

STATUS OF THE IMPLEMENTATION OF BRAZILIAN NATIONAL REPOSITORY

Clédola Cássia Oliveira de Tello
Comissão Nacional de Energia Nuclear – CNEN
Centro de Desenvolvimento da Tecnologia Nuclear - CDTN

FAPEMIG

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CENTRO DE DESENVOLVIMENTO
DA TECNOLOGIA NUCLEAR



Comissão Nacional
de Energia Nuclear

BRAZIL AND THE NUCLEAR AREA

➤ Group E – IAEA Classification

- Nuclear power plants
- Nuclear research reactors
- Fuel cycle facilities – mining to fuel element fabrication
- Application on medicine, industry, environment
- Research & Development

➤ Future

- Expansion of the nuclear area: new reactors and use of radioisotopes in different areas, especially for the medical purposes

LEGAL FRAMEWORK

Brazilian Constitution of 1988

- The Union has the exclusive competence for managing and handling all nuclear energy activities.
- The Union is also responsible for the final disposal of radioactive waste.

LEGAL FRAMEWORK

- **Laws 7.781 (1989) and 10.308 (2001)**
 - **CNEN is in charge to receive and safely store the radioactive wastes coming from the use of nuclear energy and radionuclides in Brazil.**
 - **CNEN is responsible for their disposal.**
 - **Repository design, construction and implementation are under CNEN responsibility. These activities can be delegated, but the responsibility not.**

PRESENT SCENARIO

*Angra 1
Angra 2*



Angra 3

PRESENT SCENARIO

Fuel Cycle



PRESENT SCENARIO

- **Three research reactors and one experimental facility, at CNEN institutes:**
 - radioisotope production (industry, medicine, environment, and R&D applications); general irradiation services for analyses and training.
 - Scientists and students : academic and technological research.
- **Brazilian Multipurpose Reactor – RMB – research reactor (30 MW) under licensing process.**
 - radioisotope production for application in medicine, environment, and industry; to irradiate and to test advanced nuclear fuels and other material.
 - To conduct fundamental scientific researches.

PRESENT SCENARIO

➤ R&D Institutions:

- ✓ CDTN and LAPOC – Minas Gerais
- ✓ CRCN-CO – Goiás
- ✓ CRCN-NE – Pernambuco
- ✓ IEN and IRD– Rio de Janeiro
- ✓ IPEN, CENA and CTMSP – São Paulo

