



# Presentation of Hungary

at the 6th Review Meeting of the  
Convention on Nuclear Safety

Country Group 6

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# Presentation Outline

1. Hungarian Nuclear Programme
2. Changes in the nuclear programme
  - 2.1. New regulations
  - 2.2. Service Life extension
  - 2.3. New builds
3. Safety significant events since last review meeting
4. Actions taken in the light of the Fukushima Daiichi accident
  - 4.1 Safety reassessment and national action plan
  - 4.2 Revision of regulations
  - 4.3. Support of IAEA Action Plan
5. Planned measures to improve safety
6. Developments since submittal of report
7. Recent and future challenges, good practices
8. Answers to questions raised from Peer Review of National Report



# 1. Hungarian Nuclear Programme



# Summary of basic information on the national programme

- Nuclear's decisive role: 40 percent of domestic electricity production
- Paks NPP: 4 VVER 440
- Advanced infrastructure:
  - Legislation
  - Governmental institutions
  - Research facilities, universities
  - Technical support organizations
  - Service industry
- International co-operation:
  - IAEA, EU (EURATOM, ENSREG, WENRA), OECD NEA, WANO, VVER Forum
  - Bilateral agreements with several authorities



# Summary of basic information on the national programme

- Paks NPP
  - 4 units of VVER 440/213
  - Up-rated power 500 Mwe
  - Load factor: 80-90%
- SFISF
  - Dry storage for 50 years
  - Modular expansion
  - 20 vaults, 9308 storage tubes
  - Currently stored: 7687 SF assemblies





# Summary of basic information on the national programme

- Budapest Research Reactor
  - VVER SM tank type, 10 MWth
  - Operated by CER
  - Experiments and isotope pr.
- Budapest Training Reactor
  - Pool type, 100 kWth
  - Operated by Budapest University of Technology and Economics





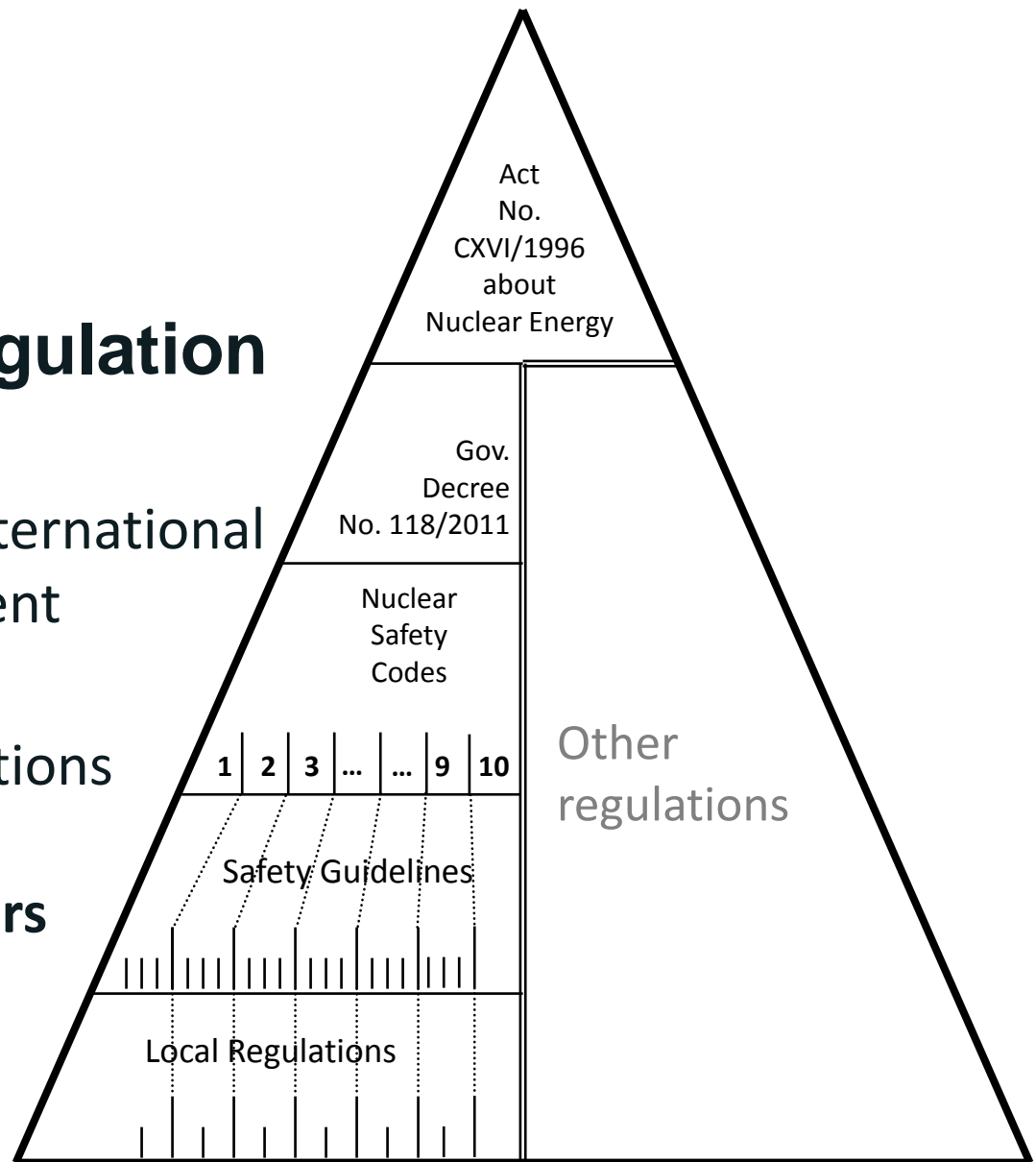
## 2. Changes in the nuclear programme

### 2.1. New regulations



# Nuclear Safety Regulation in Hungary

- HAEA shall monitor international trends and development of regulations
- Nuclear Safety Regulations shall be **reviewed at least every five years**








