



Preparation of LTO of Atucha I NPP



Marcelo **Liendo** – Atucha Unit I NPP

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Eng. Marcelo Liendo metallurgical engineer graduated from the National Technological University at Buenos Aires with more than 35 years of experience on metallurgy applied to the nuclear industry. Fellowship of the IAEA and the National Atomic Energy Commission of Argentina on Mechanics of the Fracture applied on the integrity of pressurized nuclear components, at University of Tennessee, USA.

At the present, Chairman of the International Working Group in Argentina of ASME (American Society of Mechanical Engineers), Section III and member of several organizations related to metallurgy and the nuclear industry.

Participation in the IAEA IGALL Working Group 1 and Host Plant Peer on the SALTO missions at Atucha I (November 2021 and February 2024).

At the present, Technical Advisor of the LTO Atucha I NPP.



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Background of CNA Unit I

Nuclear Power Stations in Argentina



Atucha I

- 1974
- PHWR – Siemens
- Electric Output: 362 MWe

Atucha II

- 2014
- PHWR - KWU
- Electric Output: 745 MWe



Embalse

- 1983 (2019)
- PHWR – AECL
- CANDU-6
- Electric Output: 656 MWe

Background of CNA Unit I

Atucha I began its construction in June 1968 and became the first nuclear power plant in Latin America.

Milestones	
Designer and constructor	Siemens (Germany)
First Concrete	June 1968
First Criticality	January 13rd, 1974
First Grid Connection	March 19th, 1974
Commercial Operation	June 24th, 1974
Power	
Thermal Power	1.179 MWt
Gross Electrical Capacity	357 MWe



