The PRR-1 Situation

A. Regulatory Requirements

* The PNRI is both an operator of nuclear facilities and the national nuclear regulator.
* Current Philippine laws are interpreted to mean that the PNRI nuclear facilities (such as the PRR-1) are exempted from nuclear regulations.
* The PNRI is working with other government agencies to create a new nuclear law that will move the Philippine nuclear regulatory framework closer to agreement with international safety standards.
* Under the law that is being drafted, the PNRI will transfer its regulatory powers to a separate and independent regulatory agency that will be newly created. All nuclear activities and facilities in the Philippines, including those of the PNRI, will be regulated by the new agency.
* The enactment of the new nuclear law is expected to take several years. To serve until then, the PNRI has created an interim internal regulatory system that provides separation and independence between the operating and regulating PNRI divisions, and requires the PNRI nuclear facilities and activities to be formally authorized (licensed) by the PNRI regulatory division (the NRLSD).
* The decommissioning of the PRR-1 will be within the purview of the internal regulatory system.
* Under the interim internal regulatory system, the same regulations that the PNRI imposes on facilities not owned by the PNRI are also directly imposed by the NRLSD on the PNRI facilities. The PNRI has a set of nuclear regulations called the Code of PNRI Regulations (CPR) based on, among others, the IAEA Safety Standards.
* However, the CPR does not yet have regulations for the decommissioning of nuclear facilities. Those regulations will have to be created by the NRLSD in time for the decommissioning of the PRR-1.

B. Decommissioning Process

* Transition Phase: Discussed in Section F.
* Decommissioning Strategy
    - Of the three basic decommissioning strategies:
        + Time has already passed beyond the immediate dismantling strategy.
        + The entombment strategy is not acceptable because the PNRI does not own the site, and the owner (the University of the Philippines) considers the land a valuable asset that will be eventually returned.
        + The deferred dismantling strategy is selected by default. Nevertheless, a choice must still be made on the desired final state of the site.
    - The final state has several possibilities, among which are:
        + All structures are torn down and the site is restored to a "green field".
        + The shell of the reactor building is preserved but the interior is converted to some non-nuclear productive use.

- The PNRI will have to initiate and drive the process to choose the final state, but the decision cannot be made without the participation of the site owner and other stakeholders.

* Surveillance and Maintenance Phase
  - The PRR-1 went into this phase informally when funding for reactor repair was exhausted around the year 1999.
  - Under the new internal regulatory system of the PNRI, the condition of the PRR-1 during shutdown has to be formally defined and authorized (or licensed). The reactor is undergoing the authorization process, which is aimed to be completed by the end of 2006.
* Preparation Phase
  - The PRR-1 entered the Preparation Phase, without actually leaving the Surveillance and Maintenance Phase, when a firm decision to decommission was made in 2005.
  - Activities in the PRR-1 that would have been done during Facility Transition in an ideal decommissioning process will be done during the Preparation Phase instead. The activities include doing the characterization survey and preparing a decommissioning plan.
  - The PRR-1 decommissioning project team will be formally organized at an early stage of the Preparation Phase.
  - The decommissioning plan will be reviewed and approved under the PNRI's internal regulatory program during the Preparation Phase.
  - And very important: Funding to go into the Decontamination and Dismantling Phase will be obtained during the Preparation Phase.
* Decontamination and Dismantling Phase
  - Under the PNRI's internal regulatory system, the PRR-1 will have to obtain a new authorization to enter the Decontamination and Dismantling Phase. A key requirement of the new authorization will be the submission of a decommissioning plan and its approval by the NRLSD.
  - There is more to say about PRR-1 decontamination and dismantling in the other sections.
* Final Phase
  - After the completion of the Decontamination and Dismantling Phase, the PRR-1 will apply for a cancellation of its authorization as a nuclear facility under the PNRI's internal regulatory system, and its removal from the regulatory process.
  - It is expected that the application will be supported by final reports on decontamination and dismantling and a final radiological characterization survey.

