

CHALLENGES TODAY.
RESPONSIBILITY FOR AGES

Ignalina NPP- Key Decommissioning Projects Overview



IGNALINA
NUCLEAR
POWER PLANT

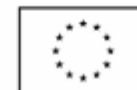
7th Central & Eastern Europe Nuclear Industry Congress 2022
Sep.12-13, 2022 | Prague, Czech Republic



ACCREDITED
MSCB-113



ISO 9001:2015
GKLT-0199-QC



Ignalina NPP decommissioning
activities are co-financed by
the European Union

Content

INPP decommissioning: background information

INPP New Waste Treatment Facilities and radioactive waste streams

Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Scale of INPP dismantling and overview of applied technologies

Progress in decontamination and dismantling projects

New project: Reactor dismantling and graphite storage



INPP decommissioning: background information



Location: Far north-east corner of Lithuania. Immediately bordering Latvia and Belarus



Design: 2 × RBMK-1500 water-cooled, graphite-moderated channel-type power reactors



Capacity: Intended to supply NW region of former USSR (not Lithuania). After independence, one unit could produce 80% of Lithuanian electricity demand



Operation:

Unit 1 commissioned Dec 1983 / closed Dec 2004

Unit 2 commissioned Aug 1987 / closed Dec 2009



INPP decommissioning: background information



Early closure: Required to facilitate EU accession due to safety concerns. **First decommissioning of RBMK-type NPP**



Progress: Planning started in **2001**. Investment projects to open waste-routes started in **2003**. Dismantling started in **2010** (Unit 1) and **2014** (Unit 2)



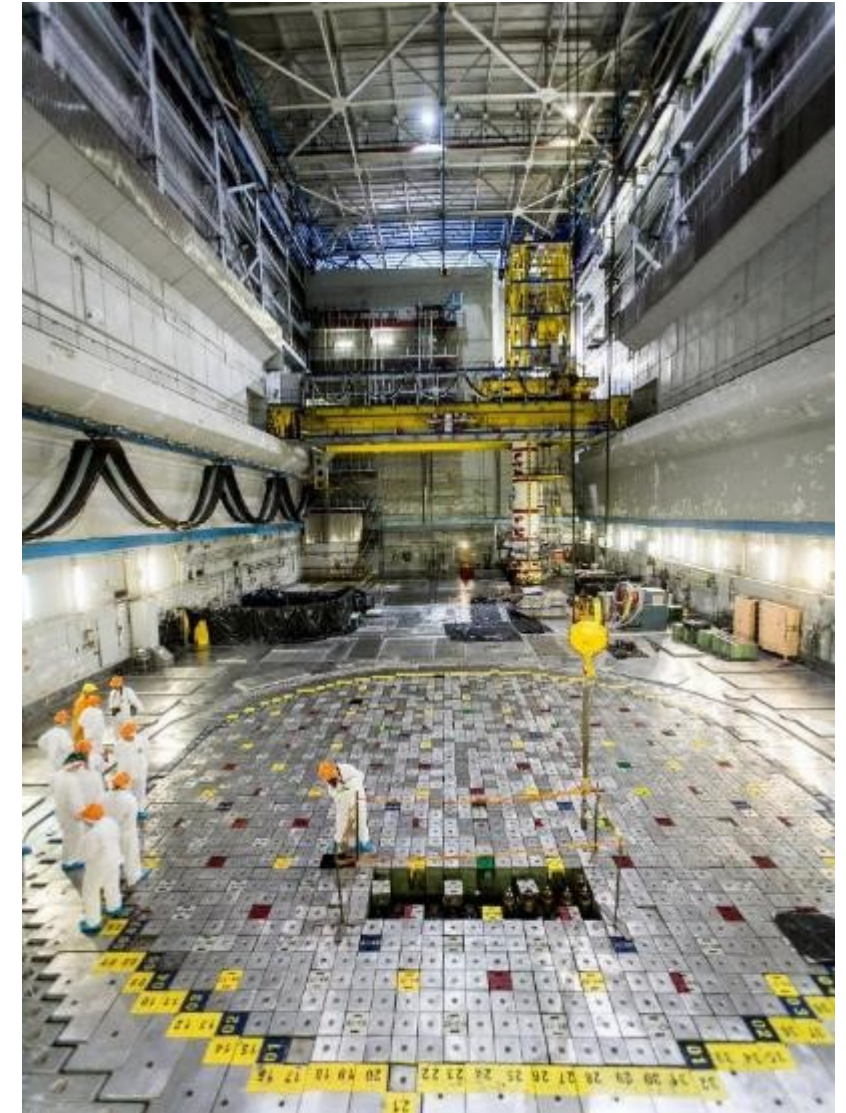
Licensing: Plant is still licensed as “**operating**” because of nuclear fuel in the units. Preparation for decommissioning license obtaining is ongoing



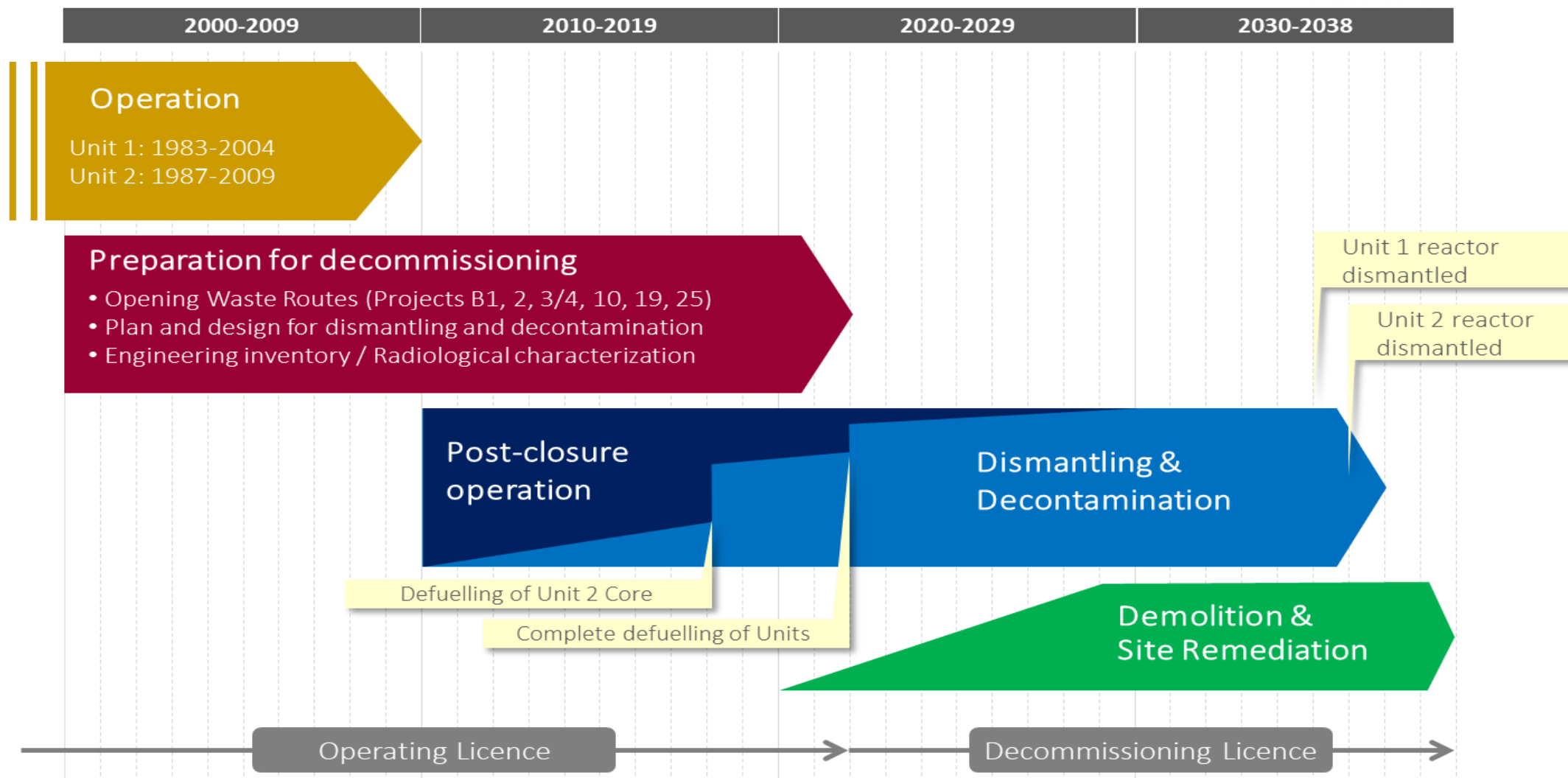
Schedule and cost: Completion by end **2038**
Cost approx. **3.4 billion euro** (with 3% inflation and risks)










Staffing: A key factor in immediate dismantling that is being implemented using **INPP’s own resources**. INPP by far the main employer in the region



INPP decommissioning: background information



INPP decommissioning: background information

Stored Operational Waste (legacy)	Solid Waste A B C	27,000 m ³	 
	Bituminized Waste B	14,000 m ³	
	Cemented Waste C	4,000 m ³	
Decommissioning Waste from Technological equipment D&D	Technological equipment (Steel) 0 A B C D E	176,282 t	
Decommissioning Waste from Reactor D&D	Steel 0 A B C D E	10,580 t.	 
	Graphite D E	3,800 t.	
	Fillers 0 A D	13,150 t.	
Decommissioning Waste from Buildings demolishing	Construction 0 A B	1 919,419 t	
Spent nuclear fuel	Fuel Assemblies	21,571 item	 

Waste classification

0 Free Release Waste

Short-lived Low Level and Intermediate Level Waste:

A Very Low Level Waste (<0,5 mSv/h)

B Low Level Waste (0,5-2 mSv/h)

C Intermediate Level Waste (>2 mSv/h)

Long-lived Low Level and Intermediate Level Waste:

