely in accordance with the law 142-12 and international standards.

Morocco has a radioactive waste facility dealing with LILW provided with the necessary equipment and infrastructure, capable of treating and storing radioactive waste.

The licensees of installations and activities involving radioactive material perform the interim storage of all generated radioactive waste on their sites until their transfer to CNESTEN.

Wastes are collected by CNESTEN and treated in its installation located in the research centre of the Maamora nuclear centre. The aqueous radioactive effluents are treated by evaporation, while solid wastes are segregated into compactable and non-compactable waste before the drum compaction in 120 litre drums. Organic wastes are solidified and conditioned in 120 litre drums.

The matrix used in the immobilization of waste is cement.

Management by decay for the waste that has half-life below 100 days is discharged when it reaches the exemption limit set out by AMSSNuR.

Any user or holder of sealed radioactive sources should have an importation authorization from AMSSNuR, without which the user could not clear his radioactive material through customs. The disused sealed radioactive sources are collected and stored in CNESTEN, awaiting the conditioning in 120 litre drums.

Authorization of discharge of radioactive material is given to producers on a case-by-case basis according to the limits recommended by the IAEA documentation.

TENORM and NORM, mainly phosphogypsum, are not handled by the CNESTEN.

The importation, utilization or transportation of radioactive material is subject to a license from AMSSNuR. The owners of radioactive material are responsible for the safety and the security of this material and for the management of the radioactive waste resulting from its use.

In order to manage spent fuel, CNESTEN has designed and constructed a spent fuel pool for storage which can handle up to 324 TRIGA spent fuel elements.

B-3: Categorization of Radioactive Waste

There is no formal categorization of waste published by AMSSNuR.

For the purposes of the implementation of a national policy and to establish a strategy for radioactive waste management, Morocco generally follows the guidelines of the IAEA regarding the classification of radioactive waste.

The classification of radioactive waste is expressed in the draft of policy and strategy of RWM as follow:

1- **Exempt waste (EW):** Waste that meets the criteria for clearance, established by regulations.

2- **Very short-lived waste (VSLW):** Waste that can be stored for decay over a limited period of up to a few years and subsequently cleared from regulatory control according to arrangements approved by AMSSNuR, for uncontrolled disposal, use or discharge.

3- **Very low-level waste (VLLW):** Waste that does not necessarily meet the criteria of EW, but that does not need a high level of containment and isolation and, therefore, is suitable for disposal in near surface-landfill type facilities with limited regulatory control. Concentrations of longer-lived radionuclides in VLLW are generally very limited.

4- **Low-level waste (LLW):** Waste that is above clearance levels, but with limited amounts of long-lived radionuclides. Such waste requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near surface facilities.

   This class covers a very broad range of waste. LLW may include short-lived radionuclides at higher levels of activity concentration, and long-lived radionuclides, but only at relatively low levels of activity concentration.

5- **Intermediate level waste (ILW**): Waste that, because of its content, particularly of long-lived radionuclides, requires a greater degree of containment and isolation.

LLW and ILW satisfying the WAC are collected by CNESTEN to be treated and stored in CNESTEN.

As mentioned in subsection E-1 of this report, a draft Decree on the Safety of radioactive waste management, disused radioactive sources and spent fuel and its associated ordinance on modalities of characterization of radioactive waste were submitted to the Head of Government respectively in June 2018 and February 2020.

These regulatory texts state general requirements for developing the WAC by the centralized radioactive waste management organization.

Based on that, CNESTEN is finalizing its WAC referential and will submit it to AMSSNuR for approval. This document will be an input to define the final classification of radioactive waste and the end point of different waste stream.

B-4: Detection of radioactive sources in scrap metal

The most important companies dealing with scrap metal are equipped with a fixed portal monitoring system to detect radioactive material inside vehicles transporting scrap before entering its facilities.

Furthermore, Morocco has equipped two large harbors in the country with a fixed portal monitoring system to detect any suspicious radioactive material in scrap metal coming from abroad. In this regard, a draft protocol was signed between harbors' authorities and the former regulatory body to take over radioactive sources detected in scrap metal.

It is noted that Morocco has adhered to the Code of Conduct on the Safety and security of Radioactive Sources and its supplementary guidance.

In addition to that, and in accordance with the provisions of Law No. 142-12, and IAEA standards and guidelines for nuclear safety and security, AMSSNuR is working on updating the National Register of ionizing radiation sources and on the national strategy for securing orphan sources. The details on these subject matters are given in sections D and I.

Section C: SCOPE OF APPLICATION

Article 3

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 defense programs, 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 defense programs if and when such materials are transferred permanently to and managed within exclusively civilian programs.
4. This Convention shall also apply to discharges as provided for in art. 4, 7, 11, 14, 24

All spent fuel will be stored in a pool located at the reactor's building.

The present report applies to safety of the management of radioactive waste originating from the civilian program for nuclear applications in medicine, industry, education, and research.

Morocco has no radioactive waste of military origin; this report does not apply to this type of waste.

This report covers the discharges of radioactive wastes.

NORM and TENORM are not included in the scope of application of this report.

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, provide 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.

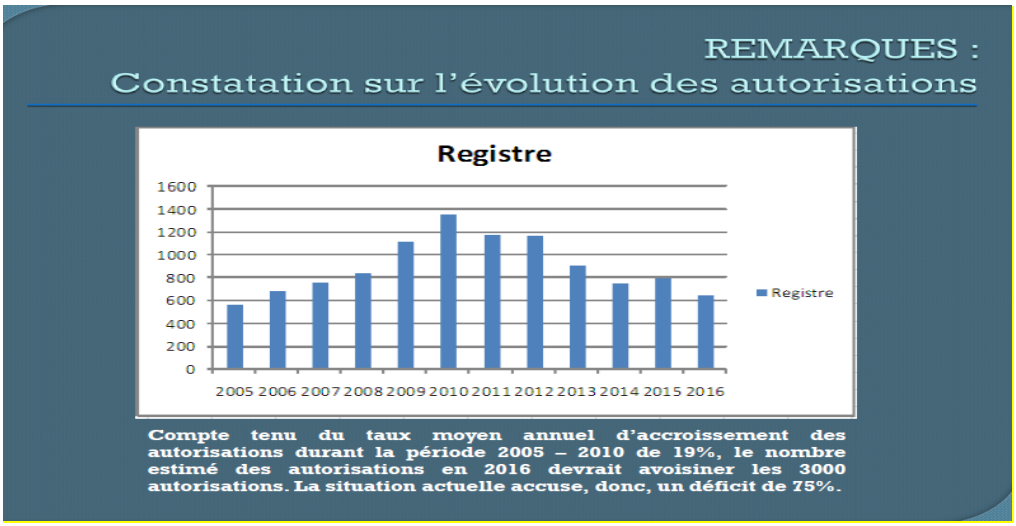
IV-an inventory of radioactive waste that is subject to this Convention that:

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 data 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 in these facilities.

CNESTEN has designed and constructed a spent fuel pool for storage of up to 324 TRIGA spent fuel elements. In addition, CNESTEN is operating a radioactive waste facility dedicated to receiving, sorting, handling, treating, conditioning and storing radioactive waste generated in industries, hospitals, universities, research organizations and its own generated waste.

Figure n° 1 : authorizations Evolution



With regard to the inventory of SRS and DSRS, AMSSNuR has received from CNRP (former regulatory body) the inventory of DSRS and SRS concerning more than 14000 documents covering the period 1985-2016 (figure n°1).

AMSSNuR has launched its vision and strategy on the implementation of its assigned mission as stipulated in article 175 of law 142-12, especially the register of ionizing radiation sources.

In this framework, AMSSNuR received in 2017 the Regulatory Authority Information System called "RAIS" from the IAEA. The software application was developed by the IAEA, to assist its Member States in managing their regulatory activities in accordance with IAEA Safety Standards and guidance, including the Code of Conduct on the Safety and Security of Radioactive Sources and supplementary Guidance. AMSSNuR has trained its staff on the utilization of RAIS.

One of the most important objectives of this strategy is the reinforcement of the core missions, i.e. authorization and inspection. In doing so, AMSSNuR has dedicated a full programme covering the following elements and actions:

- Update the national register of ionizing radiation sources which would enable AMSSNuR to have radiological risk mapping.
- Develop a regulatory framework associated to law 142-12.
- Reinforce the authorization and control system.

The resulting inventory will provide accurate information about the SRS in use and DSRS that are pending return to their suppliers or their transfer to the national interim storage facility.

Collected data will be compared to the data that could be sent by users and owners according to article 90 of law 142-12 and data that will be collected during the AMSSNuR inspection and control mission. So, the inventory will also provide an estimate of quantities of SRS that will become DSRS. Nevertheless, according to CNESTEN inventory, an estimate of DSRS quantity collected by CNESTEN is presented in **table n°1** and **figure n°2**.

Progress made since the last review meeting:

AMSSNuR initiated, in 2018, within the framework of its cooperation programme with the IAEA and the EU, the national strategy for managing and monitoring the movements of radioactive sources including orphan sources as well as the National Register of ionizing radiation sources.

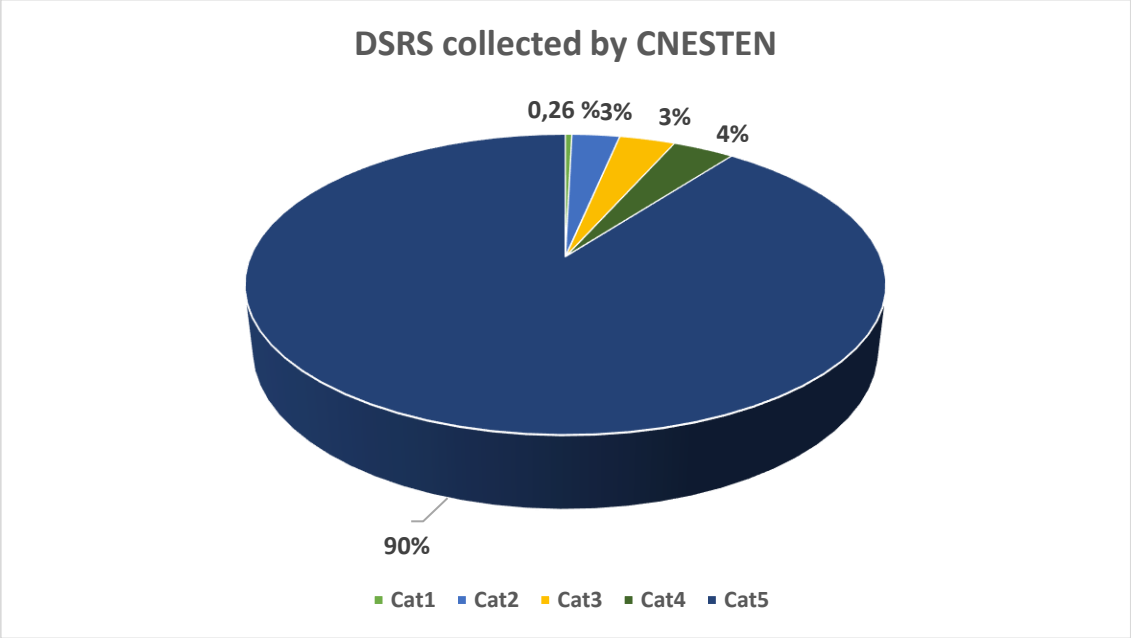
In this framework, the following activities were carried out:

1. Development of the information collection form, available on its website,
2. Adaptation of the IAEA RAIS system to current practices,
3. Development of an internal guide for its use,
4. Supplying of regulatory data available at AMSSNuR level to this system,
5. Use of data received during the archiving operation.

Table n° 1: Moroccan DSRS collected by CNESTEN - Current situation (March 2020)

	Cat1	Cat2	Cat3	Cat4	Cat5	Total
Collected	9	66	77	85	2055	2292
Repatriated	6	0	0	0	0	6
Stored	3	66	77	85	2055	2286

Figure n° 2: DSRS collected by AMSSNuR



It is worth mentioning here that before the adoption of law 142-12, the producer of DSRS had to choose one of the three following possibilities to manage their waste:

1- Handling over DSRS by the CNESTEN,

2- Returning DSRS to their original supplier,

3- Storing them in a safe place at the user premises until they were returned to the original supplier or given to the CNESTEN.

This situation was tackled appropriately by the decree on the safety of radioactive waste and spent fuel management see "**Section J: DSRS"**

Section E: LEGISLATIVE AND REGULATORY SYSTEM

E-1: Implementing Measures

Article 18.

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 Kingdom of Morocco strongly supports international community programmes and actions aiming at advancing nuclear safety and security in the use of ionizing radiation sources. Morocco became an IAEA Member State in 1957 and has promulgated the first law 005-71 related to the protection against ionizing radiation sources in 1971.

In 1997, the Kingdom of Morocco adopted two decrees related to radiation safety, namely:

- Decree n° 02-97--30 related to the protection against ionizing radiation sources.
- Decree n°02-97-132 related to the use of ionizing radiation substances in the medical sector.

Along with the radiation safety regulation, Morocco issued the decree n°2-94-666 related to the authorization and control of nuclear facilities.

Furthermore, Morocco has signed and ratified a set of international conventions and treaties to comply with the principles and objectives of the international instruments and to fully honor its commitment vis-à-vis the international community. In doing so, Morocco has conducted a major reform of its legislative and regulatory framework.

This reform resulted in the adoption of law 142-12 related to nuclear and radiological safety and security, which set up a single and unique independent regulatory authority in charge of both aspects of radiation and nuclear safety and security.

In the light of the new current situation, law 142-12 perfectly reflects the essence of the principles and safety objectives of the joint convention on the safety of spent fuel management and on the safety of radioactive waste. It is important to note that law 142-12 has been established with IAEA assistance.

A National Council of Nuclear Energy (CNEN) was set up by decree 2-90-352 of 5 May 1993 reporting to the Prime Minister. Its mission aims particularly to:

- Propose orientations and objectives for the national policy in the field of peaceful uses of nuclear energy and suggest measures to implement them.
- Give opinions on all issues related to nuclear regulations.

