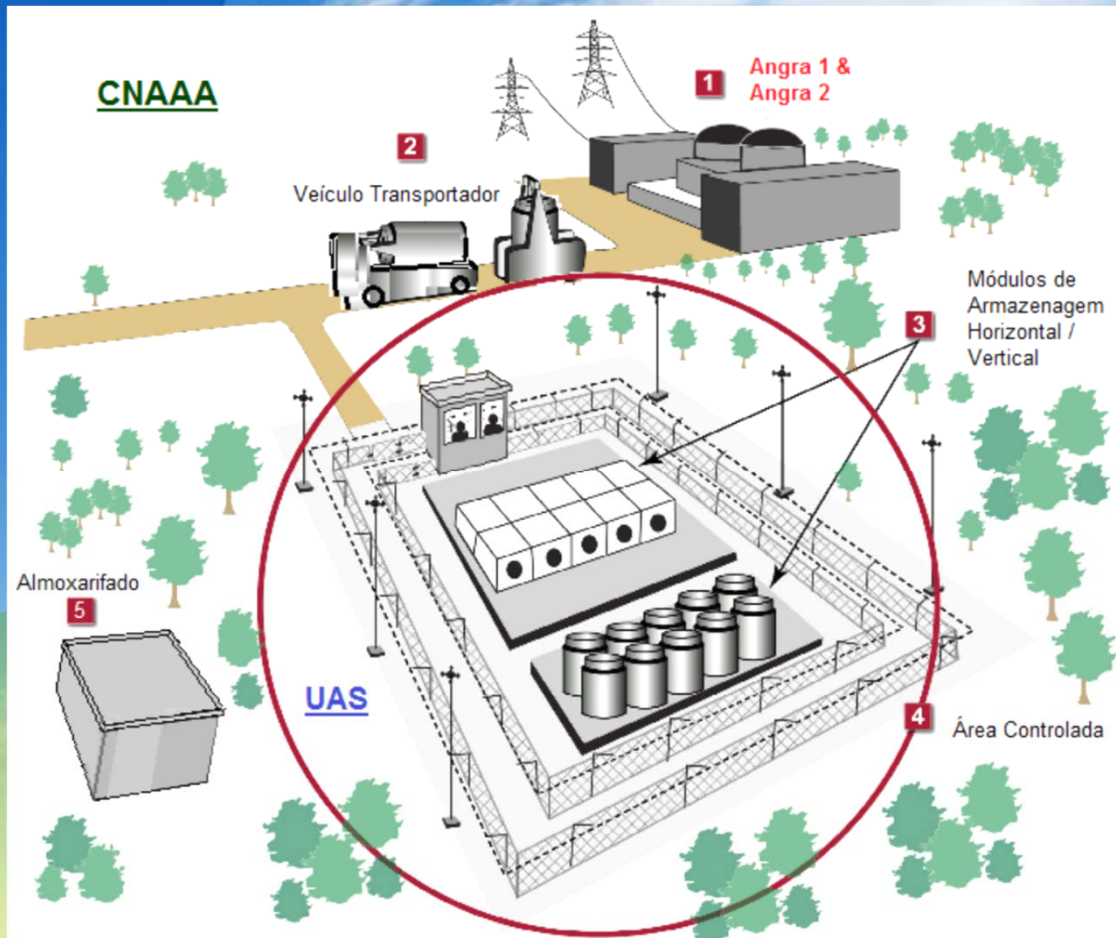
IMPLEMENTATION OF THE SPENT FUEL COMPLEMENTARY DRY STORAGE UNIT – UAS

Eletrobras
Eletronuclear



Public Hearing in compliance with article 39 of Law 8.666/93

Rio de Janeiro, August 24, 2016

Contents

Section 1:

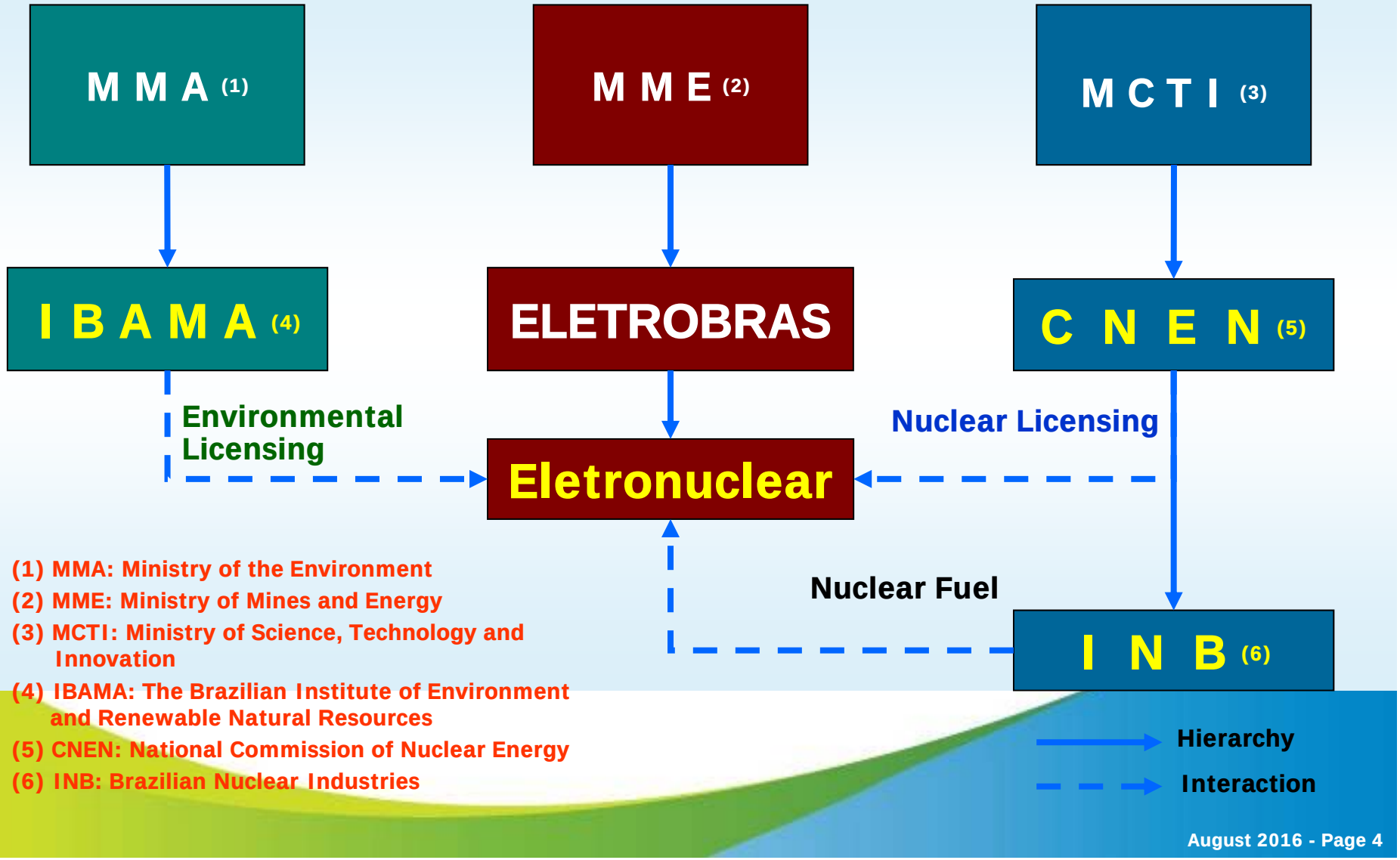
- The Company
- Rationale for the Project
- Project Feasibility

Paulo Carneiro

Public Hearing

Rio de Janeiro, August 24, 2016.

The Company


M M A (1)
M M E (2)
M C T I (3)
I B A M A (4)
ELETROBRAS
C N E N (5)
Environmental Licensing
Nuclear Licensing
Eletronuclear
Nuclear Fuel
I N B (6)
(1) MMA: Ministry of the Environment
(2) MME: Ministry of Mines and Energy
(3) MCTI: Ministry of Science, Technology and Innovation
(4) IBAMA: The Brazilian Institute of Environment and Renewable Natural Resources
(5) CNEN: National Commission of Nuclear Energy
(6) INB: Brazilian Nuclear Industries
Hierarchy
Interaction

The Company

Eletronuclear's Objective

Design, build and operate nuclear power plants with high standards of safety, efficiency and social and environmental responsibility

