Ignalina NPP

Ignalina NPP Decommissioning Key Projects

Decommissioning of Ignalina NPP is co-financed by the European Union

Content

Decommissioning of Ignalina NPP is co-financed by the European Union

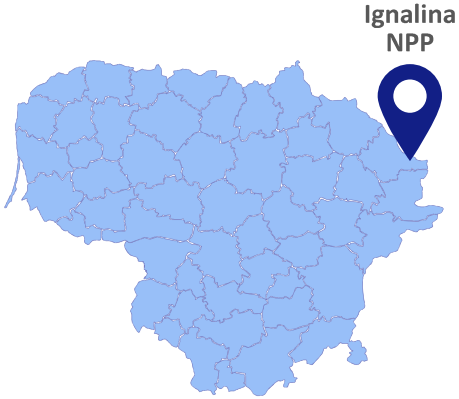
Ignalina NPP - Design and operation

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



Decommissioning of Ignalina NPP is co-financed by the European Union

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

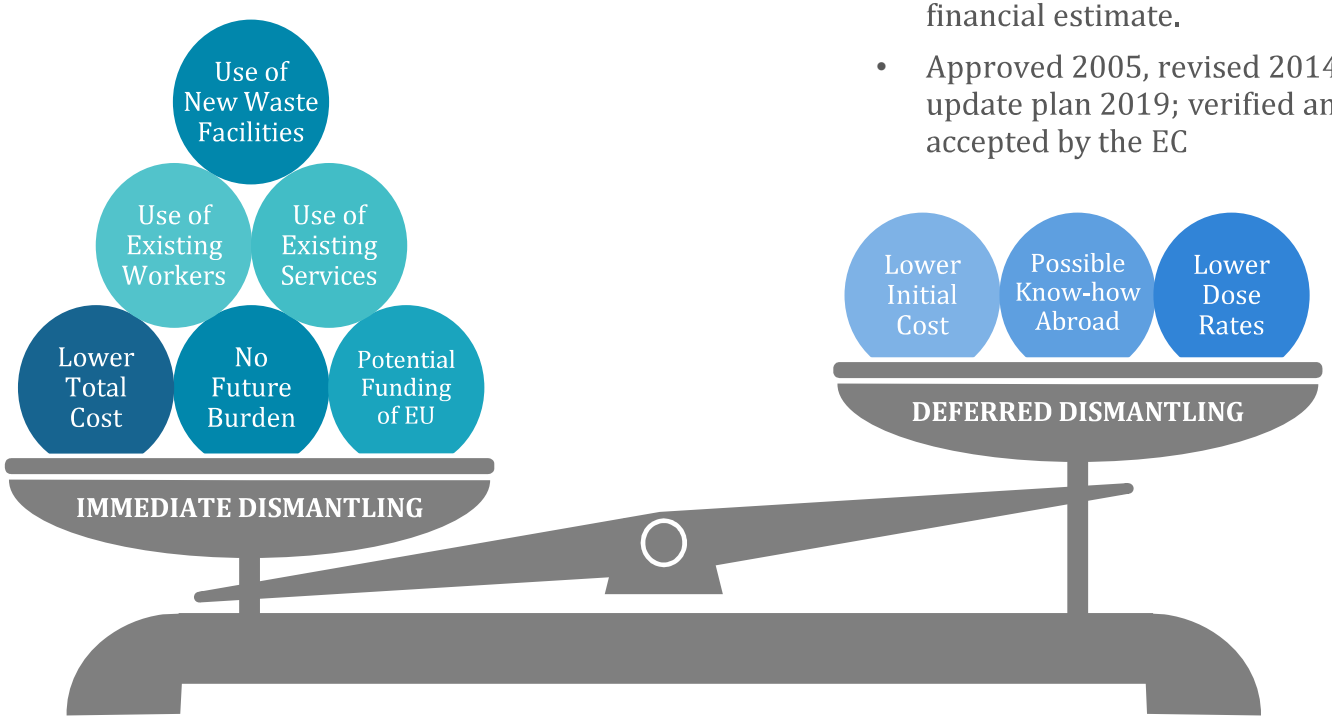
Ignalina NPP - Strategy and plan

Strategy

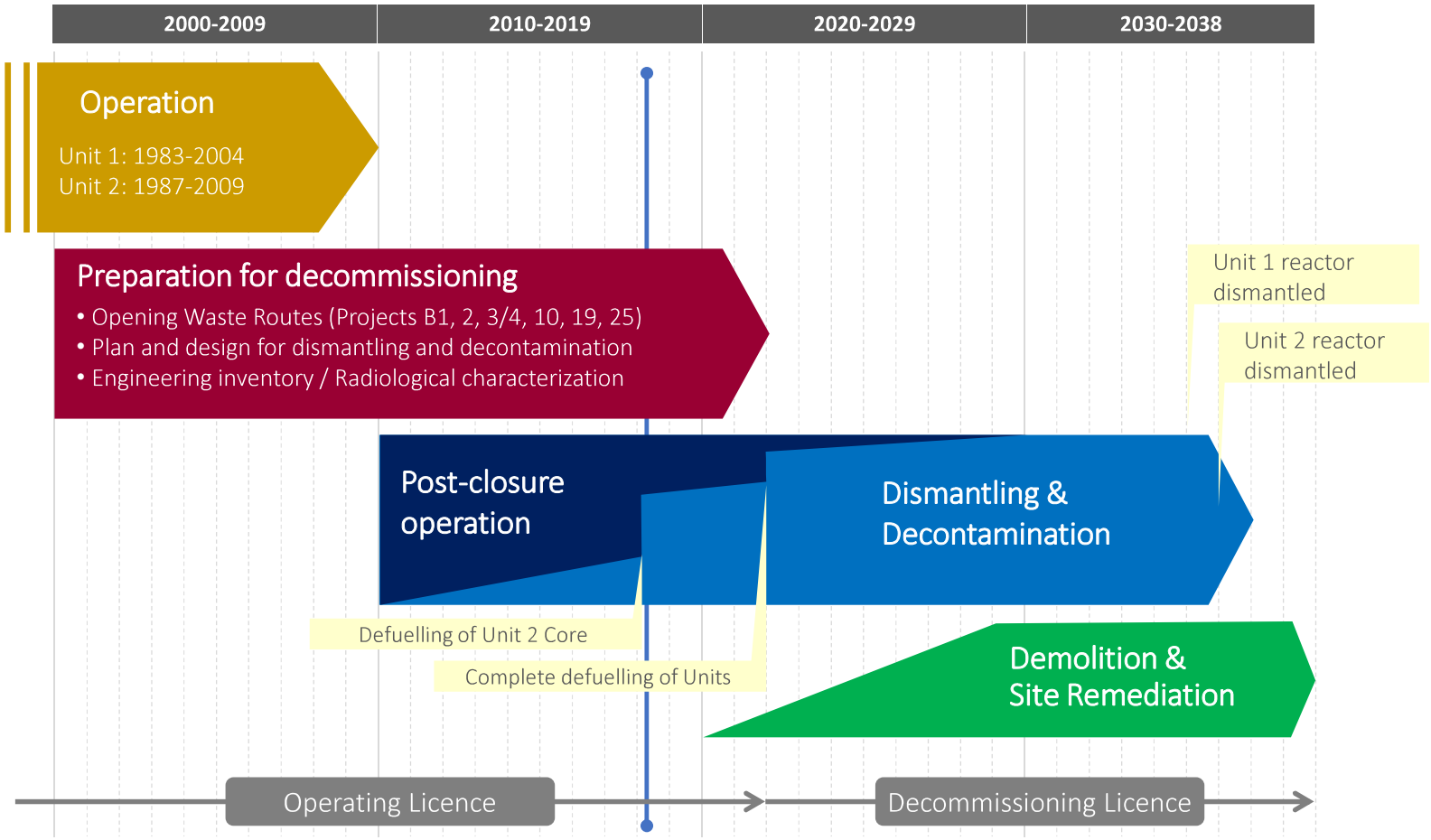
- **Immediate Dismantling** selected by Government for technical, social and financial reasons

