



Ignalina NPP, Lithuania

Ignalina NPP Decommissioning Key Projects and Issues

SNETP Forum 2021, 4 February



Decommissioning of Ignalina NPP is
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Content



INPP decommissioning: background information

INPP New Waste Treatment Facilities

D&D key projects

**New project: Reactor dismantling and
graphite storage (focus on optioneering
study)**



Ignalina NPP - Design and operation



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



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Ignalina NPP - Design and operation



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)



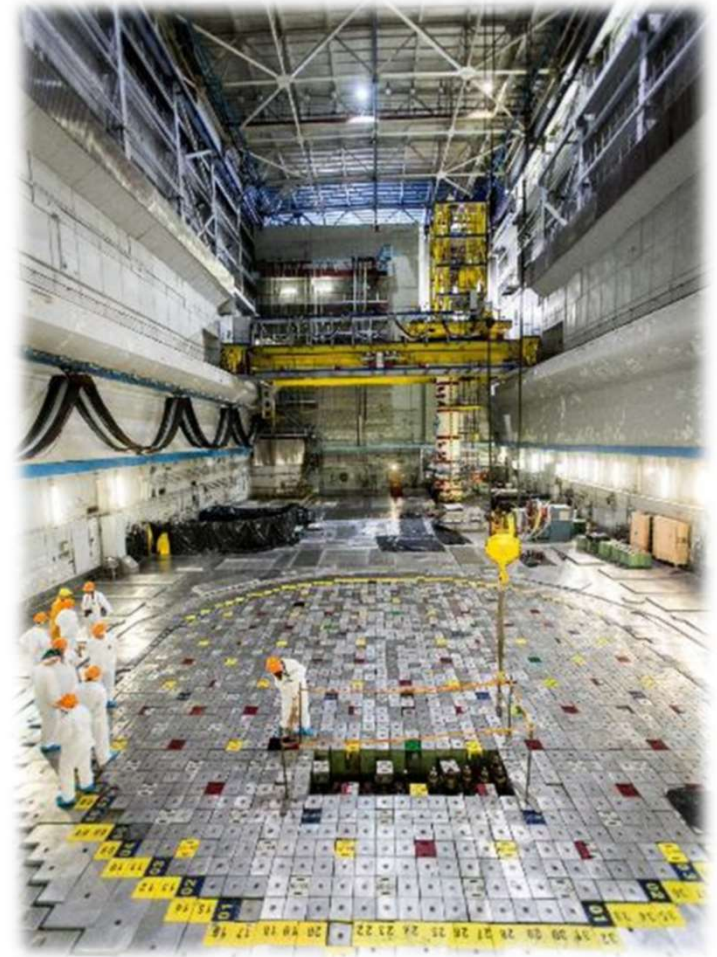
Licensing: Plant is still licensed as “**operating**” because of nuclear fuel in the units. Preparation for decommissioning license obtaining is ongoing



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



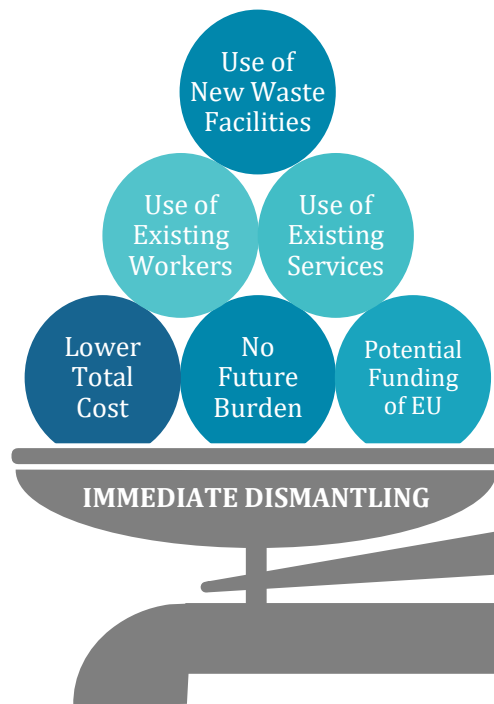
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Ignalina NPP - Strategy and plan



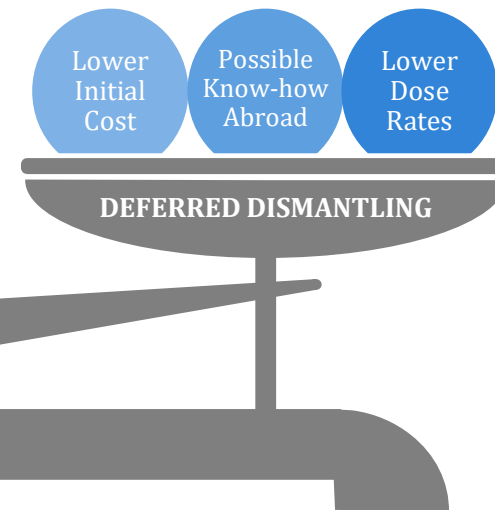
Strategy

- **Immediate Dismantling** selected by Government for technical, social and financial reasons

