Radioactive Waste Management at Paks NPP

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Facilities and Activities in Hungary

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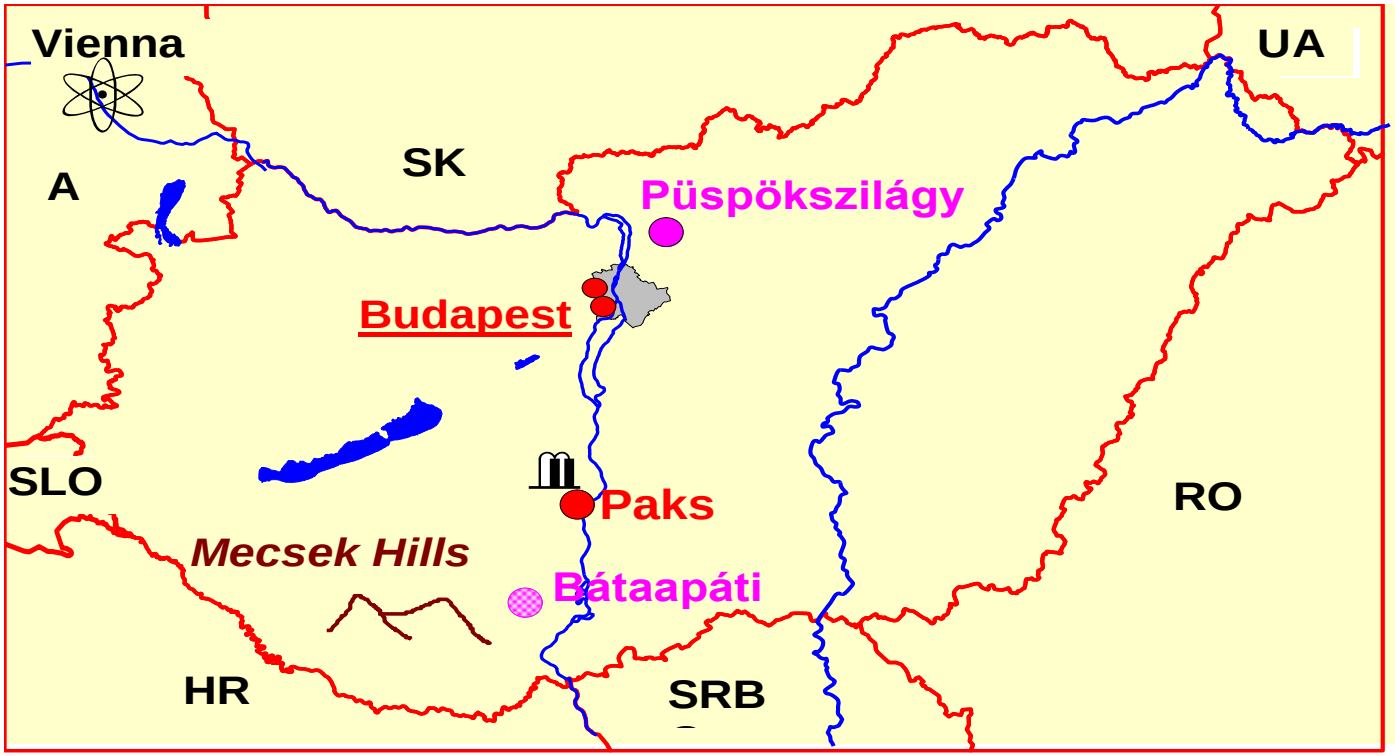

Budapest: - Budapest Research Reactor
- Training Reactor at the Budapest University of Technology and Economics

Püspökszilágy: - Radioactive Waste Treatment and Disposal Facility (RWTDF)

Paks: - Nuclear Power Plant
- Interim Spent Fuel Storage Facility (ISFSF)

Bátaapáti: - National Radioactive Waste Repository (NRWR)

Mecsek Hills: - Area investigated for HLW repository

Introduction

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The radioactive wastes generated in Hungary mainly originate from the operation of Paks NPP.

This facility provides 40 % of the produced electrical energy of Hungary, based on Soviet-design WWER-440/213 type reactors