Angra 1 and 2 in operation

Angra 3 under construction

ANGRA 1

Output..... 640 MW

Start of Operation.. Jan-1985

ANGRA 2

Output..... 1,350 MW

Start of Operation... Feb-2001

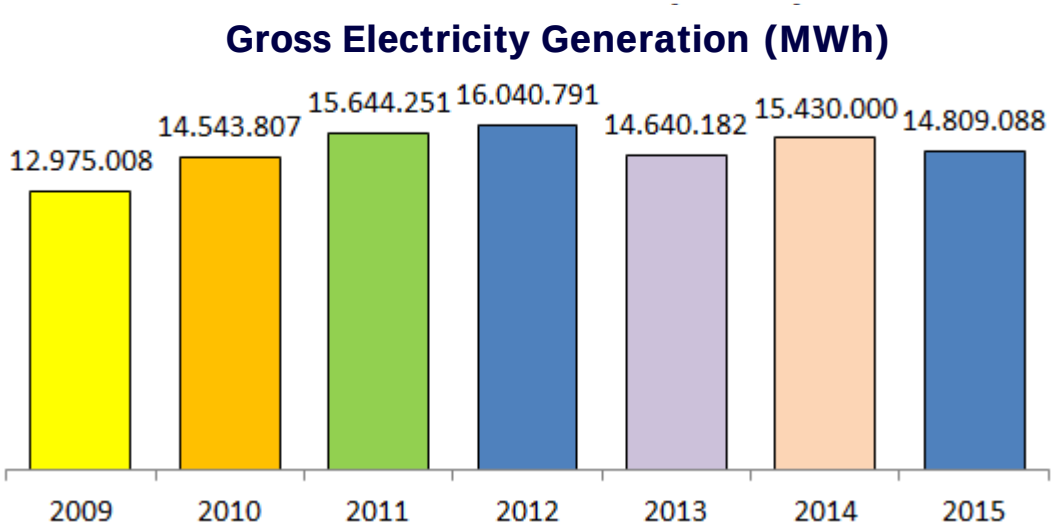
ANGRA 3

Output..... 1,405 MW

Expected Start of Operation 2022*

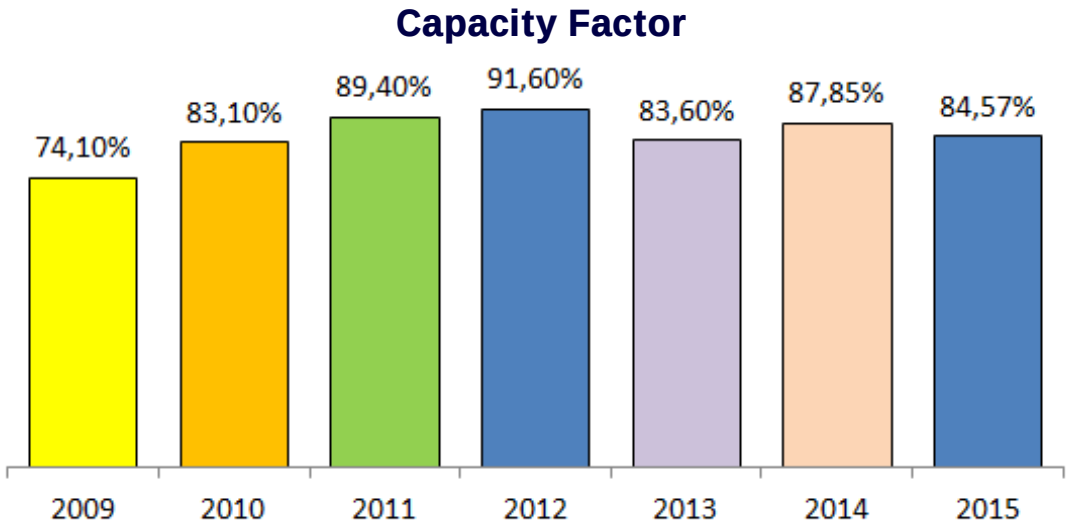
*** Evaluation under way**

The Company



Performance

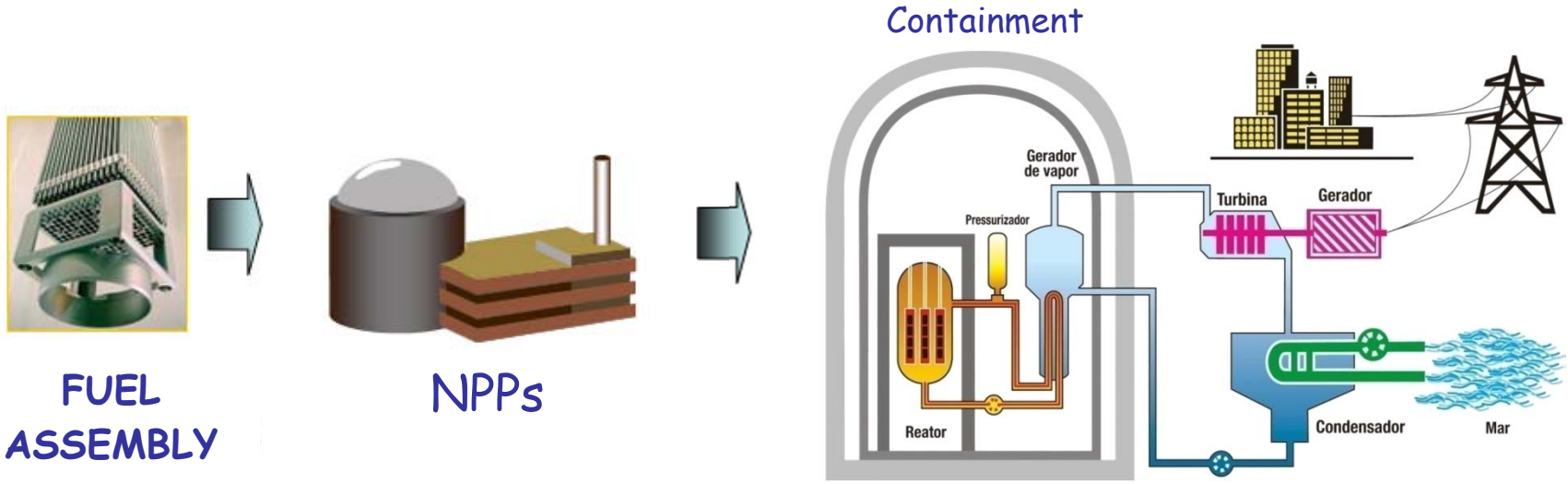
- Records for generation
- High standards of operational performance and safety
- Continuous improvement of the indicators



The Company

Electrical Power Generation

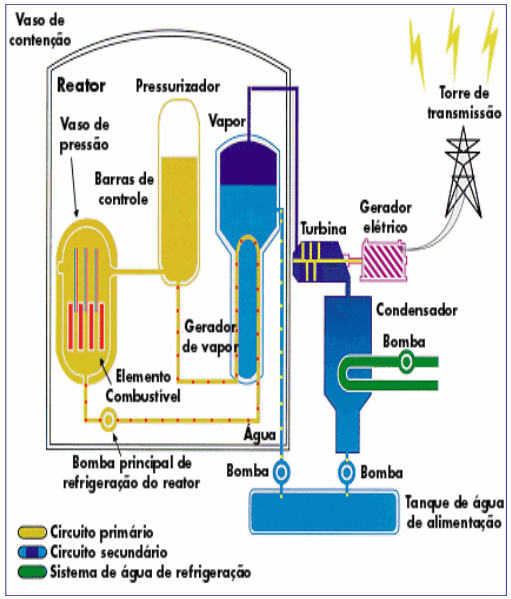
In the power supply chain, ELETRONUCLEAR works in the generation sector, producing electrical power by using Fuel Assemblies.



After being used, these Fuel Assemblies are called **Spent Fuel Assemblies (SFAs)** and they are stored in the existing pools called **Spent Fuel Pools (PCUs)**, in each NPP.

The Company

Management of SFAs



GENERATION OF ELECTRICAL POWER

NPPs

SPENT FUEL POOLS (PCUs)

CNAAA

SFAs COMPLEMENTARY DRY STORAGE UNIT (UAS)

Angra	Storage capacity in the PCUs / Current Occupancy (Cells)	Fuel assemblies in the reactor core (SFAs)	Estimated capacity exhaustion of the PCUs (year)
1	1,252 / 945	121	2021
2	1,084 / 656	193	2021

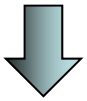
Rationale for the Project

Exhaustion of the storage capacity for SFAs in the PCUs of Angra 1 and 2 NPPs

The need to keep generating electrical power

The need to implement a solution:

- That is technically certified, which minimizes the licensing risks
- That can be implemented within the deadline
- That has a disbursement schedule compatible with ELETRONUCLEAR's financial resources



Spent Fuel Complementary Dry Storage Unit (UAS)

Project Feasibility

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➢ Turnkey Contract for the Dry Storage Solution

- Estimated Value: **US$ 62.51 million→ R$ 201.70 million**

  Remarks:
  1 – Reference date: June 2016
  2 – Exchange rate (19-Aug-2016): 1US$ = R$ 3.2267
  3 – This value does not include the levied taxes

- Estimated Date of Contract Signature: **May 2017**

- Performance Term: **36 months**

- Performance Term for the Transfers: **6 months**

➢ Sources of Funds:

- Own funds

Section 2

- The Project
- Scope of the Contracting

Lúcio Ferrari

Public Hearing

Rio de Janeiro, August 24, 2016.

The Project

The Adopted Solution

After evaluation of the options of dry storage, ELETRONUCLEAR chose the solution based on Canisters, placed vertically or horizontally above ground, because of the following aspects:

