

NATIONAL REPORT FROM HUNGARIAN NUCLEAR SITES DECOMMISSIONING

Hungarian nuclear sites



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4 NPP's units in Paks ~2000 MW

- Life time extension for 20 years
- Final shut down 2032-2037 → safety enclosure 20 years → decom. will 2052-2074
- Planned enlarge 2 x 1000 MW → “Edward Teller” project starts in 2013



Bird view form Paks NPP's



Reactor Hall



Control room

2 Research Reactors in Budapest

- KFKI site: WWR-SM10 → 10 MW /1959 – 2023, renewed/ → decom. will 2025-2027
- Budapest University of Technology → 100 kW /1971 – 2027, Hungarian developed/ → decom. will 2029-2031



Bird view from BRR site



BRR control room



BUTE reactor building



Active core of BUTE

Interim spent fuel store in Paks

- Storage capacity enlarging continuously → decom. will 2052-2074

Radioactive waste repositories /low- and medium level/

- Near surface repository near Budapest
- Geological repository near Paks
- High level RAW store will 2047-2067 /planned phase/
- Very low level RAW store → planned phase

## Legislation, Main Acts and Ministerial Decrees



### Legality

- Act of Atomic Energy
- Nuclear Safety Codes
- Ministry decrees
- Site Decom. Plan

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### Act on Atomic Energy No. CXVI (1996)

#### *“Storage and Disposal of Radioactive Waste and Spent Nuclear Fuel*

*Section 38. (1) A licence for the application of atomic energy shall be granted only if the safe storage, i.e. interim storage or final disposal, of the radioactive waste and spent fuel generated can be assured in accordance with the most recent certified results of science, international expectations, as well as experience.*

*(2) The interim storage and final disposal of radioactive waste and spent fuel shall be considered safe if*

*a) the protection of human health and the environment is ensured throughout the entire duration of these activities;*

*b) the impact on human health and the environment is not higher beyond the country borders than that accepted within the country.*

*Section 39. The interim storage of radioactive waste and spent fuel shall be licensed for a definite period of time only.*

*Section 40. As the solution of such matters is in the national interest, the performance of tasks related to the final disposal of radioactive waste, as well as to the interim storage and final disposal of spent fuel, and to the decommissioning of a nuclear facility shall be the responsibility of an organisation designated by the Government.*

*Section 41. The licensee, or in the case of budgetary organisations, the central budget shall be liable to cover the costs of the final disposal of radioactive waste, as well as the interim storage and final disposal of spent fuel, and of the decommissioning of a nuclear facility.”*

Nuclear Safety Code 5<sup>th</sup> book → Authority requirements for decommissioning → 5.1; 5.14 and 5.15 chapters.

#### Ministry decrees:

- Minister of Health Decree No. 16/2000 on the execution of certain provisions of Act on Atomic Energy associated with radiation protection
- Minister of Health Decree No. 47/2003 on certain issues of interim storage and final disposal of Radioactive Wastes
- Ministerial decree 7/2007. (III. 6.) IRM on the rules of accountancy for and control of nuclear material
- Decree of the Minister of Interior 33/2004 (VI. 28.) on the registration of radioactive materials
- Decree of the Minister of Economy 27/1999. (IV. 4.) on the charges of the subcontractors connected to the final disposal of radioactive wastes
- Decree of the Minister of Health 30/2001. (X. 3.) on the operational radiation protection of the outside workers

#### Decommissioning plans

##### Paks NPP'S and Interim Spent Fuel Store:

- First version in 1993 (DECOM Slovakia Ltd.)
- Continuously upgrades, last version in 2008 (DECOM Slovakia Ltd. and TS-Energon Ltd.)