- Recommend priorities for international cooperation.

A National Commission of Nuclear Safety (CNSN) was also set up by decree n° 2-94-666 of 7 December 1994 as consulting entity. The Commission gives opinions on the requested authorizations for nuclear installations, and the conditions imposed on these authorizations, as well as on any modification related to the safety of nuclear facilities. The secretariat of the Commission is ensured by the Department of Energy and Mines.

However, due to the new law 142-12 and the creation of AMSSNuR, the mission of CNEN should be reviewed, especially its associated commission in charge of regulatory issues.

Morocco also uses the safety standards and all documents related to the radioactive waste management published by the IAEA.

In addition to this, and in order to carry out its assigned mission, law 142-12 has foreseen some provisions allowing AMSSNuR to be endowed by:

- The status of independence from promotional activities involving Ionizing Radiation Sources 'IRS',
- Qualified human resources,
- Sufficient financial resources.

It is also important to mention that, according to a systemic approach, the national legislative and regulatory framework was reviewed based on IAEA international standards and good practices. For instance, the joint convention was promulgated by a 'Dahir' (A Royal Law) by which the country abides by its provisions.

AMSSNuR reviewed the national nuclear and radiological safety and security regulatory framework in accordance with international commitments and best practices in this field and set, within its strategic plan 2017-2021, the objective to upgrade the national regulatory framework based on consultations held with all relevant stakeholders.

As a result, so far, twelve regulations were elaborated and submitted by AMSSNuR to the Head of Government for approval. These first regulations are related to the following areas:

1. Authorization and declaration regime for "Category II" facilities and activities,
2. Protection of workers, the public and the environment against ionizing radiation,
3. Uses of ionizing radiation sources in the medical field,

4. Security of radioactive sources,
5. Implementation of nuclear safeguards agreements,
6. Emergency Preparedness and Response,
7. Safety of radioactive waste and spent fuel management,
8. Safety and authorization of category I facilities and activities,
9. Modalities and conditions for granting technical service approvals,
10. Clearance and exemption levels,
11. Characterization modalities of radioactive waste,
12. Training and qualification in radiation protection

Eight other regulatory texts are under development and will be submitted to the head of government during the period 2020-2021 in the following areas:

1. Training and qualification of medical physicists.
2. Import and export of nuclear materials, equipment, and related technologies.
3. Physical protection of nuclear materials and associated facilities.
4. National Nuclear Security Committee.
5. Safe transport of radioactive materials.
6. Technical inspection procedures.
7. Authorization of radioactive ores.
8. National plan for radiological and nuclear emergency preparedness and response.

Regarding Radioactive waste management, AMSSNuR plan to develop a guide on classification of Radioactive waste.

Whenever required, these regulations will be completed by guides, ordinances, technical prescriptions, etc.

E-2: Legislative and Regulatory Framework

Article 19.

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 license.
IV- a system of appropriate institutional control, regulatory inspection and documentation and reporting; the enforcement of applicable regulations and of the terms of the licenses.
V-a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.
3. While considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.

As mentioned in section E1" legislative and regulatory system", the attributes of the national legislative and regulatory framework always take in consideration its international dimension. On that basis, the legislative and regulatory framework consists of, on one side, the domestic legislation and regulation and on the other side, the international instruments, signed and ratified by the Kingdom of Morocco.

Domestic legislation and regulation

The main national instruments related to nuclear and radiological safety and nuclear security are listed below:

- Law 142-12 on "nuclear and radiological safety and security, and the setting up of the Moroccan Agency for Nuclear and Radiological Safety and Security" (AMSSNuR), published in the Official Gazette on September 11, 2014.
- Law 17-83 of 1987 promulgated by Decree N° 1-85-98 on 14 November 1986 establishing the National Centre for Nuclear Energy, Science and Technology (CNESTEN);
- Decree N° 2-94-666 of 7 November 1994 related to the authorization and control of nuclear installations.
- Decree N° 2-97-30 of28 October 1997 related to the protection against ionizing radiations.

- Decree N° 2-97-132 of 28 October 1997 pertaining to the use of ionizing radiations for medical purposes.
- Law 12-02 pertaining to Civil Liability for Nuclear Damage promulgated by Decree.
- Law 12-03 on Environmental Impact Studies promulgated by Decree N° 1-03-60 of 12 May 2003 applicable to the development of nuclear installations, including radioactive waste management facilities.
- Dahir No. 1-99-126 of 19 May 2000 publishing the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
- Ordinance of the MEME, n° 2004-08 of 19 January 2009, related to the operation authorization of the CEMN of CNESTEN.

General overview of Domestic legislation and regulation

Law 142-12 on "nuclear and radiological safety and security

Law 142-12 defines the processes of authorization, notification, control and inspection, of all activities using ionizing radiation sources and provides enforcement provisions and penalties in case of violation of its provisions. It also addresses the aspects related to the transport of radioactive materials, radioactive waste management, public information, issuance of accreditations to service providers in safety and security, setting up of a national emergency plan to nuclear or radiological emergencies, the national physical protection system, and the national system for accounting and control of nuclear materials.

Additionally, law 142-12 created the AMSSNuR as an independent regulatory body in charge of nuclear and radiological safety and security.

Decree n°2-97-30 of radiation protection

Decree n° 2-97-30 of 28 October 1997 sets the general principles of protection against hazards resulting from the use of ionizing radiation. It provides the following radiation protection principles:

1. The justification principle requires that no practice implying an exposure to ionizing radiations be able to be authorized if its application does not produce a net positive advantage.

2. The optimization principle implies that the irradiation of people and the number of people exposed to ionizing radiations must be as reduced as possible.
3. In all cases, the received amounts of exposure must be lower than the limits aimed to under title III of decree n° 2-97-30.

Thus, exposure of the public and workers to ionizing radiation must be kept as low as reasonably possible, as must be the number of persons and workers exposed to ionizing radiations. Professional exposure of any worker should not exceed the limits hereafter:

- Effective dose of 20 mSv per year on average over five consecutive years.
- Effective dose of 50 mSv in only one year.
- Equivalent dose to the crystalline of 150 mSv in only one year.
- Equivalent dose to the extremities (hands, feet) or to the skin of 500 mSv per year.

In the case of women in age to procreate, all radio exposure must be distributed as uniformly as possible in time. Any woman who nurses cannot be assigned or maintained at a working station involving a risk of incorporation of radionuclides. Any woman found pregnant cannot work under working conditions 'A' in which annual exposures under normal terms of employment could exceed three tenth of the above-mentioned limits. Exposure of a pregnant woman within the framework of her employment must be the weakest reasonably possible to obtain.

In the case of students who are enrolled in ionizing radiations and their applications curricula, the limits of exposure must be equal to the limits planned for professional exposure. Students and apprentices aged between 16 and 18 can be exposed under working conditions 'B', in which, under normal terms of employment, annual exposures have little chance to exceed three tenth of the above-mentioned limits. Only those aged 18 and above can be exposed under working conditions 'A'. The protection of students and apprentices must be assured in the same way as that for workers having an occupational exposure.

Moreover, a radiological monitoring in accordance with the standards of protection against radiation and an individual medical supervision must be established in all cases.

The exposure of the public to practices should not exceed the limits which apply to the average doses estimated for the critical group. These limits are:

- Dose effective of 1 mSv in one year.
- In particular circumstances, effective dose going up to 5 mSv in only one year provided that the average amount over 5 consecutive years does not exceed 1mSv in one year.
- Dose equivalent to the crystalline of 15 mSv in one year.
- Dose equivalent to the skin of 50 mSv in one year.

Decree n° 2-97-30 of 28 October 1997 describes the technical measurements to protect workers exposed to radiation. Working areas are divided into "controlled" and "supervised" areas and workers are classified in different categories, provisions and measurements of control and monitoring related to various working areas and the various categories of workers are set out. The aforesaid decree:

- Deals with classification of establishments in categories and classes.
- Determines authorization, declaration and exemption modes.
- Fixes the conditions of radio-exposure in normal and abnormal circumstances.
- Fixes the fundamental principles of worker monitoring through administrative, technical, and medical measures.
- Foresees the record keeping of data and files.
- Fixes the principles of monitoring of public health.
- Fixes the modes of control and inspections.

In addition, the owner is held responsible for ensuring the medical supervision of its exposed workers. This monitoring is based on the general principles applicable to occupational medicine and must take into consideration the last or existing conditions of exposure to other toxic, chemical substances or other physical conditions implying a potential risk.

A licensing system for non-nuclear facilities is also described in the above-mentioned decree; thus, import, export, acquisition, manufacture, transformation, detention, use and sale of radioactive substances or ionizing radiation sources are subject to preliminary authorization or declaration. Authorization requests must comprise information on the applicant and the installation, competency of staff, the operations considered, technical features of radiation sources, the provisions taken for management of the radioactive waste.

Decree 2-97-132 on radiation protection in the medical sector

Decree n° 2-97-132 of 28 October 1997 governs especially medical and dental installations; it describes the following:

- The conditions of use of ionizing radiation sources and their conformity with international standards.
- The prohibition of the use of fluoroscopes, without the image intensifier devices, at the end of the diagnosis.
- The conditions of setting up working areas where ionizing radiation sources are installed.
- The processes of evacuation and storage of effluents and radioactive waste.
- Staff qualification.

According to article 63 of this decree, the inspector has the right to:

- Access, for the sake of control, buildings vehicles, ships or aircrafts containing ionizing radiation sources.
- Take samples on any radioactive or supposed radioactive substance for the sake of examination.
- Examine and calibrate any apparatus comprising a radioactive source.

Decree 2-94-666 related to authorization and control of nuclear facilities

Decree n° 2-94-666 of 7 December 1994 is applicable to nuclear installations.

It describes the supporting documents required to obtain an authorization for:

- Construction of nuclear installations,
- Discharging of liquid and gas effluents to the environment,
- Commissioning,
- Operating,
- Final shutdown and Decommissioning.

The above decree states that the license holder remains the primary one responsible for the nuclear safety of their facility.

In fact, the provisions related to responsibilities of license holders stated in this decree are covered by law 142-12.

Law N° 12-02 related to Civil Liability for Nuclear Damage

Law 12-02 of 07 January 2005 was promulgated to ensure civil repair of the damage which could be caused by certain peaceful nuclear energy uses; this is in accordance with the Vienna Convention pertaining to the civil liability as regards nuclear damage.

It designates the owner of the nuclear installation as the only one responsible for any nuclear damage caused by a nuclear matter coming, being or emanating from its nuclear installation. For the application of this Law, the Decree n° 2.06.04 of 1 February 2006 states the government financial guarantee to CNESTEN. The above regulations were completed by a certain number of the following ordinances regarding:

- The nature of radionuclides composing the groups of radio toxicities.
- Cases of exemptions of authorizations and declarations.
- Values of the radiological and tissue weighing factors.
- Dose limits and methods for using dosimeters.
- Delimitation and particular indication of working areas.

Hereafter is a brief description of the procedure followed for the construction of the Nuclear Research Centre of Mâamora (CENM) which contains the only waste management facility in the country.

Law N° 12-03 on Environmental Impact Studies

- It defines the objectives and contents of the Environmental Impact Study.
- It creates National Committee and Regional Committees on Environmental Impact Studies to examine the environmental impact studies and to provide their position on the environmental acceptability of the projects.
- It foresees mechanism to detect Cases of Non-Compliance with the provisions of the present law and its regulatory texts for its implementation.
- It approves any project submitted for an EIS subject to an environmental acceptability decision.
- It grants the local community and stakeholders the right to access the content of EISs (with the exception of information deemed confidential), to get answers about their enquiries and to express their acceptance of the project.
- This paragraph describes draft regulations dealing with radioactive waste management.

Since the last review meeting, AMSSNuR has developed the following regulations:

Draft Decree on safety of radioactive waste and spent fuel management

This decree defines the framework and principles of radioactive waste management, the authorization and inspection regime of radioactive waste and sets general requirements to meet before the release of radioactive waste to the environment.

Furthermore, it states obligations and responsibilities of the operator, the waste generator in terms of respecting waste acceptance criteria and commitment to ensure high level of safety, and states responsibilities and missions of the centralized radioactive waste management organization in accordance with articles 83 and 84 of the law 142-12.

It also sets requirements related to interdependencies between predisposal steps of radioactive waste management.

Moreover, this decree also includes sections defining requirements dealing with disused radioactive sources, safety cases and safety assessment of predisposal and disposal facilities, management systems and periodic safety reviews of radioactive waste management facilities.

Ordinance on characterization of radioactive waste

Regarding the characterization of radioactive waste, this regulatory text:

- Provides regulatory provisions on the characterization of radioactive waste in order to make sound decisions concerning the subsequent stages of their management from their production to their disposal in accordance with the regulations in force and by adopting the best available methods and technologies,
- Provides general guidelines for the development of waste acceptance criteria for the centralized radioactive waste management organization at national level,
- Defines radioactive waste management measures in accordance with the waste acceptance criteria for predisposal and disposal.

Clearance and exemption levels ordinance

Based on the IAEA general safety requirements GSR Part 3 entitled "Radiation Protection and Safety of Radiation sources: International Basic Safety Standards" and in accordance with the provisions of article 78 of the law 142-12, this ordinance defines requirements on clearance and exemption levels.

International Instruments

The Kingdom of Morocco has committed to the following legally binding and non-binding instruments.

Legally binding instruments

1. Convention on the Physical Protection of Nuclear Material (CPPNM) (entered into force on September 22, 2002);
2. Amendment to the Convention on the Physical Protection of Nuclear Material.
3. Convention on Early Notification of a Nuclear Accident (entered into force on November 7, 1993);
4. Vienna Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (entered into force on October 7, 1993);
5. Convention on Nuclear Safety entered into force on August 19, 2019;
6. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (signed on September 29, 2001);
7. Vienna Convention on Civil Liability for Nuclear Damage (signed on November 30, 1984);
8. Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage (entered into force on October 4,2003);
9. Convention on Supplementary Compensation for Nuclear Damage (entered into force on April,15, 2015);
10. Convention on nuclear Safety ratified in May 2019.

