



**AMAZUL**

**AMAZÔNIA AZUL  
TECNOLOGIAS DE DEFESA S.A.**

**TECNOLOGIA NACIONAL EM  
BENEFÍCIO DA SOCIEDADE**

## 2022 LAS / ANS SYMPOSIUM

### AMAZUL – “BLUE AMAZON DEFENSE TECHNOLOGIES”



22/06/2022

**Leonardo Dalaqua Junior**  
Nuclear Technical Coordinator



# AMAZÔNIA AZUL TECNOLOGIAS DE DEFESA S.A.

- **AMAZUL**
- **PROGRAMS**
  - Navy Nuclear Program
  - Submarine Development Program - PROSUB
  - Brazilian Nuclear Program
- **CONCLUSION**

- **AMAZUL**
- **PROGRAMS**
  - Navy Nuclear Program- PNM
  - Submarine Development Program - PROSUB
  - Brazilian Nuclear Program- PNB
- **CONCLUSION**



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THE BLUE AMAZON



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- **CONCLUSION**

- State-owned company incorporated on August 16th, 2013
- Public limited company – Federal Government is the single shareholder
- Linked to the Ministry of Defense, through the Navy Command
- Headquarters in São Paulo

Headquarters – São Paulo



Navy Technology Center – São Paulo



Aramar Industrial Nuclear Center – CINA





# AMAZÔNIA AZUL TECNOLOGIAS DE DEFESA S.A.

- **AMAZUL**

- **PROGRAMAS**

- Navy Nuclear Program
- Submarine Development Program - PROSUB
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- **CONCLUSÃO**

## MISSION

Develop, transfer and maintain technologies necessary for the Navy Nuclear Program; the Brazilian Nuclear Program; and the Submarine Development Program through the management of people and knowledge, in order to contribute to the country's technological independence, to the benefit of our society.

## VISION

Deliver to the Nation, in a sustainable way, technologies, knowledge and trained professionals in the nuclear and submarine development areas.

## VALUES

- Innovation
- Initiative
- Integrity
- Commitment
- Responsibility
- Safety

## SOCIAL OBJECT

Promote, develop, transfer and maintain sensitive technologies to the activities of:

- Navy Nuclear Program (PNM)
- Brazilian Nuclear Program (PNB)
- Submarine Development Program (PROSUB)
- Demands of the Navy Command



- Attraction
- Training
- Retain high skilled human resources

KNOWLEDGE  
MANAGEMENT



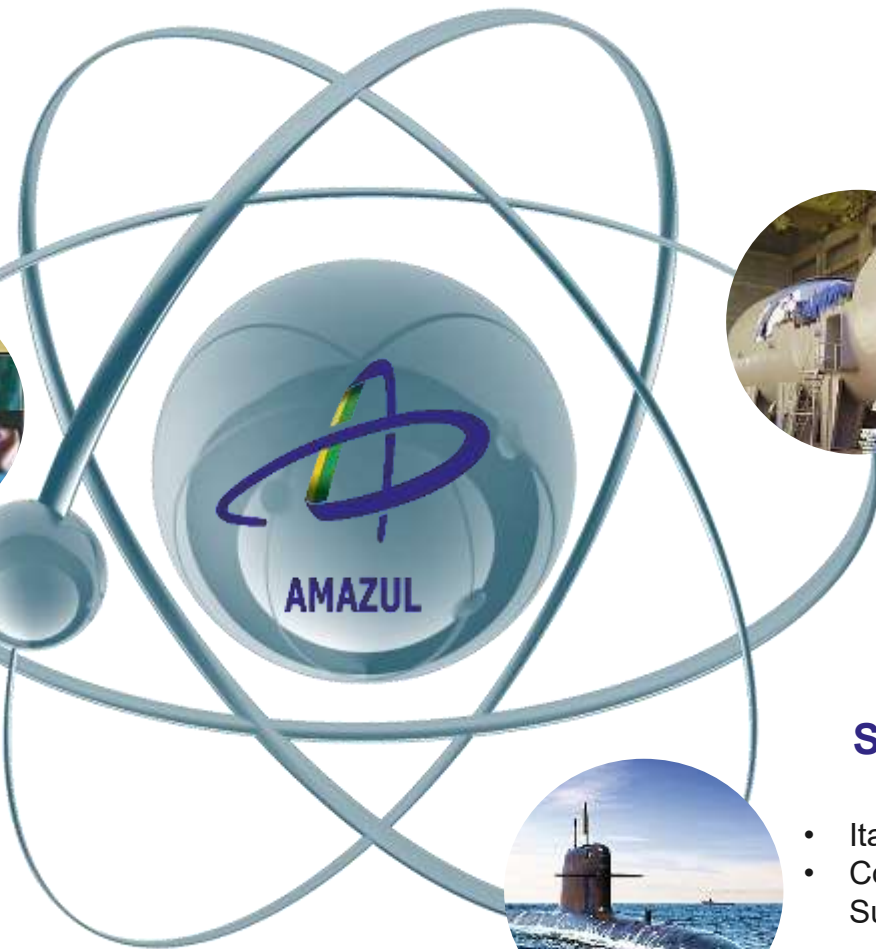
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### PROGRAMS

