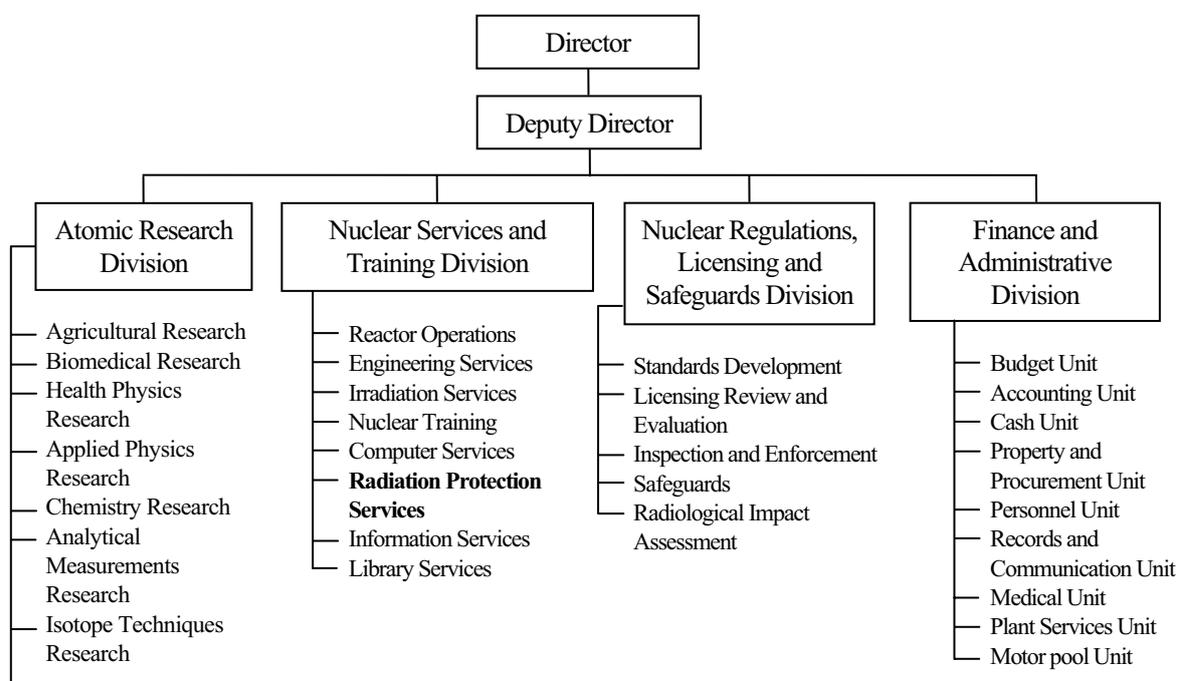


### 3.7 Radioactive Waste Management (RWM) Status in the Philippines

#### 3.7.1 National Policy for Radioactive Waste Management

The Philippine Nuclear Research Institute (PNRI), formerly the Philippine Atomic Energy Commission (PAEC), was created upon the passage of Republic Act No. 2067. PNRI is mandated to perform the following functions: (1) to conduct research and development studies in the utilization of radioactive materials for commercial, industrial, medical, biological or agricultural or other peaceful purposes, (2) to regulate and license the acquisition, distribution and use of radioactive material by issuing rules/regulations and establishing such standards to govern the shipments, possession and use of radioactive materials for the purpose of protecting the health and safety of the general public. See Figure 3.7-1 PNRI Organizational Chart).



**Figure 3.7-1 PNRI Organizational Chart**

The authorized users of radioactive materials from medicine, industry, research and other applications all over the country generate radioactive waste. Exempt level wastes are disposed as ordinary refuse while wastes exceeding the clearance level are accepted at PNRI Radioactive Waste Management Facility.

To ensure effective independence between the regulatory body and R& D including the service functions of PNRI, the Radioactive Waste Management Facility is securing authorization to operate and maintain a centralized facility for the collection, segregation, treatment and interim storage of

radioactive waste from the PNRI regulatory body which is Nuclear Regulations, Licensing and Standards Division.

The PNRI Radioactive Waste Management Facility shall perform all activities with utmost regard for the protection of man and environment in compliance with the relevant standards and regulations.