# The main sources of revision between 2008-2011

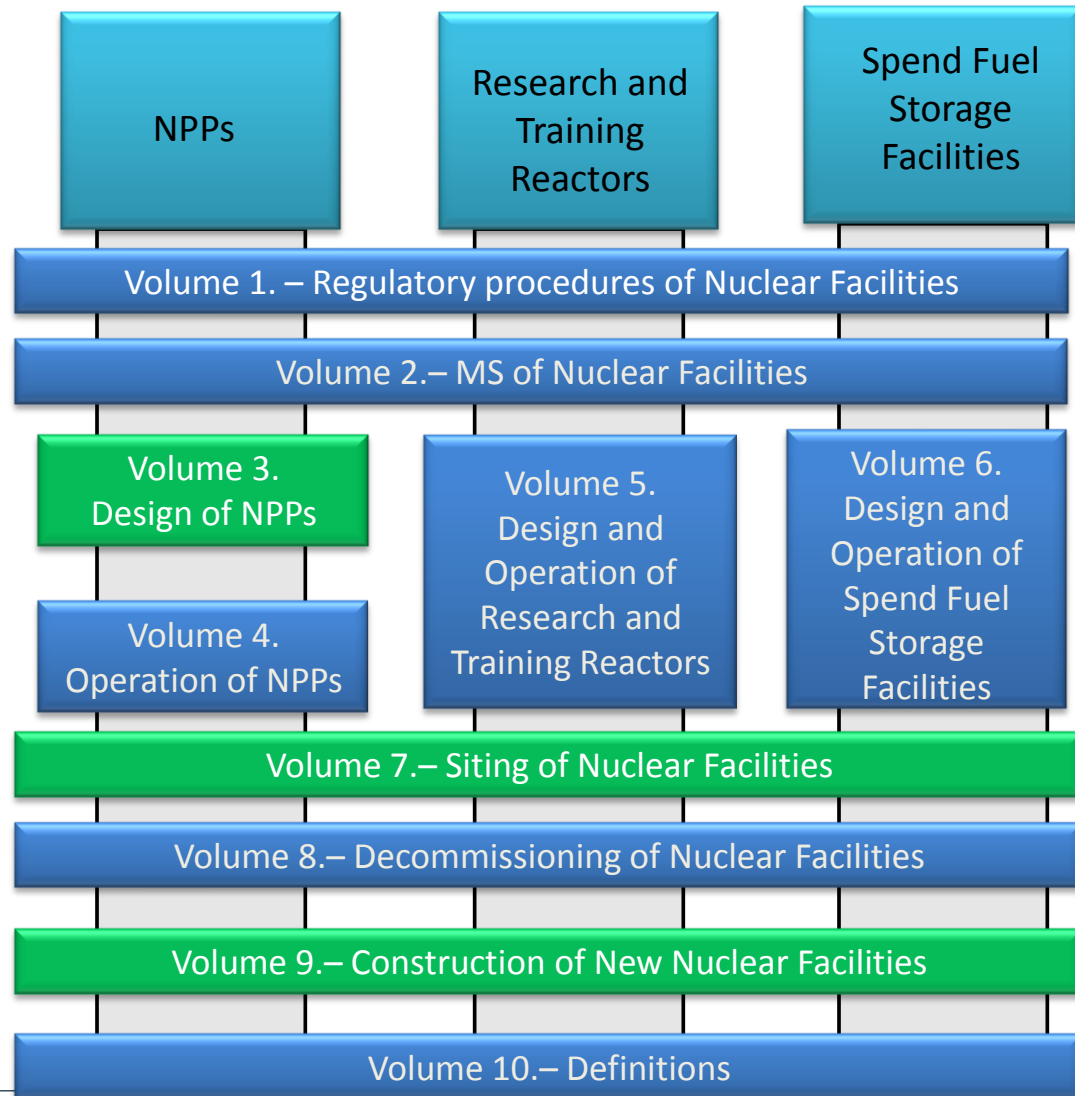
- Lessons learned from use of existing regulations
- Recently issued IAEA standards, guides
- Achievements of the WENRA
- Recommendations from international reviews
- European Utility Requirements
- Experience from other countries
  - Finland, France, Russia, USA, UK





# New set of regulations

- Act CXVI of 1996 on Atomic Energy
- Government Decree No. 118/2011. (VII. 11.)
  - on the nuclear safety requirements of nuclear facilities and related regulatory activities)
- Annexes  Nuclear Safety Code
- Guidelines





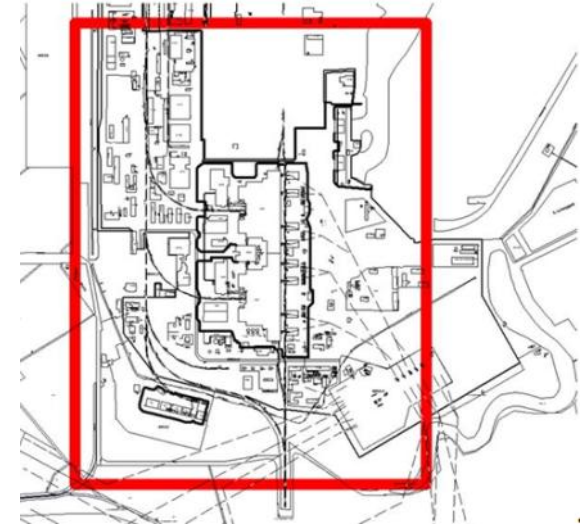
# Main achievements of the revision

- Final rules for service life extension of NPP units
- More risk-informed regulatory activities
  - Inspection-centered, less licensing steps
  - Independent expert review
- Full compliance with WENRA Reference Levels
  - in terms of safety of nuclear installations
- Adaptation of WENRA reference levels
  - in terms of radioactive waste management, nuclear facility decommissioning and radioactive waste disposal



# Re-definition of safety zone around nuclear and radwaste facilities

- Radiation exposure of public and environment during normal operation
- Environment influence on safety of the facility
- Analysis shall demonstrate distance
- Public hearing: first in nuclear safety
- It is required now for all important license





## 2. Changes in the nuclear programme

### 2.2. Service life extension of Unit 1 of Paks NPP



# Service life extension of Paks NPP Unit 1

- Original design lifetime (30 years) expired in 2012
- Application submitted by operator in 2011
  - 25 HAEA experts
  - 560 engineering days
  - 21.000 pages
  - >30 inspections
- License was granted at end of 2012 for additional 20 years of operation





