Presentation of Hungary

at the 7th Review Meeting of the Convention on Nuclear Safety

Country Group 4
31/03/2017, Vienna, IAEA

Presented by: Dr. Gábor Petőfi
Hungarian Atomic Energy Authority

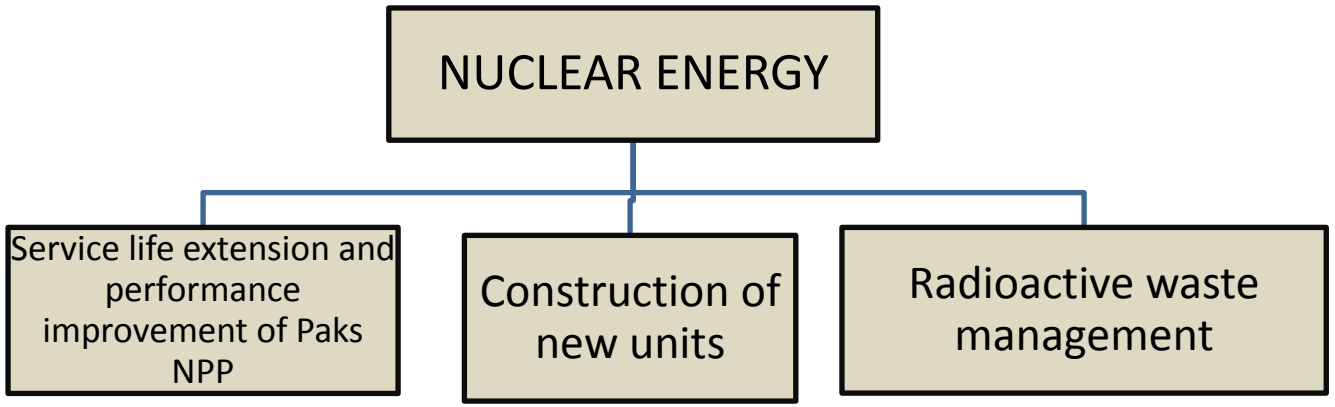
Presentation Outline

1. Hungarian Nuclear Programme
2. Changes in the nuclear programme
3. Safety improvements
4. Response to challenges and suggestions of the 6th review meeting and IAEA missions
5. Vienna declaration
6. Fukushima follow-up
7. Current and future challenges
8. Good practices and areas of good performance
9. Answers to questions raised from Peer Review of National Report
10. Updates to national report since publication
11. Conclusions

1. Hungarian Nuclear Programme

Hungary's National Energy Strategy – Role of nuclear energy

- Major role of nuclear power
- In 2016: 51,3% of gross electricity production and 36,5% of electricity consumption
- Three main pillars of nuclear energy policy



Summary of basic information on the national programme

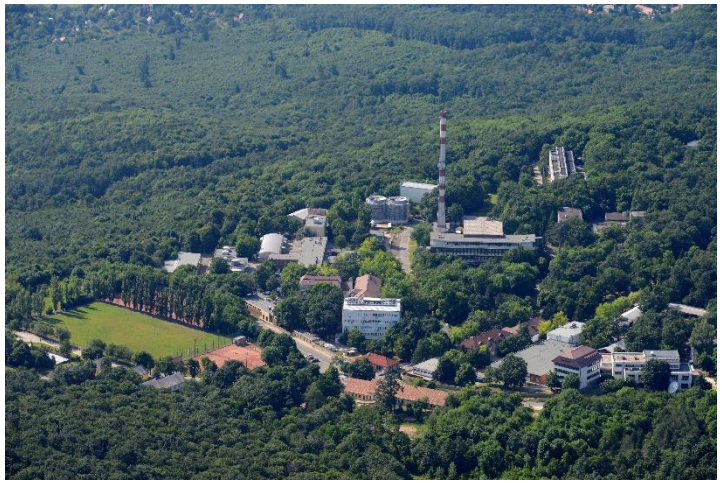
- Advanced infrastructure
  - Legislation
  - Governmental institutions
  - Research facilities, universities
  - Technical support organizations, industry
- Broad international co-operation
  - IAEA, EU (EURATOM, ENSREG, WENRA, ENSRA, HERCA), OECD NEA, VVER Forum
  - Bilateral cooperation with several countries and authorities

Summary of basic information on the national programme

- Paks NPP
  - 4 units of VVER 440/213
  - Uprated power 500 Mwe
  - Load factor: 80-90%
- SFISF
  - Dry storage for 50 years
  - Modular expansion
  - 20 vaults, 9308 storage tubes
  - Vaults 21-24 under construction
  - Currently stored: 8738 SF assemblies

Summary of basic information on the national programme

- Budapest Research Reactor
  - VVER SM tank type, 10 MWth
  - Operated by Center for Energy Research
  - Experiments and isotope production
- Budapest Training Reactor
  - Pool type, 100 kWth
  - Operated by Budapest University of Technology and Economics



2. Changes in the nuclear programme

Major amendments of Act on Atomic Energy (Atomic Act)

- System of public hearings for all facility level licensing
  - E.g. siting, construction, operation, decommissioning
- Determination of clients for waste storage facilities
- Increasing HAEA independence (considering IRRS results)
  - Higher salaries for officers at HAEA
  - HAEA DG is authorized to decide on some certain extra-salary contributions to the HAEA officers
  - Nuclear oversight fee shall be exclusively used to cover HAEA costs

Major Amendments of Act on Atomic Energy (cont.)

