MOROCCO

a) National framework for management of spent fuel and radioactive waste

Morocco has a 2 Megawatts TRIGA research reactor located at the CENM (Centre d'Etudes Nucléaires de la Maâmora). Morocco has not a formal policy for the management of radioactive waste management; however a draft document on the policy has been drafted under the project INT9176. The document is submitted to the NLO.

Morocco has adopted the centralized radioactive waste management strategy by mandating the National Center of Nuclear Energy, Sciences and Nuclear Techniques (CNESTEN: Centre National de l'Energie, des Sciences et des Techniques Nucléaires)) to manage radioactive waste at national level. For that mission the CNESTEN has constructed an installation in his Maâmoura site where the Nuclear Research Centre is located (CENM: Centre d'Etudes Nucléaires de la Maâmoura)

Radioactive waste contaminated by short lived which the half-life is inferior to 61 days are managed by decay at the origin of production, those contaminated by radioelements which the half-life is superior to 61 days are collected by the CNESTEN to be treated and stored in his installation at CENM. There is no final disposal in Morocco; only long term storage is adopted in Morocco. In the new law 142-12 related to nuclear and radiation safety and security and the creation of the Agency responsible for ensuring the control, the disposal is considered as nuclear installation which request an authorization from the regulatory body to be operated. According to the new law the radioactive waste management must respond to a distribution of responsibilities between the following parties:

- The producer of radioactive waste is responsible of his waste until the waste is received by the national operating organism. The producer of radioactive waste has an inventory, to date, of its waste. He submits to the Agency an annual report on the status of radioactive waste that it manages
- The body responsible under the law of the centralized waste management Radioactive generated nationally, The operator sets up radioactive waste management measures to:
    - Keep to the lowest possible level, the production and activity of radioactive waste
    - Take into account the interdependencies between the various stages of the management of radioactive waste, such as pre-processing, processing, packaging, storage and disposal
    - Take into account the biological, chemical and other risks associated with radioactive waste management
    - Apply the characterization procedures and management of such wastes in accordance with the provisions laid down by regulation

    - Take measures to assess the safety of the installation of radioactive waste management and its impact on Man and his environment
- The Agency, its responsibilities are licensing and inspections

In any event, the State remains responsible in the absence of any other party appointed.

Pending the implementation of the new agency (the director of the agency was nominated) there are two regulatory bodies:

- National Centre of Radiation Protection (CNRP) which is the regulatory body for radiation protection in the country is under the Ministry of Health and covers all activities taking place in no nuclear installations
- The Ministry of Energy and Mines which is the regulatory body of nuclear safety and covers activities occurred in nuclear installations

The producer of radioactive waste has the choice between three possibilities to manage his waste:

- Giving the waste to the CNESTEN which is the operating organism;
- Returning the waste to their origin supplier,
- Storing them in a safe place at the user premises until they are returned to the origin supplier or given to the CNESTEN.

Morocco has adopted the international categorization scheme for radioactive sources. The National Register of sealed radioactive sources maintained by the CNRP covers all categories of sealed sources. Information on licensing of radiation sources and practices is recorded in the CNRP inventory database. The classification of radioactive waste in Morocco is accomplished as following according to level of activities:

- Level I: low level waste (<10MBq) contaminated by short lived (half-life <61 days) are managed by decay at the place of production and discharge after 10 times of half-life with authorization from regulatory body;
- Level II: low level waste contaminated by radio-isotopes which have half-life below or equal to 30 years and long lived radionuclides in restricted quantity with the condition that their decay don't let them reach the discharge level in 12 months following their production with the alpha emitters are limited to 4000 Bq/g for each package;
- Level III: low and intermediate level waste containing radionuclides having a half-life above 30 years and alpha emitters in quantity exceeding the limits fixed for level II. This waste can be evacuated only in geological disposal;
- Level IV: high level waste having a thermal flux superior to 2 KW / m3 and containing alpha emitters in quantity exceeding the limits fixed for the level II (spent fuel for example). This waste can be evacuated only in geological disposal.

b) National legal and regulatory framework

The law 142-12 is entered into force since last September. This law will replace the previous law and decrees. The aim of this law is to upgrade the national legislative and regulatory framework to ensure consistency with the international regime related to nuclear safety, security and safeguards.