Regarding this Convention on Nuclear Safety, AMSSNuR drafted its first national report in collaboration with all stakeholders and submitted it in December 2019 for the 8th Review Meeting of the contracting Parties to this convention which was postponed to March 2021 due to the current global situation of the COVID-19 pandemic.

Non-Legally binding instruments

1. Code of Conduct on the Safety and Security of Radioactive Sources
2. Supplementary Guidance on the Import and Export of Radioactive Sources.
3. Supplementary Guidance on the Management of the disused radioactive sources.
4. Code of Conduct on the Safety of Research Reactors.

Examination of the authorization of construction of the CENM:

The CNESTEN submitted to MEME in October 1996, together with a preliminary safety analysis report, an application for a construction authorization of the CENM.

This department addressed the National Commission of Nuclear Safety (CNSN) and the Provincial Assembly of Kenitra city to ask for their opinion on this request.

The Provincial Assembly of Kenitra gave a favorable opinion for the construction of the CENM on 04 April 1997.

Between December 1996 and April 1997, the CNSN examined the technical documents of the authorization request and delivered a favorable opinion. The authorization of construction was granted by the Prime Minister's decree n° 2-99-111 of 26 February 1999.

Examination of the authorization of Discharge of liquid and gas effluents:

The authorization of discharge of radioactive effluents, liquid or gaseous, is issued by a joint order of the Minister of Energy, the Minister of Public Health, the Minister for Environmental Protection and the Minister of Public Works after the National Commission for Nuclear Safety's opinion.

The application for authorization of the discharge of liquid or gaseous radioactive effluents must be addressed to the Minister in charge of energy, together with a document giving information on the systems envisaged for the treatment of liquid and gaseous radioactive effluents to maintain the quantity and the concentration of radioactive releases within the prescribed limits.

This application must be supported by a detailed study containing all possible information concerning the nature, the importance and the modalities of these discharges in relation to the normal operation of the envisaged installation.

CNESTEN submitted, in August 2001, the technical dossier of the impact study of the liquid and gas discharges to be generated by the normal operation of the CENM at the National Committee of the Impact studies (CNEI) which issued a favorable opinion.

The MEME carried out the examination and evaluation of the conformity of the information provided by CNESTEN with the national regulation requirements and those relating to international references (in particular IAEA). The Ministers of Health and of Environment and Water, as well as the National Commission on Nuclear Safety (CNSN), approved the dossier presented by CNESTEN.

Based on observations and recommendations provided by the qualified services of MEME, of CNSN, by the Minister of Health and through the contribution of the international co-operation, the project of decree was worked out and finalized. The Ministerial Order was issued on 23 December 2005.

Examination of commissioning authorizations

CNESTEN submitted to MEME, the former regulatory body, the application for authorizations of commissioning, together with the temporary safety analysis report. After consultation with different departments concerned, the commissioning authorization was issued to CNESTEN by ministerial ordinance.

Examination of operating authorizations

CNESTEN submitted to MEME, the former regulatory body, the application for authorizations of operation, together with the final safety analysis report. After consultation with different departments concerned, the operating authorization was issued to CNESTEN by ministerial ordinance.

E3 Regulatory body

Article 20:

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 fulfill 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.

As mentioned above, law 142-12 set up AMSSNuR as an independent authority body to regulate all issues related to nuclear and radiological safety and security. It took over the missions and attributions related to nuclear and radiation safety and security that were previously assigned to the Ministry of Energy and Mines and to the Ministry of Health.

According to law 142-12, AMSSNuR is placed under the authority of the Head of Government and endowed with a legal personality and a financial autonomy.

AMSSNuR is governed by its Board of Directors that is vested with all the necessary powers and approvals necessary to its functions.

According to art 174, AMSSNuR ensures its missions excluding any function, use and promotion of nuclear energy or sources of ionizing radiation sources.

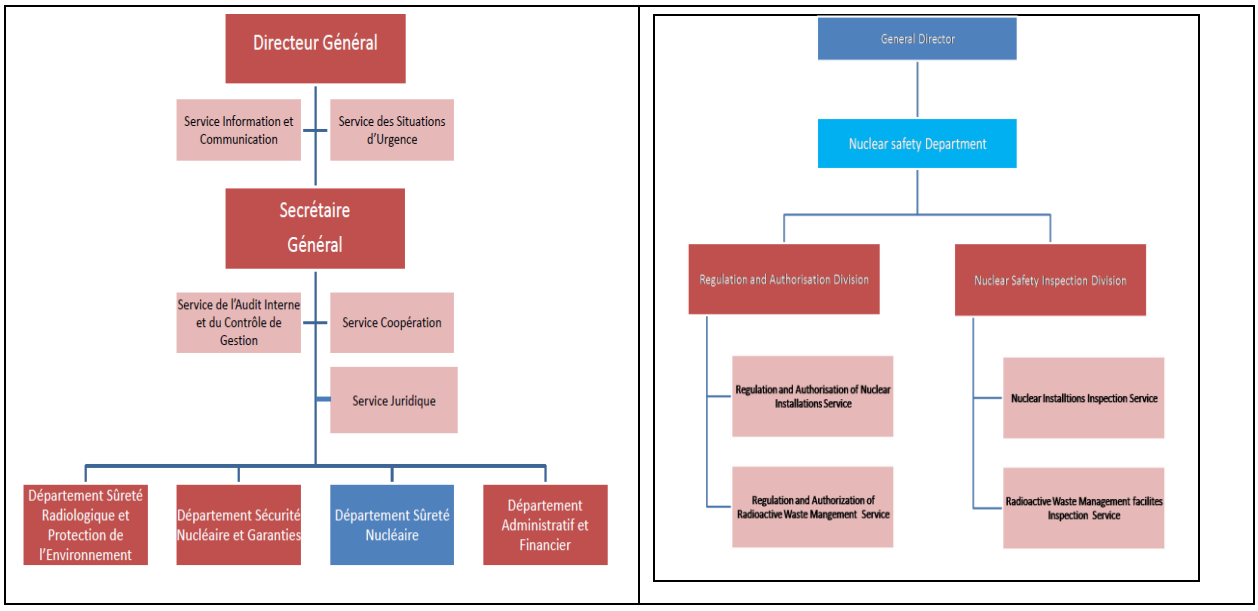
In terms of human resources management, by the end of 2020, AMSSNuR has so far recruited 82 persons, 7 of whom are originally from the CNRP, the former regulatory body in the field of radiation safety and it expects to recruit 110 persons by 2022.

In addition, and as stipulated in art. 182, AMSSNuR may also seek external consultants and national or international contractors to carry out well-defined missions and tasks.

In order to accomplish its assigned mission as appropriate, AMSSNuR is structured as mentioned in its organizational chart.

As mentioned in the chart of figure n°3, AMSSNuR has made management of radioactive waste its top priority.

Figure n° 3: AMSSNuR's organizational chart



Indeed, AMSSNuR has dedicated two separate services dealing with radioactive waste management.

AMSSNuR has a service in charge of authorizations and regulations and another one responsible for the inspection of radioactive waste facilities. Both services are respectively under the authorization and regulation Division and the inspection of radioactive waste facilities Division.

These Divisions are under the umbrella of the nuclear safety Department.

Progress made since the last review meeting:

To ensure its missions and attributions, AMSSNuR has set an organizational chart based on its core functions, governance, and support processes.

This organization includes 42 responsibility positions (heads of departments and two lower positions for sections and operational units). 54 % of the responsibility positions have been filled by the end of October 2020 where 46 % of responsibility positions are occupied by women.

Regarding capacity building and Human Resources, the subsection F-2 on Human and Financial Resources provides more details about these subjects.

Section F: OTHER GENERAL SAFETY PROVISIONS

Article 21. F.1: 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 license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.
2) If there is no such license holder or other responsible party, the responsibility rests with the Contracting Party, which has jurisdiction over the spent fuel or over the radioactive waste.

ROLES AND RESPONSIBILITIES

According to Article 83 of Law 142-12, the main organizations responsible for radioactive waste management are:

- Radioactive Waste generators.
- Radioactive Waste management organizations to be designated by law; and,
- AMSSNuR.

In the absence of any duly designated party, the State is deemed responsible.

F.1. Radioactive Waste Generators

License holders of facilities generating radioactive waste and practitioners licensed to utilize radiation sources are required to perform their activities in compliance with Law 142-12 and its associated regulations.

According to Articles 1, 86, 90 and 92 of Law 142-12, the operator implements measures of radioactive waste management with a view to:

- Keeping the level of production and activity of radioactive waste as low as possible.
- Considering the links of interdependence between the different stages of the radioactive waste management such as preprocessing, processing, packaging, warehousing, and storage.
- Considering the biological, chemical and other risks associated with the management of radioactive waste.
- Implementing the characterization and management procedures of this waste, according to the provisions set by the regulation.
- Maintaining updated records of radioactive waste generated and/or managed (types, characteristics, quantities, status, location, etc…).

- Reporting annually to AMSSNuR on the current inventory and expected short-term and long-term inventory of radioactive sources.
- Ensuring that adequate human resources are available to maintain these resources.
- Complying with the prescriptions and technical regulations foreseen by law 142-12.
- Notifying to the Agency significant incidents related to the safety, security, or physical protection of the authorized activities.

Moroccan regulations stipulate that the license holder is responsible for safety of waste management facilities. They must inform AMSSNuR about any modification or change in the installation that could impact its safety. All activities pertaining to radioactive waste or spent fuel require the corresponding authorization.

Operators of facilities generating radioactive waste and practitioners authorized to utilize ionizing radiation sources are required to perform their activities in compliance with Law 142-12.

Regarding the radioactive waste management at CENM, a dedicated radiation protection unit worker is appointed in each installation where the radioactive material is used, to keep an eye on the respect of radiation protection and safety requirements.

The Moroccan regulation also stipulates that, beside the safety of the installation and workers, the license holder is responsible for waste until it is collected by CNESTEN or discharged to the environment with the authorization from AMSSNuR. The characterization, segregation and storage according to safety and radiation protection requirements are defined by AMSSNuR, while waste acceptance criteria are defined by CNESTEN.

Furthermore, based on the license holders operational experience and the undertaken research and development, the facilities generating radioactive waste are required to periodically reassess the safety of their facilities and practices and re-evaluate their radiological and environmental impact on workers, the public and the environment.

They shall also set up financial arrangements to manage their waste in accordance with the Polluter pays principle, stated in article 92 of law 142-12.

F-2: Human and financial resources

Article 22.

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

a) Qualified staff is available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility.

b) 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.

c) Financial provision is made which will allow the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

According to article 31 of law 142-12, adequate financial resources and sufficient qualified staff must be available for activities related to the safety of a nuclear facility throughout its lifetime. These activities must cover the design, construction, operation, final shutdown and decommissioning of the nuclear facility.

By law, the availability of trained and qualified personnel is part of the licensing process. The law states that the licensee ensures that workers involved in the use of radioactive material are sufficiently trained in radiation protection and capable of implementing radiation protection measures to protect themselves and the surrounding environment.

The government provides funding to CNESTEN to finance safety of the radioactive waste management facility during its operating lifetime and to carry out all operations related to radioactive waste management.

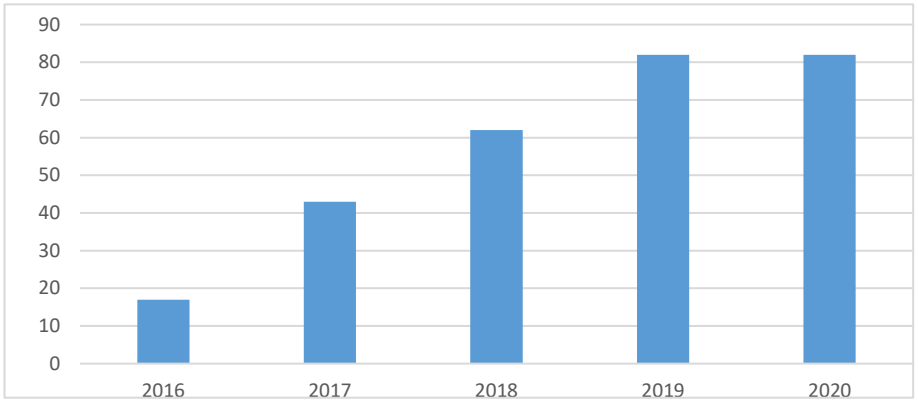
According to article 92 of the law and to the polluter pays principle, the radioactive waste generator pays fees for the collection, treatment, and storage of his generated waste.

The Administration considers the technical and financial capacity of the applicant that would ensure that the project is carried out in compliance with the provisions of this law, including dismantling of the facility, restoration, and monitoring of the site.

Progress made since the last review meeting

In order to comply with international obligations and with provisions of law 142-12, the national policy and strategy for nuclear safety stipulates considerations on the requirements and provisions for human and financial resources to ensure an effective nuclear safety regime.

Figure n° 4: AMSSNuR's Workforce Evolution



To support the development of all its activities and programmes detailed in the above parts, AMSSNuR has implemented a recruitment and integration programme for its staff, whose overall workforce is established at 82 employees at the end of August 2020, recording an increase of 1.23 % compared to the end of 2019 .

Pursuing its human resources development strategy, the workforce targeted by AMSSNuR is around 110 employees for the full development phase in 2021/2022, as presented in figure n°4 above.

In 2020, for reasons related to budget restrictions due to COVID 19, AMSSNuR froze its recruitment and appointment programme for senior positions provided for in its organization chart, the execution rate of which was 56% at the end of August 2020.

Within the framework of human resources development, AMSSNuR is implementing a master plan for its staff and a national strategy for education and training in nuclear and radiological safety and security.

To manage effectively regulatory body competences, AMSSNuR is using the Systematic Assessment of Regulatory Competence Needs (SARCoN) tool in order to determine its required regulatory competences. Furthermore, the implementation of this tool will contribute to the definition of competency needs and assist managers in planning and implementing the necessary training to meet expected future competency needs, when internally sourced.

As a support to the Government, a national strategy for education and training on nuclear and radiological safety and security was developed by AMSSNuR with a view to meeting the future needs resulting from the development of the use of ionizing radiation in the socio-economic sectors which was presented to the Board of Directors in November 2019.