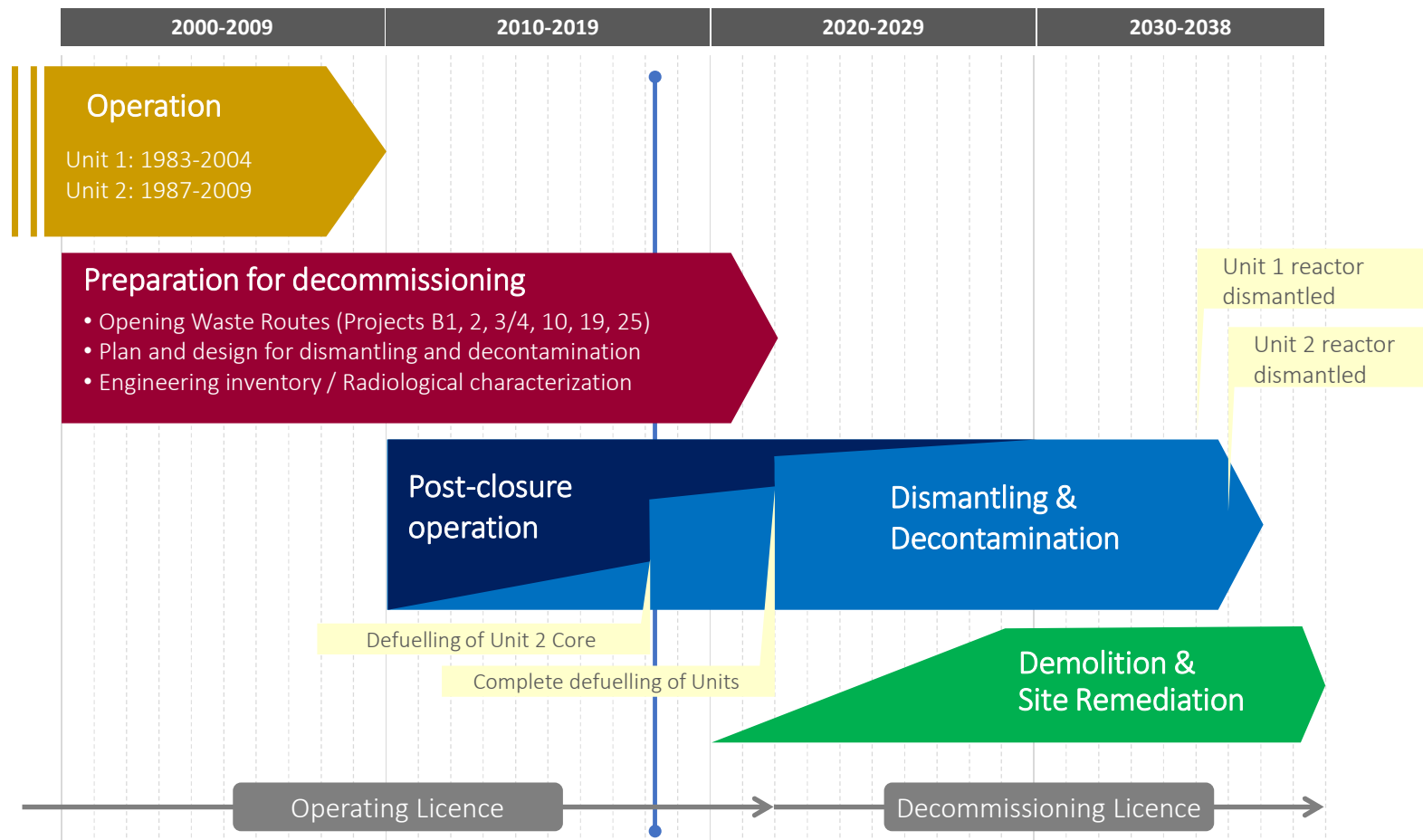


Final decommissioning plan

- **Technical measures** for dismantling, radioactive waste management and disposal with financial estimate.
- Approved 2005, revised 2014, next update plan 2019; verified and accepted by the EC










Ignalina NPP Decommissioning Plan



Ignalina NPP Decommissioning Programme



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) A B C 160,000 t		
Decommissioning Waste from Reactor D&D	Steel A C D E	12,170 t.	 
	Graphite D E	3,800 t.	
	Fillers A C	11,940 t.	
Decommissioning Waste from Buildings demolishing	Concrete 0 A B	900,000 m ³	
	Steel 0 A	200,000 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)



