6. Status of Decommissioning/Clearance in the Philippines

6.1 Concept and Strategy of Radioactive Waste Management

6.1.1 National Policy

The Philippines has a legislative framework which includes laws, executive orders and regulations with the objective of protecting the public health, safety, security and the environment from potential damage resulting from activities involving radiation and nuclear/radioactive materials.

The Science Act of 1958 created the Philippine Atomic Energy Commission (PAEC) now known as the Philippine Nuclear Research Institute (PNRI) to promulgate rules and regulations to ensure the safe use and application of radioactive materials in different fields of application.

The Atomic Energy Regulatory and Liability Act of 1958 or the Republic Act 5207 provides the licensing and regulation of atomic energy facilities and materials, establishing the rules on liability for nuclear damage and other purposes.

The Nuclear Wastes Control Act of 1990 prohibits the entry and even in transit of nuclear wastes and their disposal into the Philippine territorial limits for whatever purposes. However, States which are signatories to the Basel Convention are exempted from the requirements of the Act provided that prior notice and arrangements have been complied with.

The propose House Bill No. 5429 – an Act providing for a Comprehensive Hazardous and Nuclear Waste Management that outlines the principal guidelines in the safe management of nuclear and radioactive waste in the country. This proposed Act shall cover the requirements for processing, handling, storage, transportation, collection, recovery, use, and final disposal of hazardous and nuclear wastes in the country for whatever purposes.

6.1.2 Regulatory Framework

The PNRI has a dual role of promoting and regulating the peaceful use of radioactive materials for nuclear application in the country. The PNRI is headed by a Director and a Deputy Director. It consists of four (4) divisions namely: (a) Nuclear Regulations, Licensing and Safeguards Division (NRLSD) - the regulatory body, (b) Atomic Research Division (ARD) - the research arm (c) Nuclear Services and Training Division (NSTD) - the service provider and (d) Finance and Administrative Division (FAD) - for administrative support. (See Fig. 1 PNRI Organizational Chart)

NRLSD regulates the acquisition, possession, use, storage, transport, commercial sale, export and import of radioactive materials for peaceful application. To ensure the protection of the workers, public and the environment, NRLSD issues practice specific regulations known as Code of PNRI Regulations (CPR) which also impose specific safety and security requirements. These CPRs are reviewed and revised periodically through a system of consultations involving a number of stakeholders.

In 2004, the Regulatory Control Program for PNRI Nuclear and Radiation Facilities and Laboratories was established thru PNRI Office Order No. 2 Series of 2004. The purpose of the Regulatory Control Program is to set up an internal authorization process for all PNRI nuclear and radiation facilities/laboratories. The program covers the following : (a) Philippine Research Reactor (PRR-1) (b) Co-60 Multipurpose Irradiation (c) Radioisotopes Dispensing Laboratory (d) Radioactive Waste Management and Storage Facility (e) Secondary Standard Dosimetry Laboratory (f) other PNRI research laboratories handling radioactive materials. NRLSD was tasked to implement the program. A Task Force was created within the Division to review and evaluate the applications for authorization. The NRLSD is independent from all PNRI nuclear and radiation facilities and laboratories.

Although the Regulatory Body does not have specific CPR for radioactive waste management, the Radioactive Waste Management and Storage Facility submitted the requirements for the authorization based on CPR Part 3 and is currently being evaluated. The safety and security provision is included in the requirements.