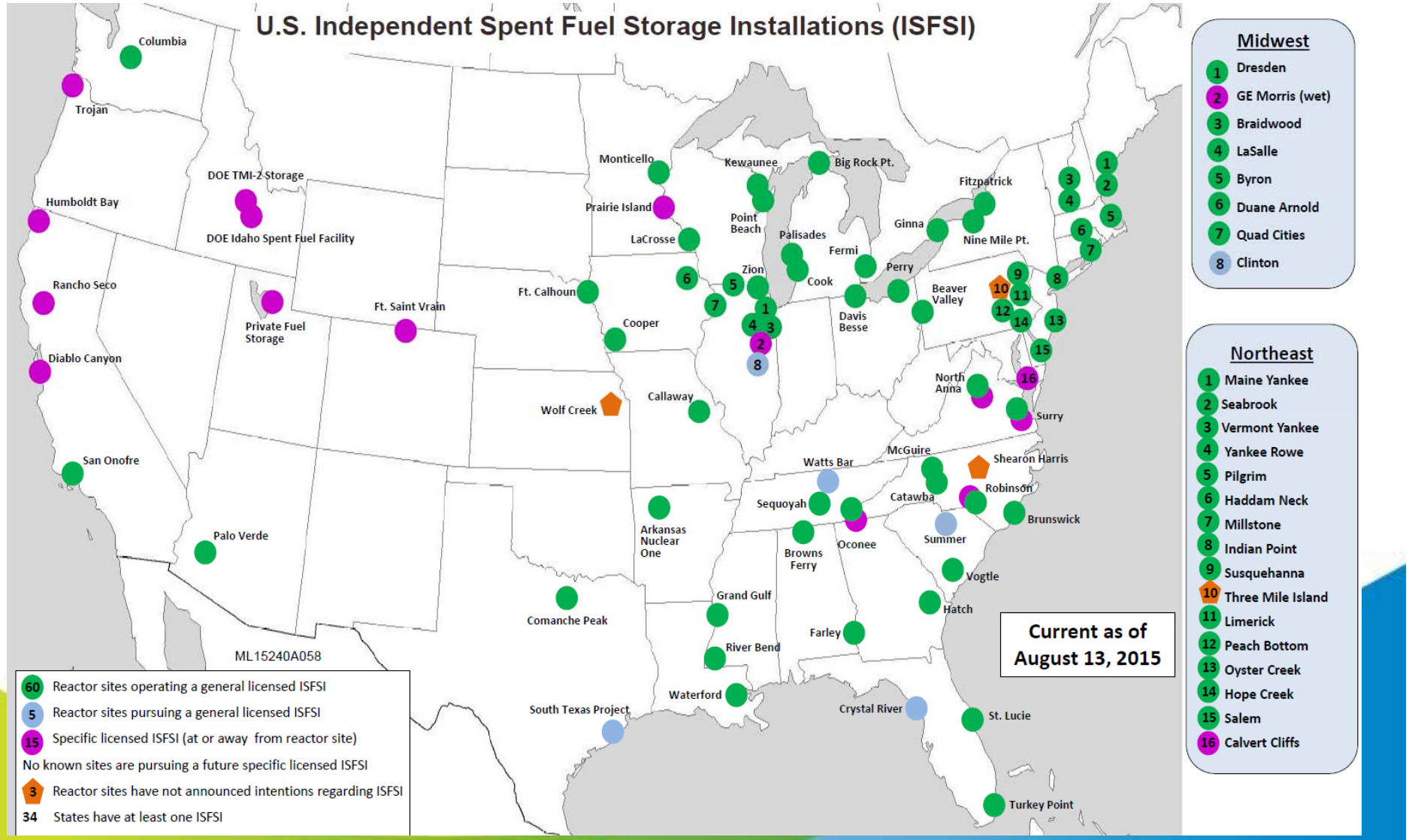
- This technology is safe, well established and widely used in the United States and other countries
- The licensing process is based on the use of “General License” documentation, prepared by suppliers and approved by the NRC (Nuclear Regulatory Commission) in the United States for general use
- Compatible costs and terms

The Project

The Adopted Solution

Eletrobras Eletronuclear

Licensed Dry Storage Units in the United States



The Project

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The Adopted Solution

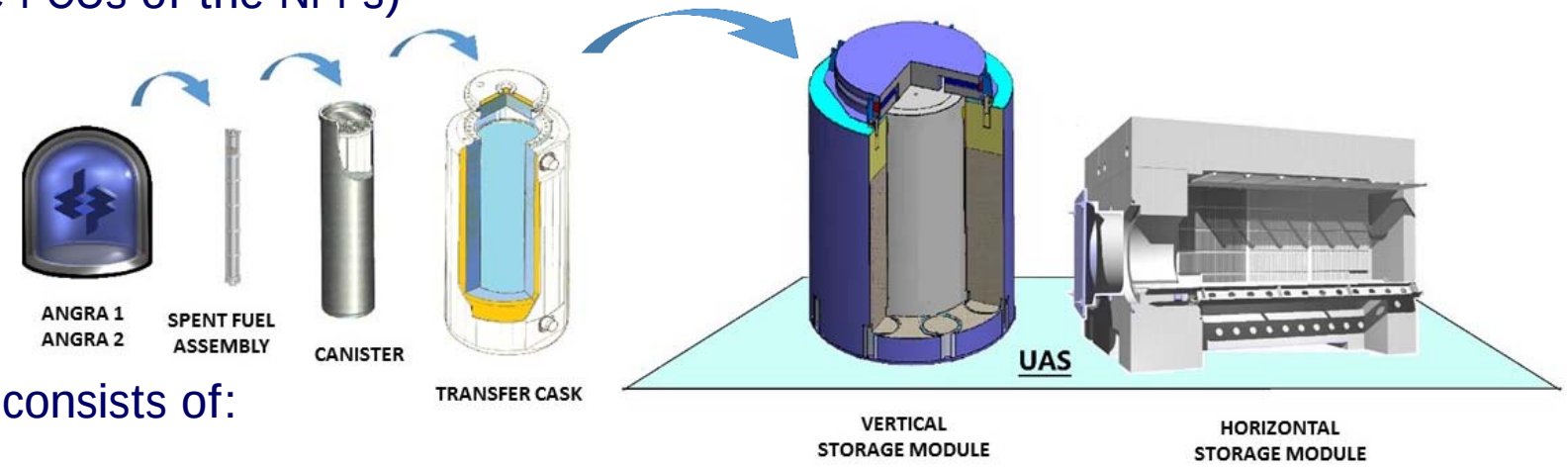
➢ Canister Solution in the International Market

- The Dry Storage Solution based on Canister was/is being implemented in the following countries:
  - ✓ Spain / Mexico / England / Slovenia / United States
  - ✓ In the countries mentioned above, the Dry Storage Solution based on Canister is used in approximately 70 NPPs
  - ✓ Approximately 2,300 Storage Devices based on Canister are used in these 70 NPPs

The Project

Technical Characteristics

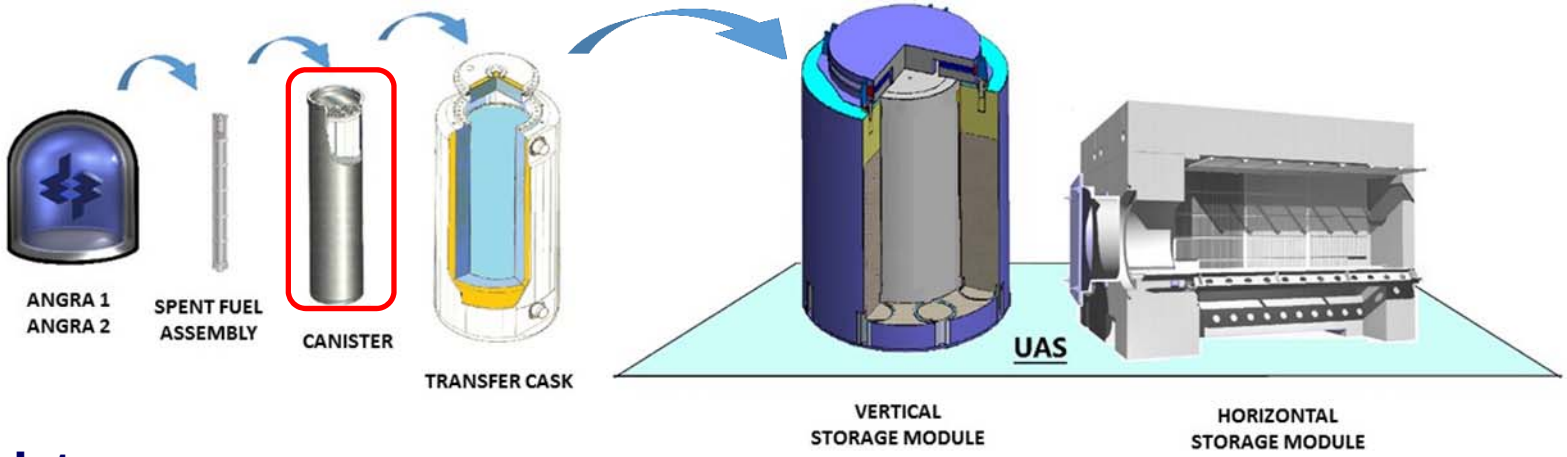
- The project is planned to meet 5 cycles of operation after the exhaustion of the capacity in the PCUs of Angra 1 and 2 (at least undamaged 480 SFAs, 220 of Angra 1 and 260 of Angra 2, which will stay no less than 10 years inside the PCUs of the NPPs)



- It consists of:
  - Canisters
  - Transfer Cask(s)
  - Storage Modules (Overpacks)
  - Dry Storage Facility