PRESENT SCENARIO

RADIOACTIVE INSTALLATIONS

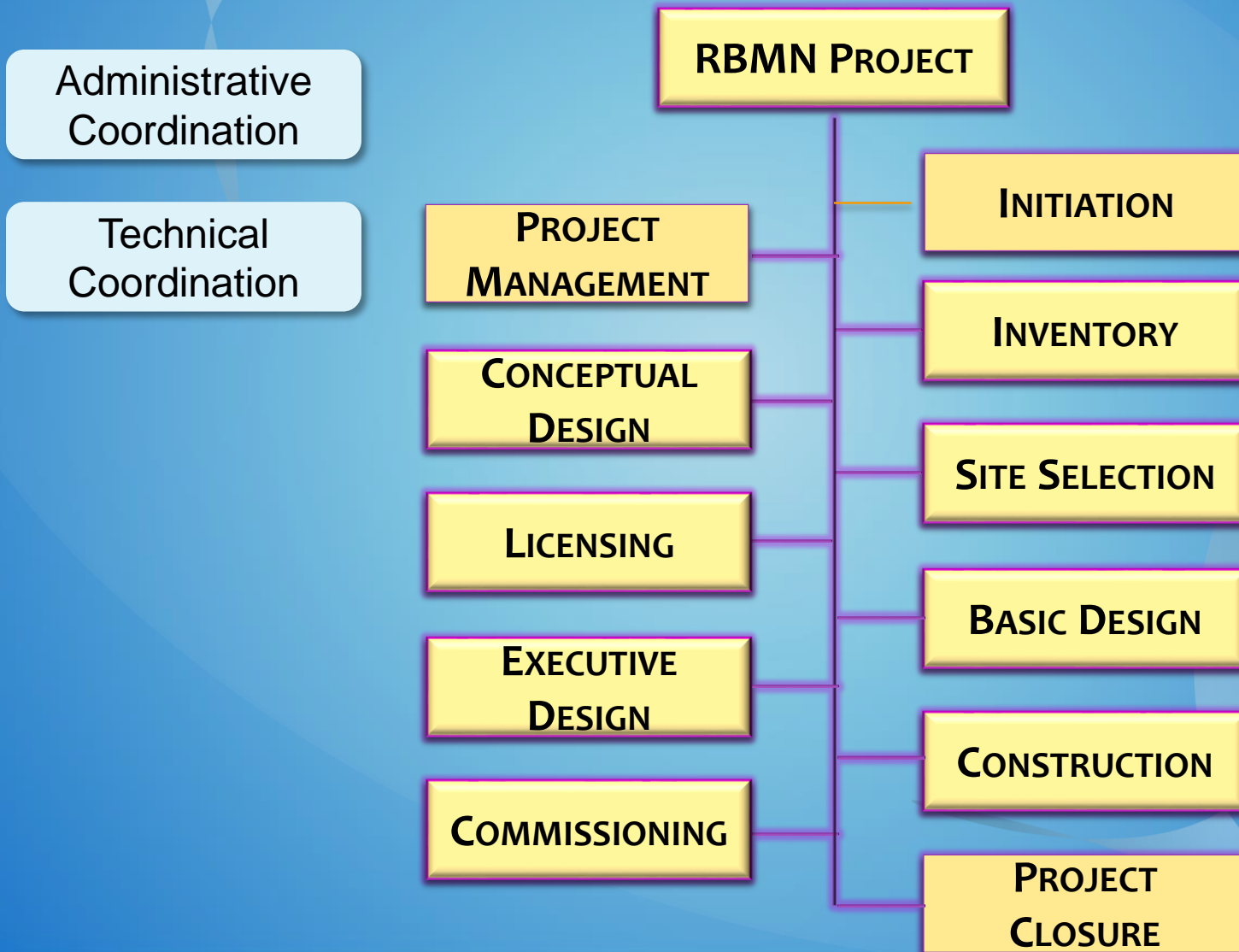
MEDICINE	INDUSTRY	R&D	DISTRIBUTION	SERVICES	PRODUCTION CYCLOTRONS	TOTAL
1,705	1,829	931	83	304	20	4,872

This scenario justifies the construction of a national repository.

RBMN PROJECT

- **It started in 2009, as part of the national solution for the storage of radioactive waste generated in Brazil.**
- **It aims at implementing the National Repository to store the low- and intermediate-level radioactive wastes from NPPs operation, and from other activities using radionuclides.**

WBS FOR RBMN PROJECT



INVENTORY – ASSUMPTIONS

➤ Repository Operation

- ✓ Start: 2020
- ✓ Closure: 2080

➤ Nuclear Power Plants

- ✓ Operation: about 60 years
- ✓ Angra 1, Angra 2 and Angra 3
- ✓ Four new NPPs 1.000 MWe, coming in operation in 2020

➤ INB

- ✓ New units for the fuel cycle

➤ Decommissioning activities

- ✓ Data are based in international experience

REPOSITORY ESTIMATED INVENTORY

ORIGIN	LL/ILW (m ³)		VERY LLRW (m ³)	TOTAL (m ³)	
	MINIMUM	MAXIMUM		MINIMUM	MAXIMUM
NPP operation	10,340	28,340	-	10,340	28,340
Other installations	1,083	1,517	-	1,083	1,517
Decommissioning	6,353	6,392	21,150	27,503	27,542
TOTAL (m³)	17,776	36,249	21,150	38,926	57,399

LILW= Low and intermediate-level wastes; VLLW= Very low-level wastes

Not included: Sealed disused sources; lightning sources and smoke detectors; NORM