The law is structured to cover the following topics:

- Nuclear and radiological safety and security:
  - Definitions;
  - General provisions;
  - Licensing and notification processes;
  - Common provisions to licensing and notification processes;
  - Licensing of radioactive waste management activities;
  - Protection against ionizing radiation sources;
  - The use of ionizing radiation sources for medical or dental purposes;
  - Physical protection, security safeguards and non-proliferation;
  - Emergency planning;
  - Accreditation of services providers.
- Enforcement and penalties;
- Creation of the nuclear and radiation safety and security Agency;
- Final provisions.

Pending the entry into force of the new law, regulation of radiological protection and nuclear energy is based on the framework Law of 12 October 1971 on the protection against the hazards of ionizing radiation, which establishes general principles. These principles formed the basis for executive regulations. The law 142-12 apply to the importation, exportation, acquisition, production, transformation, detention, use, sale, transit, transport, recycling and re-use of equipment or substances capable of emitting ionizing radiation. They also apply to the treatment, handling, conditioning, storage, elimination and disposal of radioactive substances or waste and to any other activity involving a risk arising from ionizing radiation.

Others laws related to the nuclear field are:

- Law N° 12-02 relating to Civil Liability for Nuclear Damage promulgated by Decree
- Law N° 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 May 19, 2000 publishing the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The director of the Nuclear Safety and Security Agency was nominated. The Agency will take over the regulatory functions currently assigned respectively to the Ministry of Energy, Mines, Water and Environment (MEMEE) for the licensing and regulatory control of nuclear installations and to the National Centre of Radiation Protection (CNRP) under the Ministry of Health's authority for all other radiation practices and sources, pending the establishment of the agency's structures, the CNRP and The MEMEE continue to cover activities taking place respectively in non-nuclear installations and in nuclear installation

The use of radioactive material and substances are subject to authorization and declaration to the agency

The radioactive waste management installation is authorized to manage radioactive waste base on a safety analysis report. Each year CNESTEN submit an annual safety analysis report where he describe any change taking place during the year

c) Radioactive waste management, decommissioning and spent fuel strategy

In Maâmora forest, forty kilometres north of Rabat, the capital of Morocco, at the CNESTEN location, is located the radioactive waste facility dedicated to receiving, sorting, handling, treating, conditioning and storing radioactive wastes generated in industries, hospitals, universities, research organisations and waste generated in CENM. Until now all radioactive wastes generated in Morocco are arising from the use of radioactive materials in the form of sealed and unsealed sources in industry, medical, education and research fields.

The government provides fund to the CNESTEN to finance safety of radioactive waste management facility during its operating life-time and to carry out all operation related to the radioactive waste management. The producer of radioactive waste pays for the collect, the treatment and the storage of his generated waste.

Morocco has not a definitive disposal but the conditioned wastes are stored in a long term storage building.

In Moroccan regulation there is no article where the financial aspect of decommissioning is specified and who is the responsible to provide fund, but as the Nuclear Centre of Maâmoura (CENM) is a public research centre. The government assures the responsibility to cover any cost of its future decommissioning including the reactor. The decommissioning of the nuclear installation is not considered for the foreseeable future.

The item 6 in the decree n° 2-99-111 related authorization of the construction of Nuclear Study Centre of Maâmoura (CENM) requires for radioactive waste management that:

- No disposal of radioactive waste will be realized in the perimeter of the CENM;

- The installations of management of radioactive waste will allow reducing the volume and the hazard of the waste generated inside the CENM and those received from the outside. To facilitate their treatment, their conditioning and their later storage, the radioactive waste will be sorted out by nature and by category of radioactive or radiotoxic nuisance;
- Any radioactive expedition of waste outside of the CENM will have to be the object of controls and of statutory authorizations;
- An inventory of all the types of radioactive waste inside the perimeter of the CENM, notably indicating their origin, the physical and chemical characteristics, their mode of conditioning, their volume and their activity will be held up to date by the CNESTEN within the framework of the general rules of exploitation planned.