The Project

Technical Characteristics



➢ Canisters

- **Functions**

✓ Confining the SFAs

✓ Ensuring the subcriticality of the SFAs bundle

✓ Facilitating the heat exchange with the environment

- **Characteristics**

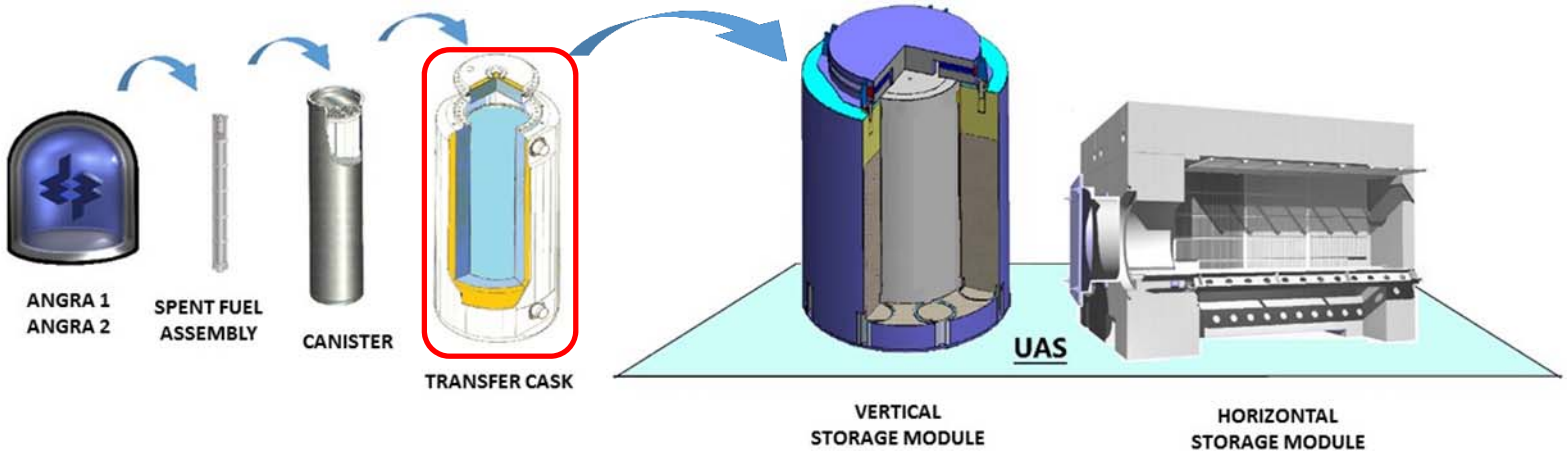
✓ Cylindrical vessel made of stainless steel with a diameter of 2.0 m, height of 4.6 m and 25 mm of thickness

✓ Confinement of SFAs in inert gas (He)

✓ Sealing of the Canisters by welding

The Project

Technical Characteristics



➢ Transfer Cask(s)

- **Functions**

✓ Ensuring the radiation shielding and structural stability during the operations of loading and unloading of the Canisters and during the transport from the PCUs to the Dry Storage Facility

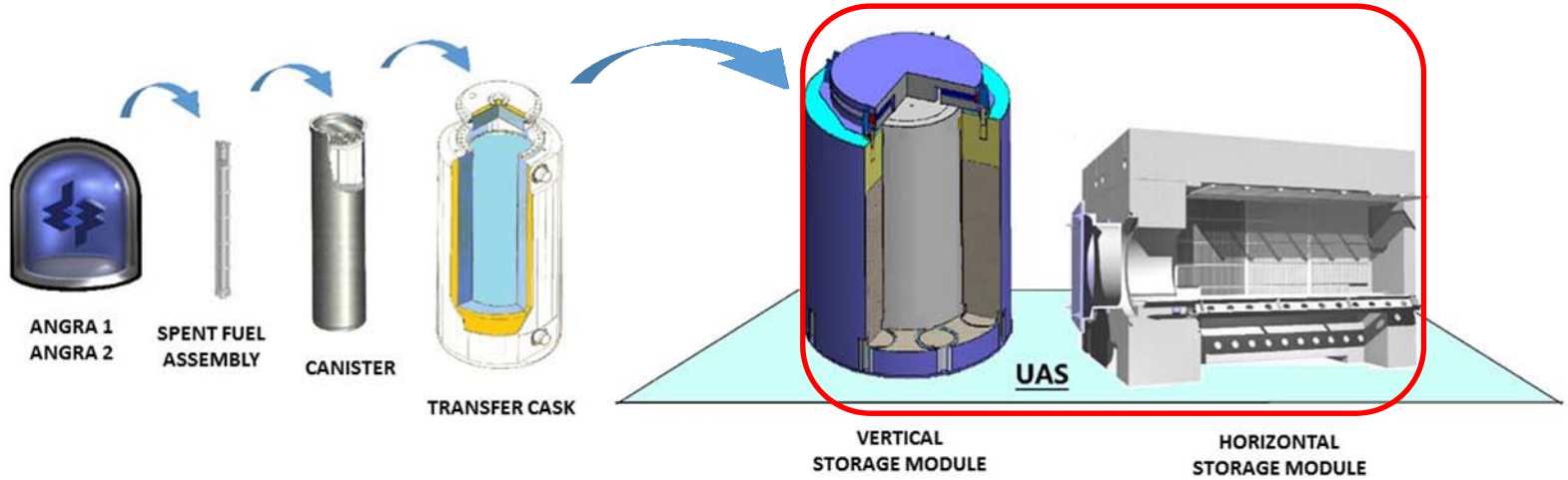
- **Characteristics**

✓ Cask made of carbon steel with a diameter of 2.5 m, height of 4.7 m and 300 mm of thickness

✓ Reusable

The Project

Technical Characteristics



➢ Storage Modules (Overpacks)

- **Functions**

✓ Ensuring the physical protection, radiation shielding and structural protection for the Canister during the storage period

✓ Ensuring the heat exchange between the Canister and the environment

- **Characteristics**

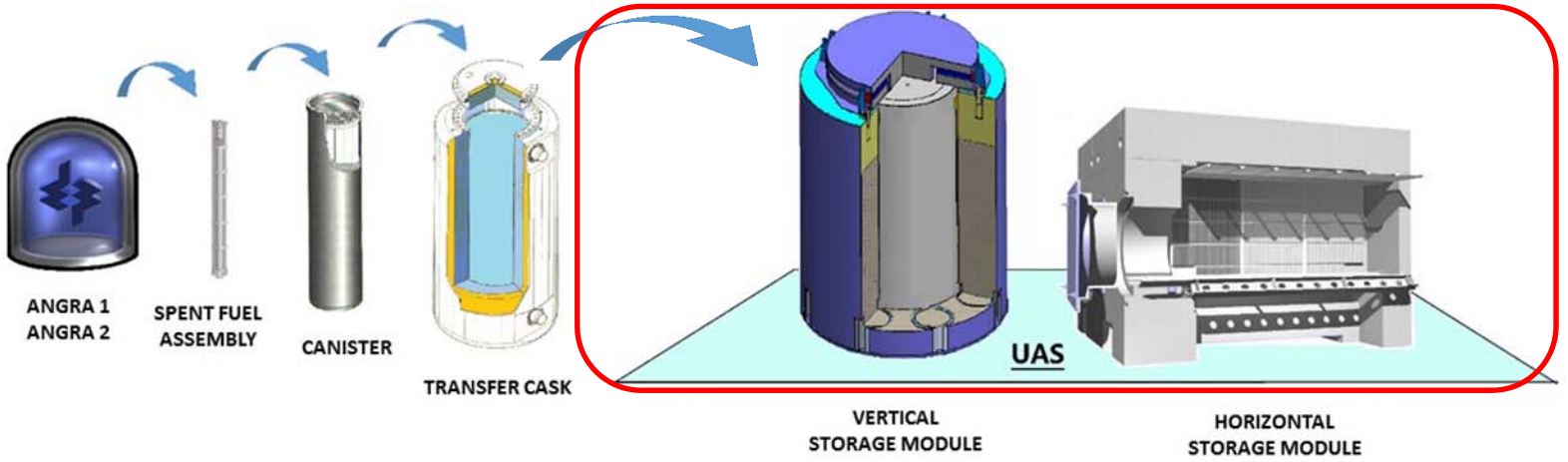
✓ Mixed structure of concrete and steel, with wall thickness of about 700 mm and devices for air inlet and outlet

✓ Storage of Canisters in the horizontal or vertical position

✓ It allows the monitoring of temperature and radiation and inspection of the Canisters

The Project

Technical Characteristics



- **Dry Storage Facility**
- Controlled area with restricted access in CNAAA
- Physical protection with double fence
- Area with radiation monitoring and control of the personnel
- Gatehouse and warehouse

The Project

Location

Located at the foot of the slope of the Information Center – Itaorna

The Project

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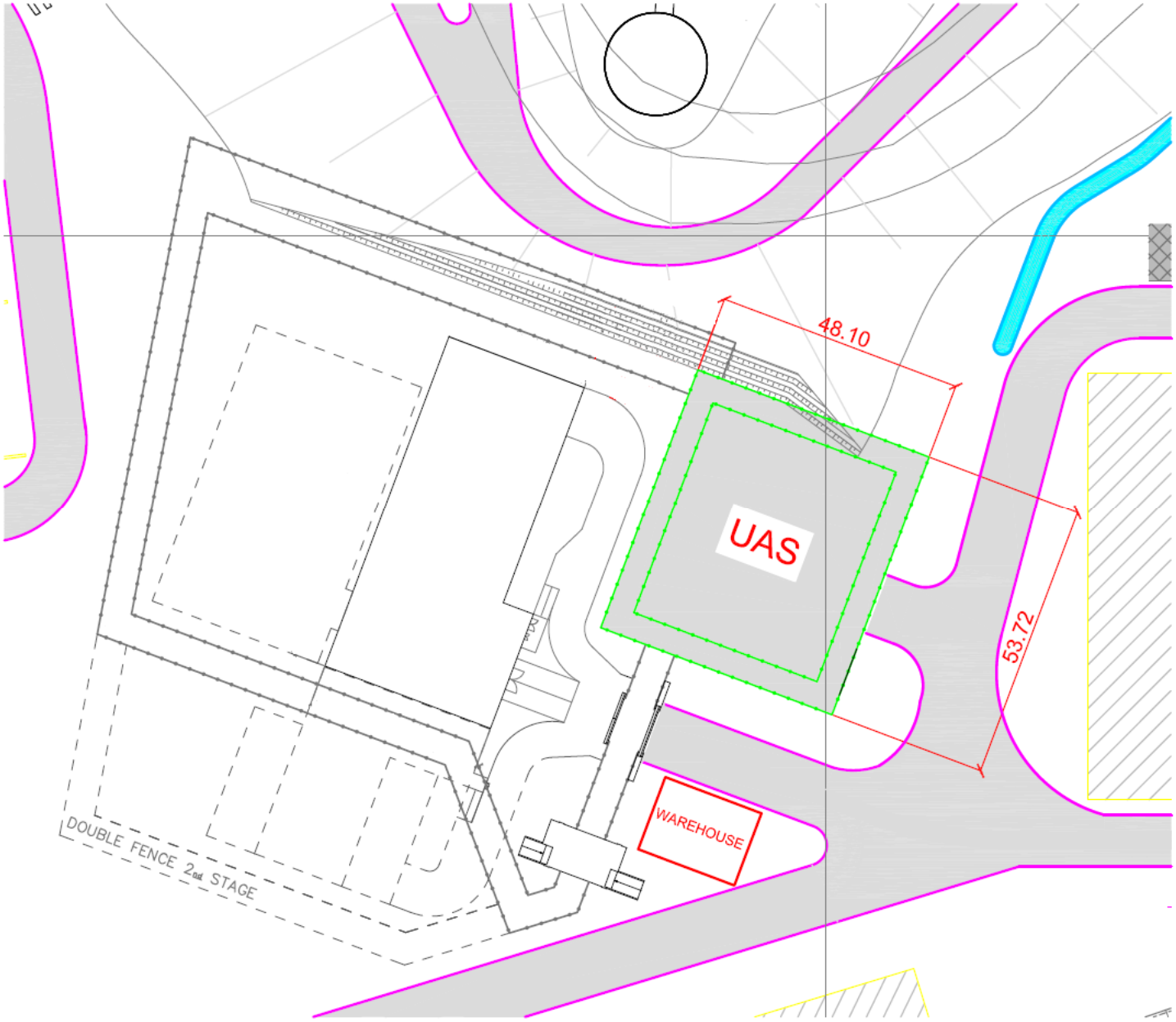