#### PNB

#### BRAZILIAN NUCLEAR PROGRAM

- Brazilian Multi-Purpose Reactor (RMB)
- Eletronuclear
- Nuclear Industries of Brazil (INB)
- Center for Nuclear and Environmental Technology (CENTENA)
- Irradiation facilities



#### PNM

#### NAVY NUCLEAR PROGRAM

- Nuclear Fuel Cycle
- Prototype of Nuclear Reactor for Propulsion

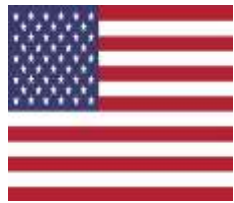
#### PROSUB

#### SUBMARINE DEVELOPMENT PROGRAM

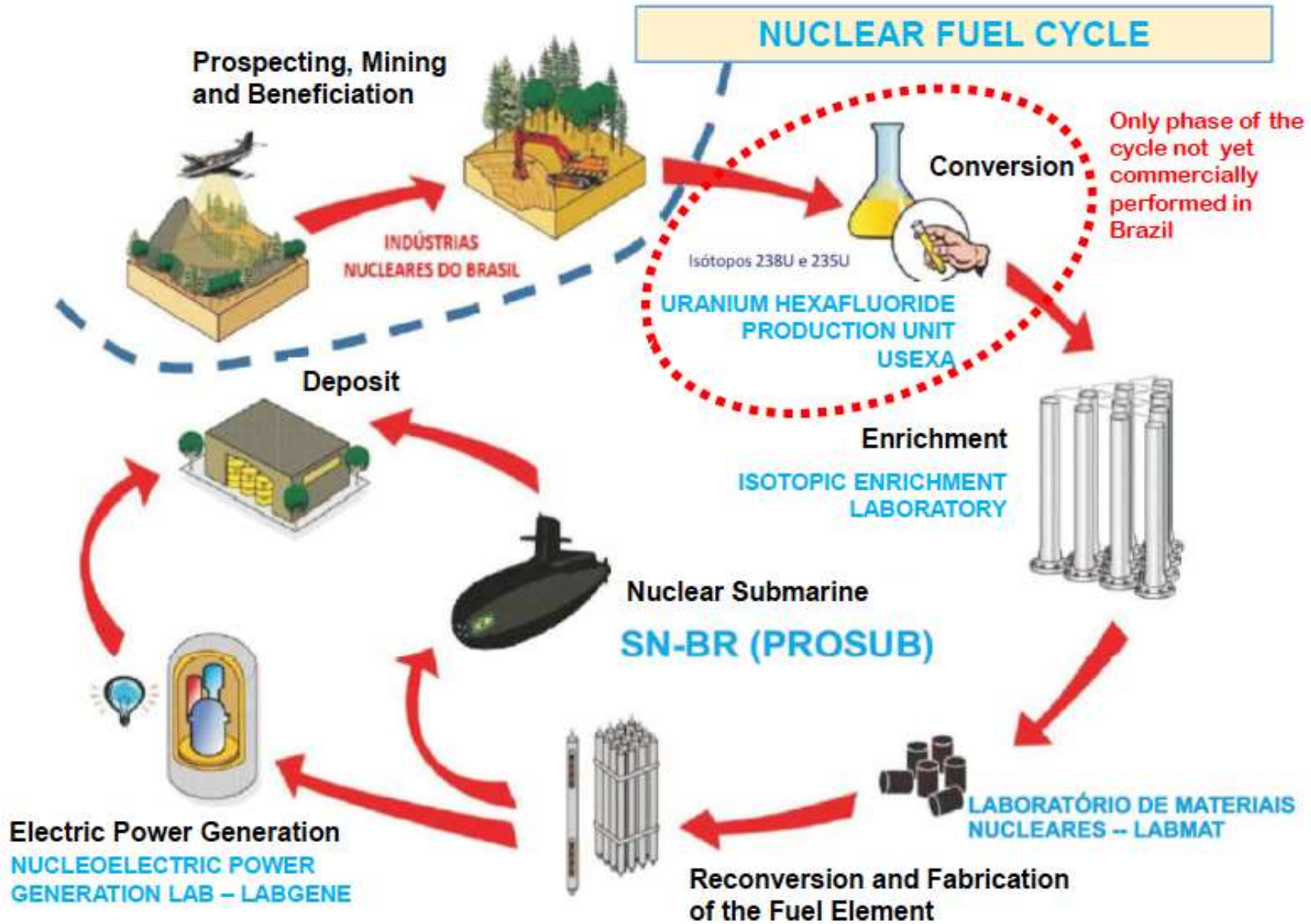
- Itaguaí Naval Base Shipyard
- Conventional and Nuclear Propulsion Submarine (S-BR and SN-BR)