REPOSITORY: REFERENCES



FRANCE



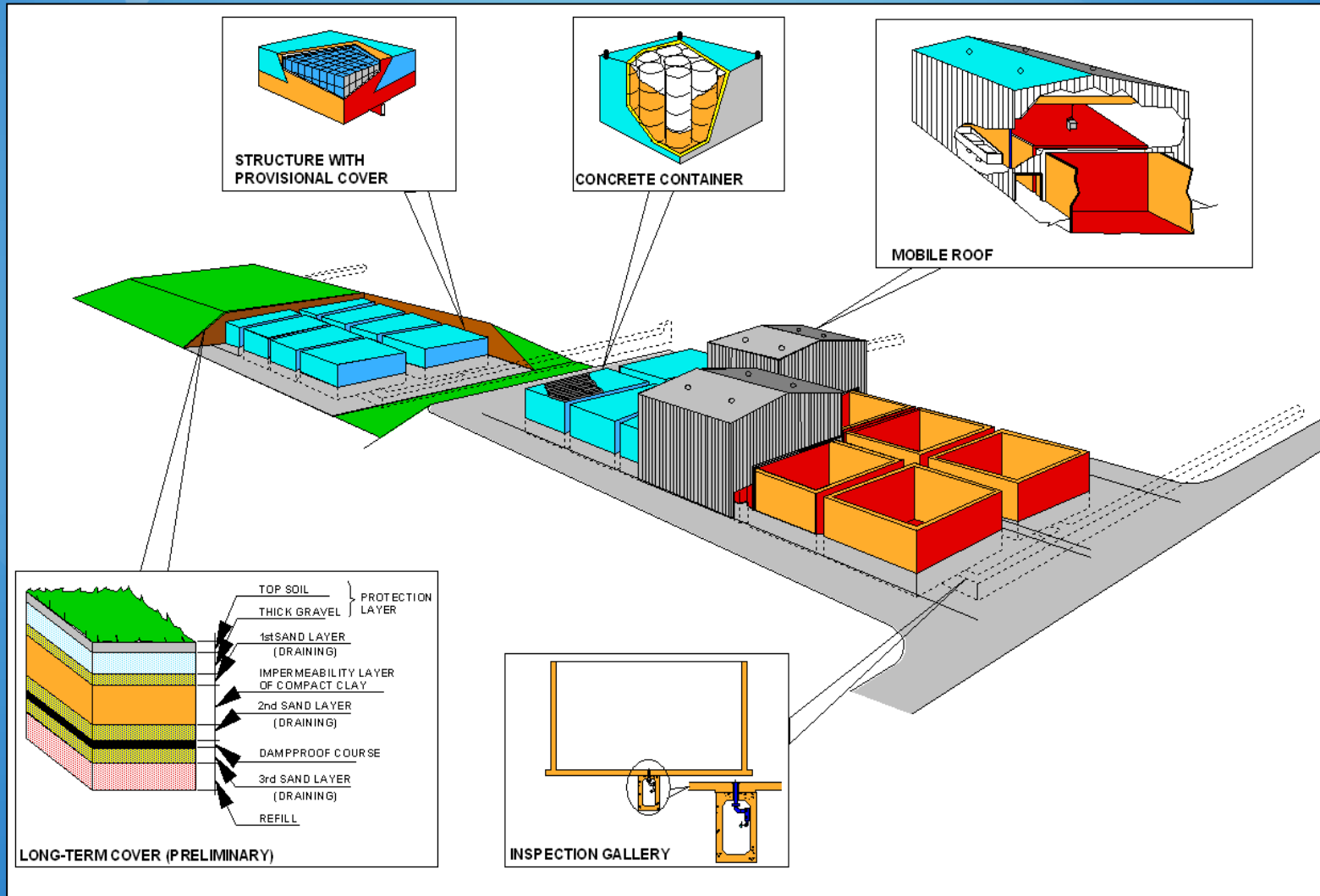
SPAIN



- *L'Aube*
- *Operator: ANDRA*
- *Expected Volume:*
 $1,000,000 \text{ m}^3$
- *Start: 1992*
- *59 NPPs*