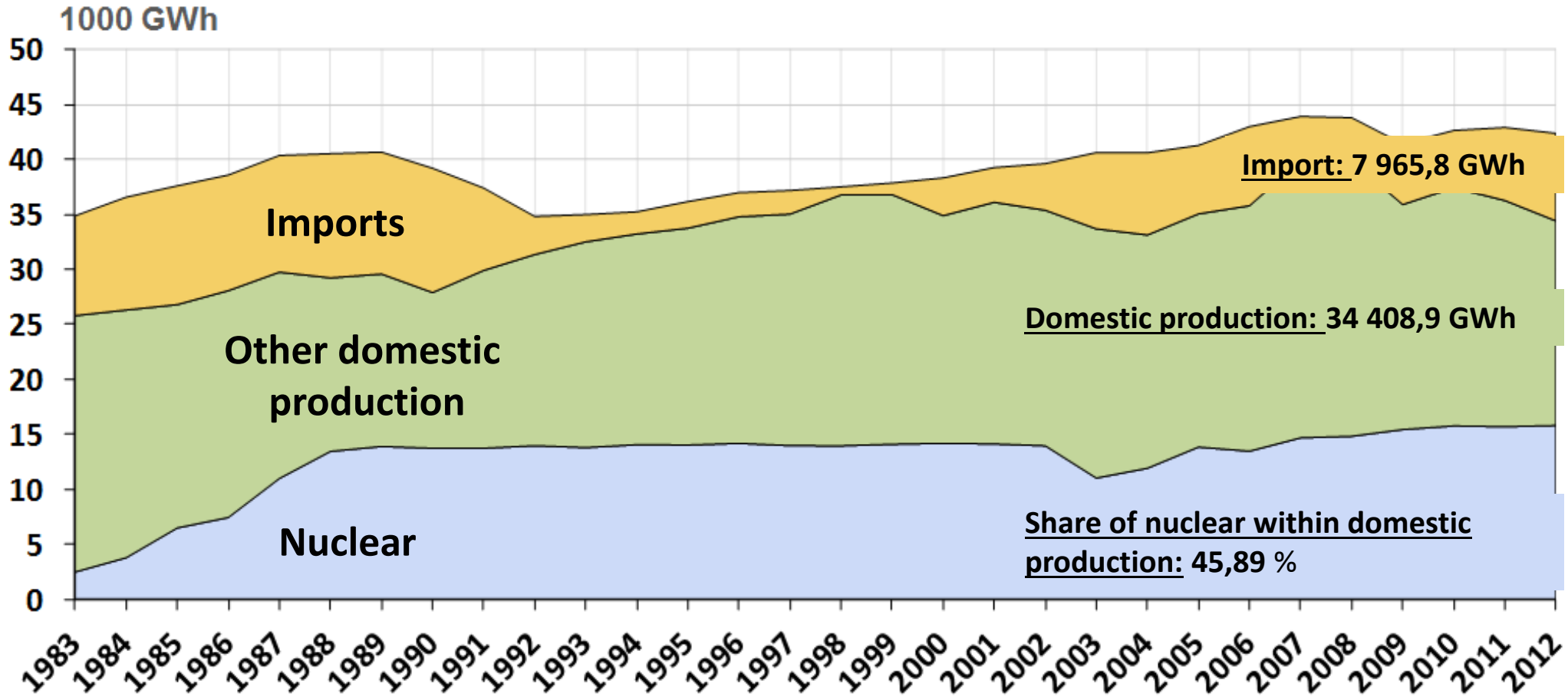
Four units.

Main Projects:

- Service Life Extension
- Capacity Upgrade
- New Unit(s)

National figures

share of the MVM Paks Nuclear Power Plant Ltd.



The units of the MVM Paks NPP Ltd. produced **15 793 GWh** electric-energy in 2012

VOLUME OF RADIOACTIVE WASTE

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Solid Waste

- 170 m^3/y (850 drums/y)

Distribution:

- Compacted: 55 %
- Non-compacted: 30%
- Filters: 5 %
- Sludge (from the bottom of the items of equipment): 10 %

Liquid Waste

- Evaporation residues: 250 m^3/y
- Ion exchange resins: 5 m^3/y
- Acidizing solutions of evaporator: 15 m^3/y
- Decontamination solutions (separately since 2003): 220 m^3

Wet Waste

- Sludge:
  - Settling tank: 270 m^3
  - Evaporation bottom tanks: 270 m^3

Developments in the legal framework

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- The Act on Atomic Energy was amended in 2011. Changes relevant to SF/RW management are:
  - A national programme for RW and SF management has to be maintained by the national waste management organization (PURAM Ltd.)
  - Any closure option of the fuel cycle – not only disposal – can be financed by the Central Nuclear Financial Fund

New executive orders of the Act on Atomic Energy:

- Amendment of the Nuclear Safety Codes
- Legislation work is going on in order to transpose the new COUNCIL DIRECTIVE 2011/70/Euratom