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

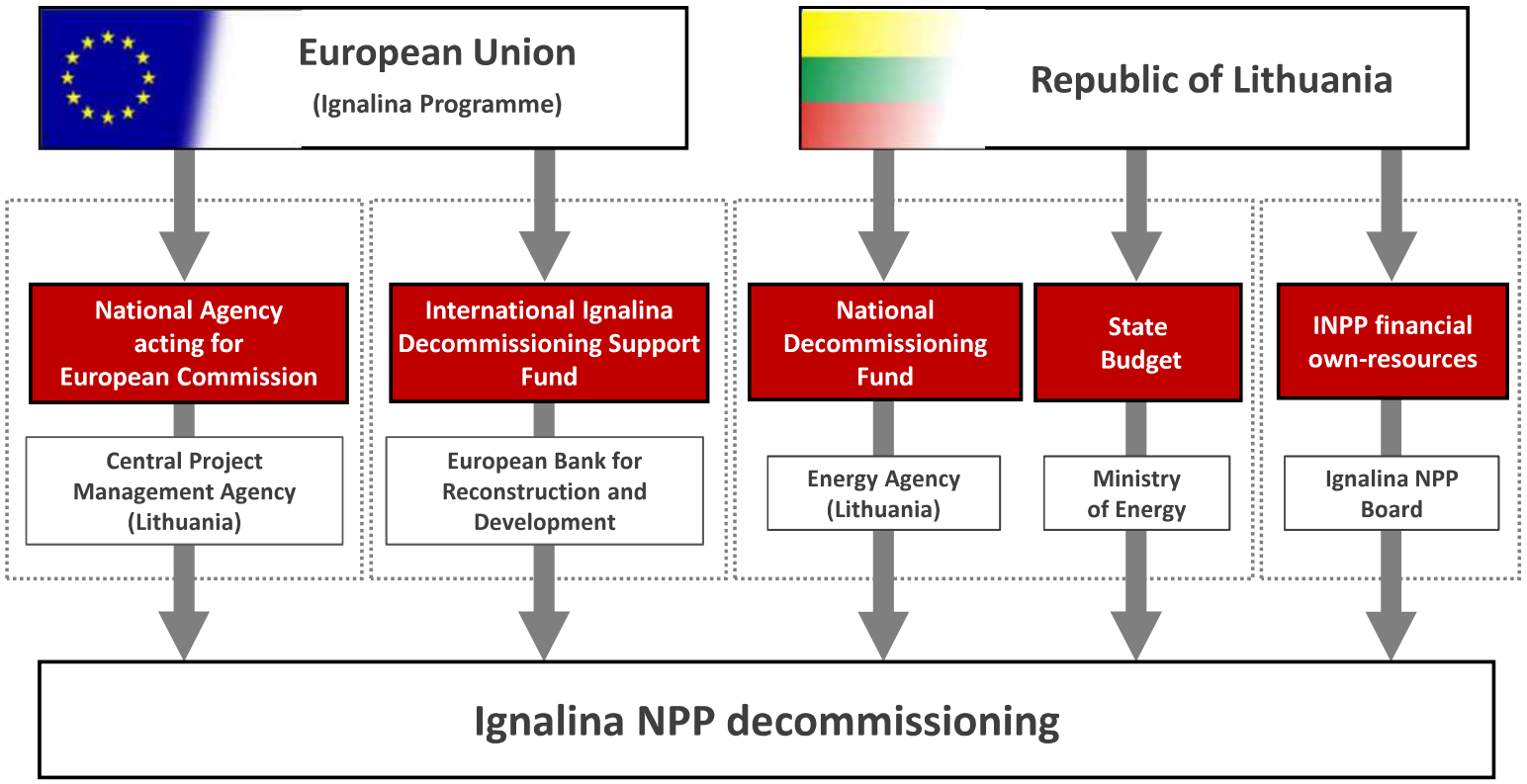


Ignalina NPP Decommissioning financing

In accordance with Final Decommissioning Plan (revision 2019):

Total for the remaining decommissioning **period 2014-2038** (including inflation + risks)

3.4 MEUR

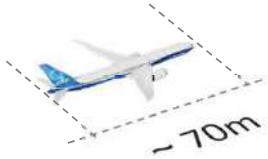


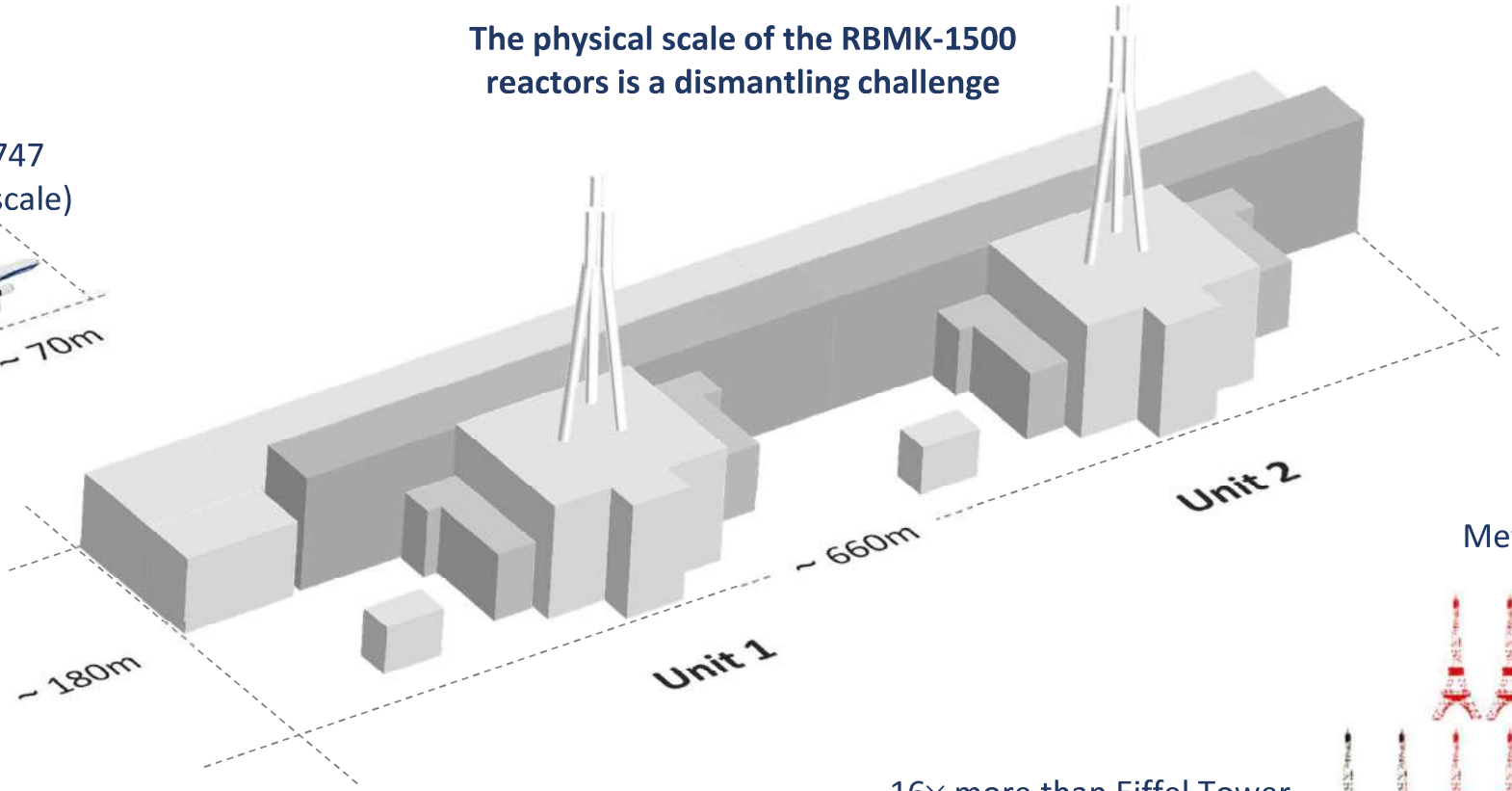
Content

Scale of Dismantling

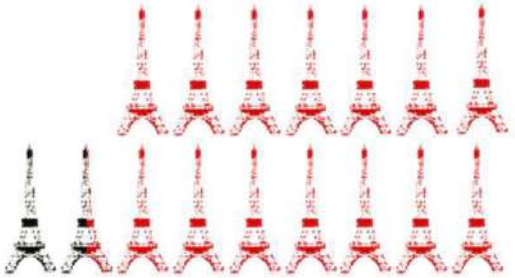
The physical scale of the RBMK-1500 reactors is a dismantling challenge

Boeing 747
(to same scale)



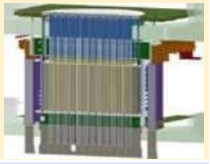


Metal to dismantle



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

Ignalina NPP Waste Inventory

Stored Operational Waste (legacy)	Solid Waste A B C	27,000 m³	  
	Bituminized Waste B	14,000 m³	
	Cemented Waste C	4,000 m³	
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 m³	
	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 (**<0,2 mSv/h**)

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

C Intermediate Level Waste (**>2 mSv/h**)