F-3: Quality assurance

Article 23. Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programs concerning the safety of spent fuel and radioactive waste management are set and implemented.

According to the provisions of law 142-12, a quality assurance program is requested for any nuclear facility and radioactive waste management installation during construction, commissioning, operating lifetime, and decommissioning. This programme is subject to evaluation by AMSSNuR.

The safety analysis report on nuclear installation includes data on the quality assurance programs of the applicant and their services and equipment suppliers. The quality assurance program contains the organization, staff skills, work procedures, periodical check of the equipment efficiency, periodic calibration of measuring equipment, traceability and record keeping of data.

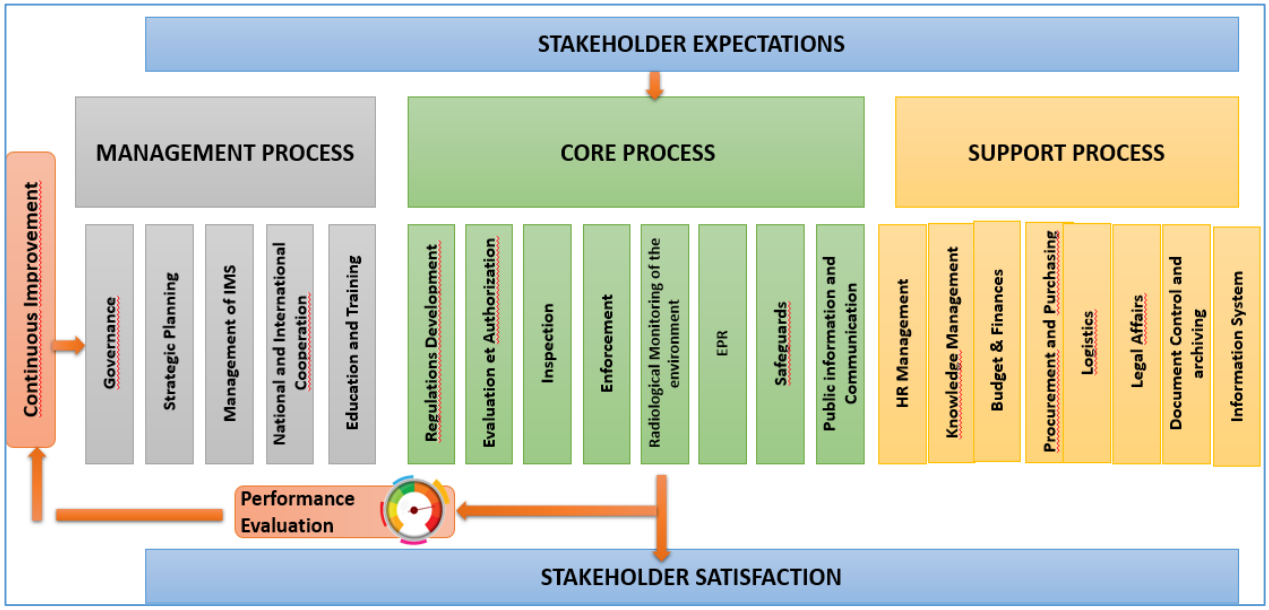
A Management System was developed by CNESTEN for its radioactive waste facility which was inspected by AMSSNuR in April 2019. This management system includes a quality assurance manual and its associated operating and management procedures. It is noted that all recommendations were implemented.

Concerning AMSSNuR, in the framework of its cooperation with EU and IAEA, it established a strategy to develop and implement its specific integrated management system based on IAEA GSR part 2 and ISO 9001: 2015 standard.

In 2020, AMSSNuR started the implementation of three prior processes dealing with core functions 'Authorization', 'Development of Regulations' and 'Safeguards'.

Based on the following process mapping (Figure n°5), AMSSNuR will continue, in 2021/2022, the strategy of the IMS implementation with the objectives aiming at anchoring the safety and security culture and consequently at maintaining a high level of safety.

Figure n° 5: Process mapping of AMSSNuR's Integrated Management System



In this regard, AMSSNuR has developed a manual of its IMS which will include all policies, strategies, processes, procedures and records with the objectives to continuously improve nuclear safety and security and to develop and maintain nuclear safety and security leadership.

F-4: Operational radiation protection

Article 24.

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:

a. The radiation exposure of workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account.

b. 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.

c. Measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.

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

a. to keep radiation exposure as low as reasonably achievable, economic and social factors being taken into account; and

b. 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 the appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in case of an unplanned or uncontrolled release of

radioactive materials into the environment occurred, appropriate corrective measures should be implemented to control the release to mitigate its effects.

The Decree n° 2-97-30 of 28 October 1997, currently in force, sets up the general principles of radiation protection against hazards resulting from the use of ionizing radiation to protect workers and members of the public from the risks deriving from ionizing radiations. Consequently, these principles are applicable to facilities where the spent fuel and radioactive waste are managed.

The regulation establishes justification, optimization and limitation as the basic principles of protection and specifies the general conditions and requirements applicable to the different groups and situations. At the nuclear installations where the spent fuel and radioactive waste are managed, operational radiation protection measurements include:

- Classification and delineation of working areas.
- Classification of employees in different categories.
- Individual monitoring and/or monitoring of the working area.
- Respect of dose limitation.
- Respect of procedures related to radiation protection.
- Surveillance and monitoring of the discharge of liquid or gaseous effluents.

The discharge of radioactive gaseous and radioactive aqueous effluents are specified and quantified by a ministerial order. The radioactive waste management facility in CENM has a radiation protection system which ensures the surveillance of individuals and the environment with regard to the radiological nuisance caused by the facility.

The functions performed by this system are as follows:

- Local control of external radiation by fixed or mobile device.
- Monitoring risk areas of beta-gamma contamination with fixed or mobile aerosol monitors.
- Local control of contamination and irradiation by portable devices.
- Control of personnel and small equipment contamination at the exit.
- Assessment of radioactive discharges into the stack.

The operating principles of this system are:

- Fixed radiation monitoring equipment of the facility are parts of the network of the site's radiation protection.

- A computer station in the facility's control room is exclusively dedicated to radiation protection monitoring. Such a device allows a Radiation protection officer to manage the facility's radiation protection.

F-4.1: Protection of workers

To keep exposure to radiation at its reasonably achievable lowest level, all measures are adopted in the nuclear facility. Workers' professional exposure as mentioned in the decree on radiation protection should not exceed the limits hereafter:

- Effective dose of 20 mSv per year on average over five consecutive years.
- Effective dose of 50 mSv in only one year.
- Equivalent dose to the crystalline of 150 mSv in only one year.
- Equivalent dose to the extremities (hands, feet) or to the skin of 500 mSv per year.

In the case of women in the age of procreation, all radioactive exposure must be distributed as uniformly as possible in time. Any woman who nurses shouldn't be appointed or maintained in a post involving a risk of incorporation of radionuclides. Any woman found pregnant shouldn't work under working condition 'A' where the annual exposure under normal situation can exceed three tenth of the above-mentioned limits. The exposure of pregnant women must be as low as it is reasonably possible to achieve.

Law forbids appointing any worker under 18 to a post where s/he can be exposed to radiation. Professional exposed workers are provided with regulatory thermoluminescent dosimeters which are read monthly by CNRP.

In addition, workers need to use individual direct reading dosimeters to know the daily dose received at work. In order to know their internal dose, professional exposed workers are controlled annually by direct measurement of body radioactivity.

In radioactive waste management installation, contamination of personnel is controlled with a hand-and-foot monitor connected to a radiation protection network at the exit of the controlled area.

F-4.2: Protection of the public

During the licensing process, the applicant should provide evidence that public exposure is kept as low as reasonably possible in compliance with the following dose limits, as mentioned in the regulation:

1. An effective dose limit of 1mSv per year.
2. In particular circumstances, the effective dose limit may be authorized to reach 5 mSv in one year provided that the average over five consecutive years does not exceed 1 mSv per year.
3. Equivalent dose limits of 15 mSv per year for the crystalline and 50 mSv/y for the skin.

In order to guarantee compliance with the above limits, the licensee should have:

- An authorized installation based on the evaluation of the installation's safety analysis report.
- An authorization from the corresponding regulatory body for the environmental release of radioactive effluent (liquid or gaseous);
- An environmental impact study where it proves that the environmental release of radioactive effluent and the dose received by the population fully respect the regulatory limits.
- An appropriate storage area to keep radioactive sources safe and secure.

F-4.3: Unplanned or uncontrolled release of radioactive material

In order to prevent unplanned or uncontrolled release of radioactive material into the environment, the nuclear research reactor and radioactive waste management facilities at the CENM are equipped with the following:

- Surveillance instrumentation to detect any release,
- Alarms and shut down systems of any operation when the release exceeds the safety settings values,
- Administrative controls and record keeping,
- Emergency plan and response.

F-5: Emergency preparedness

Article 25.

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

F-5.1: National plan for nuclear and radiological emergencies

Morocco has ratified the two conventions on:

- Early Notification of a Nuclear Accident; and,
- Assistance in the case of a Nuclear accident or Radiological emergency

In this framework, Morocco has implemented the provisions of the Conventions on Early Notification and Assistance by developing its national capacities to address radiation emergencies, resulting either from an incident or from a security event through training and exercises.

The Kingdom of Morocco has a national crisis center at the ministry of interior to manage all types of emergencies including Emergency Preparedness and Response "EPR".

To further strengthen the national infrastructure and to meet the objectives of national EPR arrangements, Morocco has undertaken the following main actions:

- The establishment of the Monitoring and Coordination Center (CVC) of the Ministry of the Interior which is the National Crisis Center to coordinate the management of disasters and emergencies, including nuclear or radiological situations.

  The CVC (strategic level of emergency management), attached to the Ministry of the Interior, is the intermediate level of emergency management between the political level and the operational level. This center is in charge of monitoring the evolution of rescue operations and liaises and disseminates data between the interministerial Committee and the Director of Rescue Operations.

  The CVC is seen as an organizational and operational realization of the investment of the Kingdom of Morocco in terms of reviewing approaches and strengthening emergency management tools.

  The creation of the CVC in response to a need for the existence of a tool for decision support, management and coordination between all the actors gives it a leading role in terms of crisis management in the event of a natural or anthropogenic risk,

  The CVC provides the interface with the operational centers of the different parties (DGPC, DGSN, GR, etc.)
- The development of the technical crisis center of CNESTEN.
- The preparation and conduct of the following exercises:

- A full-scale drill to test national response to a transportation accident involving radioactive materials (2009),
- An international exercise, combining tabletop exercises with field activities, within the framework of the Global Initiative to Combat Nuclear Terrorism (GICNT) (2010 – 2011),
- A Joint Exercise with Spain "REMEX-2013" on Response and Mitigation (2013),
- An International Exercise "ConvEx3" (Bab Al-Maghrib), with the participation of 58 States and 10 international organizations (2013),
- In collaboration with the International Atomic Energy Agency, Spain and Morocco organized a joint exercise entitled "Gate to Africa", on secure transportation of radioactive sources for medical use by sea between the port of Algeciras (Spain) and Tangier Med (Morocco) from 27 to 29 October 2016.

These exercises constitute an excellent opportunity for Morocco to adopt a coordinated global approach and operational protocols and to enhance its capacities in terms of organization, national and international coordination, information exchange, technical infrastructure development and training of a significant number of participants from national institutions involved in the preparation for and response to radiological emergencies.

Currently, AMSSNuR is preparing a specific national emergency nuclear and radiological plan which is based on the national emergency plan named ORSEC (Plan d'ORganisation des SECours).

Progress made since the last review Meeting

To meet the objectives of the national EPR arrangements, Morocco has organized national exercises supervised by the general direction of civil protection in 2018 as listed below:

- FTX 1 exercise organized at Casablanca Port on May 8, 2018, relating to an accident in the transport of radioactive materials used for medical purposes that occurred inside the port of Casablanca.
- FTX 2 exercise organized at Fes-Sais airport on May 10, 2018 concerning the loss of a package containing a radioactive source.

- FTX 3 exercise organized at Laayoune on September 24, 2018 relating to a traffic accident involving a stolen gamma radiography device.
- FTX 4 exercise organized in Marrakech on September 27, 2018 concerning a malicious act at the Ali hotel.

Furthermore, in the framework of the international conventions on Early Notification and Assistance, AMSSNuR has been designated since June 2019 as a competent authority for a domestic emergency.

AMSSNuR was also designated, in 2018, by the IAEA, as a regional center for developing Capacity Building on Preparedness and Response for Radiological Emergencies and was elected as president of an international network dealing with emergency preparedness and responses.

In this context, AMSSNuR continued its efforts to develop regulations related to the Preparedness and Response to a Nuclear or Radiological Emergency (PR-NRE). This work is carried out in consultation with the ad hoc national committee created for this purpose in order to establish a national integrated management system for a coordinated response in the event of nuclear or radiological emergencies, with all the national stakeholders, from the phase of prevention until the restoration phase, in accordance with the provisions of Law No. 142-12 relating to PR-NRE. Through the cooperation project with the EC / EU, a methodology for developing the PNI-SUNR was established based on a step-by-step approach. It consists in particular in developing:

- A national framework for the preparedness and radiation emergency management.
- A mapping of the hazards associated with installations and activities involving the use of ionizing radiation sources in case of emergency.
- A planning basis and an operating concept for emergency preparedness.

Once the methodology for developing the plan was approved by the members of the Ad-Hoc committee, weekly meetings were held with that committee to prepare the various documents agreed upon, namely:

- The national framework on Emergency Preparedness and Response "EPR"
- The mapping of the hazards associated with facilities and activities in the event of Nuclear or Radiological Emergency.
- The planning basis and operation concept for EPR.

As part of the cooperation with the European Union and with the IAEA, the various aforementioned documents have been revised by European experts in order to meet international guidelines for the preparedness and response to a nuclear or radiological emergency. These documents thus constituted the reference documentation for the development of the first draft of the National Plan on EPR "PNI-SUNR".