Background of CNA Unit I

Reactor Type: PHWR

Moderator/Coolant: Heavy Water

Inlet Temperature to RPV: 260°C

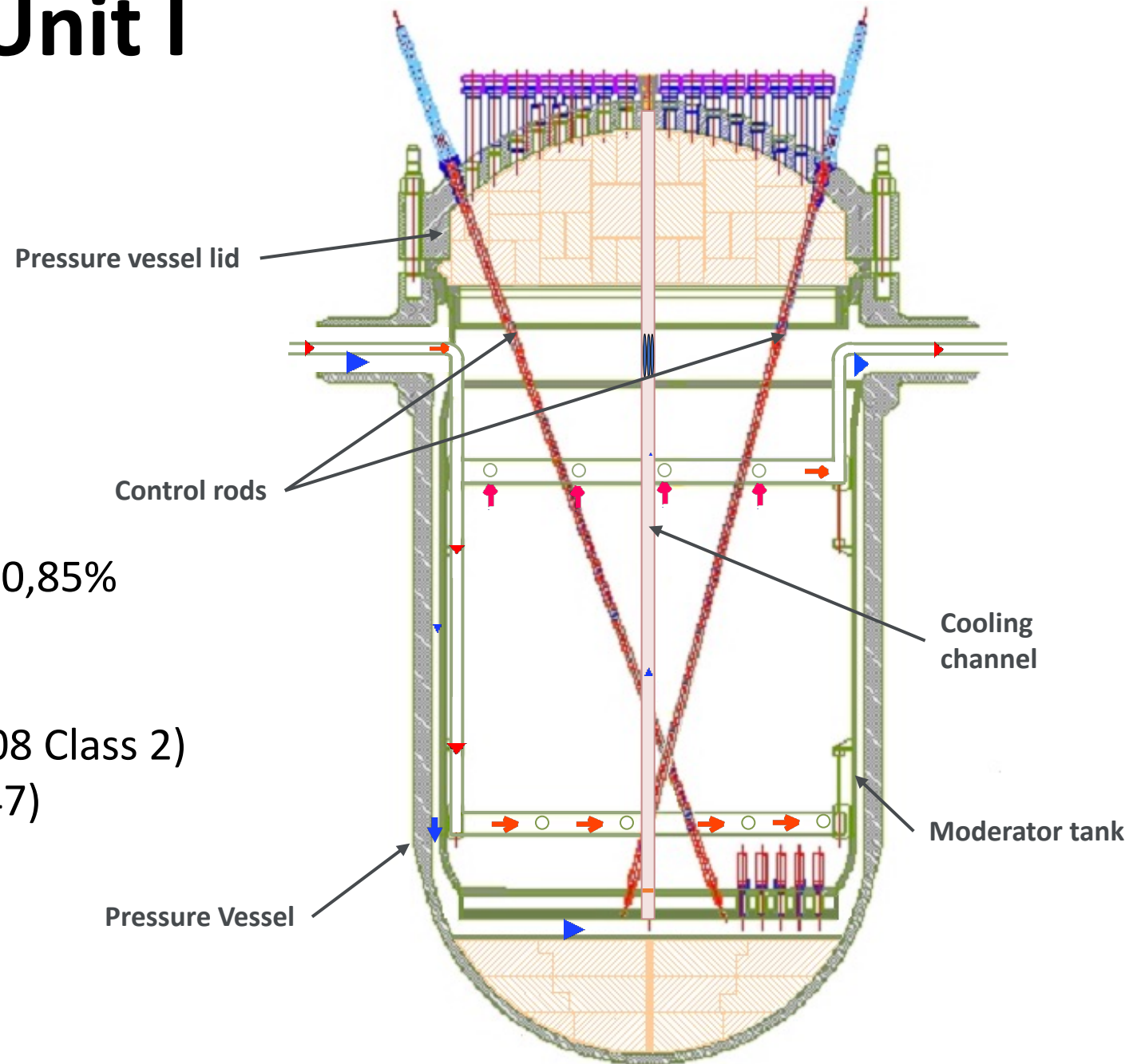
Outlet Temperature to RPV: 320°C

Fuel: Natural Uranium (slightly enriched - 0,85% U235)

RPV Steel: DIN 22NiMoCr37 (similar SA 508 Class 2)

RPV Cladding : DIN 1.4550 (similar AISI 347)

Cooling Channels: 253





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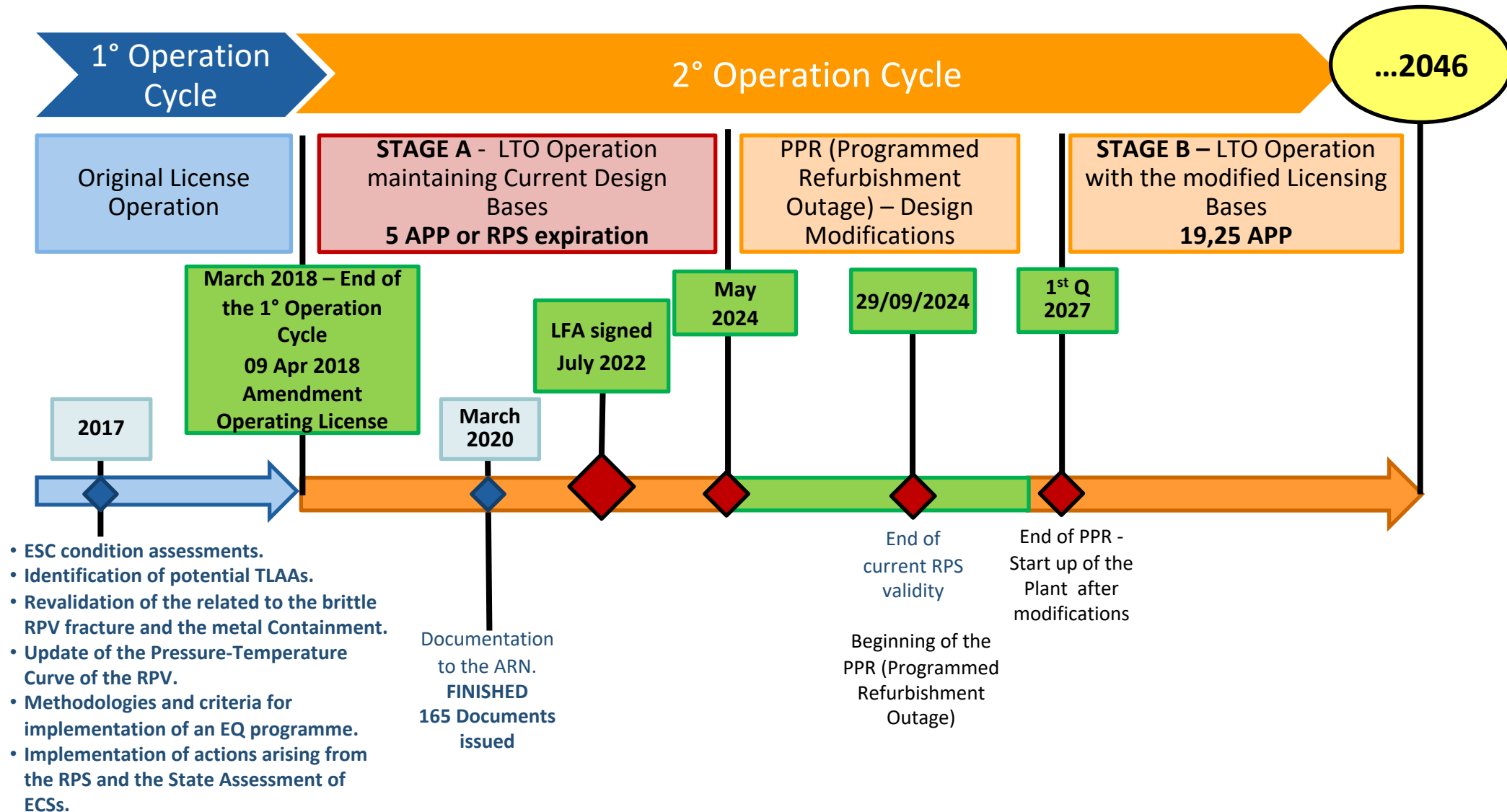
Strategy of the LTO project