Location Plan

The Project

Location

The Project

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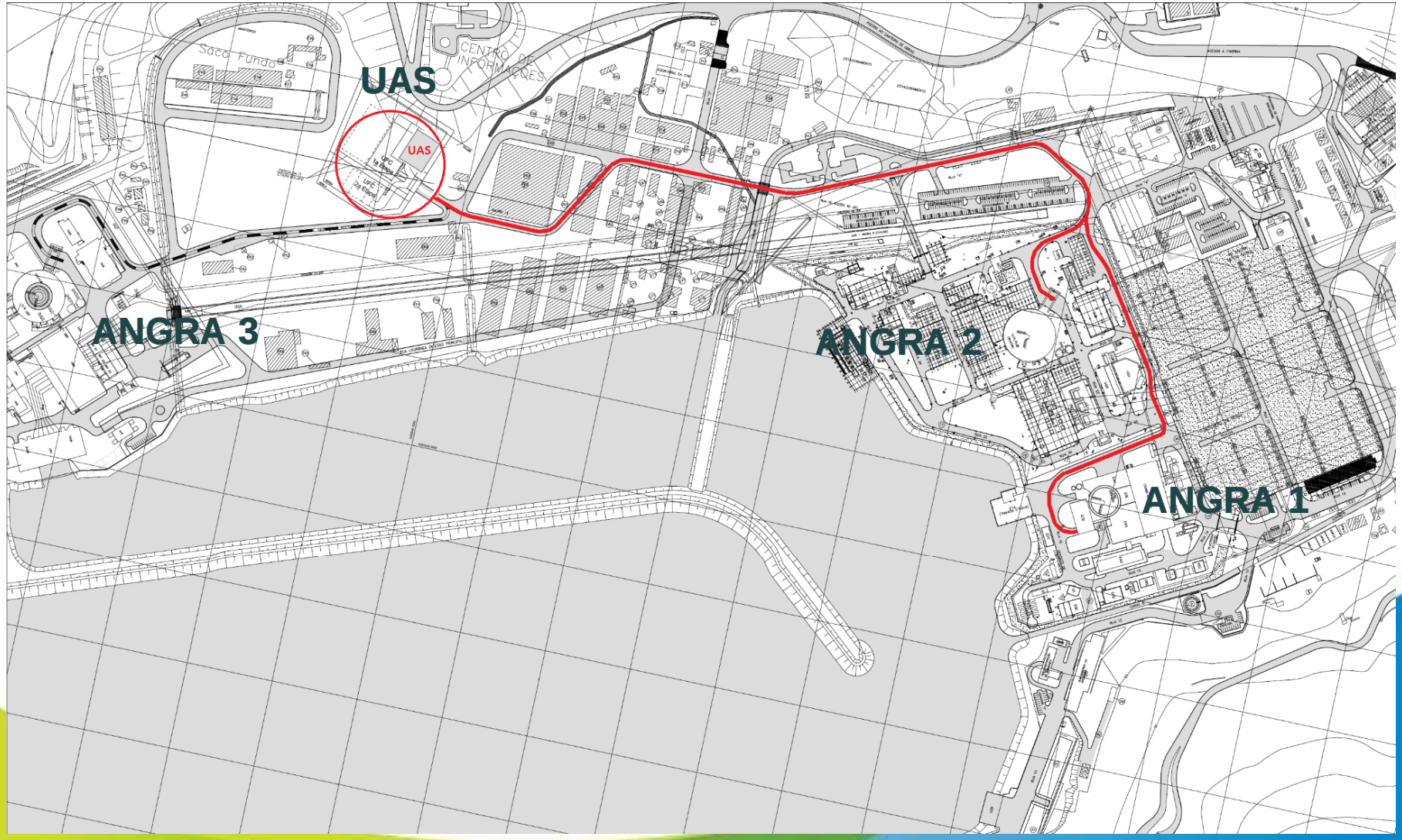
Location

- **Site characteristics**
  - In CNAAA's property
  - The site was already characterized and investigated. Geological, geotechnical and seismological investigations have been carried out.
  - The site has been already studied in relation to meteorology and hydrology.
  - It allows the transfer of SFAs in the CNAAA and it is on the same plane of the NPPs.
  - Transfer routes, without large interventions (reinforcements, retaining walls, etc.).

The Project

Transfer Route



The Project

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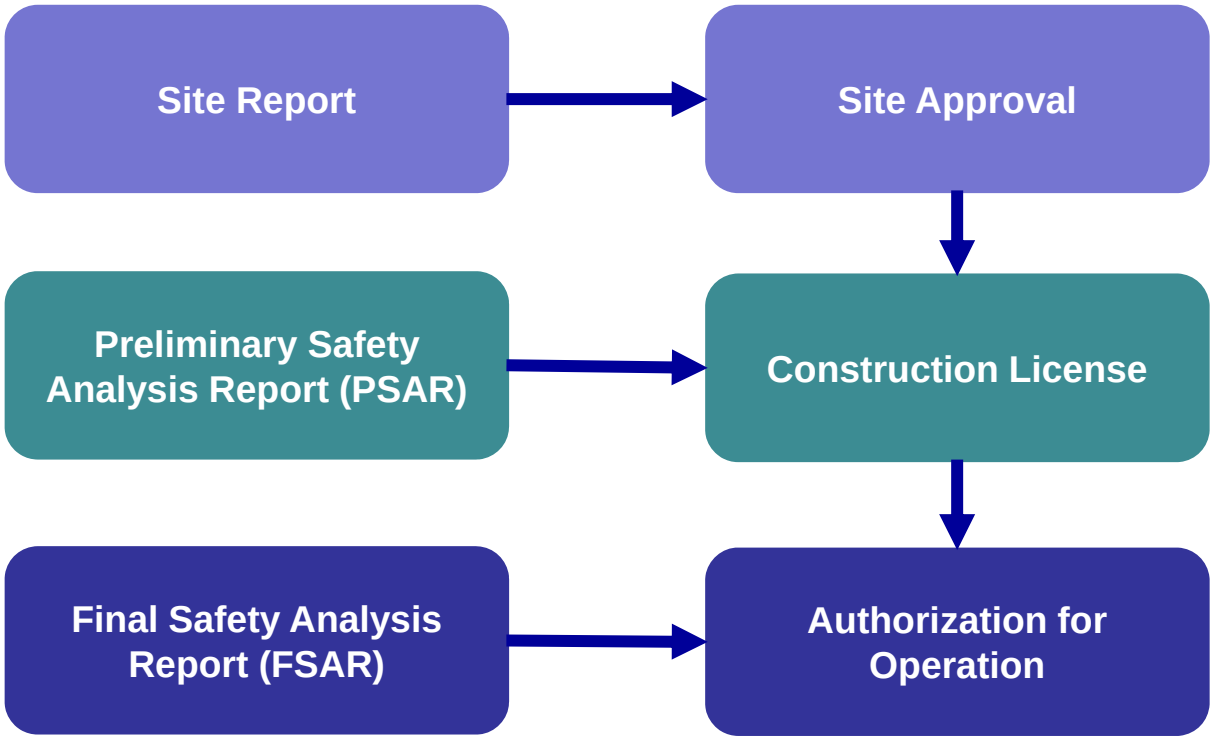
Nuclear Licensing



The Project

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Nuclear Licensing

- **CNEN Resolution – No. 199 of July 27, 2016**

  Article 1 – Adopt, as the standard model for preparing the Safety Analysis Report of the Independent Spent Fuel Dry Storage Unit (UAS), the American recommendation of the Nuclear Regulatory Commission, titled **Regulatory Guide 3.62 – "Standard Format and Content for the Safety Analysis Report for Onsite Storage of Spent Fuel Storage Casks"**

The Project

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Nuclear Licensing

- **Conditions for the preparation of the Safety Analysis Report of the Independent Spent Fuel Dry Storage Unit (UAS):**

1) ... the standard model shall be used together with the document **NUREG-1567 – "Standard Review Plan for Spent Fuel Dry Storage Facilities"** ....

