PRR-1 Decommissioning: Preparing for Dismantling and Decontamination

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- Contents of this presentation:
  - Characterization Survey
  - Preparing Fuel Storage
  - Preparing Waste Storage
  - Other Activities Under the Transition Phase

Characterization Survey

- The characterization survey of the PRR-1 has started
  - The Characterization Survey Plan is ready
    - Chapter 2 in attached references
    - An overview of the plan was presented in the R2D2P meeting in December 2007
  - Physical activities have begun
    - Radiation protection survey was started in May 2008
    - Lab analytical systems are being set up
  - Authorization for more intrusive activities, including sampling, will be sought very soon

- Main objective of the characterization survey is to provide radiological data for planning the dismantling and decontamination (D&D) of the PRR-1
  - Find location, nature, and extent of contamination
    - Reference for evaluating contamination is clearance levels
  - Predict hazards (including non-radiological) that may be encountered during D&D

- The PRR-1 Characterization Survey Plan was designed to do the following:
  - Quickly confirm that there is no contamination in areas with no history of radiation use
    - Primarily West Wing, some of East Wing, most of Grounds
    - Initially perform general area survey only in those areas
    - Radiation will be compared with natural background

- In areas with potential contamination, quickly determine whether any exists
  - Primarily most of East Wing, some of Grounds
  - Perform general area survey and selective scanning and sampling
  - Radioactivity in those areas compared with natural levels

- In areas with known contamination, identify radionuclides and precisely define distribution above clearance level
  - 100% surface scanning
  - Extensive sampling for laboratory analysis
  - Radioactivity will be compared with clearance levels
- In areas where contamination may be a significant worker hazard during D&D, also collect data for radiation protection purposes

- It is hoped that the characterization survey will 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

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

Preparing Fuel Storage

- The PRR-1 decommissioning project includes the transfer of residual fuel elements to a storage vault to be constructed outside the reactor area
  - All spent fuel shipped out in 1999, but slightly-irradiated and fresh TRIGA fuel rods are still stored in the reactor building
  - PNRI management has decided to keep the fuel instead of immediately disposing of it, so there is a need to relocate the fuel before D&D

- A storage vault for the residual fuel is more similar to one for fresh fuel than for spent fuel
  - Minimal shielding required; dose rate is only 80 μSv/hr at one meter from a fuel rod
  - No wet cooling required; fuel can go into dry storage
  - 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

- The current (early) concept for the fuel container is:
  - 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

- 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 build inside a secure fenced perimeter
  - Strong double fence topped with razor wire
  - Strong gate with multiple locks
  - Grounds intrusion alarm
  - Remote closed-circuit TV external monitoring

- The vault will be built in the grounds of the PNRI's Radioactive Waste Management Facility (RWMF), whose own fence and security system (including patrolling armed guards) will provide another layer of physical protection

- The PNRI intends to start construction of the fuel storage vault in 2009
  - However, the budget requested by the PNRI for 2009 was not fully granted

Preparing Waste Storage

- All radioactive waste produced by PRR-1 decommissioning will be packaged and placed in the RWMF for temporary storage
  - No Philippine disposal site yet

- The storage capacity of the RWMF will be expanded to accommodate the PRR-1 decommissioning waste
  - Waste is stored in the RWMF in simple roofed concrete enclosures, each with a capacity of 300 x 200-liter drums of low-level waste
  - Two enclosures currently exist, but are already partly filled

- 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
- At least 4 more new enclosures should be built
  - There is ground space in the RWMF for several more if necessary

- The PNRI intends to design and perhaps begin building the new enclosures in 2009
  - However, the budget requested by the PNRI for 2009 was not fully granted

Other Activities Under the Transition Phase

- Transfer movable radiation sources stored inside the reactor building to the RWMF
  - Co-60 sealed pencils in two shielded casks containing 7.15 TBq (193 Ci) and 13.5 TBq (365 Ci), respectively, and an unknown (but smaller) amount in another cask
    - Casks will be moved to RWMF as they are
  - Several small neutron sources that were used for reactor start-up
    - The reactor's old Cf-252 and Sb-Be sealed neutron sources now have negligible neutron strength and will just be packaged as low-level waste and moved to RWMF

- There is a small Pu-Be sealed neutron source that has not significantly decayed away - this will be packaged in a paraffin-filled 200-liter drum and moved to RWMF

– Various loose neutron-activated material
  - Mostly discarded irradiation rigs and sample holders
  - Will be packaged and moved to RWMF
– This activity will be done in 2008; authorization to transfer the Co-60 sources and some of the loose activated material has already been requested

- Remove loose uncontaminated material from the East Wing and Reactor Bay
  - Will clear the area for D&D
  - Trash will be disposed of; some material will be sold for recycling
  - The regulator's authorization to remove the uncontaminated material will be requested as soon as the characterization survey has verified them

- Isolate the West Wing from the rest of the building if the characterization survey proves that it is not contaminated
  - Will prevent contamination of the West Wing from D&D in the other parts of the building
  - Easy to isolate because there are only two access passages from the West Wing to the rest of the building, both of which can be completely sealed with concrete walls

- Make sure that the reactor's systems that will be used during D&D are maintained in good working order
  - Reactor building crane
  - Electrical system and lighting
  - Emergency diesel generator
  - Forklift
  - Compressed air system
  - Water supply
  - General building maintenance - fix leaky roofs, etc.