Furthermore, AMSSNuR, in close collaboration with concerned ministerial departments, carried out a self-assessment of the regulatory infrastructure for Emergency Preparedness and Response "EPR" on the IAEA EPRIMS platform "Emergency Preparedness and Response Information management System" for EPREV "Emergency and Response Review "mission purposes.

In 2020, AMSSNuR continued its efforts and its consultation activities with the ministerial departments and concerned parties, as well as its cooperation activities with the EU, IAEA, and American partners, aimed at establishing the National Plan on EPR in which AMSSNuR and the following key organizations are involved:

1. Ministry of Interior;
2. General Directorate of Civil Protection (DGPC);
3. General Directorate of National Security (DGSN);
4. National Defense Administration (ADN);
5. Royal Armed Forces (FAR);
6. Royal Gendarmerie (GR);
7. The Royal Navy (MR);
8. Ministry of Foreign Affairs, African cooperation and expatriates;
9. Ministry of Health;
10. MEME;
11. Ministry of Agriculture;
12. Ministry in charge of equipment and transport;
13. General Directorate of Meteorology;
14. National Radiation protection Center (CNRP);
15. CNESTEN;
16. Ministry in charge of economy and finance;
17. Royal Center for Remote Sensing;
18. National Ports Agency;
19. Customs and indirect tax administration.

Once this National Plan project is finalized by the Ministry of Interior, AMSSNuR intends to pursue its efforts and its consultation activities with ministerial departments and concerned parties, as well as its cooperation activities with the EU, IAEA and US partners, as follows:

- The review by the committee for upgrading the regulatory framework of two draft decrees setting:
  - ✓ The content of internal emergency plans under the responsibility of the operators of the authorized facilities and activities.
  - ✓ Protection strategies in the event of a nuclear or radiological emergency.
- The establishment of a strategy for the design and implementation of emergency response exercises to ensure the periodic updating of the national plan arrangements to verify its effectiveness;
- Through its Capacity Building Center on Preparedness and Response for Radiological Emergencies, AMSSNuR plans to organize, in collaboration with the concerned ministerial departments, the first edition in French of the regional school of radiation emergency management for the benefit of executives from African countries (30 participants), in Rabat from April 5 to 23, 2021; and
- Identification and strengthening of resources and equipment for nuclear and radiological emergencies.

F-5.2: Internal emergency preparedness in CENM

Regarding the decree n° 2-99-111 of 26 February 1999, CNESTEN has established, maintains, and conducts an emergency plan for each facility as well as for the whole site of the Mâamora Nuclear Research Centre (CENM). The emergency preparedness and response program is continually subjected to up-to-date enhancements and improvements based on the operational feedback.

The internal emergency plan describes all the arrangements CENM management takes, in case of crisis, or a radiological or a toxic emergency, in order to:

- Preserve the installation's safety and limit the accident's consequences through the implementation of emergency procedures,
- Protect the staff, the surrounding population and the environment by limiting and controlling the release and adopting the necessary radiation protection measures,

- ❖ Provide first aid to the injured,
- ❖ Inform the competent authorities and the media to take the necessary actions.

The internal emergency plan consists of two documents: The first one describes the means and the organization defining the conditions needed for their implementation, while the second one describes the consequences of a typical accident related to CENM's installations.

Furthermore, CNESTEN is conducting a specific program of environmental surveillance and monitoring in and around the CENM site. Emergency exercises are performed on a regular basis.

It is worth mentioning that the third inspection conducted by AMSSNuR in November 2019 covered the internal emergency plan and the follow up on previous inspection recommendations.

F-6: Decommissioning

Article 26.

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

1- qualified staff and adequate financial resources are available.

2- the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied.

3- the provisions of Article 25 with respect to emergency preparedness are applied; and,

4- records of information important to decommissioning are kept.

Decommissioning as defined in law 142-12 is any step leading to the release from control of a nuclear facility, other than a disposal facility. These steps include the processes of decontamination and dismantling.

The decommissioning of the nuclear installation is not considered for the foreseeable future; nevertheless, law 142-12 addresses this issue as follows:

- According to article 8 of law 142-12, decommissioning of a nuclear facility is subject to an authorization
- As stipulated in article 28 of law 142-12, the operator is responsible, during the decommissioning phase, for:
  - The facility's safety.

- The management of radioactive waste and materials
- The facility's physical protection,

- According to article 29 of law 142-12, the operator should take appropriate measures to ensure the safety and security of the nuclear facility decommissioning namely:
  - Availability of qualified staff and adequate financial resources.
  - Compliance with radiation protection measures and effluents discharges and unplanned or uncontrolled emissions measures.
  - Compliance with the provisions related to the organization of emergencies.
  - Preservation of records containing important information for decommissioning.

As to the financial aspect related to decommissioning, article 31 of law 142-12 states that obligations are imposed on all licensees to allocate adequate human and financial resources for a safe performance of their RWM activities throughout the entire lifetime as licensed facilities, including closure and decommissioning. However, article 32 of law 142-12 also specifies that the costs incurred at the RW disposal sites after facility closure during the institutional control period will be borne by the State.

Additionally, decree n° 2-94-666 of December 1994, related to the authorization and control of nuclear installations states that any decommissioning must be subject to an authorization.

To obtain this authorization, the applicant must submit a report where he describes:

- The arrangements taken for decommissioning, including dismantling, transport and storage operations of radioactive components taking into consideration the radiation protection regulation,
- The measures envisaged to face risks and to limit the consequences of an eventual accident,
- The important radioactive components which will be removed from the installation, the estimate of their radioactivity as well as the proposed measures for their elimination,
- Radiological protection measures to be observed during decommissioning,
- The final physical state in which the operator suggests leaving the installation and an estimate of its safety.

Section G: SAFETY OF SPENT FUEL MANAGEMENT
G1: General safety requirements

ARTICLE 4.
Each Contracting Party shall take the appropriate steps to ensure that during all the 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 abides by 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.

G2: Safety of spent fuel management

Morocco has only one research reactor and there is no spent fuel at the moment. If the return of spent fuel to the country of origin is not possible, it will be stored in the reactor building where a pool was built for this purpose. Concerning nuclear safety conditions, this pool is designed to:

- Store up to 324 TRIGA fuel elements,
- Ensure the reactivity coefficient "k_{eff} "less than 0.8,
- Evacuate the residual heat,
- Ensure a dose rate below the required limits,
- Be resistant to seism, so as to prevent or minimize deformation of the swimming pool and its structures,
- Allow an effective handling of the spent fuel elements during their insertion or their withdrawal, without involving any special biological, chemical and other non-radiological hazard.

G3: Existing Facilities.

Article 5.

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.

As mentioned above under 'G1', the spent fuel will be stored at the dedicated pool at the reactor's building according to the operation authorization.

Regarding law 142-12, both AMSSNuR and CNESTEN are working on the review of the actual regulation and global nuclear safety conditions at the CENM including the spent fuel management.

In this framework, national policy and strategy for radioactive waste and spent fuel management are in the process of finalisation with IAEA support.

G4: Sitting of proposed facilities

ARTICLE 6.

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

(i) evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime.

(ii) evaluate the likely safety impact of such a facility on individuals, society and the environment.

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

(iv) 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.

According to the law 142-12 (Art. 11), the authorizations of the spent fuel management facilities shall be granted only if the applicant demonstrates, in the documents submitted in support of the application for authorization that the technical or organizational provisions taken or planned in the various stages of the site evaluation,

of the design, of the construction of the commissioning tests and the operation, as well as the general principles proposed for the dismantling and shutdown of nuclear facilities, comply with the technical requirements and regulations regarding nuclear and radiological safety and security and of safeguards.

The administration takes into account the technical and financial capacity of the applicant, which should enable it to conduct its project in compliance with the provisions of the law 142-12 including dismantling of the facility, restoration and monitoring of the site.

Concerning existing facilities, CNESTEN, according to the decree 2-94-666 of December 1994 related to the authorization and control of nuclear installations, and before the construction of CENM, submitted a preliminary safety analysis report to the former regulatory body (MEME) for assessment. This report was also evaluated by the National Commission of Nuclear Safety as consultant of the former regulatory body. All the concerned ministries were represented in that Commission.

G 5: Design and construction of facilities

ARTICLE 7.
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.

As mentioned above under 'G1', the spent fuel will be stored at the dedicated pool at the reactor building according to the operation authorization.

At the design stage and conceptual plans, CNESTEN has taken appropriate measures to facilitate the decommissioning of the spent fuel storage facility such as the use of adequate structural materials.

Regarding the law 142-12, AMSSNuR is preparing a regulatory provision dealing with the design and construction of nuclear facilities including the spent fuel management.

G 6: Assessment of the safety of the facilities

ARTICLE 8.

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).

During the authorization's process for the construction, commissioning and operation, CNESTEN has carried out all the required safety analysis of the spent fuel management installation including criticality, environmental impact, radiation protection, etc...

The provisions of the law 142-12 require the nuclear safety analysis report of the facility and environmental impacts.

G 7: 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.

Up to now, the spent fuel pool is empty, since all the fuel elements are under use in the reactor. The provisions of the law 142-12 require the authorization for the operation of any new nuclear facility.

G 8: Disposal of spent fuel

ARTICLE 10.

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.

Not applicable because Morocco does not have a disposal for radioactive waste, including spent fuel.

Section H: SAFETY OF RADIOACTIVE WASTE MANAGEMENT

H1: GENERAL SAFETY REQUIREMENTS

Article 4

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.

Article 11

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;

v-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;

vi-take into account the biological, chemical and other hazards that may be associated with radioactive waste management;

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

viii-aim to avoid imposing undue burdens on future generations.

Regulatory Requirements

The legislative framework has dedicated a full section to RWM. In fact, according to article 85 of the law 142-12, the management of radioactive waste must meet the following principles:

- Achieve and maintain a high level of safety and security regarding the management of spent fuel and radioactive waste;
- Ensure adequate protection of people, environment and future generations against the harmful effects of ionizing radiation, without compromising their abilities to fulfill their aspirations;
- Prevent accidents and mitigate the consequences.

In connection with the reduction of RW during all stages of their management, the law 142-12, through its art 86, stipulates that the operator implements measures of radioactive waste management with the purpose of:

- Keeping the level of production and activity of radioactive waste as low as possible;
- Taking into account the links of interdependence between the different stages of the RWM such as preprocessing, processing, packaging, storage and disposal;
- Taking into account the biological, chemical and other risks associated with the management of radioactive waste;
- Implementing the characterization and management procedures of this waste, according to the provisions set by AMSSNuR.

The law 142-12, through its article 87, puts the responsibility of safety and security on the operator of radioactive waste management facility.

Operational management of RW

The Moroccan licensing process imposes to each user of radioactive materials to manage his radioactive waste in a safely and securely manner. The expected inspections carried out by AMSSNuR ensure that, at all stages of radioactive waste management, individuals, society and the environment are adequately protected.

The item 6 of decree n° 2-99-111 related to the authorization of the construction of CENM requires, as far as radioactive waste management is concerned, that:

- No disposal of radioactive waste be realized in the perimeter of the CENM;
- The installations of management of radioactive waste allow the reduction of the volume and the hazard of the waste generated inside the CENM and those

received from outside. To facilitate its treatment, its conditioning and its later storage, radioactive waste will be sorted taking into account the WAC.

- Any radioactive shipment of waste outside of the CENM will have to go through controls and statutory authorizations,
- An inventory of all types of radioactive waste inside the perimeter of the CENM, clearly indicating their origin, their physical and chemical characteristics, their mode of conditioning, their volume and their activity will be kept up to date by the CNESTEN within the framework of the general rules of exploitation.

Without prejudice to the application of the current regulations, any nuclear accident or incident having or that may have considerable consequences on the safety of the installations of the CENM, will have to be reported within 24 hours by the CNESTEN to the Regulatory body, to the Minister of Interior, the Minister of Health and the Minister of Environment.

There is no exemption limit in our regulation but the release or the discharge of radioactive waste is subject to an authorization from AMSSNuR while using the clearance level of the IAEA.

Criticality and removal of residual heat is not a concern for low and intermediate level waste (LILW) treated and conditioned in the Nuclear Research Centre of Mâamora (CENM).

The waste minimization concept is taken into consideration in order to keep the generation of waste at the minimum practicable. The minimization is ensured by means of volume reduction practices, established procedures and decontamination.

Interdependences of the various steps in radioactive waste management are taken into account in the waste management facility located in CENM.

All the waste treatment, conditioning, handling, storing and transport operations are carried out in the radioactive waste management facility, except the management of spent fuel which takes place in the reactor's building.

The application for the authorization of operation must be addressed to the Regulatory body, accompanied by the final safety analysis report that complements and updates the preliminary safety analysis report. The final report must include:

- Test results of commissioning of the nuclear facility;

- Operating Limits and Conditions 'OLCs', which must take into account the final characteristics and the results of the commissioning of the plant. These OLCs include:
  - safety limits
  - the settings of safety systems;
  - the limits and conditions for normal operation of the facility;
  - the need for monitoring safety and radiation protection, including maintenance, in-service inspection and periodic testing;
- The operating programs and detailed procedures for operating the installation.

Biological, chemical and other hazards present in radioactive waste are considered and all the requirements to protect workers and the environment are taken into account during the management of such type of waste. Some contents of these substances in radioactive waste are limited within the "Technical Specifications" of the radioactive waste management unit.

H2: EXISTING FACILITIES AND PAST PRACTICES

Article 5.

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.

Article12.

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.

Past practices before the construction of the RWM installation

Radioactive waste generated in Morocco arises from medical, industrial and research applications of radioisotopes. They are essentially disused sealed and unsealed sources, solid waste materials that contain residual activity and liquid radioactive waste mainly generated by the medical sector.

Disused sealed sources practices are treated separately under section **J Article 28**.

Requirements for the licensing of the use of sealed and unsealed sources are established by Article 51 of the decree n°2-97-30 of October 28th, 1997 on radiation protection.

The authorization includes the conditions relating to the safe management of radioactive waste generated by licensees.

Solid waste materials that contain residual activity are segregated and controlled at source; they are isolated and stored in an interim storage room for decay until the levels of radioactivity are near the background level.