- The LTO of the CNA Unit I was declared of national interest by the National Congress through the National Law No. 26566, article 15 (2009).
- Several safety improvements were implemented such as the new EPS, the 4th water river cooling loop (UK) and the spent fuel dry storage.
- The original operation time was 32 FPY and the request to the regulator is for additional **24.25 FPY**. (Total = 54.25 FPY)
- In 2018, the Regulator issued the Amendment to the Operating License, authorizing the start of the first stage (**Stage A**) of the LTO.

Strategy of the LTO project

- NASA and the Regulator on July 1, 2022 signed an agreement (Documento Marco de Licenciamiento). Establishes the improvement activities that NA-SA must address to the satisfaction of the ARN to begin the **Stage B** of the LTO.

Strategy of the LTO project





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Challenges of the project

- The unique design features of CNA Unit 1, therefore no LTO experience for that kind of reactor.
- CNA Unit I designed during the final 60's and beginning of the 70's. Many OEMs were no longer in business.
- Update of the plant to the present state of the art.
- Original information not updated to the state-of-the-art knowledge or missing (for the primary circuit was used a ASME Code, Section III, Edition 1965).

Challenges of the project

- The TLAA neither were identified nor revalidated. The only TLAA identified and revalidated was the RPV neutron embrittlement.
- Therefore, a **huge task of the reconstitution** of the design basis had to be planned and executed in short time.



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Actions

Reconstitution of the design basis. More than 1500 boxes and folders were searched and classified



Actions

A procedure for identification of the information was issued.

