

Research Reactor Decommissioning Demonstration Project (R²D²P)

WORKSHOP ON COST ESTIMATES

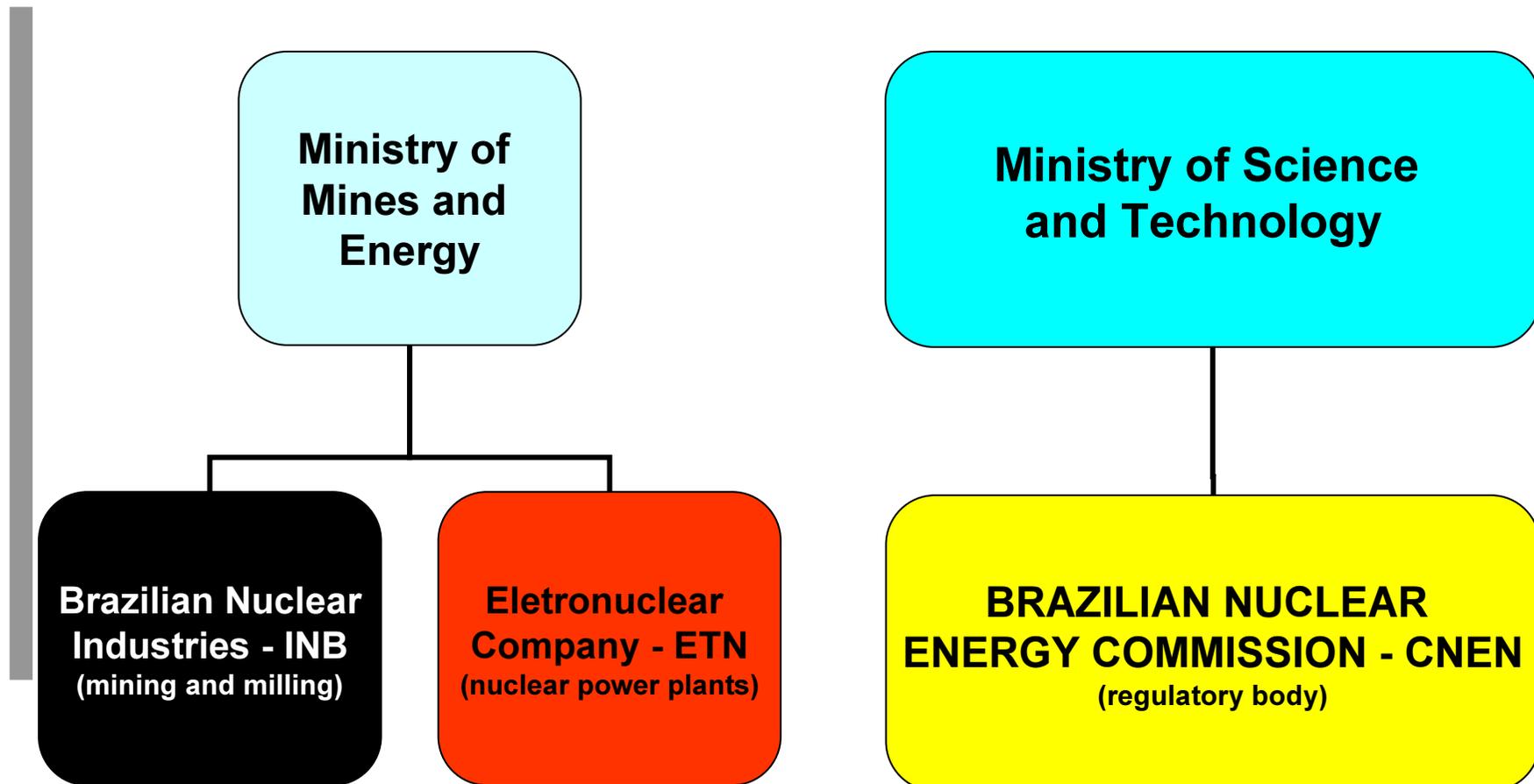
NERBE J. RUPERTI JR.*

PABLO ANDRADE GROSSI

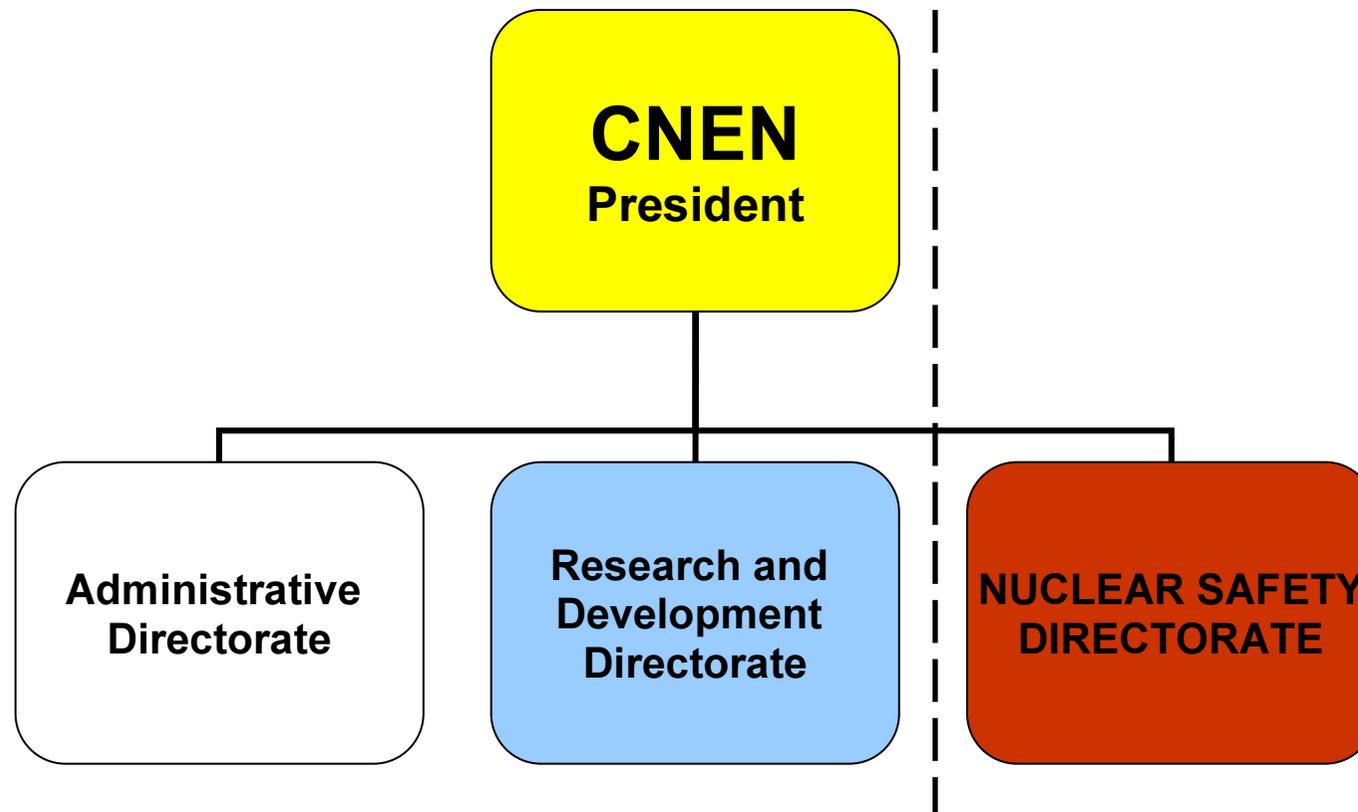
**DEPUTY HEAD, RADIOACTIVE WASTE DIVISION
BRAZILIAN NUCLEAR ENERGY COMMISSION*

OUR FRAMEWORK

NUCLEAR LEGISLATION FRAMEWORK IN BRAZIL



THE BRAZILIAN NUCLEAR ENERGY COMMISSION



Nuclear Licensing

- CNEN is the Regulatory Body in charge of regulating, licensing and controlling nuclear energy in Brazil.

