3.7 Radioactive Waste Management (RWM) Status in the Philippines

The Philippine Nuclear Research Institute (PNRI), formerly the Philippine Atomic Energy Commission (PAEC), was created upon the passage of Republic Act No. 2067. PNRI was 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.

3.7.1 RWM Policy

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.

To carry out its mandate of regulation and control in the use of radioactive materials, the Philippine Nuclear Research Institute, through the Nuclear Regulations, Licensing and Safeguards Division (NRLSD), issued specific regulations known as the Code of PNRI Regulations (CPR) to address the safe and peaceful application of nuclear energy (see Figure 3.7-1 PNRI Organizational Chart).

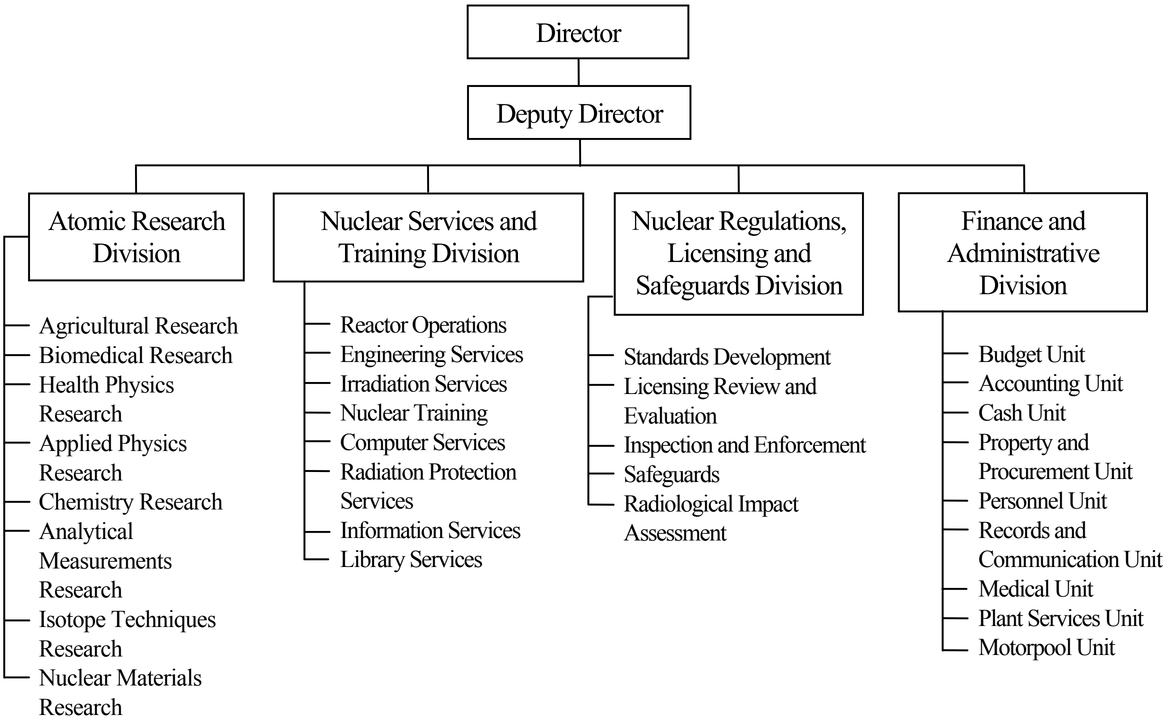

Figure 3.7-1 PNRI Organizational Chart

The following are specific regulatory provisions, which address safe management of radioactive 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 CPR Parts 3, 14, 15 and 16, 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 be 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 RWM Practices

The PNRI, through the Radiation Protection Services (RPS) of the Nuclear Services & Training Division (NSTD), has established, operates and maintains a centralized facility for collection, segregation, treatment and interim storage of radioactive wastes. The facility was established through the technical assistance from the International Atomic Energy Agency (IAEA) and the Department of Science and Technology (DOST) (see Figure 3.7-2 Functional Chart of Radiation Protection Services).