 **SIEMENS AKTIENGESELLSCHAFT**

Abteilung TS 116 B (RE 52) Erlangen August 68 Spezifikation Nr.: RE-L 292
Anlage zu Anfrage
Aktenzeichen TS 116 B/ 753 314/ 88

Lieferumfang und technische Abnahmebedingungen
für Reaktoreinbauten, 300MWe - D₂O - D₂O Kernkraftwerk Atucha
- Einbauten -

Anlagenkennzeichen Atucha

Bestellkennzeichen 753 314

Erstellungsdatum August 68 Bearbeiter Schildhauer/ Ilgmeier

Anderung	Datum	Blatt / Seite

Tutorial de identificación de documentos especificaciones de planta del Archivo 10

1. Objetivo

La tarea se centrará en identificar especificaciones técnicas a partir de su código de RE-L, revisando EXCLUSIVAMENTE la portada de los mismos. Los modelos de portada son los siguientes:

- El código escrito a mano en el lado superior derecho y el equipo o sistema identificado más abajo

 **SIEMENS AKTIENGESELLSCHAFT**

Abteilung ... Spezifikation Nr.: RE-L 292
Anlage zu
Aktenzeichen TS 116 B/753 314/88

Lieferumfang und technische Abnahmebedingungen
für ...
300 MWe Kernreaktor Atucha (CANDU)
Hauptkühlmittel- und Dampferzeuger

Equipo o Sistema
Anlagenkennzeichen Q P01 201
Q P02 201

Bestellkennzeichen A/0104/112/753 314

Anderung	Datum	Blatt / Seite
1	10.1.68	1/11 2/11 3/11 4/11 5/11 6/11 7/11 8/11 9/11 10/11

Actions

The Goldfire software was installed to search on the scanned documents.

The screenshot displays the Goldfire search interface. The search bar contains the term "moderator" and shows 8,022 results. The interface is divided into several sections:

- Left Panel (Filters):** Includes filters for Content Classes (Corporate), Modification Date (2010-2022), Document Location (doccnal, CNA-F904, etc.), File Type (pdf, etc.), and Document Language (English, German, etc.).
- Search Results:** Lists five documents with details such as document source, file name, and knowledge base. The second result includes a snippet: "By means of this measure the flange part of moderator cooler including the connected moderator pipe up to the flange connection ND200 will be removed. More (15)".
- Right Panel (Categories):** Features a donut chart titled "General Facts" and a table of "Definitions". The donut chart shows various categories related to "moderator". The definitions table lists terms like "zentrier?element" and "moderator/ downcomer".

Actions

Support from the following organizations and companies:

- **IAEA.** Workshops and Safety Aspects for Long Term Operation (SALTO) missions in 2016, 2018, 2021 and 2024. The CNA Unit I is based on several IAEA documents such as Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, IAEA Safety Standards Series No. SSG-48, IAEA, Vienna (2018) and Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL), Safety Reports Series No. 82, IAEA, Vienna (2015).
- **NRG.** To develop a methodologic procedure to identify and revalidate the TLAA. Support to “low cycle fatigue” TLAA calculations and methodology.
- **EPRI.** To improve the methodology and have access to documents with international experience.

Actions

Support from the following organization, companies and documents:

- **Comisión Nacional de Energía Atómica (CNEA)**. Support on our SALTO missions, develop the methodology to perform the Condition Assessments. Support on FE calculations for the Low Cycle Fatigue TLAA.
- EQ program. Close to CNA site a LOCA chamber was installed .



Actions

Support from the following organizations and companies:

- **FRAMATOME.** Supplied some of the original design documents. It is the main supplier for CNA site.
Supplier of the update of the Reactor Protection System
Supplier of the decontamination process on the Moderator system.
- **SIEMENS.** Replacement of the 3 (three) Low Pressure stages of the turbine and other turbine upgrades.
- **Interaction** with other nuclear power plants such as Borssele (Netherlands) and Angra 1 (Brazil).

Actions

Projects under development for the CNA Unit I LTO

Mechanical and Civil Engineering Dept.