Only waste which is properly labelled, including all required information (origin, date of storage, radionuclide, etc.) is accepted for interim storage which is protected by sufficient shielding, either in the walls or as movable shielding material to ensure that individuals' radiation doses in accessible areas outside the storage area are below regulation's dose limits.

An authorization for elimination of radioactive waste into the environment is required following a control carried out by the regulatory authority. Licensees are obliged to report the quantities of radionuclides disposed of into the environment. Gaseous and liquids wastes are mainly generated in hospitals and medical analysis laboratories.

Gaseous radioactive wastes generated by medical activities, to be discharged into the atmosphere, must have a specific activity level below 4Bq/m3.

Liquid radioactive wastes generated by medical activities are routed through special pipelines to two tanks for storage and decay, until the specific activity is below 7Bq/l, then they can be disposed of into sewers after a licence is granted by the regulatory authority. For the activities in the CENM, the annual release is as follows.

Table n° 2: Annual activity to be released

Parameters	Annual activity to be released (GBq)
Tritium	50
Carbon 14	0.5
Nobel gas	15000
Nitrogen 16	25000
Radioactive iodine	0.9
Other beta and gamma emitters	0.05

Description of the RWM installation

The only existing radioactive waste management facility in Morocco is the waste treatment and storage facility at CENM. It consists of an operational waste treatment building and waste storage building for low and intermediate level radioactive waste:

- Treatment building named DT (surface area at the ground472.5 m^2) at three levels –4.00, 0.00, +3.50. The underground level houses the storage tanks, the ground level houses the evaporation system, compaction system and the radiochemical laboratory, the 1st floor houses the offices of the technical staff and the concrete laboratory,
- Long term storage building called DE consists of four vaults (616 drum/vault); each one has a surface of 52 m^2 (8.8m x5.9 m) and a height of 3.5 m while the thickness of the concrete wall is 0.40 m.

Earthquake risk has been taken into account in the design of the treatment building, of the long term storage building and of the travelling crane for handling.

The DT contains:

- an evaporator unit designed to treat 5 m^3 of aqueous liquid during each campaign ;the volume of the sludge generated after each campaign is 200 liters;
- A compactor for compactable waste;
- A glove box to sort solid waste;
- A mortar injection system used to condition the sludge in 100 liters' drums;

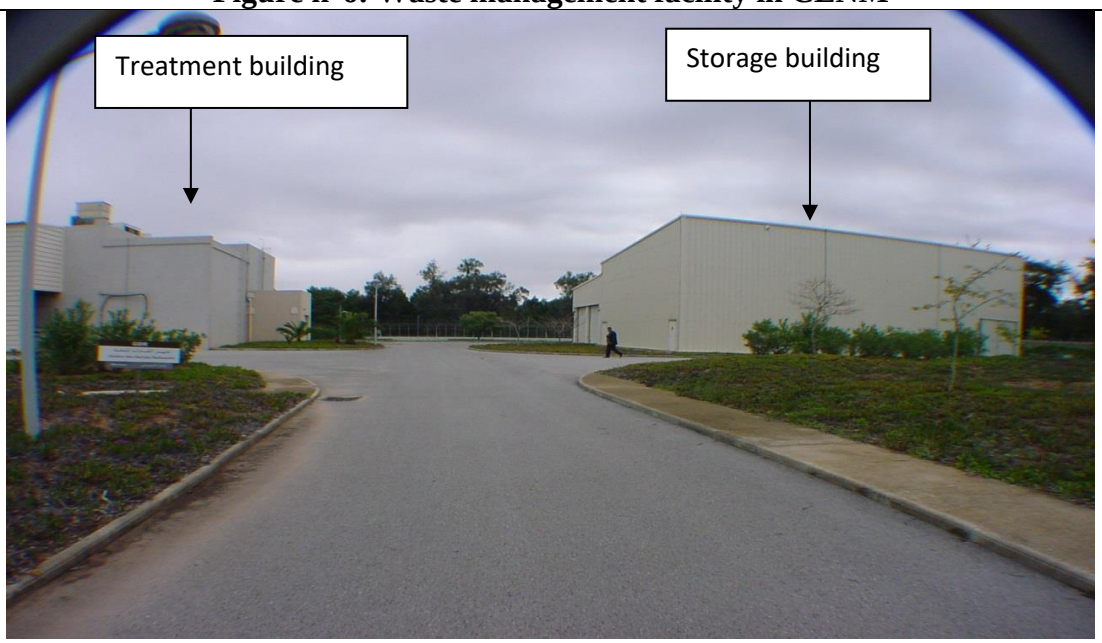
- A mixing machine to ensure the homogeneity of radioactivity inside the conditioned drum of sludge;
- Two stainless steel storage tanks for radioactive aqueous waste. Each one has a capacity of 6 m^3 and two other tanks have a capacity of 3 m^3 each to store clean effluent before its discharge to the close river;
- A chemical laboratory to characterize radioactive liquid waste;
- A concrete laboratory.

The main characteristics of DE are:

- long term storage,
- capacity of 2496 drums placed in 4 levels, with the fourth one containing only unconditioned waste,
- designed to enable an expansion when the current storage is full.

Currently, the LILW facility is able to receive raw radioactive waste from the producers.

Figure n°6: Waste management facility in CENM



Vault in storage building

The radioactive waste management installation existing at the CENM is based on the processes of cementation of sludge issued from evaporation of liquid aqueous radioactive effluents and of compacting of compressible radioactive solid wastes to reduce their volume. Spent sealed sources are conditioned in a cemented drum and the organic radioactive waste is solidified and cemented in a 100 litre drum.

According to the regulation, the safety analysis report of the installation must include:

- Information on control, handling and storage of the radioactive waste generated in the installation;
- Information on the basic conception of the envisaged installation and safety and radiological protection systems as well as the results of the safety analysis, susceptible to affect the structure, the systems and the constituents involved in the safety;
- Measures relative to the civil liability in case of nuclear damages.

The examination of the safety of the radioactive waste management installation, particularly the most important element of the safety, is performed periodically by AMSSNuR.

From the commissioning, in terms of safety, important installations and equipment will have to correspond to the description given in the approved final safety analysis report and must be operated according to the operation OLCs.

If the CNESTEN wishes to carry out modifications in installations that may have an incidence on the conditions of safety as stated in the authorization, the regulatory

measures of the decree concerning the authorization and control of nuclear installations are applicable.

H3: SITING OF PROPOSED FACILITIES

Art 6

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.

ARTICLE 13.

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.

As it was stipulated in article 2 of the law 142-12, nuclear installations and nuclear activities, as well as final disposal facilities under Category I are subject to the

authorization of the administration, in accordance with the procedures laid down in the regulation.

The category I includesnuclear installations and nuclear activities as defined below:

- ❖ Design, construction, commissioning tests, operation and maintenance of installations implementing ionizing radiation sources as well as their final shutdown, including their decommissioning and dismantling.
- ❖ Manufacture, acquisition, import, export, transit, distribution, possession, use, transfer for free or for a fee, transportation, storage and disposal of ionizing radiation sources;
- ❖ Management of radioactive waste;
- ❖ Extraction and processing of radioactive ores;
- ❖ Disposal facilities.

According to the law 142-12, the process of authorisation for construction of waste management facilities shall be delivered by the Administration after the assessment of the SAR submitted by the applicant to AMSSNuR. The preliminary report includes:

- ➢ A location plan indicating the perimeter of the site where the envisaged installation will be built;
- ➢ The calculations and evaluations showing that natural phenomena and characteristics of the site were duly taken into account, together with an environmental impact study intended to demonstrate that the envisaged installation can be built and operated without risk for the operating staff, the public and the environment;
- ➢ Information on the basic design of the envisaged installation and on the systems of safety and radiological protection as well as the results of related safety issues , that may affect the structure or the components in terms of nuclear safety;
- ➢ Information on the quality assurance programme of the applicant and his suppliers of services and equipment.

The evaluation of the capacity of the site to receive the installation shall take into account the following aspects, in particular:

- ➢ Effects of external events due to natural causes or to man-induced actions which would occur in the region of the site,
- ➢ Characteristics of the site or its environment, that may influence the transfer of released radioactive materials to human beings,

- Density and distribution of the population in the vicinity of the site, with a preliminary evaluation of the radiological effects on the population.

Concerning information of the public and its involvement in the decision making process, the law 142-12 has included a set of requirements governing the public hearing.

In fact, according to art 14 of this law, the project of construction of a category I installation gives rise to a public inquiry whose process is set by regulation.

The purpose of this inquiry, which is to enable the public to become acquainted with the project and to make any comments on a register opened for this purpose, is conducted by the president of the municipality council concerned.

It is to be noted that the national legislative framework has includes the law N° 12-03 on Environmental Impact Studies by which all issues related to public involvement in the decision making process are dealt with.

H4: DESIGN AND CONSTRUCTION OF FACILITIES

Art 7

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 the decommissioning of a spent fuel management facility.

Art 14.

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

1-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;

2-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;

3-at the design stage, technical provisions for the closure of a disposal facility are prepared;

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

A radioactive waste management facility in the Moroccan legislation is submitted to five authorizations:

- ✓ Authorization for construction;
- ✓ Authorization for discharge of liquid and gas effluents;
- ✓ Authorization for commissioning;
- ✓ Authorization for operation;
- ✓ Authorization for decommissioning.

All these authorizations are subject to the submission of a report by the owner of the facility in which he specifies all the safety and radiation protection measures taken to protect individuals, the society and the environment.

All these authorizations are assessed and granted by AMSSNuR.

H5: ASSESSMENT OF SAFETY OF FACILITIES

ARTICLE 8.
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.

ARTICLE 15.
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;
3-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).

During the authorization process for the construction, commissioning and operation of any spent fuel or radioactive waste management facility, the applicant has to submit a safety analysis report to AMSSNuR.

AMSSNuR shall assess this SAR in order to allow the Administration to deliver the requested authorization.

H6: OPERATION OF FACILITIES

ARTICLE 9. Each Contracting Party shall take the appropriate steps to ensure that:
i-the license 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 program 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 license to the regulatory body,
vi-programs to collect and analyze 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.
ARTICLE 16: Each Contracting Party shall take the appropriate steps to ensure that:
i-the license 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 program 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 license to the regulatory body;
vi-programs to collect and analyses relevant operating experience are established and that the results are acted upon, where appropriate;
vii-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;
viii-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.

The operational technical specifications for a waste management facility are listed in the authorization document. Any changes in these operational limits and conditions must be approved by AMSSNuR before they are carried out.

The holder of the license is the primary responsible for the safety and the security of his facility; he has to notify AMSSNuR in a timely manner of any incidents or accidents that occurred in his installation.

An annual report regarding the following points must be established by the owner of the facility and sent to AMSSNuR:

- Site and environmental radiological surveillance ;
- Quantities of radioactive materials at the facility and those disposed of;
- Operational regime of the installation and information about its exploitation including abnormal events;
- Maintenance, monitoring, inspection and testing realized;
- Medical surveillance and staff training.

Decommissioning of any waste management facility is subject to an authorization issued by AMSSNuR. In order to have a decommissioning license, the owner must submit a decommissioning plan which must contain:

- The decommissioning process, including dismantling, transport and storage of radioactive materials taking into consideration radiation protection regulations;
- Measures taken to avoid risks and accident's consequences;
- The most important radioactive material to be kept away from the installation, the estimation of their activity and the proposed measures for their elimination.
- The radiation protection measures to be taken after decommissioning.
- The final physical state that the owner proposes for the installation and its safety assessment.

As the radioactive waste management facility is considered similar to a nuclear installation, the regulation establishes that the licensee of a nuclear installation is obliged to report to the corresponding authority on any event that implies an alteration to the normal operation of his installation or that might affect nuclear safety or radiation protection, to have an emergency plan for responding to accident conditions. The radioactive waste management organization (CNESTEN) accepts wastes that comply with the technical specifications of the equipment and waste acceptance criteria that it has set up.

With respect to inspection of radioactive waste management, the CNESTEN radioactive waste management facility has been subject to an inspection in 2019 by AMSSNuR; which resulted in 13 recommendations and 2 suggestions to the CNESTEN to enhance the safety of radioactive waste management. 77% of these recommendations were implemented and suggestions were fully implemented by CNESTEN.

H7: INSTITUTIONAL MEASURES AFTER CLOSURE

ARTICLE 17.
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 restriction are carried out, if required; and
(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into.

According to the law 142-12, institutional measures applicable to nuclear activities and facilities after closure are the responsibility of the Government and of the applicant for authorization of commissioning of a nuclear facility.

Article 11 states that the authorizations of nuclear installations and of nuclear activities, as well as of final disposal facilities, under Category I, may be granted only if the applicant demonstrates, in the documents submitted in support of the application for authorization, that the technical provisions or the organization taken or envisaged at the various stages of the site assessment, design, construction, commissioning and operation tests, as well as the proposed general principles for decommissioning and final shutdown of nuclear installations, comply with the technical requirements and regulations for nuclear and radiological safety and security and safeguards.

The administration shall take into account the technical and financial capacities of the applicant, which must enable him to carry out his project in accordance with the provisions of this law, and in particular to cover the costs of final shutdown, dismantling of the installation, restoration and monitoring of its location.

Article 32 of the law 142-12 states that, after the closure of a radioactive waste disposal facility, the State shall take appropriate measures, including necessary financial arrangements to enable:

- Keeping the records required by the Agency regarding the location, design and contents of the facility;
- Ensuring, if necessary, controls such as monitoring or access restrictions;
- Implementing, if necessary, emergency response during the period of control, if an unplanned release of radioactive materials into the environment is detected.

Section I: TRANSBOUNDARY MOVEMENT

ARTICLE 27.

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 license the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal

There is no specific regulation promulgated on the transboundary movement of radioactive material; however in item 48 of the decree related to radiation protection, the regulation stipulates that, when radioactive substances or sources of ionizing radiations in transit on the national territory are off-loaded there or transshipped, they have to be the object of a preliminary declaration to the ministry of health clarifying the nature and the quantity of radioactive substances transported by road, air, sea or

river. They are stored and treated according to the directives of the afore mentioned department and are moved only with its authorization.