Natural resources +  
Technology



## NAVY NUCLEAR PROGRAM



**Aramar Industrial Nuclear Center – CINA  
Iperó (Sorocaba) / SP (100 Km SPaulo)**

## Nucleoelectric Generation Laboratory - LABGENE

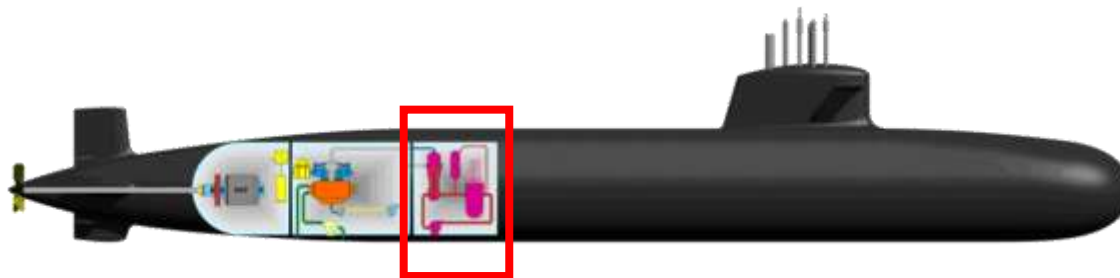


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## SUBMARINE DEVELOPMENT PROGRAM (PROSUB)

- Itaguaí Naval Base Shipyard
- 4 conventional propulsion submarines
- 1 nuclear propulsion submerine (SN-BR)

- Naval Base and Shipyard
- Itaguaí / RJ (80 Km Rio de Janeiro)



KNOWLEDGE ABSORPTION FOR APPLICATION IN THE DEVELOPMENT OF  
SMALL MODULAR REACTORS (SMR)

## SUBMARINE DEVELOPMENT PROGRAM (PROSUB)

- Thermohydraulics
- Radiological Protection
- Probabilistic Safety Analysis (PSA)
- Nuclear Safety and Security
- Facility design



KNOWLEDGE ABSORPTION FOR APPLICATION IN THE DEVELOPMENT OF  
SMALL MODULAR REACTORS (SMR)