The Central Nuclear Financial Fund

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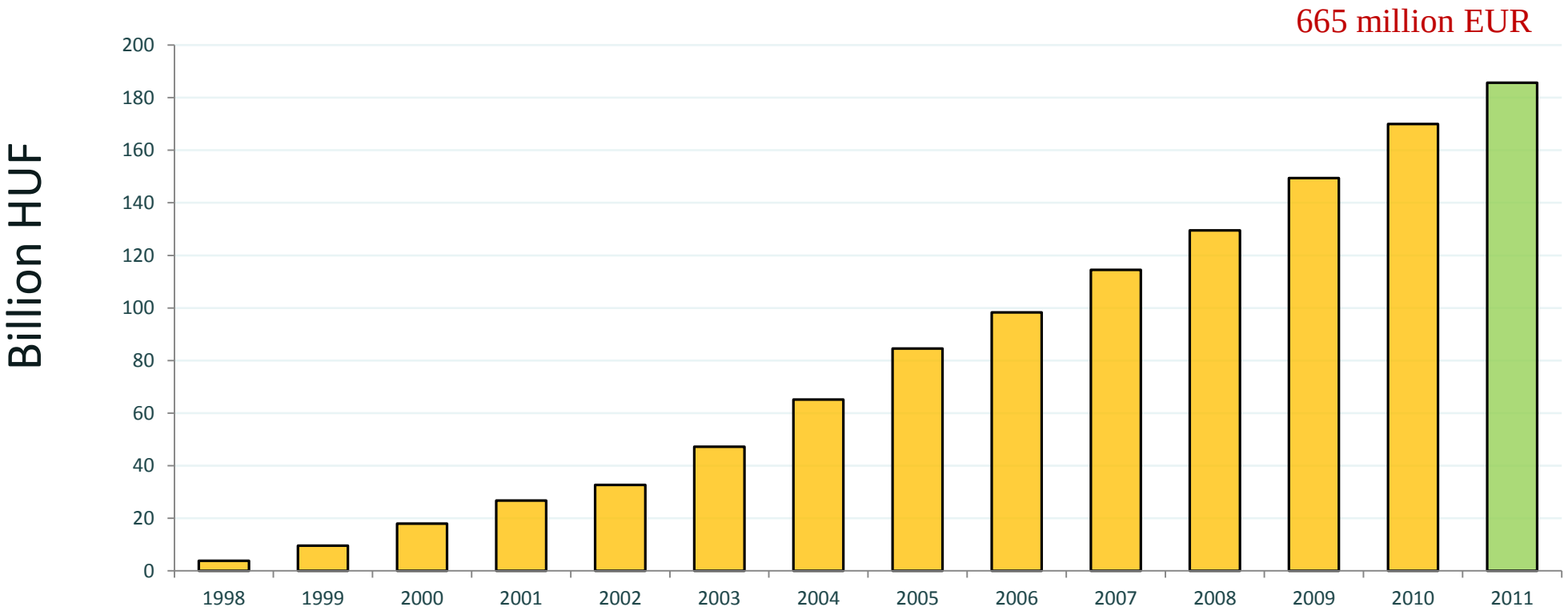
- The Central Nuclear Financial Fund (CNFF) /established by the Act in 1998/
  - all costs of RW and SF management as well as closure of the fuel cycle and decommissioning
  - the main contributor is the Paks NPP

Accumulation in CNFF



Scope of duties

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- Collection
- Treatment
- Conditioning
- Characterization
- Interim storage

Take-over, transportation

- Buffer storage
- Overpacking
- Disposal

Goals of waste producer

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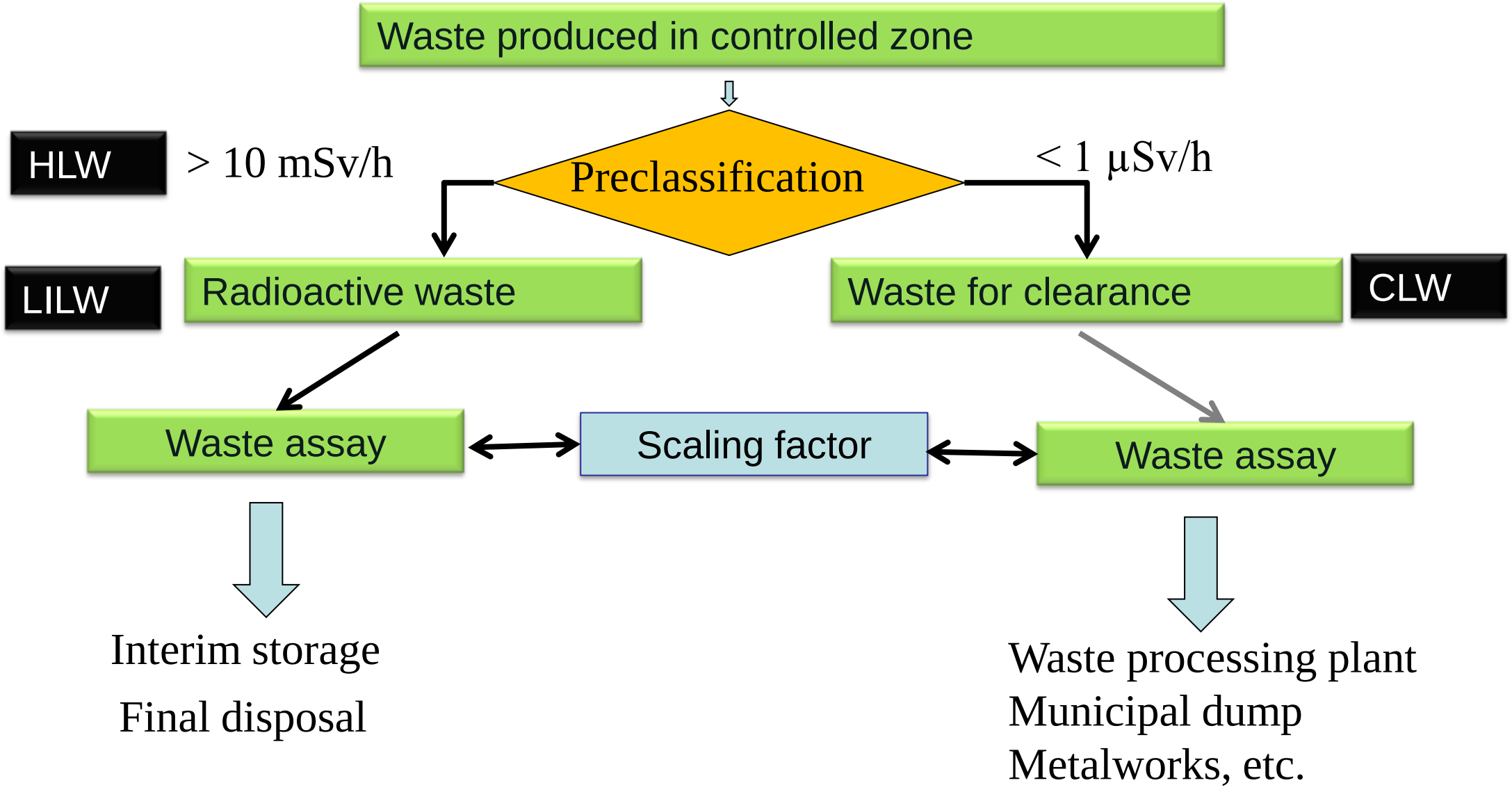
- The operation of NPP must be free of disturbance potentially caused by the presence of radioactive wastes
- Waste volume optimization/minimisation with the use of suitable techniques
- **Waste treatment processes must be capable of generating waste packages to satisfy all WAC**
- Safe interim storage until transport to final disposal facility