- Radiation protection
  - Change of regulatory system (centralized)
  - Implementation of new Basic Safety Standards
  - National dosimetry register
  - RP training and registered radiation protection experts
- Concerning new units
  - Use of standards during construction licensing
  - Rules of Preliminary Safety Information before construction licensing

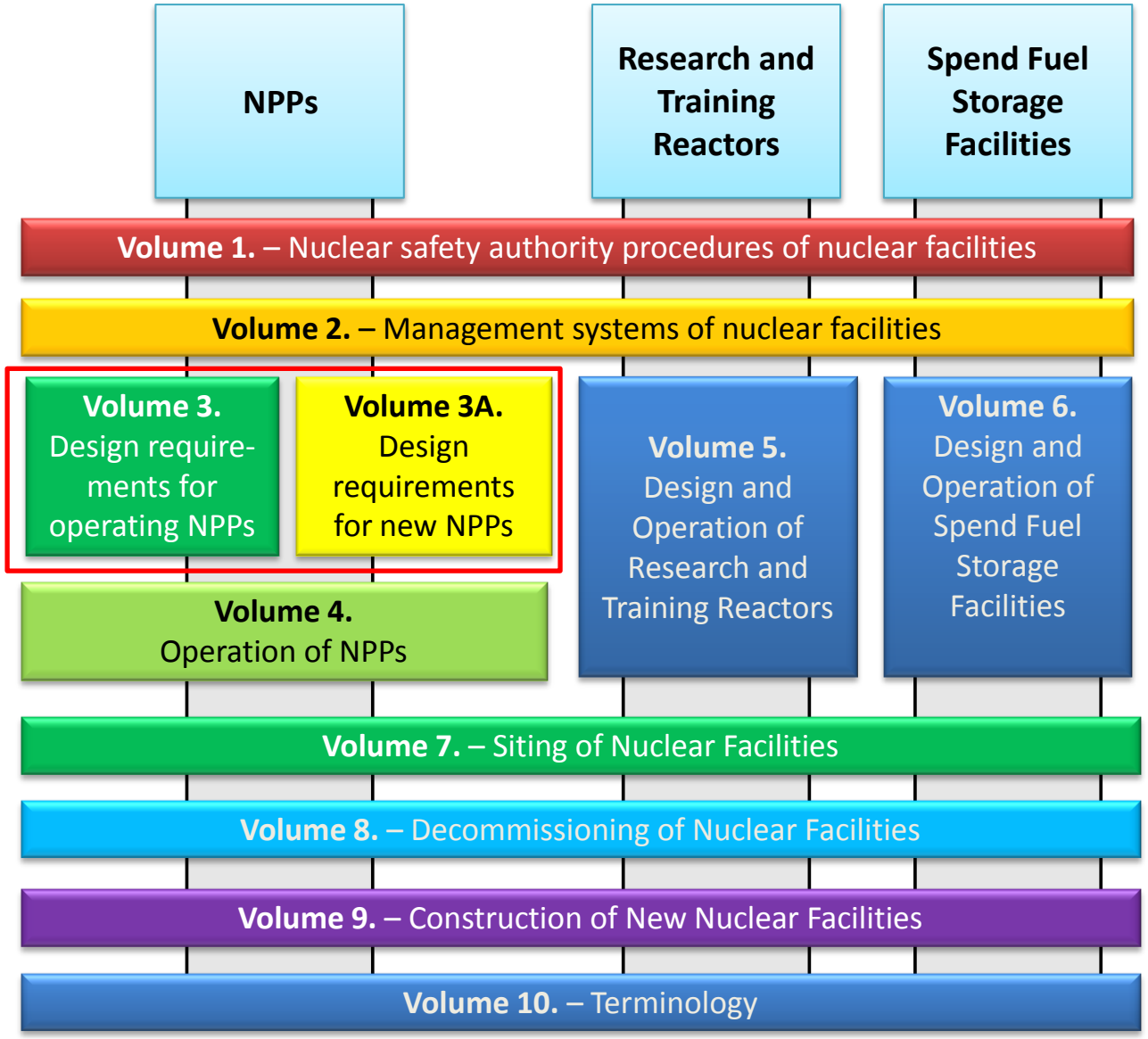
Major Amendments of Act on Atomic Energy (cont.)