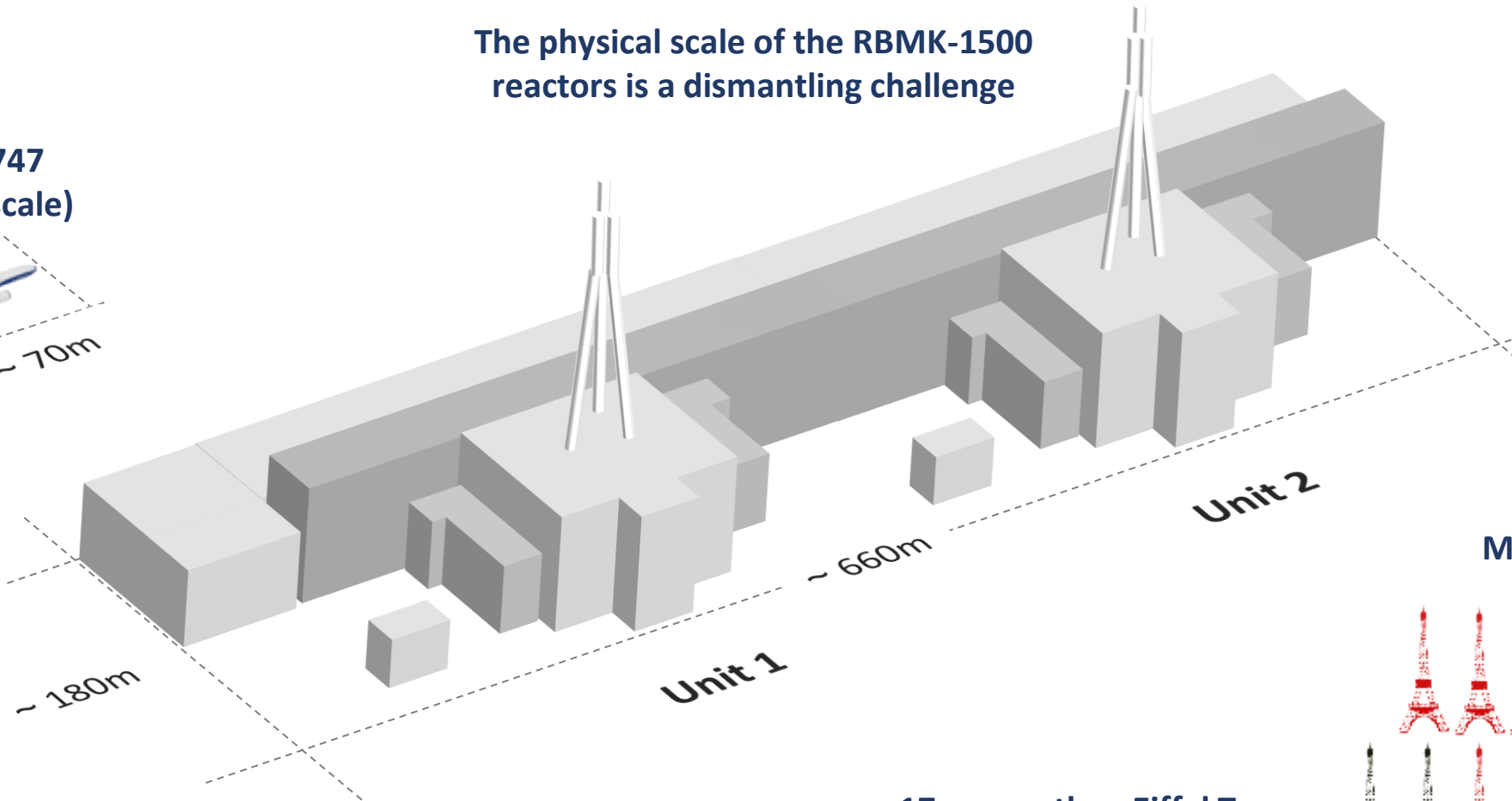
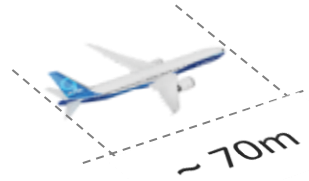
D Low Level Waste (<10 mSv/h)

E Intermediate Level Waste (>10 mSv/h)

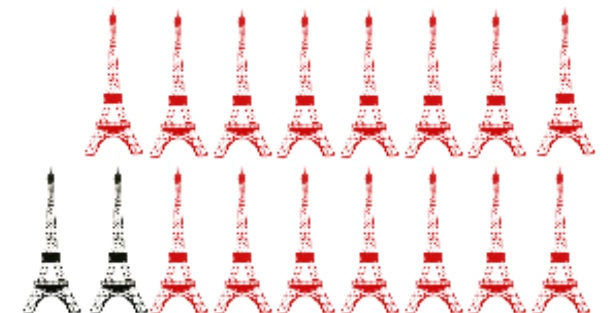
INPP decommissioning: background information

The physical scale of the RBMK-1500 reactors is a dismantling challenge

Boeing 747
(to same scale)



Metal to dismantle



17× more than Eiffel Tower
(of which 15 contaminated)

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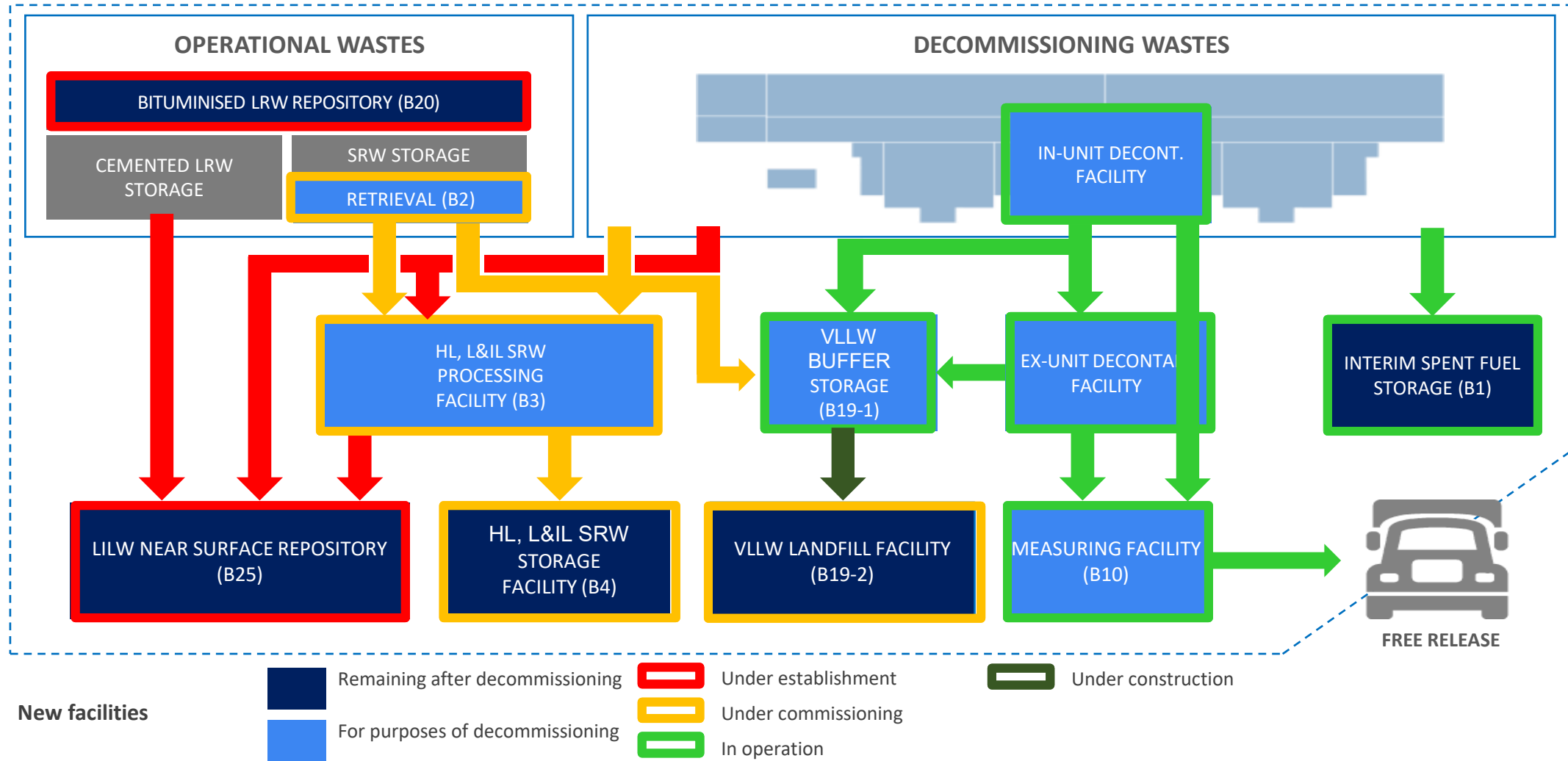
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INPP New Waste Treatment Facilities and radioactive waste streams



INPP New Waste Treatment Facilities and radioactive waste streams

Progress in defueling

- **189 casks** loaded and finally put to the B1 Storage Hall in line with the schedule including **22 casks with damaged SF**
- The last **190th cask** was loaded by the last damaged SFs and fuel debris cartridge **on 16 March 2022**
 - ✓ Dispatch of the last cask to B1 ISFSF – **21 April 2022**
 - ✓ Will be welded after final confirmation of fuel fragments absence in the Units 1&2 pools
- **Unused Nuclear Fuel Assemblies** had been inspected by IAEA / Euratom inspectors in May/June 2022 – packages have been sealed and are stored temporarily in 165 bld.