##### Research Reactors:

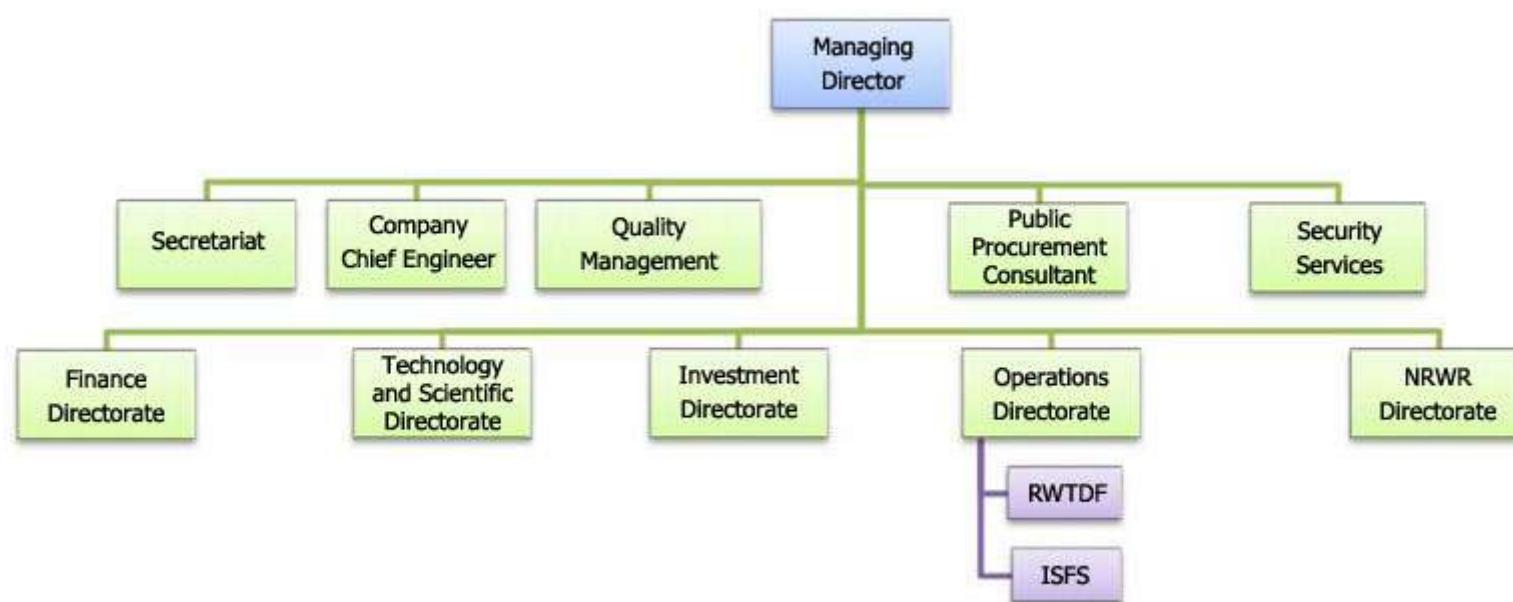
- First version is 2003 and 2005; made by licensee
- Taking over and application the IAEA and OECD requirements (e.g. Safety Standards, CERREX cost estimate)
- Revision: every 5 years, approval by Hungarian Atomic Energy Authority

## PURAM Ltd. the responsible organization for decommissioning

According to Act of Atomic Energy: “The decommissioning of nuclear installations in Hungary is imposed by § 40 of the Act on Atomic Energy upon the Agency with the additional provision that the responsibility for the maintenance, surveillance and guarding of nuclear facilities from their closure to the dismantling shall be with our Agency. The dismantling and the area recultivation work shall also be within the scope of responsibility of the Agency.”

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### PURAM's organization chart



### Scheduling of the tasks

2008-2009

- Establishment of the database required for the preparation of the Final Decommissioning Plan
- Review of the Preliminary Decommissioning Plan

2010–2022

- Finalisation and approval of the Decommissioning Plan
- Graduated shutdown of the Units
- Transfer of spent nuclear fuels into the Interim Spent Fuel Store
- Demolition of the inactive parts of the power plant
- Preparation of the active parts of the power plant for safe custody

2022–2052

- Surveillance of the active parts of the power plant (including ISFS after 2070)