2) Other documents of the NRC that may change or replace the adopted standard model, up to one year before issuing the Safety Analysis Reports, shall also be sent to CNEN ...

3) The adoption of the standard model shall not prevail over the compliance with specific requirements of CNEN

4) The applicable technological rules and codes shall be mentioned in the Safety Analysis Reports

5) The licensing process of the UAS shall comply with the **Standard CNEN-NE-1.04** - Licensing of Nuclear Installations, and the particularities shall be determined by the CNEN's department responsible for the licensing of the UAS

The Project

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Eletronuclear

Nuclear Licensing

➢ Normative Basis

- CNEN-NE-1.04 – Licensing of Nuclear Installations
- Regulatory Guide 3.62 – Standard Format and Content for the Safety Analysis Report for Onsite Storage of Spent Fuel Storage Casks
- NUREG-1567 – Standard Review Plan for Spent Fuel Dry Storage Facilities
- 10 CFR 72 – Licensing Requirements for the Independent Storage of Spent Fuel and High-Level Radioactive Waste

The Project

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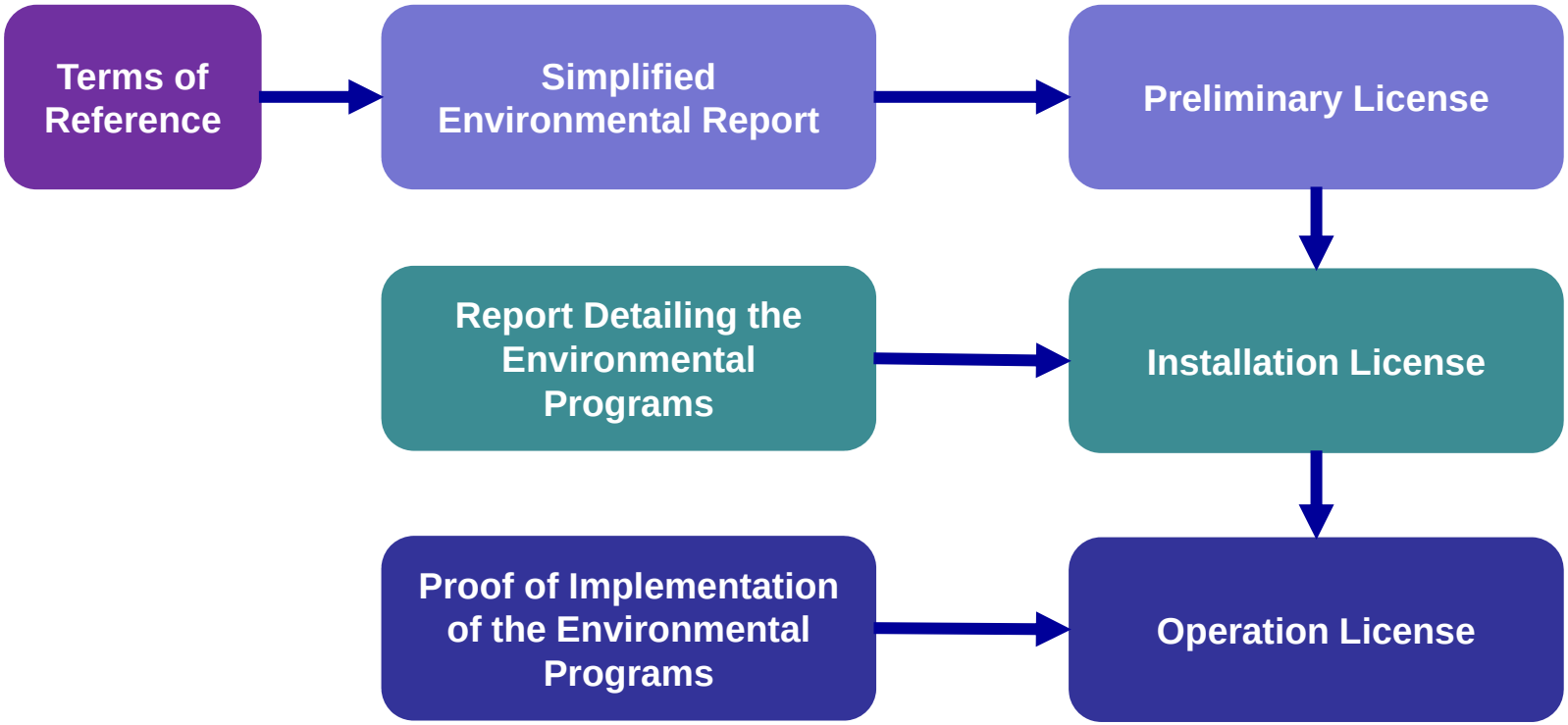
Eletronuclear

Environmental Licensing



The Project

Current Situation

- **Contracting of the Dry Storage Solution**
  - The bidding documents are in the final phase of preparation
- **Nuclear Licensing**
  - The Site Report was sent to CNEN on August 09, 2016
- **Environmental Licensing**
  - Term of Reference, in the Simplified Environmental Licensing mode, issued on August 19, 2016 by IBAMA

The Project

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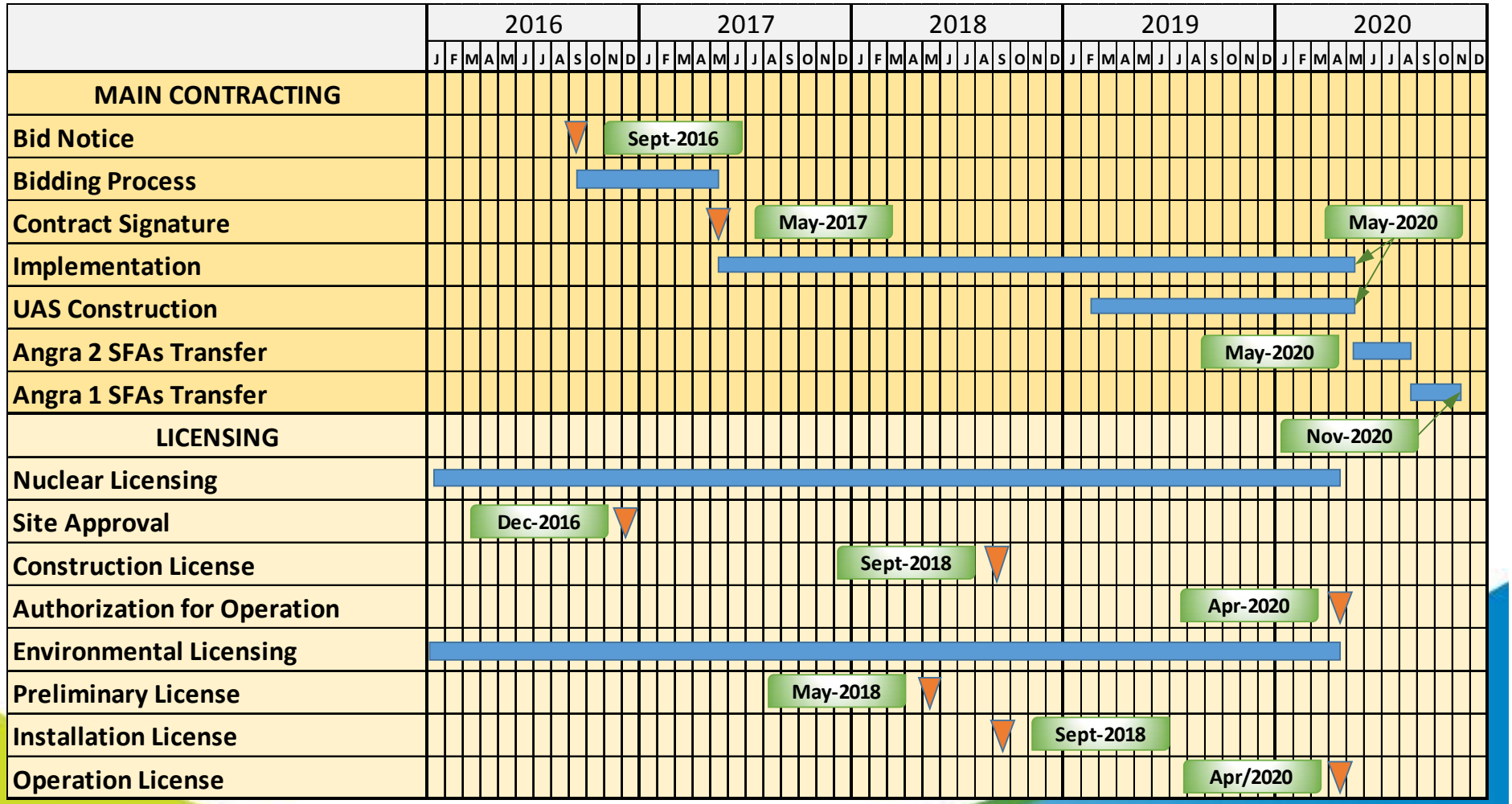
Simplified Time Schedule



Scope of the Contracting

A. Supply of the Dry Transfer and Storage Devices

B. Construction of the Dry Storage Facility

C. Adjustment to Angra 1 and Angra 2 NPPs

D. Transfer of the SFAs from the NPPs to the Dry Storage Facility

E. Preparation of the Documentation and Support in the Licensing Process

F. Preparation of the Design of the Complementary Dry Storage Unit Project

Scope of the Contracting

A. Supply of the Dry Transfer and Storage Devices

- **Supply of the following devices**

(sufficient for at least 220 SFAs of Angra 1 and 260 SFAs of Angra 2)

  - Canisters
  - Transfer Cask(s)
  - Storage Modules

- **Services related to the supply of the devices**

  - Design
  - Manufacture
  - Transport and delivery at CNAAA

Scope of the Contracting

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B. Construction of the Dry Storage Facility