- New suction pumps filters of the emergency cooling injection system
- Revalidation of TLAAAs identified for CNAI
- Assessment of the Consequent Failure
- Anti-corium barrier
- Civil upgrade of the Second Heat Sink building
- Rehabilitation of the epoxy coating at the radiological controlled areas
- Fast boron injection shutdown system modifications
- Replacement of the QP pumps (moderator system)
- Replacement of the 3 Low Pressure Stages of the Main Turbine
- Assessment of CNA I civil buildings

Actions

Projects under development for the CNA Unit I LTO

Electrical and I&C

- Changes on the Reactor Protection System
- Modernization of Primary Control Room
- Implementation of the Secondary Control Room
- Control Room simulator
- Equipment qualification (EQ)
- Physical separation of electric trains
- Update of neutron flux measurement
- Update of automatic regulations
- Modernization of control and protection system of the steam turbine
- Replacement of modular I&C electronics by obsolescence
- Replacement of electrical components by obsolescence

Actions

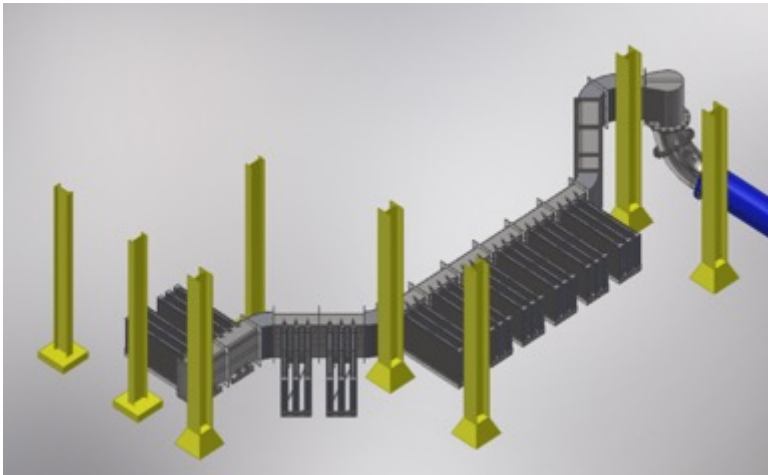
Projects under development for the CNA Unit I LTO

Safety Dept.

- Global Assessment
- Decontamination of the Moderator system
- Assessments for internal explosions and rotating equipment missile
- Master EQ List – Upgrade
- Feed & Bleed of the Primary system
- Main Control Room habitability
- Segregation of the Mechanical Components
- Upgrade of the APS Level 2 and 3