- Licensing of deviations from the design during construction (HAEA initiative)
- Government to create rules in Nuclear Safety Code
- Goal: deviations shall be categorized by the licensee (based on safety assessment), category shall be approved by HAEA:
  - Important to safety: approval by HAEA
  - Minor safety relevance: HAEA shall be informed and HAEA to oversee the implementation
- Agreement with HAEA (and IAEA) approach on modifications
- HAEA's effective independence is not affected

Amendments of Nuclear Safety Code in 2014-2015

- Implementation of Fukushima experience (mainly stress test, WENRA RLs, SSR 2/1)
  - Independence of DiD levels
  - Cliff edge
  - Extension of DEC requirements
  - Multi-units
  - Waste management in emergencies
- Siting and design requirements for new units
- Detailed content requirements for PSAR for new units

Structure of Nuclear Safety Code



Regular review of Nuclear Safety Code (2015-2016)

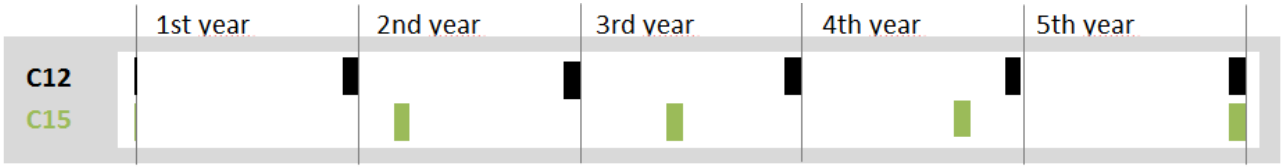
- Atomic Act requires 5-yearly review
- Review was carried out based on
  - National experience
  - EURATOM Nuclear Safety Directive (change)
  - IAEA Safety Standards (change)
  - WENRA Reference Levels (change)
  - Changes in regulatory system
    - Oversight of radiation protection (+ inclusion of new BSS)
    - Oversight of civil structures
- Proposals sent to Government in February 2017

Life time extension of Units 1-4 of the Paks Nuclear Power Plant

- Life time extension licences for Units 1, 2 and 3 were granted until 2032, 2034 and 2036 respectively
- Licensing of life time extension of Unit 4 is currently in progress
- Challenge 4: To complete the life extension of Unit 2, 3 and 4

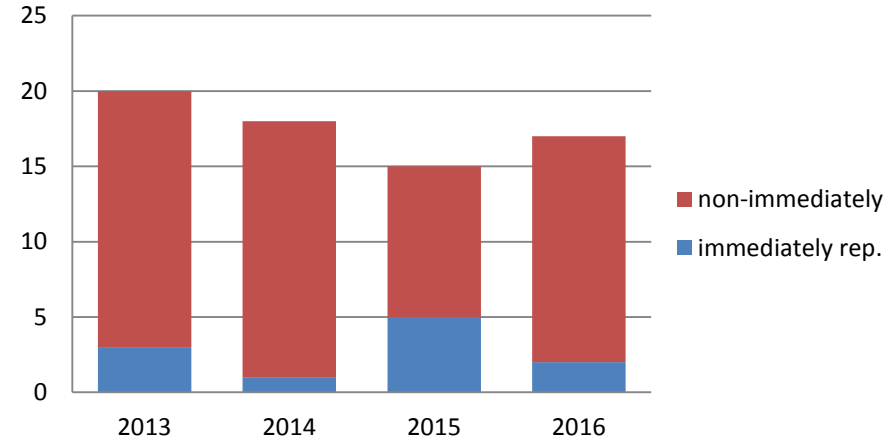
Introduction of a 15-month operation cycle at the Paks NPP

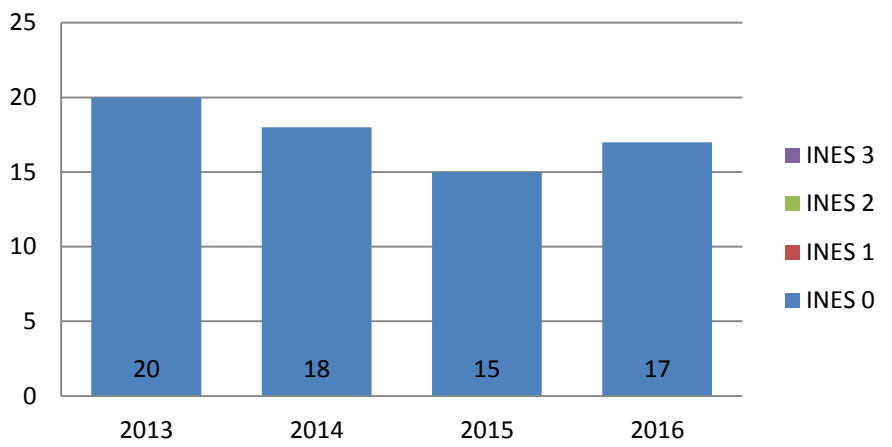
4 outages vs. 5 outages in a 5 year period

