Nuclear Regulation: The impact of operating experience

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Improving Risk Regulation
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Background

✓ Safety first
✓ Prime responsibility for safety rests with the industry
✓ Accident consequences (From public health to social disruption)
✓ Deterministic vs. Probabilistic (Risk-informed)
✓ Technological evolution (Knowledge and practices)
✓ Crisis and Operating Experience feedback
✓ Defence-in-Depth concept
Operating Experience

- **Regulatory side**
  - International Nuclear Event Scale INES
    Communication tool. Safety significance. 48h

- **Industry side**
  - WANO 1987. Cooperation vs competition

- **Common goals**
  - Reducing frequency and severity
  - Improvements in systems, procedures and training
Main challenges/problems
- System problems. Operator mistakes. Organizational problems

Main improvements
- Operator training
- Operating procedures
- Feedback of operating experience
- Control room design
- Emergency response
- Regulatory changes (Severe accident)
Crisis studies – Chernobyl 1986

- Main challenges/problems

- Main improvements
  - Emergency response
  - System improvements
  - Radiation protection and Public health
  - Organizational aspects
  - Research
Crisis studies – Fukushima Daiichi 2011

Main challenges/problems


Main improvements

- External events. Risk assessment
- Design changes
- Emergency response. Evacuation.
- Design extension conditions. Long term.
- Human and organizational factors under extreme conditions
- From public health to social disruption
Conclusions

- 1975 WASH 1400 Measuring probability for Reactor Safety
- What can go wrong ➔ How likely is it
- Risk informed regulation, but …
- Low frequency, high consequences
- Common cause failures
- Human and organizational factors
- Need to combine deterministic criteria with risk regulation to ensure that adequate nuclear safety is achieved
- Broad social impact considerations. Accident costs.
- Continuous learning and sharing information