- **Area of the dry storage facility**
  - Foundation slab
  - Waterproofing
  - Finishing
- **Facilities related to the dry storage facility**
  - Warehouse (for the safekeeping of equipment, devices, etc.)
  - Double fence
  - Gatehouse
- **Supply and installation of the equipment**
  - Equipment for measurement and monitoring of the devices
  - Equipment of personnel monitoring

Scope of the Contracting

Eletrobras
Eletronuclear

C. Adjustment to Angra 1 and Angra 2 NPPs

- **Supply of the items required for the transfer of SFAs**
  - Lifting yokes and beams
  - Transfer carriage (Angra 2)
  - Working platforms
  - Equipment for the transfer activities (welding, drying, He injection, etc.)
  - Devices for provisional relocation of pool equipment
- **Verification of the sufficiency of available equipment at the NPPs and performance of the needed modifications**
  - Lifting devices (traveling cranes)

Scope of the Contracting

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D. Transfer of the SFAs from the NPPs to the Dry Storage Facility

- Supply of the transporter vehicle of the transfer cask(s)
- Verification of the suitability of the transfer route path and adjustment, if needed
- Performance of the transfer process of the SFAs of both NPPs, in consecutive campaigns in only one period
- Provision of the traveling crane operation and radiation protection services

Scope of the Contracting

E. Preparation of the Documentation and Support in the Licensing Process

- Supply of the General License, Safety Analysis Report – SAR and Certificate of Compliance – CoC of the NRC for the device(s) of transfer and storage, which will be the basis for implementation of the storage solution of ELETRONUCLEAR
- Preparation of the reconciliation documents for adjustment of the specific data of CNAAA site, of the SFAs of the NPPs and of the possible design modifications
- Preparation of the specific Safety Analysis Report (preliminary and final) of the UAS project
- Support in the environmental and nuclear licensing of the UAS project

Scope of the Contracting

F. Preparation of the Design of the Complementary Dry Storage Unit Project

- Preparation of the documents of the dry transfer and storage devices
- Preparation of the civil design and of the design of the supplies of the dry storage facility
- Preparation of the documents related to the adjustment to Angra 1 and Angra 2 NPPs
- Preparation of the complete documents of transfer

Section 3

➢ Bidding Process

José Amaral

Public Hearing

Rio de Janeiro, August 24, 2016.

Bidding Process

Purpose

Selecting, among the bids that comply with the requirements provided for in the Bidding Instructions, the bid that is less expensive to ELETRONUCLEAR for implementation of the Dry Storage Unit

Bidding Process

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Eletronuclear

General Characteristics

- Mode: **International Bidding**
- Type: **Lowest Price**
- Performance regime: **Turnkey Job**
- Bid Notice: **September 2016**
- Estimated duration of the process: **8 months**

Bidding Process

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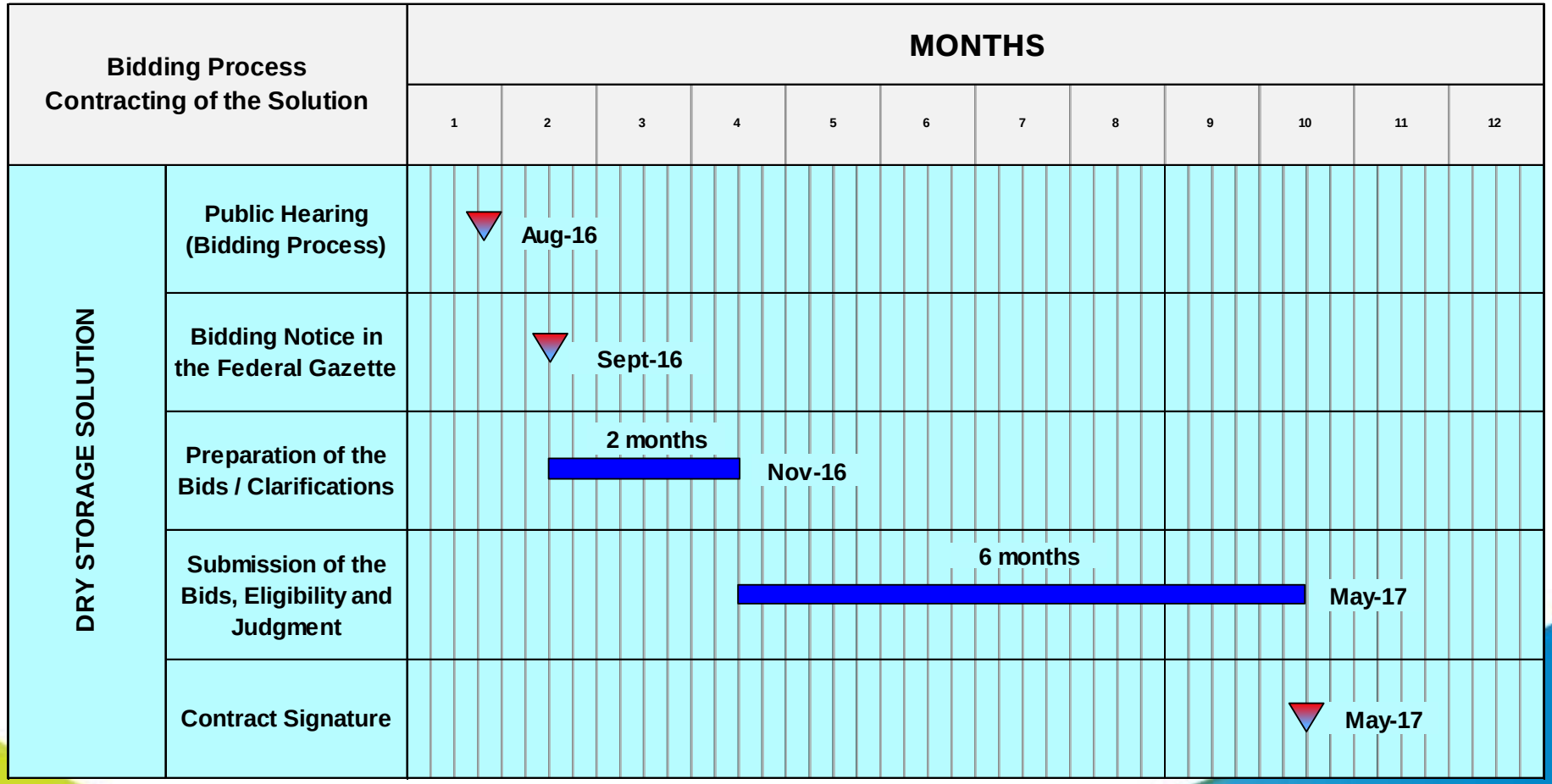
Estimated Time Schedule



Bidding Process

General Requirements

- **It shall not be allowed the participation of:**
  - **Consortia**
  - **Cooperatives, of any formation type**
  - **A company in whose staff there is a person with an employment relationship with ELETRONUCLEAR, even if the person is a manager or member of the company**
- **Partial subcontracting of the bidding object, by means of Brazilian and/or foreign companies, after previous and express approval of ELETRONUCLEAR**
- **The subcontractors shall comply with the same eligibility requirements of the BIDDER, as applicable to its scope**

Bidding Process

Contractor's Obligations

Contractor's obligations are those established in the Draft Contract, Annex IV to the Bidding Instructions to be issued. It is worth mentioning the performance of the SERVICES in accordance with the requirements established in the Technical Specification and the full compliance with the other contractual provisions and the Brazilian laws, including matters related to the levied taxes.

Bidding Process

Eletrobras
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Eligibility Documents

- **Legal Eligibility**
- **Fulfillment of Fiscal and Labor Obligations**
- **Economic-Financial Qualification**
- **Technical Qualification**
- **Statement as per item V, article 27, of Law no. 8.666/93**

  (statement saying that it does not engage minors for night, dangerous or unhealthy work)
- **Statement as per item III, article 9, of Law no. 8.666/93**

  (statement saying that there is nobody among the company's members and in its staff with an employment relationship with ELETRONUCLEAR)

Bidding Process

Eligibility Documents

- **LEGAL ELIGIBILITY**

- **BRAZILIAN BIDDER**
  - ✓ **Trade register, in case of sole proprietorship**
  - ✓ **Documents of organization, articles of incorporation or articles of organization in force, duly registered in the Commercial Registry**
  - ✓ **Registration of the documents of organization in the Civil Registry of Legal Entities**
  - ✓ **Authorization decree in case of foreign company or corporation operating in Brazil and registration act or authorization for operation in Brazil as issued by the competent body, if required for the activity in question**

- **FOREIGN BIDDER**
  - ✓ **Evidence of the company's legal incorporation in its home country, issued by a governmental entity**

Bidding Process

Eligibility Documents

➢ **FULFILLMENT OF FISCAL AND LABOR OBLIGATIONS**

- **BRAZILIAN BIDDER**
  - ✓ **Proof of registration in CNPJ**
  - ✓ **Proof of registration in the State or Municipality Taxpayers' Roll, if any.**
  - ✓ **Proof of fulfillment of obligations towards the Federal, State and Municipal Revenues**
  - ✓ **Proof of fulfillment of FGTS obligations**
  - ✓ **Proof that there are no debts in default towards the Labor Courts**
- **FOREIGN BIDDER**
  - ✓ **NOT APPLICABLE**

Bidding Process

Eligibility Documents

- **ECONOMIC-FINANCIAL QUALIFICATION**

- **BRAZILIAN BIDDER**

  - ✓ **Financial statements of the last fiscal year, as required and presented in accordance with the "International Financial Reporting Standards" (IFRS), including very small businesses and small businesses**
  - ✓ **Certificate(s) of clearance of bankruptcy and court-supervised or out-of-court reorganization**
  - ✓ **Evidence of the bidder's sound financial situation by means of the criteria provided for in the Bidding Instructions**

