OPERATING EXPERIENCE FEEDBACK

THE HUNGARIAN EXPERIENCE

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Presented at the First Regulatory Conference on Nuclear Safety in Europe
Brussels, 27-28. 06. 2011

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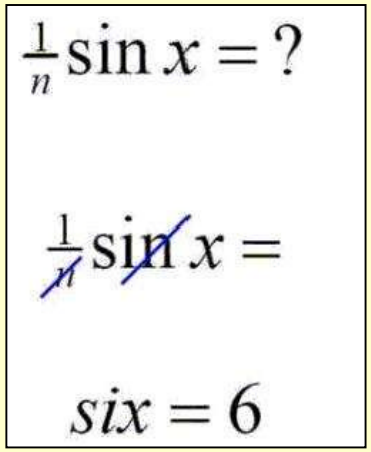
- Quantitative Event Assessment
- Safety Performance Indicators
- Graded approach to event investigations
- European Clearinghouse
- Safety Analysis Review Survey in WENRA

QUANTITATIVE EVENT ASSESSMENT

- A fine scale method to compare safety importance of operational occurrences
- Numerical values assigned to various aspects of the event
- Effective in evaluating human factor and safety culture issues
- Aspects valued:
  - Initiating event
  - Functioning of ESFs
  - TechSpec limit crossing or violation
  - Personnel activity
  - Core melt risk
  - Root cause of the event
  - Other factors (CCF, repetition, safety function degradation, failure in DB or analysis, …)
  - Safety class of the component
  - Personal doses
  - Radioactive release or contamination



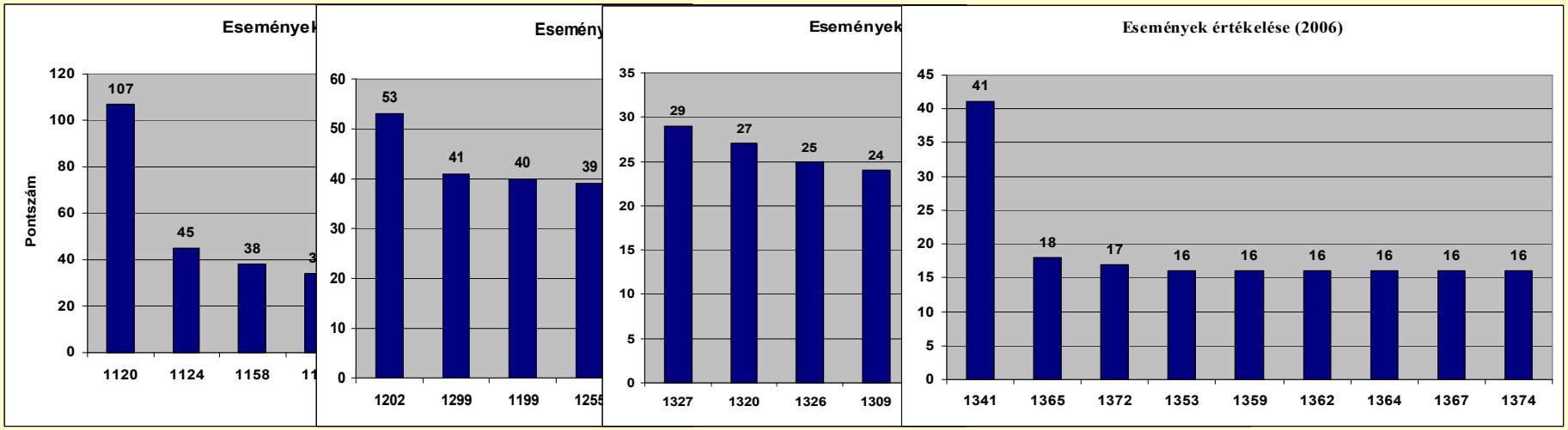
QEA – Examples of values

- Initiating event
  - No real (only potential) initiator: 1 point
  - Real initiator: 4 points
  - Anticipated occurrence ($f > 2x10^{-2}/y$) 1 point
  - Possible o. ($2x10^{-2}/y > f > 3x10^{-4}/y$) 2 points
  - Unlikely o. ($3x10^{-4}/y > f$) 3 points