## BRAZILIAN NUCLEAR PROGRAM

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- **PROGRAMS**

- Navy Nuclear Program
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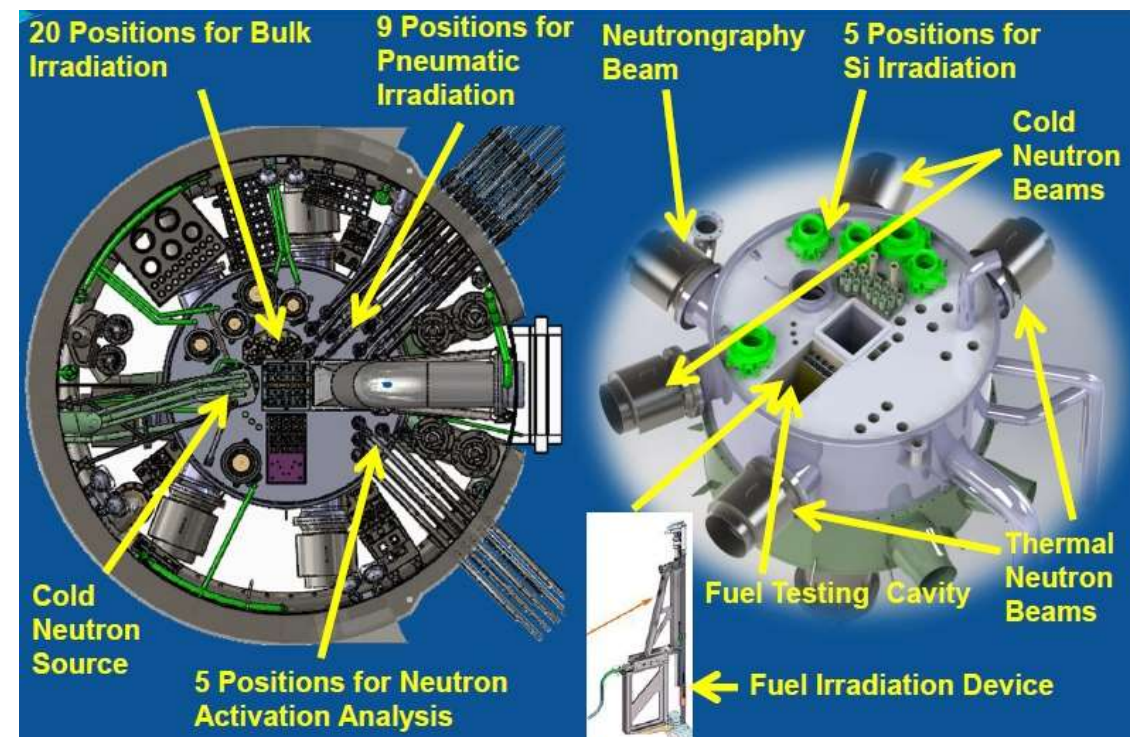
- CONCLUSION



## BRAZILIAN MULTIPURPOSE REACTOR (RMB)

- AMAZUL
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- CONCLUSION

- 5<sup>th</sup> Research Reactor in Brazil
- Open Pool Type
- 30 MW
  - Research
  - Radioisotope production
  - Material Testing



Located close to the Aramar Industrial Nuclear Center – CINA  
Iperó (Sorocaba) / SP

## RADIOPHARMACY CENTER - IPEN

- **AMAZUL / CNEN partnership in benefit of IPEN**
- **Implementation of Good Manufacturing Practices (GMP)**
- **Quality warranty**
- **Supply chain management**
- **Logistics: radiopharmaceuticals distribution**





## ANGRA 1 LONG TERM OPERATION (LTO)



- Start of operation: 1985
- Licensed: 40 years
- LTO request: 2019

AMAZUL professionals allocated in Angra dos Reis (2019 / 2024)  
Knowledge acquisition for future projects



## COMMERCIAL URANIUM ENRICHMENT PLANT (UCEU)



Resende / RJ

- Implementing the 1<sup>st</sup> stage of the 2<sup>nd</sup> phase

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## BUSINESS ENVIRONMENT

- **Angra 2: Ageing Management Program (AMP)**
- **Irradiation facilities**
- **Center for Nuclear and Environmental Technology - CENTENA**
- **Small Modular Reactors (SMR) e micro reactors**
- **RTG (*Radioactive Thermo Generators*)**

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### SMALL MODULAR (SMR) AND MICRO REACTORS

