Decommissioning the Philippine Research Reactor (Under R2D2P): Updates and Challenges

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- Philippine Research Reactor (PRR-1) located at the Philippine Nuclear Research Institute (PNRI) is a host reactor to the Research Reactor Decommissioning Demonstration Project (R2D2P)
- PRR-1 was obtained about 45 years ago under the “Atoms for Peace” program of the U.S.A., started operation in 1963 at 1 MW, converted to TRIGA in the 1980’s, shutdown in 1988

Decommissioning Objective

- Specific Objective – removal of all contaminated facilities other than the external shell of the reactor building and its adjacent wings, allowing unrestricted use of these buildings
- Major outputs:
  - Characterization survey completed
    - Construction of TRIGA fuel storage
  - Decommissioning Plan approved by regulatory group
  - Additional enclosures for radwaste completed
  - Decommissioning work successfully completed

Research Reactor Fuel

- All of the spent plate-type fuel was shipped back to the USA in 1999, although slightly-irradiated (15 MW-hrs) and fresh TRIGA fuel elements are still stored in the reactor building

TRIGA fuel elements now inside the reactor will be moved to a secure storage in the PNRI compound

Challenges

- Decommissioning a research reactor in a developing country faces challenges in terms of limited human resources and funding constraints
- Philippine Nuclear Research Institute is both the operator and regulator; internal regulatory control program is in place and effective independence of the regulatory and operator divisions/units is maintained
- Activities not normally covered by decommissioning such as designing and constructing additional enclosures for storing decommissioning waste in the PNRI radwaste facility, have to be addressed

Decommissioning Plan

- Decommissioning report follows the format of SRS-45, Standard Format and Content for Safety Related Decommissioning Documents
- Chapters on Site Description and Characterization Plan have recently been submitted to the regulatory group of PNRI
- Detailed Chapter 3 on Dismantling and Decontamination Technologies is in preparation (started in 2008)
- Authorization from the regulatory group for decommissioning work is obtained in phases

Project Management

- Project management structure and organization was improved after the completion of an IAEA Expert Mission (31 March-4 April 2008) under the project
- Project Manager has been designated, instead of a Project Management Committee which is now the Project Coordination Committee

PRR-1 Characterization Survey

- Preparatory activities for characterization survey of the PRR-1 is ongoing
  - Radiation protection survey was started in May 2008
  - Lab analytical systems (counting equipment obtained from IAEA through the TC project) are being set up
- It is hoped that the characterization survey will indicate extent of D&D required and verify some key assumptions made by initial D&D plans for the PRR-1
  - An initial assumption is that heavy D&D will be limited to the bioshield, reactor core box, some parts of the water purification system, and old spills in the radioisotope labs
  - Another assumption is that all of the West Wing, most of the East Wing and most of the Grounds will not need decontamination
  - Above assumptions are based on operational history and long decay time since last operation

PRR-1 Characterization Survey

- There has been some delay, but the characterization survey should be completed in mid-2009

Design of TRIGA Fuel Storage

- The PRR-1 decommissioning project includes the transfer of TRIGA fuel elements to a storage vault to be constructed outside the reactor area
- Dry storage vault would be more similar to that for fresh fuel than for spent fuel
  - Minimal shielding required; dose rate is only 80 μSv/hr at one meter from a fuel rod
  - Fuel is less than 20% enriched but is not radioactive enough to be self-protecting, so strong physical security measures are needed
  - There is sufficient fuel to form a critical assembly under some conditions, so appropriate precautions are necessary

Design of TRIGA Fuel Storage

- Concept for the fuel container has been firmed up after an IAEA Expert Mission this year under the project:
  - An array of vertical holes made of 150-mm stainless-steel pipes about 110 cm long, embedded in a concrete block
  - Holes have sealed bottom ends and removable air-tight top covers
  - Holes are interconnected with small-diameter tubing for drying and inert-gas fill
  - 24 holes will hold all of the fuel inventory (up to 7 TRIGA rods per hole)
  - Concrete block volume will be about 10 cubic meters, assuming a very generous infinitely-subcritical spacing between holes

Design of TRIGA Fuel Storage

- The fuel container will be built inside a small room built like a reinforced-concrete bank vault
  - Walls and roof built to resist assault
  - Floor built to resist tunneling
  - No windows; bank vault door for access
  - Building intrusion alarms
  - Remote closed-circuit TV internal monitoring
- The vault will be built inside a secure fenced perimeter
- PNRI intends to construct the storage vault in 2009

Other Option for TRIGA Fuel

- Another option for the TRIGA fuel that PNRI is looking into is to ship the fuel to the U.S. under a USDOE project, in exchange for credits (for supply of fuel should PNRI need it for a future research reactor)

Decommissioning Waste Storage

- All radioactive decommissioning waste will be packaged and stored inside additional enclosures to be built in the PNRI radwaste facility
- The early estimate of radioactive waste volume is about 300-400 cubic meters
  - Biggest volume will be contaminated concrete rubble
  - Nearly all of the waste is expected to be low-level and not expected to require additional shielding of their containers
- The PNRI intends to design and perhaps begin building the new enclosures in 2009

Project Schedule – Output 4 – Decommissioning completed

Activity	Status/condition	Target date
Obtain funding for decommissioning	Detailed cost estimates required	Budget request for 2010
Obtain authorization for decommissioning		To start second half of 2009, full authorization middle of 2010
Bidding of decommissioning	Identify phases to be contracted out	Middle of 2010

Project Schedule – Output 4 – Decommissioning completed

Activity	Status/condition	Target date
Start Decommissioning		3rd Quarter 2010
End of decommissioning		EO 2012
Verification		1st quarter 2013
Apply for clearance		2nd quarter 2013

Needs from the IDN

- For actual dismantling work (depending on results of characterization survey), a Brokk Model 180 Nuclear is needed
- Sharing of information and experiences, e.g., on safety assessment, analysis of special samples
  - This year PNRI participated in the teleconference and discussion on the videos of decommissioning in France
- Training of PNRI personnel (regulatory staff and operating staff)
  - PNRI regulators and operators visited ENRESA and CIEMAT in Spain
  - PNRI operators participated in MOL decommissioning demonstration

Workshops Under R2D2P

- Technical Meeting on Legal and Regulatory Aspects of Decommissioning, Manila, Philippines, 26-30 June 2006
- Workshop on the Basics of Decommissioning of Research Reactors, Manila, Philippines, 16-20 October 2006
- R2D2P Workshop on Transition Phase, Sydney, Australia, 12-16 November 2007, hosted by ANSTO
- R2D2P Workshop on Characterization Survey, Manila, Philippines, 3-7 December 2007
- Regional Workshop on Safety of Research Reactors Decommissioning Activities: Project Planning, Management, Regulatory Review and Safety Assessment, Manila, Philippines, 15-19 September 2008

Thank you for your attention!