RMB
THE NEW BRAZILIAN MULTIPURPOSE RESEARCH REACTOR

Jose Augusto Perrotta
November 2014
## Responsibilities

<table>
<thead>
<tr>
<th>Owner</th>
<th>Nuclear Energy National Commission - CNEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Responsible</td>
<td>Research and Development Directory - DPD</td>
</tr>
</tbody>
</table>

### Support

- [ipen](#)
- [CDTN](#)
- [ien](#)
- [IRD](#)
- [CRCN](#)
# RESEARCH REACTORS IN BRAZIL

<table>
<thead>
<tr>
<th>Name</th>
<th>Utilization</th>
<th>Power</th>
<th>Site</th>
<th>Startup</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPEN/MB-01</td>
<td>Critical facility – PWR Core analysis</td>
<td>100 W</td>
<td>IPEN/CNEN-SP São Paulo</td>
<td>1988</td>
<td>Open Core - Pin Type</td>
</tr>
<tr>
<td>ARGONAUTA</td>
<td>Research -Education</td>
<td>500 W</td>
<td>IEN/CNEN-RJ Rio de Janeiro</td>
<td>1965</td>
<td>Argonaut</td>
</tr>
<tr>
<td>IPR-R1</td>
<td>Research -Education</td>
<td>100 kW</td>
<td>CDTN/CNEN-MG Belo Horizonte</td>
<td>1960</td>
<td>TRIGA MARK-I</td>
</tr>
<tr>
<td>IEA-R1</td>
<td>Research Radioisotope Production</td>
<td>5 MW (2MW)</td>
<td>IPEN/CNEN-SP São Paulo</td>
<td>1957</td>
<td>Reator MTR Piscina Aberta</td>
</tr>
</tbody>
</table>

1957 : IEA

2014: IPEN/CNENSP
RESEARCH REACTORS IN BRAZIL

IEA-R1 (1958) ----- IPEN (2014)
The RMB will provide Brazil with a key infrastructure to national development activities of the nuclear sector in the areas of social, strategic, industrial, scientific and technological development and application.

Structuring project.
RMB MAIN FUNCTIONS

- Radioisotope Production for Medical and Industrial Applications
- Fuel and Materials Irradiation Testing
- Neutron Beam Laboratory
- Education and Training
RMB PROJECT MANAGEMENT

- Project managed by the Research and Development Directorate of the Brazilian Nuclear Energy Commission (DPD-CNEN)

- Scope and conceptual design, licensing process management, and commissioning verification are performed by the Research Institutes of CNEN: IPEN, CDTN, IEN, CRCN

- CNEN – CNEA (Argentina) Cooperation Agreement on Reactor Design of RMB and RA-10 based on INVAP / Opal design

- Preliminary and detailed design, manufacturing, construction, assembling and their management will be carried out by national and international companies.

- Project technically supported by Brazilian Academy

- Project Cost estimation of US$ 500 million

- Project time span of at least 6 years after the first contract signature and availability of funds.
CNEN Institutes technicians developed the conceptual engineering design of the reactor systems and main facilities.

Preliminary engineering design of systems, buildings and infrastructure of the RMB (except preliminary engineering design of pure nuclear systems and components). Brazilian company INTERTECHNE contracted. Ends in November 2014.


Environmental licensing process started. Term of Reference for EIA approved by IBAMA. EIA done by Brazilian Company MRS. EIA under analysis of IBAMA. Three public hearings done.

Nuclear licensing process started. Site Evaluation Report is under analysis by DRS/CNEN.
RMB PROJECT STATUS