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- **Current situation \***
  - Approximately 6 projects in an advanced stage of development (72 total),
  - Government, Universities, Research Centers and Private companies
- **Window of technological opportunity**
- **Diversified applications**
  - Localized power generation
  - Naval propulsion
  - H<sub>2</sub> generation
  - Desalination
  - Deep water energy
  - Integrated technology parks



\*Ref.: Advances in Small Modular Reactors Technology Developments. A Supplement to: IAEA Advanced Reactor Systems (ARIS)

## SMALL MODULAR (SMR) AND MICRO REACTORS

Design basis  
Conceptual design  
Basic design



- Thermohydraulics
- Radiation Protection
- Probabilistic Safety Analysis (PSA)
- Nuclear Safety and Security
- Facility design

**DURAÇÃO ESTIMADA DOS PROJETOS: 10 ~ 15 ANOS**

• AMAZUL

• **PROGRAMS**

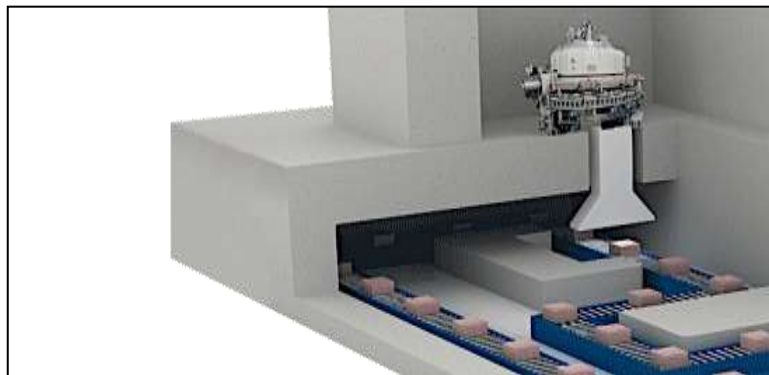
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## APPLIED NUCLEAR TECHNOLOGIES

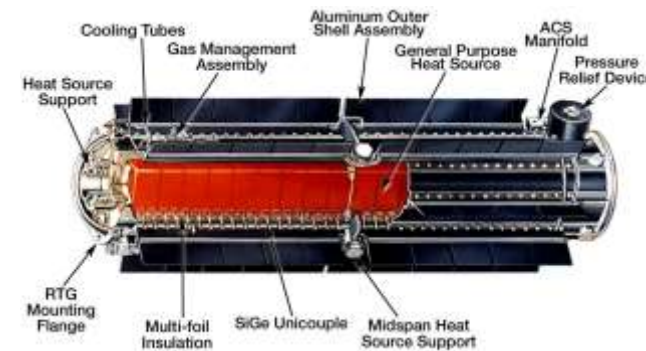
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Irradiation facilities



CENTENA



RTG

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- **Food irradiation**
- Brazil = 3rd largest fruit producer; only 23rd world exporter\*
- Agribusiness = 25% GDP
- ~ 30-40 % of the national production of fruits and vegetables is lost\*
- More than 60 countries carry out commercial transactions of foods that have been irradiated (spices, tubers, grains, fruits, pork, chicken, fish, seafood, medicinal herbs, etc).

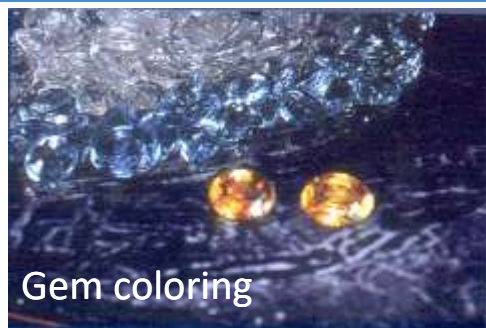
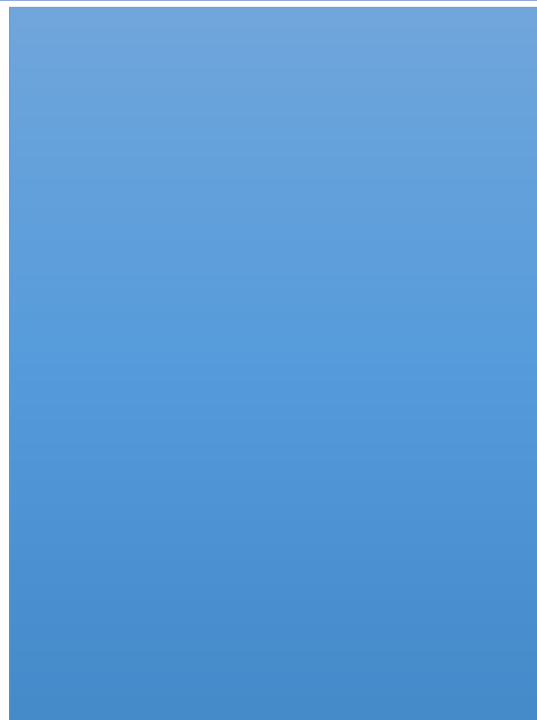
\* Ref.: Plano Nacional de Desenvolvimento da Fruticultura, MAPA, 2018.