- *El Cabril*
- *Operator: ENRESA*
- *Expected Volume:*
 $180,000 \text{ m}^3$
- *Start: 1992*
- *07 NPPs*

MULTIBARRIERS CONCEPT

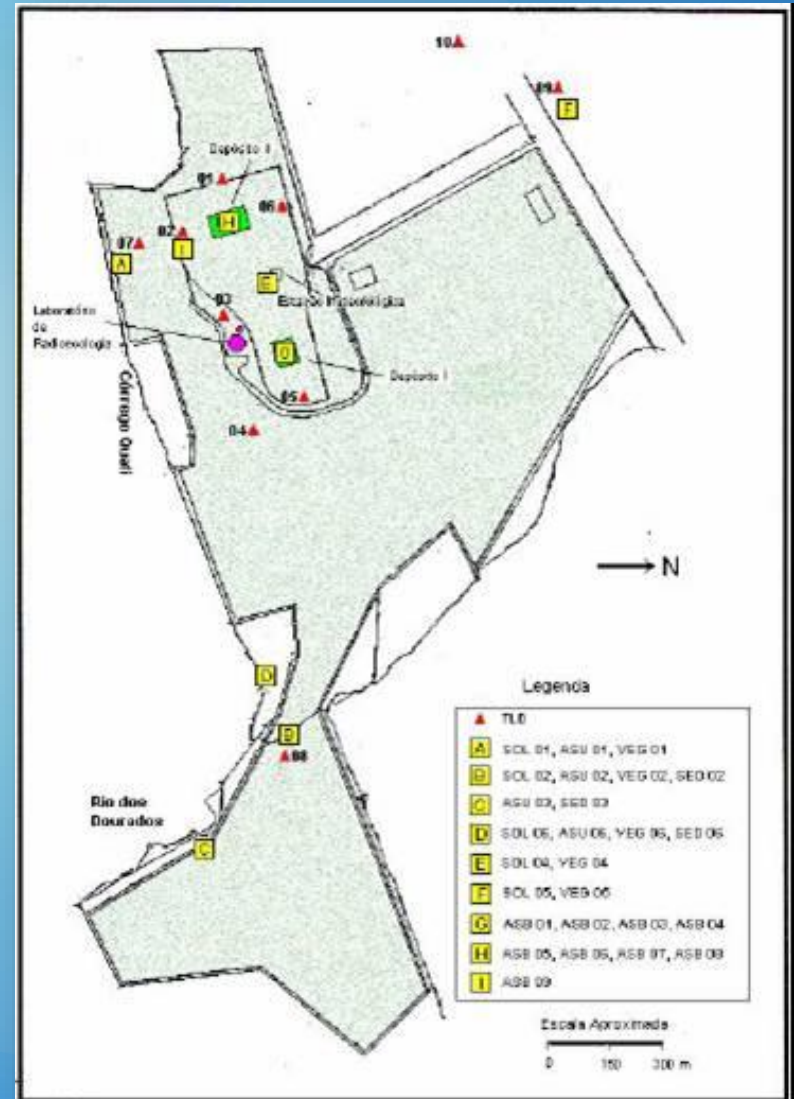


El Cabril, Spain

PREVIOUS EXPERIENCE



*Abadia de Goiás
(Cesium radiological
accident in Goiânia)*



REPOSITORY CHARACTERISTICS

- ✓ **Passive installation**
- ✓ **Treated wastes according established criteria**
- ✓ **Multiple barriers**
- ✓ **Safety analysis for long-term**
- ✓ **Performance study for long-term**
- ✓ **Radiological control**
- ✓ **Environmental control**
- ✓ **Monitoring for 300 years (Institutional control)**

LICENSING PROCESSING

- Environmental licensing – Brazilian Environmental Agency (IBAMA)
- Nuclear licensing – Nuclear Regulator (DRS)