# Conditions and requirements in the extended operation license

- Ultrasonic test of nozzle NA250 of the RPV
- Completion of reinforcement of turbine building steel structures, seismic requalification of some bridges
- Installation of new wind measurement
- Activities to operate core barrel beyond 40 years
- Revision of the load catalogue to demonstrate the applicable cycle numbers are considered
- RPV
  - Cavity dosimetry to verify neutron calculations
  - Non-linear fracture mechanics
  - Evaluation of thermal ageing surveillance specimens
- Conditions of environmental license



## 2. Changes in the nuclear programme

### 2.3 New builds





# New National Energy Strategy

Goal: to ensure the long term sustainability, security and economic competitiveness of energy supply in Hungary

'Nuclear-Coal-Green' scenario



the long-term preservation of nuclear energy in the energy mix



LTO



New Units

March 24, 2014

Presentation of Hungary at the 6th Review Meeting of the CNS

14 Febr 2012

NATIONAL ENERGY STRATEGY

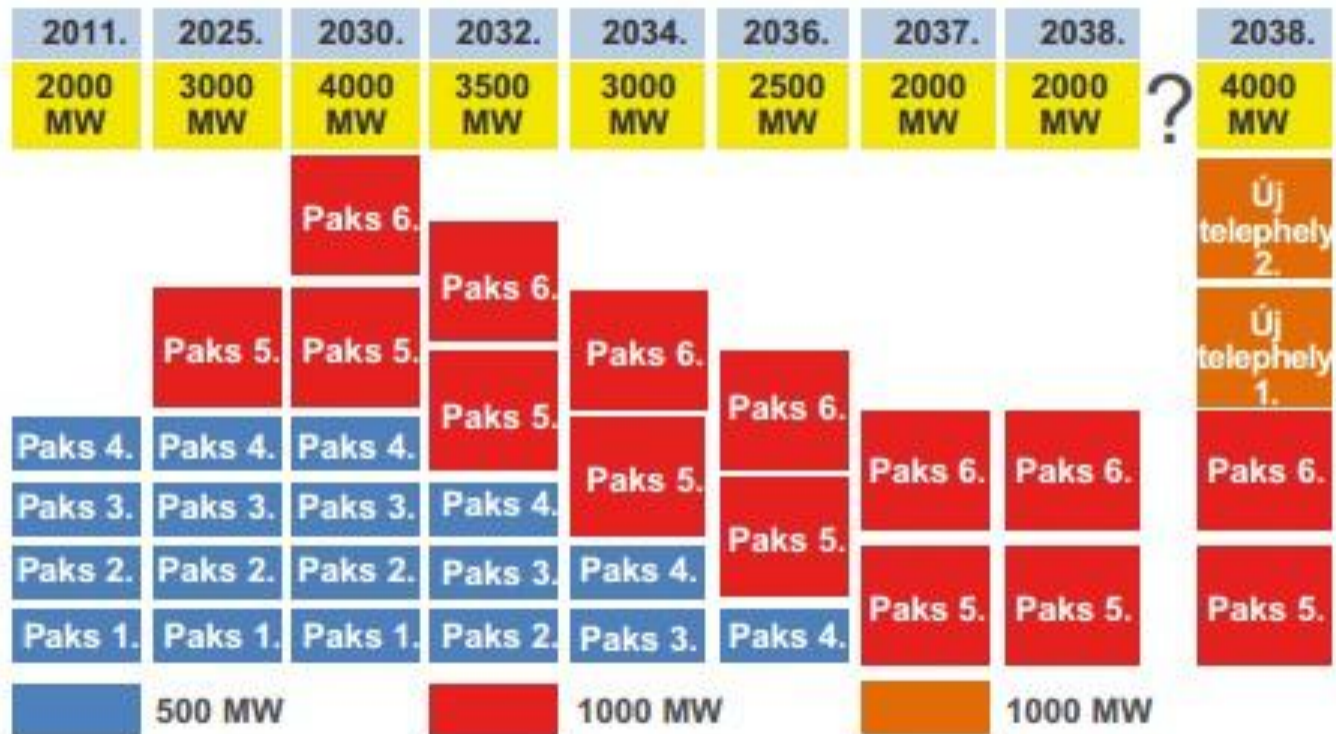
2030





# New National Energy Strategy

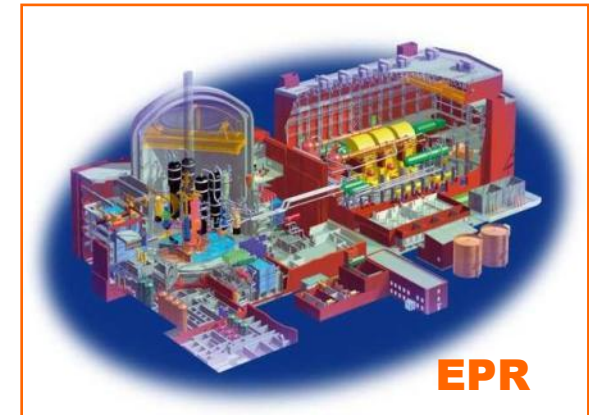
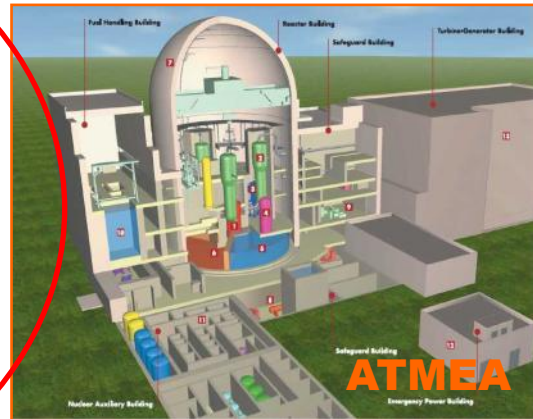
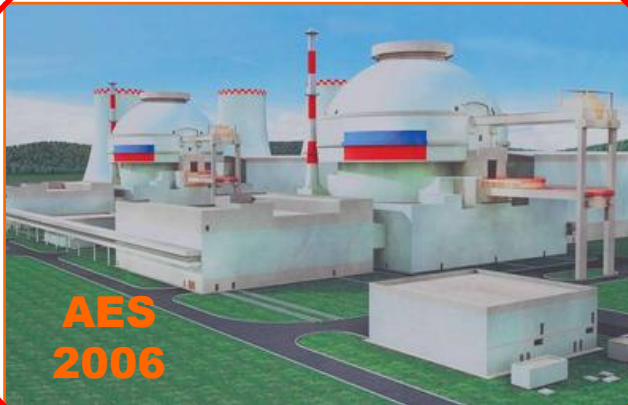
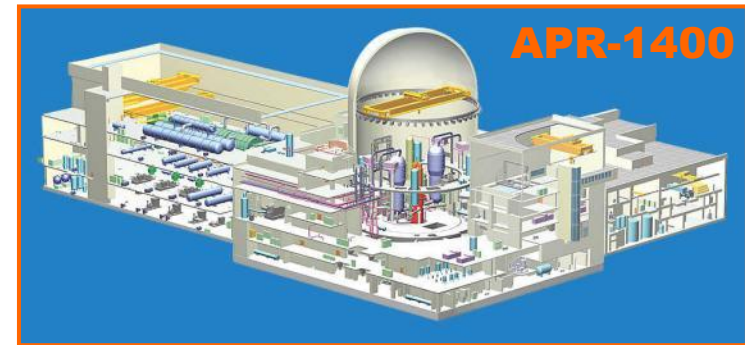
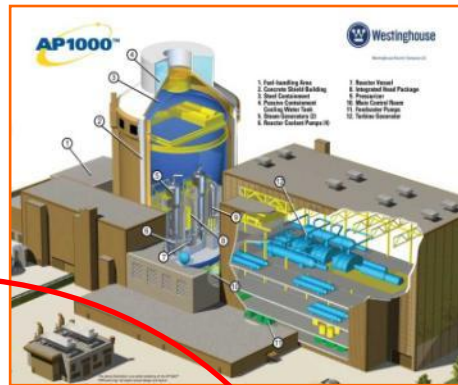
## New Units



