# BRAZIL REPORT: DECOMMISSIONIG ASPECTS

**R²D²P Workshop on Transition Phase**

Sydney, Australia
12-16 November 2007

## 1. Legal and Regulatory Framework

The legal and regulatory framework for decommissioning in generally is presented in small paragraphs in the CNEN licensing norms for specific facilities (mining, enrichment etc.). They done the guidelines for the report preparation, but there aren't any established requirements for each step. These guidelines are only a suggestion and then the operator has no fixed rules to direct the decommissioning work. Then the report is send to the regulatory body for each phase to be approved.

Specifically for research reactor there is no decommissioning guidelines in the norms.

Some documents give some information about the decommissioning subject.

### 1.1. **National Report of Brazil**

The ***"National Report of Brazil***"for the Joint Convention on the safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. (http://www.cnen.gov.br/seguranca/documentos/Waste_final_06.pdf), (May 2006) presents the following statements:

- ✓ There's no regulation that establish the funds composition for the decommissioning.
- ✓ For the NPP Angra 1 and Angra 2 the strategy is deferred dismantling, that means, confinement of the plants for 10 to 30 years, based in international studies of similar facilities. The funds for the decommissioning will subsidized by the electrical energy taxes. The wastes from this activity will be managed later when the national repository will be ready.
- ✓ For research reactors no decommissioning policy has been adopted.
- ✓ In this document is described the decommissioning of one nuclear facility in Brazil: USAM Monazite Sand Treatment Facility. This facility has produced rare earth since 1950's. Now the area is free of regulatory control for unrestricted use.

1.2. "**Nuclear Facilities Licensing**" – CNEN -NE-1.04.

1.3. **"Safety Assessment Report Guidelines"** – CNEN-NE-1.08, CNEN-NE-1.09, CNEN-NE-1.11.

1.4. **"Brazil: A Country Profile on Sustaintable Energy Development" -**

✓ Discussion about Nuclear Power Plants Decommissioning.

For all nuclear and radioactive issues in Brazil when the national regulations don't cover a specific situation the consensus is to use the IAEA recommendations.

In a discussion with the Regulatory Body it was identified this lack, and they said that one of the primary tasks is to prepare a document that covers the Decommissioning subject. In the Brazilian Radioactive Wastes Management Program that deficiency was also pointed out.

The present Brazilian Nuclear Program isn't greatly developed. There are 4 RR and 2 NPP. The operator of NPP is Eletronuclear that is separated from the regulator. The regulator is DRS (Diretoria de Radioproteção e Segurança Nuclear) – Nuclear Safety and Radiological Protection Directory and the RR are operated in the research institutes that belong to the DPD.