LICENSING		1 ST EVENT	2 ND EVENT	3 TH EVENT
ENVIRONMENTAL	License	LP Previous License	LI Installation License	LO Operation License
	Demand	Approval of the Repository site	Repository Construction	Repository Operation
NUCLEAR	Document	Site Report	Preliminary Safety Analysis Report	Final Safety Analysis Report
	Demand	Approval of the local	Construction	Operation

MAIN EVENTS



PRESENT ACTIVITIES AND RESULTS

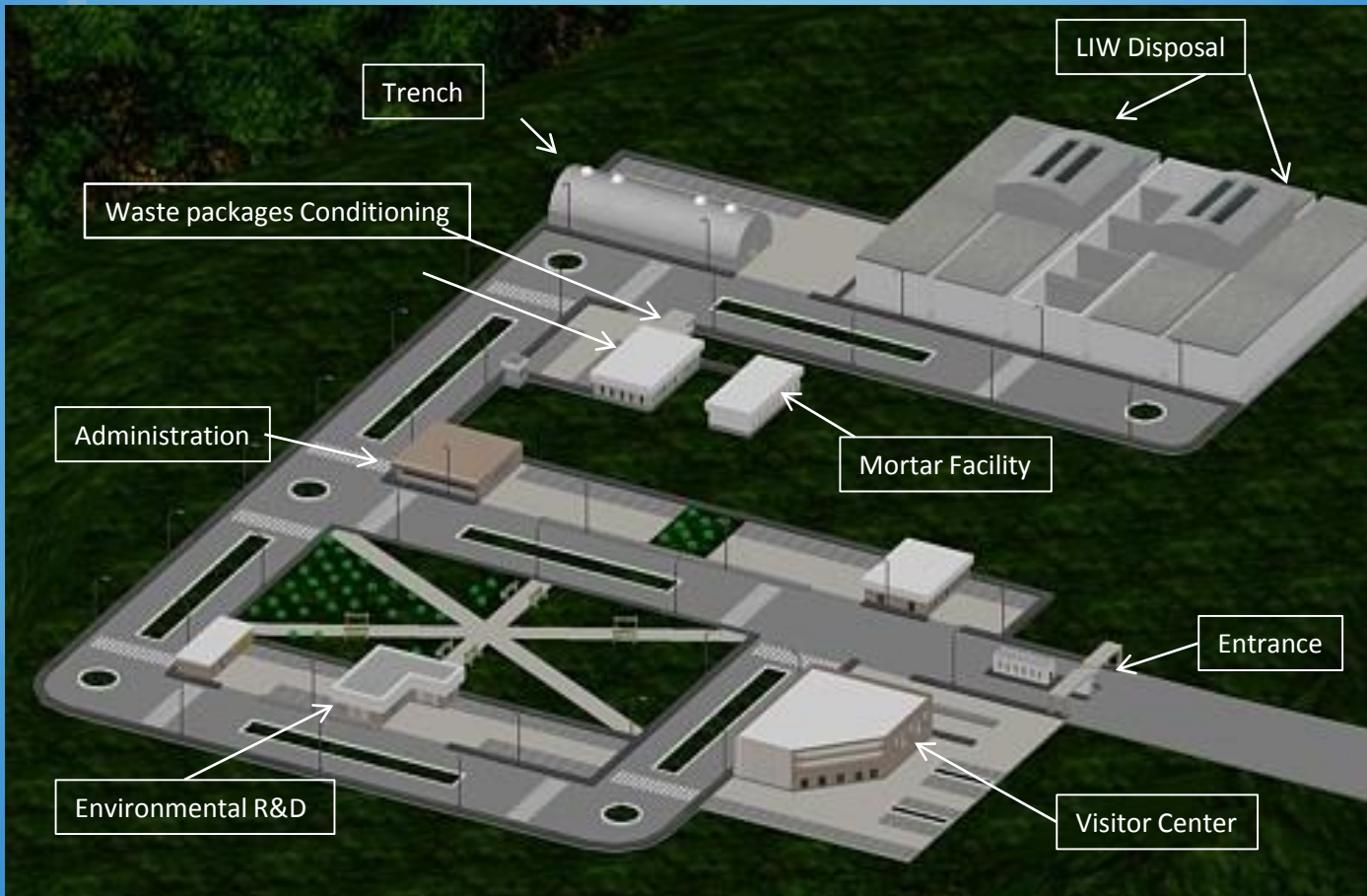
➤ Inventory

- Data bank of the current waste and package
- To manage the information about the waste generated in the Country, and to forecast their future streams.