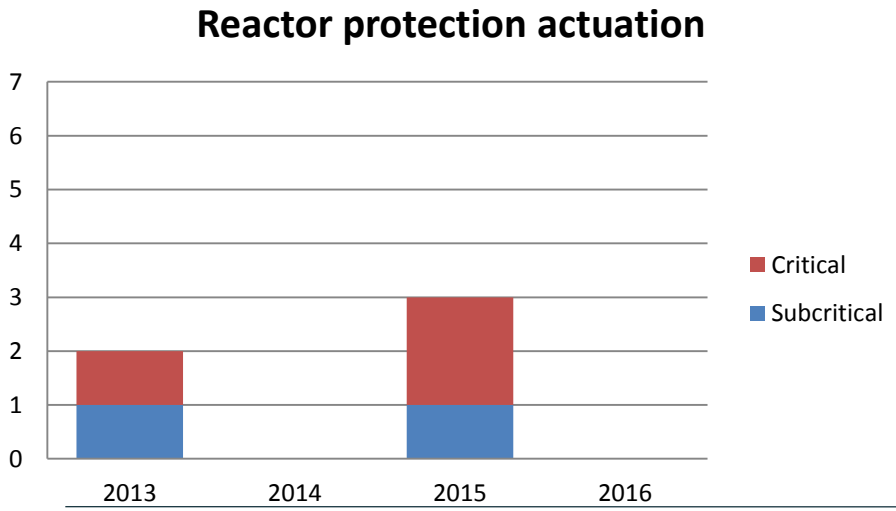


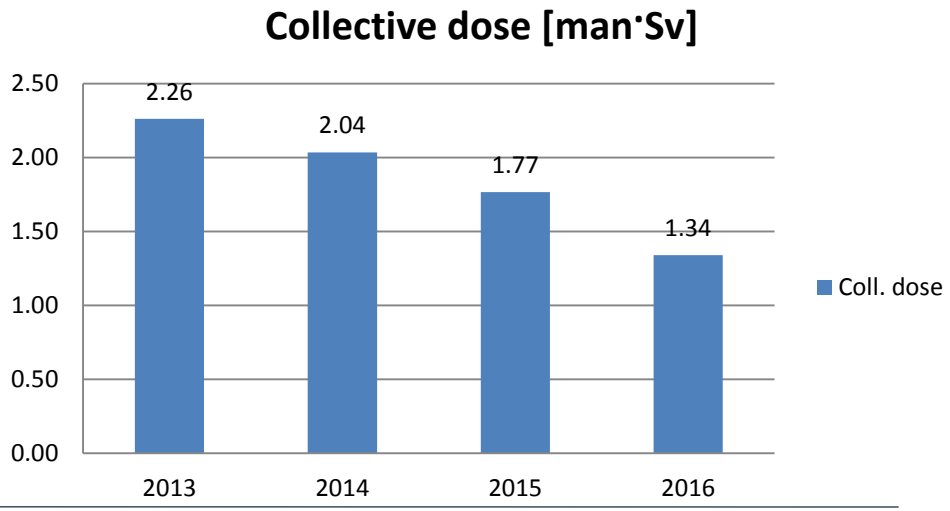
Consequences	Results
20% less load transient	• Decreased Core Damage Frequency (PSA) • Favourable fatigue and crack growth analysis results
26 days additional operation	• +2% electricity production
15% less periodic work volume	• Less maintenance cost • 15% less collective dose • 10% less overtime • Decreased work accident probability • Decreased maintenance human error risk • 10% less radioactive waste • 5% less non-radioactive waste
Doubled gadolinium, higher UO_2 enrichment, optimized core	• 3% less spent fuel • Unchanged or less neutron fluence on RPV wall