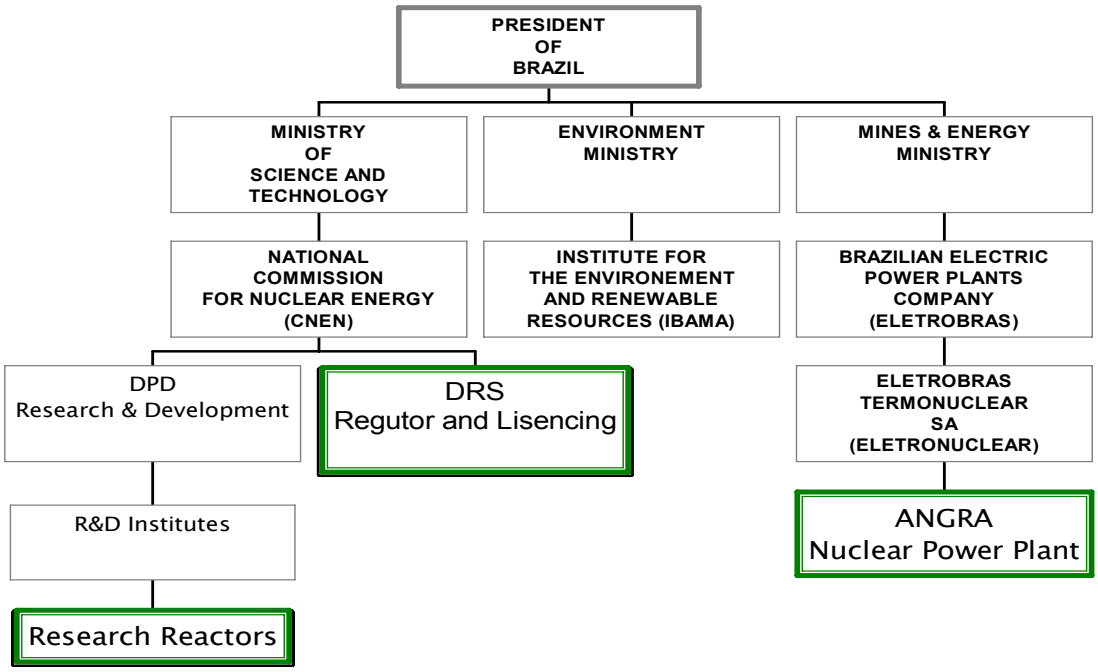


Figure 1: Brazilian Nuclear Structure

## 2. Decommissioning Plan and Strategy

To comply with CNEN requirements the basic Decommissioning planning will include these phases:

- ✓ a detailed decommissioning plan, including waste management and radiological procedures for the demolishing of the buildings (floors, walls, sanitary system, water distribution system, etc);
- ✓ procedures that would be adopted for the radiological characterization of the site (deepness of soil samples, frequency, etc) and frequency of reports to be submitted to CNEN;
- ✓ the radiological criteria to be used for clearance;
- ✓ a radioactive waste plan including the necessary and appropriate description of packages;
- ✓ description of the scenarios that would be used for the determination of area clearance values (cut off limit) in accordance of the previewed use;
- ✓ radiological procedures for the workers involved in the clean up; and
- ✓ procedures to control and guarantee that the doses on the neighboring population would not exceed 1 mSv/a.

Following these phases some guidelines for IPR-R1 decommissioning were established:

a) It will be followed the safety and environmental principles defined by they regulatory bodies;
b) The procedures for radioactive waste management of CDTN and IAEA will be used. For the hazardous and regular wastes it will be used the procedures established by the environmental institution.
c) The packages will be selected among the qualified ones, in accord of the waste to be conditioned. The preliminary qualitative assessment showed that the radioactive waste could be some concrete, aluminum and stainless steel structural pieces, pumps, contaminated with U, fission products and activation products.
d) The spent fuel elements will be stored in a special package, which is being developed by a multinational group in South America (IAEA Project). After a cooling period their final destination will be decided in accord of the future political scenario.
e) The equipment and staff requirements will be defined depending on the decontamination activities and on the material defined as radioactive waste.
f) The safety and environmental assessments will be done by CDTN´s radiological and environmental protection staff, respectively.

g) Costs should be estimated in advance, so that it would be provided the necessary budget.
h) A special report with the decommissioning plan should be prepared and sent to the regulatory body just before the reactor shutdown requesting the license for that.

The structure of the Decommissioning Plan Report will be, in accordance of the IAEA decommissioning documentation:

2.1. Introduction; done

2.2. Facility description: Physical description of the site and facility; operational history; systems and equipment; radioactive and toxic material inventory; done

2.3. Decommissioning strategy: Objectives; decommissioning alternatives; safety principles and criteria; waste type, volumes and routes; dose estimates; cost estimates; financial arrangements; selection and justification of preferred option; partly done

2.4. Project management: resources; organization and responsibilities; review and monitoring arrangements; training and qualifications; reporting and records; to be done

2.5. Decommissioning activities: description and schedule of phases and tasks; decontamination activities; dismantling; waste management; surveillance and maintenance programs; to be done