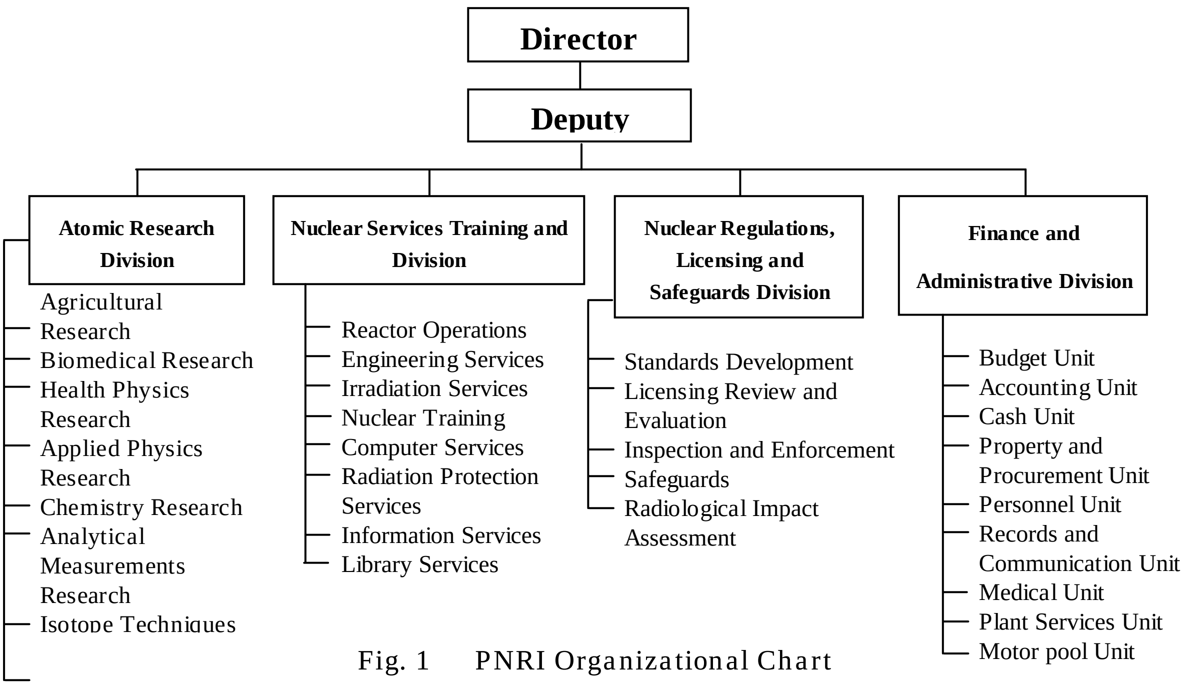

Fig. 1 PNRI Organizational Chart

6.1.3 Criteria to define Waste Category

Under the propose Comprehensive Hazardous and Nuclear Waste Management Act the criteria to define radioactive wastes category is as follows:

1. Exempt Wastes (EW) are radioactive wastes with activity level at or below clearance levels set by the PNRI which are based on an annual dose of 0.01 mSv to members of the public
2. Low and intermediate wastes (LILW) are radioactive waste with activity or concentration level above the clearance levels set by the PNRI. LILW may be a short lived waste or a long lived waste. A short lived waste (LILW-SL) is a waste containing radionuclide with half lives below or equal to the limits set by the PNRI. Long lived wastes (LILW-LL) are wastes containing radionuclide with long half-lives and with activity exceeding the short lived waste limits set by the PNRI; and
3. High level waste (HLW) is radioactive waste with activity or concentration level exceeding the limits for low and intermediate waste set by the PNRI.

The RWMSF is guide by IAEA recommendations, guides, standards, procedures and Code of PNRI Regulations in the categorization and characterization of radioactive waste.

6.1.4 Radioactive Waste Management Policies and Practices

The following Code of PNRI Regulations has specific provisions that address the safe management of radioactive waste generated from the authorized practice in the Philippines:

1) The Code of PNRI Regulations (CPR) PART 3 entitled *Standards for Protection Against Radiation* establishes the standards for protection against ionizing radiation arising from the authorized use of radioactive materials. It provides the general requirements for radioactive waste management and disposal of licensed radioactive material which includes (a) storage under controlled conditions, (b) control and monitoring of environmental discharges, (c) regulatory limit for airborne and waterborne discharges adopting the IAEA Clearance Levels for waste resulting from medical, industrial and research application of radioactive materials and the IAEA Safety Guide No. RS-G-1.7 entitled “Application of the Concepts of Exclusion, Exemption and Clearance for solid waste materials. In the case of disused sources, the licensee has the following options in the management of disused 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 disused sources, (c) return to the original manufacturer or supplier. These options should be thoroughly considered prior to disposal at the PNRI Centralized Radioactive Waste Management and Interim Storage Facility.

2) The Code of PNRI Regulations (CPR) PART 4 entitled *Regulations for the Safe Transport of Radioactive Materials in the Philippines* establish standards of safety to protect persons , property and the environment from the hazardous effects of radiation associated with the transport of radioactive material in the country. The CPR provides the following: (a) requirements for packaging and package, preparation for shipment and transport (b) procedures and standards for the control of shipment and for the approval of packaging and package.
3) The CPR Part 23 *entitled Licensing Requirements for Land Disposal of Radioactive Waste* contains technical and procedural provisions applicable to all phases of the lifecycle of a LLW Facility. This includes specific technical requirements involving siting, design, operations and closure, monitoring, waste classification, and institutional requirements. The requirements were basically based on international best practices and accepted guidelines such as those recommended by the IAEA. This regulation provides a basis for land disposal of solid radioactive waste that ensures that there is no unacceptable risk or detriment to humans, other biota and the environment at present and that the future risk or detriment will not exceed those currently accepted.