Process of classification



The basic of WAC

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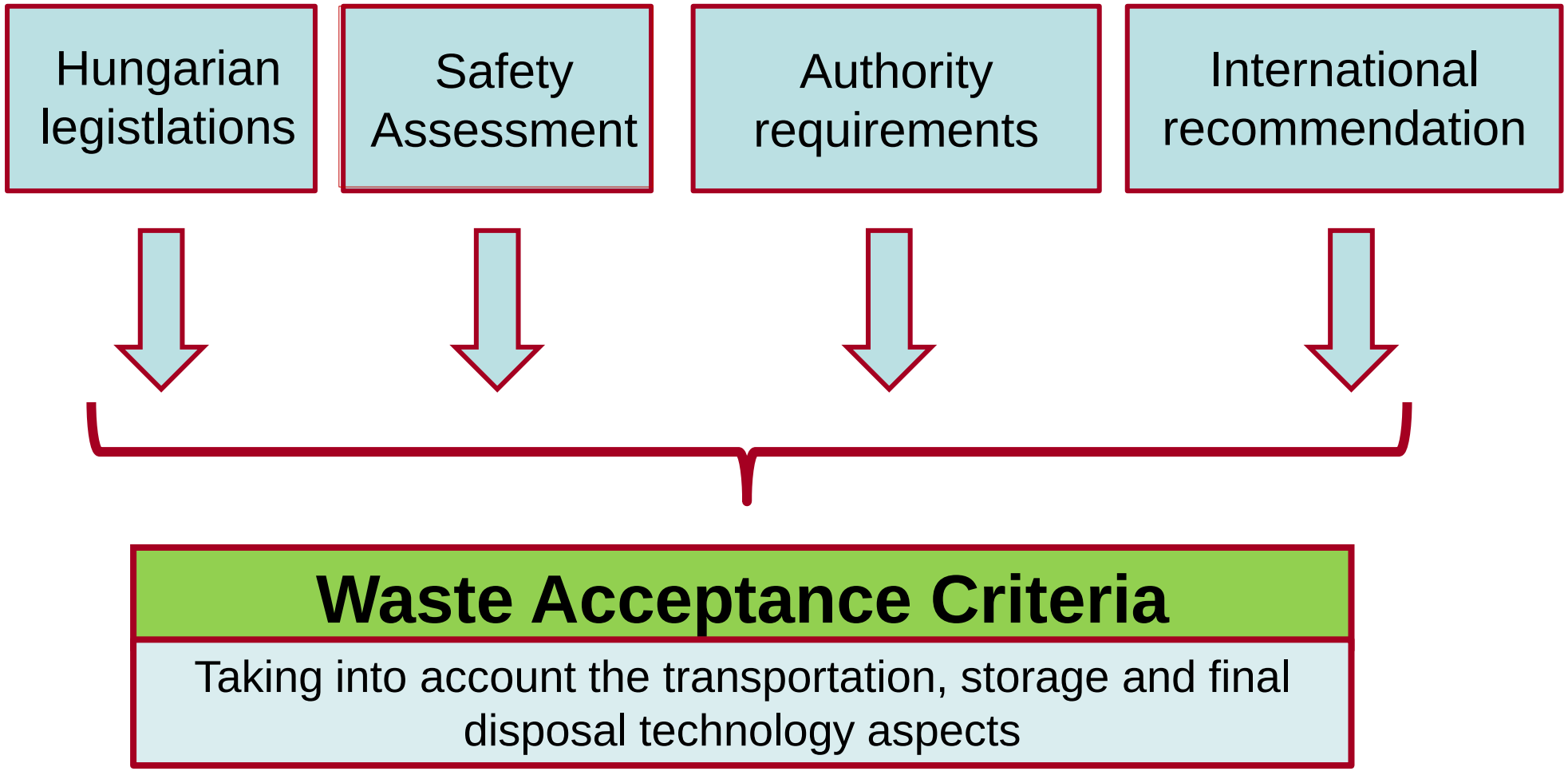