➤ Conceptual design

- The conceptual design report is ready
- Description of facilities and flows of waste packages, materials and persons.

REPOSITORY: MAIN BUILDINGS



PRESENT ACTIVITIES AND RESULTS

➤ Repository virtual design

- IEN
- Group of specialist in virtual reality,
- Objective – better explanation and visualization
 - ✓ for the public
 - ✓ for the regulatory bodies (licensing processes)
 - ✓ radiological and physical protection

PRESENT ACTIVITIES AND RESULTS

➤ Site Selection

- Identification of Regions of interest
- Elimination of non-acceptable areas (different criteria)
- Pre-selection of candidate sites in public areas
- Final decision
 - ✓ Local geological survey for technical criteria verification
 - ✓ Public acceptance program.

PRESENT ACTIVITIES AND RESULTS

- **ANDRA (French National Radioactive Waste Management Agency)**
 - **Responsible for managing all repositories in France**
 - **Consultancy contract**
 - ✓ **International technical support**
 - ✓ **Socio-political consultancy**
 - ✓ **Conceptual, Basic and Executive Design phases**

PRESENT ACTIVITIES AND RESULTS

➤ Environmental licensing

- **Two official meetings to present the Repository**
 - ✓ **Terms of reference proposal presented to IBAMA**
 - ✓ **Supporting documents provided to IBAMA**
- **iBAMA is preparing the licensing activity agenda.**

ACTIVITIES FOR 2015 /2016

- **Inventory Data Bank**
- **Local selected**
- **Environmental Impact Study (EIA)**
- **Nuclear Licensing Process**
- **Conceptual and Basic Design– ANDRA
Consultancy**

CHALLENGES

- **The first repository in Brazil to be licensed for several wastes and radionuclides**
 - ✓ Challenge for the regulatory bodies
 - ✓ optimize the resources and the time, associated to the quality in order to give confidence to all stakeholders.
- **The first repository in South America**
 - ✓ real challenge for the continent.
 - ✓ very carefully managed, in order to avoid misunderstandings, mainly with public acceptance.

CHALLENGES

- **Brazil`s history began in 1500 – 516 years.**
- **The Repository construction and release**
 - ✓ about 360 years, i.e. longer than a half of Brazilian history
 - ✓ This aspect is very new for the Brazilian people, bringing a new dimension to public acceptance.
- **The negative events occurred in nuclear area bring always worries to the public**
 - ✓ the differences between a NPP and a repository are not clear.

CONCLUSION

- ✓ **The RBMN Project intends to bring a national solution for the safe storage of radioactive waste (LILW) generated by the use of radioisotopes and nuclear energy in Brazil.**

CONCLUSION

- ✓ The discussion with the stakeholders, especially those from the region where the repository will be installed, will require political negotiations, and certainly hearings, that can affect the schedule.
- ✓ Beyond this, it will be necessary optimize the resources and the time, preserving the quality, in order to give confidence to all stakeholders.

SUSTAINABILITY OF NUCLEAR AREA $\equiv \mathcal{F}$ (REPOSITORY)

- ✓ Sustainable Community is the one “that can satisfy their own needs without reducing the opportunities of future generations.” .(Lester Brown; CAPRA in TRIGUEIRO, 2005)
- ✓ The waste management is a key component for achieving the sustainability in the nuclear area.
- ✓ Waste life cycle – from generation to disposal.



L'Aube - France

ACKNOWLEDGMENTS

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➤ **FINEP**

➤ **FAPEMIG**



Thanks

tellocc@cdtn.br