Decommissioning Activities at IPEN/CNEN-SP 
Brazil

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Acknowledgements

First of all, on behalf of IPEN/CNEN-SP and myself, I am very grateful to:

- Necsa – South Africa Nuclear Energy Corporation
- IAEA
- Elna Fourie, Lazya van Heerden / NECSA
- Patrick O’Sullivan, Miriam De La Cruz / IAEA
- IAEA Coordinated Research Project BRA 12800 (2004-8)
Federative Republic of Brazil

- **26 states and a Federal District**
- Capital: Brasília
- Most known and beatiful city: Rio de Janeiro
- Biggest city, industrial/economic center: São Paulo
- Population: over 190 million inhabitants (5°)
- Area: 8,514,876 km² (5°)
  - USD 2,090 billion (7°)
  - USD 10,816 (63°)
- Electric Sector

*Installed Electricity Generation Capacity: ~112.4 GW (2010)*
Small contribution of the nuclear generation

In comparison with some developed countries, Brazil has a modest and recent nuclear program:
- 2 NPPs in operation
- 1 NPP in construction

Source: Agência Nacional de Energia Elétrica (Aneel), 24th May 2011
Eletronuclear
NUCLEP
FCN INB

Two nuclear power plants:
Angra-I 657 MWe 1985 (com.op.)
Angra-II 1345 MWe 2001 (com.op.)

Sixth world uranium reserves
310,000 t $U_3O_8$ L.C.
Caitite county - Ba

MAIN BRAZILIAN NUCLEAR FACILITIES

CNEN
R & D Centers

CRCN

CDTN

IEN and IRD

IPEN

CTM
Brz. Navy
Current Status of Nuclear and Decommissioning Activities

- Brazilian Constitution states: *Federal Government* has the exclusive competence for all nuclear energy activities

- *Nuclear Energy National Commission – CNEN* - is the Regulatory Body in charge of regulating, licensing and controlling nuclear energy utilization, besides research and development, radioisotopes production and radioactive waste disposal

- Brazil has presently:
  - 15 nuclear facilities (power and research reactors, U mining, U enrichment, UO₂ pellets plant, fuel assembling, nuclear materials storage)
  - > 3000 radioactive facilities (medical, industrial, research, radioactive waste storage)

- Decommissioning Activities Accomplished
  - Nuclear Fuel Cycle Pilot Plants – IPEN (2000-06): Isotopic Charact. Lab.; UF₄/Aqueous Route PP; Thorium Sulfate PP; U Dissolution and Purification PP; UF₆ Conversion PP; UO₂ PP.

- Near Future Decommissioning Activities
  - Nuclear Fuel Cycle Pilot Plants – IPEN: ADU Precipitation PP; Calcination of ADU to UO₃ PP; Fluidized Bed Denitration (NUH to UO₃); UF₄ Production - Moving Bed Units I and II; Thorium Sulfate Dissolution and Thorium Nitrate Purification; Reprocessing Laboratory.
  - Uranium mines: Buena/RJ
Nuclear and Energetic Research Institute - IPEN

• Is an institution owned by the Government of Sao Paulo State
• Is supported and operated technical and administratively by the Brazilian Nuclear Commission – CNEN (it is the biggest of the CNEN’s Institutes)
• Is associated to the University of Sao Paulo for postgraduate courses
• It was created in 1956 with the main purpose of performing research and development of nuclear energy peaceful applications

IPEN is located in Sao Paulo City at the Campus of Sao Paulo University in an area of nearly 500,000 square meters
Pilot Plants Already Decommissioned at IPEN

- Most Brazilian nuclear fuel cycle R&D activities were accomplished at IPEN, in laboratory and pilot plant scale.
- Most facilities were built in the 70’s and 80’s years.
- Beginning of 90’s – radical changes of the Brazilian nuclear policy ⇒ Interruption of most R&D fuel cycle activities and shutdown of facilities at IPEN.
- *Old facilities and occupied area constitute a valuable resource: after decommissioning, buildings have been used for other governmental strategic programmes: fuel cells, Lasers, polymers, biomaterials, environment, nanotechnology.*
Dismantling of the U Purification Pilot Plant - IPEN

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August 2011
Decommissioning of Thorium Sulfate Dissolution and UF₄ Aqueous Route Pilot Plants

Decommissioning of the Isotopic Characterization Laboratory
UF₆ Pilot Plant Dismantling Operations

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Decommissioning of the UO$_2$ Fuel Pellets Pilot Plant

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Conditioning and Decontamination of Radioactive Wastes

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August 2011
Future Decommissioning Activities

Pilot plants

- ADU Precipitation
- Calcination to UO$_3$
- Denitrination - Fluidized Bed (NUH to UO$_3$)
- UF$_4$ production - Moving Bed - Units I and II
- Thorium Nitrate Purification
- Reprocessing Laboratory

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Present Decommissioning Projects at IPEN

- Design of the Brazilian Multipurpose Reactor: Subsystem 19300 – Decommissioning

- Person in charge: P. Lainetti

Objectives:
- Licensing requirements
- Use of international experience and lessons learned to give recommendations aiming to facilitate the reactor decommissioning in the future
In comparison with some developed countries, Brazil has a modest and recent nuclear program (2 NPPs, < 2% of the generation capacity = 112 GW, 4 RR)s.

Reduced dimensions of the nuclear market and lack shutdown of facilities/projects ⇒ there are not companies specialized in decommissioning.

Indefinition of the Nuclear Program for a long period (~20 years).

Lack of a specific Norm related to decommissioning (under preparation, now).

Political hesitation about the D&D decision and priorities.

There is limited expertise in this field in the country.

Personnel retirement or dispersion (public servants – most nuclear activities).

Exhausted capacity of radioactive waste storage in IPEN.

Lack of decontamination / treatment techniques suitable for Medium and Low Level Waste volume reduction, considering the amount generated in the dismantlement operations.

Usual lack of resources.
Thank all of you, for your attention!