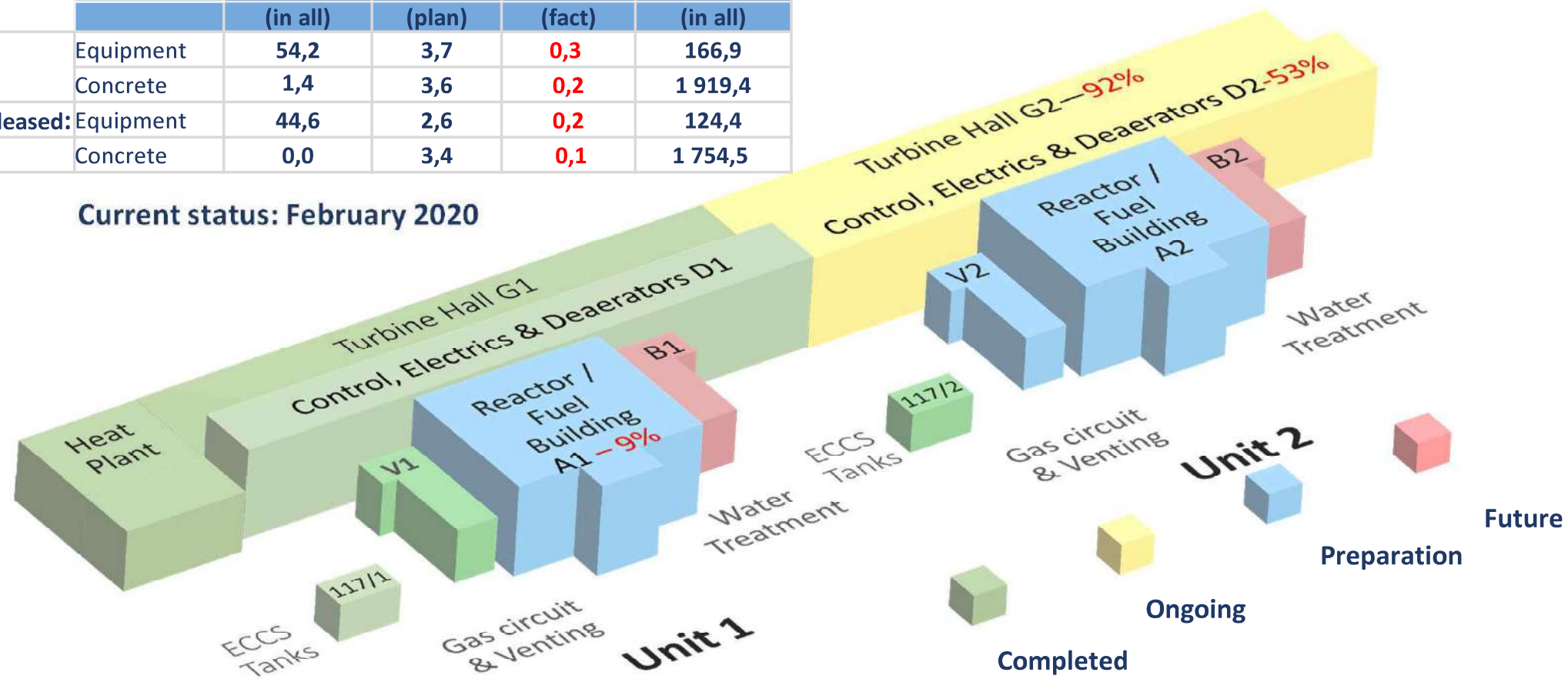
Long-lived Low Level and Intermediate Level Waste:

D Low Level Waste (**<10 mSv/h**)

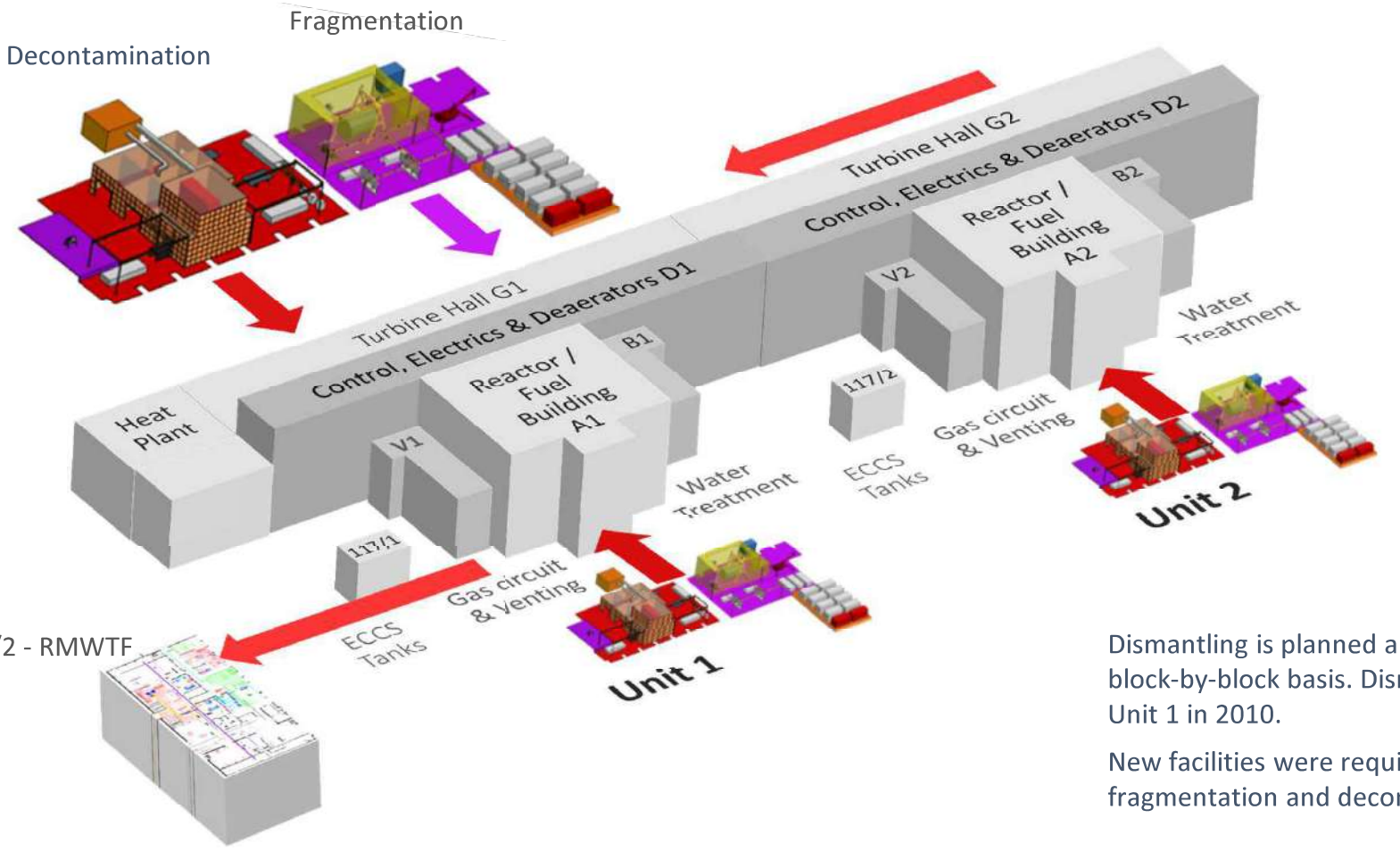
E Intermediate Level Waste (**>10 mSv/h**)

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**	**0,3**	**166,9**
	Concrete	**1,4**	**3,6**	**0,2**	**1 919,4**
Waste free-released:	Equipment	**44,6**	**2,6**	**0,2**	**124,4**
	Concrete	**0,0**	**3,4**	**0,1**	**1 754,5**



Overview of current status of INPP decommissioning



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

Decommissioning of Ignalina NPP is co-financed by the European Union

Overview of current status of INPP decommissioning

Remaining tasks for timely & safe defueling of INPP Units

- Fuel Inspection Hot Cell modification at ISFSF – regulator requirement to ensure handling of old design casks
- Removal of nuclear fuel pellets & metal debris from spent fuel storage pool's Unit 1&2 and transfer to ISFSF with the **last 190th cask – July 2022**

Dismantling and decontamination of the equipment of Units A-2 and V-2

Dismantling and decontamination of the equipment of Units A-2 and V-2

POVEIKIO APLINKAI VERTINIMO ATASKAITA

IAE A-2 IR V-2 BLOKŲ ĮRANGOS IŠMONTAVIMAS IR DEZAKTYVAVIMAS (PROJEKTAS 2210, 1-OJI FAZĖ)

Planuojamos ūkinės veiklos organizatorius — **Valstybės įmonė Ignalinos atominė elektrinė**

PAV ataskaitos rengėjas — **Ignalinos atominės elektrinės Eksploatacijos nutraukimo departamentas**

2019 m.