Environmental Licensing

- IBAMA (Institute for Environmental and Renewable Natural Resources) under the Ministry for Environment is responsible for the environmental licensing process.

OUR EXPERIENCE

- The Santo Amaro monazite sand treatment facility (USAM) is the only decommissioned nuclear facility in Brazil;
- USAM operated since the 1950's in a small town near São Paulo, separating rare earth materials from monazite sand;
- The growth of urban areas around the site led to the decision to decommission the facility.



- Before decommissioning, the operator implemented, after approval of CNEN, a monitoring program for assessing the radiological impact on the environment;
- CNEN required that INB submitted: a detailed decommissioning plan, radiological procedures, the radiological criteria to be used for clearance and description of the scenarios that would be used for the determination of soil clearance values (cutoff limits).

- The scenario calculations performed by the Institute of Radiological Protection and Dosimetry (IRD), based on unconditional use of the area (soil), led to a clearance value of 0.6 Bq/g of ^{226}Ra for soil;
- The total waste volume generated was of the order of 8,250 m³;
- 372 m³ of slightly contaminated radioactive waste were transported to another INB installation, USIN, to be stored.



MANILA – 30 March - 03 April 2009

DIREJ/DRS



MANILA – 30 March - 03 April 2009

DIREJ/DRS

REGULATIONS

CNEN-NN-3.01 Basic Standards of Radiation Protection (Jan. 2005)

- Based on ICRP-60;
- Incorporates the same exemption levels of IAEA's BSS-115.

Draft of the standard Decommissioning of Nuclear and Radioactive Facilities

Based on the following documents:

- *WS-R-5, Decommissioning of Facilities Using Radioactive Material;*
- *DS333, Decommissioning of Nuclear Facilities;*
- *DS376, Safety Assessment for Decommissioning of Facilities Using Radioactive Material.*

Draft of a Federal Law that creates a national fund for the decommissioning of Nuclear Power Plants (Dec 2008)

Thank you for your attention!

Salamat pô!

nruperti@cnen.gov.br



**Brazilian
Report**

DECOMMISSIONING OF RESEARCH REACTORS: ON PROGRESS DECOMMISSIONING PLAN LEGAL AND REGULATORY FRAMEWORK

**Pablo Andrade Grossi
Nerbe José Ruperti Júnior**

Nuclear Technology Development Center - CDTN
National Commission of Nuclear Energy - CNEN



Ministério da
Ciência e Tecnologia



CONTENTS

- Introduction
- Compliance with international recommendations: main drivers and activities
- CNEN Institutional Projects
- National commitment/Legal and regulatory Framework
- Actual steps toward IPR-R1 Decommissioning Plan: Structure and General Aspects (Draft)
- Knowledge Diffusion

BRAZILIAN NUCLEAR AND RADIOACTIVE INSTALLATIONS

- Two Nuclear Power Plants
- Four research reactors
- One Pilot Scale Fuel Cycle Facility, including conversion $U \rightarrow UF_6$ and U enrichment
- One Fuel Element Assembly Facility
- One Monazite Sand Processing Facility
- Two Uranium Mine and Milling Facilities
- Mineral-industrial activities (Niobium, tantalum, zirconium etc.)
- Petroleum exploitation (NORM)
- 3500 Medical, Industrial and Research Facilities

RESEARCH REACTORS

<i>FACILITY</i>	<i>POWER (kW)</i>	<i>TYPE</i>	<i>STATUS</i>
ARGONAUTA	0.20	ARGONAUTA	Oper.
IEA-R1	5,000.00	POOL	Oper.
IPEN-MB 01	0.10	ZPR TANK	Oper.
IPR-R1	250	TRIGA-Mark I	Oper.