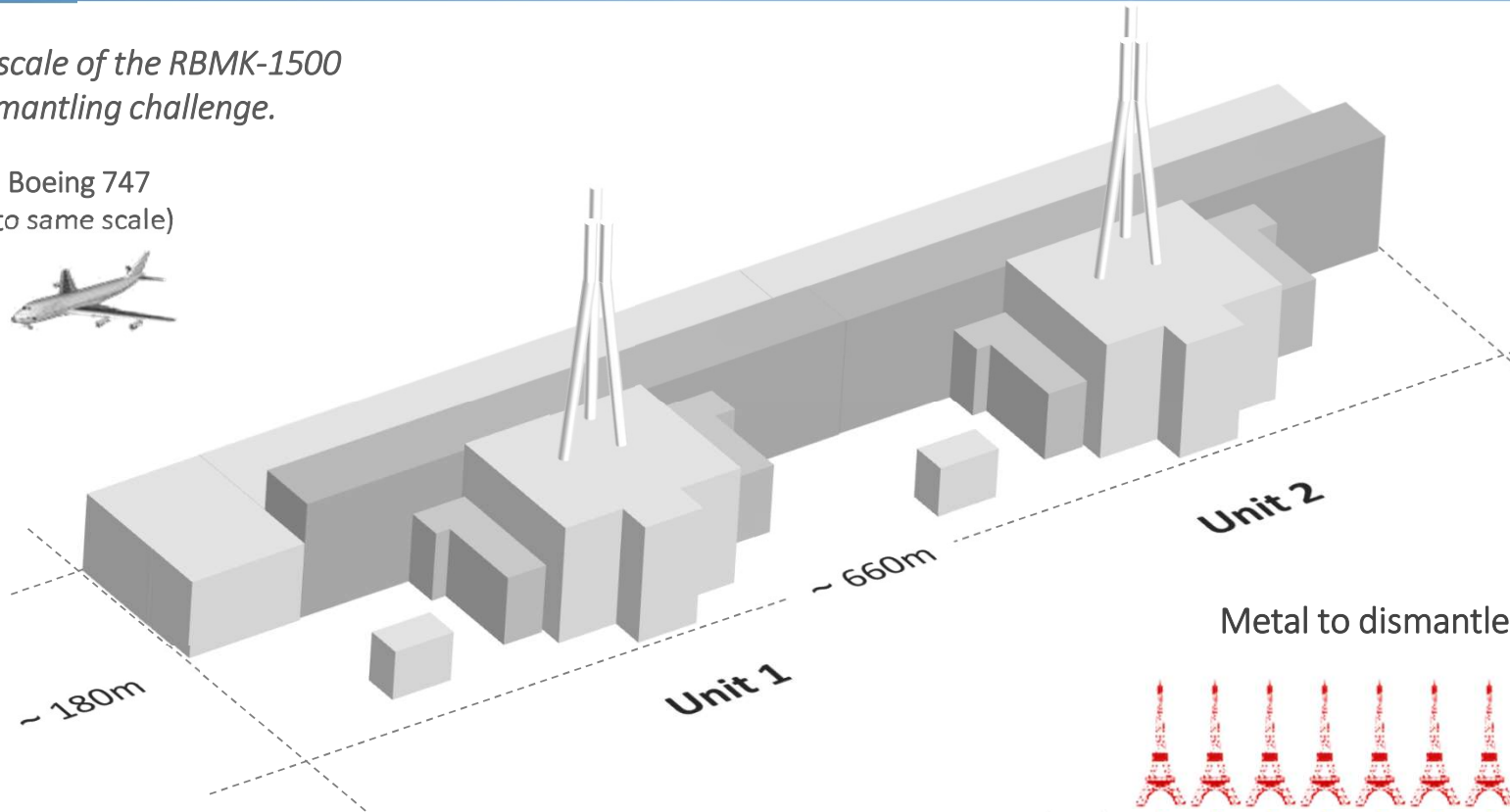
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Scale of Dismantling



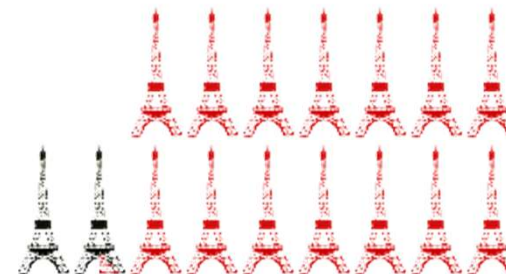
*The physical scale of the RBMK-1500
Units is a dismantling challenge.*

Boeing 747
(to same scale)



Metal to dismantle

16x more than Eiffel Tower
(of which 14½ contaminated)



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Ignalina NPP Decommissioning Programme