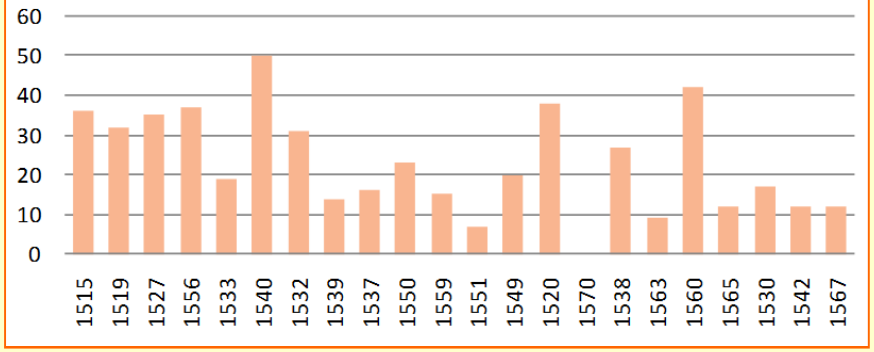
  $\sum$ = 2÷7 points
- TechSpec limits
  - No limit crossing (meeting conditions) 0 point
  - Limit crossing but not violation 1 point
  - Limit crossing at unknown past instance 6 points
  - Inadvertent limit violation 8 points
  - Intentional limit violation 12 points

  $\sum$ = 0÷18 points

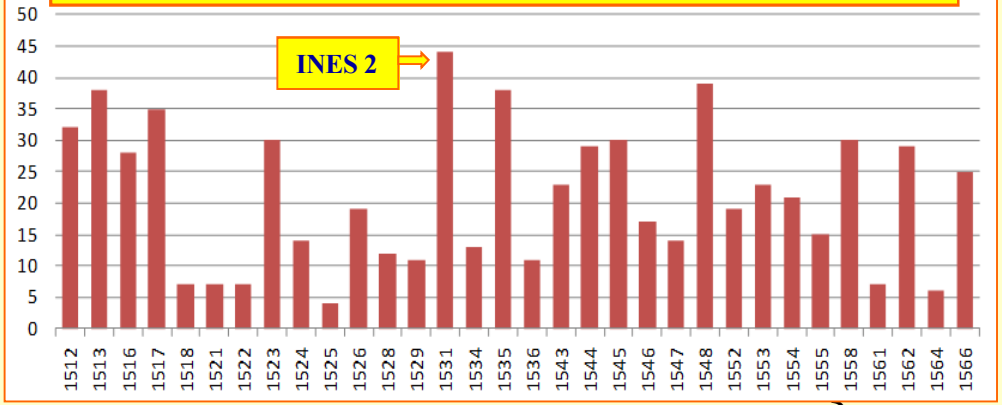
QEA – Examples of results



Safety evaluation of non-reportable events – 2009 (points)



Safety evaluation of reportable events – 2009 (points)



SAFETY PERFORMANCE INDICATORS

- Evaluated annually since 2001
- Follows the methodology elaborated by IAEA
- Parallel evaluated by the RB and the licensee (harmonized with minor alterations)
- Suitable for evaluation of safety performance and for trending
- **Green**: acceptable
- **Yellow**: note
- **Red**: not accepted
- **White**: not known
- Areas, sub-areas, indicators

SPI area – Smooth operation

1.1. Operational performance		1.2.Status of systems and components			1.3. Events
1.1.1. Unplanned scrams and power reductions	1.1.2. Maintenance planning	1.2.1. Maintenance	1.2.2. Material condition	1.2.3. Status of physical barriers	1.3.1. Reportable events
1.1.1.1. Power reductions due to internal causes	1.1.2.1. Ratio of planned and real duration of refueling	1.2.1.1. Maintenance of components classified to SCS	1.2.2.1. Use-up of load cycles	1.2.3.1. Fuel reliability	1.3.1.1. Immediately reportable events
1.1.1.2. Plant capacity factor	1.1.2.2. Ratio of unplanned work instructions	1.2.1.2. Ratio of preventive and total maintenance	1.2.2.2. Ratio of closed SG tubes	1.2.3.2. Primary incompactness	1.3.1.2. Reportable events
		1.2.1.3. Ratio of unsuccessful safety examinations	1.2.2.3. Foreign materials	1.2.3.3. Containment leakage	1.3.1.3. Indirectly reportable events
					1.3.1.4. Event investigations ordered by NSD