2 versija

VĮ IGNALINOS ATOMINĖ ELEKTRINĖ	A-2 ir V-2 blokų įrangos išmontavimo ir dezaktyvavimo projekto poveikio aplinkai vertinimo ataskaita (2210, 2-asis blokas)	1 lapas iš 226 2 versija
2019-12-16 Nr. 41-3741(15.94.2) Visaginas	Eksploatavimo nutraukimo projektų valdymas 2210 projektas1 1-oji fazė	**TVIRTINU** Eksploatacijos nutraukimo departamento direktorius Sergej Krutovcov
Pagrindas	Lietuvos Respublikos planuojamos ūkinės veiklos poveikio aplinkai vertinimo įstatymas, 2017 m. birželio 27 d. Nr. XIII-529; VĮ IAE eksploatacijos nutraukimo Megaprojekto grafikas, DVSed-0115-3, Gf-686(15.80.1); 2210 projekto „A2 ir V2 blokų įrenginių išmontavimas ir dezaktyvavimas" tikslinis planas, Gf-685(15.94.2); PAV subjekto (VATESI) 2019-07-31 raštas Nr. (13.5-43)22.1-553 su pastabomis 1-ai PAVA versijai; PAV subjekto (PAGD prie VRM) 2019-08-07 raštas Nr. 9.4-1348(10.18) su pastabomis 1-ai PAVA versijai.	

Parengė:

Padalinys	Pareigybė	Vardas, pavardė, telefono Nr.	Skyrių numeriai	Parašas	Data
PPS	Vyresnysis inžinierius	Aleksandr Šabliuk, (8-386) 24459	1, 2, 3, 4		2019-10-15
PPS	Vyresnioji inžinierė	Inga Puodžiukienė, (8-386) 28307	5, 6, 7		2019-10-15
IPPV	Projekto vadovas	Ilja Izmodenov (8-386) 24330	8		2019-12-16

Vizos:

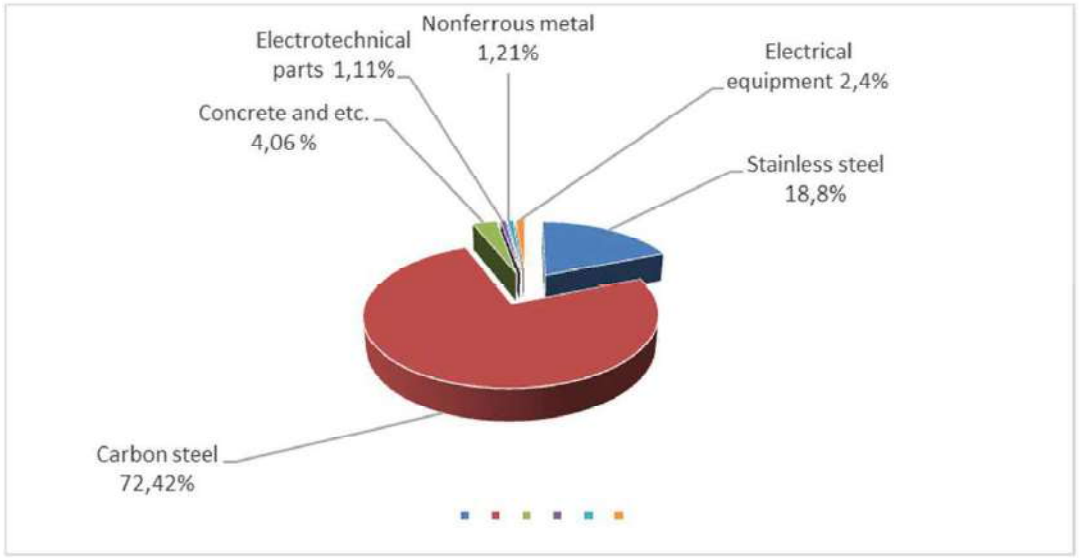
PVT	Vadovas	Dmitrij Jekateriničev	Visas dokumentas		2019.10.15
RST	Vadovas	Kęstutis Gediminskas	Visas dokumentas		2019-10-16
RATT	Vadovas	Aleksandr Orlov	Visas dokumentas		2019.10.16
AS ir KVS	Vadovas	Jurij Kruglov	2,3		2019-10-16
DVS	Vadovas	Vidmantas Pranevičius	Visas dokumentas		2019-10-16

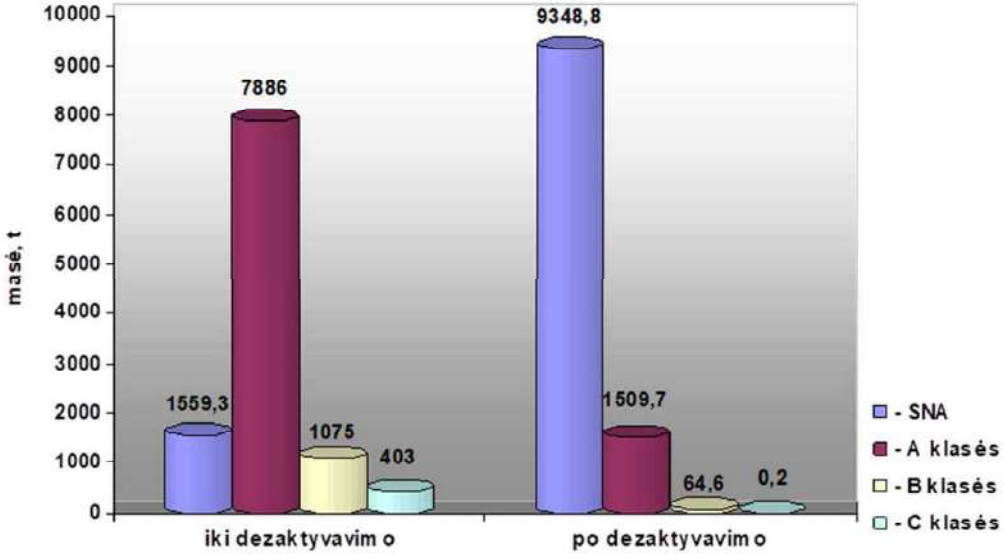
Ryšys su kitomis PAV ataskaitos versijomis

Versija, registracijos numeris	Bleidimo metai	Aiškinimas
1 versija	2019 m.	Pateikta susipažinti visuomenei, PAV subjektams.
2 versija	2019 m.	Pagal PAV subjektų (VATESI, PAGD prie VRM) pastabas atnaujinta versija.

POVEIKIO APLINKAI VERTINIMO ATASKAITA IAE A-2 ir V-2 blokų įrangos išmontavimas ir dezaktyvavimas (PROJEKTAS 2210, 1-OJI FAZĖ)	3 lapas iš 226
TURINYS	2 versija

Dismantling and decontamination of the equipment of Units A-2 and V-2





General composition of the dismantling waste

Dismantling and decontamination of the equipment of Units A-2 and V-2

Evaluation of the annual effective dose to the representative (the member of the critical group of the population) due to the radiological impact (airborne and waterborne discharges) on the environment from all the Ignalina NPP decommissioning activity for the period of years 2019-2029, mSv

No.	Source of the impact	Year										
		2019	***2020***	***2021***	***2022***	***2023***	***2024***	***2025***	***2026***	***2027***	***2028***	***2029***
1.	***Proposed activity***	**-**	**-**	**-**	***3.97E-05***	***1.08E-04***	***1.08E-04***	***7.93E-05***	***7.93E-05***	***7.93E-05***	***7.93E-05***	***3.97E-05***
	D&D of equipment of Units A-2 and V-2, Phase 1 (2210)	-	-	-	3.97E-05	1.08E-04	1.08E-04	7.93E-05	7.93E-05	7.93E-05	7.93E-05	3.97E-05
2.	***Activity performed at the INPP site***	***1.10E-02***	***8.78E-03***	***8.78E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***	***3.40E-03***
	Liquid waste treatment facility	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03	3.00E-03
	Liquid waste grouting facility, temporary storage of the grouted liquid waste [20]	3.78E-03	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04	3.98E-04
	Project U1DP0	2.54E-06	1.60E-03	1.60E-03	-	-	-					
	Project U2DP0	3.78E-03	3.78E-03	3.78E-03	-	-	-					
	Storage facility for short-lived very low level waste, Project B19-1	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06	2.54E-06
	Project B9-1	3.93E-09	-	-	-	-	-					
	Project B9-1(2)	5.95E-11	-	-	-	-	-					
	Project B9-7(1)	4.15E-04	5.95E-11	5.95E-11	5.95E-11	5.95E-11						
	Project 2203	-	9.25E-09	9.25E-09	9.25E-09	9.25E-09	9.25E-09	9.25E-09	4.62E-09			
	Project 2101	-	0.98E-09	1.96E-09	1.96E-09	1.96E-09	1.96E-09	0.98E-09				
3.	***Proposed activities on the INPP site, for which EIA Report were developed previously***	***8.96E-03***	***7.84E-03***	***7.84E-03***	***7.84E-03***	***1.28E-02***	***1.28E-02***	***1.28E-02***	***1.28E-02***	***1.28E-02***	***1.28E-02***	***1.28E-02***
	ISFSF, Project B1	4.48E-03	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04	4.15E-04
	SWMSF, Project B3/4	5.60E-07	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03	2.94E-03
	SWRF, Project B2	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03	4.48E-03
	Landfill facility for short-lived very low level waste, Project 19-2	-	-	5.60E-07	5.60E-07	5.60E-07	5.60E-07	5.60E-07	5.60E-07	5.60E-07	5.60E-07	5.60E-07
	Surface repository for low and intermediate level short-lived radioactive waste, Project B25	-	-	-	-	5.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03
4.	***Proposed activities on the INPP site, for which EIA Report were not developed previously***											
	D&D of equipment of Units B-1, B-2 and the reactors of Units 1 and 2	*EIA development is planned*										
	Total dose	**2.00E-02**	**1.66E-02**	**1.66E-02**	**1.13E-02**	**1.63E-02**	**1.63E-02**	**1.70E-02**	**1.70E-02**	**1.70E-02**	**1.70E-02**	**1.66E-02**