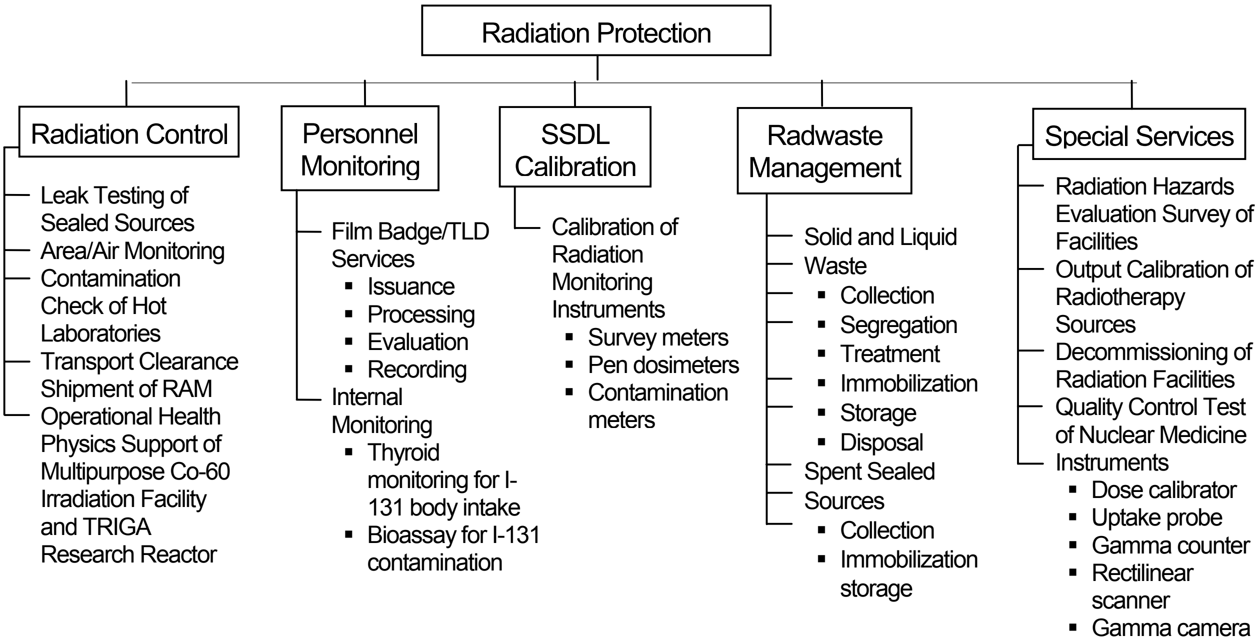

Figure 3.7-2 Functional Chart of Radiation Protection Services

The facility has a total land area of about 0.4 hectare and a floor area of about 600m^2 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 and compaction area for compactible wastes. It also includes an interim storage for conditioned wastes with a capacity of about 200m^3, or about 220 drums (200-litre capacity), of conditioned wastes. It is a concrete-lined trench with concrete slabs roofing and an opening on one end, with access from the Radioactive Waste Management Facility (RWMF) Building (Figure 3.7-3). 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. Figure 3.7-4 shows the present layout of the Radioactive Waste Management Facility Area.