Chronogram

Lack of resources to start
### Licensing Steps

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<tr>
<th>Etapa - CNEN</th>
<th>Etapa-IBAMA</th>
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<tr>
<td>Aprovação do Local</td>
<td>Licença Prévia</td>
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<tr>
<td>Autorização de Operação Inicial</td>
<td>Licença de Operação</td>
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<tr>
<td>Autorização de Operação Permanente</td>
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<table>
<thead>
<tr>
<th>Etapa - IBAMA</th>
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<tbody>
<tr>
<td>Concepção</td>
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<tr>
<td>Projeto Básico</td>
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<tr>
<td>Projeto Detalhado</td>
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<table>
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<tr>
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<tbody>
<tr>
<td>Licença Prévia</td>
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<tr>
<td>Licença de Instalação</td>
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<tr>
<td>Licença de Construção</td>
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<table>
<thead>
<tr>
<th>Construção</th>
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<tbody>
<tr>
<td>Prédios e Estruturas Convencionais</td>
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<tr>
<td>Prédios com Itens de Segurança</td>
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<thead>
<tr>
<th>Comissionamento</th>
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<tr>
<th>Documentos - CNEN</th>
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<tr>
<td>Relatório de Local</td>
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<tr>
<td>Relatório Preliminar de Análise de Segurança</td>
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<tr>
<td>Relatório Final de Análise de Segurança</td>
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<tr>
<td>Relatório de Operação Inicial</td>
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<tr>
<td>Plano Preliminar de Proteção Física</td>
</tr>
<tr>
<td>Plano Final de Proteção Física</td>
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<tr>
<td>PGQ da Fase de Operação Permanente</td>
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<th>Documentos - IBAMA</th>
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<tr>
<td>EIA/RIMA</td>
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<tr>
<td>Planos Ambientais</td>
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<tr>
<td>Relatórios sobre os Programas Ambientais</td>
</tr>
<tr>
<td>Audiências Públicas</td>
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<tr>
<td>Cumprimento de Condicionantes</td>
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Distâncias: (Rota / Linear)
- Iperó / São Paulo (140 Km / 109 Km)
- Iperó / Sorocaba (50 Km / 39 Km)
Morro do Araçoiaba
RMB SITE WORKS

Topography Survey

Ground Survey

Meteorological Tower
Pre operational Environmental Monitoring

Air Monitoring - Iperó

Meteorological Tower Detail

Air Monitoring - Site
1 – Nuclear Research and Production Area
2 – Administrative Area
3 – Infrastructure Area
4 – Electrical Station
5 – RMB Entrance
RMB INSTALLATIONS HIGHLIGHTS

RMB Main Gate

Site Services Area
RMB INSTALLATIONS HIGHLIGHTS

Administrative Area
RMB INSTALLATIONS HIGHLIGHTS

Administration - Auditorium and Education Center – Restaurant – Medical Center
Nuclear Research and Production Area

1 - NRPA Entrance
2 - Researchers Bld.
3 - Workshop Bld.
4 - Waste Processing and Storage Bld.
5 - Electrical Supply Bld.
6 - Cooling Towers
7 - Reactor Auxiliary Bld.
8 - Reactor Bld.
9 - Spent Fuel Bld.
10 - Post Irradiation Lab.
11 - Radioisotope Processing Bld.
12 - Radiochemistry Lab.
13 - Operator Support Bld.
14 - Neutron Beam Lab.
RMB INSTALLATIONS HIGHLIGHTS

Nuclear Research and Production Area
Core Design Features

- Thermal Power: 30 MW
- Fuel Assemblies: LEU – MTR (U₃Si₂-AL)
- Core configuration: 5 x 5 grid with 23 FAs and 2 in-core irradiation positions
- Control Rods: 6 Hf plates (3 per Guide Box)
- Core Cooling: 3100 m³/h upward direction
RMB PROJECT HIGHLIGHTS

South – North Building Section
RMB PROJECT HIGHLIGHTS

+ 13.00 m level
RMB PROJECT HIGHLIGHTS

- 6.50 m level
RMB PROJECT HIGHLIGHTS

Reflector Vessel Irradiation Facilities

- **Bulk Irradiation Positions** (3000 Ci end of irrad.)
  - Quantity: 17 + 3
  - Main Dimension: Ø 60mm

- **Pneumatic Irradiation Positions**
  - Quantity: 12
  - Dimension: Ø 110mm
    - 2
    - 110mm x 260mm

- **NTD Irradiation Positions**
  - Quantity: 3
    - 2
  - Main Dimension: Ø 6”
    - Ø 8”

- **Loop Irradiation Area**
  - Quantity: 1
  - Main Dimension: 410mm x 750mm
RMB PROJECT HIGHLIGHTS

A – B : THERMAL BEAMS
C – D : COLD BEAMS
E : NEUTROGRAPHY BEAM
Pneumatic Irradiation Facilities

9 In Pile Assemblies (Aluminum Cans)

5 In Pile Assemblies (Short time irradiation - Plastic Cans)
Pneumatic Irradiation Facilities
Thank You!