Content

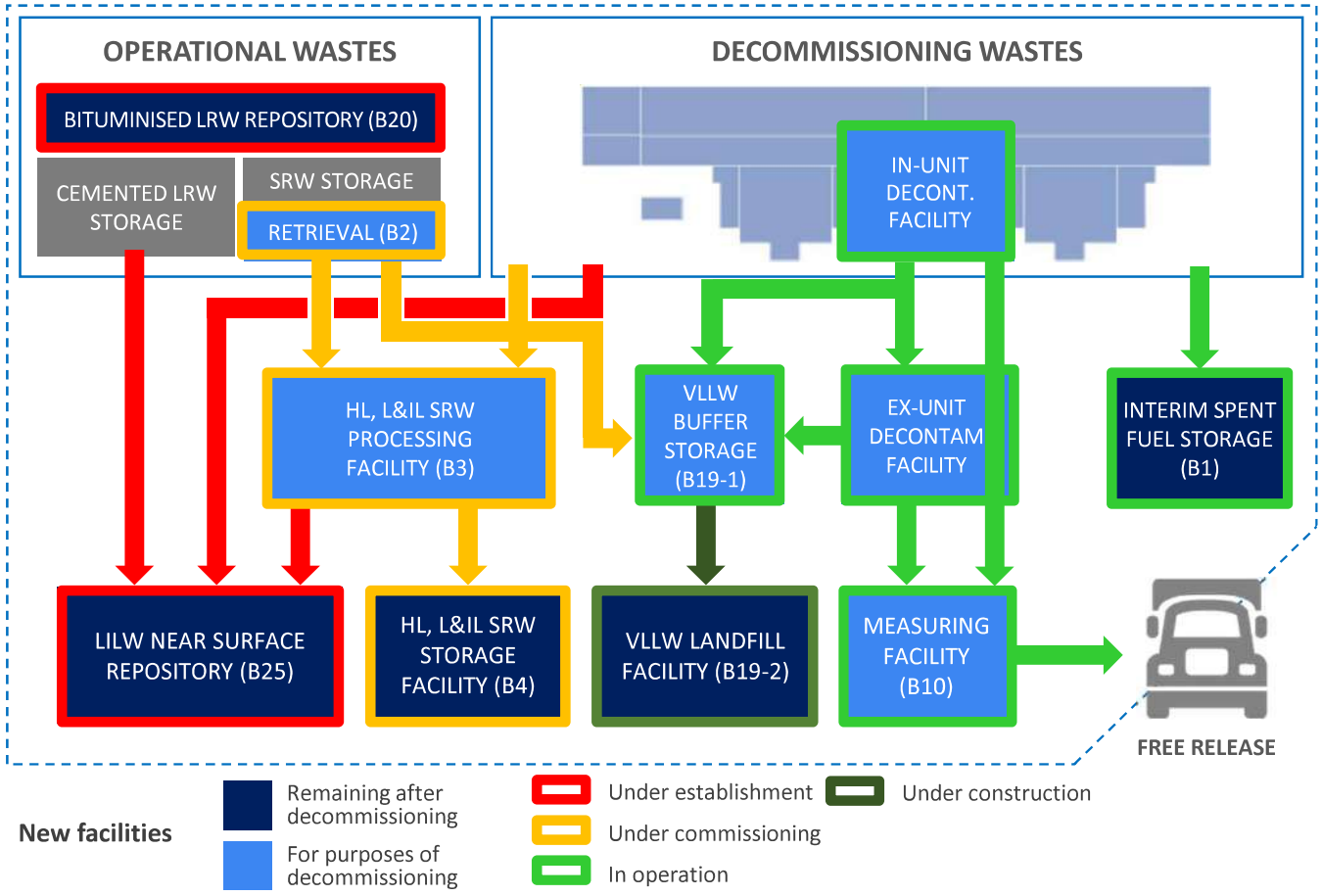
- INPP decommissioning: background information
- Overview of current status of INPP decommissioning
- **INPP New Waste Treatment Facilities**
- New project: Reactor core dismantling
- Environmental monitoring

Ignalina NPP New Waste Facilities

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

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

Ignalina NPP Opening waste routes



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 industrial operation – **5 May 2017**
- Reactor Unit 2 defueling – **28 February 2018**
- 129 casks loaded to date

Next steps:

- SPH Unit 1,2 defueling Intact SF – **2021**
- SPH Unit 1,2 defueling 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:

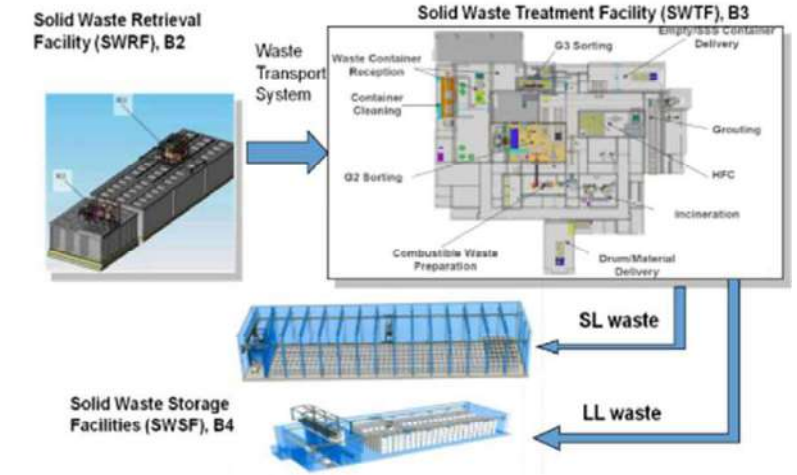
- Start of hot-trials – **9 June 2017**
- Finish of hot-trials – **October, 2018**
- Start of Industrial operation – **April 2019**

Results for B3/4:

- Operational License and start of hot-trials – **13 October 2017**
- Finish of hot-trials – **August 2019**

Next steps:

- License for Industrial operation of B3/4



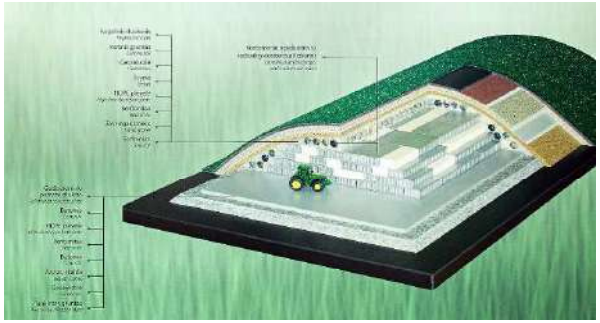
New Very Low Level Short Lived Waste Storage Facility (B19)

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 – **2020**



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

Objectives:

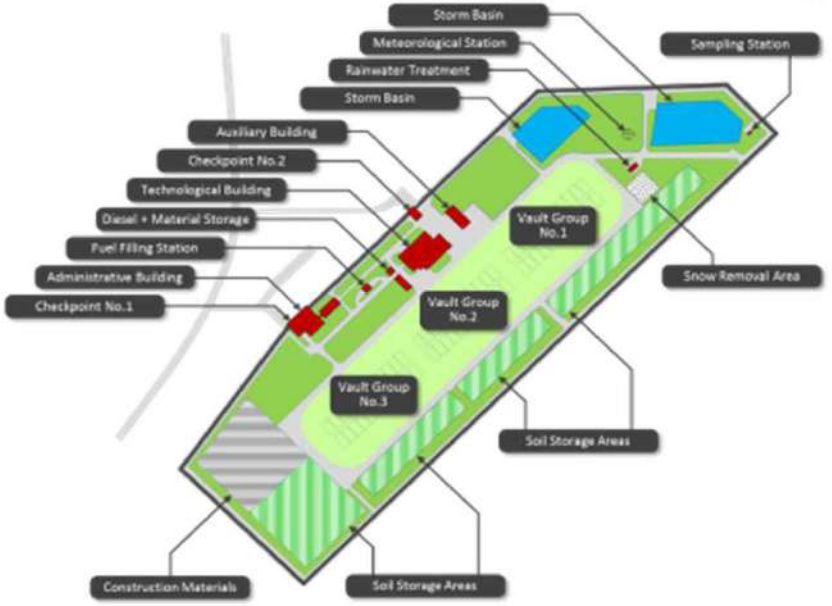
- Construction of Near Surface Repository for 100 000 m3 Low and Intermediate Level Short-lived Radioactive Waste arising from:
  - ✓ Operational solid waste retrieved from B2
  - ✓ Operational cemented liquid waste
  - ✓ Units 1 and 2 dismantling
- After its closure the surveillance of the repository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