Nuclear capacity expected till 2038



# Assessment of Candidates





## 2. Changes in the nuclear programme

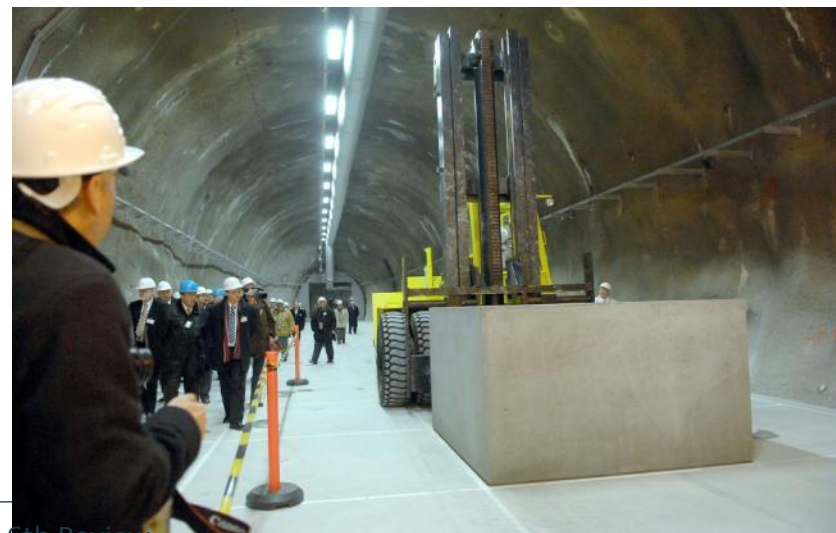
### Licensing of low and intermediate radwaste disposal facility



# Commissioning of the radioactive waste disposal facility

**2012:** Operation license for  
**End of 2012:** first disposal chamber in operation

From **July 1, 2014**  
HAEA will be the supervising authority of radwaste disposal facilities



