# National Report of Hungary

at the 7th Review Meeting
of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

# Presentation outline

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*FRAMEWORK*

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*SF & RW MANAGEMENT*

PURAM

# *FRAMEWORK*

- National Energy Strategy
- National Policy
- National Programme
- ARTEMIS mission
- Central Nuclear Financial Fund (CNFF)
- Regulatory authority: changes in HAEA

# Hungary's Energy and Climate policy objectives

**Reduction of GHG emission**

- **2030: min. -40% GHG emission on 1990 base**
- **2050: climate neutrality**
- **Carbon-free and flexible electricity production**
- **improvement of energy efficiency**
- **greening transport**
- **innovation**

**Energy policy goals**

- **Safe, affordable and sustainable energy,**
- **2030: min. 21% RES in final energy**
- **After 2030 increase in final energy consumption comes from carbon free energy sources**

# Hungary's National Energy Strategy – Nuclear Energy

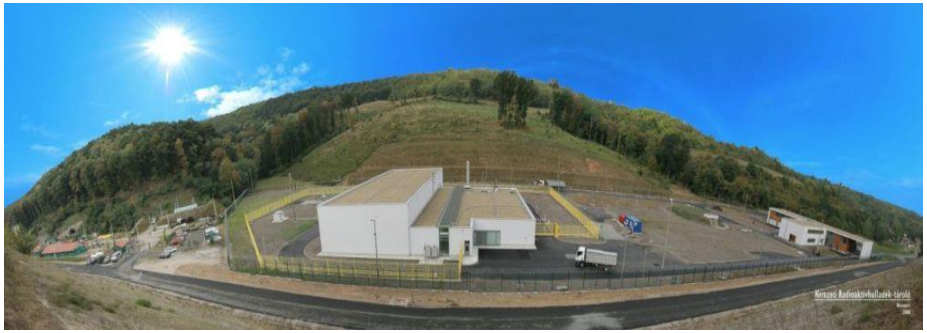
- **The main objectives are to strengthen energy independence, energy security and to decarbonise energy production.**
- **Nuclear energy is part of the sustainable energy mix** to meet growing demand for reliable, affordable and clean electricity
- Decarbonisation of **90%** of domestic power generation **2030**
- **Maintaining nuclear capacities** is **one of the main pillars** of Hungary's Energy Strategy
  - Processes finished for long-term operation of additional 20 years and for uprating the existing units
  - **Paks II. new build project** (2 WWER 1200 MW units)

The National Energy Strategy adopted in 2020 is planned to be revised due to the significantly changed challenges of the energy policy (growing energy prices, impacts of the Russian-Ukrainian conflict, FitFor 55, Repower EU).

# National Policy and National Programme for Radioactive Waste and Spent Fuel Management

- Each EU MS shall have a national policy on SF and RAW management - principles
  - **NATIONAL POLICY** – *basic principles* – adopted by the Hungarian Parliament in April 2015, reviewed in 2020.
  - **NATIONAL PROGRAMME** – *implementation and scheduling* – adopted by the Hungarian Government in August 2016 – its revision is currently in progress

**By reviewing the National Policy and the National Programme the results of JC review meetings are taken into account.**



# National Policy Principles

## Nuclear energy shall only be used

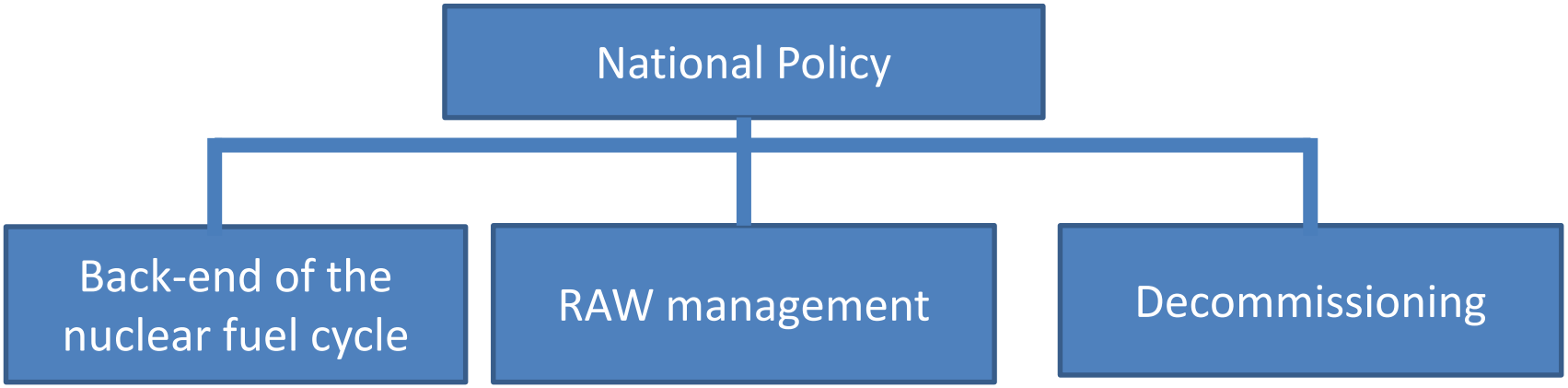
- within the socially-acceptable level of risk;
- without posing any hazards to present and future generations, environment and material assets
- by ensuring a regular review and update of safety requirements;
- by ensuring that the quantity of generated RW is kept as low as achievable.

## Spent fuel and radioactive waste

- shall be managed by recognizing the **ultimate responsibility of the Hungarian State;**
- **shall be disposed of in Hungary** unless an agreement has entered into force between Hungary and another Member State or a third country;
- shall be managed **without place any undue burden on future generations**

# National Policy – subpolicies

The National Policy consists of three fundamental subpolicies



# National Policy – subpolicies (1)

## *I. Back-end of the nuclear fuel cycle*

- **No final decision yet** on the back-end of the nuclear fuel-cycle;

**„Do end see" principle**

- **The open fuel cycle option is set as a reference scenario, until decision is not available**
- Key decision nodes at certain time points are identified; a flexible step-by step decision-making process is applied with regard to
  - **the construction of new NPP units at Paks**;
  - **future technological advances**
- **A domestic deep geological repository is necessary regardless of the future decision on the back-end of the fuel cycle**

# National Policy – subpolicies (2-3)

***II. Radioactive waste management policy***

- **LILW-SL** shall be disposed of in domestic disposal facilities
- **LILW-LL, HLW** shall be disposed of in a deep geological disposal facility in Hungary. (Note: If the option of the direct disposal is chosen, SF will be declared as HLW, too.)

***III. Decommissioning policy***

- Decommissioning plan shall be prepared, regularly reviewed and updated to follow up changes in regulation and developments technology.
- Decommissioning plan shall include **appropriate timing and set out** the **final state that has to be achieved** by decommissioning in view of the long-term utilization concept of the site.
- **Possible synergies between site specific decommissioning plans** of different nuclear facilities shall be taken into account.

# Review of the National Policy

- The Atomic Energy Act stipulates that the National Policy **must be reviewed in every five year**
  - the first revision successfully closed at the end of 2020
  - since 2015, no new circumstances emerged, no technical or scientific progress was made, or other technical project has occurred
- During the revision, the **National Policy was amended**
  - to reflect certain minor changes in competencies,
  - the new schedule for the operation of the facilities,
  - to clarify the wording for a better understanding and to create legal consistency.

# National Programme (1)

**The programme specifies the technological implementation and scheduling of the National Policy, as follows:**

- Objectives, general principles, responsibilities formulated by the national policy, the aim and boundary conditions of the national program,
- Classification, generation and inventory of radioactive waste,
- Generation of spent fuel,
- Management of spent fuel,
- Final Disposal of Radioactive Wastes,
- Decommissioning of the Nuclear Facilities,
- Research & Development Activities Related to the Implementation of the National Programme,
- Provision of Transparency, Involvement of the Population into Decision-making,
- Financing.

# National Programme (2)
# Main Actors

**Regulatory authority** (with the tasks of licensing, inspection, enforcement, safety review and *as of 1 May 2022 law-making*) **:** Hungarian Atomic Energy Authority (HAEA)

In case of nuclear facilities (i.e. spent nuclear fuel storage facility) and radioactive waste repositories, the HAEA is the competent oversight authority within the whole country

**Ministry of Technology and Industry** (*as of 23 May 2022 Ministry for Technology and Industry)*

- Responsible for submitting the draft National Policy and Programme to the Parliament and to the Government
- Management of the Central Nuclear Financial Fund

**Waste Management Organization (WMO)**

The Public Limited Company for Radioactive Waste Management (**PURAM**) in 100% state-ownership is the organization designated by the Government to fulfil the tasks associated with the disposal of radioactive wastes, interim storage of spent fuel, closure of the nuclear fuel cycle and decommissioning of the nuclear facilities

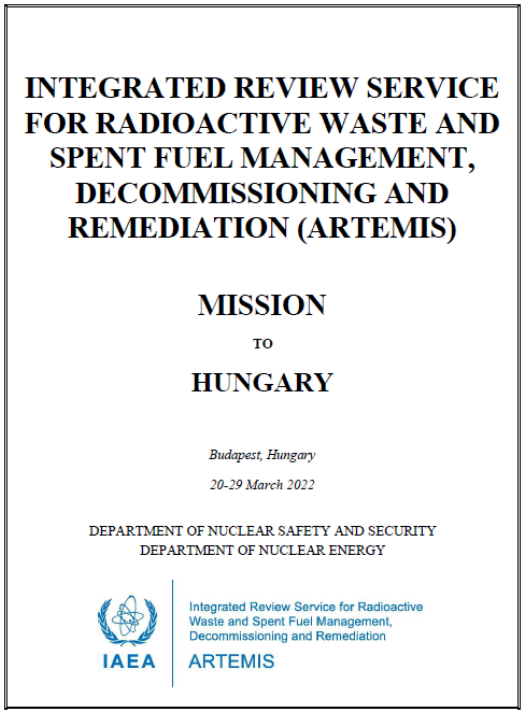
# Review of the National Programme

The preparation of the review is in progress in line with:

- the results of the ARTEMIS mission conducted in March 2022 and
- the implementation of the Paks 2 project

# ARTEMIS mission in Hungary

- Independent review mission (in every 10 year as required by the Council Directive 2011/70/EURATOM)
- *March 2022* - about national frameworks and programmes for the management of SF&RW



**INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT, DECOMMISSIONING AND REMEDIATION (ARTEMIS)**

**MISSION**

**TO**

**HUNGARY**

*Budapest, Hungary*

*20-29 March 2022*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY

IAEA | Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
ARTEMIS

# Results of ARTEMIS mission

➢ **Recommendation:** 1

The Government should provide the mechanism for when and on what basis the decision shall be made on the back-end of the nuclear fuel cycle.