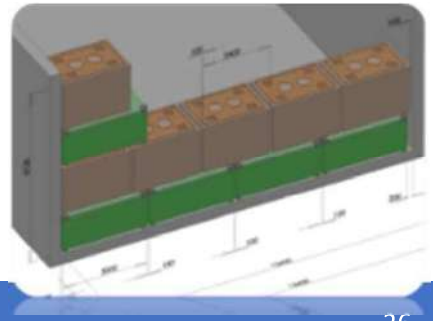
Key dates:

- 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:

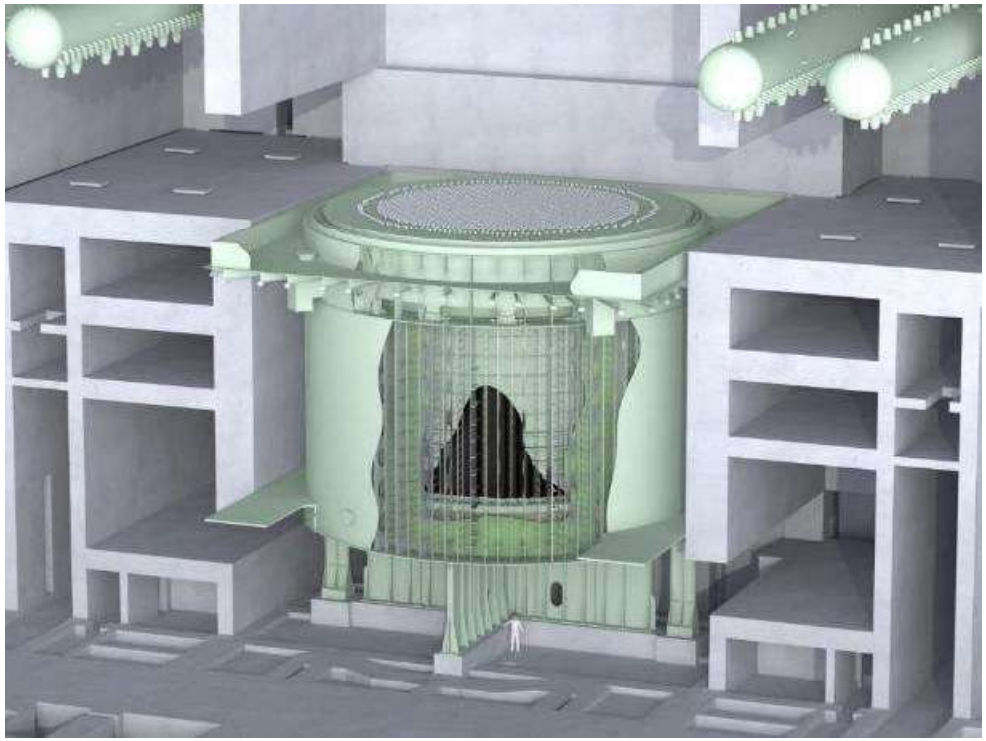
- Tender procedures





Content

RBMK-1500 reactor core dismantling

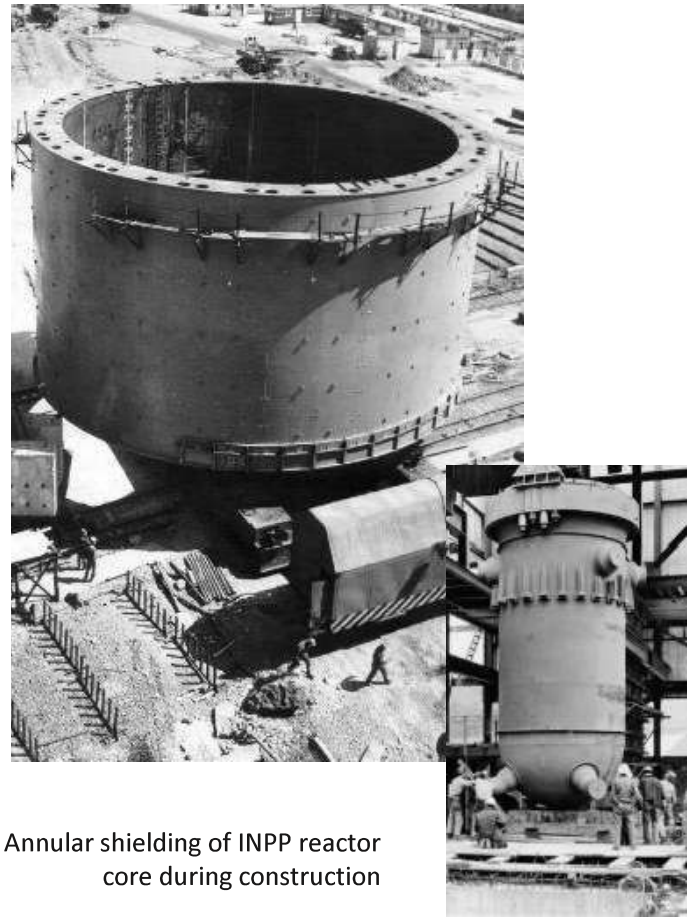


RBMK-1500 reactor core dismantling

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 *in situ.*
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

RBMK-1500 reactor core dismantling

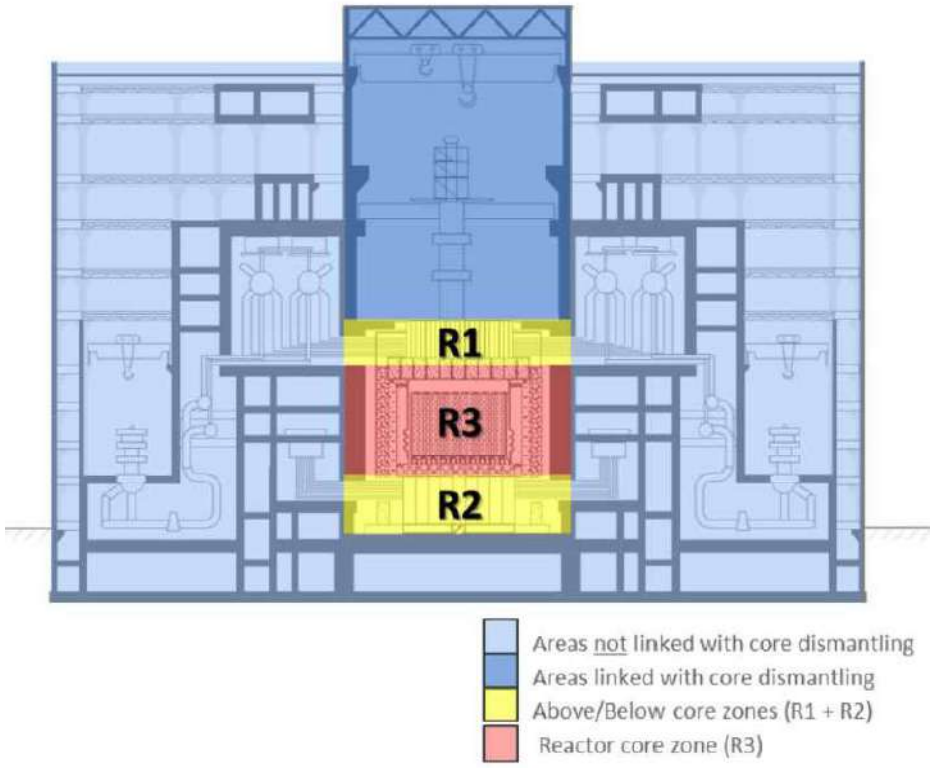
R3 reactor core dismantling is the key project for INPP decommissioning critical pass

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.