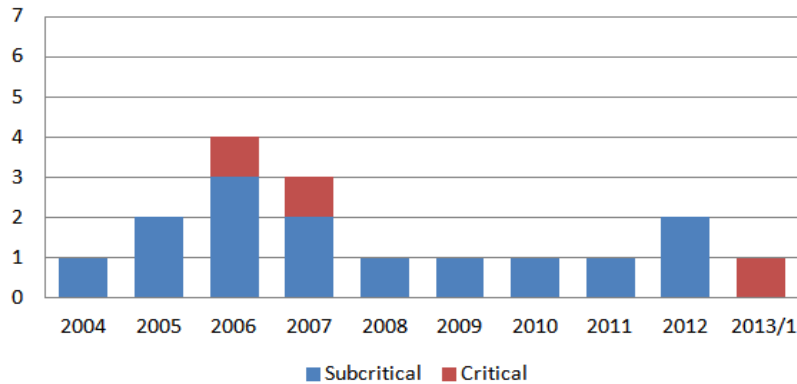


### 3. Significant events since the last Review Meeting

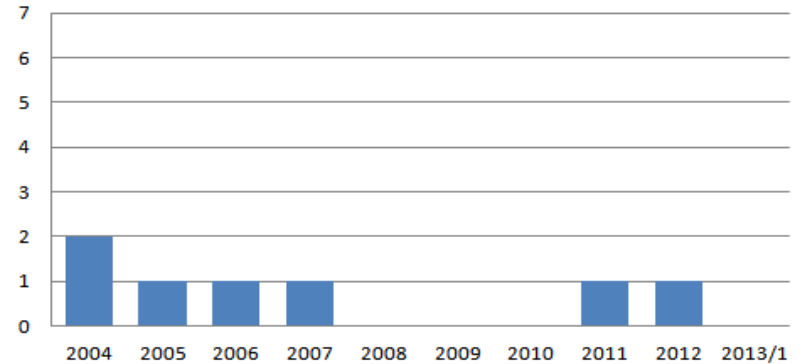


# Paks NPP events

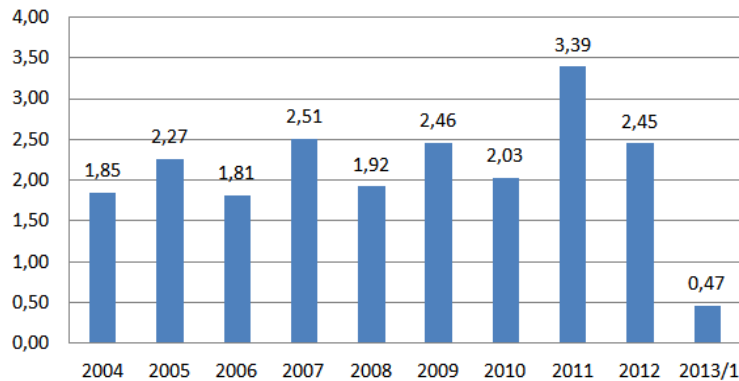
### Reactor protection actuation



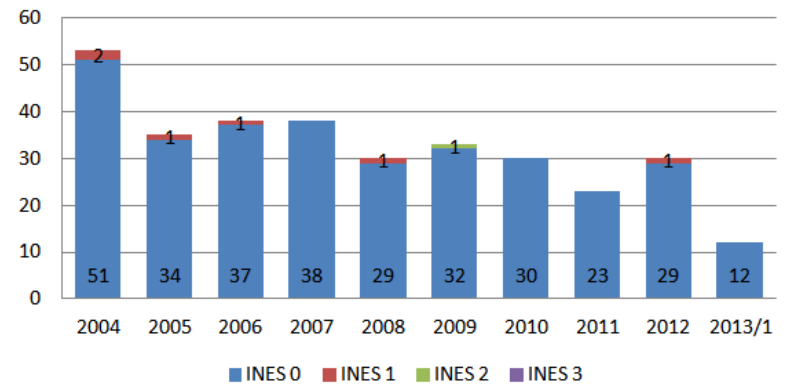
### Techspec violation



### Collective dose [man'Sv]



### Number of INES rated events





## One INES-1 event during the 3 year reporting period

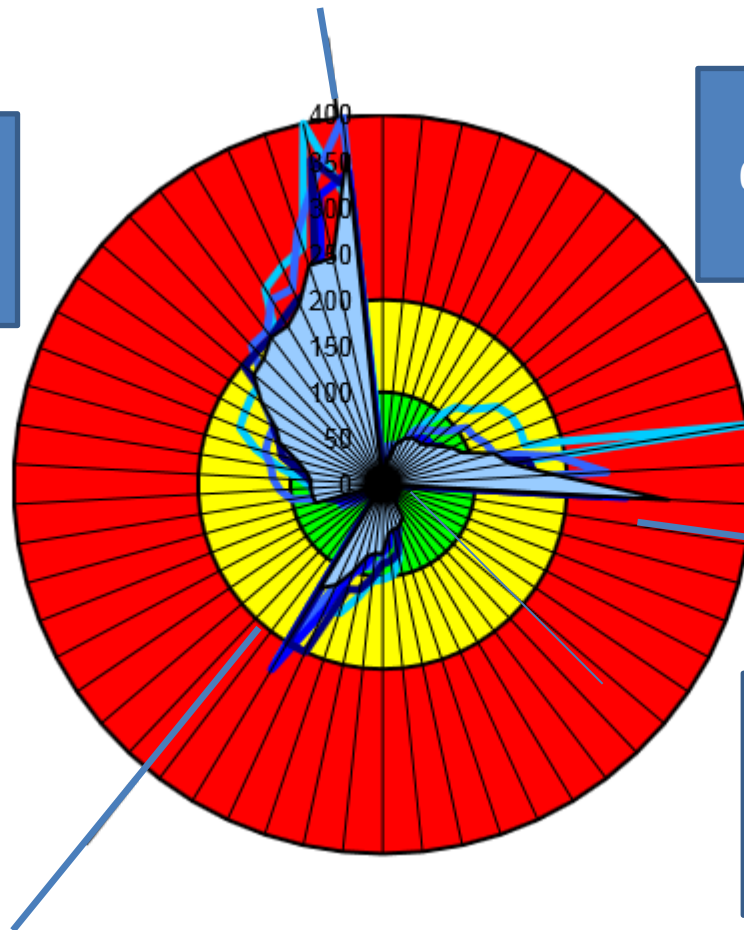
- Violation of an administrative limit of the TechSpec
- A modification of cooled water system was delayed from outage time to operation time
- 3 isolation valves of the system at the border of containment shall be operable
- Although this was recognized and the functions were provided by backup valves, no exemption from the effect of the TechSpec was formally requested to remove the valves from operation
- Violation of administrative limitation was evaluated to be INES 1 (abnormality)





# Safety Performance of Paks NPP

Safety Attitude  
9 SPI based on 22  
LLI



Smooth Operation  
6 SPI based on 17  
level indicator LLI

- 2008
- 2009
- 2010
- 2011
- 2012

Operational Safety  
7 SPI based on 18 LLI



## 4. Actions taken in the light of the Fukushima Daiichi accident

### 4.1. Safety re-assessment and national action plan



# Post-Fukushima safety reassessment in Hungary

- Initiated by the European Commission
- Goal: reassessment of safety margins and find place for improvement
- Scope: Paks NPP reactor core and spent fuel pools
  - Analyses of safety margins
  - Potential complete loss of safety functions
  - Opportunities for management of such situations
  - Severe accident management

Transparency

- Aspects
  - Cliff edge effects
  - Tenability
  - Multi-unit
  - SFP coolability
  - Off-site support
  - Hydrogen issue
  - Liquid waste
  - Harsh environment



# Safety reassessment process

- Two phase: preliminary and final report
- Self-assessment by licensee
  - PSR, FSAR
  - Walkdowns
  - Extra analyses
  - Development of new methodology
- Regulatory assessment, inspections and questions
- Regulatory approval
- National report by the Authority



**National Report of Hungary**  
on the Targeted Safety Re-assessment  
of Paks Nuclear Power Plant



Compiled for the European Commission  
by the Hungarian Atomic Energy Authority

Hungarian Atomic Energy Authority  
Budapest, December 29, 2011

	Name, assignment	Signature	Date
Editor:	Dr. Ferenc Adorján HAEA Chief Advisor		25/12/2011
Verified by:	Gyula Fichtinger DEG of HAEA		29/12/2011
Approved by:	Dr. József Rónaky DG of HAEA		29/12/2011



# Regulatory inspection during the self-assessment process

- General inspection
  - Deadlines
  - Scope
  - Result: appropriate progress
  - Methods, resources are appropriate
- Commissioning tests of severe accident diesel generators
- Validation test of the SAMGs
- Low Danube level measures
- Review of seismic classification