➢ **Suggestion:** 5

1) The HAEA should complete development of safety regulations for management of VLLW including disposal.
2) The Government should consider approving an updated national program without undue delay taking into account the Paks II NPP project, and other relevant and technical circumstances.
3) The HAEA should consider assessing and developing its resources and competences … with regard to the development of deep geological and VLLW disposal facilities. …

➢ **Good Practices:** 1

The PURAM's safety improvement programme at Püspökszilágy repository based on a comprehensive comparison of different options in terms of long term safety assessment and evaluation of radiological risks for workers and the public.

# Financing through CNFF

- **A separate state fund was set up** for financing specific tasks of SF and RW management, as well as decommissioning;
- **Managed by the Ministry of Technology and Industry**;
- **”Polluter pays” principle** – Payments into the fund shall be made by waste producers; the main contributor is Paks NPP;
- The function of the CNFF is financing of the activities related to
  - the final disposal of radioactive waste,
  - the temporary storage of spent fuel,
  - the closure of nuclear fuel cycle and
  - the decommissioning of nuclear facilities.

**CNFF was established by Act CXVI of 1996 on Atomic Energy.**

**The yearly contributions to and expenditures from the Fund shall be defined by the Act on Central Budget.**

# Revenues of the CNFF

- **According to law the following licensees are obliged to contribute to the CNFF:**
  - nuclear power plant,
  - the central budget in the case of nuclear installations operated by a state budgetary institution established by the Hungarian Academy of Sciences, by institutions of higher education or other bodies,
  - any user of nuclear technology producing radioactive waste, that is not mentioned above.

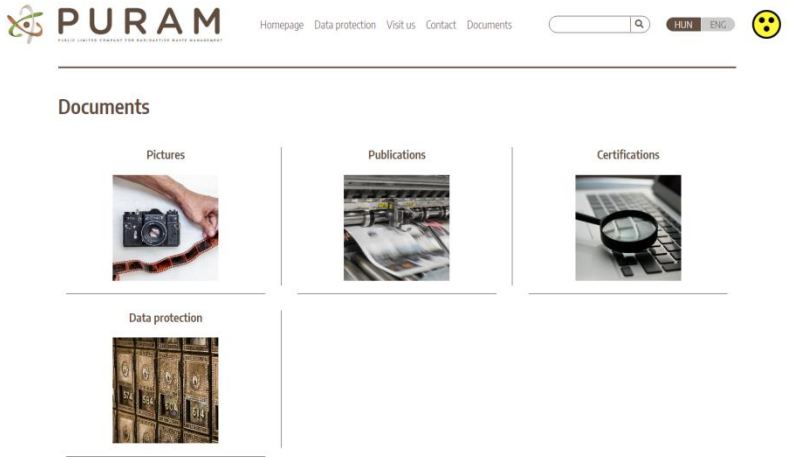
- In order to ensure that the CNFF maintains its value, it receives annually a revalorization central budget subsidy in the amount of the consumer price index published by the Central Statistics Office for the previous year, plus three per cent, based on the average assets of the CNFF in the previous year.

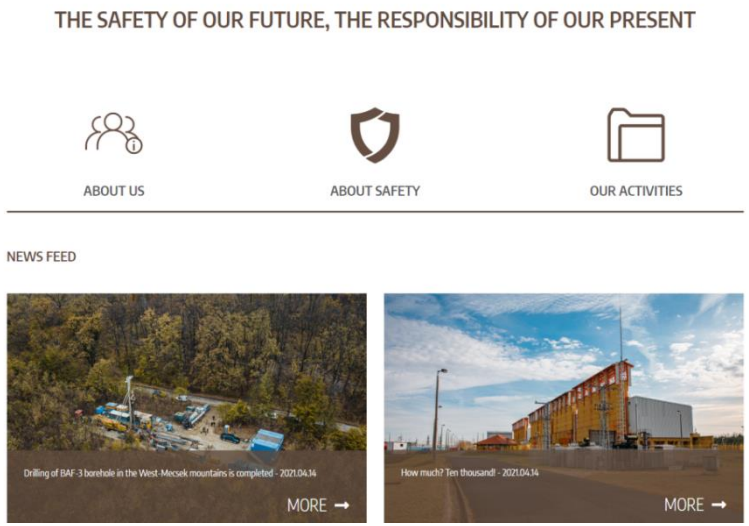
# Expenditures of the CNFF

- The costs related to the following activities:
  - **final disposal of radioactive waste**:
    - investment and development of the National Radioactive Waste Repository in Bátaapáti,
    - investment and security enhancement program of the Radioactive Waste Treatment and Disposal Facility,
    - operating expenses of the radioactive waste repositories,
    - selection of the location of a deep geological repository,
    - contribution to the activities of the local government association.
  - **implementation and operation of facilities for the temporary storage of spent fuel**:
    - extension and renovation of the Interim Spent Fuel Storage Facility,
    - operating expenses of the repository.
  - **decommissioning of nuclear installations,**
  - **closure of nuclear fuel cycle,**
  - **operation of the Public Limited Company for Radioactive Waste Management;**
  - **management of the CNFF.**

# Medium and long-term plans - financing

- **Medium and long-term plans prepared by PURAM**
  - **Calculation and specification** of payments into the CNFF;
  - **Cost estimation for activities** paid from the CNFF: operation of RW disposal and SF storage facilities, future investments, construction of a deep geological repository and other activities (such as financial support to municipal associations)



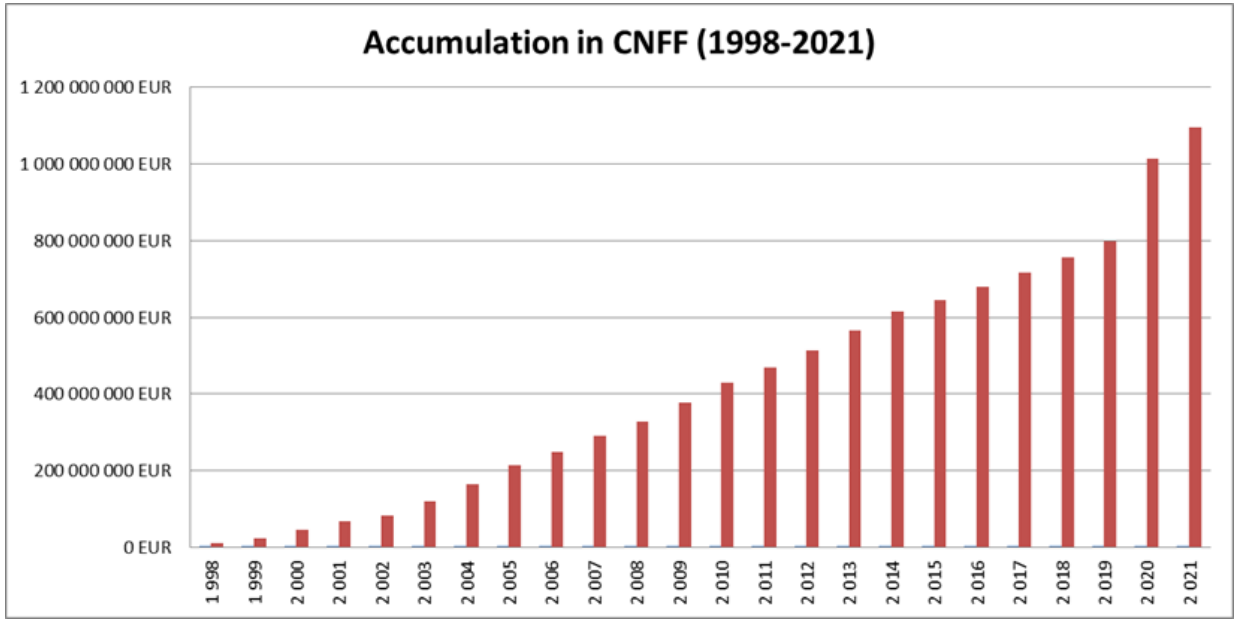



# Accumulation in CNFF

- Main contributor is Paks NPP (according to the reference scenario)
- Consideration on new units contribution to the CNFF is ongoing
- Maintaining the guaranteed value of the CNFF is mandatory by the Act on Atomic Energy
  - Significant budgetary contribution to the CNFF was made in 2020-2021 to maintain its value

1 Euro ~ 395,46 HUF

(22. 06. 2022.)



# Hungarian Atomic Energy Authority (HAEA)

- Supervises **peaceful and safe and secure application of atomic energy** and guarantees for the public
- Responsible for regulatory tasks in connection with use of atomic energy
  - nuclear safety and building activities of nuclear facilities, radioactive waste repositories, transport containers, radiation protection
  - nuclear security of nuclear and other radioactive materials and associated facilities
  - non-proliferation (nuclear safeguards and export control),
  - national registry of nuclear and other radioactive materials,
  - nuclear emergency management.

# Human Resource Development of HAEA

The number of staff of HAEA and the related Department

| Staff | Dec 2013 | Dec 2016 | Dec 2019 | March 2022 |
|---|---|---|---|---|
| **HAEA** | 80 | 164 | 161 | 208 |
| **Department Oversight of RW&SF** | - | - | 13 | 17 |

The number of employees has been increased both throughout the whole organization of HAEA and in the special Department earmarked to deal with SF&RW management issues.

Main aims of the extension on HAEA level

to ensure the licensing activities of the new units

to provide sufficient human resource

– **for oversight of repositories (from 1 July 2014)**

– for radiation protection (from 1 Jan 2016)

# Changes of the legal status - International requirements

- International requirement for the independence of public authorities
- EU Directives (2011/70/EURATOM, 2013/59/EURATOM, 2014/87/EURATOM)
- International Atomic Energy Agency (requirements, recommendations, missions - IRRS mission 2015, 2018)
- The International Atomic Energy Agency and the European Commission have indicated that the HAEA should be granted greater organisational independence.

The HAEA needed to be strengthened in the light of international legal frameworks, recommendations and future tasks.