Bidding Process

Eligibility Documents

- **ECONOMIC-FINANCIAL QUALIFICATION**

- **FOREIGN BIDDER**

  - ✓ **Financial statements of the last fiscal year, as required and presented in accordance with the "International Financial Reporting Standards" (IFRS)**
  - ✓ **Evidence of the bidder's sound financial situation by means of the criteria provided for in the Bidding Instructions**
  - ✓ **Statement saying that the company is not liable to any bankruptcy proceedings in its home country and that it is not indebted to state-owned or private organizations**

Bidding Process

Eligibility Documents

- **TECHNICAL QUALIFICATION**

- **BRAZILIAN and FOREIGN BIDDERS**

  - ✓ **Register or enrollment in the competent professional regulatory body**
  - ✓ **Certificate that expressly and clearly proves that the BIDDER, as main contractor, supplied dry transfer and storage devices (based on Canisters) for SFAs from a PWR NPP and performed the services of transfer of these SFAs to an external storage unit, in accordance with the standard NRC 10 CFR 72.**
  - ✓ **Certificate number(s) of the transfer and storage device(s), which will be the basis for implementation of the dry storage solution of ELETRONUCLEAR, according to the standard NRC 10 CFR 72.214 – List of approved spent fuel storage cask, valid on the date of delivery of the ELIGIBILITY DOCUMENTS**
  - ✓ **Technical Visit Certificates (CNAAA and head office of ELETRONUCLEAR)**

Bidding Process

Bid

- **The BID shall consist of:**

- **Price worksheets**
- **Statement of the BIDDER undertaking to perform the SERVICES by means of a Quality Assurance System that meets the requirements of the standard CNEN-NN-1.16, or an equivalent nuclear standard, such as the NRC 10 CFR 50 Appendix B, 10CFR71 Subpart H and 10CFR72 Subpart G. This system shall be accepted by ELETRONUCLEAR before the start of the activities.**

Bidding Process

Eletrobras
Eletronuclear

Analysis and Judgment

- **Analysis of the Eligibility Documents**
- **Analysis of the BID**
  - **Completeness of the BID by analyzing and verifying the price worksheets**
  - **Verification of the acceptability of the bid prices, according to the acceptance criteria provided for in the Bidding Instructions, including the verification of the taxes**

Bidding Process

Analysis and Judgment

- **The BIDS shall be classified according to the ascending order of the TOTAL PRICE FOR JUDGMENT PURPOSES (total costs incurred by ELETRONUCLEAR = total amount of payments made to the BIDDER + levied taxes)**
- **The winning BIDDER will be the one that fulfills all requirements established in the Bidding Instructions and submits the lowest TOTAL PRICE FOR JUDGMENT PURPOSES**

Bidding Process

Eletrobras
Eletronuclear

Analysis and Judgment

PRICE WORKSHEET "A" ENGINEERING AND SERVICES Values in the currency of the BIDDER's country				
Item	Description	X3 Total value of the Services (X3 = X1 + X2)	X1 Portion of the value to be paid in the currency of the BIDDER's country	X2 Portion of the value to be paid in reais, converted to the currency of the BIDDER's country
1	Design Engineering and Documentation			
2	Licensing engineering			
3	Civil engineering design			
4	Civil construction (materials and execution)			
5	Personnel for the operation of the traveling crane, radiation protection and management at CNAAA			
6	Design and documentation related to the modifications at the NPPs			
7	Services related to the modifications at the NPPs			
8	"Pool to pad" transfer process			
SUBTOTAL A		A3 = (A3 = ∑ X3)	A1 = (A1 = ∑ X1)	A2 = (A2 = ∑ X2)

Bidding Process

Analysis and Judgment

PRICE WORKSHEET "B" SUPPLIES Values in the currency of the BIDDER's country				
Item	Description	Y3 Total value of the Supplies (Y3 = Y1 + Y2)	Y1 Portion of the value to be paid in the currency of the BIDDER's country	Y2 Portion of the value to be paid in reais, converted to the currency of the BIDDER's country
9	Materials / Equipment for Modifications at the NPPs			
10	Main devices (Canisters, Transfer Casks and Storage Modules)			
11	Auxiliary devices			
SUBTOTAL B		B3 = (B3 = ∑ Y3)	B1 = (B1 = ∑ Y1)	B2 = (B2 = ∑ Y2)
TOTAL BID PRICE	SUBTOTALS A + B (PRICE WORKSHEETS "A" + "B")	A3 + B3 = (Values in the currency of the BIDDER's country)		

Bidding Process

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Analysis and Judgment

PRICE WORKSHEET – SUMMARY FOR JUDGEMENT PURPOSES Values in the currency of the BIDDER's country			
TOTAL BID PRICE	**Z1** (Portion of the value to be paid in the currency of the BIDDER's country)	**Z2** (Portion of the value to be paid in reais, converted to the currency of the BIDDER's country)	**Z3** **Z1 + Z2**
SUBTOTAL 1 **(Engineering and Services)**	(Z1 engineering and services= A1 x 1.4899)	(Z2 engineering and services= A2)	(Z3 engineering and services= Z1+Z2)
SUBTOTAL 2 **(Supplies)**	(Z1 supplies= B1 x 1.7400)	(Z2 supplies= B2)	(Z3 supplies= Z1+Z2)
TOTAL PRICE FOR JUDGMENT PURPOSES	**Currency of the BIDDER's country =**		(Z3 engineering and services + Z3 supplies)

REMARK:

1.The field Z1 applies to FOREIGN BIDDERS and it is equal to A1 x 1.47 (Engineering and Services) and B1 x 1.74 (Supplies)

2.The field Z2 applies to BRAZILIAN BIDDERS or to the portion to be paid in reais to the BRAZILIAN SUBCONTRACTOR of the FOREIGN BIDDER and it is equal to the subtotals A2 (Engineering and Services) and B2 (Supplies)

IMPLEMENTATION OF THE SPENT FUEL COMPLEMENTARY DRY STORAGE UNIT – UAS

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Thank you

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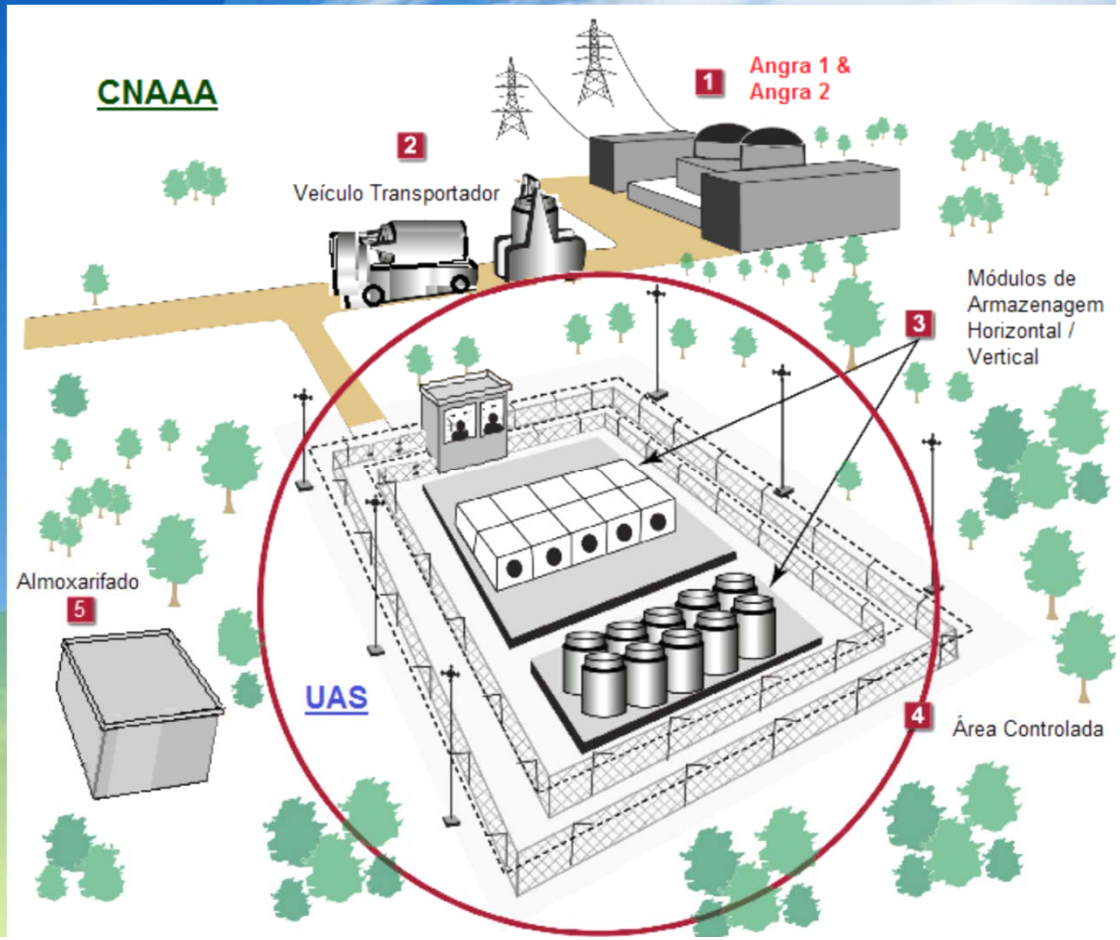
Public Hearing in compliance with article 39 of Law 8.666/93

Rio de Janeiro, August 24, 2016



Questions and Answers

Public Hearing

Rio de Janeiro, August 24, 2016.