RBMK-1500 reactor core dismantling

SE Ignalina Nuclear Power Plant (INPP) is planning to launch two procurements:

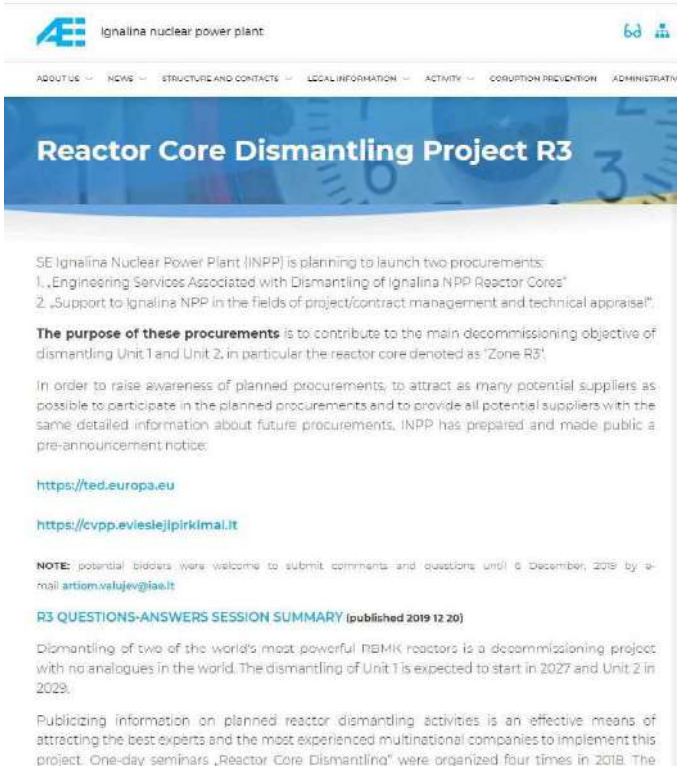
- „Engineering Services Associated with Dismantling of Ignalina NPP Reactor Cores“
- „Support to Ignalina NPP in the fields of project/contract management and technical appraisal“.

The purpose of these procurements is to contribute to the main decommissioning objective of dismantling Unit 1 and Unit 2 zones R3.

One-day seminars „Reactor Core Dismantling“ were organized four times in 2018:

- Seminars were attended by representatives of 46 companies from EU, as well as by representatives of the European Commission, Ministry of Energy, Central Project Management Agency, State Nuclear Power Safety Inspectorate (VATESI), INPP.
- The material of these mentioned seminars is available on the INPP website https://www.iae.lt/naujienos/pateiktys/25

INPP has prepared and made public a pre-announcement notice:
https://ted.europa.eu
https://cvpp.eviesiejipirkimai.lt
Responses to received questions were published 20 December 2019:
R3 QUESTIONS-ANSWERS SESSION SUMMARY

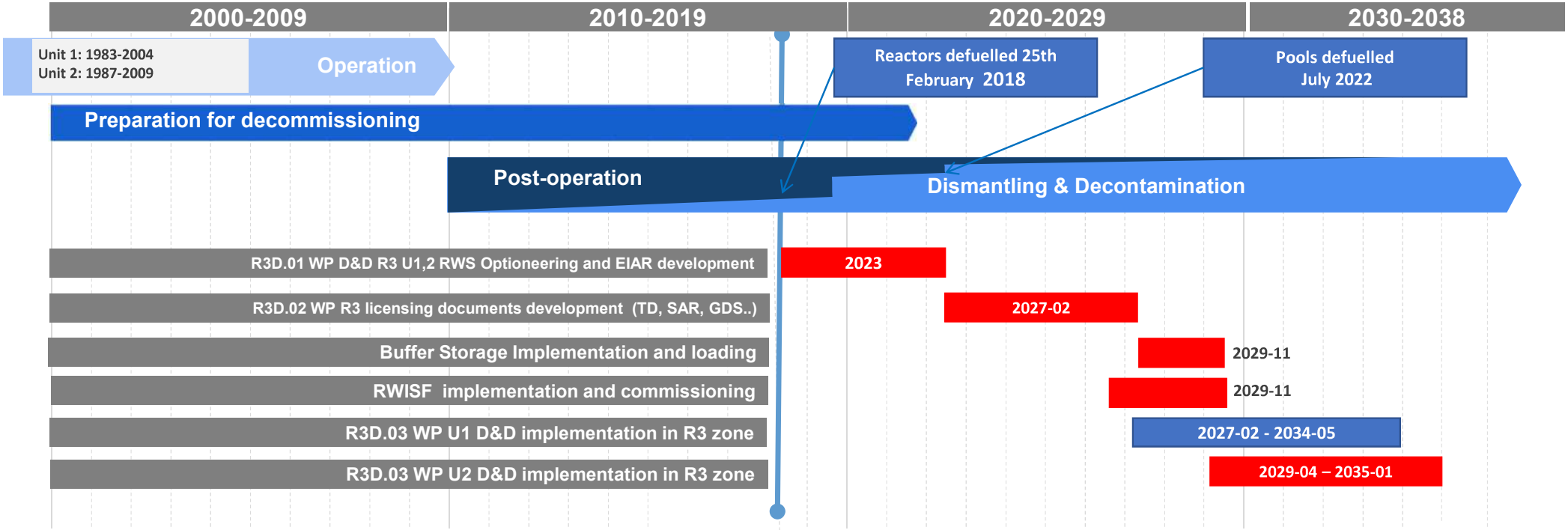


Decommissioning of Ignalina NPP is co-financed by the European Union

RBMK-1500 reactor core dismantling

Next main steps:

- To complete **tender documents** preparation
- **R3D.01 and R3S Tenders** announcement by **2020/Q1**



RBMK-1500 reactor core dismantling

R3 tender preparation:

As a part of R3 tender preparation the information, ideas, exchange of experiences with regard to Reactor Dismantling and Waste Routes Optioneering, Concept Design and Environmental Impact Assessment Report Development were collected.

The following activities were undertaken by INPP:

- The set of the meeting/workshop “Experience of Reactors Dismantling” was held (**18th and 25th October , 8th and 15th November 2018**).
- **49 companies** and stakeholders (EC, EBRD, MoE of RL, CPMA, VATESI) have taken part in the workshops
- **In total 19 bid abstracts** and preliminary budgets (9 companies) were provided
- Presentations, INPP answers to the major questions published at INPP web page

https://www.iae.lt/en/news/press-releases/pre-announcement-of-planned-procurements/376

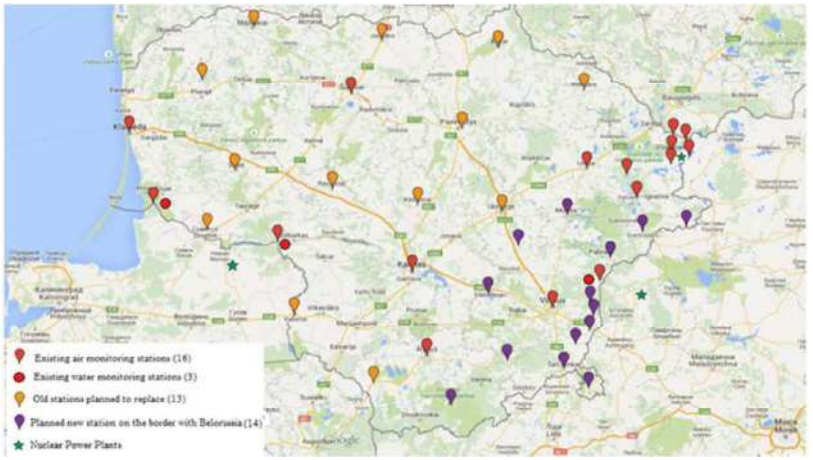
Content

- INPP decommissioning: background information
- Overview of current status of INPP decommissioning
- INPP New Waste Treatment Facilities
- New project: Reactor core dismantling
- **Environmental monitoring**

Environmental monitoring

National environmental radiological monitoring program - Environmental Protection Agency

- Automated monitoring network (gamma dose rate and gamma spectroscopy) including 5 stations in vicinity of INPP
- Continuos monitoring of radionuclides in aersols and deposition (including 3 stations in vicinity of INPP)
- Monitoring of radionuclides in water, bottom sediments and biota (including Drūkšiai lake used for cooling)



Average value of annual ambient doze equivalent , 2019 (mSv)

Environmental monitoring

Ignalina NPP radiological monitoring of the environment

The Laboratory of Environmental Monitoring started its activity in 1986 and carried out radiological monitoring of the environment during the INPP operation phase (1986-2009) and also performs monitoring at the decommissioning stage.

The INPP environment monitoring program includes:

- Monitoring of the radionuclides concentration in the air and fallouts;
- Monitoring of the radioactivity of the sewage and drainage water from the INPP site;

Monitoring of the radioactive releases to the air;

- Meteorological observations;
- Monitoring of the radionuclides concentration in the lake and groundwater;
- Dose and dose rate monitoring in the sanitary protection zone (3 km) and observation area (30 km);

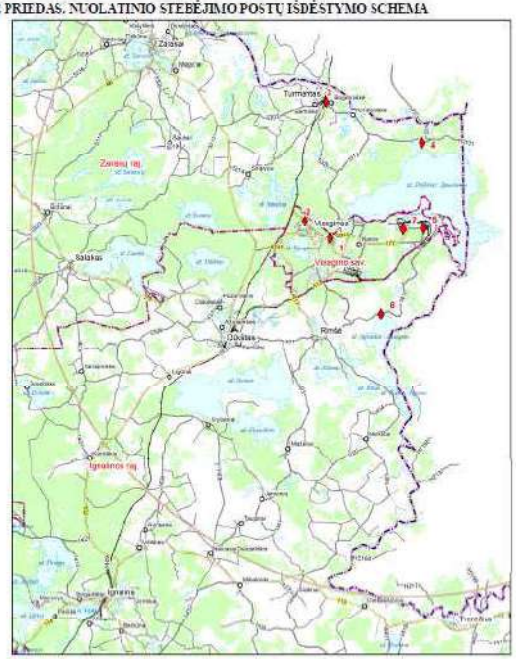
Monitoring of the radionuclides concentration in fish, algae, soil, grass, sediments, mushrooms, leaves;

- Monitoring of the radionuclides concentration in food products (milk, potatoes, cabbage, meat, grain-crops).