# The legal framework for preparing the transformation

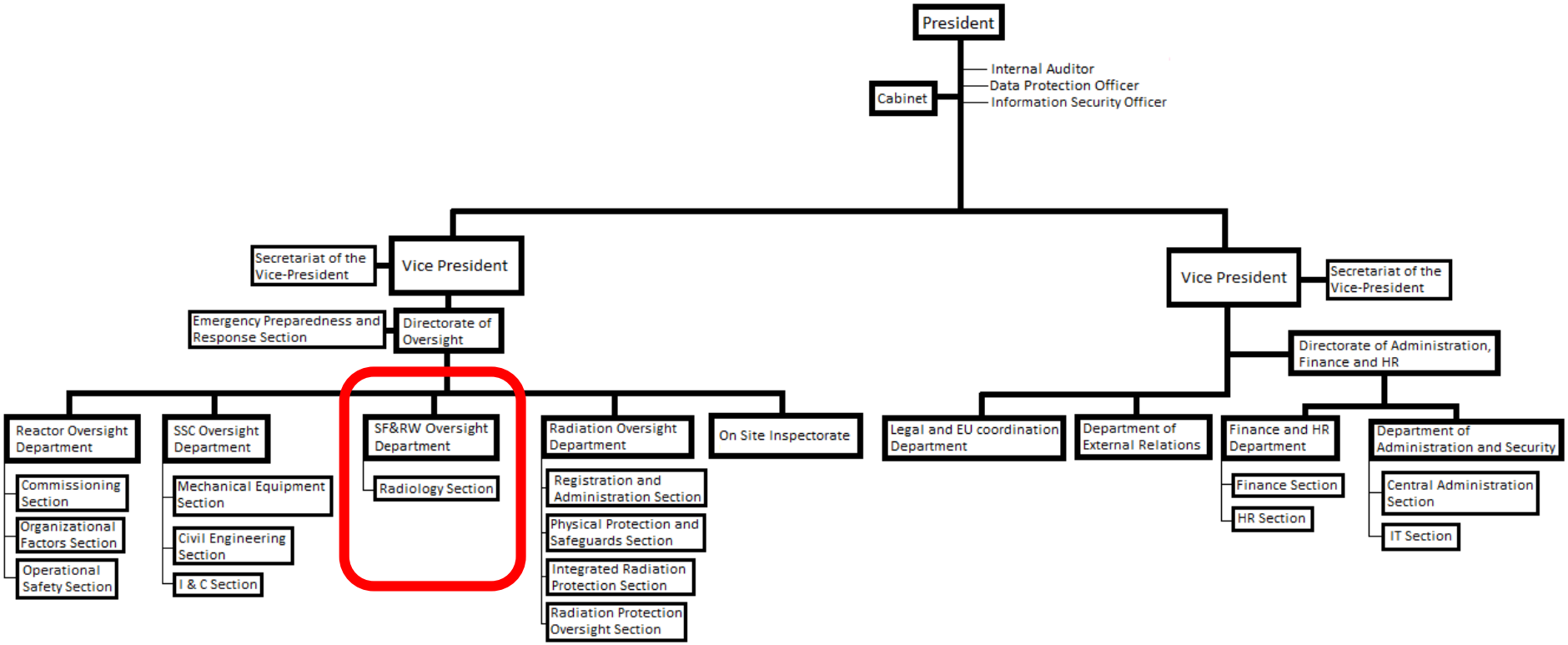
- It was an important goal that the HAEA would be an independent, modern and efficient organisation and a competitive employer in the labor market, while meeting EU requirements
- The solution was to make the HAEA an organisation with a special status (there have been other examples in Hungary: Hungarian Energy & Utilities Regulatory Agency, Economic Competition Office, etc.)
- The Hungarian Energy & Utilities Regulatory Agency has provided a practical example for this transformation
- In amending the Act on Atomic Energy, it was an important legislative intention to settle all the issues that arose in the long term
- The European Commission has been notified about the amendment (no objections raised)

# Special legal status in practice

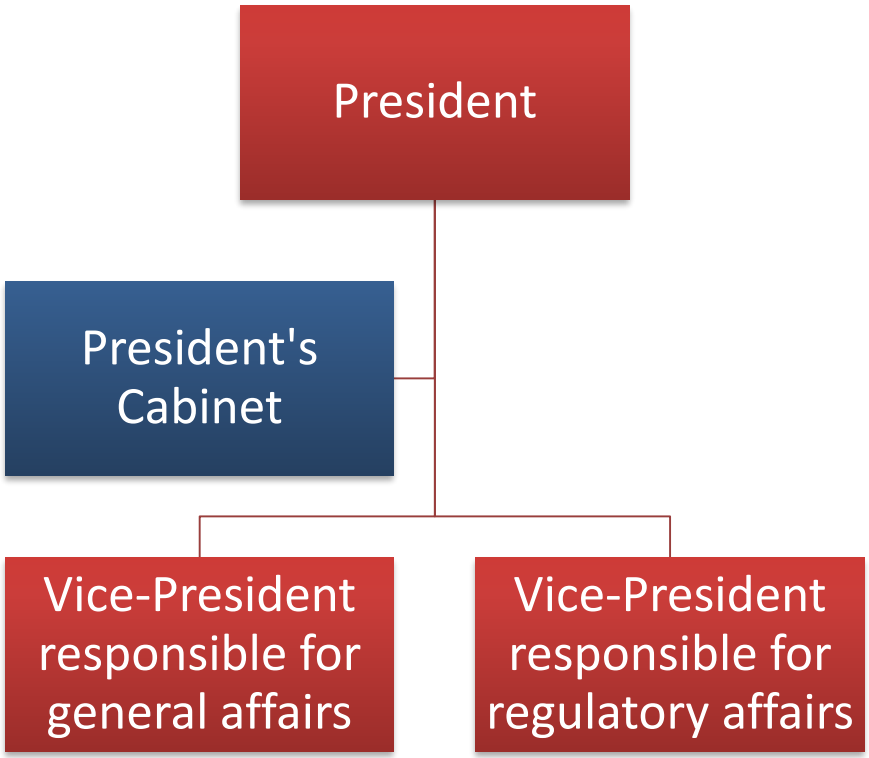
- HAEA is directly accountable to Parliament
- HAEA is led by a president, appointed for 9 years
- President can appoint up to two vice-presidents
- HAEA a central budgetary body with an independent heading in the annual budget act
- HAEA has full autonomy on decisions related to its organization (headcount, structure, salaries, etc.)

As a result, HAEA becomes a more independent, flexible authority able to better adapt to changing circumstances, allowing for more effective and efficient operation.

# Reorganization of HAEA



# Special status in practice




- From January 2022, the organisation is led by a President, who can choose and appoint the two Vice-Presidents
- The President's term of office is 9 years, he or she may be removed from office only in cases specified by law
- The authority's tasks will be carried out in the existing departmental structure

# A stronger regulatory role

Regulations

Guidelines

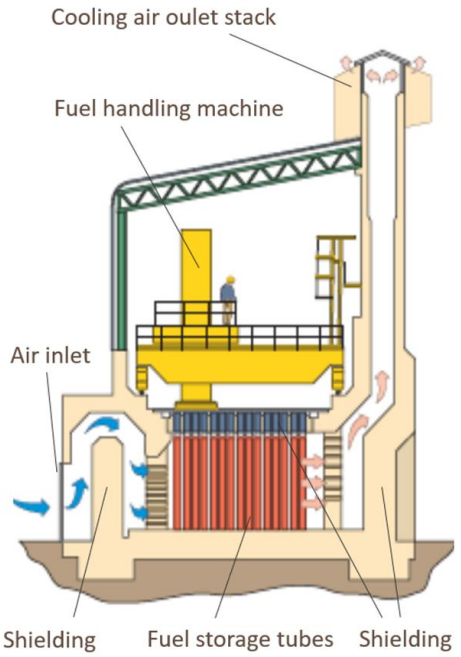
- From May 2022, the HAEA became a law-making body - organisational set-up, defining tasks, internal and external processes
- The new task also means a new opportunity - strengthens the regulatory role of the Authority, ensuring fast and efficient regulatory action

# *SF & RW MANAGEMENT*

- Extension and operation of the Spent Fuel Interim Storage Facility (SFISF) in Paks
- Extension and operation of National Radioactive Waste Repository (NRWR) in Bátaapáti
- Operation and modernization & safety upgrading of the Radioactive Waste Treatment and Disposal Facility (RWTDF) in Püspökszilágy
- Introduction of VLLW category
- Siting a future HLW/SF repository in the Mecsek region
- Remediation activities of the former uranium mine

# Extension and Operation of SFISF

- Modular vault dry storage (MVDS) type,
- SFAs in tubes in inert $N_2$ atmosphere, cooling is provided by passive airflow

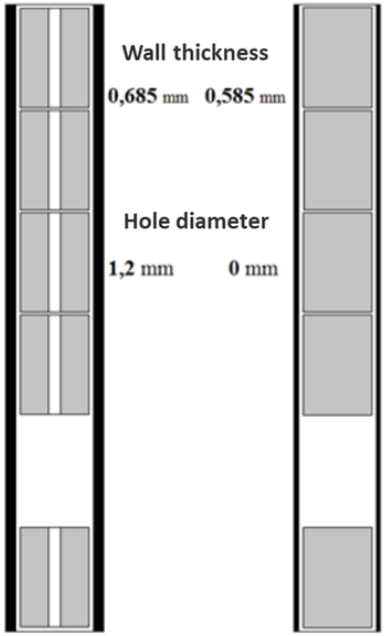



# Major Events Since Last RM

- The operational licence has been issued for 1-24 vaults in 2018 and modified (new fuel type) in 2020
- A resolution has been issued for periodic safety review in 2018
- INES-1 event occurred in 2021
- The extension of the facility is ongoing
- The concept for leaking fuel management has been developed

# Introduction of New Fuel Type

- A new fuel type is introduced in Paks NPP
  - The outer diameter of the fuel rods is reduced (9.1 mm => 8.9 mm) and the wall thickness is also reduced with 0.1 mm
  - There is no hole in the pellets of the new fuel, so the uranium mass is increased to 128.8 kg
  - With this modification the number of spent fuel assemblies will be reduced




- It is a requirement before introducing a new fuel type in the reactors to prove the feasibility of the interim storage of the irradiated new fuel.
  - The environmental protection licence was modified
  - The operational licence was modified (2020)