Paks NPP events



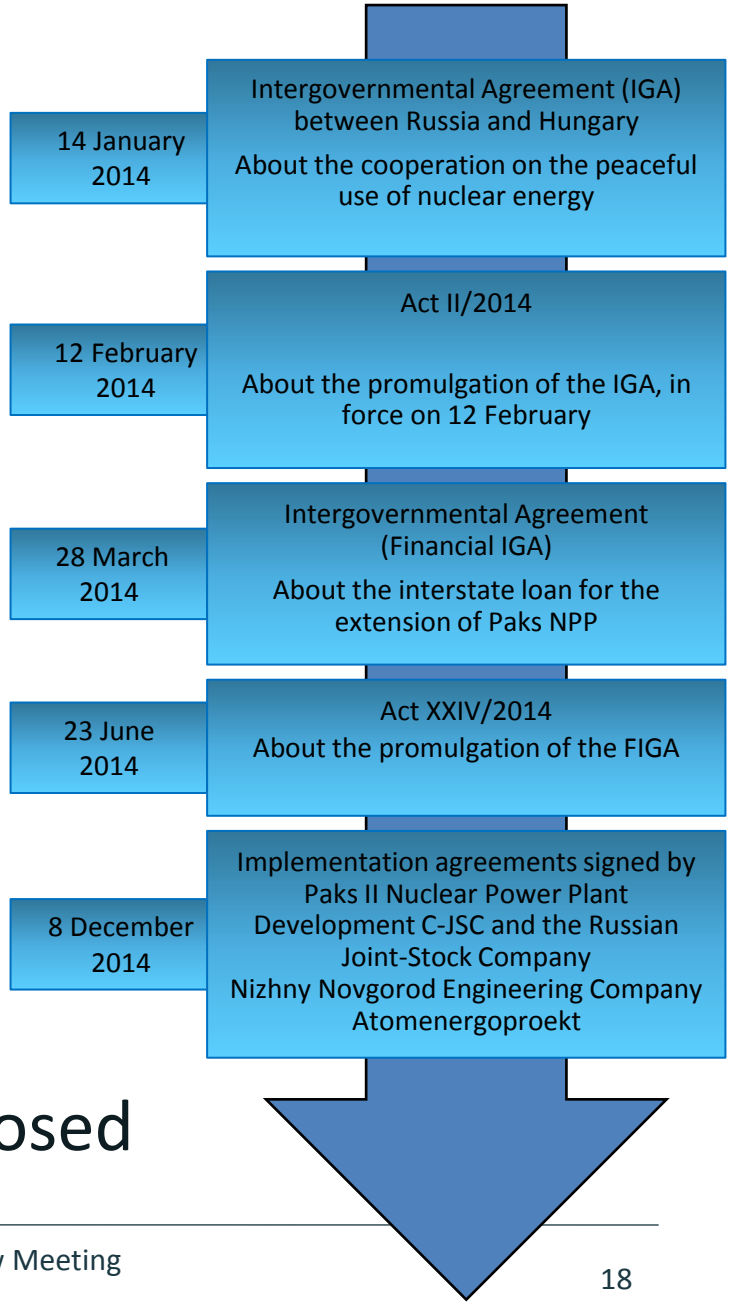






Paks II NPP milestones

- IGA
  - Two VVER-1200 type reactors
  - Russian loan for the 80% of construction costs
- Implementation agreements
  - EPC contract
  - Operation and maintenance support contract
  - Fuel supply contract
- March 2017: EC investigations closed



Paks II NPP regulatory licensing

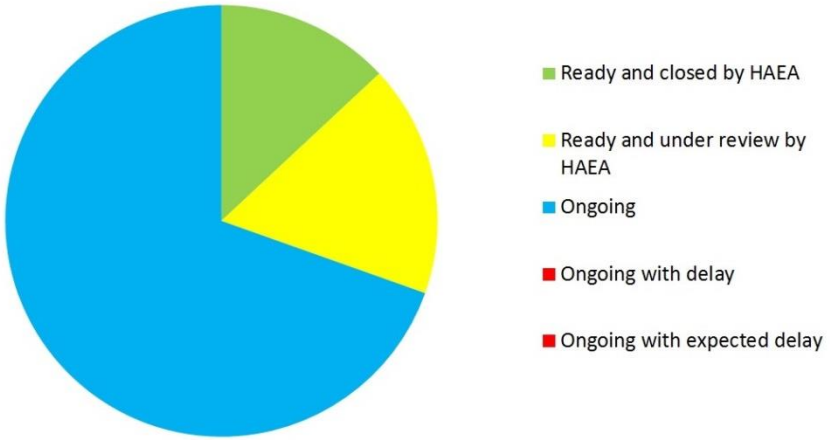
- November 2014: Site investigation and evaluation license granted for Paks site
- September 2015: Preliminary safety information report
- September 2016: Environmental license granted
  - appealed at environmental authority of second instance
- October 2016: Site license application submitted
  - Regulatory decision: first half of 2017
- Next step: construction license application

3. Safety improvements

Stress test tasks status 2014-2017

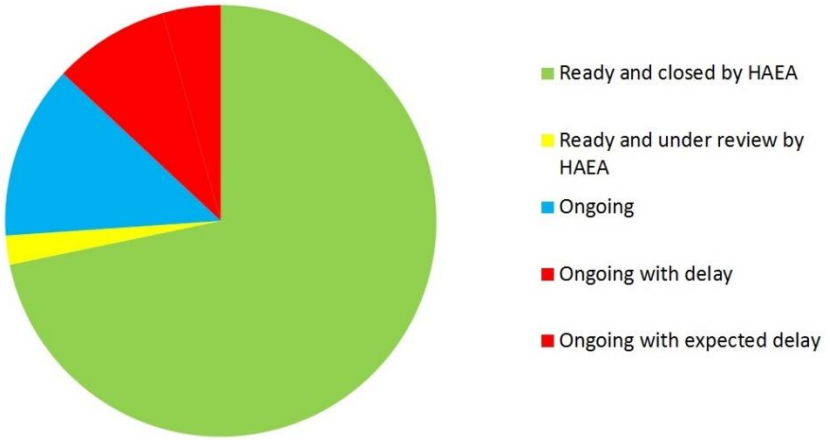
18.2.2014

Tasks	Ready and **closed** by HAEA	Ready and **under review** by HAEA	Ongoing	Ongoing with delay	Ongoing with expected delay
46	6	8	32	0	0



