Development of the PRR-1 Decommissioning Plan

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Objectives of PRR-1 Decommissioning

- The objective of PRR-1 decommissioning has been defined by the PNRI to be the release from nuclear regulatory control for unrestricted future use of the Reactor Building and its immediate grounds
- It is an equal objective that the radiation protection of decommissioning personnel and the public meet Philippine regulations and IAEA safety standards

Considerations in Developing the PRR-1 Decommissioning Plan

- The ideal orderly transition from operation to decommissioning did not occur in the PRR-1
  - The reactor was unintentionally shut down in 1988, but decommissioning never became an option until 2002 and was never accepted until 2005
    - "Put the reactor back in operation" was the goal although never fully realizable because of lack of funds
  - No decommissioning plan was in existence and no funds were ever set aside to cover decommissioning while the reactor was in operation

- The PRR-1 until recently was never under any independent regulation
  - The PNRI is the nuclear regulatory agency of the Philippine government; the PRR-1, like all PNRI self-owned facilities, is considered exempt from licensing under current Philippine law
  - The PNRI did not devise an internal but effectively independent regulatory system for its self-owned facilities until 2004; the PRR-1 was not licensed under this system until 2006
    - The Nuclear Regulations, Licensing and Safeguards Division (NRLSD) is the PNRI's internal regulatory body
    - The PRR-1 is under the Nuclear Services and Training Division (NSTD)

- A law that will separate the regulatory function from the PNRI has been drafted; if passed, the law will put the PNRI-owned facilities under a completely independent regulatory body
  - The Philippine legislature has just begun to consider the draft law
- In the absence of the new regulatory body, the PNRI will regulate PRR-1 decommissioning under its internal system, applying the same regulations as it would apply to an external facility
- The PNRI's internal regulatory system explicitly applies the IAEA safety standards to the PNRI facilities in addition to the local regulations it applies to external licensees

- The current resources of PNRI are not sufficient to fully support PRR-1 decommissioning
  - The current budget of PNRI is already not sufficient to fully support all its mandated activities, let alone any new big project
    - The PNRI annual budget is only about 100 million pesos (US$ 2.3M), which is supposed to cover practically all nuclear research, facility operation, and regulation in the Philippines
  - The PNRI has only about 250 personnel in 33 units, of which the PRR-1 is just one
    - Less than 40 have an M.S. degree or higher, with rarely more than 2 or 3 in a field of specialization

- The Philippines has no radioactive waste disposal facility
  - The Radioactive Waste Management Facility (RWMF) of the PNRI is the only one of its kind in the Philippines, but it is small and capable only of temporary storage of low-level waste
  - The RWMF (like the PRR-1) is in the PNRI compound, although fenced-off separately
  - The PNRI is seeking to identify a site for long-term storage
    - Construction of a long-term storage facility is likely to be many years in the future

- Some nuclear fuel remains in the PRR-1, which is practically fresh and still considered usable by the PNRI
  - All spent fuel were shipped back to the U.S.A. In 1999
  - The 130 fuel rods that were used for TRIGA conversion remain in storage inside the reactor building
    - The fuel rods were irradiated to only about 15 MW-hours in 1988
    - Because of the very low burn-up and the long decay time, the fuel is not highly radioactive; a typical dose rate is 80 μSv/hr at one meter in air from one rod

- At present, the PNRI wishes to preserve the option to find some productive use for the fuel and does not consider it waste for disposal

- Unrestricted use appears to be the desired decommissioning end-point
  - The PNRI does not own the reactor site; the land must eventually be returned to the University of the Philippines, presumably in unencumbered condition
  - Urbanization has crept up on the site, with new buildings being built up to the fence less than a hundred meters from the PRR-1
  - However, a green field is not the desired end point; there is a wish to preserve at least the external shell of the reactor building because of its architectural significance

Approaches to be Adopted in Developing the PRR-1 Decommissioning Plan

- Assume that a credible decommissioning plan is necessary to get funding for PRR-1 decommissioning
  - Funding for PRR-1 decommissioning likely will be large and have to be provided by some congressional appropriation, and how the money will be spent will have to meet close scrutiny

- Immediately plan and implement a reliable characterization survey
  - Can be done with relatively easy to obtain external assistance and some reassignment of existing PNRI personnel and funding
  - Will provide data for planning and costing essential parts of the decommissioning plan:
    - Dismantling and decontamination
    - Waste packaging and storage
  - Quality assurance should be built into the survey from the start to ensure the reliability of the data generated, and consequently the reliability of the decommissioning plan

- Prepare a decommissioning plan in parallel with the characterization survey
  - Will not be firm until characterization survey is completed, but much work can nevertheless be done while the survey is underway
  - Like the characterization survey, can be done with obtainable external assistance and some reassignment of existing PNRI resources