**The requirement is fulfilled**

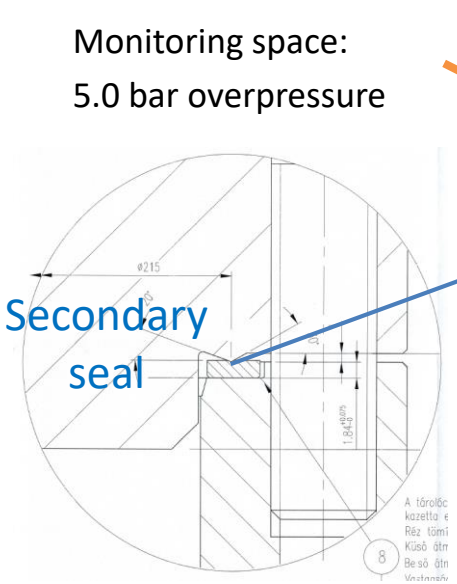
# Periodic Safety Review

- The resolution on the Periodic Safety Review was issued in 2018.
- All identified actions have been accomplished.
- Some examples for improvements:
  - Evaluation of the effects of hydrochloric acid, $Cl_2$ or $NH_3$ discharge as a consequence of a traffic accident
  - Update of extreme meteorological conditions taking into account climate change models
  - Update the external hazard assessment with the event combinations of external human actions

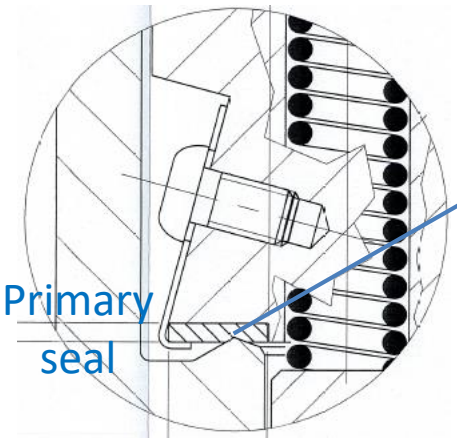
# Introduction of Nitrogen Monitoring System

Monitoring space:
5.0 bar overpressure

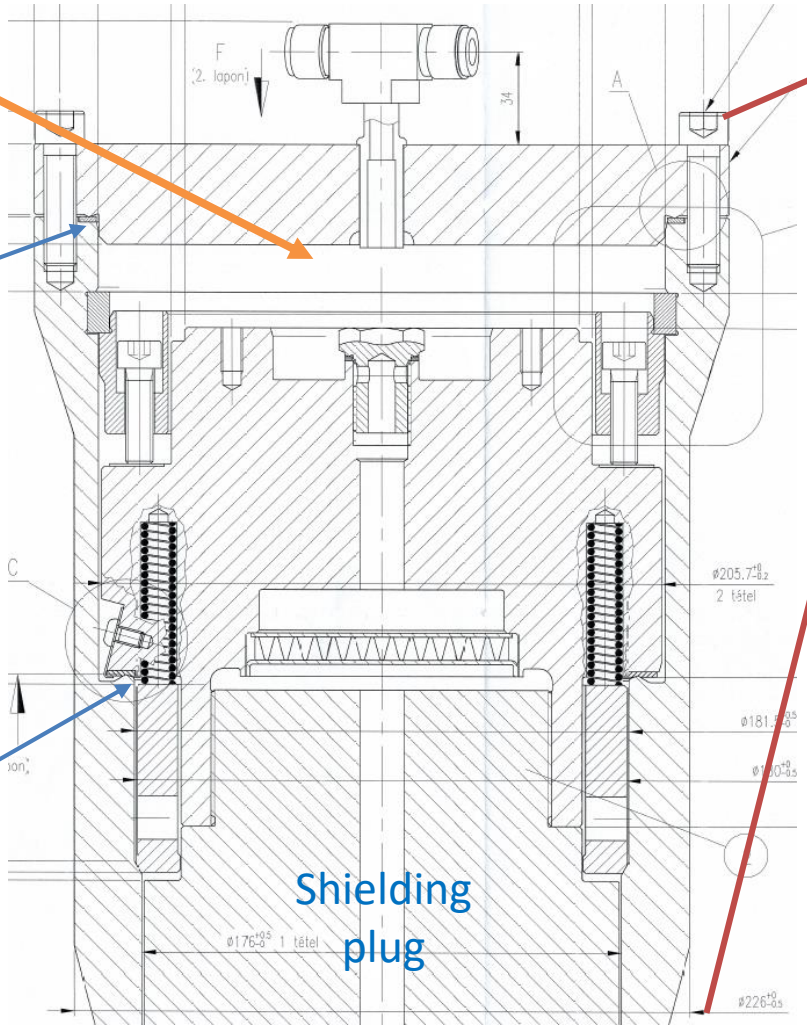
Storage tube:
0.24 bar overpressure



Secondary seal



Primary seal



Shielding plug

Spent fuel assembly

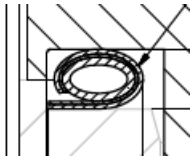
Storage tube

# Event Concerning Nitrogen Monitoring System

- On the 11th of February 2021, the overpressure of the monitoring space of group of storage tubes no. 18/7 has decreased close to the operational limit
- The operator refilled the monitoring space
- This was the 5th refill of the monitoring space no. 18/7
- Based on the requirements in the operational limits and conditions before the 5th refill a detailed investigation programme should have been implemented for evaluating the sealing properties of the 68 storage tubes in group no. 18/7
- The event was classified as INES-1, because of violating the operational limits and conditions

# Consequences and Corrective Actions

- Consequences of INES-1
  - There were no airborne releases and liquid discharges to the environment
  - Neither the workers, nor the public received extra radiation dose
- Decided corrective actions
  - The specification of the copper sealing rings had been refined
  - In the scope of the currently ongoing extension the secondary sealing concept is modified to ‚C' shape metallic sealing ring from flat copper sealing ring



  - The administrative procedures have been specified and clarified for the vacuuming, nitrogen filling and sealing actions
  - The underlying assessments of the monitoring overpressure calculations were reviewed and the operational limits and conditions have been clarified

# Status of Extension

- The construction of the reinforced concrete structures are ongoing according to the schedule
- The manufacturing of mechanical structures (loading deck structures, holding structures of the storage tubes etc.) has been started
- The manufacturing licence application of the storage tubes is performed in two stages
- According to the current plans, the commissioning of the 4 new modules shall be finished in 2025, which is achievable according to the updated schedule

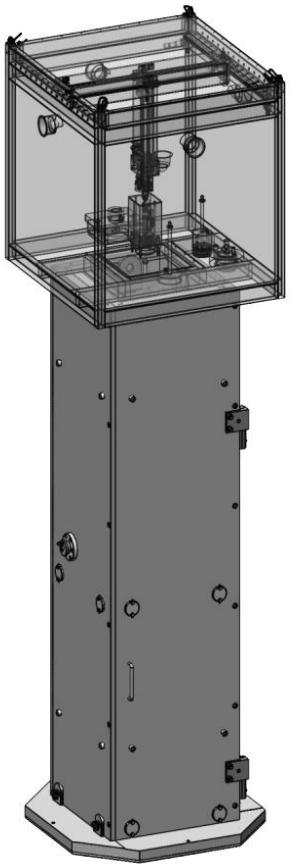
# Concept for Leaking Fuel Management

- The concept is based on an international reference, which was developed by Höfer&Bechtel and GNS
- The basis is that, the spent fuel assemblies with detectable level of leakage will be managed in the reactor hall of Paks NPP after the shutdown of the units
- The main management steps are:
  - Vacuum drying
  - Encapsulation and closure with welding
  - Transfer to a new building of the SFISF in a dual purpose cask

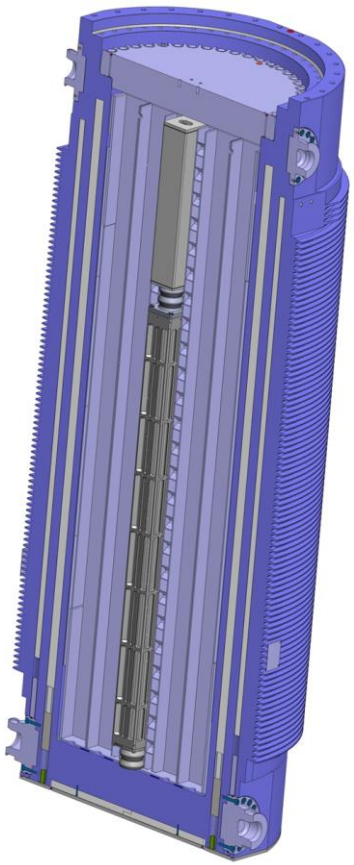
# Concept for Leaking Fuel Management

Capsule for the leaking fuel assembly

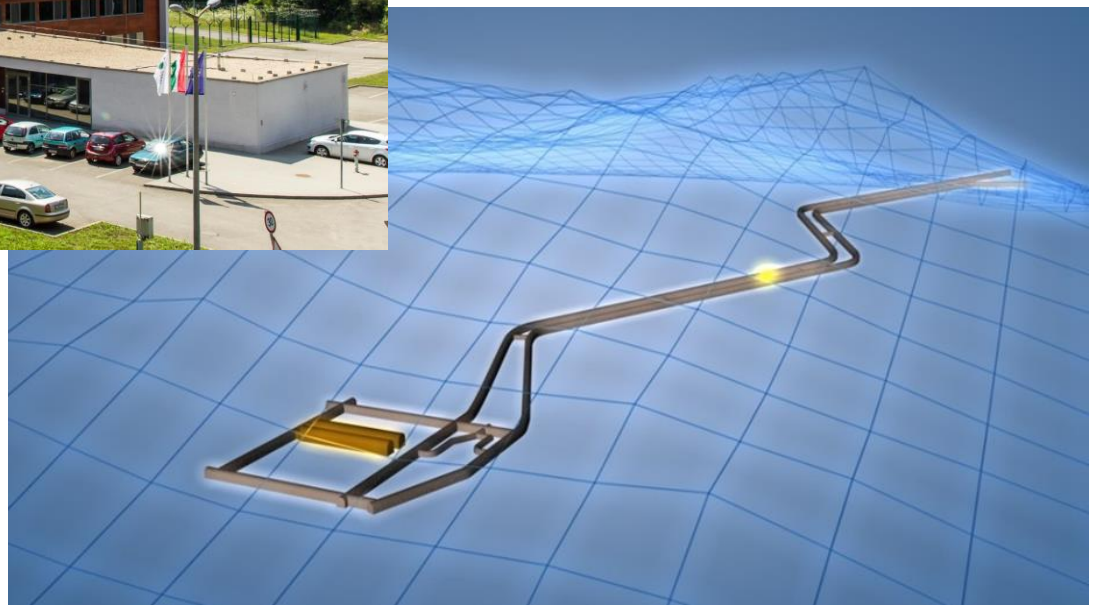
'Gas box': the capsule is heated (>150 °C ) and vacuum dried here (remote controlled)