INPP New Waste Treatment Facilities and radioactive waste streams

Progress in Fuel Debris Recovery Project

- Cleaning of pools 234, 235, 236/1, 236/2 and 157 canyon in Reactor Hall have all been completed.
- Contractor (H&B) commenced video survey Unit 1 on **20-24 May 2022 and 24 June 2022**
- Sludge Removal Equipment transportation from Unit 1 to Unit 2 until **1 July 2022**
- Remaining Contractor surveys are scheduled to be completed at Unit 2 **in September 2022**



SPH Pools bottom in 2019



New Waste Treatment Facilities and radioactive waste streams

B2/3/4: contract closure :

- The Final SAR B3/4 was agreed by VATESI in **December 2021**:
- B3 and B4 Industrial Operation Permissions was issued by VATESI on **28 March 2022**
- The waste incineration campaign performed in **April-May 2022**



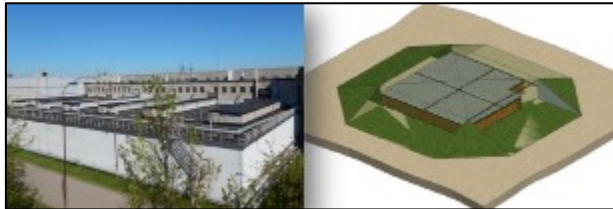
New Waste Treatment Facilities and radioactive waste streams

Landfill Facility for Short-lived Very Low-Level Waste (B19)



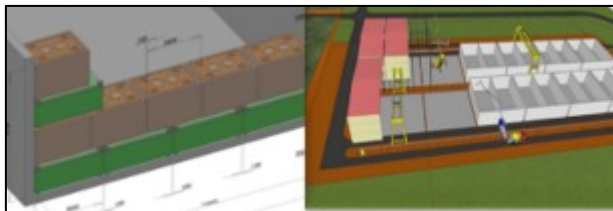
- VATESI Permission was granted for radwaste transfer to the disposal
- 1-st loading campaign is ongoing and will be completed in **November 2022**

Upgrade of Bituminized Waste Vaults, BWR.01 Project (B20)



- IAEA experts review of the Concept and Site Evaluation Report – intensive discussion of the comments by INPP/VATESI/experts in **April – June 2022**
- **As a result:** comments to be resolved before VATESI approvals of the Site Evaluation Report to proceed the next stage of EIA procedure

Near Surface Repository NSR.02 (B25)



- The tender for the Main Construction works was terminated on **3 June 2022**:
- Preparation of the next tender:
 - ✓ Market research to identify a budget, proc. documentation update, etc.
 - ✓ The new tender launch – **October 2022**

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Progress in decontamination and dismantling projects

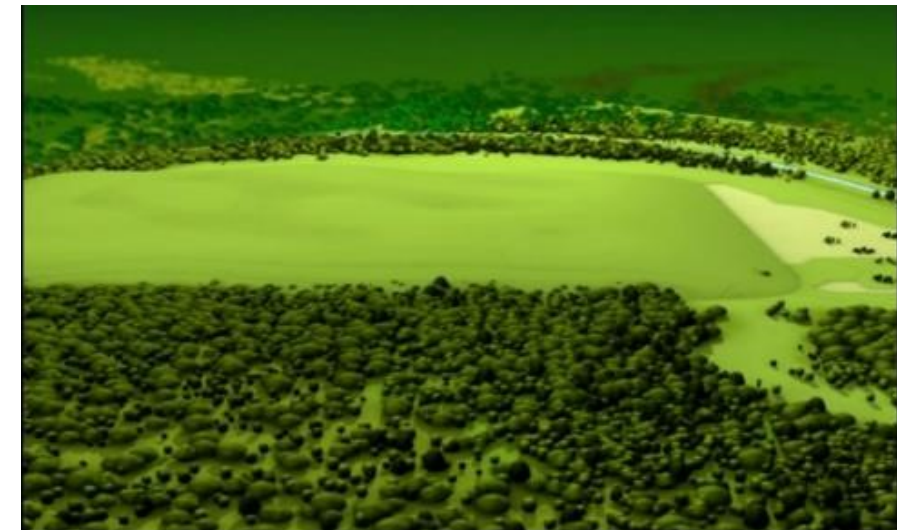
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Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Conception

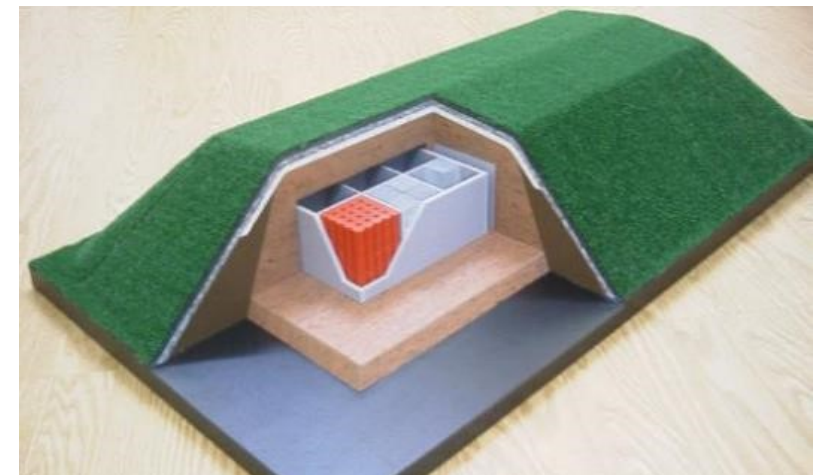
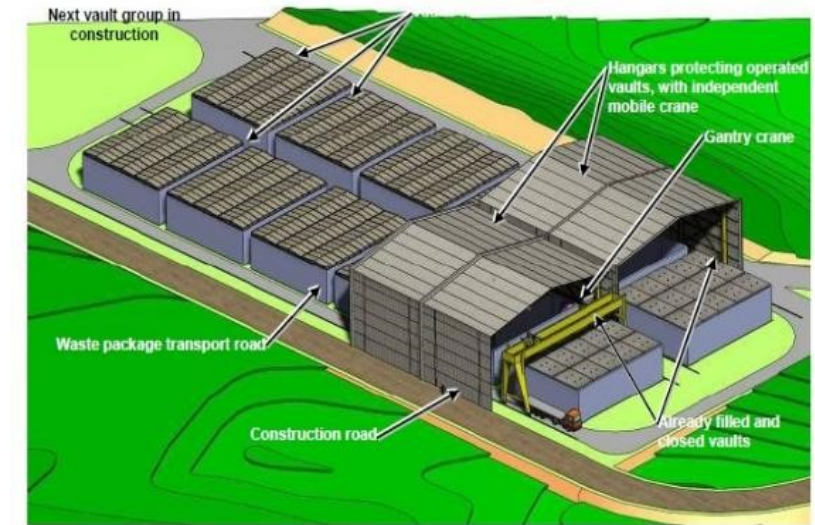
- B25 repository is a radioactive waste management facility designed for final storage of radioactive waste.
- It is planned to place **up to 100,000 m³** of radioactive waste in the B25 repository. The repository itself, its protection zones and auxiliary structures required for its operation will occupy an area of **~ 45 ha**.
- The entire infrastructure of the repository includes **more than 20 facilities** (administrative, technological and auxiliary buildings, engineering networks, communications and other facilities).
- Closed repository shall be institutionally supervised for **300 years: 100 years** - active maintenance (physical safety is ensured, necessary maintenance works, environmental condition monitoring), **200 years** - passive maintenance (use of land will be limited).
- Construction site of the repository is **within 1 km distance** from SE Ignalina NPP.



Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

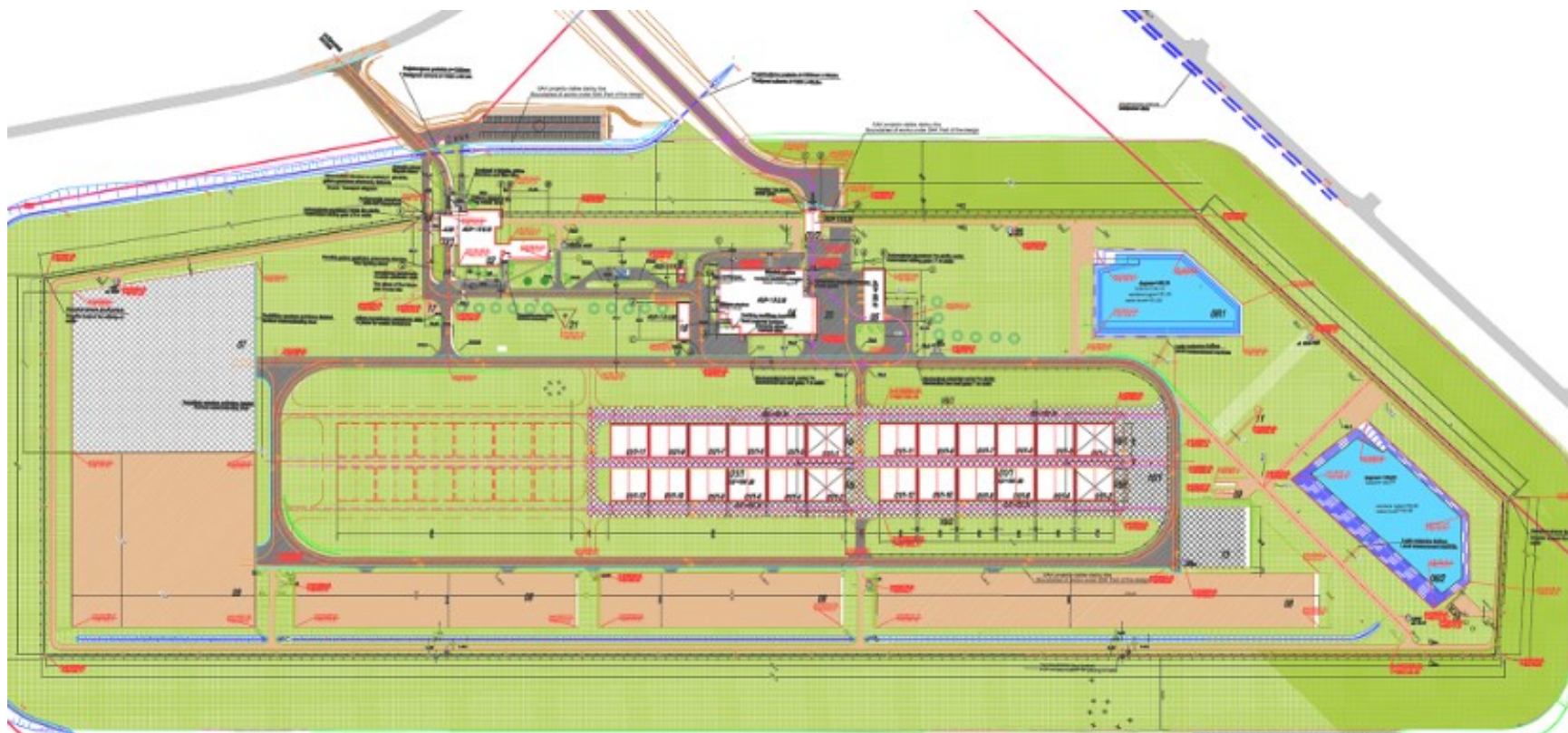
Conception and main infrastructure

- The main infrastructure of the repository is made of reinforced concrete basements in which containers with processed radioactive waste will be stored. 3 groups of basements are foreseen to be build. One group consist of **12 vaults**, each from two sections (measurements of one vault is **23,3x26,3m**).
- Mobile shelters shall be installed above the operating cellars to protect the infrastructure from atmosphere impact. Two cellars of one group covered with mobile vault shelter will be operated at the same time. On other basements temporary steel roofs will be installed.
- The vault shelter will be moved to the other basements after the operational basements are fully loaded with containers and grouted.
- In order not to maintain open basements for a long time, the filled basements of one group will be immediately closed by **installing the final engineering barrier** above them.
- The engineering barrier is designed to divert rainwater away from basements and protect structures from physical impact due to animals or other activities.



Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Main infrastructure



- Since the waste will be stored for a long time, the repository is divided into three groups of basements, as not to build all the basements at the same time, so reducing atmospheric impact to the unfilled basements.
- In the first phase of the construction (construction stages IA and IIA), the entire infrastructure of the repository and two groups of basements will be installed.

Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Conception



El Cabril repository in Spain



Center de L'Aube (CSA) repository in France



Mochovce repository in Slovakia

- B25 repository, while unique as being a part of the decommissioning program of the Ignalina Nuclear Power Plant, is not the first facility of its kind. At the moment, radioactive waste disposal sites are being built and operated in various European countries.
- The B25 technical design was prepared in consultation with the French radioactive waste management agency ANDRA, and the B25 solutions were prepared based on the concept of the already operating CSA repository.

Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Scope of general contract

The general contract covers detail design preparation and construction of I/A and II/A stages:

- Earthworks in the preparation of the entire repository site (including preparation of separate TDD and connection of the External Rainwater Drainage Networks to the INPP Infrastructure);
- Construction of repository infrastructure (fences, engineering networks, internal roads, telecommunications, rainwater ponds, auxiliary sites, access roads, drainage system of the site);
- Construction of administrative, technological and other auxiliary buildings;
- Construction of group I and II basements (2 x 12 units), installing temporary roofs over each basement;
- Construction of a temporary drainage system and access roads to basements;
- Construction of monitoring boreholes;
- Installation of temporary shelters above the first two basements of the I-st group, as well as installation of gantry cranes.



Stages I/B, II/B - installation of r/c slabs for basements and stages I/C, II/C - final covering of basements (engineering barrier system) shall be purchased separately

Construction of the NSR for Low- and Intermediate-Level Short-Lived RW

Procurement procedure and contracting milestones

- **2022-10-03** procurement announcement
 - **2022-11-30** Submission of offers
 - **2023-03-30** Determination of the winner on
 - **2023-05-15** mandatory inspection of procurement procedure documents and potential contractor (CPMA and National Security Commission)
 - **2023-05-30** signing of the general contract
 - **2023-06-15** start of works
-
- ✓ Planned procurement budget - **not published**, a single price (lump sum) contract will be signed, with a flexible indexing mechanism
 - ✓ The preliminary duration of the contract is **1 650 days**
 - ✓ The repository is a nuclear energy facility; accordingly the general Contractor and Subcontractors are subject to BEOS certification requirements (legal recognition requirements for foreign suppliers).

Construction of external technological road, installation of external power supply and telecommunications engineering networks, modular boiler station construction, installation of r/c slabs for basements, final covering of basements (engineering barrier system), 3th vault group construction will be purchased separately.

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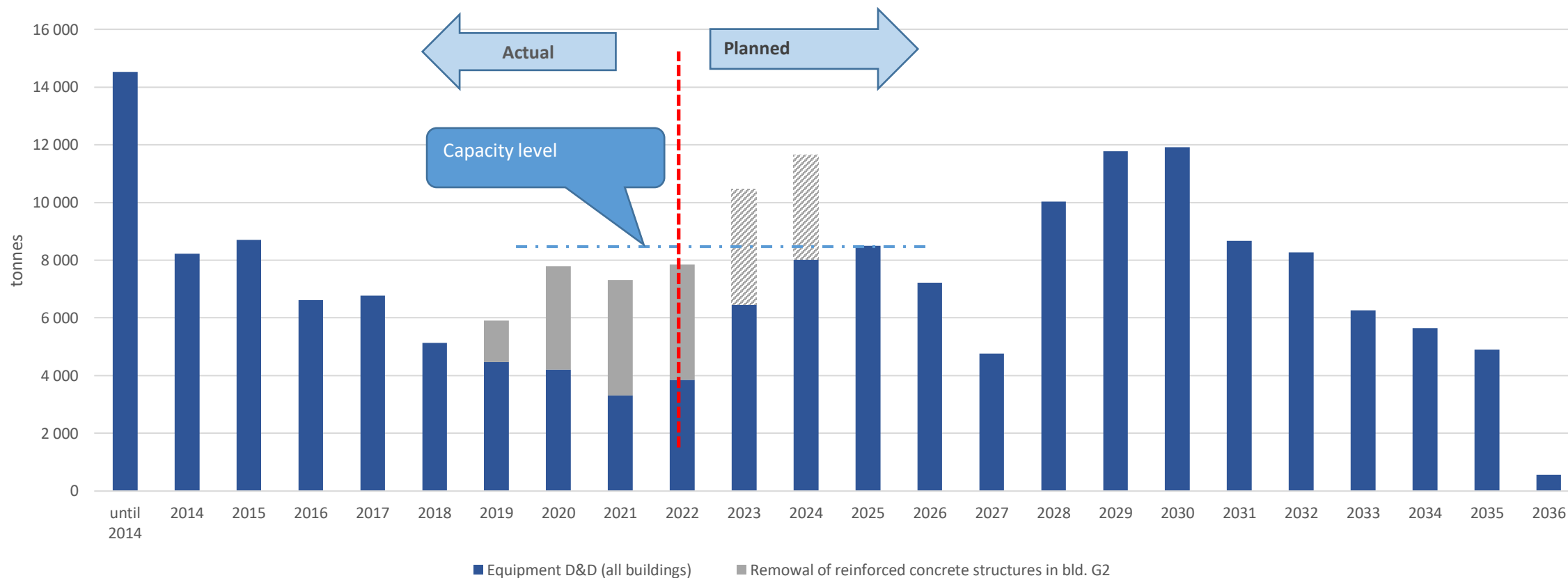
Scale of INPP dismantling and overview of applied technologies

Progress in decontamination and dismantling projects

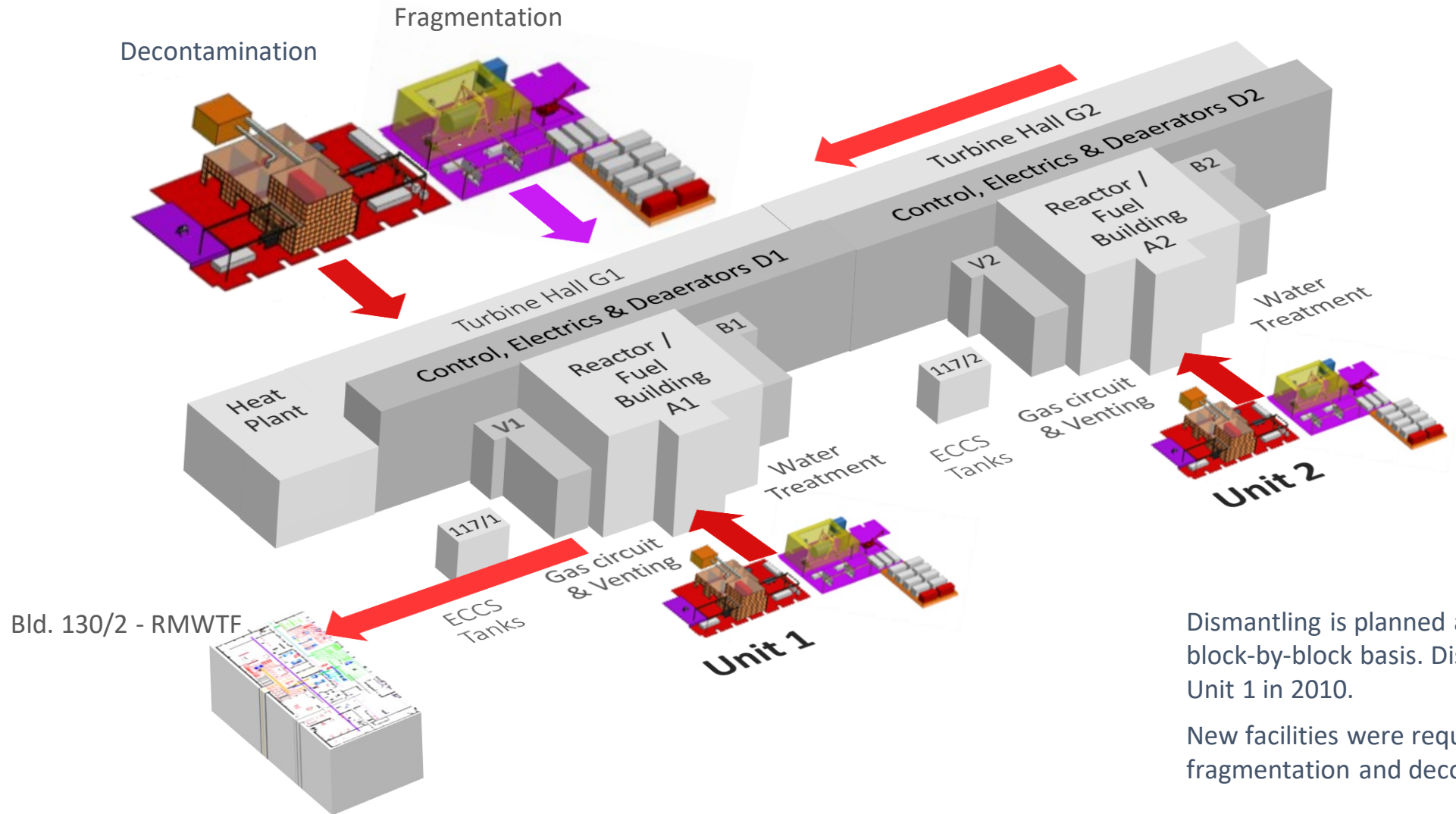
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Scale of INPP dismantling and overview of applied technologies



INPP New Waste Treatment Facilities and radioactive waste streams



Dismantling is planned and executed on a block-by-block basis. Dismantling started in Unit 1 in 2010.

New facilities were required for fragmentation and decontamination

Scale of INPP dismantling and overview of applied technologies

Cutting methods:

- Hot cutting – plasma cutting, acetylene oxygen cutting.
- Cold cutting – band saws, electric hand saws, electric and hydraulic shears, etc.