2.6. Safety assessment: dose predictions for tasks; demonstration of ALARA for tasks; radiation monitoring and protection system; physical security and materials control; management of safety; risk analysis; operating rules and instructions; justification of safety for workers, general population, and environment; to be done (established norm and procedures by CNEN 3.01 and CDTN, internal competency identified)

2.7. Environmental impact assessment; to be done (CDTN has environmental protection staff)

2.8. Quality assurance program; partly done (application of the existing procedures)

2.9. Radiation protection and safety program; partly done (CDTN has radiological and environmental protection staff)

2.10. Final radiation survey proposal / radiological criteria to be used for clearance; partly done (exemption levels established and CDTN has radiological and environmental protection staff)

Since that the reactor has about at least 10-year operation time, now the strategy was not decided. In our case one of these strategies can be applied:

- ✓ Immediate dismantling: This option allows for the facility to be removed from regulatory control relatively soon after shutdown or termination of regulated activities. Usually, the final dismantling or decontamination activities begin within a few months or years, depending on the facility. Following removal of regulatory control, the site is then available for reuse.
- ✓ Safe enclosure: This option postpones the final removal of controls for a longer period, usually of the order of 40–60 years. The facility is placed into a safe storage configuration until the eventual dismantling and decontamination activities occur.

As options for the decommissioning it can be considered: removal of the fuel assemblies and decontamination for following restricted uses or removal of all radioactive materials and thorough decontamination of the remaining structures to permit unrestricted use.

Just little time before the shutdown the decommissioning will be selected in accordance with the actual legislation, and the political and economical situation. As the reactor is at CDTN`s site probably the strategy will be: take off the fuel elements and the interns of the reactor. The concrete will be classified and the area can be used for other applications, because the core is in an excavated hole.

## 3. End State / Final Goal of Decommissioning Activities

The final goal of the first strategy is the unrestricted use of the local.

In the second strategy initially the local will be classified for restricted use, for example, as a historical piece of a TRIGA technology. After some decades the goal will be the unrestricted use of the place, after the full decontamination.

## 4. Cost Estimate and Funding

The TRIGA Reactor IPR-R1 belongs to CDTN one research institute of CNEN, and then the decommissioning costs will be provided by CNEN. CNEN is a public institution that takes part of the Science and Technology Ministry, and the budget for its work is defined in accordance of the previewed project.

## 5. Management of materials / waste

As the reactor facility is situated in a building, where there laboratories, offices, a library and a cafeteria (see Fig. 3), the dismantling will occur only in the facility rooms, when necessary.

The radiological protection staff will define the criteria for the release of material and facility rooms following CNEN norms 6.02 (Licensing of Radioactive Installations) and 6.05 (Management of Radioactive Wastes), and internal procedures.

The radioactive wastes will be classified and collected following the CNEN Norm 6.05 – Radioactive Waste Management.

The segregation will be done in accordance of the treatment options available in CDTN. Bailing, crushing, cementation, chemical precipitation and immobilization are the present possibilities. The low and intermediate waste product will be stored in the Intermediate Storage Facility in CDTN site.

Other materials will be classified as recyclable, regular or hazardous material and treated according to the environmental standards (10.000 ABNT Norm Series).

## 6. Decommissioning Expertise and Tools

Yes. There was already a decommissioning experience in Brazil, done in USAM Monazite Sand Treatment Facility. This facility has produced rare earth since 1950's. The area is now free of regulatory control for unrestricted use. As presented in the Guidelines at CDTN there is the expertise to perform the majority of decommissioning works, and for other ones there are enough expertise in Brazil to carry out them.

## 7. Additional Information

There was a International Congress in Santos, Brazil, in October and we presented the paper **"IPR-R1 TRIGA Research Reactor Decommissioning: Preliminary Plan"**. The objective of this presentation is to join dispersed expertise in Brazil and know about isolated experiences in decommissioning. We have some information about some decommissioning work in São Paulo inside and outside IPEN, another CNEN Institute.

At CDTN we discussed with the Director in order to create a group to develop this task.