Castor V/19 cask with the capsule and a spacer



# Extension and Operation of NRWR



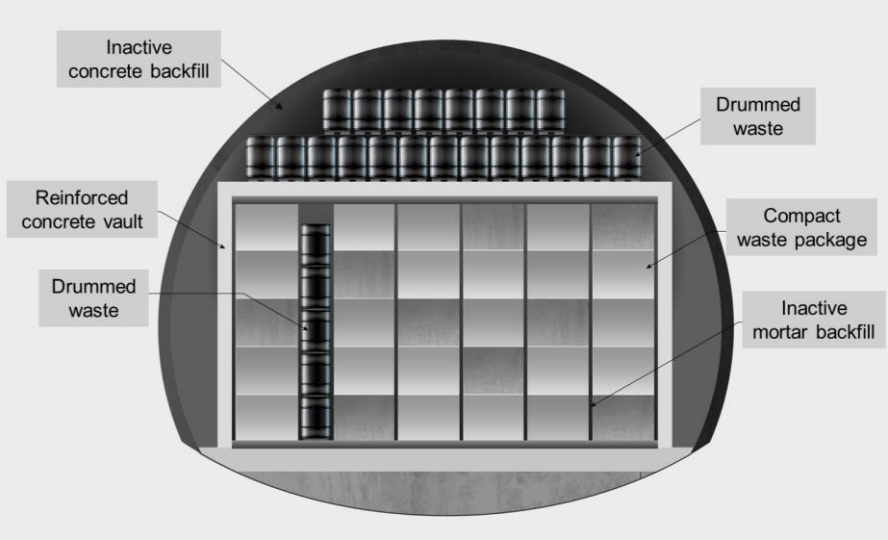
# Significant Events Since the Last RM

- Status of implementing the new disposal concept
- Operational licensing
  - takeover from RWTDF,
  - new entrance point
- Construction licensing
  - new cross section for western chambers
  - new disposal concept for spent ionexchange resins
  - new extension concept
- Periodic Safety Review

# Commissioning of Cementation Technology at Paks NPP

- The conditioning has not been started yet (all the liquid wastes are stored in tanks)
- The commissioning of the cementation technology (plant) is ongoing at Paks NPP
- The recipe for all waste streams has been developed to be able to meet the respective WAC

# Complex Inactive Test of Disposal Operations

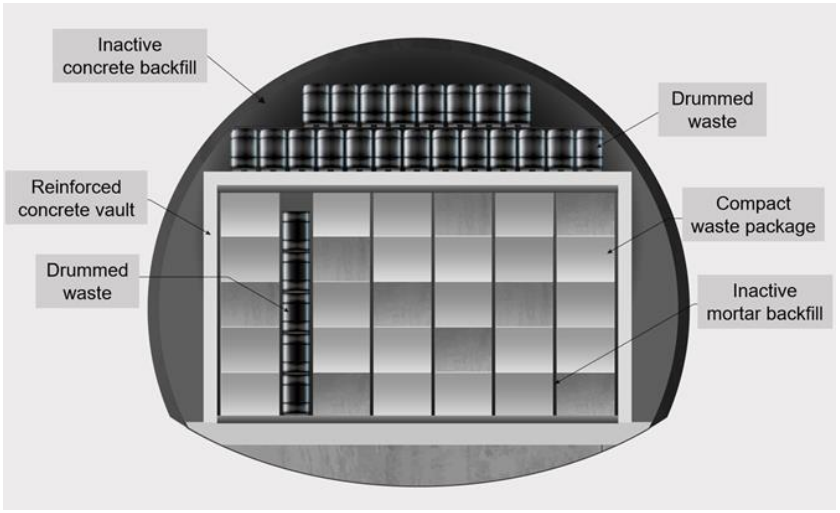


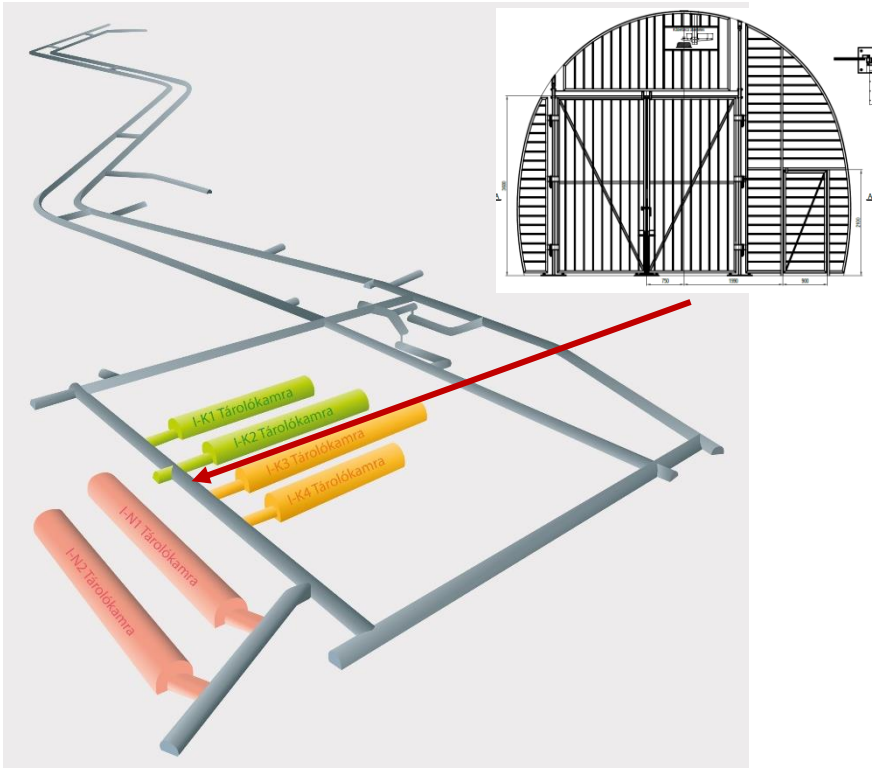


Inactive test of emplacement activities

# Modification of the operational licence

- Main reasons
  - Takeover of some waste from RWTDF (the waste inventory has been updated and the takeover protocol to check the compliance of the WAC has been extended)
  - New underground entrance point