Figure 3.7-3 Interim Storage - Engineered Trench

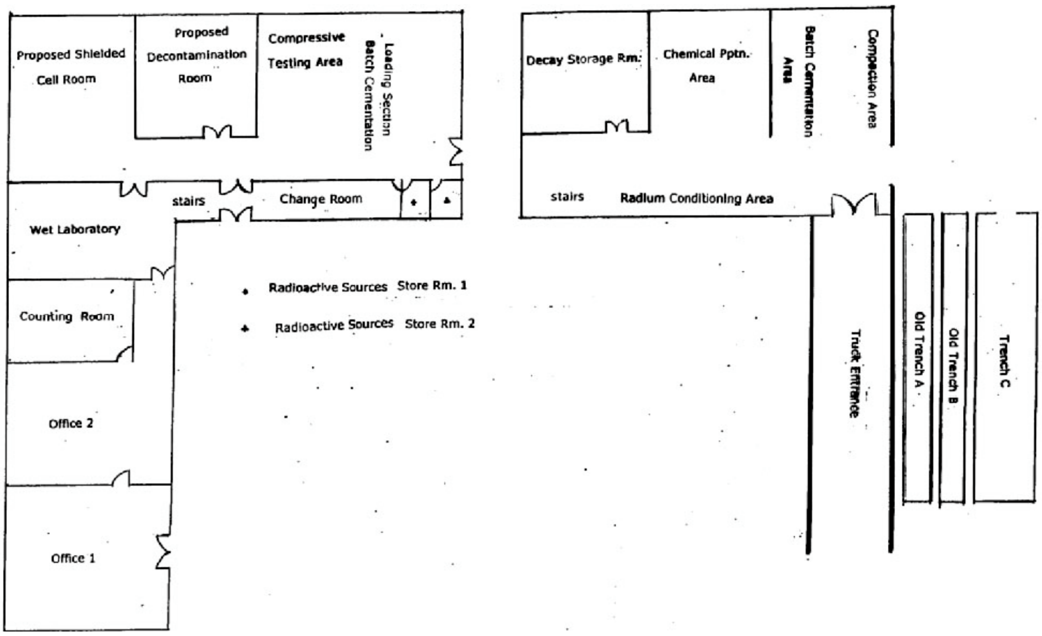

Figure 3.7-4 Present Layout of Radioactive Waste Management Facility

Radioactive wastes are generated from authorized use of radioactive materials in medicine, industry, research and other applications from all over the country including the Institute (Figure 3.7-5).

REGION	No. of Authorized Users
I	2
II	-
III	25
IV	44
V	2
VI	8
VII	15
VIII	2
IX	2
X	4
XI	10
XII	4
CARAGA Region	2
ARMM Region	-
CAR Region	4
NCR Region	189
TOTAL	313

Figure 3.7-5 Licensees of Radioactive MATERIALS

The PNRI Centralized Radioactive Waste Management Facility (RWMF) adopted two basic waste treatment and conditioning options on Waste INVENTORY (Table 3.7-1).

Table 3.7-1 Waste INVENTORY

Year	Solid (m^3)	Liquid (L)	Sealed Sources (units)
1979	6.88	116	6
1980	7.18	155	1
1981	11.26	631	25
1982	6.30	4044	3
1983	1.60	862	0
1984	6.23	987	87
1985	5.80	637	15
1986	5.60	400	2
1987	10.40	380	1236
1988	5.00	1600	30
1989	7.40	100	71
1990	7.18	89	325
1991	9.41	265	16
1992	42.94	148	41
1993	4.65	109	17
1994	2.68	93	32
1995	4.84	137	77
1996	6.46	261	20
1997	5.74	495	12
1998	6.99	58	31
1999	4.17	28	53
2000	5.50	131	118

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 last option, it includes compaction of compactible waste and chemical precipitation/ion exchange of aqueous wastes (see Figure 3.7-6 Chemical Precipitation Batch Plant).

Figure 3.7-6 Chemical Precipitation Batch Plant

Depending on their chemical composition and physical properties, wastes are appropriately treated and conditioned in cement (immobilized) prior to interim storage in an above ground facility which is engineered, secured and routinely monitored. Conditioned wastes are coded in accordance with a system established for the purpose.

In the first option, radioactive waste with activity below the allowable limit for disposal is considered exempt waste and 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.