## Main conclusions of stress tests

- Paks NPP is in compliance with its licensing conditions, able to withstand extreme loads
- Regulatory requirements for extended design basis are established
- Design basis as extended through former safety improvement programme is adequate
  - Periodic Safety Review is effective
- Severe accident management as a pre-condition for service life extension is justified



## Main actions decided

- Reinforcements against quakes
  - Non-safety electric power supply systems
  - BDB soil liquefaction/building settlement
- Flooding issues: protection of some important rooms
- Procedural modifications: maximization of fuel and water reserves, seismic walkdowns
- Ex-containment hydrogen management
- Alternate power and water supplies
- External coolant injection to containment
- SA diesel generators
- EP: multi-unit, off-site support, SA simulator
- New emergency centre



# Development of a National Action Plan

- 51 items
- Structure: 6 topics according 2nd Extraordinary CNS
- Part I: actions decided for the NPP
  - Natural hazards
  - Loss of safety systems
  - Severe accident management
- Part II: actions by the country
  - National organizations
  - Off-site emergency preparedness and response
  - International Cooperation
- Plan reacts to all recommendations
  - stress test peer review
  - 2nd Extraordinary CNS





# NACP Part IV – list of actions

Task <sup>3</sup>		Topic	Action	Comment	Identifier in the HA5589 resolution [12]	Final deadline	TSR national report [3] reference	ENSREG report [9] reference
	<b>1.</b>	<b>Natural hazards</b>						
1.	1.1.	Recurrence frequency taken into account in the design basis	Considering natural hazards of 10 thousand year recurring frequency. For earthquake, flooding and low water level of Danube.	Successful termination of assessments in December, 2011. No open task in this area.		Task completed.	2.1.1	3.1.1
2.	1.2.	Secondary effects of earthquakes	1 - Interventions to protect the personnel and equipment in the fire brigade barrack, which is made of reinforced concrete, but has not yet been seismically qualified.		1.2.	15.12.2015.	2.3.3, 3.1.1	3.1.2
3.			2 - The demineralised water tanks in Installation II that play an important role in ensuring demineralised water stocks are located in the direct vicinity of the medical and laboratory building. The walls of the building shall be seismically qualified and, if necessary,		1.9.	15.12.2015.	2.1.2	3.1.2



## Expected results after NAcP actions

- Probability of severe accidents due to loss of power supply and ultimate heat sink decreases
- Severe accidents of reactors and spent fuel pools can be prevented or mitigated
- Risk of damage by and consequences of extreme external events is reduced
- Capability to prevent and/or mitigate multi-unit accidents is enhanced
- Wider scope of emergency response solutions



## 4. Actions taken in the light of the Fukushima Daiichi accident

### 4.2. Post-Fukushima revision of regulations



# Lessons learned from Fukushima

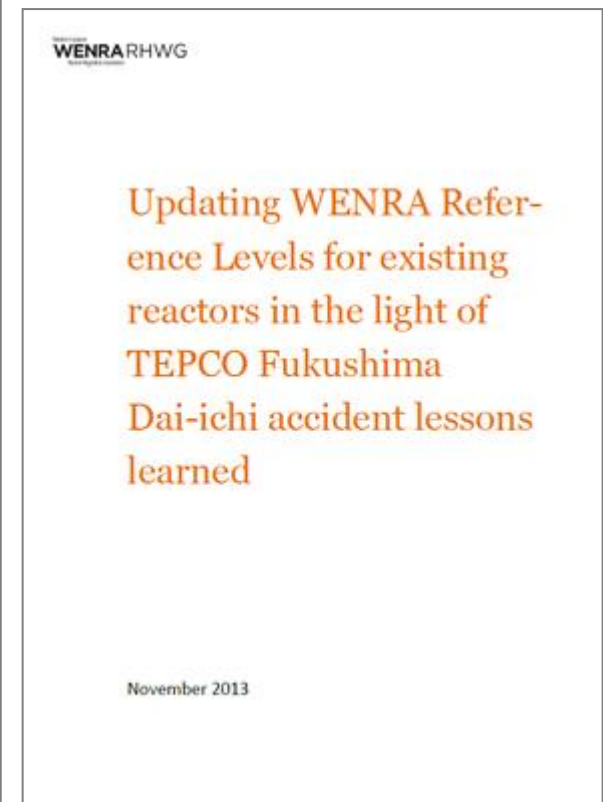
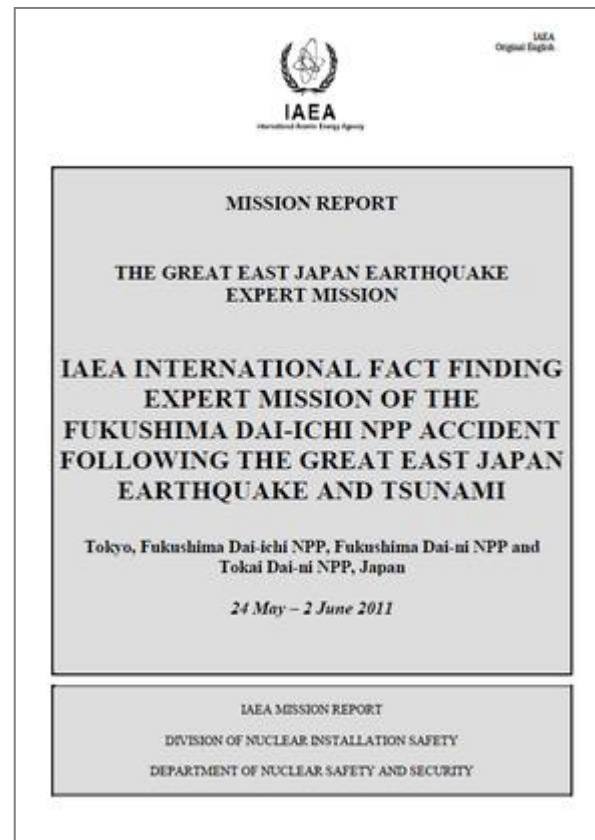
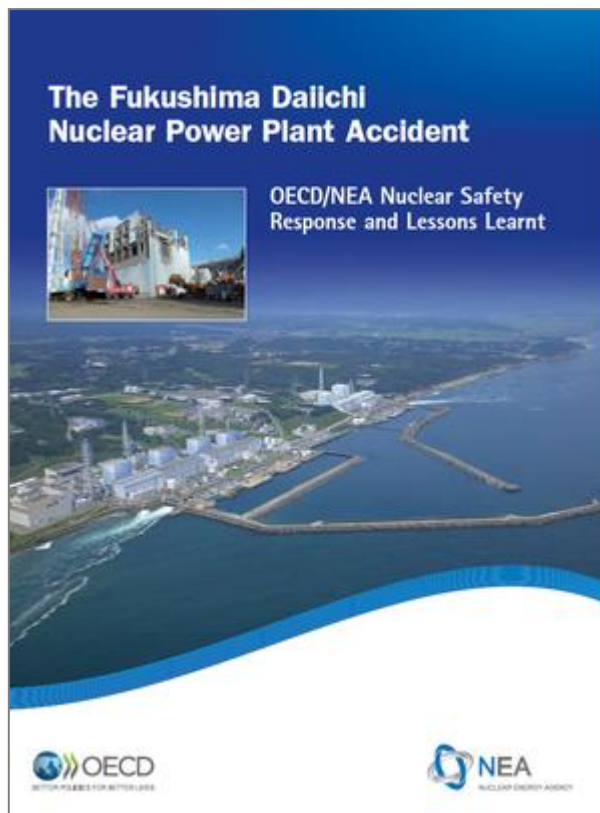
DS462 - Amendments to the IAEA Safety Requirements:



<p>IAEA Safety Standards for protecting people and the environment</p> <p>Safety of Nuclear Power Plants: Design</p> <p>Specific Safety Requirements No. SSR-2/1</p> 	<p>IAEA SAFETY STANDARDS SERIES</p> <p>Site Evaluation for Nuclear Installations</p> <p>SAFETY REQUIREMENTS No. NS-R-3</p>	<p>IAEA Safety Standards for protecting people and the environment</p> <p>Safety Assessment for Facilities and Activities</p> <p>General Safety Requirements Part 4 No. GSR Part 4</p>
<p>IAEA Safety Standards for protecting people and the environment</p> <p>Governmental, Legal and Regulatory Framework for Safety</p> <p>General Safety Requirements Part 1 No. GSR Part 1</p> 	<p>IAEA Safety Standards for protecting people and the environment</p> <p>Safety of Nuclear Power Plants: Commissioning and Operation</p> <p>Specific Safety Requirements No. SSR-2/2</p> 	



# Lessons learned from Fukushima





## Additional sources of revision

- Lessons learned from the use of existing regulations
  - Licensing of modifications
  - Expansion of Spent Fuel Interim Storage Facility
- Inclusion of international experience on new builds
  - WENRA report on new builds
  - Relevant regulation of other countries (STUK, HSE)
- More detailed regulation of site and construction licensing
- Uniform use of the concept of operating states
- To be issued in 2014



## 4. Actions taken in the light of the Fukushima Daiichi accident

### 4.3. Support of IAEA Action Plan



# Support of IAEA Action Plan

- Hungary strongly support the IAEA efforts to improve international arrangements for nuclear safety:
  - Undertook the design re-assessment
  - Supports the conduct and development of international peer reviews
  - Invited EPREV mission and support the RANET with own offers
  - Hungarian authorities are conducting a self-assessment
  - Paks NPP is going to host an OSART mission in the Fall of 2014
  - Hungary takes part in the revision of the IAEA safety standards
  - International legal framework: Hungary is party to all conventions with respect to nuclear safety
  - Supports the embarking countries
  - Improves its communication to be transparent and effective in information share





## 5. Planned Measures to Improve safety (in addition to Post-Fukushima measures described above)



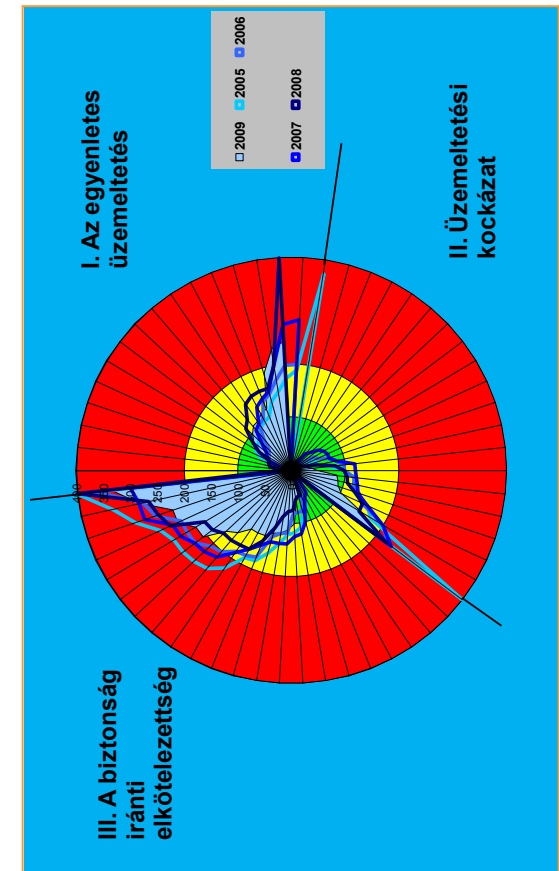
# Status of severe accident modifications in Paks NPP

<b>Measure</b>	<b>Unit 1</b>	<b>Unit 2</b>	<b>Unit 3</b>	<b>Unit 4</b>
Flooding the reactor vessel cavity for external cooling	Implemented	Implemented	Implemented	2014 main outage
Provision of an autonomous power supply to essential I&C consumers	Implemented	Implemented	Implemented	Implemented
Installation of passive hydrogen recombiners	Implemented	Implemented	Implemented	Implemented
Reinforcement of the spent fuel pool cooling system against loss of coolant	Implemented	Implemented	Implemented	Implemented
Installation of a severe accident monitoring system	Implemented	Implemented	Implemented	Implemented
Introduction of severe accident management guidelines	Implemented	Implemented	Implemented	31 Dec 2014