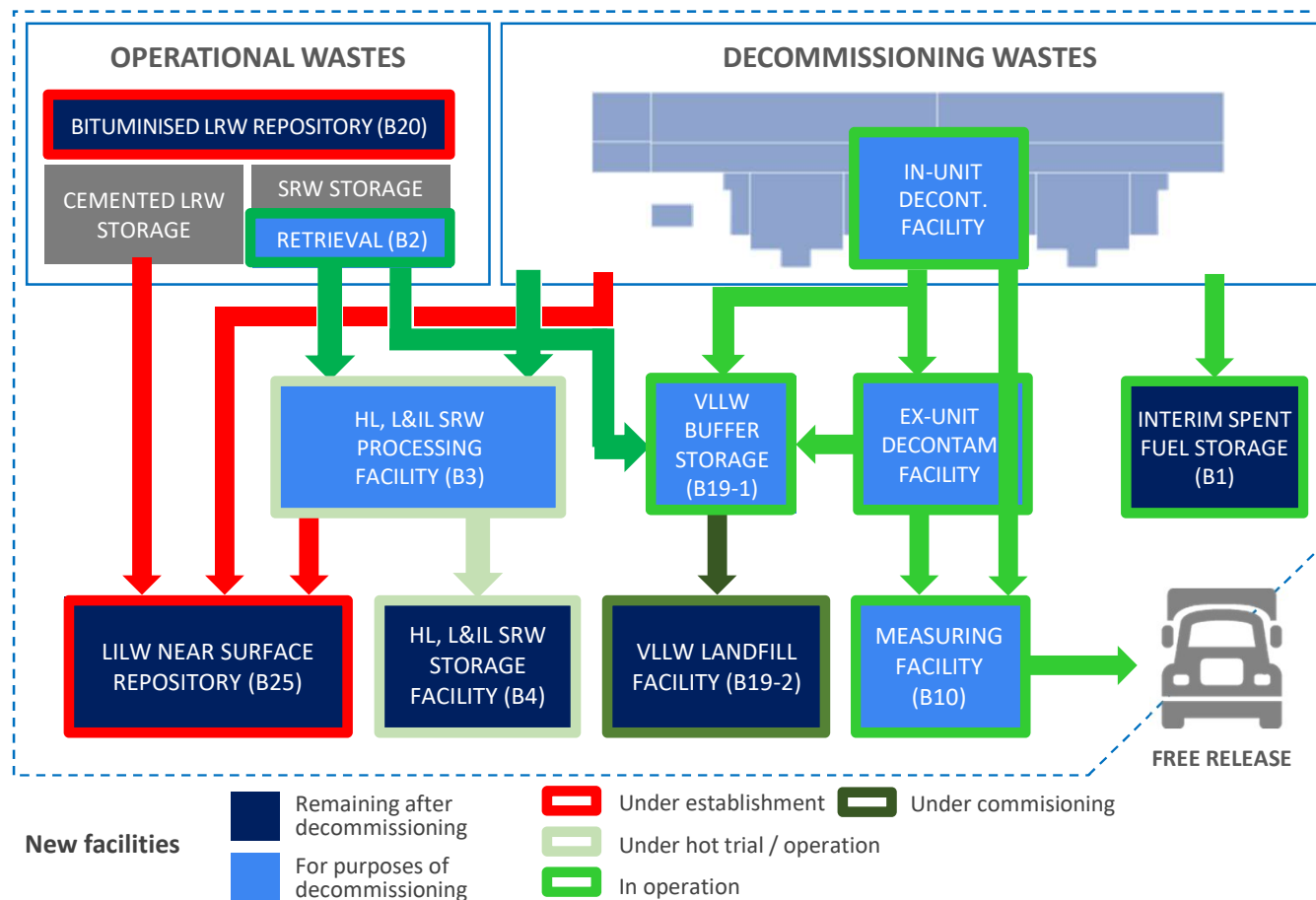


INPP New Waste Treatment Facilities



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Ignalina NPP Opening waste routes



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Ignalina NPP New Waste Facilities



All new waste interim-storage or disposal facilities to be created on, adjacent to, Ignalina NPP site (radius ≈ 1.5 km)



- Simplifies permissions
- Reduces new infrastructure
- Reduces transport
- Facilitates physical protection



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Interim Spent Fuel Storage Facility (B1)



Objectives:

- To build an Interim SF Storage Facility, to manufacture and install all related equipment
- To design and manufacture **191** new-type casks with 80% increased capacity for INPP RBMK-1500 type reactor spent fuel (incl. damaged SF)
- To develop the technologies for casks loading and transportation to ISFSF and install it

Results:

- Start of Hot Trial with 10 casks – **26 September 2016**
- Start of industrial operation – **5 May 2017**
- Reactor Unit 2 defueling – **28 February 2018**
- SPH Unit 1 defueling Intact SF – **2020**
- 169 casks loaded to date
- Damaged SF loading is proceeding at Unit 1

Next steps:

- SPH Unit 2 defueling Intact SF – **2021**
- SPH Unit 1,2 defueling completion, incl. damaged SF – **2022**



New-type
CONSTOR® RBMK1500/M2
cask

Capacity: 91 assemblies

Diameter: 2.63 m

Empty cask weight: 91 t

Loaded cask weight: 118 t



Solid Waste Management & Storage Facilities (B2/3/4)

Objectives:

- To build facility for treatment of solid operational and radioactive waste from dismantling, comprising:
 - B2 Retrieval Facility (retrieval from existing interim storages and transportation to B3)
 - B3 Processing Facility (sorting and treatment before transportation to B4)
 - B4 Storage Facilities (for long and short lived waste)

Results for B2:

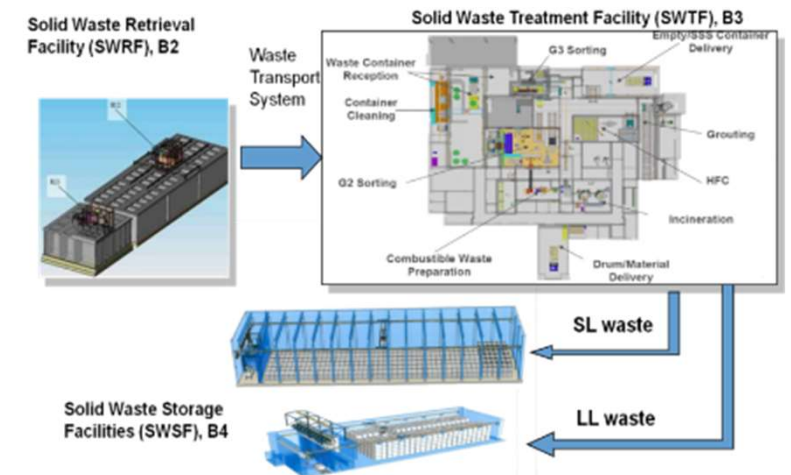
- Start of hot-trials – **9 June 2017**
- Finish of hot-trials – **October, 2018**
- Start of Industrial operation – **April 2019**