Decontamination methods:

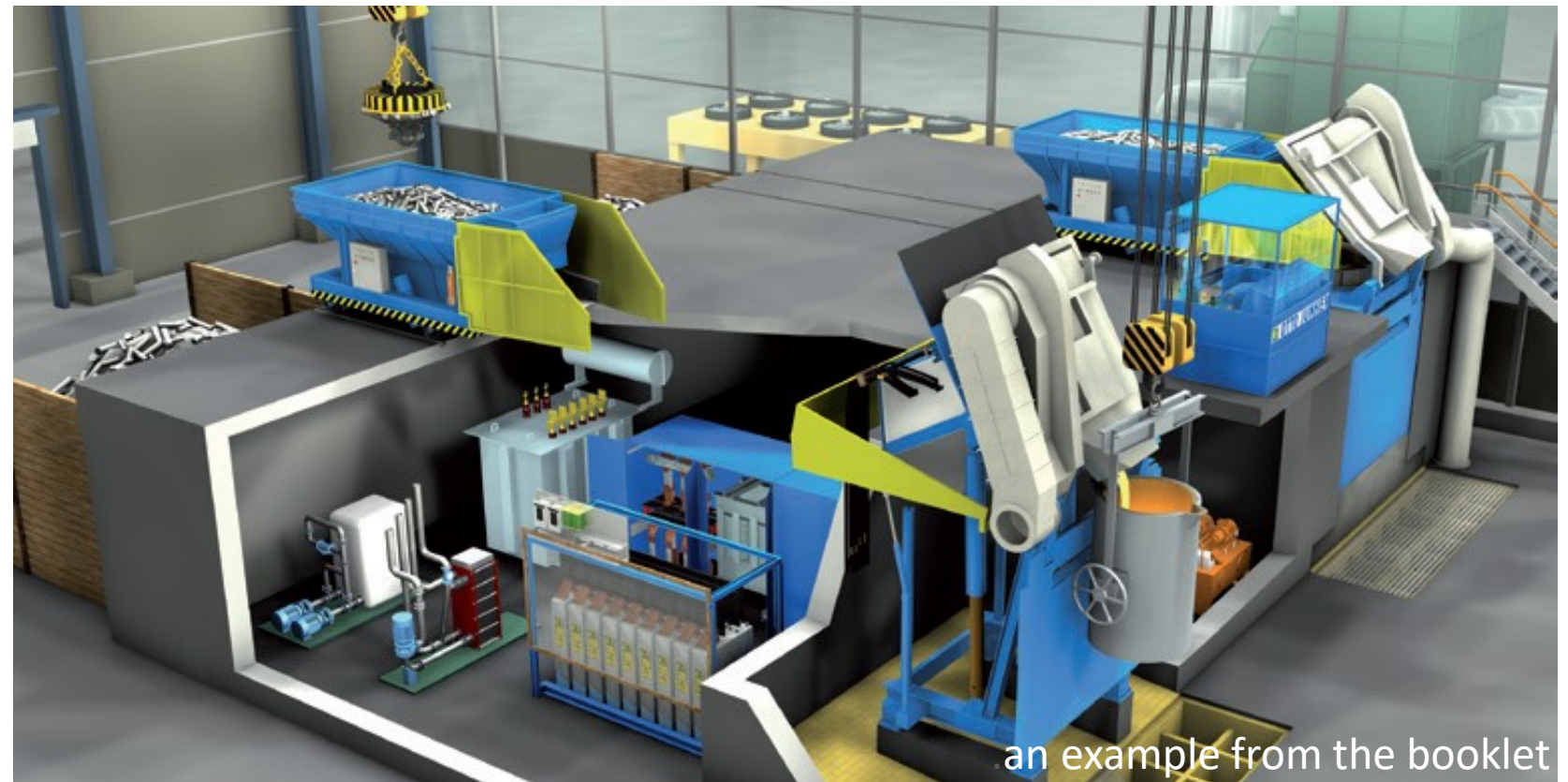
- physical (mechanical) techniques such as blasting, jetting, wiping, brushing, etc
- ultrasonic techniques
- chemical techniques

Scale of INPP dismantling and overview of applied technologies

Radioactive Metal Waste Melting Facility (under consideration - the cost benefit analysis is required)

Expected technical data:

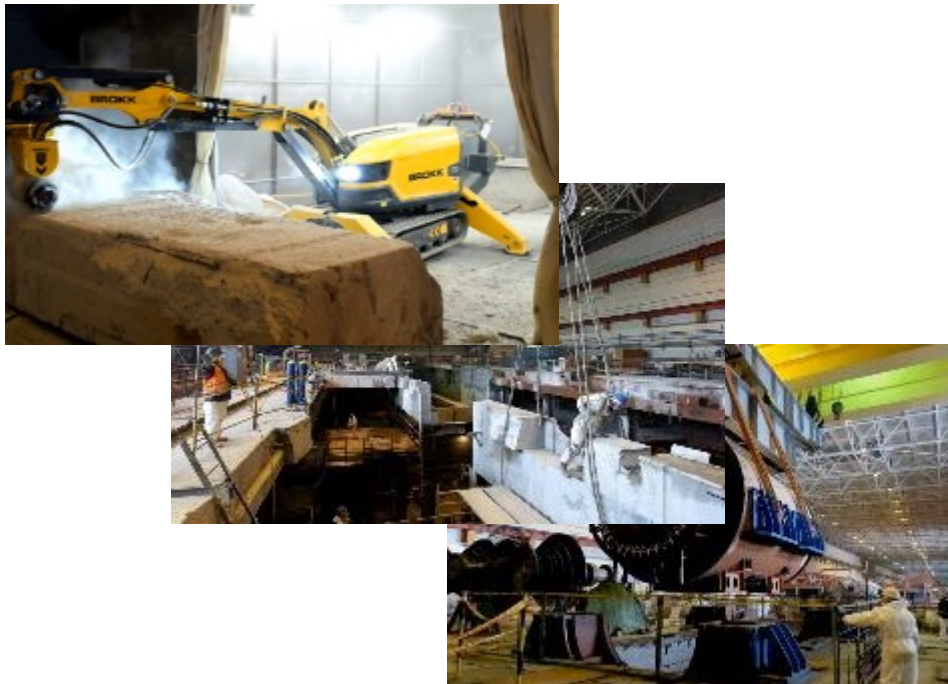
- Melting of VLL/LL metal waste - copper, stainless/carbon steel, etc.
- Two medium-frequency induction furnaces.
- Capacity is 1 ton per furnace.
- Electric power is around 800 kW.



Scale of INPP dismantling and overview of applied technologies

Video:

- Unit G1, G2 D&D (Turbine hall)
- Dismantling of reinforced concrete
- Decontamination of reinforced concrete
- Metal waste moving and cutting
- Through-type shot blasting facility with roller conveyer



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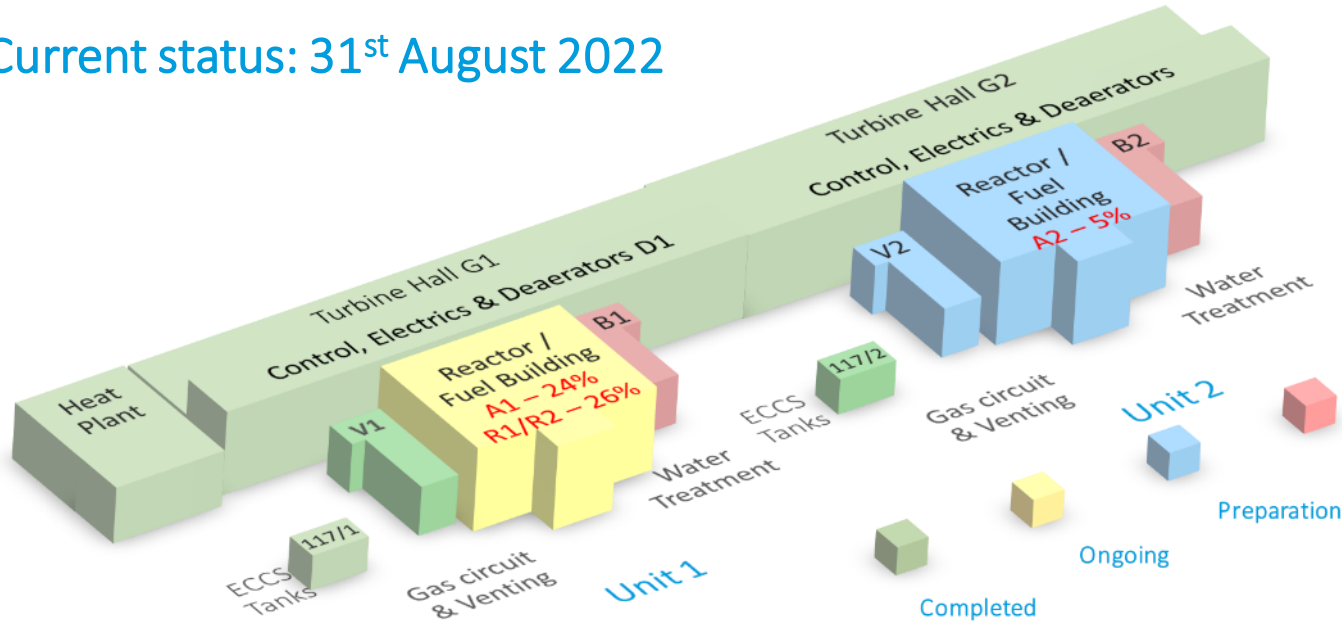
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Progress in decontamination and dismantling projects