Also, the provisions of the following international conventions and directives are applicable:

- ADR (European Agreement Concerning the International Carriage of Dangerous Goods by Roads);
- RID (Regulation Concerning the International Carriage of Dangerous Goods by Rail);
- Technical instructions of the ICAO and the Dangerous Goods Regulations of the International Air Transport Association (IATA);
- Convention on the Physical Protection of Nuclear Materials and other relevant conventions.

Internal transport of any radioactive material is submitted to an authorization delivered by AMSSNuR after satisfying all transport requirements. A control of the transporting vehicle, types, characteristics, quantities, radionuclide activities, the packaging and labeling of the package containing the radioactive material, is necessary before proceeding to any internal transport.

In case of exportation of radioactive material, an import permit granted by the receiving country shall be submitted to AMSSNuR. This will ensure that a transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination. In this regard, the law 142-12 has dedicated a full section dealing with import, export and transit of nuclear material. So, according to article 34 of the law 142-12, the import, export and transit through the national territory of nuclear material by land, watercourse, airport or seaport, are authorized by the Administration, after the application file has been examined by the Agency.

As stipulated in article 35 of the law 142-12, the granting of an authorization to import nuclear material, equipment or related technology depends on the following conditions:

- the material, equipment or related technology to be imported should not be prohibited by a legislative or regulatory provision in force;

- the operator must demonstrate that it has the technical, human, and financial resources and capabilities allowing the use of the material, equipment, or related technology in the conditions of safety and security required for by this law.
- the applicant must have an authorization for its facility to become operational and comply with all requirements related to its activity;
- the applicant must ensure the monitoring, accounting, containment, control and physical protection of nuclear materials and nuclear facilities;
- the nuclear material imported must be under the safeguards of the Treaty of Non-Proliferation of Nuclear Weapons;
- The transfer of nuclear material to the applicant must have been previously notified to the Kingdom of Morocco and authorized by the State of origin;
- The potential reprocessing of nuclear material provided or any other modifications of this material, are subject to prior approval by the State of origin.

Import of nuclear material, equipment or related technology to free industrial zones on the national territory is subject to the same requirements.

With regard to export of nuclear material, article 37 of the law 142-12 states that, the granting of an authorization for the export of nuclear material, equipment or related technology depends on the following conditions:

- The importing State's commitment to use nuclear material, equipment or a related technology, as well as transferred information, only for pacific purposes;
- The importing State's commitment to submit to international safeguards all its nuclear materials and facilities, as well as nuclear material, equipment, and related technology to export;
- The importing State's commitment not to transfer to a third State a material or previously transferred technology without the prior agreement of the Kingdom of Morocco;
- The levels of physical protection to be applied to the exported material shall conform to those fixed by the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities,
- The recipient must communicate to the Agency information on the final use and final destination of nuclear material, equipment or related information to be transferred, to confirm its pacific use;

- The importing State must possess the administrative and technical capacity, the resources, and the necessary legislative and regulatory structure to manage safely of these materials;
- The State of destination must have received a prior notification of transfer and given approval to the latter;
- The recipient must have the required authorizations for its facility or activity and follow all related requirements;
- The recipient must have the necessary resources for the monitoring, accountancy, containment, control and physical protection of nuclear materials exported.

In case of transboundary movement requiring transit through other States, the international requirements pertaining to the particular modes of transport utilized is applicable. In addition to this, the law includes some requirements dealing with the transport of nuclear and radiological materials.

Until now, exportation of radioactive material from Morocco to other countries has been limited to the return of disused sources to their suppliers or to an overseas waste management facility.

Progress made since the last review meeting:

In order to complete and consolidate the national register of ionizing radiation sources, AMSSNuR initiated in 2018 a project to develop the national strategy for securing orphan sources, which is part of the cooperation project with the European Union.

Thus, AMSSNuR has drawn up a draft strategy for the development of a national program for the recovery and securing of orphan sources which was submitted to EU experts at the beginning of 2020 for review before its submission to the Head of Government for approval.

Moreover, the decree n° 2.40.452 was published on August 12 ,2020 which designates the MEME as the administration that grants import, export and transit authorizations on the national territory of nuclear material by roads, waterways, airports or seaports, after obtaining the opinion of AMSSNuR.

Section J: DISUSED SEALED SOURCES

ARTICLE 28.

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.

DSRS are broadly used in agriculture, medicine and industry, including for non-destructive testing, radioactive sterilization, manufacturing of health care products, control systems in production line operations, raw material elemental analysis, evaluation of mineral resources, food irradiation, smoke detection, and medicine, such as for treatment of malignant tumors. Upon removal from use, DSRS need to be managed in a safe manner.

Article 7 of the law 142-12 stipulates that, without prejudice to the legislative or regulatory provisions submitting to authorization or prior declaration the exercise of certain activities or professions, the activities, facilities and ionizing radiations sources under Class II are subject to authorization by or declaration to AMSSNuR, according to the modalities fixed by the regulation.

According to article 45 of the law 142-12, the authorizations of category II "radiological facilities" are granted and renewed only if the requirements are met in relation to:

- Compliance of ionizing radiation sources (subject to the authorization application) with standards of design and manufacturing required for their certification;
- Qualification regarding radiological protection of the personnel in charge of handling ionizing radiation sources (subject to the authorization application) and of the person competent in radiation protection;
- Safety analysis relating to the facility, the activity and the sources of ionizing radiation, which are associated. The projects of facility, which are selected by the regulatory body, must also be subject to an assessment of the environmental impacts;
- Conformity of premises to protection standards;
- Protection measures of workers exposed, of the population and of the environment against the effects of ionizing radiation;

- Compliance with local radiation protection standards;
- Equipment for detection and measurement of ionizing radiation;
- Medical monitoring of exposed workers in accordance with regulations;
- Dosimetry monitoring of workers exposed to radiation;
- Measures taken in the event of a radiological emergency for ionizing radiation sources that expose to a high risk, according to the classes referred to in Article 4 of this law;
- If necessary, physical protection of facilities;
- If necessary, means of transport;
- **If necessary, measures taken to ensure the compliance with the legislative and regulatory requirements related to the management of radioactive waste;**
- Applicant's commitment to deliver ionizing radiation sources only to operators authorized for this purpose;
- **If necessary, means provided for the return of sealed sources;**
- A commitment to subscribe to an insurance policy, in respect of the classes defined by regulatory body, covering civil liability results of the activity subject of the application.

Moreover, the law 142-12, through its article 55, states that any user of sealed sources is required to have the expired or no longer usable sources retrieved by the supplier. However, by way of derogation, this obligation does not apply when the characteristics of sources allow a decay on the location of use or when the activity threshold is below the limits laid down by the regulatory body.

During the process of authorization, AMSSNuR verifies that the applicant has made all necessary arrangements for returning the radioactive sources when they become DSRS to the supplier or manufacturer. In fact, the applicant should present to AMSSNuR an agreement from the supplier to accept to take back the source after its use. If the option of returning the DSRS to its supplier is not possible, the user should, according to law 142-12, proceed to transfer its DSRS to the centralized radioactive waste management organization according to its WAC approved by AMSSNuR.
With regard to the becoming of the DSRS, the provisions of article 38 of the draft decree on safety of radioactive waste management, disused radioactive sources and spent fuel, give the holder of the source the responsibility to consider the following options : (1) Reuse and Recycle or (2) Repatriate.

In the second case, the holder must notify the Agency within one month of the disuse of its radioactive source by specifying the date for its repatriation. Transfer to the centralized radioactive waste management organization or to any other body has to be authorized for this purpose.

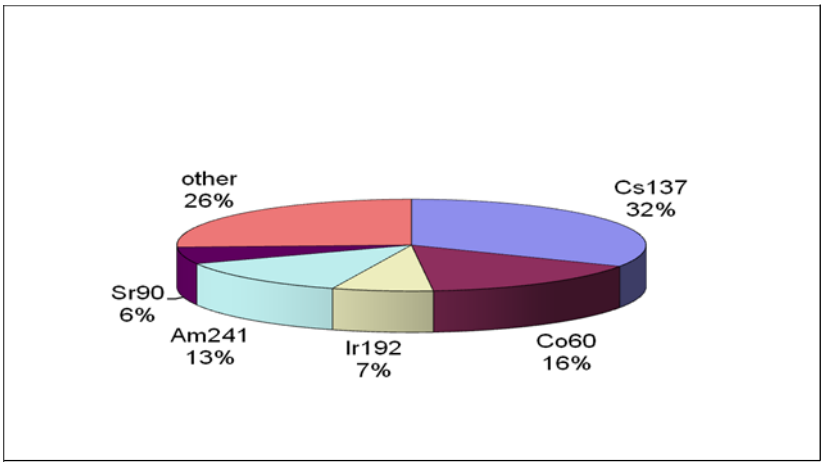
In this case, if the holder cannot provide justification for its subsequent use and that the operation of its repatriation cannot be realized, this source is considered as radioactive waste. Therefore, the holder must proceed, within three months, in accordance with the regulations in force, to the transfer to the centralized radioactive waste management organization or to any other body authorized for this purpose.

In addition, according to article 2 of the law 17-86 of its creation, CNESTEN is responsible for collecting all DSRS, transporting and managing all DSRS at national level. The management of DSRS is described as follow:

- No manufacturing of sealed sources takes place in Morocco;
- 1500 radioactive sealed sources are used in 150 establishments recorded in 2018.

The main radioelements are 137Cs and 60Co as indicated in the following figure.

Figure n° 7: Radioelement's rates used in Morocco recorded in 2018



The analysis of the quantity of radioactive sealed sources used in Morocco and their applications, shows that a large part of these sources are used as radiometric gauges: level gauges, density gauges, thickness gauges and moisture gauges, which are often incorporated into fixed installations, come then the applications in the technique of industrial radiography, in medicine and in the logging, then, finally, a small quantity of sources are used in laboratory analysis, quality control and in the calibration process.

The following figure shows the location where radioactive sealed sources are currently in use in Morocco.

Figure n°8: Example of storage facility requested by the law 142-12

All facilities where sealed sources are used are inspected by the regulatory body in order to ensure that the use and the storage of these sources comply with the regulation. Conditions for granting an authorization to each licensee should be the following: have at least 20 square meters surface of storage to store the DSRS and radioactive waste.

When the source is disused, there are two options:

- Returning the disused source to the supplier,
- Or transferring the disused source to the central waste management facility (CNESTEN).

Orphan sources are not frequently found in Morocco. In case such an event occurs, the regulatory body takes control of the sources to ensure their safe storage and finds the owner if possible, in order to pay the cost of its management and sends it to the CNESTEN.

Orphan sources, for which the owner can't be identified, are transferred to CNESTEN for its management.

There is a special case related to orphan sources which are detected in metallic scrap. The owner of a metallic scrap facility should inform the regulatory body and according to the law it becomes responsible for the safety of the source until the source is transferred to the CNESTEN.

In addition to that, in accordance with the provisions of Law No. 142-12 and safety and security standards and guidelines issued by the IAEA, AMSSNuR is working on the strategy for updating and gradually setting up the National Register of ionizing radiation sources as well as the national strategy for securing orphan sources, within the framework of its cooperation programme with the IAEA and the EU. Section D on

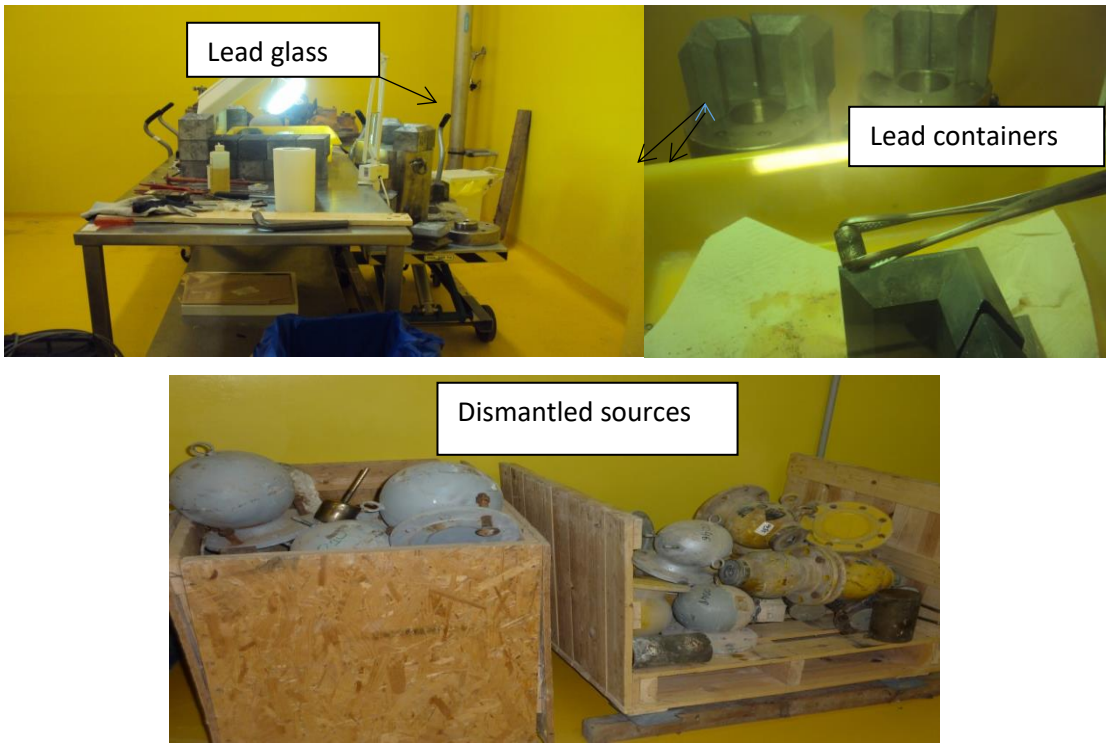
inventories and lists and Section I on transboundary movements provide more details on these subjects.

At national level, CNESTEN has adopted the dismantling of low radioactive DSRS, mainly category 3 to 5, as a method for the management of DSRS.