Results for B3/4:

- Operational License and start of hot-trials – **13 October 2017**

Next steps:

- License for Industrial operation of B3/4



New Very Low Level Short Lived Waste Storage Facility (B19)

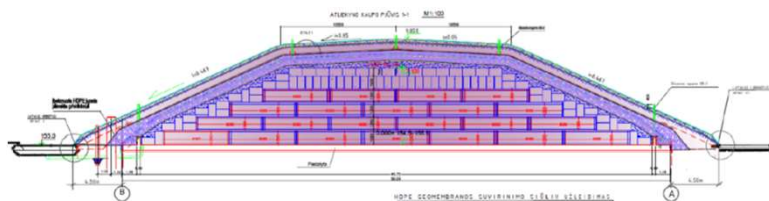


Objective:

- Construction of Landfill type disposal modules for SL VLL waste 60,000 m³ arising from:
 - Operational waste retrieved from B2
 - Units 1 and 2 dismantling

Key dates:

- Landfill Buffer storage facility in operation **since 2013**
- The contract for construction works signed on **29 June 2017**
- Construction completion – **December 2020**



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Near Surface Repository for Low and Intermediate Level Short-lived Radioactive Waste (B25)



Objectives:

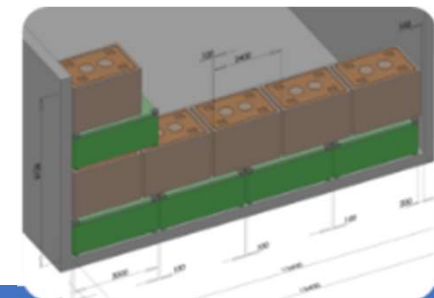
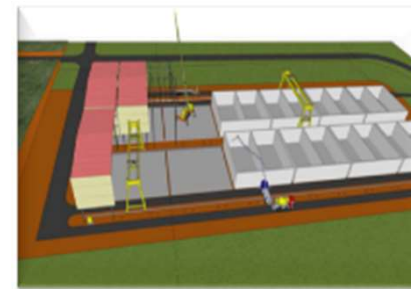
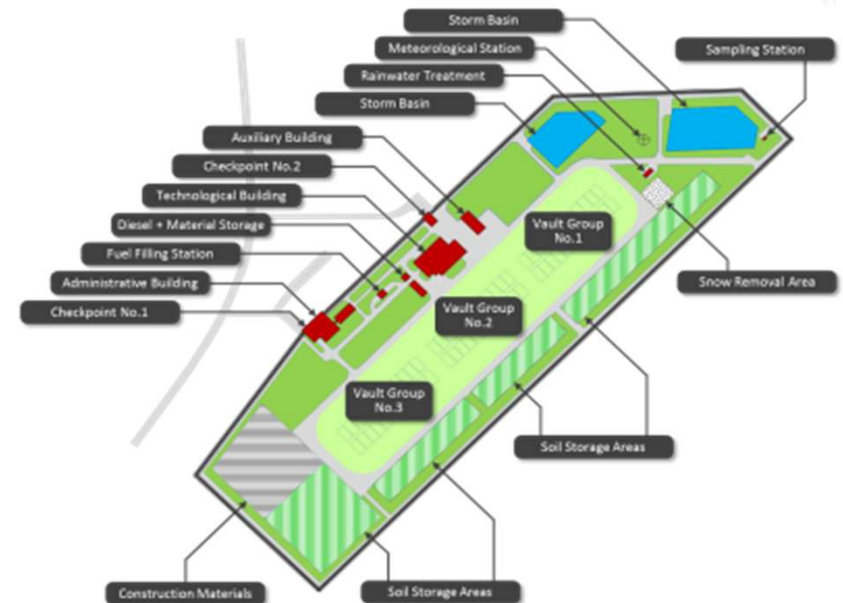
- Construction of Near Surface Repository for 100 000 m³ Low and Intermediate Level Short-lived Radioactive Waste arising from:
 - ✓ Operational solid waste retrieved from B2
 - ✓ Operational cemented liquid waste
 - ✓ Units 1 and 2 dismantling
- After its closure the surveillance of the repository will be carried out for at least 300 years

Key dates:

- Technical Design and PSAR completed and agreed with state institutions - **May 2017**
- Construction Permit - **May 2017**
- VATESI Licence for Construction and Operation - **November 2017**

Next steps:

- Tender procedures, contract to be signed in March / April 2021



D&D key projects and issues

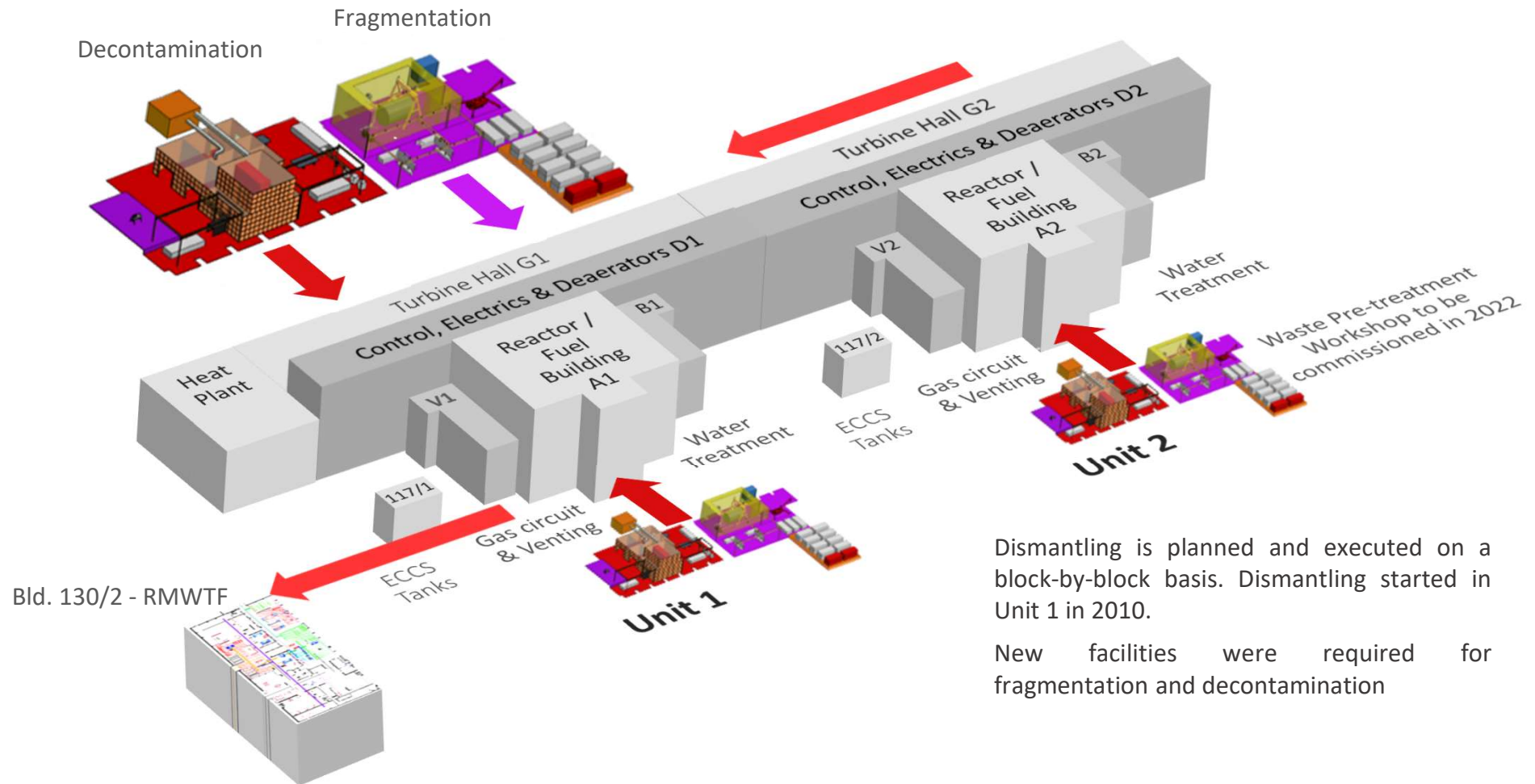


Progress in decontamination and dismantling projects



D&D key projects and issues

Ignalina NPP approach for D&D



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



General information. The D&D methods that currently using at INPP.



Cutting methods:

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



Decontamination methods:

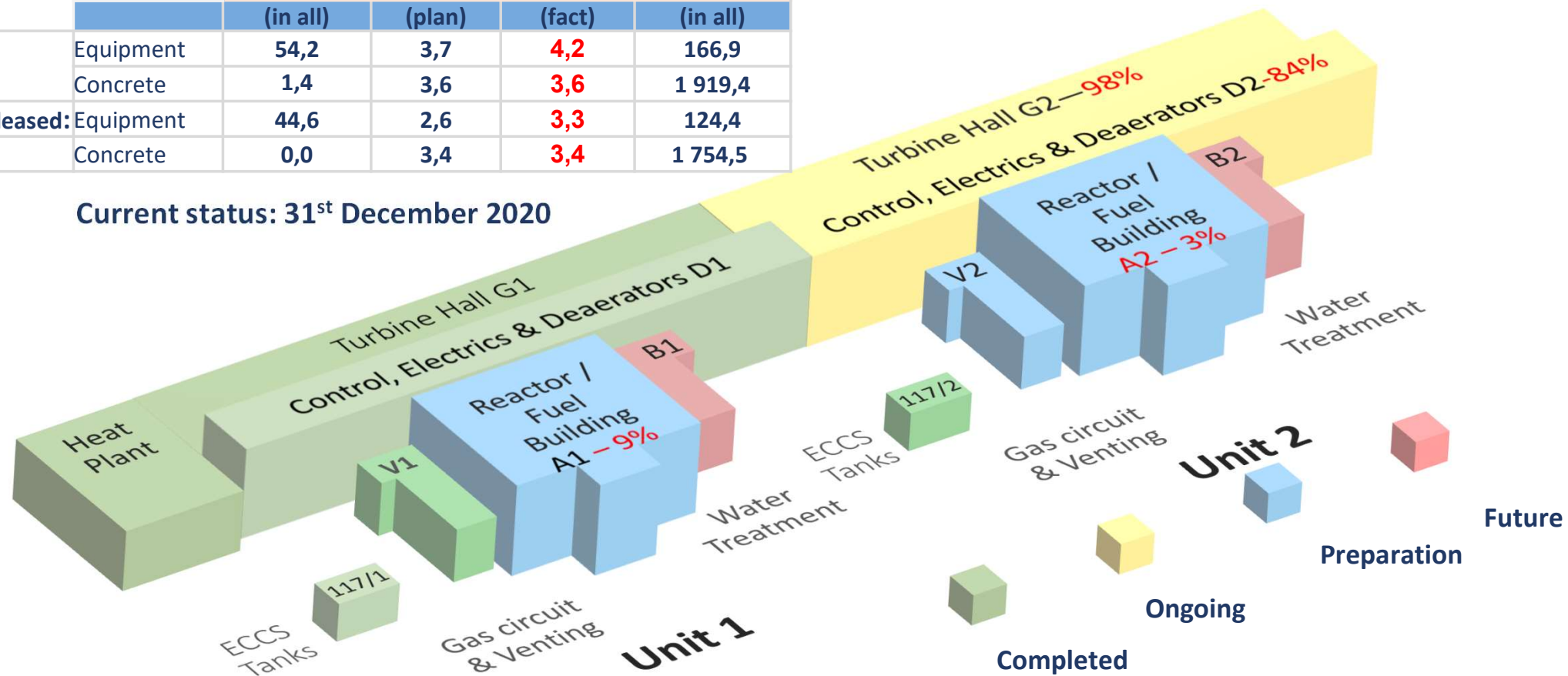
- physical (mechanical) techniques such as blasting, jetting, wiping, brushing, etc
- ultrasonic techniques
- chemical techniques