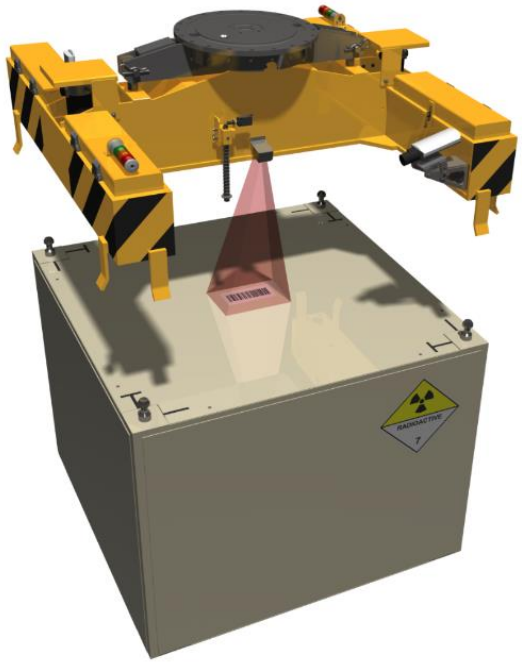


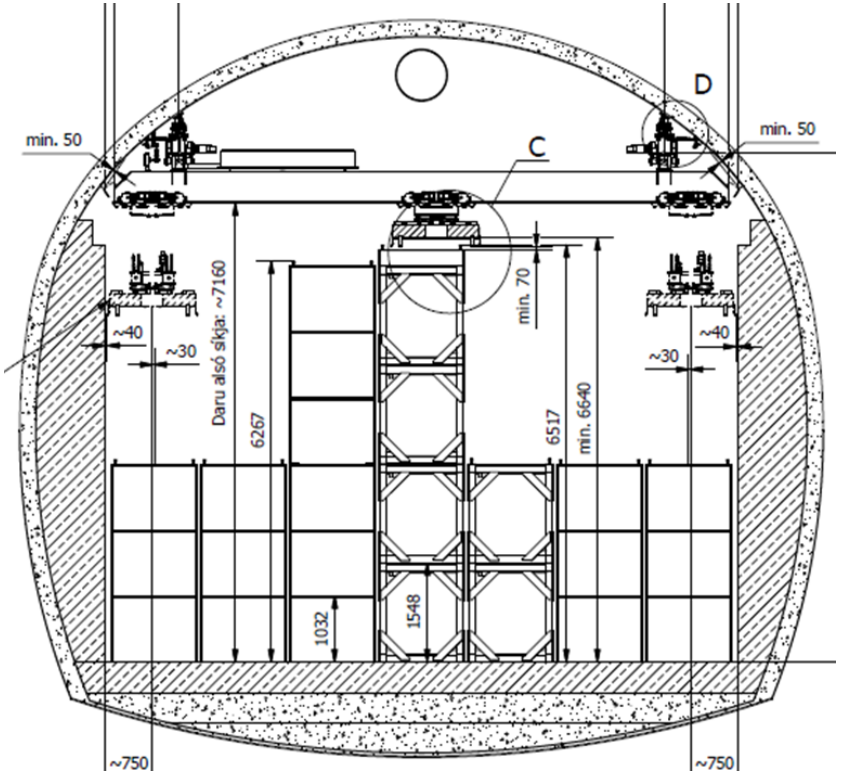

The licence was issued on 18th March 2022

# Modification of the construction licence 1

- Scope of the licence application
  - New disposal concept for chamber I-K4



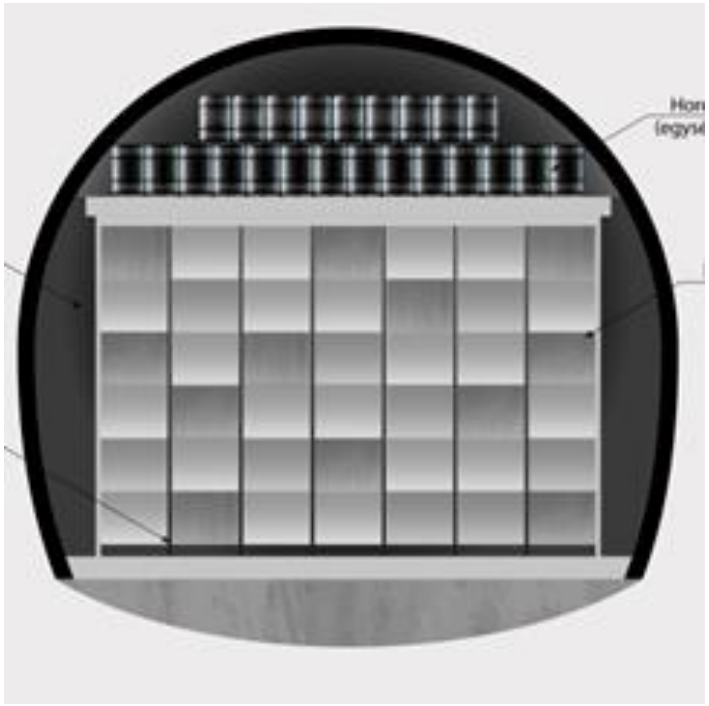
Disposal by crane



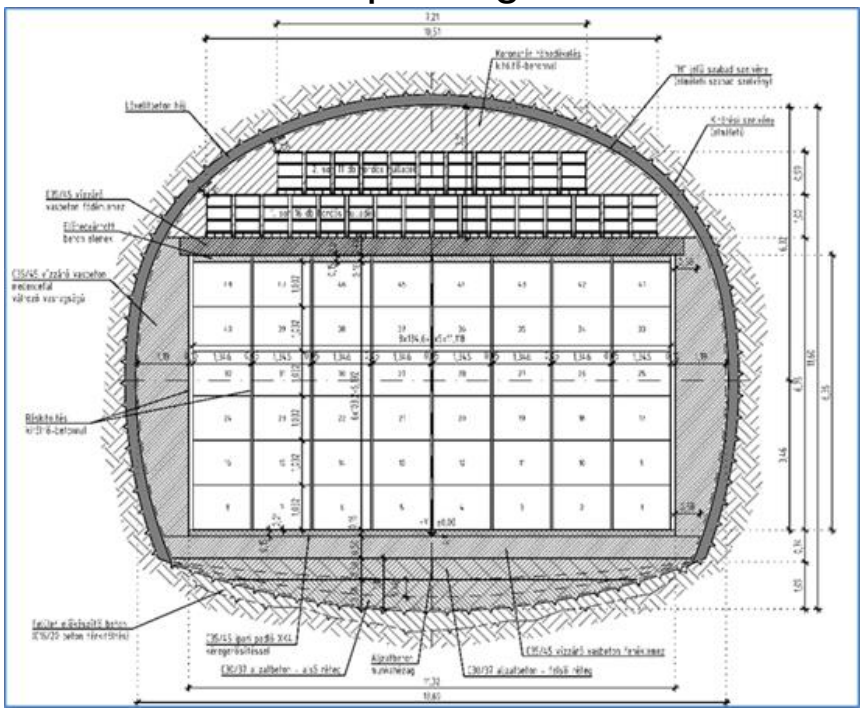
# Modification of the construction licence 2

- Scope of the licence application
  - New disposal concept for chamber I-K4
  - New cross section of chambers I-N1 and I-N2

115 $m^2$ => 7×6 packages + 23 drums



135 $m^2$ => 8×6 packages + 27 drums



# Modification of the construction licence 3

- Scope of the licence application
  - New disposal concept for chamber I-K4
  - New cross section of chambers I-N1 and I-N2
  - New extension direction for II. chamber field

# Operation and Safety Upgrading in RWTDF

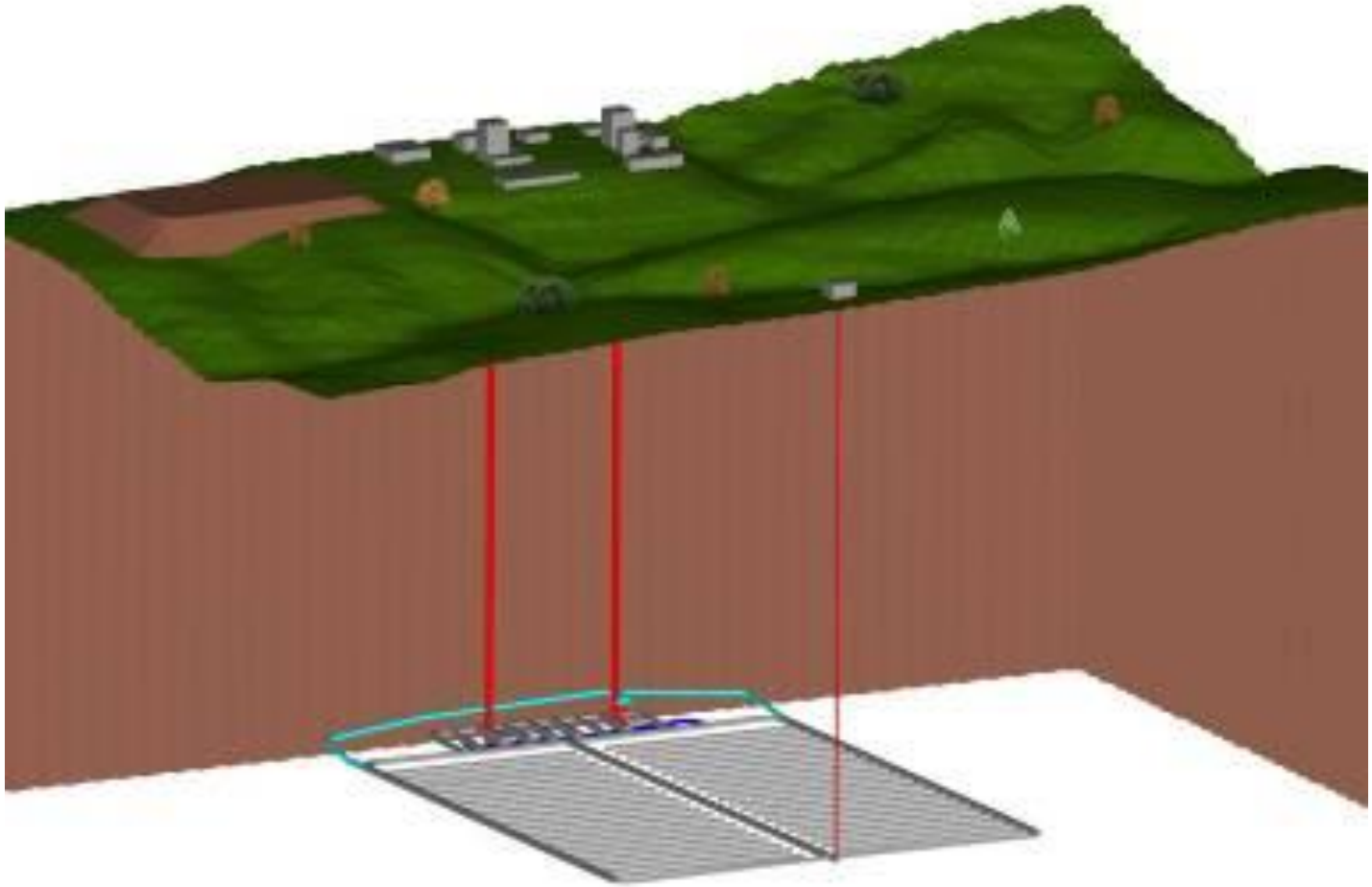
# Status of the Safety Upgrading Programme

- A light structure hall has been constructed above the I. row of vaults to provide weather protection
- An inner containment (to provide safe working conditions) and the necessary technologies (e.g.: crane, ventillation, radiation protection) have been installed (covering 4 vaults)


# Preparation for Safety Upgrading

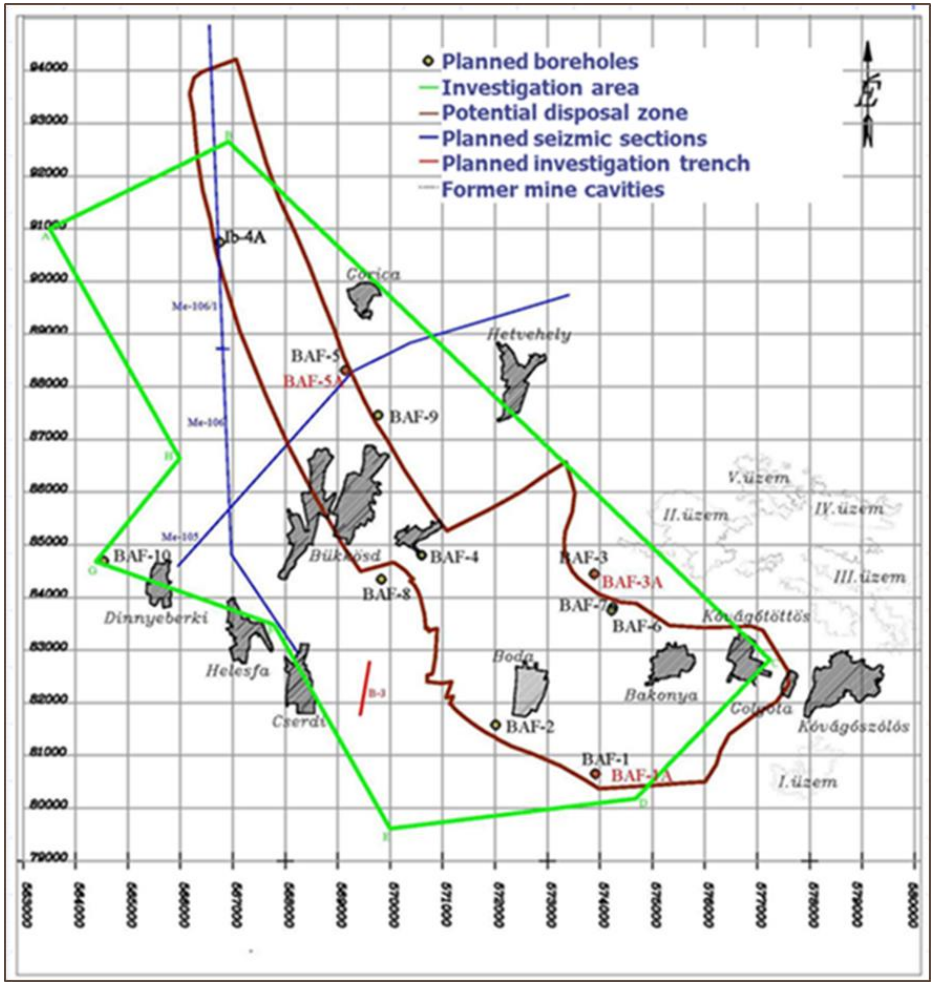
- Re-characterization and if necessary repackaging of wastes to be transported to the NRWR and transporting those to free up capacity in the RWTDF
- Preparation of the modification licence application and supporting documents for the authorization of the retrieval
- Purchasing of some tools and equipment (demolition hammer, lifting device etc.)
- Finalization of the detailed rules of procedures and training of the staff