### **3.7.2 RWM Practices**

#### **3.7.2.1 Legislative Framework**

In 1990, the Philippine Congress enacted the Toxic Substances, Hazardous Wastes and Nuclear Waste Control Act of 1990, commonly known as Republic Act 6969. The Act seeks to protect the public health and environment from unreasonable risks posed by these substances. This legislation is under the jurisdiction of the Department of Environment and Natural Resources (DENR) with the PNRI as the authority, specific for the control of nuclear/radioactive waste in the Philippines. The implementing rules and regulations under this law are as follows:

- DENR and PNRI shall exercise their rights to monitor and inspect all shipments that may be potential risks to public safety and the national interest.
- Abandoned and unclaimed nuclear wastes, and whose ownership cannot be ascertained, shall be subject to PNRI regulations on the management and disposal of nuclear wastes.
- Any importer of scrap metals intended for domestic processing shall certify to the DENR that the imported scrap metals, including billets and ingots, do not contain radioactive material in any form, shape or containment.
- Scrap metals found to be contaminated with radioisotopes should not be allowed to be processed for fabrication of metal products.
- Any person shall immediately notify the PNRI or DENR if orphan and disused sources are discovered or of any discovery of nuclear waste in the country.

#### **3.7.2.2 Regulatory Body Framework**

The Nuclear Regulations, Licensing and Safeguards Division (NRLSD) of PNRI, issues regulations known as the Code of PNRI Regulations (CPR) with specific provisions which addresses the safe management of radioactive waste generated by the authorized users of radioactive materials. The following CPR has specific provisions for the safe management of waste:

CPR Part 2 - Licensing of Radioactive Materials

CPR Part 3 - Standards for Protection against Radiation

CPR Part 4 - Regulations for Safe Transport of Radioactive Materials in the Philippines

CPR Part 11 - Licenses for Industrial Radiography and Radiation Safety Requirements for Radiographic Operations

CPR Part 12 - Licenses for Medical Use of Sealed Radioactive Sources in Teletherapy

CPR Part 13 - Licenses for Medical Use of Radiopharmaceuticals

CPR Part 14 - Licenses for Medical Use of Sealed Radioactive Sources in Brachytherapy

CPR Part 15 - Licenses for Large Irradiators

CPR Part 16 - Licenses for the Use of Sealed Sources Contained in Industrial Device

Under the CPR, the licensee has the following options in the management of spent sealed sources:

- (a) transfer of source to another licensee for application or use at the current activity level,
- (b) decay storage of short half-life spent sealed sources,
- (c) return of spent sealed sources to the original manufacturer or supplier

Only after exhausting the above options should the disposal of spent sealed sources at the PNRI Centralized Radioactive Waste Management Facility is considered. But for large irradiator sources, the only option is return to the original supplier due to the nature of the licensed material contained in irradiators.

### **3.7.2.3 Responsibility of License Holder/Authorized to Operate**

It is the prime responsibility of the PNRI Radiation Protection Services to protect man and environment by maintaining and operating safely & efficiently the centralized radioactive waste management facility in compliance with the relevant regulations.

### **3.7.3 Criteria Used to Define and Characterize Radioactive Waste**

The PNRI Radioactive Waste Management Facility is guided by IAEA recommendations, guides, standards, procedures and Code of PNRI Regulations in the categorization and characterization of radioactive waste.

#### **3.7.4. Radioactive Waste Management Facility**

The PNRI, through the Radiation Protection Services Unit (RPS) of the Nuclear Services & Training Division (NSTD), operates and maintains the Radioactive Waste Management Facility for collection, segregation, treatment and interim storage of radioactive wastes.

The facility is located inside the PNRI compound in Quezon City. The facility includes the following: wet laboratory for R&D activities, proposed shielded cell and decontamination rooms, compressive strength testing area for concrete specimens, decay storage room, chemical precipitation area, cementation area for conditioning process, compaction area for compactible wastes and two engineered trenches for interim storage. (See Fig.3.7-2) The interim storage trenches are concrete-lined with concrete roofing filled with top soil about 30 cm thickness planted with carabao grass. It has a total volume of about 520m<sup>3</sup>. The facility has a truck entrance leading to the basement level of the building. This serves as the only entrance for large and heavy waste packages for management and also serve as the emergency exit for personnel in case of any untoward accident.

The PNRI Centralized Radioactive Waste Management Facility (RWMF) adopted two basic waste management options. These are (1) waste collection and packaging for decay storage for final disposal as ordinary refuse (2) waste collection, segregation, treatment, conditioning and packaging followed by interim storage awaiting disposal in a final repository.

In the first option, radioactive waste with activity below the clearance limit for may be disposed as ordinary refuse. But strict administrative measures are exercised. Exempted waste considered as toxic waste compound are excluded from dumping as ordinary refuse these includes organic scintillants/ solvents. At present, organic scintillants/solvents are stored in the decay room awaiting further treatment studies, incineration is generally used for such waste but the use of incinerator is banned under the new Clean Air Act.



**Fig.3.7-2 Interim Storage ( Engineered Trenches A & B)**



**Fig. 3.7-3 Chemical Precipitation Plant**

In the second option, compaction is generally employed as a volume reduction method for solid waste. Aqueous waste are segregated, treated and conditioned depending on the characteristic of the waste. The facility has a chemical precipitation plant made of polypropylene material that can process 300 liter waste per batch operation. Sludge from the process is conditioned by cementation using the in-drum mixer.