### AMAZUL

### PROGRAMS

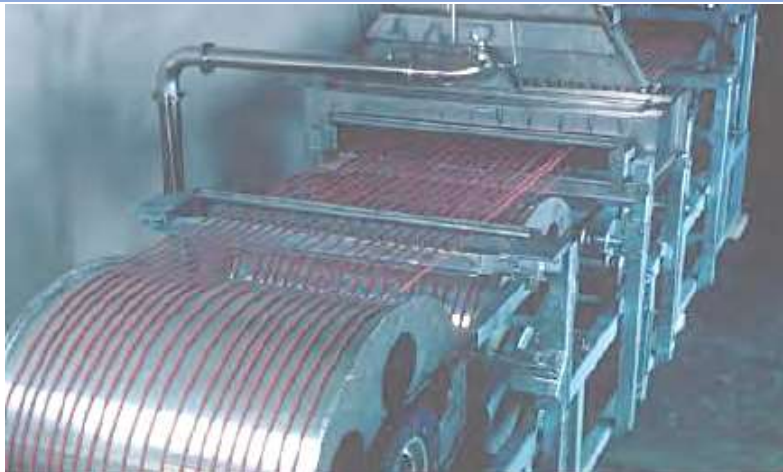
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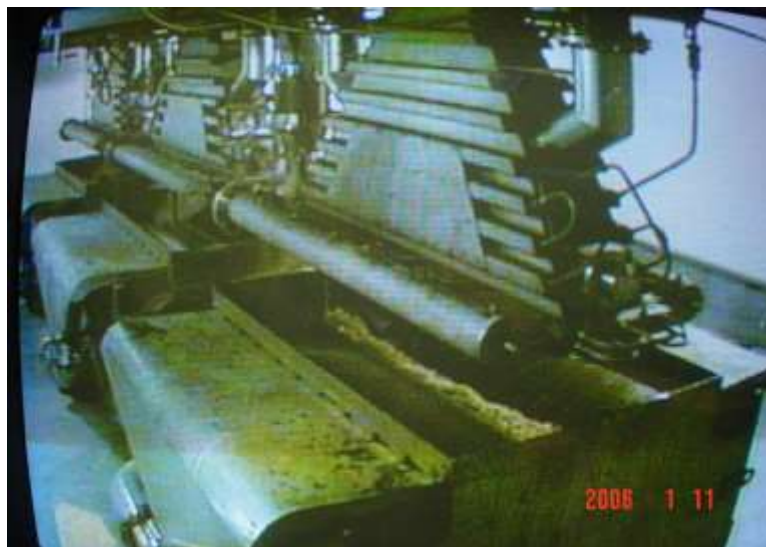
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**Crosslink induction**



**Waste treatment**





## CONCLUSION

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- **Potential to increase activities in the nuclear area**
  - Forecast for growth of the nuclear generating park (PNE 2050)
  - Broad interest in SMR technology and micro reactors
- **Applied nuclear technology activities**
  - Health (research, diagnosis and therapy)
  - Industry (food, medical, hospital, electrical cables, collections, gems...)
  - Agriculture (sterile insect, tracers...)
  - Environment (effluent treatment, environmental tracers...)

IMPORTANCE OF NUCLEAR TECHNOLOGY FOR DEVELOPMENT



AMAZUL

# NAVIGATING NUCLEAR

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**THANKS**

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