C. Decommissioning Planning

* Of the three stages of decommissioning planning, the first two (Initial Planning and On-Going Planning) were never done in the PRR-1. The third stage (Final Planning) will be entered without the benefit of the first two stages and probably made more difficult thereby.

* Project Scope:
    - Bounds:
        + Decommissioning is expected to be performed only on the reactor building (including both east and west wings) and its immediate grounds. The other buildings and facilities in the PNRI site will remain operational.
        + The project is expected to include the expansion of the existing interim waste storage facility in the PNRI site to hold the PRR-1 decommissioning waste. The waste will go into temporary storage pending the creation of a long-term disposal site in the Philippines.
        + The project is also expected to include the construction of a secure dry storage vault for the TRIGA fuel rods of the PRR-1, somewhere outside the reactor building but still inside the PNRI site.
    - Expected end-state:
        + Not yet determined. The sentiment at present is to preserve the shell of the reactor building and convert it to some other use.
    - Final release criteria:
        + Not yet determined. To be defined mainly by the NRLSD.
* Selecting the Decommissioning Option (or Strategy):
    - Discussed under Decommissioning Process (Section B).
* Project Initiation:
    - The PRR-1 is actually now in this stage, entered without the benefit of advance planning. This was the penalty of not doing Initial Planning and On-Going Planning during reactor design construction and operation.
* Preliminary Studies:
    - The PRR-1 is about to formally enter this stage.
    - The IAEA will provide TC assistance for a characterization survey, which will begin in 2007.
* Detailed Design Studies:
    - It is hoped that the PRR-1 will be in this stage by 2008.
    - The topmost levels of the Work Breakdown Structure (WBS) will probably be defined earlier.
* Project Execution:
    - It is expected that the tasks under Project Execution will be performed by contractors. It is expected that the PNRI will not be able to perform the tasks by itself.
* Project Control:
    - The PRR-1 decommissioning project team will likely play a more direct role in Project Control than it will in the performing of tasks under Project Execution.
* Project Closeout:
    - It is expected that as the regulatory body, the NRLSD will have a strong role in Project Closeout.

D. Management of Decommissioning Projects

* The PNRI expects to form the core of the PRR-1 decommissioning project team from the old reactor operations staff.
* The reactor staff only has 10 people left, and cannot supply all of the competencies needed in a decommissioning organization.
* All of the core competencies required seem to be available in other PNRI units, but only in a few people in each field, and those people are already doing other jobs. The PNRI should be prepared to supply these other people to the decommissioning project team, even if only in a temporary or consulting basis.
* In addition to the decommissioning project team, the PNRI also has the responsibility of creating a strong decommissioning regulatory team within the NRLSD.
* The NRLSD may not have all the competencies needed to regulate PRR-1 decommissioning.
* The PNRI should be prepared to hire consultants and contractors for jobs that cannot be done by any of the PNRI staff, in both the operations and regulations sides.

E. Safety Related Documentation

* National Requirements
  - The PRR-1 nuclear regulatory situation has been discussed in Section A.
  - The PNRI follows IAEA safety standards and guides whenever possible. This is of course one reason the PRR-1 is in the R2D2P.
  - There are existing Philippine laws on hazardous wastes, solid wastes, air quality and environmental impact assessment. It is presumed that the PNRI will have to comply with regulations that apply to non-nuclear waste.
* Site Policies, Programs and Procedures
  - Policies will have to be set by top-level PNRI management (the Director and the Senior Staff), with the agreement of the site owner (the University of the Philippines).
  - It is expected that programs will be drafted by the PRR-1 decommissioning project team, and approved by top-level PNRI management.
  - Procedures and work instructions will be created by the PRR-1 decommissioning project team.
* Decommissioning Plan
  - The PRR-1, probably in common with many research reactors of its age, did not have an initial decommissioning plan during design, construction and operation.
  - The PRR-1 has been forced by circumstance into the Deferred Dismantling strategy, but without a proper Safe Enclosure Plan and a proper Shutdown Plan, nor a proper Surveillance and Maintenance Plan for the time it has been shut down. It is expected that this will now be remedied under the PNRI internal regulatory system.
  - The PRR-1 will need to have one authorization (license) for its present shutdown state, and another authorization for decommissioning. The decommissioning plan will support the latter.