2052–2074

- Dismantling the active parts of the power plant
- Dismantling of the ISFS

## Wastes management

### Inactive waste

Kind of waste	Disposal manner
Textile, protective clothes, heat isolation materials	Communal waste deposit (old mine; cover with soil)
Chemicals, accumulators, active carbon, oil	Accumulator recycling and waste burning factory
Metal scrap	Metal factory (melting)
Communal waste, plastic, glass, construction waste	Conventional waste deposit
Paper	Paper factory

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### Radioactive waste sorting

RAW category	Compared to activity concentration
Low level activity	$\sum \frac{AK_i}{MEAK_i} \leq 10^3$
Medium level activity	$\sum \frac{AK_i}{MEAK_i} = 10^3 - 10^6$
High level activity	$\sum \frac{AK_i}{MEAK_i} > 10^6$

Remark:  $AK_i$  – unit i activity concentration [Bq/g],  $MEAK_i$  – unit i exemption activity concentration [Bq/g]

### Radioactive waste repositories /low- and medium level/

#### Near surface repository in Püspökszilág /near Budapest/



Bird view of the site



Store shafts



Technological building

- 10-20 m<sup>3</sup>/year from RRs, Hospitals and Laboratories
- 2-3000 pc used radiation sources (<sup>60</sup>Co, <sup>192</sup>Ir)
- BRR ~10 drums/year
- BRR decommissioning ~430 m<sup>3</sup> (in 2025-2027)

## Wastes management (cont.)

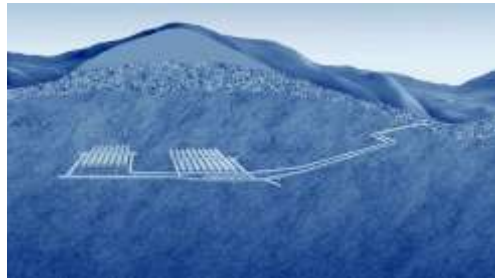
Geological repository in Bataapati /near Paks/



Site (under construction)



Transport tunnel



Storing tunnel



Technological building

- Liquid rad. wastes → evaporate to concentrated „boric acid content”  
quantity: 250 m<sup>3</sup>/year, ∑ 7400 m<sup>3</sup> (30 years)
- Solid RAW: volume reduction → reduction factor „5”  
quantity: 850 drums/year, ∑ 2900 m<sup>3</sup> (30 years)
- NPP's decommissioning 17.900 m<sup>3</sup> → HLRAW ~410 m<sup>3</sup> (estimate data)

## Earlier decommissioning activities

Partial decommissioning at Budapest Research Reactor in 1986

- Reconstruction and modernization project after 27 years operation
- That was the first WWR-S reactor which was dismantled
- Hungarian Atomic Energy Authority evaluating the all decom. activities

IAEA Expert missions

- Training reactor of Budapest University of Technology in 2004
- Budapest Research Reactor in 2010

Workshops

- National workshop for RR decommissioning in 2004 /organized by HAEA/
- Workshop on activation calculation, Budapest in 2010 /organized by IAEA/

## Publications

- Hungarian Atomic Energy Authority →  
→ [http://www.oah.hu/web/v2/portal.nsf/download\\_en?OpenView&ExpandView&Count=200](http://www.oah.hu/web/v2/portal.nsf/download_en?OpenView&ExpandView&Count=200)
- Paks Nuclear Power Plant → <http://paksnuclearpowerplant.com/publications>
- Atomic Energy Research Institute → <http://aekiweb.web.kfki.hu/index.php?contentid=169&lang=en>
- Budapest University of Technology →  
→ [http://www.reak.bme.hu/en/staff\\_members/bogdan\\_yamaji/publications.html](http://www.reak.bme.hu/en/staff_members/bogdan_yamaji/publications.html)
- PURAM Ltd. → <http://www.rhk.hu/en/documents/>
- The Hungarian Nuclear Society → <http://mnt.kfki.hu/index.php?page=&lang=en>
- "Frédéric Joliot-Curie" National Research Institute for Radiobiology and Radiohygiene →  
→ [http://www.osski.hu/kiadvanyok/kiadvanyok\\_en.html](http://www.osski.hu/kiadvanyok/kiadvanyok_en.html)