In the second option, compaction is generally employed as a volume reduction method for solid waste (see Figure 3.7-7 Compactor). 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. Ion exchange process is also used for aqueous waste. For small spent sealed sources,

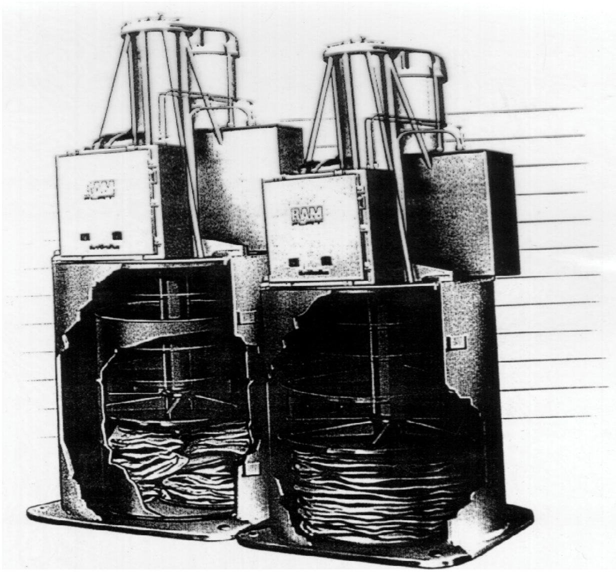

Figure 3.7-7 Drum and In-drum Compactor

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. Figure 3.7-8 shows the immobilization of spent sealed sources. Conditioning by cementation is being done to prevent unauthorized removal of the source because of the bulk, weight and robust nature of package. It also provides a barrier against loss of containment of radioactive material. Packages weigh about 450kg to 600kg removal and transport requires mechanical equipment, e.g. fork lift truck. Table 3.7-2 shows the spent sealed sources by radionuclide received for decay/conditioning.