Criteria for the waste form

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- Structural stability
  - voids volume could not exceed 10 %
  - compressive strength shall be in the range of 10-30 N/mm^2
  - leaching rate limit is $3*10^{-5}$ $g/cm^2/day$
- Free liquid criterion is 1% (volume)
- Limit for the corrosive materials is 1% (mass)
- Limit of chelating and complexing agents is 0,5% (mass)
- The amount of gas generating materials should be kept as low as possible
- If the heat generation is higher than 3,5 W/m^3, the impact on the waste form should be evaluated

Criteria for the waste package

- Size of the package shall be chosen for the purpose of easy handling, storing (systematically) and transport
- No parts causing hurt or uneasy handling should be formed on the package
- The contact dose rate should be kept below 2,5 mSv/h
- Surface contamination limits
  - Beta, gamma: 4 Bq/cm^2
  - Gamma: 0,4 Bq/cm^2
- Packages shall be provided with identification numbers

Collection of data

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COLLECTION | **CONDITIONING** | **CLASSIFICATION** | **INTERIM STORAGE**

Fixed collection device

Mobile collection device

Handover/acceptance report

Waste assay report

- point of origin,
- physical state,
- type of waste,
- danger of treatment,
- treatment method,
- date of treatment,
- package identification
- dose rate,
- activity concentration,
- mass,
- date of measurement,
- storage position,
- special properties

DATABASE SYSTEM

Generation of handover/acceptance report between Paks NPP and PURAM

Supervision

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Qualification of the whole process

The waste producer has to ensure that the produced waste fulfil all requirements

Valuation included the checking of:

- Procedures of treatment, conditioning, packaging and transport,
- Operational condition,
- Control procedures of technical parameters,
- Operation of equipments and devices,
- Assessment, reports and statements.

Self-control

Public control

Control by PURAM

Authority control

First transport from the NPP site

Transport to the NRWR

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First transport: 02. 12. 2008.

Arrangement of transport

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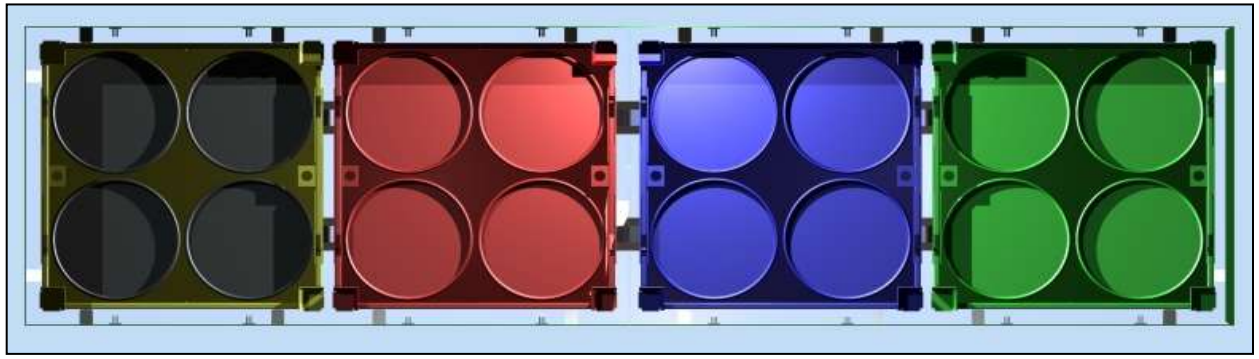
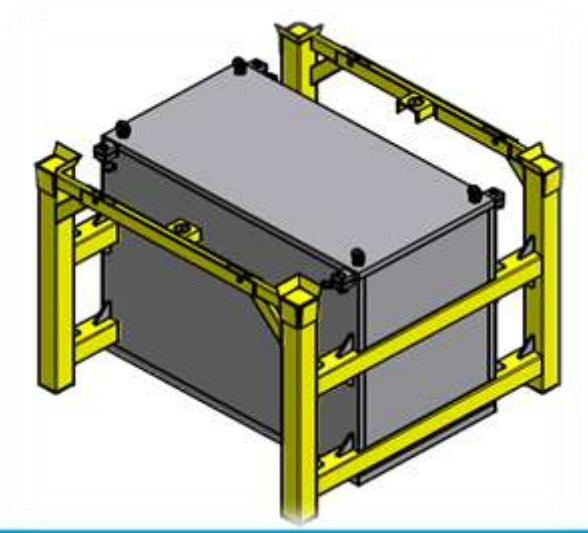
One shipment: 16 drums (4 holder)