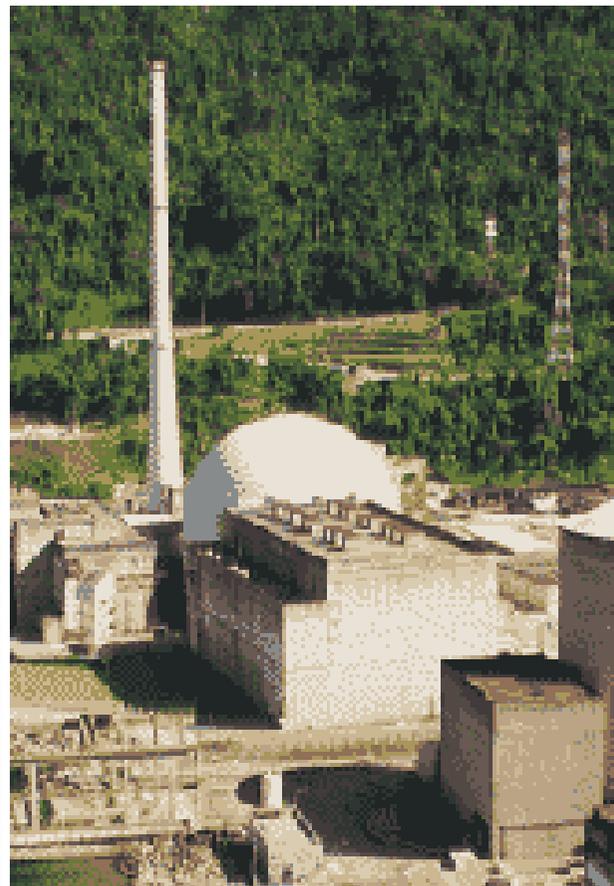
- ***Develop the IPR-R1 decommissioning plan in a joint work with the regulators*** allowing the creation of national regulatory standards applied to Brazilian RRs and other nuclear facilities (***main expected outcome of R2D2P***).

NUCLEAR POWER PLANTS

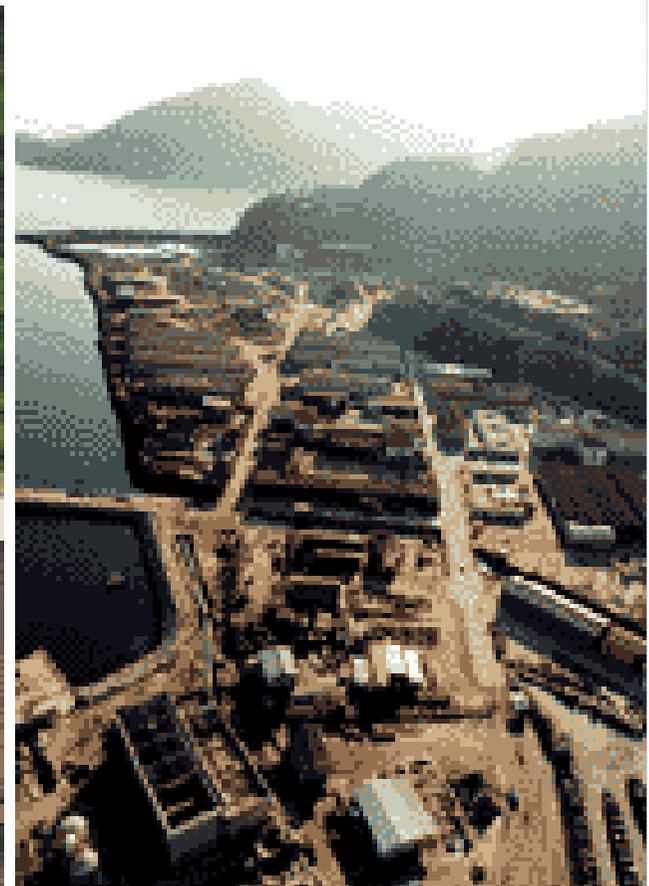
ANGRA 1 (627 MW)