- The PNRI management is realizing that the preparation of the decommissioning plan is a massive undertaking, and that it should be prepared to put manpower and other resources into it.
- The creation of decommissioning regulations and the review of the decommissioning plan appear not to be light undertakings either, and will need manpower and resources too.
- The PNRI has an IAEA TC project for assistance in creating the decommissioning plan.

* Safety Report
  - It is not certain that the Safety Report will be prepared as a separate document, but it will be an essential part of the PRR-1 Decommissioning Plan, by direct inclusion or by reference.
* Environmental Impact Assessment Report
  - It is expected that the environmental impact of PRR-1 decommissioning will be small and the Environmental Impact Assessment Report will be simple.
* Historical Site Assessment
  - Original drawings of the PRR-1 are available, but have not always been updated to show modifications and additions.
  - Beyond reactor console records, operational records are poor. Records of irradiations performed and work done in the radioisotope laboratories are incomplete.
  - In the absence of good written records, the memory of the reactor staff who remain in the PNRI and of those who have retired but are still available to be interviewed become more important. Unfortunately, much information has already been lost with the people who knew them.
* Radiological Survey Plans and Reports
  - PRR-1 radiological surveys are discussed in Radiological Monitoring During Decommissioning (Section H).
  - The Characterization Survey Report will be an essential reference of the Decommissioning Plan that will be submitted to the NRLSD under the PNRI internal regulatory system.
  - The Final Radiological Survey Report will be submitted to the NRLSD at the conclusion of PRR-1 decommissioning.
* Public Relations Plan
  - The PNRI has a Public Information Unit that is the probably the most qualified to write and implement the Public Relations Plan, but the PNRI has probably not yet fully realized that this unit will have to be an active member of the PRR-1 decommissioning project team.
  - The PNRI management will have to define a clear policy on public relations, on which the Public Relations Plan will be based.

F. The Transition Phase

* The PRR-1 was last operated in 1988. Efforts to repair the reactor continued and decommissioning was not considered until 2002. The decision to decommission was not final until 2005, when the PRR-1 was offered to the R2D2P.

* The PRR-1 was in the Transition Phase from 1988 to 2005 without knowing it.
* Nevertheless, some of the things that should be done during a deliberate Transition Phase were performed, although not for the purpose of decommissioning:
  - All spent fuel were removed from the facility.
  - The reactor pool and the coolant systems were drained.
  - All movable radioactive sources were removed from the reactor pool.
* Some things that should be done in a proper Transition Phase were not done:
  - No comprehensive characterization survey.
  - No decommissioning plan preparation.

G. Cost Estimate and Financial Mechanisms

* The PRR-1 does not yet have a well-informed cost estimate of PRR-1 decommissioning.
* At the present time, the decommissioning tasks are known only in general terms and are not yet specific enough to allow accurate cost estimates.
* The following work during 2007 could provide enough data to refine the definition of tasks:
  - Radiological characterization survey.
  - Creation of decommissioning regulations, including release criteria.
  - Decision on end-point of decommissioning.

H. Radiological Monitoring During Decommissioning

* At present, the PNRI does not have complete equipment to do the radiological monitoring properly, but will obtain equipment through an IAEA TC project.
* The PNRI intends to begin and finish the radiological characterization survey of the PRR-1 in 2007.
* The characterization survey will provide essential data for decommissioning planning. It should also settle the following major uncertainties in the PRR-1:
  - Did the pool liner leak in 1988 cause the migration of neutron activation products throughout the biological shield? It is known that leaking water percolated from 1988 to 1992 over the entire backside of the pool liner and through the seams between the pour stages of the concrete. If activation products have migrated, the amount of contaminated concrete that may have to be removed could be orders of magnitude larger.
  - How much contamination, if any, is in the ground outside the reactor building?