# Siting of Deep Geological Repository



# Site Survey Framework Programme

- In 2018 the 3rd annex of the Repository Safety Code has entered into force => the requirements became more specific for site selection
- Based on these specific requirements an R&D framework programme was compiled by PURAM and the HAEA issued the site survey framework programme licence in 2019



# Stepwise Site Selection Process

- I. phase: general data acquisition in order to rank candidate areas
- II. phase: designation and characterization of the site
- III. phase: preparations of the URF

- The site survey framework programme identifies the goals to be met at the end of each phase
- For each phase more specific site investigation plan has to be submitted for licensing (public hearing is organized as part of the licensing process)
- At the end of each phase site investigation syntheses report and a preliminary safety case has to be compiled and the site survey framework programme has to be updated if necessary

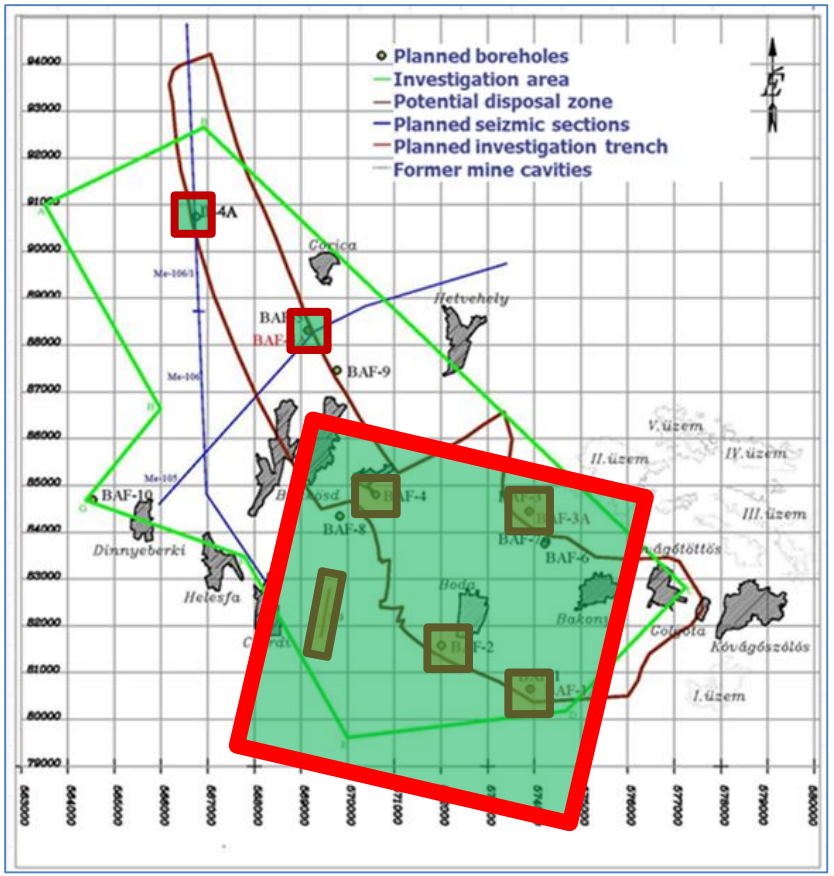
# Main Field Activities of Site Selection

## Recently finished

- BAF-1,-1A borehole (2014): 474.6 m
  BAF-1Af borehole (2017): 1030.7 m
- BAF-2 borehole (2014): 913.8 m
- B-3 trench (2015-16)
- BAF-3 borehole (2020-21): 845.2 m
  BAF-3A borehole (2021): 1319.0 m
- BAF-4 borehole (2020-21): 901.1 m

## Planned

- 3D seismic survey (2022) 49 km$^2$
- BAF-5 borehole (2023-24) 850 m
  BAF-5A borehole (2023-24) 1300 m
- Ib-4A borehole (2023-24) 1300 m



# Preparation for VLLW management

- Currently, there is no disposal facility for VLLW in Hungary, therefore the VLLW is managed as part of the low-level wastes
- The detailed legislation on safety aspects of a VLLW disposal facility has been drafted
- Once the disposal route and WAC will be available for VLLW, the whole management chain will be developed in details
- A preliminary disposal concept has been developed by PURAM based on
  - International examples (CIRES, El Cabril),
  - Legislative requirements for hazardous waste disposal,
  - Draft safety requirements for VLLW disposal

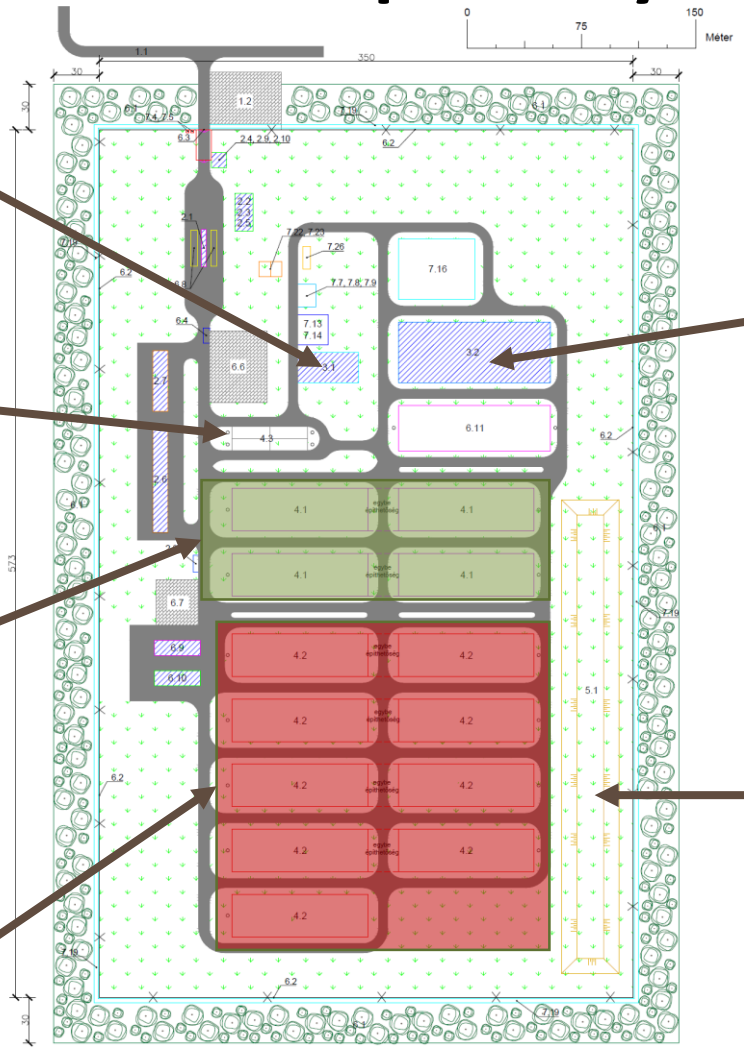
# Overall Layout of the Planned VLLW Repository

Storage building for soft waste

Concrete vaults for mixed waste disposal

Disposal trenches for soft waste

Disposal trenches for hard waste




Storage building for metallic waste

Dump of excavated soil

# Time Schedule of VLLW Repository Implementation

- Finalization of the legislative background for licensing and implementing a VLLW repository (2023)
- Investigation of potentially suitable sites and updating the conceptual plan for the facility (2025)
- Decision in principle of the Hungarian Parliament for starting the preparation of implementation (2025)
- Preparing all necessary documentation (Environmental Impact Assessment, detailed designs, safety cases etc.) and conducting the licensing process
- Constructing and putting into operation the facility ~2030s

# Overview matrix (1)

| | Long-term Management Policy | Funding of Liabilities | Current Practices / Facilities | Planned Facilities |
|---|---|---|---|---|
| **Spent Fuel** | a) Deep geological disposal of SF from the Paks NPP (reference scenario is direct disposal, but no decision on the back-end yet) | a) SF from the Paks NPP: CNFF (payment from the Paks NPP during its operation) | a) SF of the Paks NPP: Storage in the SFISF (Paks) | Future HLW/SF repository |
| | b) Repatriation of SF from research reactors | b) SF of research reactors: State Budget through the operating institute, when cost arisen | b) SF of research reactors: Repatriation/Storage on-site | |
| **Nuclear Fuel Cycle Waste** | Underground disposal in the NRWR (Bátaapáti) / Deep geological disposal / Landfill type disposal of VLLW | CNFF (payment from the Paks NPP) | Storage on-site and in the surface facility of NRWR | NRWR further chambers are constructed in parallel with the operation/ Future HLW/SF repository / Future VLLW repository |
| | | | Disposal in the underground chambers of NRWR | |
| **Non-power Waste** | Near surface disposal in the RWTDF (Püspökszilágy)/ Transfer of some waste to NRWR / Deep geological disposal | CNFF (Fee paid by the licensees) | Disposal and storage in the RWTDF (Püspökszilágy) | RWTDF / Extension of NRWR / Future HLW/SF repository |

# Overview matrix (2)

| | Long-term Management Policy | Funding of Liabilities | Current Practices / Facilities | Planned Facilities |
|---|---|---|---|---|
| **Decommissioning Liabilities** | Underground disposal in the NRWR (Bátaapáti)/ Near surface disposal in the RWTDF (Püspökszilágy)/ Deep geological disposal / Landfill type VLLW repository | CNFF (payment from the Paks NPP during its operation/ State Budget through the operating institute for research reactors, when cost arisen) | | NRWR further chambers are being constructed in parallel with the operation/ RWTDF / Future HLW/SF repository / Future VLLW repository |
| **Disused Sealed Sources** | Near surface disposal in the RWTDF (Püspökszilágy)/ Deep geological disposal | CNFF (Fee paid by the licensees) | Disposal (of short-lived sources) and storage (of long-lived) in the RWTDF (Püspökszilágy) | RWTDF / Future HLW/SF repository |