ANGRA 2 (1350 MW)



*ANGRA 3
partial permit
for construction
(CNEN, March 2009)*



MAIN DRIVERS FOR NATIONAL ACTUATION TO COMPLY WITH INTERNATIONAL RECOMMENDATIONS:

- *Brazil became a Contracting Party on the Joint Convention (1997), least National Report (2008), amendments have been done previewing:*
- *Availability of adequate financial resources to support the radioactive waste and spent fuel storage facilities during their operating lifetime (focusing NPP) and for decommissioning (NPP and RR);*

MAIN DRIVERS FOR NATIONAL ACTUATION TO COMPLY WITH INTERNATIONAL RECOMMENDATIONS:

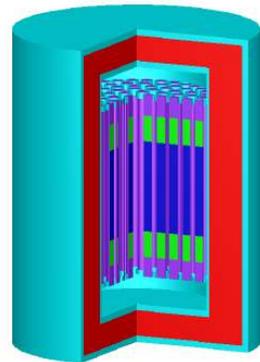
- *Brazil became a Contracting Party on the Joint Convention (1997), least National Report (2008), amendments have been done previewing:*
 - *Assurance of financial provision to enable institutional controls and monitoring arrangements during the period following the closure of the facility.*
 - *Staff qualification for decommissioning activities (thought R2D2P, IDN and efforts to establish the National Group for Decommissioning- NGD)*

MAIN DRIVERS FOR NATIONAL ACTUATION TO COMPLY WITH INTERNATIONAL RECOMMENDATIONS:

- *Partial permits for Angra 3 (NPP) Construction – emitted in March 9, 2009, allowing the sealing the area of the reactor building and concreting of safety structures.*
- *... due to Angra 3 construction were lifted the needs to have a National Radioactive Waste Repository and a NPP Spent Fuel Element Storage Facility.*

CNEN INSTITUTIONAL PROJECTS:

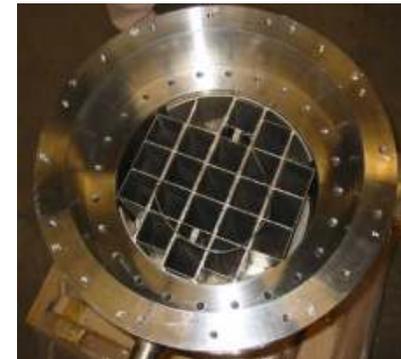
- *Multipurpose Brazilian Reactor*
 - *50 MW (maximum power, under study);*
 - *MTR fuel element, U₃Si₂-Al;*
 - *19,75% of enrichment.*



Cask numerical simulation



Prototype – external view



Prototype – internal view

CNEN INSTITUTIONAL PROJECTS:

- *National Radioactive Waste Repository for Brazil:*
 - *Storage of LLW and ILW from NPP's, RR, agriculture, medicine and industry activities;*
 - *Starts its operation in 2013;*
 - *Creation of the Brazilian Enterprise for Radioactive Waste Management – EB2R.*

CNEN INSTITUTIONAL PROJECTS:

- *Storage Facility for NPP Spent Fuel Elements*
 - *Future reuse purposes (reprocessing);*
 - *Transport cask is under advanced development;*
 - *Requirement: facility under construction when Angra 3 starts its operation*
(previewed for 2014).