Environmental monitoring

DVSed-0410-3V7	APLINKOS APSAUGA	42 lapas iš 67
	RADIOLOGINIO APLINKOS MONITORINGO PROGRAMA	Pakeit. Nr.

2 PRIEDAS. NUOLATINIO STEBĖJIMO POSTŲ IŠDĖSTYMO SCHEMA



DVSed-0410-3V7	APLINKOS APSAUGA	44 lapas iš 67
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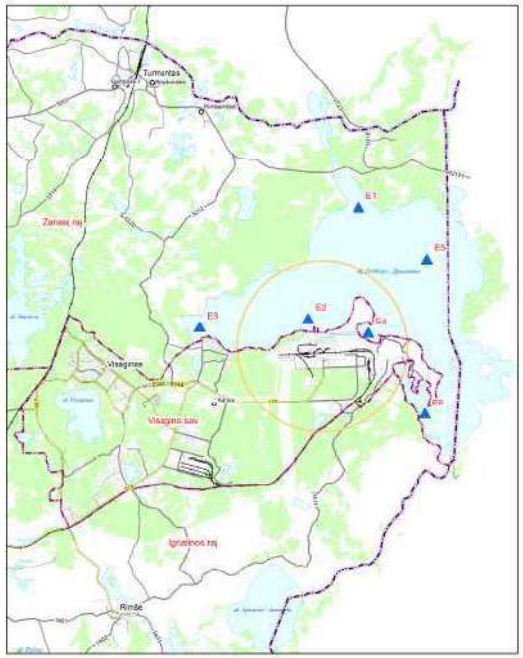
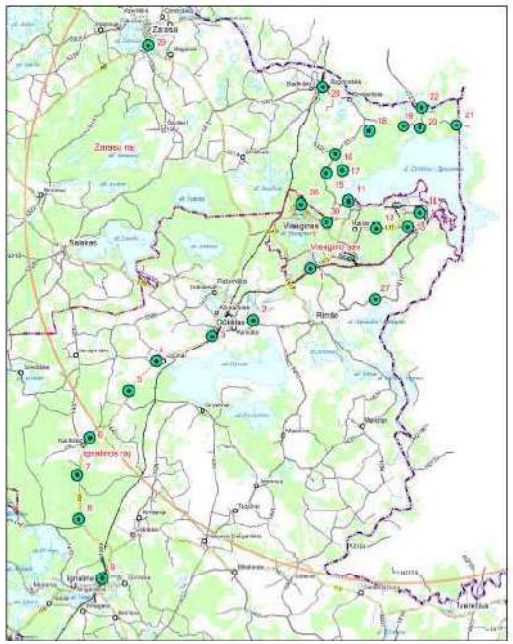
4 PRIEDAS. „NULINIO" FONO TYRIMO VIETŲ IŠDĖSTYMO SCHEMA



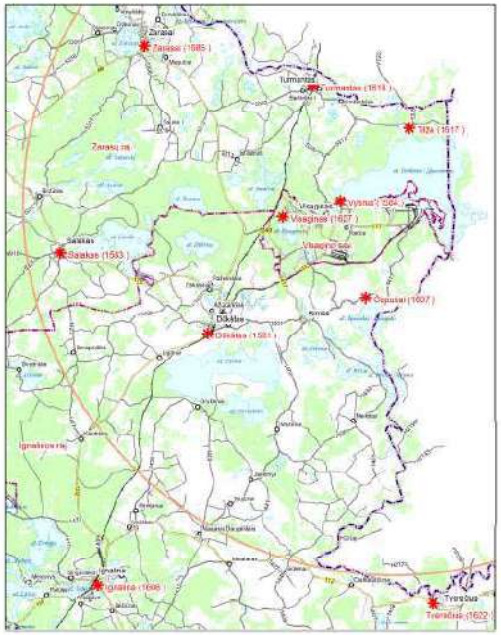
DVSed-0410-3V7	APLINKOS APSAUGA	46 lapas iš 67
	RADIOLOGINIO APLINKOS MONITORINGO PROGRAMA	Pakeit. Nr.

6 PRIEDAS. TLD IŠDĖSTYMO VIETOVĖJE SCHEMA

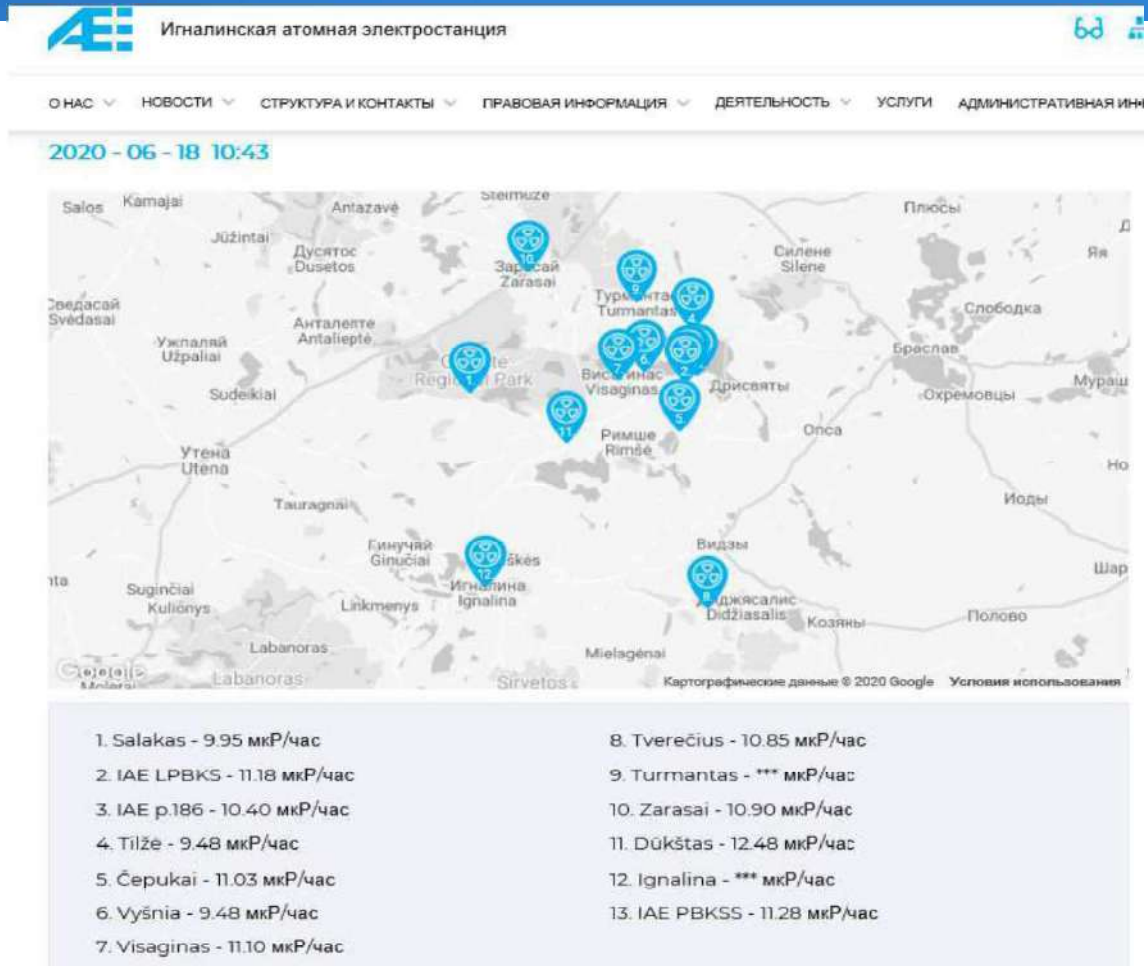


DVSed-0410-3V7	APLINKOS APSAUGA	53 lapas iš 67
	RADIOLOGINIO APLINKOS MONITORINGO PROGRAMA	Pakeit. Nr.

13 PRIEDAS. SKYLINK SISTEMOS GAMA DAVIKLIŲ IŠDĖSTYMAS IAE 30 KM ZONOJE



Environmental monitoring



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Thank you for attention!

Decommissioning of Ignalina NPP is co-financed by the European Union