Specific shielding for drums if they doserate above 2 mSv/h



NRWR for L/ILW waste of nuclear power plant origin

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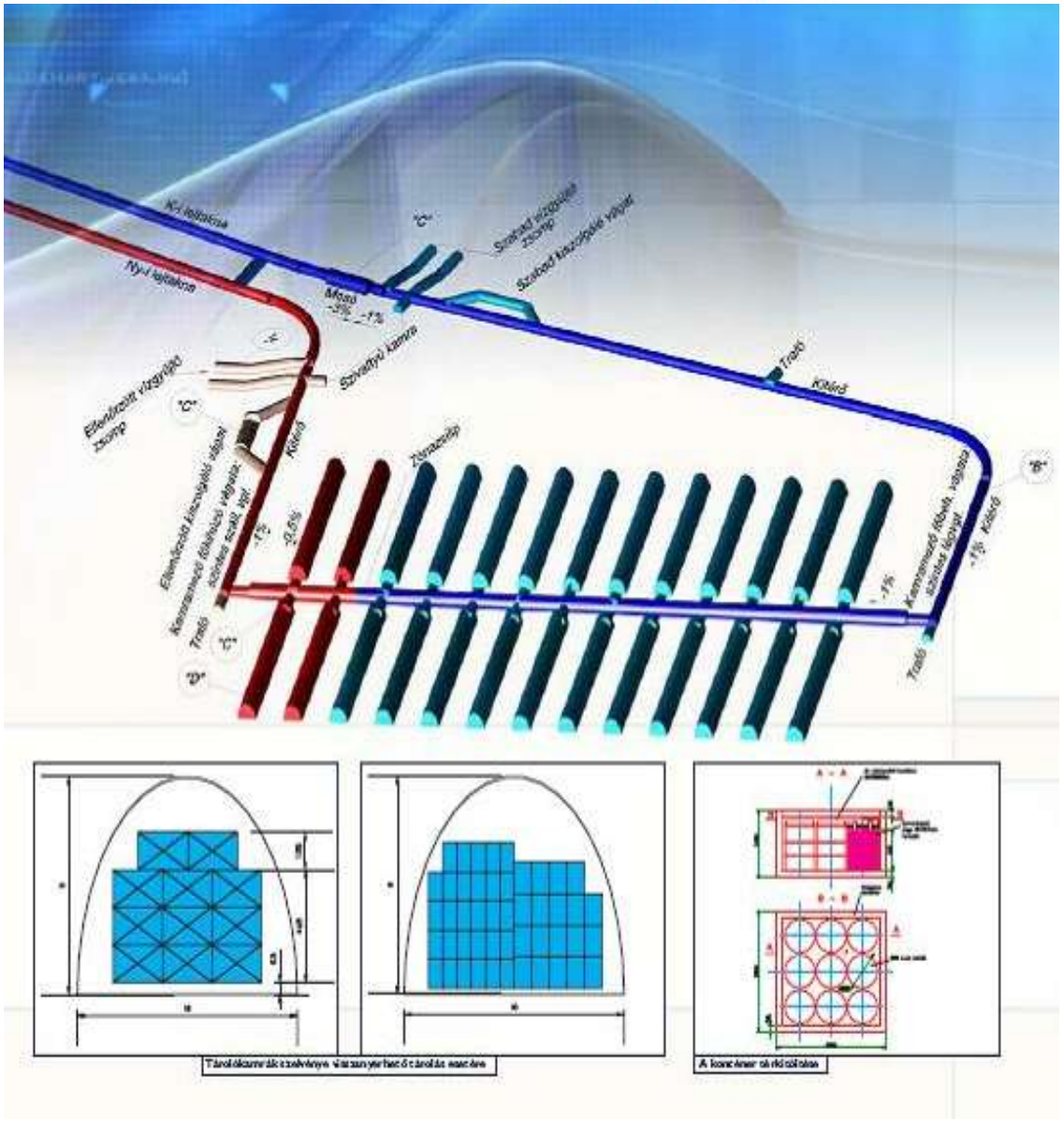

- Bátaapáti: NRWR - commissioning of the first underground disposal gallery in 2012

Waste to be placed in Bátaapáti

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- 30 years initial lifetime for the reactors
- Estimated amount of waste:
  - Operational waste: ~20.000m^3
    - Solid waste 200 l drum
    - Cemented concentrate 400 l drum
    - Ion exchange resins 200 l drum
  - Decommissioning waste:~20.000m^3

Technological Storage Building – Buffer Storage

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First chamber put into operation

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Current and Further Challenges in Bátaapáti