# Actions by the regulator

- Full scope IRRS mission to Hungary
  - Invited for 2015 May
  - Self-assessment is going on
  - HAEA (40 persons)
  - Environmental protection authority
  - National public health authority
- Initiated revision of the regulations
- Initiated the expansion of staff
- Knowledge management because of retirements





## 6. Recent developments (Significant events since the last Review Meeting)



# Preparation for transport of damaged fuel to Russia

- Drying technology elaborated
- Safety case demonstrated
- Equipment manufactured and tested
- Personnel trained
- Inactive tests performed
- Licenses obtained
- Transportation to be coordinated by Hungarian experts with involvement of Russian experts





# Intergovernmental Agreement

- Signed between Hungary and Russia on 14th of January 2014 in the field of peaceful uses of nuclear energy.
- Maintaining the current capacity of Paks NPP
- Long-term energy security
- Potential for co-operation in spent fuel management, nuclear R&D, human resource development, space applications





# Repatriation of HEU

- November 4, 2013: last HEU transport container left the territory of Hungary
- HEU spent fuel from Budapest Research Reactor
- To Russian Federation
- Completion of repatriation project
  - 2008-2013
  - US Government, GTRI
- Hungary is the ninth nation, which completely removed all HEU fuel from its territory
- Fulfillment of commitment from the Nuclear Security Summit in 2012, Seoul





## 7. Recent and future challenges, good practices





## Actions on challenges from the last Review Meeting

- Assessment of submittals on major modifications related to SLE (MCP, SAM, SDEOP) - **done**
- Licensing the lifetime extension of units 1 & 2 – **done for Unit 1 and under way for Unit 2**
- Further preparations for a new build – **done**
- Performing the Targeted Safety Re-evaluation (follow-up of the Fukushima accident) - **done, Action Plan in progress**
- Execution of a national nuclear emergency exercise – **done in 2013 november**
- Compete with other nuclear players for experienced manpower – **still existing challenge**



# Future challenges

- Site assessment and site licensing
- Preparation for construction licensing
- Prepare for and implement international missions
  - OSART in Paks NPP: 2014
  - IRRS: 2015
  - EPREV: 2016
- Service life extension of units 2, 3 & 4
- Knowledge management



# Good Practices and efforts

- Active participation in the international co-operation in nuclear safety, with special regard to post-Fukushima activities
- Systematic and continuous training and information exchange
- Support of EC in the frame of the RESPEC contract
- Wide spread, active and efficient public information: public hearings
- Licensing of service life extension
- Training support of embarking countries on bilateral basis
- Public hearings for each important licensing step





## 8. Questions Raised from Peer Review of National Report



# Number of questions by topics

- Emergency preparedness: 18
- Life extension (PSR, FSAR): 12
- Post-Fukushima: 10
- Regulatory independence, financing, staffing: 9
- Design, hazards, PSA: 10
- Organization, management: 9
- Discharges, radiation protection: 6
- Safety culture: 5
- Events, safety performance: 5
- SAMG: 5
- Regulations: 4
- Maintenance, ISI: 4
- Qualification, training: 3
- TSO independence: 3
- Transparency: 3
- New units: 2
- Others (2 or less)

Article	Q/C
General	14
6	17
7	5
8	10
9	3
10	8
11	9
12	4
13	7
14	18
15	9
16	17
17	2
18	2
19	11
Total	136



# Answers to emergency preparedness questions I

- Planning zones and emergency classes according to IAEA recommendations
  - Planning provides flexibility
  - Iodine prophylaxis is planned for the UPZ
  - Simulation results are used for decision making in early phase
  - 4 emergency class (alert, site area, facility and general emergency)
- National, regional and local Information Groups are responsible for informing the public in accidents within their own competence
  - Each player must have Emergency Communication Plan
  - Plant is responsible for informing the authorities



# Answers to emergency preparedness questions I

- Back-up Command Centre: on-site purposes, located off-site
- National exercise, 7-9 October 2013: extended command post exercise, demonstration exercise invited intl. experts
- Emergency plan regularly updated and approved by HAEA
- Emergency dose limits:
  - annual occupational effective dose limit (50 mSv)
  - 100 mSv effective dose to avoid significant population doses
  - lifeguarding or lifesaving: 250 mSv effective dose



# Answers to service life extension questions I

- HAEA required pre-conditions for SLE
  - SAMG modifications
  - Seismic reinforcement of some structures
  - Introduction of extensive ageing management
  - Re-qualification of I&C components for harsh environmental conditions
  - Review of design basis
  - Demonstration of maintenance effectiveness
- SLE supporting evidence for 20 years operation license
  - Screening and scoping SSCs for (passive and long lived)
  - Integrated ageing assessment
  - Condition maintenance for extended lifetime
  - Time limited ageing analyses
  - Justification of availability of resources





## Answers to service life extension questions II

- PSR: trends, OPEX, changes in state-of-the-art, regulations, ageing issues, PSR procedure can limit the license validity
- Stress-test results: managed under current licensing basis, did not directly influence SLE
- Power uprate influence was demonstrated acceptable: neutron irradiation of RPV, SG flow rate



# Answer to questions: regulatory independence, financing, staffing I

- HAEA
  - supervised by the minister also responsible for energy
  - law provides that HAEA decisions shall not be modified by virtue of supervision
  - no appeal may be lodged against HAEA decisions, only judicial review is possible
  - budget is planned in as separate title in the chapter of the ministry
  - Head of HAEA appointed and dismissed by Prime Minister, on proposal of the supervising Minister.
- Supervisory roles of the minister
  - representation of HAEA in front of the Government and Parliament
  - exercise employer's rights in connection with HAEA head
  - approval of organizational and operational rules of HAEA



## Answer to questions: regulatory independence, financing, staffing II

- Use of TSOs
  - independence checked on each occasion
- Staffing of HAEA
  - Problem of competitiveness (bound to public administration rules)
  - Problem of availability (only young engineers)



# Conclusions

## Hungary

- is strongly committed to the safe, peaceful application of nuclear energy
- complies with all articles and the spirit of the Convention on Nuclear Safety
- actively and strongly support all international activities meant to enhance nuclear safety
- supports and encourage the embarking countries in preparing for effective nuclear safety management
- is a HEU-free zone, after completion of repatriation



# Thank you for your attention!