Actions

New suction pumps filters of the emergency cooling injection system



Filtering surface of each unit: 4,75 m²

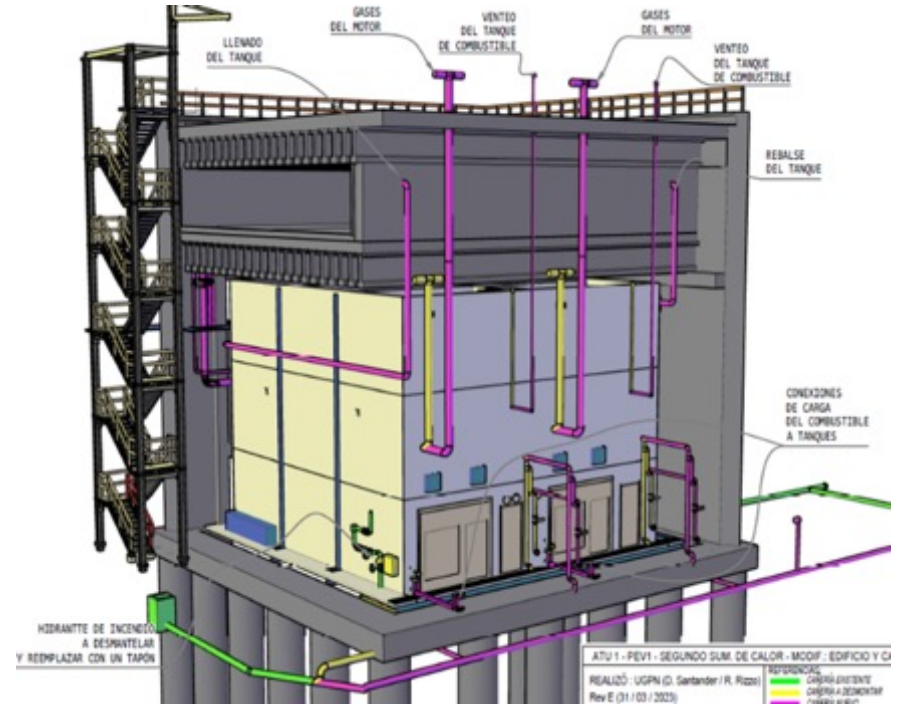
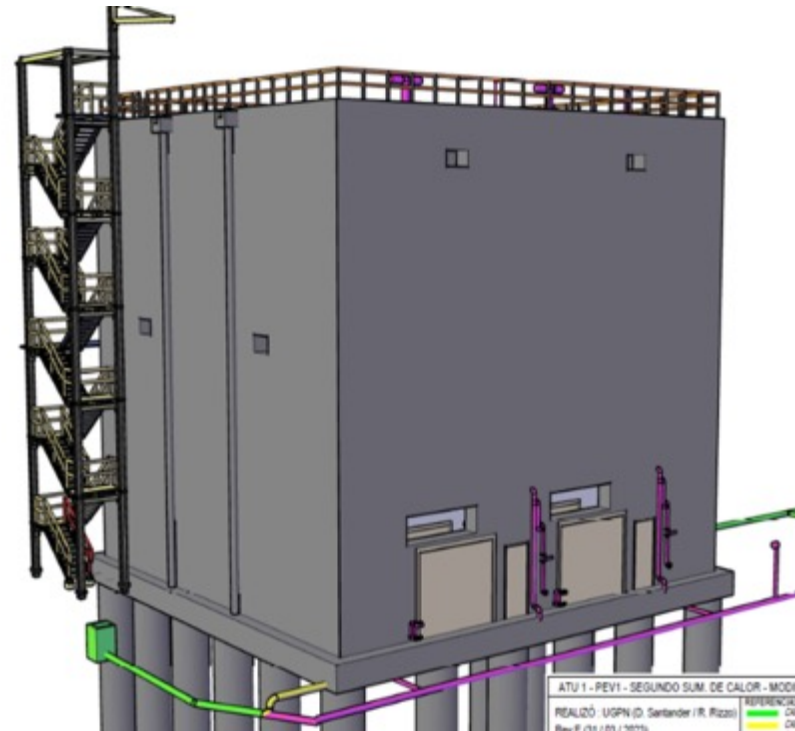
Filter unit quantity: 30

