Design and Implementation of the Brazilian Near-Surface Repository

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Obligation and drivers

- CNEN has legal mandate to design, license, construct and operate waste repositories;
- Angra NPP buffer storage will reach full capacity by 2019/2020;
- Unit 3 operation license conditioned to repository licensing application;
- Federal justice lawsuit demanding CNEN to design, license and construct the repository;
- Brazilian Comptroller General recommended the Gov't, through Ministry S&T, to fund the repository construction.

Conceptual Design

Based on L‘Aube/Morvilliers concept

Vaults for LILW and trenches for VLLW

Allowed waste types

- Short-lived low- and intermediate-level wastes;
- Beta/gamma emitters;
- Half-life up to 30 years;
- Long-lived alpha emitters:
  - < 3,700 Bq/g per package;
  - < 370 kBq/g in average.

Waste types and volumes (m^3)

ORIGIN	Low level waste	Very low level waste	TOTAL
NPP operation	27,873	-	27,873
Other nuclear and radioactive facilities operation	1,517	-	1,517
Decommissioning and dismantling	6,392(*)	21,150	27,542

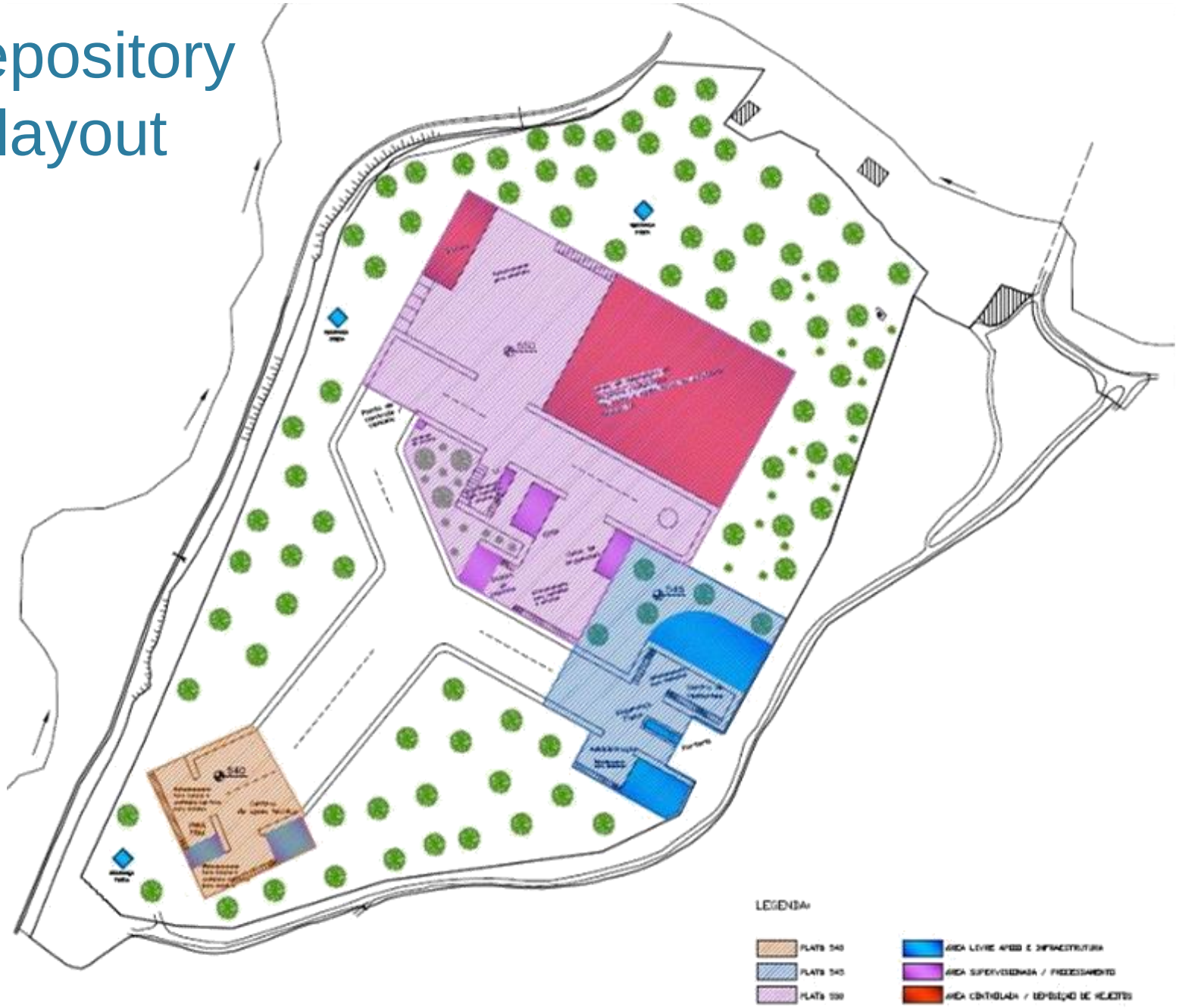
Grand total ≅ 60,000 m^3

(*) Considered 3,000 m^3 per NPP

Operational aspects

- Period of facility operation and institutional control
  - Estimated operation period: 60 yrs;
  - May be extended if safety analysis studies demonstrate that the facility's performance level is maintained after the original period;
  - 300-year institutional control period will follow the operation phase;
  - Release for use thereafter (according to safety analysis studies):
    - unrestricted – *green field* – or
    - subjected to some sort of restriction – *brown field.*

Repository layout



Repository buildings

Building	Purpose	Area (m^2)
Visitor Centre	Public information	1,500
Gatehouse	Access control	200
Administration	General administration and logistic support	1,000
Technical Support	Auxiliary services support	2,000
Suppliers Shed	Supplies and products storage	600
EMRP and RD&I Laboratory	Implementation of the EMRP and RD&I activities	1,200
Waste Processing	Waste packages reception, temporary storage and conditioning in overpack	378

Repository buildings

Building	Purpose	Area (m^2)
Waste Characterization	Waste package contents verification, radiochemical and physical testing	190
Concrete Plant	Mortar manufacture, raw materials (cement, sand and additives) and empty containers storage	525
Disposal Module	Disposal of low and intermediate level wastes	11,165
Disposal Trench	Disposal of very low level wastes	1,875
Ecological Preservation Unit	Nursery seedlings, native species preservation and public visitation	N/A
Meteorological Tower	Record of Atmospheric data	N/A
Fences	Security, delineation of the perimeter and internal areas	N/A

Site selection – main site characteristics

- Minimization of risk of human exposure to radiation and environment contamination;
- Meet suitable physiographic, meteorological, geotechnical, hydrogeological and tectonic requirements;
- Compatible socio-economical characteristics:
  - low population density;
  - no agricultural activities;
  - absence of mineral deposits of interest;
  - proximity to the paved road mesh.

Site selection strategies

- Definition of Region of Interest;
- Desk studies for preliminary site selection (numbers varying from 32 to 400-plus);
- Search for volunteering municipalities or
- Open announcement to all municipalities inside RI;
- Change of scenario: Define & Defend

Site characterization studies

- Topographical survey
- Boring (SPT and rotary)
- Monitoring wells water analysis

Site characterization studies

- Conducted at the site and its immediate vicinity to gather preliminary technical information on:
  - The candidate site's terrain and landscape;
  - Hydrogeological and geophysical features;
  - Basic data of its constituent layers – depth, nature and strength;
  - Groundwater quality.

Topographical survey

- Site perimeter, surface and declivity determined and recorded;
- Natural features and man-made buildings and elements characterized.

Boring

- Twelve boreholes executed;
- Initially SPT boring, subsequently rotary;
- 3 meters penetration in rock;
- Four boreholes subsequently changed into groundwater monitoring wells.

Preliminary evaluation and next steps

- No impediments so far to the establishment of the repository. Site pre-selected based on technical characteristics;
- Need of further studies to verify obedience to regulatory requirements and to complete characterize the soil and regional aquifers;
  - Boring mesh refinement;
  - Erosion vulnerability;
  - Acquisition of more detailed input data for the flow conceptual model;
  - Investigation of the origin of the monitoring wells water contamination.

Next site studies: hydrogeophysical methods

- Magnetometric survey: identification of the site main geological structures;
- Gamma-spectrometric survey: differentiation of the site lithologies;
- Electro-resistivity: detection of structures prone to water catchment, passage and storage.

Repository Licensing

- Environmental licensing
  - Two CNEN/IBAMA meetings
    - 1st meeting: entry of application – preliminary information;
    - 2nd meeting: Terms of Reference proposal
- Nuclear licensing
  - Preliminary interaction with CNEN licensing directorate – generic guidelines;
  - Nuclear licensing process to be conducted by IRD/CNEN.

International assistance and cooperation

- IAEA/TC Projects
  - Technical visits to L´Aube, El Cabril and Báatapaati;
  - Expert missions from ENRESA (Spain) and ANDRA (France);
  - Participation in DISPONET meetings.
- Training mission to DBE-Technology, Germany
- CNEN-ANDRA Agreement

CNEN-ANDRA AGREEMENT

- Object: provision of technical advisory services to CNEN on design and implementation of the repository
  - L´Aube conceptual design and Preliminary Safety Analysis to be made available;
  - Support in conceptual design and licensing of the Brazilian repository;
  - Support in the review of the repository´s basic engineering (to be contracted by CNEN).

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