NATIONAL COMMITMENT/ LEGAL AND REGULATORY FRAMEWORK

■ **Establishment of a National Group for Decommissioning - NGD (Brazil)**

¹Pablo Andrade Grossi (pabloag@cdtn.br) +55 (31) 3069-3248 or 9296-3703

¹Clédola Cássia Oliveira de Tello (tellocc@cdtn.br) +55 (31) 3069-3248

¹Alexandre Soares Leal (asleal@cdtn.br) +55 (31) 3069 - 3308

¹Maria Ângela (lainetti@ipen.br) +55 (31) 3069 - 3448

¹Amir Mesquita (amir@cdtn.br) +55 (31) 3069 - 3307

¹Fausto Maretti Júnior (fmj@cdtn.br) +55 (31) 3069 - 3433

¹Célia Araujo Figueiredo (caf@cdtn.br) +55 (31) 3069 – 3157

²Paulo Ernesto de Oliveira Lainetti (lainetti@ipen.br) +55 (11) 3133-9333

¹CDTN/CNEN

Centro de Desenvolvimento da Tecnologia Nuclear/ Comissão Nacional de Energia Nuclear, Av. Presidente Antônio Carlos, 6627, Campus Pampulha - CEP 31270-901, Caixa Postal 941, Belo Horizonte - Minas Gerais, Brasil.

²IPEN/CNEN

Instituto de Pesquisas Energéticas e Nucleares, Av. Prof. Lineu Prestes, 2242, Cidade Universitária, Butantã, 05508-900 - Sao Paulo, SP - Brasil - Caixa-Postal: 11049 Telefone: (11) 3133-9333 Fax: (11) 3133-9247



NATIONAL COMMITMENT/ LEGAL AND REGULATORY FRAMEWORK

■ **Establishment of a National Group for Decommissioning - NGD (Brazil)**

(Regulators)

³Ana Maria Xavier (axavier@cnen.gov.br) +55 (51) 3322-4995

³Eduardo Figueira da Silva (efsilva@cnen.gov.br) +55 (21) 2173-2631

³Nerbe José Ruperti Júnior (nruperti@cnen.gov.br) +55 (21) 2173-2619 or
9605-9253

³CNEN/SEDE

Comissão Nacional de Energia Nuclear (CNEN), Rua General Severiano No. 90, Botafogo, 22294-900 Rio de Janeiro – RJ, Brasil.



ACTUAL STEPS TOWARD IPR-R1 DECOMMISSIONING PLAN:

- OPERATIONAL DATA RECOVERY
- PROPERTIES AND CONSTRUCTION ASPECTS: *Identification of structural characteristics, materials, alterations, restructuring and significant plant modifications*
- DRIVERS TO DETERMINE THE DECOMMISSIONING - LIFETIME ESTIMATION: *Maximum Fuel Element Burn-up, Assessment of Structural and Operational Safety Conditions, Institutional and National Strategies for Nuclear Facilities*
- DEFINITION OF RESPONSIBILITIES, ACTIVITIES AND ORGANIZATION CHART (FOCUSING INVOLVEMENT OF THE STAFF ON THE PROJECT)

ACTUAL STEPS TOWARD IPR-R1 DECOMMISSIONING PLAN:

- *CHARACTERIZATION PROGRAM*
 - *Contamination Level Approach*
 - *Gridding for Sampling and number of samples to be taken*
 - *Clearance Values*
- *ASSESSMENT OF STEPS, PROCESSES AND CRITICAL TASKS OF DECOMMISSIONING*
- *DEVELOPMENT OF LEGAL AND REGULATORY FRAMEWORK AND ASSIGN DOCUMENTATION (involving the **NGD**)*

KNOWLEDGE DIFFUSION

- **“GENERAL ASPECTS TO BE CONSIDERED IN A RESEARCH REACTOR DECOMMISSIONING PLAN”**
 - INAC 2009 - International Nuclear Atlantic Conference - Rio de Janeiro - Brazil, Oct.2009
- **“IPR-R1 TRIGA Research Reactor Decommissioning Plan”**
 - IRPA 12 - Buenos Aires, Argentina, October 2008
- **“IPR-R1 TRIGA Research Reactor Decommissioning: Preliminary Plan“.**
 - International Congress in Santos, Brazil, in October 2007

*THANK YOU FOR YOUR
ATTENTION*



Ministério da
Ciência e Tecnologia