Filtering Surface of each loop: 142,5 m²

Full scale Mock-up

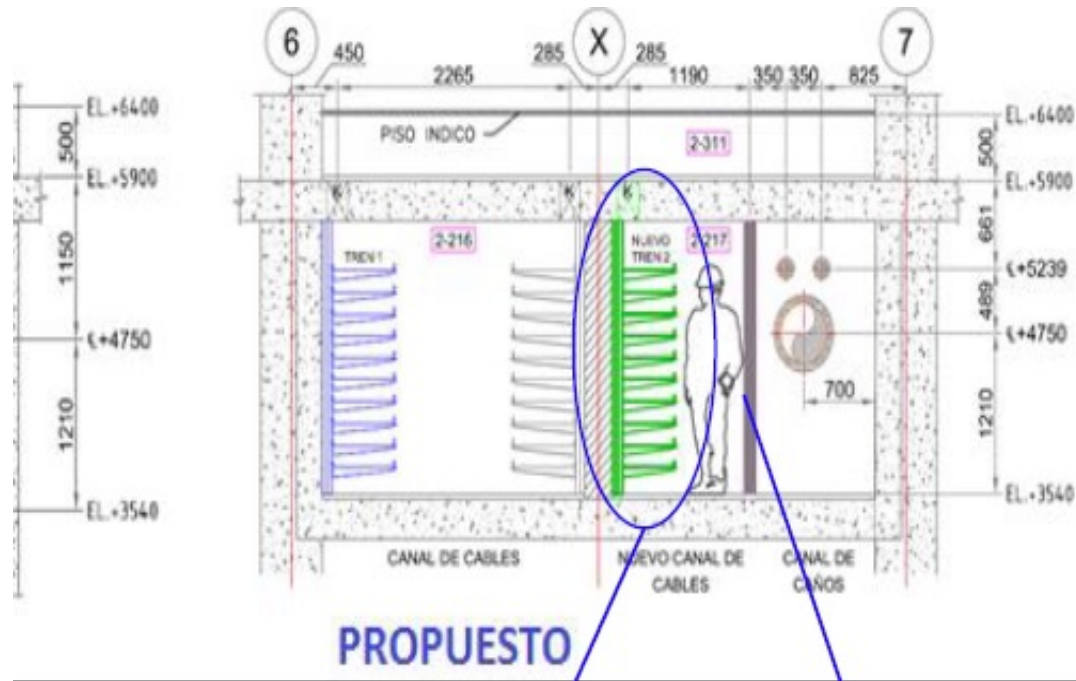
Actions

Civil upgrade of the Second Heat Sink building



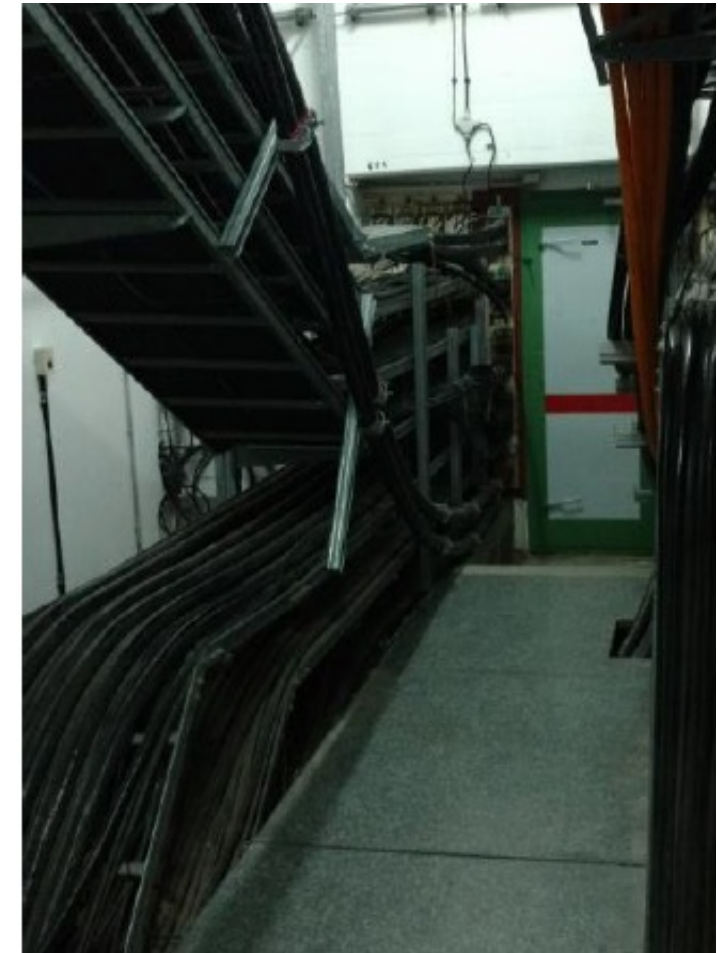
Actions

Physical separation of electric trains



EVOS CABLES DE SEGURIDAD DEL
N 2 TENDIDOS POR TUNEL 2 (60

Tabique
separador



Actions

New entrance to the controlled area





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Conclusions

- The safe LTO of CNA Unit I will supply 362 MWe to the national network up to 2046.
- Very important to have a fluid and continue communication to the Regulator.
- Interaction with other NPPs, specially with Borssele and Angra.
- One of the most important “learnt lesson” was to develop the CNAI LTO project according to the international rules such as IAEA.
- NASA and their local suppliers could perform the revalidation of the TLAA.



**Thanks for your attention!
Muchas gracias!
Ontzettend bedankt!**



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