Overview of current status of INPP decommissioning

	x 1000 tons	2010-2019 (in all)	2020 (plan)	2020 (fact)	2010-2038 (in all)
Dismantled:	Equipment	54,2	3,7	4,2	166,9
	Concrete	1,4	3,6	3,6	1 919,4
Waste free-released:	Equipment	44,6	2,6	3,3	124,4
	Concrete	0,0	3,4	3,4	1 754,5

Current status: 31st December 2020

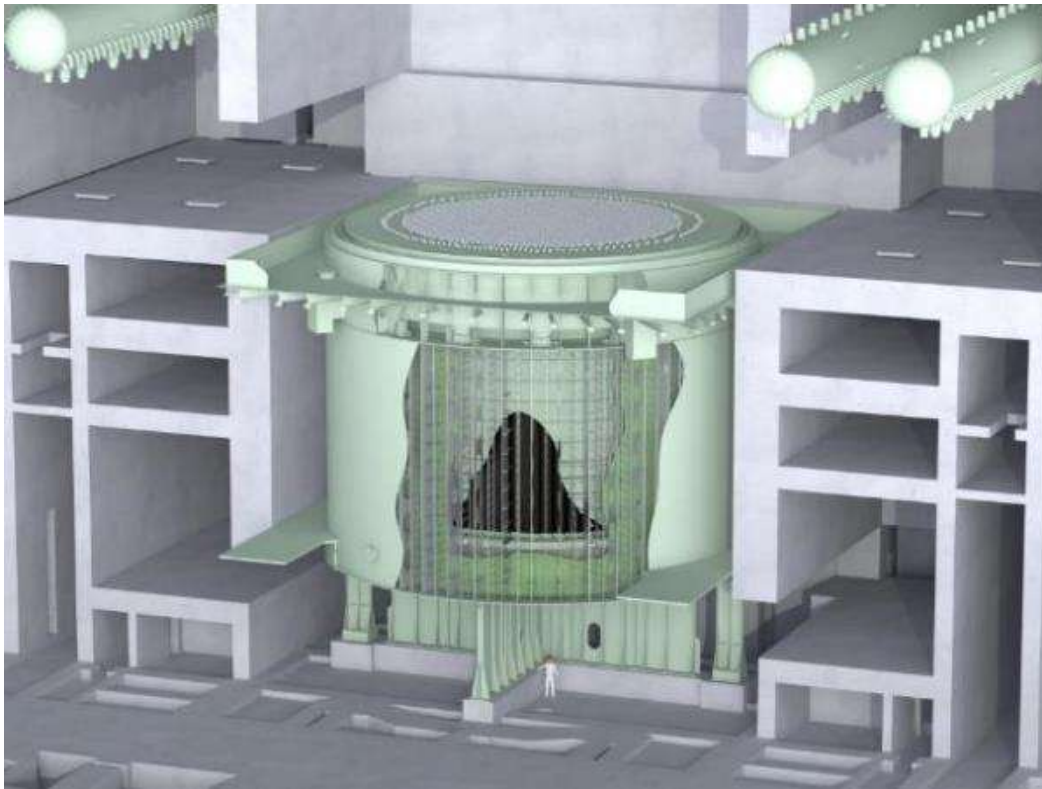


D&D key projects and issues

Reactor core dismantling



**New project: Reactor dismantling and graphite storage
(focus on optioneering study)**



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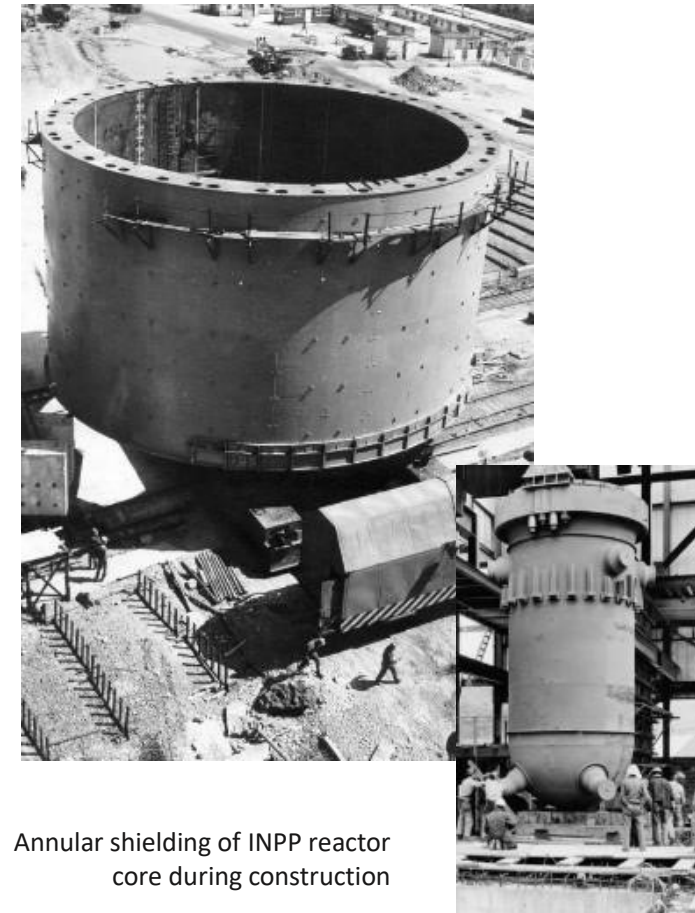
D&D key projects and issues

Reactor core dismantling

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 4.3 x 11.8 m	Dimensions Ø 21 x 25 m
Mass 2,660 tons (steel)	Mass 17,100 tons (various materials)

Closest equivalents to RBMK are Magnox/AGR (UK: Italy, Japan) and UNGG (France: Spain), but limited decommissioning experience.