The PNRI operates and maintains a centralized Radioactive Waste Management and Storage Facility (RWMSF) for collection, segregation, and treatment of wastes generated primarily from medical, industrial, research and education application of radioactive materials including those generated from the research and promotional activities of PNRI.

The facility has a total land area of about 0.4 hectare and a building with a floor area of about 600 m2 located inside the PNRI compound. The PNRI compound is part of the University of the Philippines campus. The facility includes the following : wet laboratory for R&D activities , compressive strength testing area for concrete specimens, decay storage room, chemical precipitation area, cementation area for conditioning process, compaction area for compactable waste and two concrete lined trenches with concrete slabs roofing for interim storage. The interim storage and decay store total capacity of about 535 m3 and 100m3 respectively. The facility has a truck entrance leading to the basement level. This serves as the only entrance for large and heavy waste packages for management and also as the emergency exit for personnel in case of any untoward accident.

The RWMSF adopts two basic waste treatment and conditioning options for radioactive waste. These are (a) waste collection and packaging for decay storage for final disposal as ordinary refuse; (b) waste collection, segregation, treatment, conditioning and packaging, followed by interim storage awaiting final disposal in a repository. In the first option, exempted waste considered toxicwaste compound are excluded from dumping as ordinary refuse these includes organic scintillants and solvents. In the last option, treatment includes compaction for solid compactable waste, chemical precipitation or ion exchange for aqueous wastes. Depending on chemical composition and physical properties, waste are appropriately treated and immobilized by cementation prior to interim storage. Conditioned wastes are coded before storage using the established final coding system.

For management of disused sealed sources, the present practice is to store the sources in a pre-lined 200-liter drum in the interim storage without cement grout until a waste acceptance criterion for disposal has been established. Although in the past, several spent sealed sources were immobilized by cementation in 200 liter-drums. These conditioned wastes will have to be repackaged to meet the acceptance criteria.

The facility has two above ground concrete roofed trenches which serves as the interim storage area for conditioned and unconditioned waste. (see Fig. 2 Storage Trenches) The total capacity of the interim storage is around 535m^3. The facility has a 236 m^3 decay storage room for waste containing short lived radionuclides.

A service bulletin is available at the RWMSF providing guidelines for acceptance of low level radioactive waste for waste generators intending to have their waste managed by PNRI-RWMSF.

6.2 Decommissioning of the PNRI Research Reactor (PRR-1)

6.2.1 History of PRR-1

The PNRI Research Reactor (PRR-1) is the first and only nuclear research reactor in the country. It was obtained through the bilateral agreement between the Philippines and the United States of America on July 25, 1955. Under the agreement, the United States Government was to provide the research reactor while the Philippine Government was to provide the manpower and the building for the research facility.

The PRR-1 is an open pool general purpose type reactor owned and operated by the PNRI. The PRR-I is located inside the campus of the University of the Philippines Diliman, Quezon City. The PRR-1 became the principal research facility for many research activities in the field of radioisotope production, neutron spectrometry, neutron activation analysis and reactor physics. It was also the training ground for students and new graduates in natural sciences and engineering.

The PRR-1 started operation on August 26, 1963 at 1 MW with a plate type core was operated uneventfully without any major modification for about 15 years. The original instrumentation system and other parts of the reactor became unreliable and difficult to maintain by the late 1970's. The system was modernized in the 1980s replacing the fuel, cooling system and instrumentation system with new components provided by General Atomics. The TRIGA conversion was completed and was successfully restarted at full rated power of 3 MW in 1988.

But before the reactor could resume regular operation, a serious leak developed in the pool liner. The epoxy joint between the thermal column casing and the pool liner had failed and the aluminum liner had a serious corrosion problem.

However, the resumption of reactor operation was prevented due to the following : (a) the remaining original mechanical and electrical components were very old and needed repair; (b) the reactor core container was found not to be leak-tight ; (c) the area around the reactor site had urbanized and the confinement system of the reactor building – designed and built in the 1960's could not deal with an accidental radionuclide release , even if the system had been in perfect working order; (d) a seismic fault less than 5 km away became suspected by national authorities to be capable of causing severe earthquake.