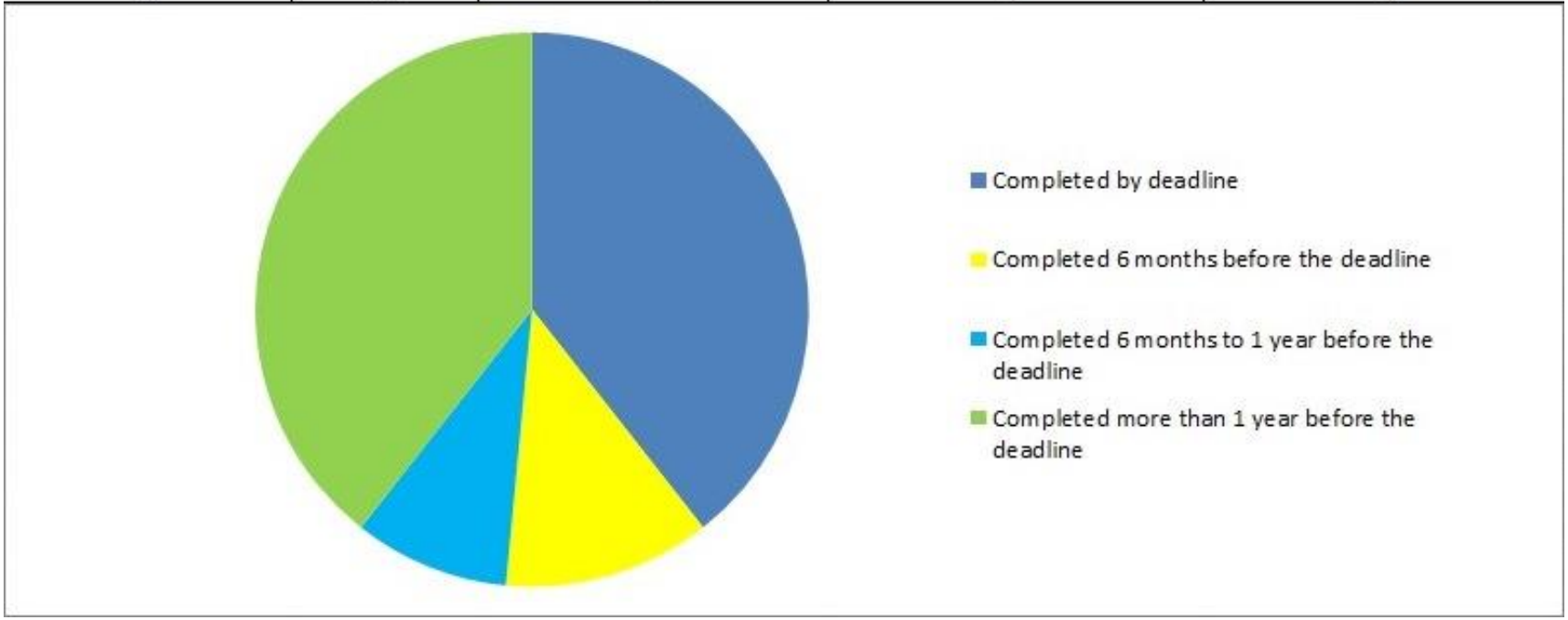
22.3.2017

Tasks	Ready and **closed** by HAEA	Ready and **under review** by HAEA	Ongoing	Ongoing with delay	Ongoing with expected delay
46	33	1	6	4	2



Ready tasks

Ready and closed by HAEA	Completed by deadline	Completed 6 months before the deadline	Completed 6 months to 1 year before the deadline	Completed more than 1 year before the deadline
33	13	4	3	13



Delayed stress test tasks from National Action Plan

- Task 2: construction of a new fire station
- Task 48: air-conditioning of protected emergency command centre (PCC)
- Task 49: backup emergency command centre (BCC)
- Task 40: storage computers to PCC and BCC
- Reasons: change of technical contents, unsuccessful public procurement, interrelation of tasks
- Delay in overall deadline (originally the end of 2018)
- No significant increase in safety risk

Periodic Safety Review (PSR) of Paks NPP

- Last PSR was carried out in 2007-2008
  - independently of service life extension licensing
- Safety improvement actions were completed
- Next PSR to take place in 2017-2018
- New Regulatory Guide (available at HAEA website)
  - Lists the relevant WENRA reference levels and the new IAEA considerations (SSG 25) as the minimum scope
  - New topics with Fukushima experience

4. Response to challenges and suggestions of the 6th review meeting and IAEA missions

Challenge 1: To carry out an IAEA IRRS mission foreseen for 2015

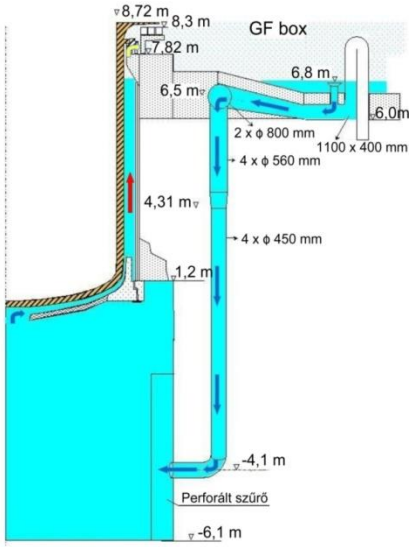
- Completed in 2015 May, most important findings
  - Independence of HAEA in terms of organization and budget
  - More effective use of graded approach
  - Enforcement policy and procedures should be revised
- Most findings were related to decentralized regulatory system
  - Resolved at January 1, 2016, when HAEA took over several tasks
- Good practices
  - Hungarian Nuclear Knowledge Data Base
  - Indicators to monitor research reactors and spent fuel facility
  - Scoring of safety significance of events
- Findings incorporated to action plans of authorities
- Follow-up expected to second half of 2018

Challenge 2: To complete the action plan drawn after the Fukushima accident and stress tests

- See slides 21-23

Challenge 3: To finalize the implementation of severe accident guidelines in all the Paks units

- SAM modifications have been completed between 2011-2014
  - External cooling of RPV
  - SA hydrogen recombiners
  - SA mobile diesel generators to implement SA strategy
  - SA measurements
  - Reinforcement of SFP cooling system



