Risk-Informed Decision Making

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Risk-Informed Decision Making (1)

- **Decision making must be based on the current state of knowledge of the decision maker (DM)**
  - **The current state of knowledge regarding design, operation, and regulation is key.**
  - **The current state of knowledge is informed by science, engineering, and operating experience, including past incidents.**
- **What we know about plant behavior is not easily available to the DM**
  - **Accident sequences, human performance, risk significance of systems, structures, and components, etc**
  - **Example: Until the Reactor Safety Study, the significance of support systems and human errors had not been appreciated**

Risk-Informed Decision Making (2)

- PRAs provide this information to the DM
  - PRAs do not predict the future
  - PRAs tell us what we know now regarding potential accident sequences, their likelihood, and consequences

- Since decision making should be based on the totality of our knowledge, the characterization "risk-informed" would appear to be superfluous
  - A fuzzy concept that may be abused

- However, it is useful as a communication tool among industry and regulatory staffs.

Communication with the Public

- **The traditional "deterministic" regulatory system does not communicate well**
  - **Saying that plants are safe because they meet the regulations is a mystifying message to the public**
  - **Even communication among experts is impeded**
- **Risk metrics such as core damage frequency (CDF) and large release frequency (LRF) communicate clearly the risks that are being managed**
- **Understanding the concept of residual risk is important**
  - **No industrial activity or facility imposes zero risk**

Evolution of RIDM in the U.S.A.

- **The NRC's 1995 PRA Policy Statement encourages (but does not require) increased use of PRA methods to promote regulatory stability and efficiency.**
- ***The use of PRA should be increased to the extent supported by the state of the art and data and in a manner that complements the defense-in-depth philosophy.***
- ***PRA should be used to reduce unnecessary conservatisms associated with current regulatory requirements.***

NRC Policy Statement on the USE of PRA in Regulations (1995)

- Deterministic approaches to regulation consider a limited set of challenges to safety and determine how those challenges should be mitigated.

- A probabilistic approach to regulation enhances and extends this traditional, deterministic approach, by:

  (1) Allowing consideration of a broader set of potential challenges to safety,

  (2) providing a logical means for prioritizing these challenges based on risk significance, and
  (3) allowing consideration of a broader set of resources to defend against these challenges.

Experience with RIDM in the U.S.A.

- Supplementing the traditional regulations
  - Station Blackout Rule (10 CFR 50.63)
    - ✓ Its significance identified by PRA
  - Maintenance management (10 CFR 50.65)
  - Fire protection (10 CFR 50.48(c)
    - ✓ Voluntary
- New reactor certification and licensing (10 CFR 52.47 and 52.79)
- Changes in the plant licensing basis (Regulatory Guide 1.174)
- Prioritization of issues according to risk significance has saved resources thus improving safety indirectly

Reactor Oversight Process

- **Motivation**
  - The previous inspection, assessment and enforcement processes were not clearly focused on the most safety important issues and were overly subjective
- **Challenges**
  - Hundreds of affected NRC and industry staff
  - Development of performance indicators using plant data
  - Quality of the licensee PRAs
  - Establishing the Action Matrix
- **Outcomes**
  - Improves the consistency and objectivity of inspections
  - Provides explicit guidance on the regulatory response to inspection findings
  - Focuses NRC and licensee resources on those aspects of performance that have the greatest impact on safe plant operation

Realizing the Full Benefits of RIDM in Japan

- The establishment of ROP is a major step forward
- It is not the final goal
- Establishing RIDM is a major undertaking for both the regulator and the industry
- We need a roadmap to identify the needs and solutions in a systematic way, including:
  - Infrastructure development (people, organizations, standards; peer reviews; safety goals)
  - "Good" PRAs meeting international standards of practice
  - Developing acceptable PRA models for hazards of great interest in Japan (earthquakes, tsunamis, volcanos)
  - Developing processes for risk-informing regulations (would the regulator use its own PRAs or rely on the peer-reviewed industry PRAs?)

NRRC Activities

- **Position paper for proper application of RIDM in Japan**
  - ➢ **Establishment of RIDM Promotion Team**
  - ➢ **Pilot projects for establishing "Good" PRAs: Ikata Unit 3, Kashiwazaki-Kariwa Units 6 and 7**
- **White paper on RIDM applications in the U.S.A.**
  - ➢ **What was the motivation?**
  - ➢ **How can Japan benefit from the U.S. experience?**
- **Research projects**
  - ➢ **Human Reliability Analysis**
  - ➢ **Seismic PRA**
    - ✓ **SSHAC process for Ikata Unit 3 (Senior Seismic Hazard Analysis Committee)**
  - ➢ **Fire PRA**
  - ➢ **Volcano PRA**

Summary

- Decision making should be based on the current state of knowledge
  - PRA results are an essential part of this knowledge
- PRAs provide metrics that facilitate communication with the public
- PRAs consider a broader set of potential challenges to safety and prioritize these challenges based on risk significance (we can’t do everything)
- RIDM allows more effective and efficient use of resources, thus improving safety indirectly
- A roadmap is needed for developing RIDM processes in a systematic way