In 2005, the PNRI formally decided to decommission the reactor and was accepted as a model reactor for the International Atomic Energy Agency (IAEA) Research Reactor Decommissioning Demonstration Project (R2D2).

The R^2D^2 Project commenced in June 2006 and expected to be completed in six years. Under this project, (a) IAEA will assist the regulatory body in developing its capability to review the necessary approach being proposed by the operator and ensure international safety standards are being appropriately applied (b) Technical assistance will be provided to the reactor operator/owner with the development of the safety documentation and supporting documents for the licensing process to decommission (c) workshops, training courses and hands-on-exercises will be conducted at the facility inviting other Member States to obtain practical experience.

6.2.2 Spent fuel management policy and practices

All of the fifty (50) spent fuel elements of PRR-1 were shipped back to United States in 1999 under the US Program to recover all spent enriched uranium fuel of US origin. The only remaining fuel elements were those from the TRIGA-converted reactor. The fuel elements had been irradiated for only for a few hours in 1988 TRIGA conversion testing. It is currently stored in the reactor bay inside the Reactor Building. It is planned to co-locate the special storage facility for the fuel element with the RWMSF meeting the radiological, safety and security requirements for special nuclear material until a decision will be made on whether to re-use the fuel for the planned new research reactor or shipped back fuel elements to the USA.

6.2.3 Decommissioning Plan

There are three basic decommissioning strategies but the deferred dismantling is the only choice since time has already passed beyond immediate dismantling strategy and the entombment strategy is not acceptable because the site was only lease to PNRI and will be eventually returned to the University of the Philippines (the owner).

The decommissioning plan will be based on the result of the radiological characterization survey of the reactor which is schedule to start and finished in 2007. The decommissioning plan will be submitted to the regulatory body for approval in the first quarter of 2008 and once approved decommissioning starts.

The main goals of the decommissioning activities are: (a) unrestricted release of the reactor building and the site; b) reduction of contamination below clearance levels specified by PNRI regulations which closely follows IAEA safety Series; c) clearance of materials and d) minimization of radioactive waste to be generated.

6.2.4 Decommissioning Waste

Since the spent fuel of the PRR-1 was shipped back to USA, the remaining residual activity is expected in the reactor core box and internal components, concrete in the biological shield (Fig. 4 Biological shield), beam tubes and pipes in the processing (see Fig 5 Processing Room) and treatment rooms(see Fig. 6 Treatment Room). The exact volume of the decommissioning waste will not be known until the radiological characterization survey is completed.

It was planned that the radioactive waste from decommissioning activities will be packaged in 200 liter drums and stored in the existing Radioactive Waste Management and Storage Facility until a radioactive disposal facility will be available.

Materials such as broken-up concrete that are below clearance levels can be placed as landfill in low areas of the PNRI compound. Non-radioactive waste such as scrap metal that has some commercial value may be sold.

6.2.3 Waste Disposal

The PNRI has still to establish a national waste disposal site but there is an on-going project with IAEA under TC PHI/9/023 “Site Selection & Conceptual Design for LILW Disposal”. The preferred site was selected based on the established set of criteria. The selected site was drilled for sub-surface characterization and the piezometer wells were monitored in the selected site is being conducted for ground water scenario. A preliminary safety assessment of ground water pathway was performed based on the conceptual design adapting the type & inventory of expected waste.

Under the TC Project it was proposed a co-location of simple trenches with minimum engineered designed for low level waste including decommissioning waste and borehole disposal for disused sealed sources.

6.3 Issues regarding radioactive waste management

(a) Assistance for managing Spent High Activity Radiation Sources (SHARS) including neutron sources
(b) Assistance to design/establish a dismantling system for small spent sealed sources and training of personnel on dismantling activities
(c) Assistance for a special storage facility for the TRIGA fuel elements to include the safety and security aspects although
(d) Construction of additional storage facility to accommodate the expected decommissioning waste (i.e. scrap metal, concrete) or to establish a final repository for the waste currently stored in the interim storage and the expected decommissioning waste
(e) Repackaging of corroded drums containing conditioned waste once an acceptance criteria has been defined in the proposed disposal site

References:

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2. Country Report presented by M.V.Palattao in the ANSN Workshop on Joint Convention , Sydney, Australia, Sept.4-7,2007
3. Updated Consolidated Report on Radioactive Waste Management in FNCA Countries, March 2007, FNCA-RWM