Dismantled sources are conditioned in lead containers (two lead containers, one for Co-60 and the second for Cs-137). So far, more than 1000 radioactive sources of category 3 to 5 are dismantled.

Before dismantling, a safety assessment of the operation is carried out using the SFRAN software and is submitted to the radiation protection unit for approval.

Figure n° 9: CNESTEN's Dismantling process of DSRS



The Kingdom of Morocco, through the CNESTEN, is providing within the framework of several AFRA projects and the INT9186 project "cradle to grave of SRS and DSRS control management" in hand training for Member States on the management of sealed radioactive sources of categories 3-5 from collection to storage.

Based on this wide experience and its associated success stories in this particular field, the CNESTN expects to present its application to the IAEA for its designation as Qualified Technical Centre (QTC) for training in the management of low and medium-level radioactive waste.

In addition to that, the Kingdom of Morocco has repatriated six DSRS of cat 1 to France (see table below and its associated pictures).

Table n° 3: Repatriated six DSRS

Head n°	Isotope	Activity (in TBq)	Activity Date
2004	(Co-60)	115	01/01/2009
4016	(Co-60)	83	01/01/2009
90127	(Co-60)	68	01/01/2009
9095	Co-60)	33	01/01/2009
90142	(Co-60)	85	01/01/2009
NA	(Cs-137)	37	12/03/2015

Figure n° 10: Conditioning of cat 1 radioactive sources for repatriation

Section K: PLANNED ACTIVITIES TO IMPROVE SAFETY

K-1: Preparation of the IRRS mission

In application of the provisions of Law No. 142-12 and in accordance with the recommendations and guidelines of the IAEA as well as international good practices in nuclear safety, AMSSNuR, in accordance with its strategic roadmap 2017/2021, prepares the achievement in 2021 of the IAEA's external evaluation known as the Integrated Regulatory Review Service (IRRS). This mission was confirmed and will be held in June 2021.

In this regard, a self-assessment using the SARIS platform was launched and is currently in the final step. The results of this self-assessment constitute the "assessment and review material "arms" for IRRS mission purpose .

In this context, AMSSNuR introduced, in August 2019, through the official channels of Morocco, a request to carry out the IRRS mission and initiated the internal realization of a self-assessment of the nuclear and radiological safety regulatory infrastructure. according to the methodology required by the IAEA and known as SARIS (Self-Assessment Regulatory Infrastructure Review).

K-2: Adoption and implementation of a policy and strategy for radioactive waste and spent fuel management

Despite the fact that the policies related respectively radioactive waste management and nuclear safety are not yet officially adopted, many activities within their framework were established, such as:

- Draft regulations of the following thematic as stated in Section E on the Legislative and Regulatory System :
  1. Safety of radioactive waste and spent fuel management
  2. Clearance and exemption levels
  3. Characterization modalities of radioactive waste
  4. Classification of Radioactive waste
  5. Technical modalities for the discharge and release of radioactive waste from category II activities
- Management System for key organizations, particularly for AMSSNuR and CNESTEN, as waste management organization as stated in Subsection F-3 on Quality Assurance ;

- Preparation of WAC for long term storage facilities by CNESTEN which will be approved by AMSSNuR as stated in Subsection B3 on categorization of radioactive waste ;
- Set up of a generic classification already stated in the draft decree by setting up boundaries between main stream waste classes as stated in the Guide on classification of radioactive waste;
- Carrying out of inspections and of their follow up missions on radioactive waste management ;
- Launch of IRRS missions as a peer review as stated in K1;
- Reinforcement of international cooperation ;
- Preparation of the EPREV Mission ;
- Reinforcement of the national register of ionizing radiation facilities and activities as stated in section D;
- Carrying out of a dozen control operations according to the overall planning of the annual inspection program for category II facilities (radiological facilities and activities);
- Finalization of the inspection guide for the management of radioactive waste within category II facilities.

SECTION L : APPENDICES

ANNEX N °1 RADIOACTIVE WASTE COLLECTED BY CNESTEN (03.2020)

Nuclides	Number	Related date	Activity	Initial use	Category
Am241	3	25/07/2001	4972,8 MBq	Radiometric gauge	Cat 4
Sr90	1	juil-99	Unknown	Medical	
Ra226 Be	1	12/09/1997	166,5MBq	Radiometric gauge	Cat4
Cs137	1	20/02/1997	281MBq	Radiometric gauge	Cat 4
Cs137	1	20/02/1997	296MBq	Radiometric gauge	Cat 4
Cs137	1	10/04/1997	203MBq	Radiometric gauge	Cat 4
Am241Be	2	10/04/1997	1850MBq	Radiometric gauge	Cat 4
Am241Be	1	10/04/1997	362.6 MBq	Radiometric gauge	Cat 4
Am241Be	1		107.3GBq	Radiometric gauge	Cat 2
Co60	4	03/05/1991	4x4.5 MBq	Radiometric gauge	Cat 4
Co60	1	03/05/1991	17.4 MBq	Radiometric gauge	Cat 4
Troxler Am241Be/Cs137	1	19/07/2002	1770	moisture/density gauge	Cat 4
Fût conditionné de Ra226	2	20/04/2002	17,49GBq	Medical	Cat 2
Fût conditionné de Co60	1		10 000GBq	Medical	Cat 2
Am241Be	2	26/10/2003	111 GBq	Radiometric gauge	Cat 2
Troxler Am241Be/Cs137	8	26/10/2003	12580MBq	moistur/density gauge	Cat 2
Cs137	3	26/10/2003	703MBq	Radiometric gauge	Cat 2
Ra226Be	2	26/10/2003	351MBq	Radiometric gauge	Cat 2
Ra226	1	26/10/2003	166MBq	Laboratory/calibration	Cat 5
Am241	1	26/10/2003	100 mCi	Radiometric gauge	Cat 4
Kr85	1	26/03/2003	14,8GBq	Radiometric gauge	Cat 2
Am241 (smoke detector)	35	23/02/2004	45,3MBq	smoke detector	Cat 5
Sr90	1	23/02/2004	1,63GBq	Radiometric gauge	Cat 3
Co60	9	05/04/2005	Sources bétonnées	Radiometric gauge	Cat 4
Cs137	3	2004	78GBq	Calibration/Radiometric gauge	Cat 2
Am241Be	2	2004	691,53GBq	Radiometric gauge	Cat 2
Ra226	1	2004	92KBq	Calibration	Cat 5
Am241	1	2004	20,35MBq	Calibration	Cat 5
Cs137	6	09/08/2005	21460 MBq	Radiometric gauge	Cat 4
Ra226	1	09/08/2005	33KBq	Laboratory	Cat 5

Cs137	3	03/03/2005	12950MBq	Radiometric gauge	Cat 4
Co60	1	05/12/2006	370MBq	Radiometric gauge	Cat 4
Cs137	12	05/12/2006	54,7GBq	Radiometric gauge	Cat 2
Co60	1		370MBq	Radiometric gauge	Cat 4
Co60	17	25/09/2006	13,6GBq	Radiometric gauge	Cat 3
Calibration sources	2	20/03/2006	74,97MBq	Calibration	Cat 5
Ra226	1	20/03/2006	5414Bq	Laboratory	Cat 5
Pb214	1	20/03/2006	5414Bq	Laboratory	Cat 5
Bi214	1	20/03/2006	5414Bq	Laboratory	Cat 5
contaminated scrap and fragments(drum)	8	20/03/2006	//	Pipe-line	
Cs137	8	07/08/2007	129,13GBq	Radiometric gauge	Cat 2
Cs137	6	07/08/2007	11,1GBq	Radiometric gauge	Cat 3
Cs137	1	20/11/2007	555MBq	Radiometric gauge	Cat 4
Co60 (located in scrap metal)	1	20/11/2007	//	located in scrabe metal	
Cs137 (curieth.)	6	16/01/2008	//	Curietherapy	Cat 2
Pm147	11	29/04/2008	48,8 GBq	Radiometric gauge	Cat 2
Kr85	3	29/04/2008	15,5 Gbq		Cat 3
Fe55	7	29/04/2008	8,14 GBq		Cat 3
Am241	1	03/06/2008	20GBq	Radiometric gauge	Cat 3
Cs137	3	05/08/2008	5,362 GBq	Radiometric gauge	Cat 3
Co60	4	05/08/2008	0,74GBq	Radiometric gauge	Cat 3
CS137	3	23/09/2008	24GBq	Radiometric gauge	Cat 3
Cs137	2	23/09/2008	11,1GBq	Radiometric gauge	Cat 3
Co60	2	12/12/2008	Unknown	Radiometric gauge	Cat 4
Co60	2	04/04/2009	7,4GBq	Radiometric gauge	Cat 3
Am241Be	1	17/03/2009	1,85 GBq	Radiometric gauge	Cat 3
Cs137	1	17/03/2009	37 Mbq	Radiometric gauge	Cat 4
Am241Be	1	17/03/2009	1,11GBq	Radiometric gauge	Cat 3
Billes de Cs137	4	19/04/2010	5,3 GBq	Curietherapy	Cat 3
Fils d'Ir192	54 pots	19/04/2010	//		
Tête de Cs137	1	20/04/2010	02//	Radiotherapy	Cat 1
Tête de Co60	2	10/02/2010	503,5TBq	Radiotherapy	Cat 1
Co60	2	20/05/2010	7,4GBq	Radiometric gauge	Cat 3
Co60	3	12/11/2010	200MBq	Radiometric gauge	Cat 4
Smoke detectors Am241	60	12/11/2010	//	smoke detector	Cat 5
Cs137	8	26/01/2011	14430MBq	Radiometric gauge	Cat 4
Smoke detectors Am241	134	14/04/2011	4,41MBq	smoke detector	Cat 5
Am241	2	2-969-2011	2x250mCi	Radiometric gauge	Cat 4
Am241	10	2-1165-2011	//	Paratonnerres	

Orphan source (depletedUranium)	1	2-358-2011	//	Orphan source	
Co60	11	2-403-2012	11x5mCi	Radiometric gauge	Cat 4
Head of Cobalt60	1	2- 53-2013	248 TBq	Medical	Cat 1
Cs137	3	2-747-2013	Unknown	Radiometric gauge	
Co60	4	02/07/2014	2x100mci+ 2x50mCi	Radiometric gauge	Cat 3
Cs137	1	02/07/2014	250mCi	Radiometric gauge	Cat 3
Head of Cobalt60	1	2-64-2014	242,3 TBq (15/01/2001)	Radiotherapy	Cat 1
	1	2	185 TBq (10/10/2007)		Cat 1
Depleted Uranium enclosure (Cobalt60 head)	//	2	//	Depleted Uranium enclosure	
Head of Cobalt60	1	2-151-2014	225,9 TBq	Radiotherapy	Cat 1
Co-60	4	05/02/2014	Unknow		
Cf-252	1	03/06/2014	0.385 GBq	Radiometric gauge	4
Cf-252	1	03/06/2014	0.403 GBq	Radiometric gauge	4
Cf-252	1	03/06/2014	0.730 GBq	Radiometric gauge	4
Cf-252	1	03/06/2014	0.738 GBq	Radiometric gauge	4
Co-60	1	23/04/2015	100 mCi	Radiometric gauge	3
Cf-252	2	03/02/2016	2x 0,36 GBq	Radiometric gauge	4
Cf-252	2	03/02/2016	2x0,2 GBq	Radiometric gauge	4
Co-60	1	08/03/2016	321,6 TBq	Radiotherapy	1
Am 241	280	01/06/2016	2µCi/Det	(Smoke Detector)	5
C14	4	01/06/2016	4 x 1,6 MBq		5
G68	2	01/07/2016	2x55 MBq		5
Co-57	1	01/07/2016	10 mCi	Radiometric gauge	4
Cs 137	13	07/12/2016	Unknow	Radiometric gauge	
Am 241	558	08/03/2017	6,19 mCi	(Smoke Detector)	5
Cs 137	1	20/09/2017	4,8 mCi	Radiometric gauge	4
Cs 137	2	20/09/2017	4,9 mCi	Radiometric gage	4
Cs 137	1	20/09/2017	5 mCi	Radiometric gauge	4
Cs 137	2	20/09/2017	5,1 mCi	Radiometric gauge	4
Cs 137	1	20/09/2017	5,2 mCi	Radiometric gauge	4
Cs 137	1	20/09/2017	5,3 mCi	Radiometric gage	4
Cs 137	1	20/09/2017	50 mCi	Radiometric gauge	3
Cs 137/Am241	1	14/11/2017	1mCi	Radiometric gage	4
Cs 137	1	14/11/2017	30 mCi	Radiometric gauge	3
Am 241	248	23/05/2018	Unknow	Smoke Detector	5
Co 60	1	23/05/2018	Unknow	Radiometric gauge	3
Am 241	724	18/07/2018	Unknow	Smoke Detector	5
Co 60	1	06/09/2018	193.6 TBq	Radiotherapy	1
Co 60	1	04/10/2018	Unknow	Radiometric gauge	2

Co 60	3	27/09/2018	1900 MBq	Radiometric gauge	3
Co 60	2	27/09/2018	740MBq	Radiometric gauge	3
Co 60	2	27/09/2018	190MBq	Radiometric gauge	3
Co 60	2	27/09/2018	Unknow	Radiometric gauge	3
Kr 85	1	26/10/2018	0.45 Ci	Radiometric gauge	4
Kr 85	1	26/10/2018	0.3 Ci	Radiometric gauge	4
Kr 85	1	26/10/2018	0.5Ci	Radiometric gauge	4
Kr 85	1	26/10/2018	0.5Ci	Radiometric gauge	4
Sr 90	1	26/10/2018	0.05 Ci	Radiometric gauge	3
Co 60	1	06/02/2019	66.24 GBq	Radiometric gauge	2
Co 60	1	07/05/2019	77.32 GBq	Radiometric gauge	2
Cs 137	1	07/11/2019	3700 MBq	Radiometric gauge	3
Co 60	1	16/01/2020	66.54 GBq	Radiometric gauge	2
Ge 68	1	05/03/2020	Unknow	Radiometric gauge	