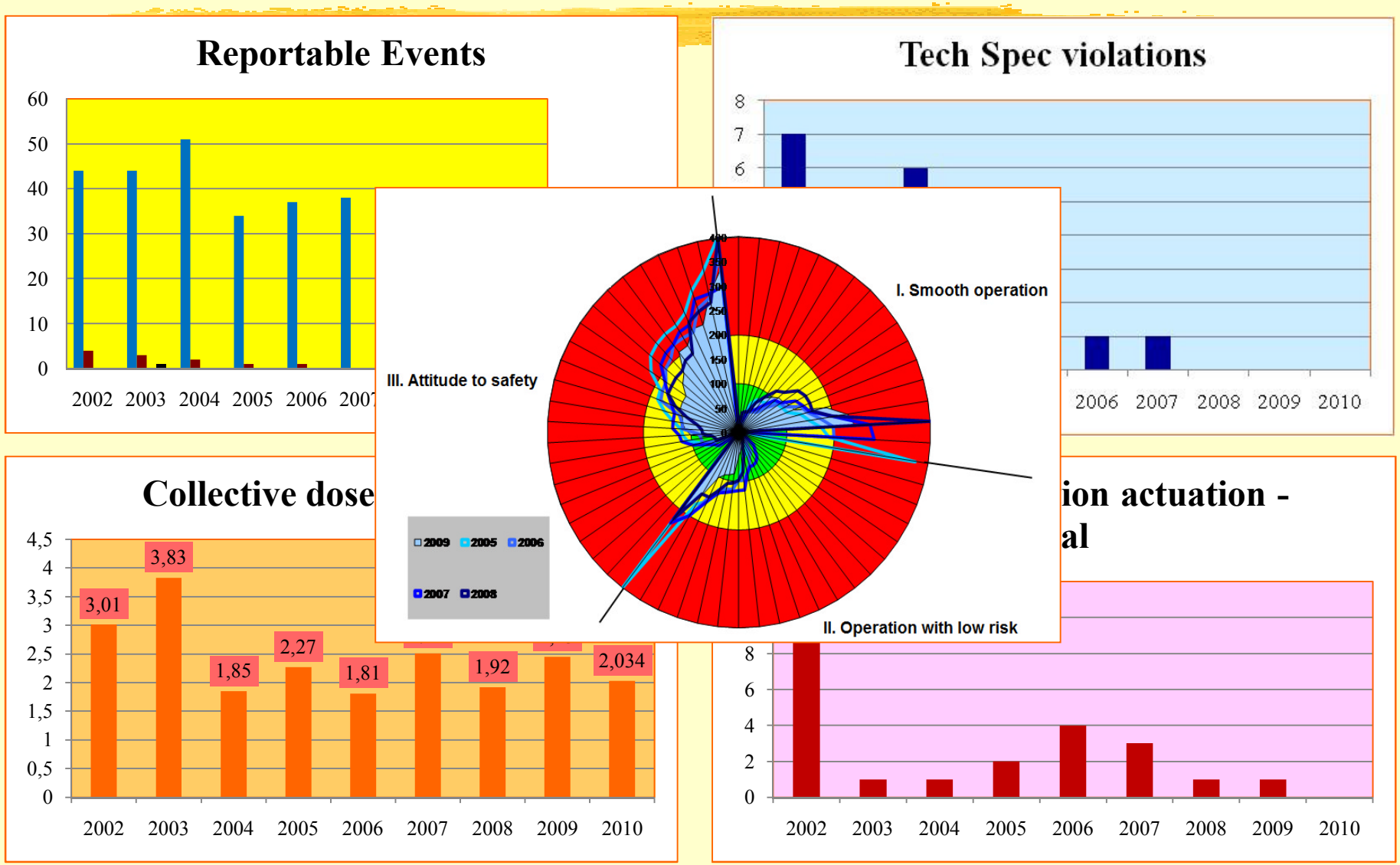
SPI area – Operation with low risk

2.1. Safety systems and components		2.2. Preparedness		2.3. Risk		
2.1.1. Actual operation of safety systems	2.1.2. Availability	2.2.1. Operational preparedness	2.2.2. Emergency preparedness	2.3.1. Operational risk	2.3.2. Calculation risk	2.3.3. Environmental risk
2.1.1.1. SCRAMs at nominal power	2.1.2.1. Unavailabilty detected during tests	2.2.1.1. Time devoted to training	2.2.2.1. Deficiencies in ERO drills	2.3.1.1. Number of TecSpecs violations	2.3.2.1. Core-melting index	2.3.3.1. Airborne radioactive release
2.1.1.2. Total number of SCRAMs	2.1.2.2. Diesels availability	2.2.1.2. Ratio of unsuccessful regulatory exams	2.2.2.2. Rate of participants in ERO training	2.3.1.2. Number of occurrences under the effect of TecSpec		2.3.3.2. Liquid radioactive release
2.1.1.3. SCRAM-III actuation	2.1.2.3. Pumps availability					2.3.3.3. Solid radioactive waste generated
2.1.1.4. ECCS operations	2.1.2.4. Reliability of safety systems					