Table 1 Radioactive Waste in Storage (including spent fuel that is considered waste)

Route Waste Class	Processed (type)/Unprocessed	Total Current Volume (m3)	Estimated Disposal Volume (m3)	Distribution (%)							Planned Disposal Route (if known)
				RO	FFE	RP	NA	DF	DC/RE	ND	
All Classes	114dismantled/100 not 1000 technetium generators									Industry, medical field	
All Classes	12 drums compacted waste 6 HEPA filter Spent resin	1.4m^3 0.4 m^3		30% 0% 100%							
Level I	Concerning the level one the wastes are discharged each three months under authorization of CNRP The technetium generator are evacuated to the CNESTEN	1m^3 each three months according to CNRP 400 stored at CNESTEN 600 at users									
Level II	12 drums Spent resin										
Level III											
Level IV											

NEWMDB waste origin type codes:
RO – reactor operations
FFE – fuel fabrication & enrichment
RP – fuel reprocessing
NA – nuclear applications
DF - defence
DC/RE - decommissioning & remediation
ND - Not Determined

Table 2 Radioactive Waste Disposed (as disposed volume)

Waste Class	Processed (not)	Total Volume (m3)	Distribution (%)							Disposal Route Used
			RO	FFE	RP	NA	DF	DC/RE	ND	
All Classes	114 source category 3 dismantled 12 drums 120 litre of compacted solid waste spent resin is collected from reactor and stored at the RWM installation	114 1.4 m^3 0.4 m^3	30% 100%						100%	Dismantling and long term storage Long term storage Conditioning and long term storage

Table 3 Spent fuel in Storage (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage	0	No spent fuel
Wet storage (AR)	0	0
Wet storage (AFR)	0	0
Dry storage (AR)	0	0
Dry storage (AFR)	0	0
Total spent fuel held in storage for other countries (amounts also included above)	0	0

Table 4 Spent fuel sent for reprocessing (in the country or sent to another country) (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total amount Spent Fuel sent to Reprocessing (in your country)	0	No one
Total amount Spent Fuel sent to Reprocessing (in another country)	0	No one
Total amount of Spent Fuel received from another country	0	No one

for reprocessing and recycling		
Total amount of Spent Fuel (MTHM) or radioactive waste (cubic metres) returned to country of origin for storage/disposal	0	No one

Table 5 Example of a translation matrix (from NEWMDB) that can be used for transition from a national classification system to IAEA classification

National Waste Classification Name	**VLLW**	**LLW**	**ILW**	**HLW**
Level I				
Level II				
Level III				
Level IV				

Table 6 Waste management facilities

The CNESTEN has constructed a pool where the spent fuel elements will be stored waiting their return to the supplier or disposal

Type	**Planned**	**Construct.**	**Commiss.**	**In Operation**	**Shutdown**	**Decomm.**	**Other**	**Total**
Spent Fuel Storage	0	1	0	0	0	0	0	
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	
Spent Fuel Conditioning	0	0	0	0	0	0	0	
Spent Fuel disposal	0	0	0	0	0	0	0	
Waste processing	0	0	0	0	0	0	0	
Waste storage	0	0	0	1	0	0	0	
Waste disposal	0	0	0	0	0	0	0	

Table 7 Summary of major sources of waste

Type	**Planned**	**Construct**	**Commiss.**	**In Operation**	**Shutdown**	**Decomm.**	**Other**	**Total**
Research	0	0	0	1	0	0	0	0

reactors								
Nuclear Power reactors	0	0	0	0	0	0	0	0
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0

Table 8 Future prospects

Type	**Current amount**	**Estimated Current amount when prepared for disposal**	**Current Disposal Capacity**	**Total forecast at 2030**	**Disposal Capacity 2030**	**Total forecast at 2050**	**Disposal Capacity 2050**
Spent Fuel Storage							
Wet storage (AR)							
Wet storage (AFR)							
Dry storage (AR)							
Dry storage (AFR)							
Total amount Spent fuel sent to Reprocessing and Recycling							
Total amount Spent fuel disposed							
Waste in storage							
Waste disposal							