Annular shielding of INPP reactor core during construction

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



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D&D key projects and issues

Reactor core dismantling



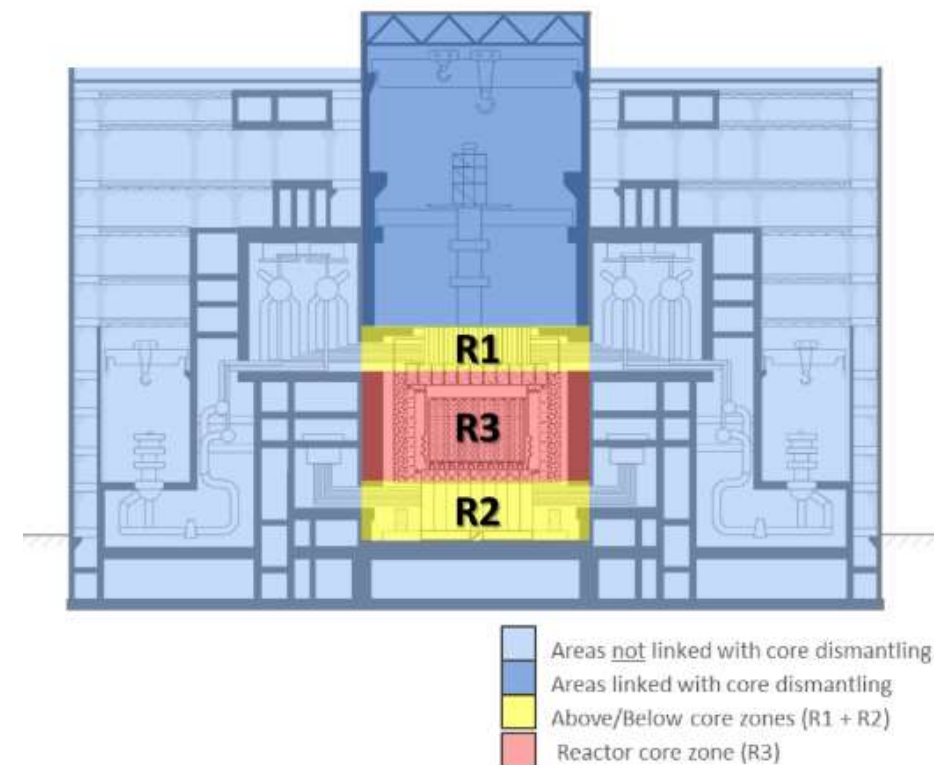
R3 reactor core dismantling is the key project for INPP decommissioning critical pass

Name of Project:

Units 1 and 2 Reactor Facility Dismantling in area R3
(UP01/R3)

Project objective:

- to develop the dismantling technologies for structures and equipment from INPP Units reactor shaft (in the R3 area);
- to develop the technologies for radioactive waste management generated as a result of both units graphite stacks dismantling;
- to dismantle the reactor structures and equipment from INPP Units reactor shaft applying the developed technologies.



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Thank you for attention!



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