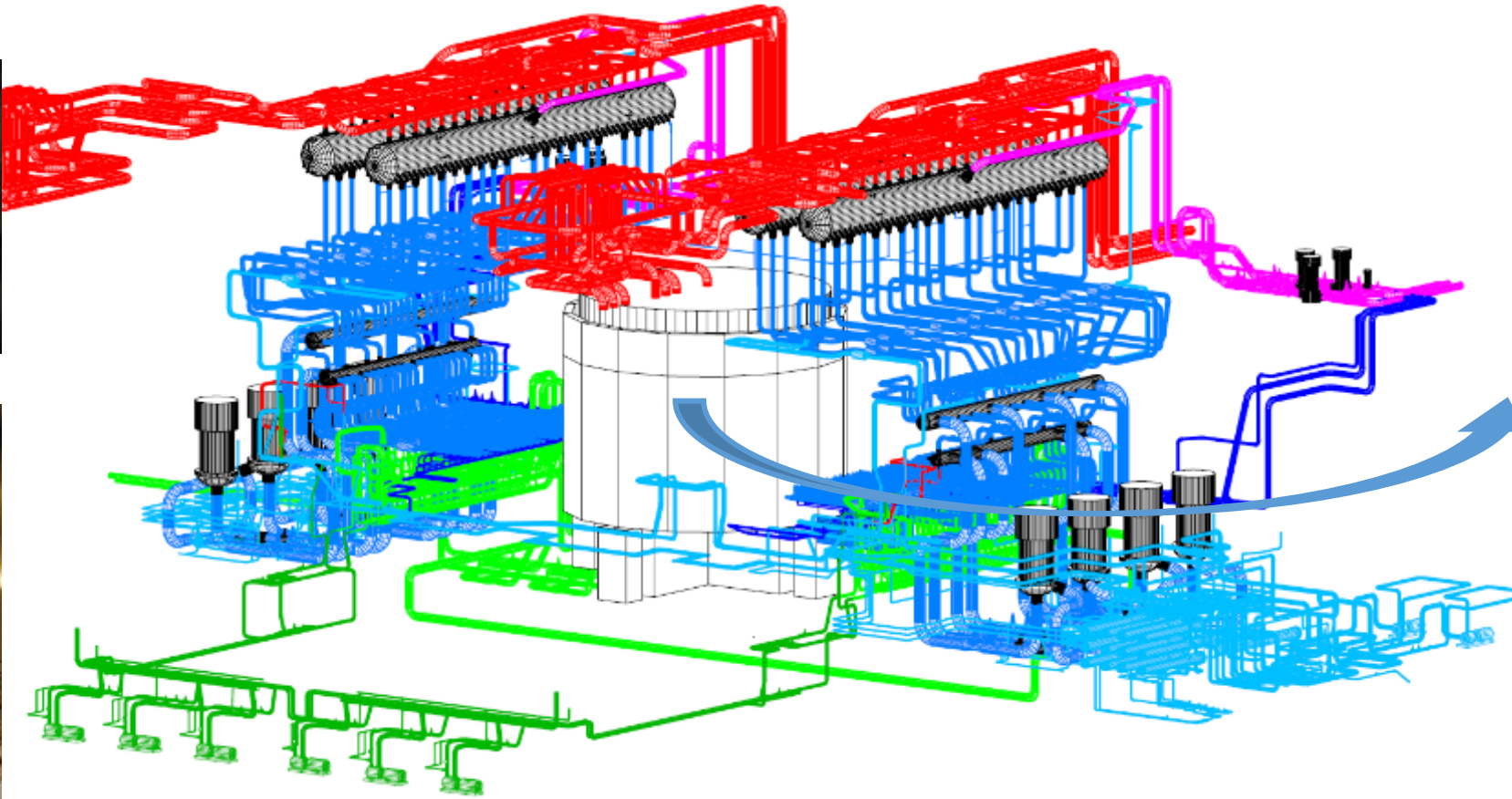
Current status: 31st August 2022



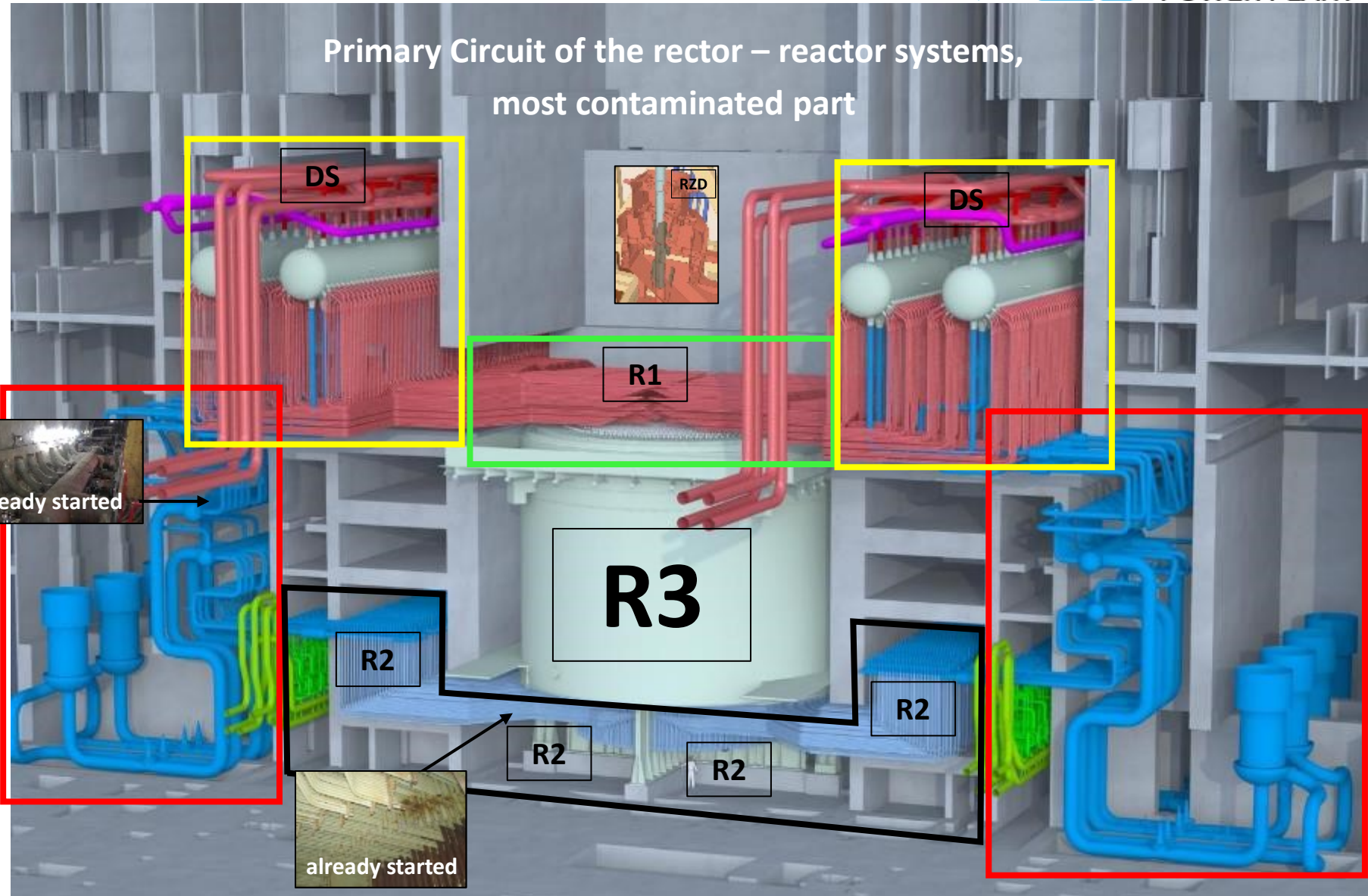
	x 1000 tons	2010-2021	2022	2022	2010-2038
		(in all)	(plan)	(fact)	(in all)
Dismantled:	Equipment	62,4	3,8	1,8	176,3
	Concrete	9,2	4,8	2,7	1 919,4
Waste free-released:	Equipment	50,6	4,4	1,4	124,4
	Concrete	8,3	3,6	2,7	1 754,5

Progress in decontamination and dismantling projects

Reactor building D&D projects: Units A1, A2/V2, R1/R2 and R3 (reactor core) zones



Progress in decontamination and dismantling projects



- R3** Reactor shaft:
 - Unit 1: 2028 – 2034
 - Unit 2: 2029 – 2035
- DS** Drum-separators:
 - Unit 1: 2023 – 2027
 - Unit 2: 2025 – 2029
- PC** Main Pumps, headers, pipework:
 - Unit 1: 2021 – 2027
 - Unit 2: 2022 – 2029
- R1** R1 zone + Reactors Channels:
 - Unit 1: 2021 – 2025
 - Unit 2: 2023 – 2028
- R2** R2 zone:
 - Unit 1: 2021 – 2025
 - Unit 2: 2023 – 2028

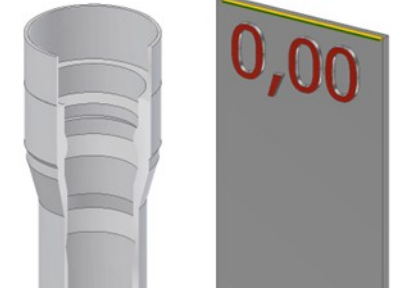
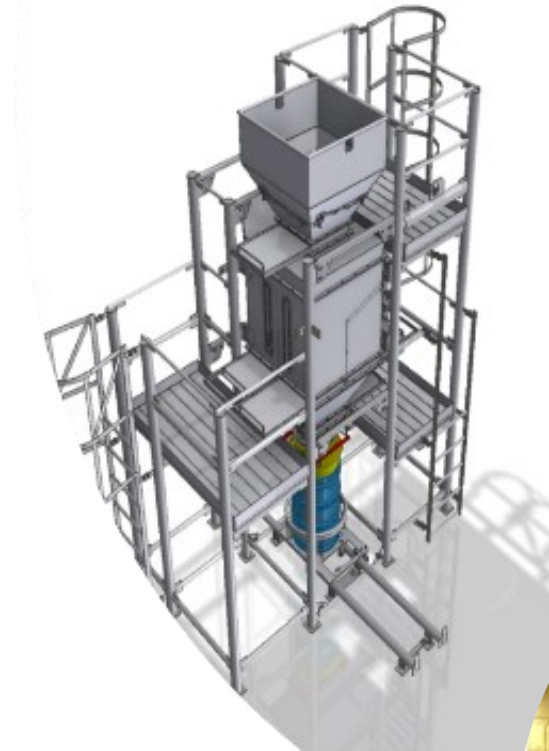
Progress in decontamination and dismantling projects

Unit 1 R1 and R2 zones (2101 project):

- D&D TD and SAR were approved by VATESI in July 2021
- “Cold” tests for Equipment for RC graphite rings and sleeves treatment (bunker-batcher) were carried out in November 2021, “Hot” trial was started in August and will be completed up to end of **September of 2022**
- D&D works in zone R2 started in **September 2021**. Up to date dismantled 129 t of zone R2 equipment (mainly B class waste)
- D&D works in zone R1 started in **February 2022**
- [Technological channel \(video\)](#)

Unit 2 R1 and R2 zones (2102 project):

- D&D TD and SAR are under preparation
- Environmental Impact Assessment procedure in frame of ESPOO is ongoing
 - all responses on questions of Latvia and Belarus was sent in August 2021. Latvia has no objection, discussion of issues with Belarus continues.