SPI area – Attitude to safety

3.1. Compliance with instructions			3.2. Human performance			3.3. Striving for improvement		
3.1.1. Departure from planned state	3.1.2. Violations of instructions	3.1.3. Departure in reporting system	3.2.1. Efficiency of radiation protection programm	3.2.2. Efficiency of industrial safety program	3.2.3. Human factor	3.3.1. Self assess-ment	3.3.2. Corrective measures	3.3.3. Experience feedback
3.1.1.1. Modifications of TecSpecs	3.1.2.1. Number of TecSpecs violations	3.1.3.1. Delay of notification in case of immidiately reportable events	3.2.1.1. Eventual reports connecting to radiation protection	3.2.2.1. Works injuries	3.2.3.1. Unsuitable state for work	3.3.1.1. Number of independent internal audits	3.3.2.1. Corrective measures of investigations	3.3.3.1. Recurrent events
3.1.1.2. Temporary modifications	3.1.2.2. Tests cancelled	3.1.3.2. Delay of notification in case of reportable events	3.2.1.2. Dispersion of contamination	3.2.2.2. Fires	3.2.3.2. Cancel of work		3.3.2.2. Corrective measures of QA audits	
3.1.1.3. Operational instructions	3.1.2.3 Violations of licensing conditions	3.1.3.3. Delay of submitting of investigation reports (30 days)	3.2.1.3. Work programs at high radiation level					
			3.2.1.4. Collective dose					

SPI – Examples



GRADED APPROACH TO EVENT INVESTIGATIONS

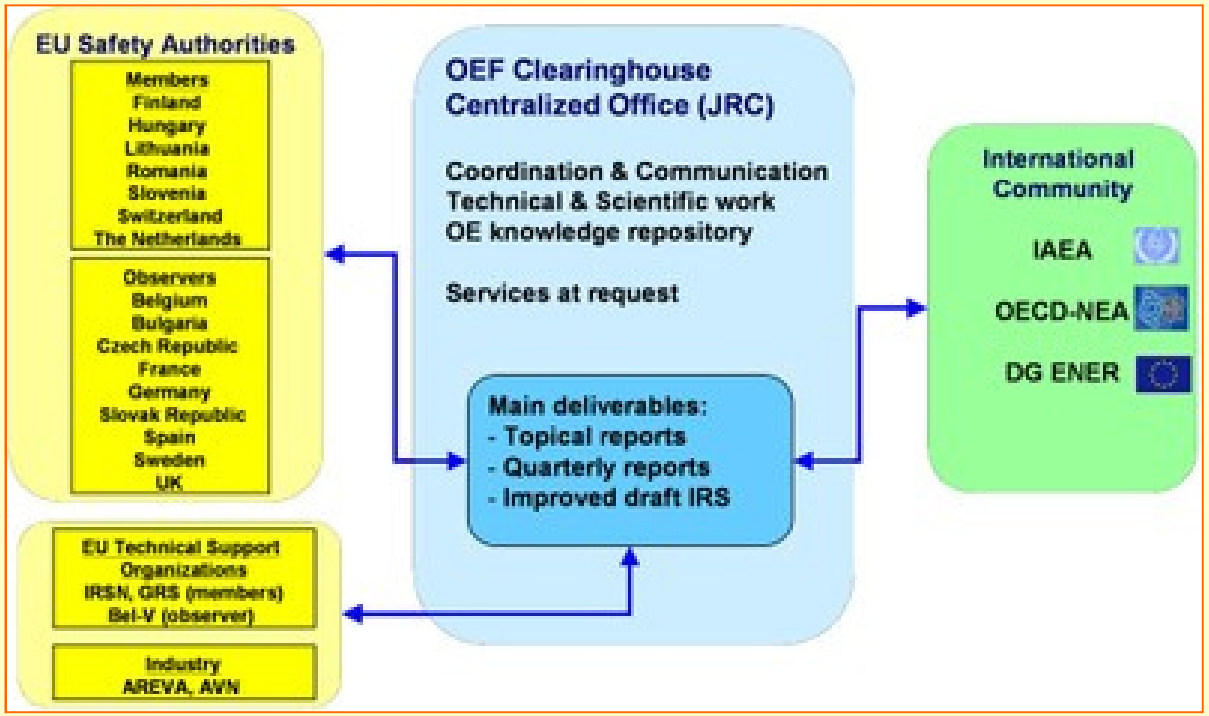
- The depth and method of the event investigation depends on the safety significance of the event
  - Type A: simplified investigation based on the review of the licensee reports and resulting in an „Event data sheet”
  - Type B: normal investigation by the assigned inspector resulting in an inspector report and an „Event data sheet”
  - Type C: extended investigation by a group of inspectors with possible inspections and interviews with the licensee

