Risk Informed Decision Making at STUK – Experience and Thoughts for the Future

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Risk Informed Regulation and Safety Management

- “Risk informed” (RI) in Finland combines both the deterministic and probabilistic insights
- PRA is an official licensing document as stated in the nuclear safety legislation
- Use of PRA in RI safety management required in Regulatory Guides issued by STUK
- PRA has been used in RI safety management for more than 30 years
  - Development of Level 1 and Level 2 PRAs required in 1984
- In recent years, STUK has increased the use of risk insights in oversight activities

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PRA Requirements in Brief

• PRA shall
  – be applied all through the plant life time
  – be plant specific, full scope Level 1 and 2 PRA, incl. internal events, internal & external hazards
  – include all operating modes
  – be up-to-date
  – demonstrate the fulfillment acceptance criteria: CDF < 1E-05/a and LRF < 5E-07/a

• Several PRA applications required as a condition for licensing and operation

PRA Applications required by Reg. Guides

• Plant modifications (identification of need and risk impact)
• RI Pre- and In-Service Inspections - RI-PSI/ISI
• RI In-Service (Periodic) Testing - RI-IST/RI-PT
• RI Operational Limits and Conditions RI-OLC
• RI Preventive Maintenance, RI-PM
• Training of Operators (and other staff)
• Procedures Development
• Safety Classification of SSCs
• Outage specific risk assessment for outage planning
• Assessment of the coverage and balance of the commissioning test programmes, and reduction commissioning risks
• “Security” PRA – vital area identification
Risk Informed Regulation in Finland

Use of PRA
- licensees & vendors
  - Design and Construction
  - Operation & maintenance
    - Level 1 and Level 2 PRA
    - PRA applications
  - Decommissioning
  - Risk assessment

Risk Informed Safety Management
Risk Informed Decisions on Daily Bases
Emphasis on Licensee’s Responsibility

Use of Risk Insights in all Regulatory Work
  - RI oversight
    - RI inspections and reviews
    - RI allocation of resources
    - More holistic handling of safety issues
  - Rulemaking
  - Research & Development

Regulatory Effectiveness & Efficiency
  - to do the right work
  - to do the work right
Benefits of Risk Informed Approach

• PRA forms a common communication platform between RB and the licensees
  – Plant specific state-of-the-art PRAs, peer review & thorough regulatory review
• Enhanced safety and operation of the NPP (plant improvements)
  – Less disturbances & "unnecessary" plant shutdown → better capacity factors
• RI allocation of resources
• Transparent, well-justified insights/rationale to support decision making (Licensees and RB)
• More consistent regulatory decisions
  – e.g. exemptions from certain requirements, if safety preserved
• Timely identification of potential design issues → more cost-benefit resolutions
  – e.g. licensing phase of new NPPs
• Balanced OLC → e.g. less forced shutdowns due to “Overly strict” LCOs
• More efficient regulatory reviews (RI grading of focus, details and resources)
• Balanced maintenance management (on-line preventive maintenance and annual outages)
• Increased staff’s risk awareness and common risk concept (Licensees and RB)
Major PRA and Plant improvements (Level 1)
RI Licensing of New NPPs

- OL3 NPP (EPR-1600 MWe)
  - PRA used to support the design of EPR NPP starting from the conceptual design phase
  - PRA used by STUK and the licensee to support risk/safety evaluation throughout the whole licensing process
    - several PRA and application updates during construction phase
  - PRA identified design vulnerabilities and led to design and procedural changes e.g. in process systems, electrical systems, I&C systems and in fire protection systems
  - Risk Informed Pre- and In-Service Inspection (RI-PSI/ISI) Methodology applied for a new NPP for the first time (in the world)
    - All piping included (all safety classes and non-safety classified pipings)
- Similar approach required also for the Hanhikivi NPP (FH-1, AES-2006, 1200MWe)
  - The project is currently in construction license application phase
  - STUK is awaiting the submittal of technical plant documentation
Recent PRA Development

• OL3 Commissioning risk assessment
• Security PRA - vital area identification
  – Analysis of brute force sabotages (explosion) already required and applied PRA application
  – Protection strategy assessment against insider threat: tool under development
• Intermediate Spent fuel storage PRAs
• Encapsulation plant PRA
• Use of PRA in practical elimination of early or large releases
• More systematic use of PRA to support regulatory decision making
  – Development project ongoing to explore methods and tools for RIDM
Summary and Conclusions

• PRA programs at the licensees are well developed and the use of PRA applications is an integrated part of safety management
• For more than 30 yrs, PRA has provided valuable insights to decision making in nuclear safety
• STUK’s implementation of risk informed regulation has also progressed fairly well
  – Included in STUK’s long term strategy 2018-2022
  – Management is committed to increase the use of PRA insights
  – Staff is open towards more formal application of RI methods and concepts
• Risk Informed Graded Approach development project ongoing at STUK
  – Formalization of Graded Approach Process
  – Development of tools, risk metrics and procedures to support RIDM

→ Enhanced Regulatory Effectiveness & Efficiency → Enhanced Nuclear Safety