4. Technical Report presented by Leonardo Leopando in the Workshop on Legal and Regulatory Aspects of Decommissioning of Research Reactor under the Research Reactor Decommissioning Demonstration Project , Manila, 26-30 June 2006
5. Paper presented by Leonardo Leopando , Reactor Operation Group in the FNCA Task Group Meeting on Decommissioning Clearance, Manila, August 15–19,2005

Figures:

Fig. 2 STORAGE TRENCHES

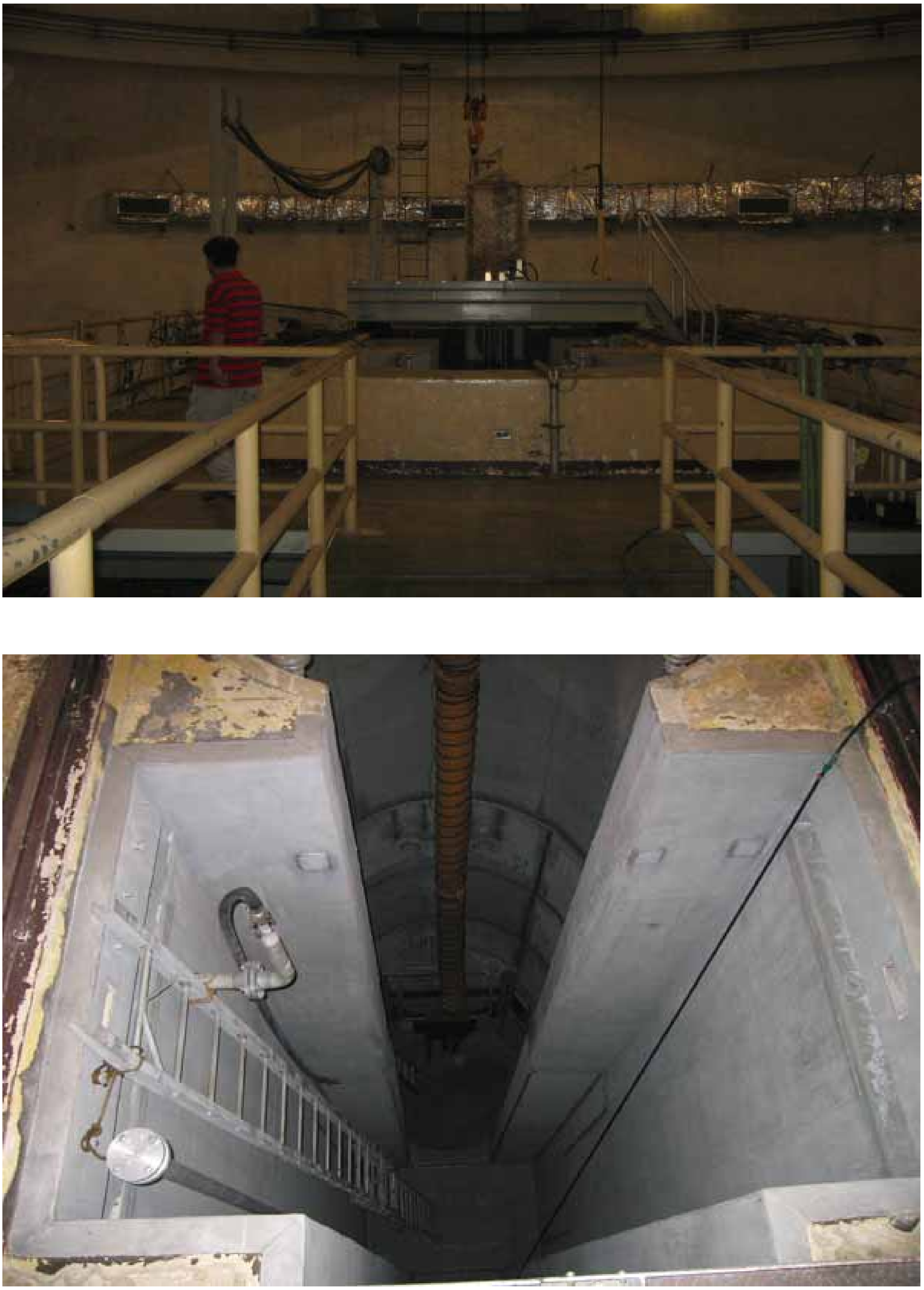

Fig. 3　PRR-1　Reactor Pool

Fig. 4 Biological Shield

Fig. 5 Processing Room

Fig. 6 TREATMENT ROOM