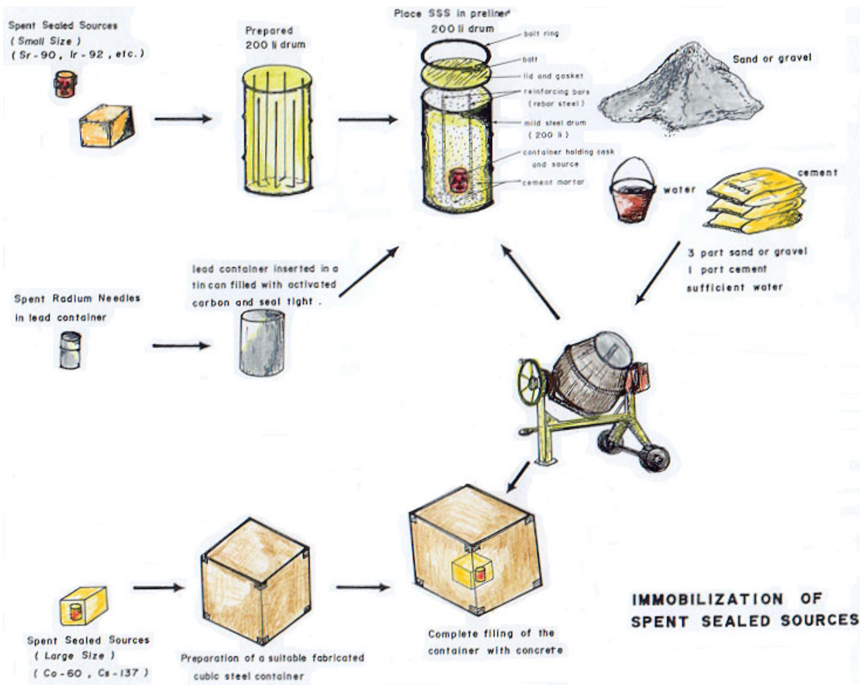

Figure 3.7-8 Immobilization of Spent Sealed Sources

Table 3.7-2 Spent Sealed Source Units Received At PNRI for Decay/Conditioning

Radionuclide	Total	%	Industrial	Hospitals/ Medical	Research/ Educational	Industrial/ Radiography	Activity Range
Cs-137 (30y)	1,252	5.5	89	28	2	3	3.7 kBq-93 TBq
Co-60 (5.27y)	148	6.7	45	96	6	1	37 kBq-221 TBq
Sr-90 (28.5y)	113	5.1	107	6	0	0	37 MBq-11.1 Gbq
Ba-133 (10.54y)	1	0.04	0	1	0	0	685 kBq
Fe-55 (2.73y)	11	0.5	10	1	0	0	54 MBq-740 MBq
Ra-226 (1600y)	261	11.77	24	228	5	4	33 kBq-2.6 GBq
Am-241 (433y)	918	41.39	916	0	1	1	1.85 GBq-37 GBq
H-3 (12.33y)	15	0.67	6	0	9	0	37 kBq-22 GBq
Kr-85 (10.72y)	5	0.22	5	0	0	0	163 kBq-2.4 GBq
Ni-63 (100.1y)	346	15.59	344	0	2	0	185 kBc-296 MBq
Pm-147 (2.62y)	17	0.77	16	1	0	0	370 kBc-2.6 TBq
Tl-204 (3.78y)	8	0.36	7	1	0	0	1.6 MBq-3.7 MBq
Pb-210 (22.3y)	4	0.18	0	1	3	0	37 kBq
Cd-109 (1.26y)	1	0.04	1	0	0	0	370 MBq
Ir-192 (74d)	29	1.31	0	1	0	28	3.5 TBq-3.8 TBq
Co-57 (272d)	3	0.14	0	2	1	0	34 MBq-410 MBq
Po-210 (134.8d)	208	9.38	207	0	1	0	99 MBq-150 GBq
In-113m (1.7h)	4	0.18	0	4	0	0	740 MBq
I-125 (60d)	1	0.04	0	0	1	0	15 kBq
C-14 (5720y)	1	0.04	0	1	0	0	
Zn-65 (245d)	1	0.04	0	1	0	0	
Ce-144 (284d)	1	0.04	0	1	0	0	
Total	2,218	100	1,777	373	31	37	

3.7.3 Accomplishments

The Philippines, through the PNRI, hosted the IAEA Regional Training Course on Management of Spent Sealed Sources and Other Waste from Small Nuclear Applications, from January 23 to February 10, 1995. The objectives of the training course were to provide principles and criteria for the safe management of spent radiation sources and other waste originating from nuclear applications in medicine, industry and research and to facilitate and encourage bilateral or multilateral cooperation regarding safe management of spent radiation sources and other radioactive waste. The course was participated in by 22 foreign participants and three local observers.

In 1998, the IAEA launched the project on Demonstration of Radioactive Waste Management Methods and Procedures. The Philippine, through the PNRI, hosted the First and Second Demonstration of Predisposal Waste Management Methods and Procedures in the East Asia and Pacific Region, from November 30 to December 11, 1998, and from November 15 to 26, 1999, respectively. The objectives of the course were to demonstrate predisposal waste management methods and procedures which are documented in IAEA publications and which are in agreement with internationally accepted standards and criteria; to supplement the theoretical knowledge with the practical experience in working with real radioactive waste and to demonstrate techniques meeting regional needs and potentials. There were seven foreign participants (two Bangladesh, one Malaysia, two Myanmar, and two Sri Lanka) in the first demonstration course and nine foreign participants (three Indonesia, three Thailand, two Singapore, and two Vietnam) in the second demonstration course.

The Philippines participated in the IAEA Model Project INT/4/131 "Sustainable Technologies for Managing Radioactive Wastes," particularly in the radium conditioning project. A national team performed the radium conditioning with the supervision of an IAEA expert. A total of 615mg of Ra-226 were encapsulated in two big and nine standard size stainless steel capsules. Figure 3.7-9 shows the mobile filtration system for conditioning of radium sources.

Figure 3.7-9 Work Area with the Mobile Filtration System for Radium Conditioning