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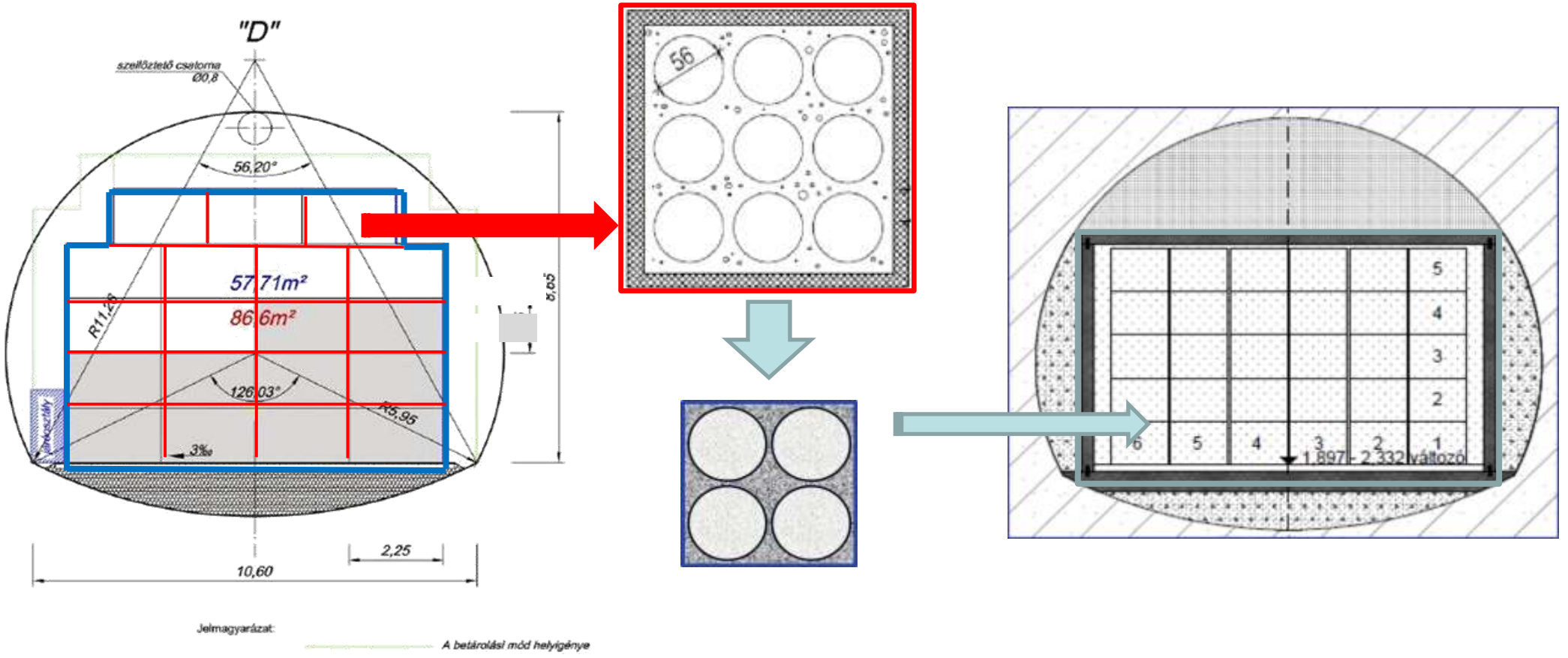
- Licensing (pre-operational safety case submitted in June, 2012) of the first gallery
- 2012 December: start of disposal operation
- Continuous waste shipments from the NPP
- 2nd stage: an optimized disposal concept is under preparation. The construction of further disposal galleries could be done hopefully by implementing this new concept. This enables that the first tunnel field will be enough to accommodate the waste generated during the originally planned life time of the NPP.