# Back-end of the fuel cycle – Paks II. NPP

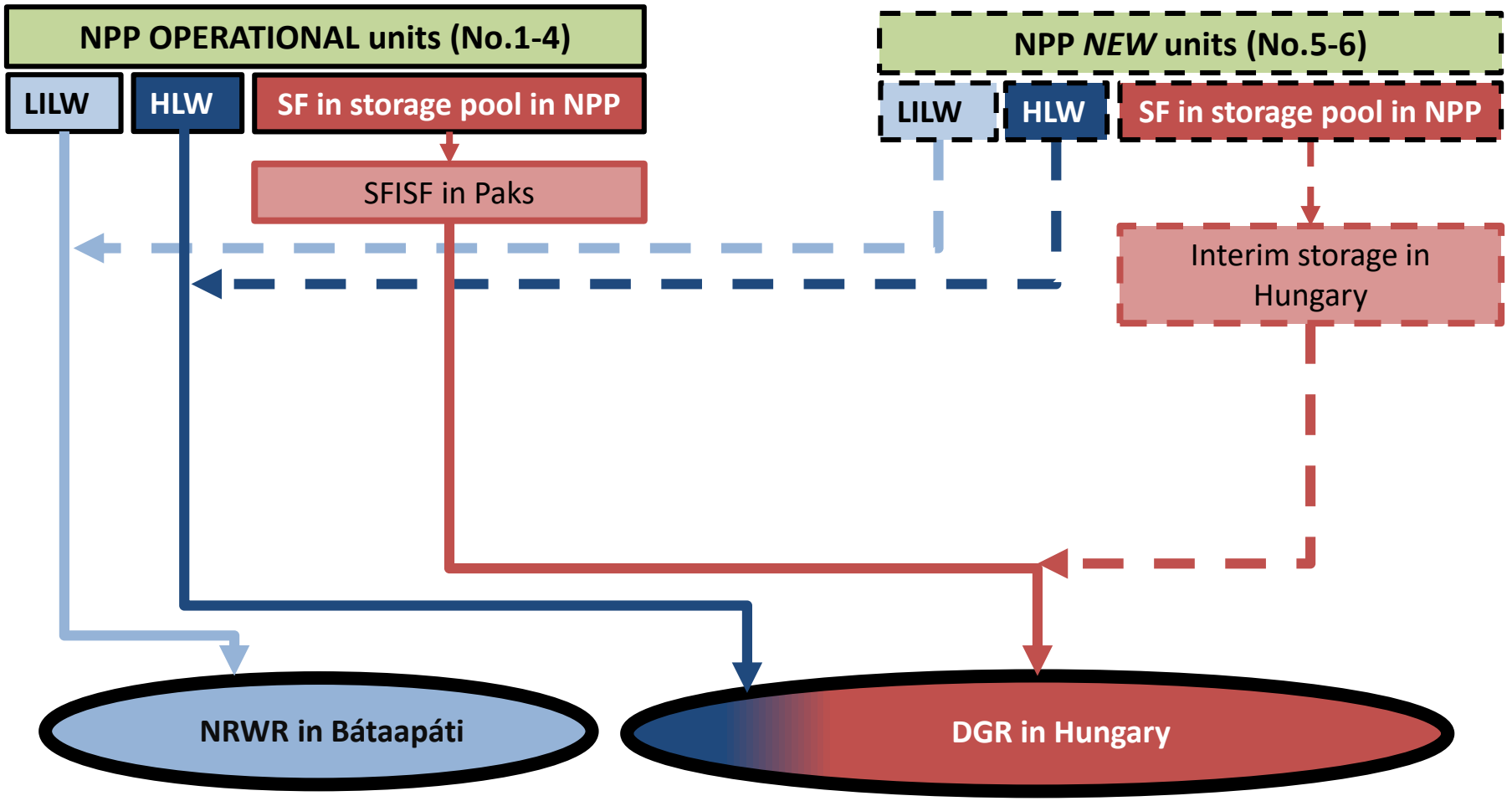
- According to the Nuclear Safety Code of Hungary the construction licence application shall include a concept of the strategy of the long-term spent nuclear fuel management and storage
- This concept is in line with the Hungarian National Programme for SF and RW management
- The basic scenario for the interim storage of SF is the dry cask storage in Hungary after 10-year cooling in the spent fuel pool of the units
- There are also alternative scenarios including interim storage and/or reprocessing of the SF
- SF generation rate is approx. 145 pcs. per 18 months, ~6100 pcs. altogether
- Reference scenario for the back-end is direct disposal of SFA

# Radioactive waste management at Paks II.

**Designed waste management technologies:**

- **Liquid radioactive waste**
  - Treatment of radioactively contaminated drain water with ion exchange resins and evaporation
  - Spent sorbent, still residue and sludge cementation
- **Solid radioactive waste**
  - Sorting
  - Preliminary compaction
  - HP compaction
  - Registration, characterization, clearance
- **Final waste packages**
  - Drums (200 $dm^3$): 62 pcs./year from one power unit
  - Containers (1,5 $m^3$): 25 pcs./year from one power unit
  - Capsules (with HLW): 360 pcs./ 60 years from one power unit

# Consideration of Paks II. in the national programme – refrence scenario



# Remediation activities of the former Uranium mine

- Responsible organization: Mining Property Utilization Ltd. (100 % state-owned company)
- First licence including radiation protection prescriptions was granted by the competent regional environmental authority in 1998, which was modified in 2018

  Limit values for discharging from the legacy site:

  Water: Ra-226: 3.1 E+10 Bq/a, U-234, U-235, U-238: 2.7 E+11 Bq/a, Po-210: 3.8 E+09 Bq/a

  Air: U-234, U-235, U-238: 2.0 E+09 Bq/a

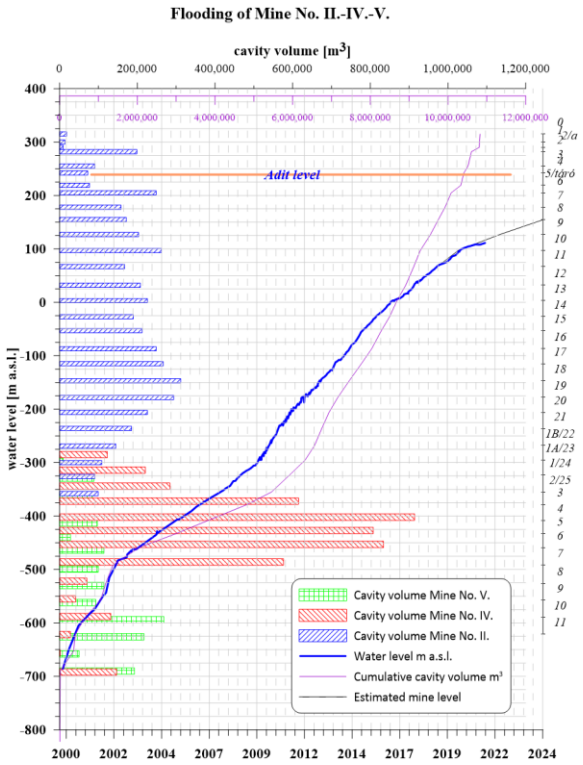
- Although the remediation work was finished at the end of 2008 certain long term activities have to be continued: water treatment (by-product: $UO_4 2H_2O$), environmental monitoring, maintenance





# Current and further tasks

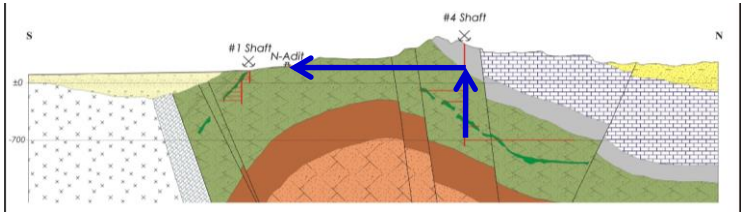
- Due to flooding of the underground mining openings an enlargement of the water management system and mine water treatment plant was inevitable, the implementation was finished in 2021.

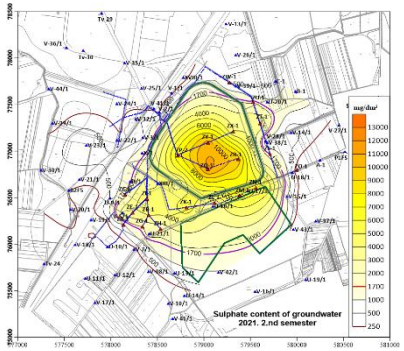



Mine water contaminated with U:

- Before 2015: cca. 0.5 Million $m^3/a$
- After 2025: cca. 1.0 Million $m^3/a$

Ground water with high salinity at the tailings ponds area: cca. 0.5 Million $m^3/a$



We hope that our 7th National Report and the written answers to the 60 questions Hungary received, as well as our presentation today convinced the Review Meeting about our strong commitment to fulfil Hungary's obligations under the Joint Convention.

THANK YOU FOR YOUR ATTENTION!

# 6th REVIEW MEETING - CHALLENGES

1. Continue according to planned steps for increasing SFISF storage capacity. (**ongoing** and **still a challenge (SC)**)
2. Start safety upgrade of RWTDF (implementation of infrastructure for enabling enhancement of safety: vault content recovery and reconditioning) according to set milestones (2017-2022) (**ongoing** and **SC**)
3. Commission disposal chambers in NRWR according to set milestones. (**ongoing** and **SC**)
4. Remediation - Enlargement of the water treatment plant in order to manage the volume of mine water that will be increased after the complete flooding of certain underground mining openings in the former uranium mine according to set milestones (2019-2020) (**completed**)
5. New NPP units Step by step integration into the Hungarian SF and RW management (**ongoing** and **SC**)

# 6th REVIEW MEETING - SUGGESTIONS

1. Consolidate plan for creating a deep disposal facility for SF and HLW (site selection, URL, conception, construction and commissioning) in considering regulatory decisions, technical skills and requirements, and public consultation will be needed at each step of the process. (**partially completed**)
2. To elaborate in the next National report on the policy of VLLW and clearance criteria and operational procedures. (**completed, the implementation (VLLW) is SC**)