Progress in decontamination and dismantling projects

Unit A1 D&D (2203 project):

- D&D TD and SAR were approved by VATESI and TSO experts in **May 2021**
- A set of D&D Working Procedures is under VATESI approval
- D&D of Unit A equipment was started in **June 2021**.
- Tender for **procurement** of dismantling of Drum Separators and associated equipment is ongoing



Units A2 and V2 D&D (2210 project):

- D&D TD and SAR are under preparation
- The transboundary EIAR procedures of the planned economic activity, a public discussion and bilateral consultations between Lithuania and Latvia was completed and EIAR was approved in April 2021.
- Pre-treatment Workshop (project APW.02) – preparation is ongoing

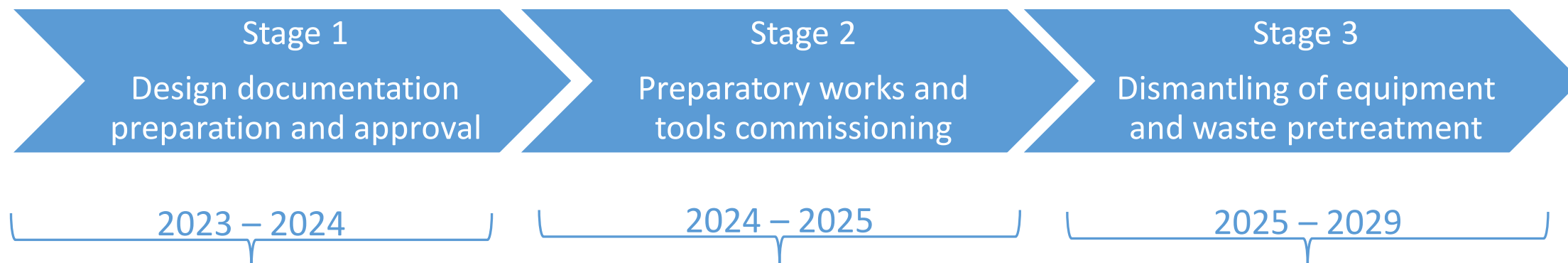
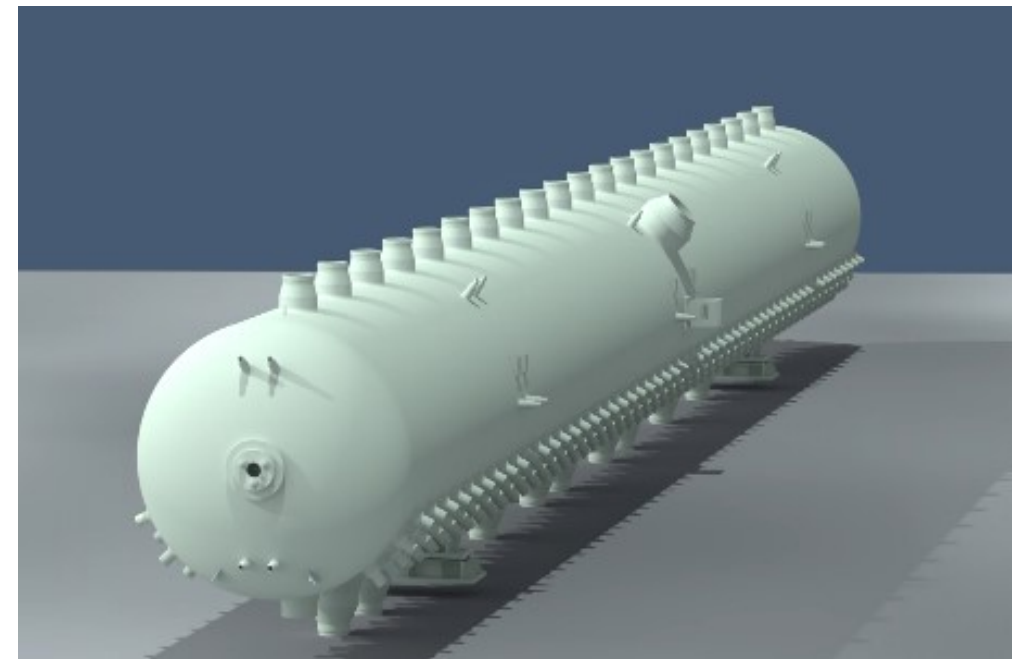


Progress in decontamination and dismantling projects

SE Ignalina NPP intends to procure services for D&D of Steam Drum-Separators and primary piping at block A.

The contract duration will be about **6-8 years** (depends on dismantling and waste treatment technologies)

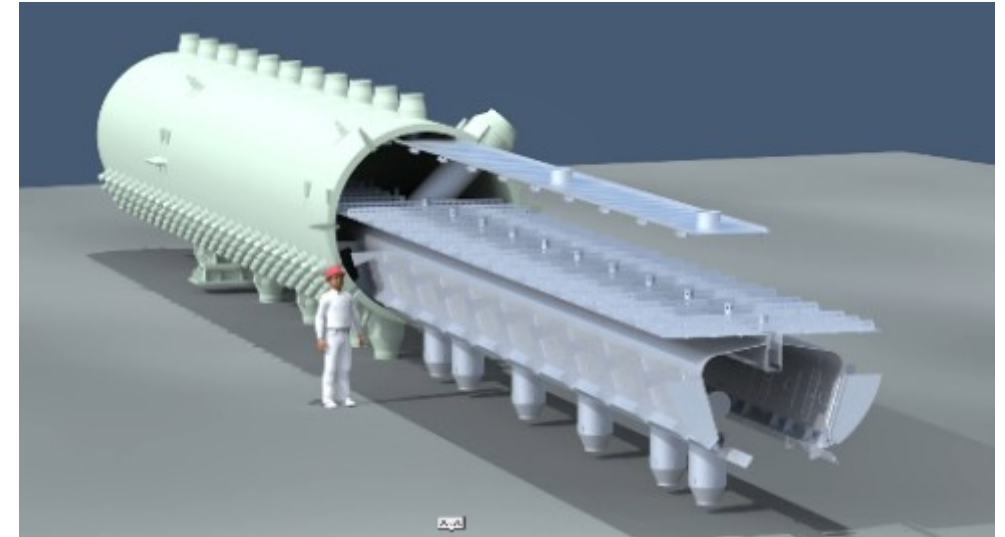
- Pre-Qualification was completed **in June 2022**
- Tender documentation is under preparation (TS and FIDIC Yellow Book Contract)
- 1st Stage Tender launch foreseen for **September 2022**
- Following clarifications and Tender documents revision, 2nd Stage Tender is foreseen **Q4/2022**
- Contract Award **Q1/2023** with contract completion expected **2029**



Progress in decontamination and dismantling projects

Scope of Supply:

- Development of new/modification of existing D&D Technological Project and SAR
- Approval of new/modified D&D Technological Project and SAR by INPP
- Approval by regulatory agencies and stakeholders
- Engineering completion and drawing/document approvals
- Procurement, manufacturing, and testing of the equipment
- Site work – installation
- D&D of DS and associated systems :
 - ✓ dismantling of equipment
 - ✓ fragmentation up to required dimensions
 - ✓ waste transportation to Waste Pre-treatment Workshop in Block A1
- Closing works (deinstallation of equipment used for D&D, rooms decontamination and cleaning)



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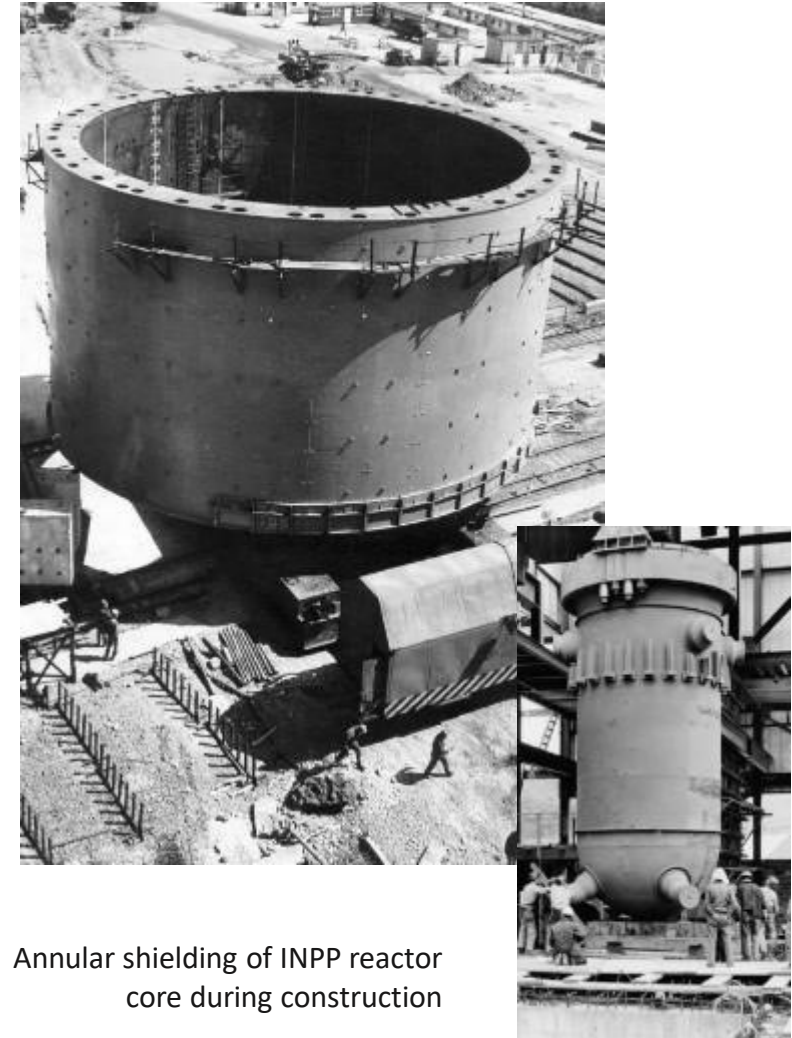


New project: Reactor dismantling and graphite storage

R3 reactor core dismantling is the key project for INPP decommissioning critical path

Challenges: Reactor dismantling for an RBMK is completely unlike corresponding activity for a pressurised water reactor (PWR/VVER):

VVER-440	RBMK-1500
Reactor vessel is factory-built structure. Can be manipulated as a single component.	All structures fabricated on site and internal components (graphite) assembled <i>in situ</i> .
Dimensions Ø 3.84 x 11,8 m	Dimensions Ø 21 x 25 m
Mass 215 tons (steel)	Mass 10 913 tons (various materials)