I. Decontamination Technologies

* The PNRI has never undertaken any large-scale decontamination activity. The PNRI has decontaminated only laboratory rooms, and even then in the context of returning them to nuclear use, not for unrestricted release.
* Entering this field will be a major learning experience, and the PNRI will need a lot of advice and training.

* It is believed that fortunately, the level of contamination in the PRR-1 is relatively low and extreme means of decontamination will probably not be needed:
  - There has already been 18 years of radioactive decay (although unplanned).
  - During the last decade before shutdown, the reactor was never operated above 100 kW (except for a few hours of testing at 3 MW).
  - There has never been a fuel cladding failure that would have released fission products.
  - The laboratories in the reactor building are believed to never have processed long-lived radioisotopes in any large quantity.

J. Health and Safety Concerns

* Industrial non-nuclear hazards have caused more injuries and fatalities in the PRR-1 than nuclear hazards. Furthermore, those casualties have been in contractor personnel rather than in PNRI personnel. It is believed that there was at least one fatality during construction in the 1960s. More recently, there was an accidental fatal electrocution in the 1990s during the repair of the PRR-1 ventilation system.
* Integrated Safety Management is something that the PNRI has never attempted before, although it now appears that it should be done during PRR-1 decommissioning.
* No asbestos or PCBs are known to be present inside the reactor building. On the other hand, the oldest paint layers in the reactor building and on the reactor pool are probably lead-based.

K. Recordkeeping

* Regretfully, the PRR-1 and the PNRI do not yet have an effective Record Management System. The records do exist, and there are individual efforts to organize and preserve them, but there is no effective institution-wide formal management system yet.
* The PNRI is creating an Integrated Management System (IMS) as recommended by the IAEA, and a Record Management System will be an important part of it. The PRR-1 decommissioning project is within the purview of the IMS, and is therefore obligated by that alone to set up a Record Management System.

L. Dismantling Technologies

* The PRR-1 has only a little experience in the dismantling of radioactive components. Some dismantling was done in the 1980s during TRIGA conversion, and again during the 1990s during the attempts at reactor repair. All that past work needed only simple technology.
* The dismantling during decommissioning will be of course be more extensive and will include work never attempted before, such as the break-up of contaminated concrete. More sophisticated technology than the PRR-1 has ever used before will probably be needed. the PRR-1 will need a lot of advice and training.

M. Waste and Spent Fuel Management

* As mentioned in Decommissioning Planning (Section C), the expansion of the PNRI's interim waste storage facility and the construction of a fuel storage vault are essential supporting activities of the decommissioning effort.

* Those activities should therefore not be handled separately, but planned, financed and managed together with decommissioning. This should assure that the decommissioning effort is not held up by delays in those supporting activities.
* The waste storage facility will have to seek an amendment of its authorization under the PNRI internal regulatory system in order to be allowed to receive the PRR-1 decommissioning waste. There will be a formal regulatory process, similar to the process the facility is now undergoing to be authorized to store the waste it already has.
* The fuel storage vault will have to be similarly authorized. It is possible that the vault will be co-located in the waste storage facility for reasons of security, and its authorization may then be included in the amended authorization of the waste storage facility.

N. Release from Regulatory Control

* The Philippine criteria for releasing material from the PRR-1, and also for releasing the site itself from regulatory control, are not yet defined and need to be established. As discussed in Regulatory Requirements (Section A), developing those criteria will be the responsibility of the NRLSD.
* It is recognized that developing the criteria is not a simple undertaking and the NRLSD may need assistance from outside the PNRI, possibly from the IAEA.