Change in the waste package and in the disposal concept



Further optimizations

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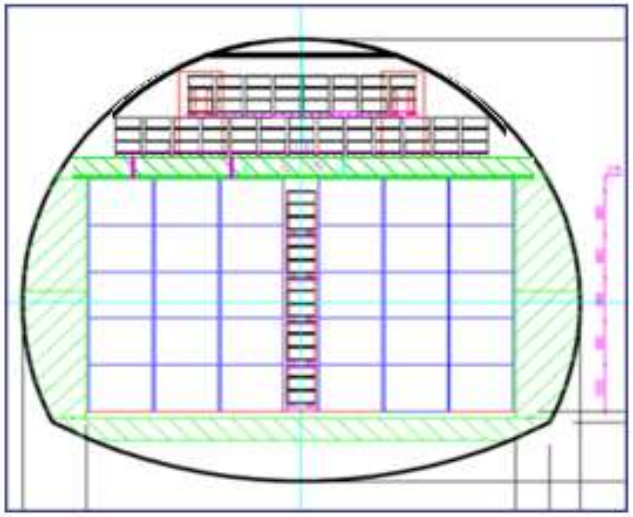
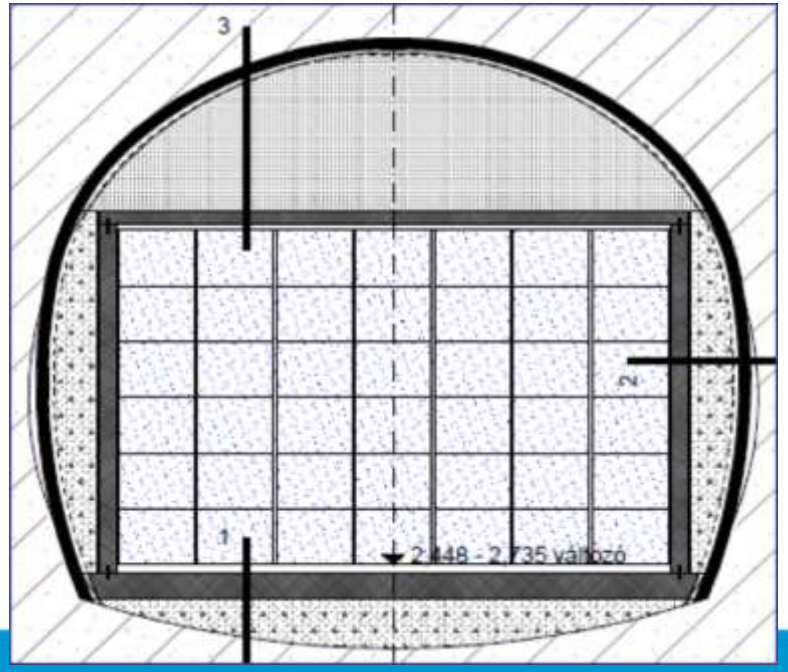
- More drummed waste than place in the compact waste packages
- More drummed waste in the vault
- New disposal chambers can have bigger diameters therefore more compact waste packages can be disposed in them.





ISFSF IN HUNGARY

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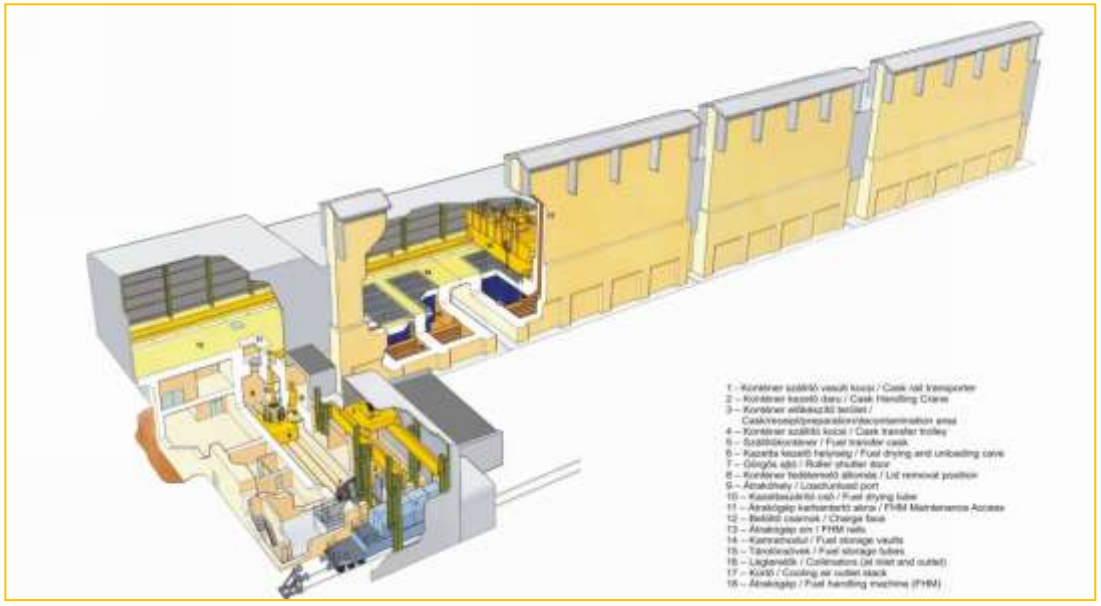
ISFSF planned for 50 years of storage
Entered into operation in 1997 with 3 vaults
Stages 1&2: 16 vaults with 450 tubes each (Σ 7200)
Further stages with 527 tubes/vault
Stored assemblies: 5107 by 2008, 5587 by 2009



Back-end of the Nuclear Fuel Cycle

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- There is no approved strategy for the back-end.
- Practically a „do and see” strategy is implemented with a reference scenario, which is currently the direct disposal of SF (basis for the cost calculation).
- The end-point is clearly defined: the SF together with other HLW and/or long-lived waste shall be disposed of in a domestic deep geological repository.

- **DO:** preparing the domestic DGR
- **SEE:** following and incorporating the developments in the field of the back-end

Summary

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- **Waste classification is part of the waste treatment process**

- **Aligned activity of every participant**

Waste producer, operator of waste treatment technologies, dosimetry service, waste classification group

- **Generated data has to satisfy criteria**

Clearance level citeria, waste acceptance criteria

- **Strict control over all stages of waste treatment, mostly the operation of waste producers at the plant site.**


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Thank You For Your Attention!