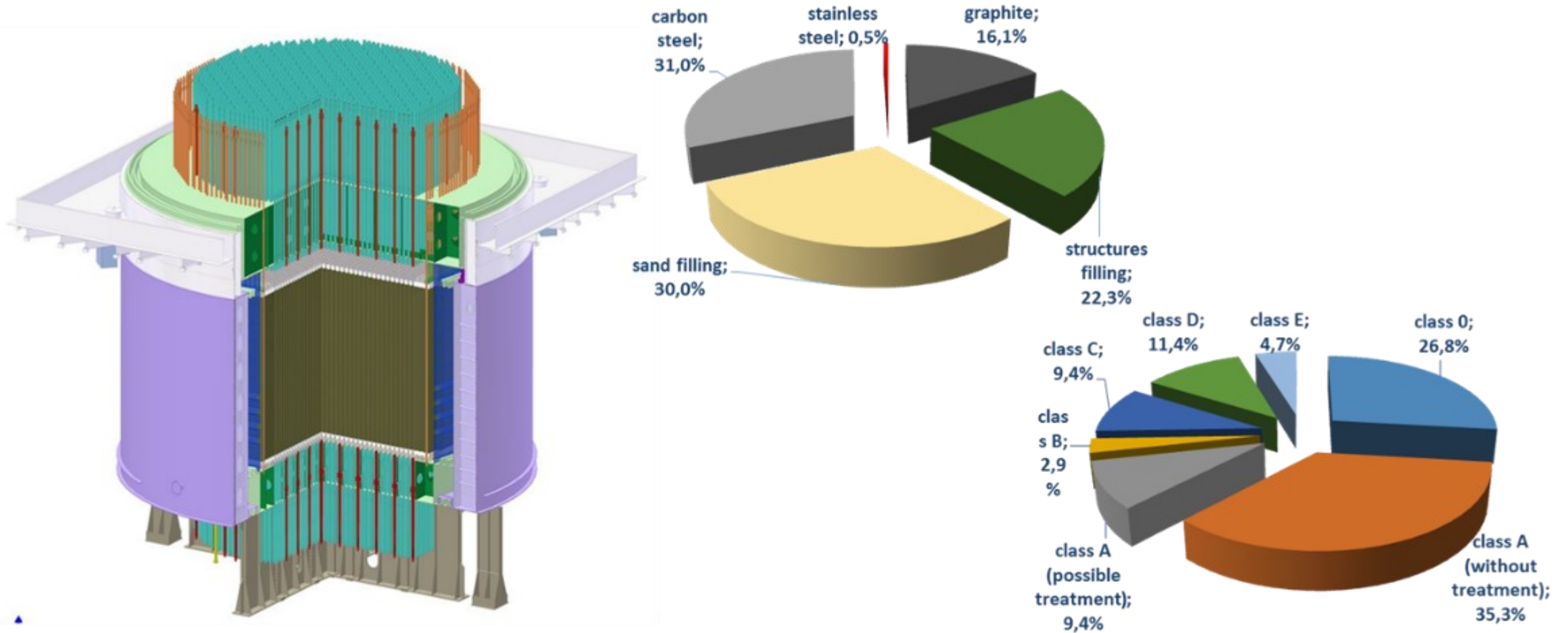


Annular shielding of INPP reactor core during construction

In excess of 250.000t of irradiated graphite world-wide - 3.400 t at Ignalina NPP

New project: Reactor dismantling and graphite storage

Reactor core material and radiological inventory - 10 913 t for each Unit

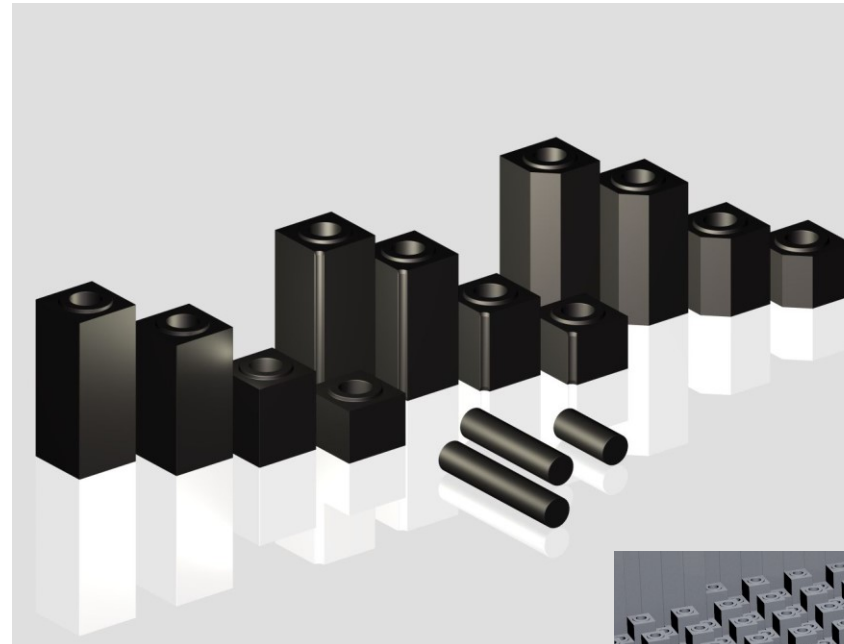


New project: Reactor dismantling and graphite storage

I-graphite treatment challenges

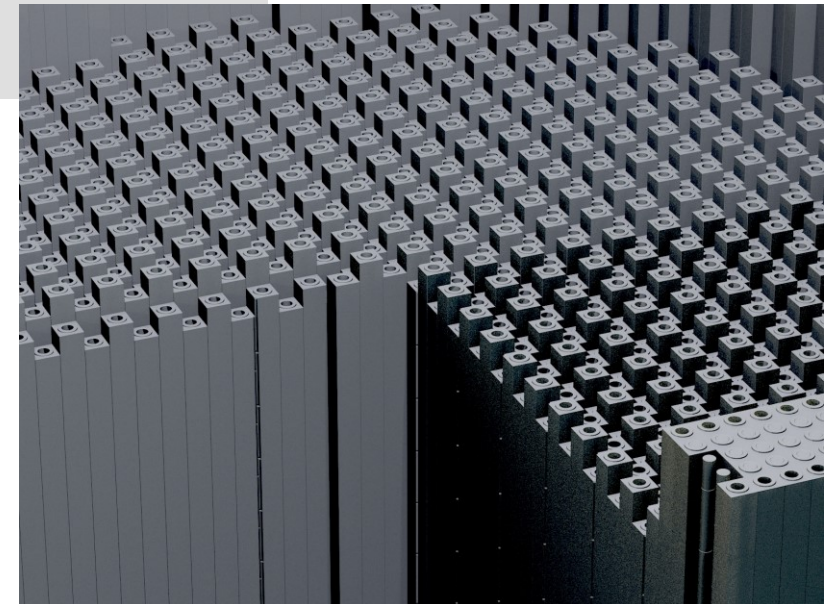
I-graphite inventory:

- 1 760 t per Unit
- 2 488 graphite collums
- N – more than 30 000 items



I-graphite inventory

- Insufficient experience
- Difficult access
- In-core irradiation, contamination in periphery
- No commercially available solution for graphite treatment



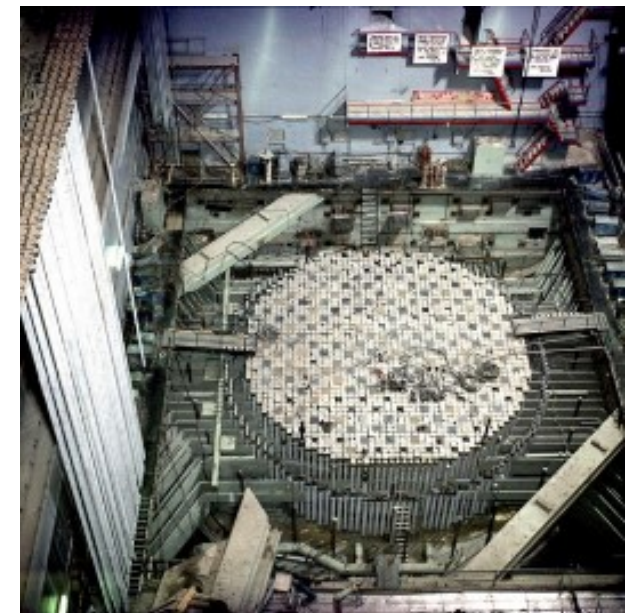
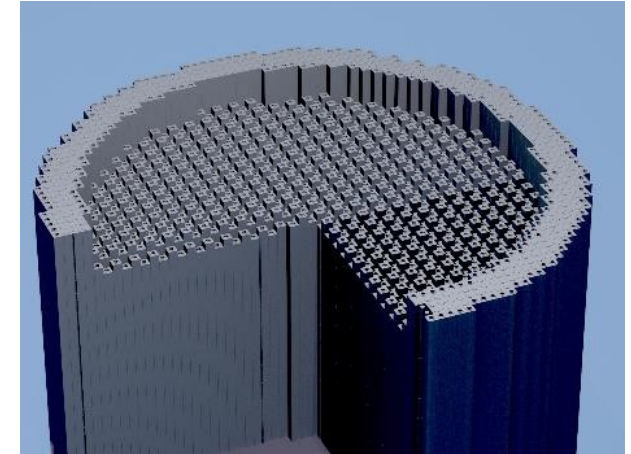
New project: Reactor dismantling and graphite storage

Zone R3 D&D (Stage 1, 2103 project):

- Amendment 01 to INPP reactor dismantling design project R3D.01 “Zone R3 D&D (Stage 1)” was approved by EC in **March 2021**
- Financing agreement St-26(13.74E) was signed in **March 2021**
- R3D tender was launched on **28 May 2021**.
- Tenderer proposals opened on **8 December 2021**
- Tender proposals evaluation completion and Contracts signing – **October 2022**

Project TSG.01:

- Project TSG.01 “INPP TSG (1)” was approved by EC in **February 2021**
- Financing agreement St-4(13.74E) was signed in **February 2021**
- TSG tender launched on **20 March 2021**
- Tenderer proposals opening - **8 July 2021**
- INPP PPC terminated TSG procurement and re-rendering was launched **in July 2022**
- Tender proposals evaluation completion and Contracts signing – **November 2022**



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INPP presentation 2022-08-13



Ignalina NPP decommissioning
activities are co-financed by
the European Union