- SAMGs were implemented in all units after the modifications completed

Challenge 4: To complete the life extension of Unit 2, 3 and 4 of Paks NPP

- Start of operation: U1-82, U2-84, U3-86, U4-87
- Lack of original design documents, design lifetime of some SSCs was 30 years
- Main principle: safety margins shall be maintained and pre-conditions shall be met:
  - Design reconsititution
  - SAM implementation
  - Ageing management implementation
  - Monitoring of the maintenance effectiveness
  - Equipment qualification of electric and I&C

Service life extension process

- Based on US approach and in full compliance with IAEA requirements and guidance
  - Scope: passive, long lived SSCs important to safety
  - Active components managed by effective maintenance and other plant programmes
  - Review of ageing management, time limited analyses
  - Modification of operating documents and FSAR
- **Licences**
  - **Unit 1 2012: service life extended until 2032**
  - **Unit 2 2014: service life extended until 2034**
  - **Unit 3 2016: service life extended until 2036**
  - **Unit 4 2017: in progress…**

Challenge 5: Strengthening the education of nuclear professionals

- Nuclear lawyer education at Széchenyi István University (Győr)
- Nuclear construction engineer education at Budapest University of Technology and Economics (BME)
- HAEA initiated fellowship at the BME
- Government decision on fellowships to Russian universities

Challenge 6: Knowledge Management

- HAEA initiated a knowledge management project in compliance with SAT
- Knowledge profile database (exists, not updated yet)
- Newly implemented items
  - Intensive initial training program of newcomers
  - Inspector training process tailored to individual needs
  - Tutoring program by senior inspectors
  - Utilization of knowledge of retiring staff members (written report + interviews about specific knowledge)
  - Leadership training

Challenge 7: Updating the regulation for new NPP, mainly the guidance for siting and for severe accident

- See slides 12-13

Suggestion 1: To establish appropriate mechanisms for the retention of qualified staff of the regulatory body and to address the human resource needs for the assessment and inspection of new reactors

- Amendment of Atomic Act (2015-2016) provided
  - Higher salaries and more free days compared to other government officers
  - Extra salary contributions
  - Opportunity for the DG to determine personal salaries in certain cases
  - More flexible opportunities to support travelling to work, clothing, accommodation, health insurance, social contribution for HAEA officers

Suggestion 2: To put in place mechanisms to ensure independence of TSO when working for the regulatory body

- By contracts
  - Declaration of independence in the given regulatory procedure
  - Regulations related to the participation of sub-contractors
  - Verification of owner background of each contractor

Comments to Special Rapporteur Challenges of the 6th Review Meeting

- To minimize gaps in safety improvements
  - Hungary supports all reasonable international exchange and peer review activity (OSART, design review, IRRS, IPPAS, EPREV, stress test, TPR)
- To harmonize emergency plans and response
  - Bilateral cooperation, HERCA, exercises, RESPEC
- Better use of OPEX and regulatory experience
  - Hungary support all reasonable forums to exchange experience (VVER Forum, ENSTTI, MDEP, bilateral cooperations)

Comments to Special Rapporteur Challenges of the 6th Review Meeting

- To improve regulatory independence, safety culture and transparency
  - Strengthening effective independence (organizational and financial decisions) in the CNS
  - See proposed Good Practice 1
- To engage all countries to commit and participate in international cooperation
  - Hungarian examples
    - System of bilateral and multilateral cooperation
    - Nuclear safety education of Vietnamese inspectors

5. Vienna declaration

Addressing Vienna Declaration Principle 1

- Govt. Decree 118/2011 (VII.11.) on nuclear safety requirements
  - Definition of new nuclear power plant unit: „A nuclear power plant unit constructed after 1 April 2012.„ (Govt. Decree 118/2011)
  - Section 6 (4): safety objectives of prevention and mitigation of consequences within acceptable limits
  - Section 6 (6): safety objectives shall be addressed throughout the plant lifetime
  - Section 7 (4a): independence of the DiD levels shall be ensured to the extent reasonably achievable

Addressing Vienna Declaration Principle 1

- Govt. Decree 118/2011 (VII.11.)
  - DEC is part of the operational states (Volume 10 Def 163 + design requirements for existing and new units)
  - HP core melt scenarios shall be avoided (3.2.2.4400., 3a.2.2.7400.)
  - CCF
    - Possibility shall be taken into account in design and safety analyses (3.2.2.3510., 3.2.3.1700., 3.3.1.0700., 3a2.2.5600, 3a.2.3.1900., 3a.3.1.1000.)
    - Shall be minimized for I&C components (3.4.5.2900., 3a.4.5.4700.)