EUROPEAN CLEARINGHOUSE

- Objectives: to facilitate efficient sharing and implementation of operational experience feedback to improve the safety of Nuclear Power Plants
- Tasks:
  - Collecting, screening, evaluating European operating experience,
  - Supporting the preparation and evaluating IRS reports
  - Providing summary reports on interesting events
  - Collecting, summarizing, distributing information on corrective actions
  - Maintaining a website

EUROPEAN CLEARINGHOUSE

- Organization:



- https://clearinghouse-oef.jrc.ec.europa.eu/

EUROPEAN CLEARINGHOUSE - Examples

- The final selection of events for the third trimester of 2009:
  1. Olkiluoto 1 NPP (Finland) on 2009-07-13: Common Cause Failure in main steam line outer isolation valve actuators.
  2. Gravelines 1 NPP (France) on 2009-08-9: stuck fuel assembly during the refuelling phase.
  3. Cofrentes NPP (Spain) on 2009-09-22: during an inspection, a fuel subassembly that was being examined was dislodged, and hit the inspection device platform.
  4. Beznau 2 NPP (Switzerland)on 2009-07-31: two employees were exposed to radiation in excess of statutory dose limits when maintenance works beneath the RPV were carried out.
  5. Dungeness B NPP (UK) on 2009-06-29: operations, made to recover a new fuel assembly that was left suspended within the new fuel transfer route, provoked a possible challenge in the margin to criticality.

EUROPEAN CLEARINGHOUSE - Examples

- The selected events for the first quarter of 2011:

1. Fukushima nuclear accident, currently INES 7 (units 1 to 3), INES 3 (unit 4) (Japan)
2. Feedwater turbopump anomaly, INES 2 (Belgium)
3. Emergency diesel generators anomaly, INES 2 (France)
4. Generic anomaly concerning the measurement of the system of high pressure safety injection in reactors of 900 MWe (France)
5. Presence of radioactivity in the distribution circuit of demineralized water (France)
6. Operation without reactor trip signal of the main turbine trip, INES 2 (Mexico)

EU CH publications

Joint Research Centre

www.jrc.ec.europa.eu

Learning from Others

Using Operational Experience to Improve the Safety of Nuclear Power Plants

JRC Scientific and Technical Reports

EU Clearinghouse on NPP OEF Summary Report on Fuel Related Events

Manuel Martin Ramos

EUR 24579 EN - 2010

JRC EUROPEAN COMMISSION

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JRC Scientific and Technical Reports

Summary Report on Nuclear Power Plants Construction, Commissioning and Manufacturing Events

Benoit ZERGER

EUR24624 EN - 2011

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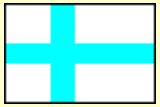
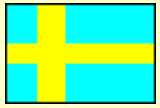
WENRA SAFETY ANALYSIS REVIEW SURVEY

- Goal: collect and disseminate information on the European practice of reviewing safety analysis submittals
- Purpose: revise and renew practice of HAEA
- Method: questionnaire with 2 main questions and several sub-questions therein:
  - *Have your authority reviewed within the last 10 years safety analyses in the FSAR of a NPP?* - *8 sub-questions*
  - *Have you approved within the last 10 years such plant modifications, which required re-evaluation of some of the safety analyses or required specific additional safety analyses?* - *8 sub-questions*

WENRA SAR SURVEY– answers from







WENRA SAR SURVEY– results

- Review of FSAR:
  - Estimated expert man*months: 45 (4 – 150)
  - Hired expert man*months: 45
  - Most review cover PSA 1 and 2
  - Coverage corresponds to NUREG-800, depth limited
  - Independent recalculation: 4 fully, 4 small parts
  - UFSAR mostly reviewed, not everywhere approved
- Analysis for modifications:
  - In depth review often with graded approach
  - FSAR is the reference
  - For large modifications the extent is the same as for licensing
  - No extrenal expert
  - Independent analysis: 5 y, 4 rarely
  - Need for independent expert opinion: 4
  - Responsibility for the analysis results: with the licensee, RB needs to be convinced

THANK YOU FOR YOUR ATTENTION

Hungarian Atomic Energy Authority

www.haea.gov.hu

The author is grateful to

Szabolcs Hullán,
and
László Juhász

(HAEA)
for their assistance