Decision Making Processes for Safety and Resilience of Complex Systems

- Deterministic Considerations
- Probabilistic Considerations
- Organizational Considerations
- Operating Experience
- Standards and Good Practices
- Security Considerations
- Other Considerations

Integrated risk-informed decision making processes
Approach to Reaching Decisions on Risk (HSE)

System for informing and reaching decisions

1. Deciding whether the issue is one for Nuclear Operators or Regulators
2. Defining and characterizing the issue
3. Examining the options available and their merits
4. Adopting decisions
5. Implementing the decisions
6. Evaluating the effectiveness of action taken

Criteria for reaching decisions
Tolerability limits
Applying the generalized TOR framework
Intolerable risks
IAEA INSAG-25 (2011)
Points of future research concerns (1/2)

• How to use the models so that they feed actual, situated decisions?

• On-site decision making processes are specific, the general framework which is applied to regulatory or political processes cannot be applied to them in extreme situations.

• Decision process in the wake of an accident has very particular characteristics. How can the operators be trained to handle such uncertain situation?

• Role of public engagement and scientists in decision making process.
Points of future research concerns (2/2)

• How to set level of conservatism in models for decision making.
• Promotion from absolutely safe towards acceptable risk as safety in public. Demonstrate very small probability in more comprehensible ways.
• Develop mechanism to gather information for decision making during severe accident.
• How can we improve decision making processes more effectively?
• Learn from accidents and consider the essence in order to achieve more effective improvement.
• Striking a balance between safety investment and affordable power supply.
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Additional Slides by Sekimura
Deterministic Approach (1)

• Defense in Depth
  – Barriers and Levels
  – Diversity and Redundancy within and among Safety Systems
  – Diverse Means for Implementing Safety Functions

• Safety Margins

• Regulatory Compliance
• Monitor Performance
• Organizational Considerations
• Operating Experience
Deterministic Approach (2)

Qualitative Assessment of Acceptable Risk of Undesired Consequences

• Are safety systems meeting their design intent?
• What are the consequences if not?

• If the DBA analysis confirms intended performance of safety systems and other deterministic requirement are met, safety is believed to be assured.
Probabilistic Consideration (1)

- ALARP principle

- Probabilistic considerations can range from the collection and evaluation of data on simple events, such as failures in maintenance, through analysis of system reliability, to complex analyses by means of a formal PSA.
Probabilistic Consideration (2)

• Comprehensive Integrated Analysis of Potential Accident Scenarios

• Handle an Unrestricted Number of Potential Components Failures and Human Errors
Summary of Probabilistic Consideration in Integrated Risk-informed Decision Making (IRIDM) Processes

Quantitative Assessment of Risk from Broad Spectrum of Internal and External Hazards, Equipment Failures and Human Errors

• What can go wrong?
• How likely it is?
• What are the consequences?
Organizational Considerations

• leadership, control, competence, communication and cooperation between staff
• review and audit to ensure maintenance, inspection and testing of equipment, staffing levels, training and managerial oversight
• Others on IAEA Safety Requirements on Management Systems (GS-R-3, 2006)