- Have the decommissioning plan reviewed and approved
  - Within the PNRI internal regulatory control program provided Philippine nuclear law does not change
  - "Go with the flow" if the law does change

- The PNRI should put priority and resources on developing the decommissioning plan to ensure a good job is done
  - The PRR-1 Decommissioning Task Force was formed in Jan 2007 to do the characterization survey and prepare the decommissioning plan
    - Personnel are assigned to the Task Force as needed, but it is hard to find PNRI people with the necessary skills, and the few who have them already have commitments to other work
    - For operational funding, the Task Force relies on savings from the PNRI budget and some grants-in-aid from the Department of Science and Technology
    - The Task Force competes with other PNRI projects for these resources, and priority should be clearly established

Some Essential Contents of the PRR-1 Decommissioning Plan

- IAEA Safety Series No. 45, *Standard Format and Content for Safety Related Decommissioning Documents*, should be used to provide general guidance on content
  - The following are elaborations and additions with respect to the PRR-1 case, not replacement of any of the content of IAEA Safety Series No. 45

- Much of the transition work that would be in a usual decommissioning plan has already been done, although not in the context of decommissioning, and should be noted thus in the plan
  - Reactor core defueling
  - Spent fuel shipment
  - Pool dewatering and clearing
  - Dismantling of old ventilation ducts
  - Dismantling of some of the irradiation facilities
  - Clean-up of some laboratory rooms
  - Upgrading of the electrical power system
  - Refurbishment of some systems

- The decommissioning plan should describe the implementation of dismantling and decontamination
  - Probably mostly decontamination or dismantling of the reactor pool and core support structure; little else of the facility is expected to be above clearance level
  - Lighting, electrical power supply, and the crane in the reactor building will be needed and their refurbishment (if necessary) will be in the plan
  - Will consider non-radiological workplace hazards and non-radiological toxic waste (if any is found; only some toxic paint is believed to have any likelihood of being present)

- Provide for radioactive waste packaging and characterization according to acceptance criteria of the PNRI rad waste storage facility
- Provide for capacity expansion of the radioactive waste storage facility, if necessary
- Provide for disposal of non-radioactive waste, such as broken-up concrete and scrap metal
- Carefully plan work flow to avoid recontamination of cleaned-up areas

- The decommissioning plan should describe the implementation of waste management
  - Most of the radioactive waste volume will probably be composed of the following:
    - Contaminated concrete
    - Neutron-irradiated metal reactor parts
    - Graphite logs from thermal column
    - Resin from ion-exchange coolant purification system
  - Provide for radioactive waste packaging and characterization according to acceptance criteria of the PNRI rad waste storage facility
  - Provide for capacity expansion of the radioactive waste storage facility, if necessary
  - Provide for disposal of non-radioactive waste, such as broken-up concrete and scrap metal

- The decommissioning plan should provide for secure storage of remaining nuclear fuel
  - More a matter of security than radiation protection, as the fuel is practically fresh
  - Small fuel volume (~4m^3 in infinitely subcritical configuration) and low radioactivity will allow building a small, easy-to-secure, and relatively inexpensive vault to hold fuel in dry storage
  - The vault could probably be built with obtainable assistance even before the rest of decommissioning is funded, and should be
    - Improves fuel security immediately
    - Allows a quick start on decommissioning once funds become available

  - The fuel storage vault could be sited in the PNRI waste storage facility to share the cost of high security arrangements that will need to be put up there soon anyway
    - A quantity of spent medical and industrial sources are already in the storage facility, and more will be coming

- The decommissioning plan should include a good radiation protection program
  - Must comply with exposure dose limits for workers and public specified by existing PNRI regulations and IAEA safety standards
  - For decontamination and dismantling work, may need to re-evaluate current default administrative limits for occupational exposure dose of 10% of regulatory limits

- The decommissioning plan should include an occupational safety program to cover non-radiological hazards
  - Decommissioning personnel probably more likely to be hurt by common industrial accidents than by the low radioactivity in the PRR-1

- The decommissioning plan should include a reliable cost estimate
  - Good characterization needed to avoid surprises that will lead to unplanned costs
  - Preferably choose mainstream dismantling and decontamination techniques with well-known costs having little risk of escalation
  - Work flow should be planned carefully to avoid delays that will increase costs

- The decommissioning plan should provide for good project management
  - Most of the work will be beyond PNRI capability and will have to be done by contractors, which will need good oversight and contract management from PNRI
  - Several inter-dependent sub-projects could be going on all at once, which will need good management to avoid conflicts and delays
  - Good management is needed to stay what is likely to be just an adequate budget