For small spent sealed sources, these are emplaced in 200-liter pre-lined drums and conditioned by cementation, while those from large sources, such as those from teletherapy machines, are conditioned in a cubic shaped container. Conditioning by cementation is being done to prevent unauthorized removal of the source because of the bulk, weight and robust nature of package. At present, conditioning of teletherapy sources was stopped and will avail of the IAEA new technology on conditioning teletherapy sources.

### 3.7.5 Inventory of Radioactive Waste as Dec. 31,2005

#### 3.7.5.1 Spent Sealed Sources (SSS)

##### *A. Conditioned SSS ( total volume = 49.5m<sup>3</sup> or 59 drums )*

Radionuclide	Activity, Bq	Volume,m <sup>3</sup>	Radionuclide	Activity, Bq	Volume,m <sup>3</sup>
Am-241	2.80E+10	2.10	H-3	1.20E+10	0.30
Ba-131	3.53E+03	0.30	In-113	0	0.30
Cd-109	1.50E+08	0.90	Kr-85	2.34E+10	0.60
Co-57	3.53E-03	0.60	Pm-147	3.96E+09	0.90
Co-60	3.03E+14	18.90	Sr-90	2.80E+10	2.40
Cs-137	1.09E+14	13.80	Tl-204	1.07E+05	0.30
Fe-55	1.31E+09	1.80	Ra-226	3.32E+10	6.30

##### *B. Unconditioned SSS ( Total volume = 8. 1 m<sup>3</sup> )*

Radionuclide	Activity, Bq	Volume,m <sup>3</sup>	Radionuclide	Activity, Bq	Volume. m <sup>3</sup>
Am-241	3.11E+11	0.62	Kr-85	4.62E+08	0.216
Cf-252	1.36E+08	0.001	Ni-63	7.83E+08	0.008
Co-57	1.37E+07	0.008	Pm-147	3.02E+09	0.128
Co-60	1.52E+12	1.50	Po-210	1.61E-07	0.001
Cs-137	3.08E+11	2.20	Pu-238	1.18E+10	0.16
Fe-55	1.36E+09	0.001	Ra-226	3.14E+09	0.20
H-3	1.86E+10	0.008	Sr-90	6.75E+10	2.77
Ir-192	2.33E+05	0.125	Tl-204	6.95E+05	0.20

#### 3.7.5.2 Solid wastes

##### *A. Conditioned Solid Waste (volume = 35.7m<sup>3</sup> or 70 drums )*

Radionuclide	Volume, m3	Radionuclide	Volume, m3
C-14	15.03	Kr-85	0.87
Cl-36	1.62	Ra-226	0.0002
Co-60	0.23	Sr-90	0.014
Cs-134	0.17	Th-232	9.0
Cs-137	3.49	U-238	0.028
H-3	4.86	Unknown	0.40

##### *B. Unconditioned solid wastes (Total volume = 91.04m<sup>3</sup>)*

Radionuclide	Volume,m3	Radionuclide	Volume,m3
Am-241	0.002	Sr-90	0.58
C-14	40.07	Tc-99	0.056
Cl-36	0.001	Th-232	3.43
Co-60	3.36	U-238	3.14
Cs-137	9.80	Mixed	1.62
H-3	24.67	Unknown	4.31

### 3.7.5.3 Inventory of liquid waste

<b>Radionuclide</b>	<b>Aqueous, L</b>	<b>Organic, L</b>
C-14	475	1170
Cl-36		128
Cs-137	210	55
Fe-59		67
H-3	107	1462
I-125		56
P-32		16
S-35		33
Sr-90	2	124
U-238	19	217

### 3.7.6 Nuclear Facilities in the Process of being Decommissioned and Status of Decommissioning Activities

The PRR-1 is a research pool type reactor and started operation in 1963 at 1 MW. In 1988, the reactor was converted to a TRIGA type reactor. It was restarted in 1992 but was on extended shut down for more than ten years due to leak in the reactor pool lining. The cost of repair is beyond the financial capacity of PNRI thus the management decided to decommission the PRR-1. The Reactor Operation Group is tasked to prepare a decommissioning plan for the PRR-1.

In preparation for the decommissioning plan, PNRI requested IAEA assistance in the radiological characterization of PRR-1. A one-week workshop (September 19-23, 2005) was conducted by IAEA experts for local technical personnel who will be involved in the future decommissioning activities. Recently, under the IAEA Project Research Reactor Decommissioning and Dismantling (R2D2), the PRR-1 was chosen as the model reactor for decommissioning in the region.