Addressing Vienna Declaration Principle 1

- Govt. Decree 118/2011 (VII.11.)
  - Limited environmental impact: shall no be need for
    - urgent protective action beyond 800 m
    - temporary action beyond 3 km
    - subsequent protective action beyond 800 m
    - any long-term restriction on food consumption
  - Large, early release shall be practically eliminated
- Implementation for existing units
  - SAM modifications are completed, SAMGs are introduced
  - Post-Fukushima modifications are being implemented

Addressing Vienna Declaration Principle 2

- Periodic Safety Review for all nuclear facilities
  - Verification of compliance with licensing basis
  - Using state-of-the-art international practice and methods
- Purpose
  - Identification of place for improvement
  - Determination of safety improvement actions
  - Demonstration of safety for next 10 years
- Actions
  - All reasonable actions shall be determined and scheduled
  - Timing shall be commensurate with safety significance

Addressing Vienna Declaration Principle 3

- Section 5 (1) of Act on Atomic Energy and Section 3 (7) of Govt. Decree 118/2011 (VII.11.)
  - Nuclear safety requirements shall be reviewed every 5 years
  - Considering state-of-the-art science, domestic and international experience
- Safety guides shall be reviewed as appropriate
  - Upon regulatory decision or licensee request
- Sources
  - IAEA, WENRA, EU, CNS, OECD NEA, other countries

6. Fukushima follow-up

Post-Fukushima National Action Plan

- Developed based on
  - stress test results of Paks NPP
  - Assessment of national arrangements
- NAcP was peer reviewed in 2013 by EU
- Progress was reviewed in 2015 by EU
- Regular updates
- Current status was described in slides 21-23

7. Current and future challenges

Challenges

- Licensing and oversight of construction of new NPP units
- Implementation of the reviewed Nuclear Safety Code
- Assessment of Safety Culture at the licensee and the regulatory authority
- 3rd Periodic Safety Review of Paks NPP
- Development of requirements and regulatory tools against fraudulent and counterfeit items
- Completion of inspector training for a large number of newcomers

8. Good practices and areas of good performance

Good practice
Transparency

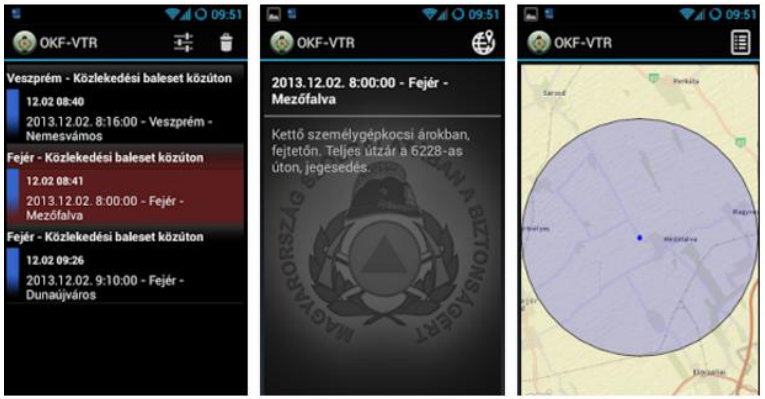
- Invitation of all European country to the ESPOO procedure, translation of licensing documentation to 10 languages, public hearings in 8 countries
- Road show in 41 villages to describe the environmental licensing process
- Public hearings in licensing processes of all life cycle phases of nuclear facilities
- Series of educational conferences for university students „About atomic energy for everyone”
- Invitation of public to comment regulatory guidelines

Good practice
Human resource development

- Recruiting 80 new inspectors
- Intensive initial training programme
  - With the involvement of TSOs, Senior experts and inspectors
  - Video recording, e-learning tools for examination
- Modification of the organization to better integrate newcomers
  - Tutoring and tailored training program within professional sections
- Preparation for inspector exam

Good performance
Use of smartphone application (VESZ) for public emergency alerts
(proposed by US)

- Pre-set or real-time GPS locations (user setting)
- App Store/Google Play/ Windows Phone



- Developed by National Directorate General for Disaster Management of the Ministry of the Interior
- Sends messages and signals

9. Answers to questions raised from Peer Review of National Report

(questions not answered in the previous slides)

Training Reactor and the Budapest Research Reactor (Q28-30)

- Design lifetime of BRR expires in 2023, life extension process is required to operate beyond that + PSR
- Training Reactor has no design lifetime -> PSR (2017)
- PSA is not mandatory for research reactors
- Core conversion of the Budapest Research Reactor
  - Detailed Quality Assurance Programme (phases and steps, schedule, education and training)
  - Hold points (LEU fuel Site Acceptance Test, Conversion process from HL1 to HL4 campaigns, Test campaign, Obtaining the operating license)
  - Experience in a referred article (see the answer Q29)

HAEA's inspection system (Q38, Q39)

- Multi-level inspection system
  - Comprehensive inspections (several areas, groups and days)
  - Specific on-site inspections including ad-hoc inspections and revealing inspections
  - Remote inspections
- Announced and unannounced
- Audits and inspections at contractors
- Inspection of licensing exams of operators
- Annual inspection plan

Results of other IAEA missions: OSART in Paks NPP (Q12)

- IAEA OSART mission in 2014
  - Conclusion: Paks NPP is committed to improve safety
  - 23 issues (15 recommendations and 8 suggestions), 7 GPs
  - Follow-up in 2016: 7 resolved, 16 satisfactory progress

10. Developments since submittal of report

All changes worth mentioning were described in the previous slides

11. Conclusions

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
- strives for continuous improvement of nuclear safety
- actively and strongly supports all international activities meant to enhance nuclear safety
- strongly supports transparency in nuclear safety

Thank you for your attention!