Reflections on Risk-Informed Decision Making

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Introduction: Scope of Presentation

- Why Risk-Informed Decision Making?
- International Guidance on RIDM Application
- The Challenge of External Events
- Institutional Strength in Depth

Why Risk-Informed Decision Making?

- Traditional approach was deterministic:
  - Ø Design Basis Accidents
  - Ø Supplemented by:
    - Defense in Depth
    - Redundant and diverse means to respond to events
    - Avoidance of vulnerability to single equipment failure
    - Conservative engineering design and application of conservative engineering codes
    - Stringent Quality Assurance in construction
    - Attention to configuration management, training, maintenance, and operational requirements
    - Application of lessons from operational experience.
    - Strong safety culture
  - Ø Result has been a strong safety record for those that followed this methodology

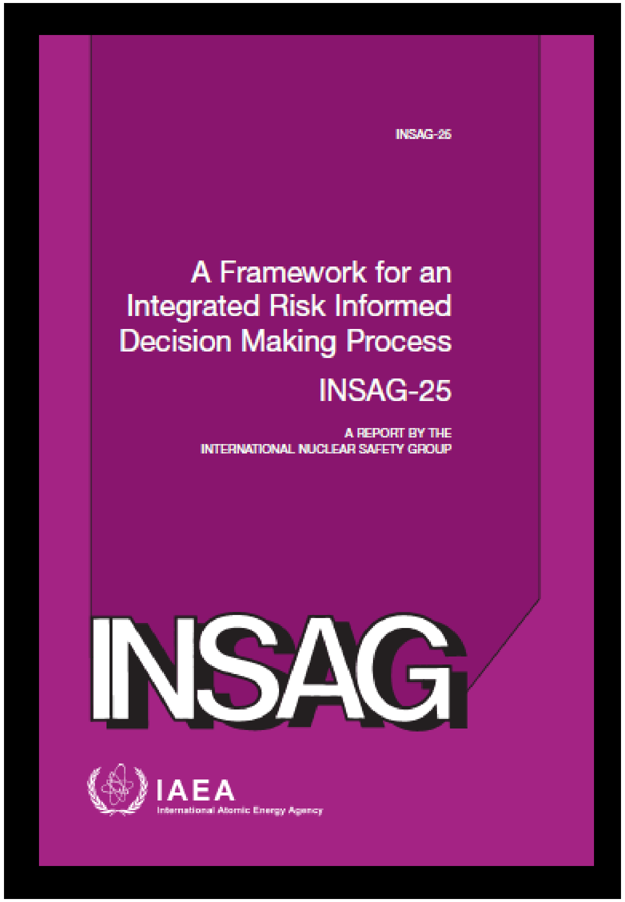
Why Risk-Informed Decision Making (2)

- RIDM requires deterministic analyses to be supplemented by probabilistic analyses
- Benefits of probabilistic analysis
  - Ø Provide a realistic view of possible evolution of an accident, thereby revealing vulnerabilities and enabling safety enhancement.
  - Ø Quantitative results provide means to set priorities.
  - Ø Enhances performance, flexibility, and cost-effectiveness
  - Ø Enables identification and reduction of unnecessary requirements
  - Ø Provides capability to monitor safety status as equipment taken out of service

Risk Informed Decision Making (3)

- Why not evolve to a risk-based approach?
  - Ø Strong experience and history with deterministic approach.
  - Ø There can be large uncertainties with Probabilistic Risk Assessments (PRAs)
  - Ø Reliability of PRAs dependent on modeling scope, choices by analysts, and availability of information.
  - Ø Probabilistic assessments do not capture all potential risks
- Conclusion: Combine deterministic and probabilistic analyses. Get the best of both approaches.

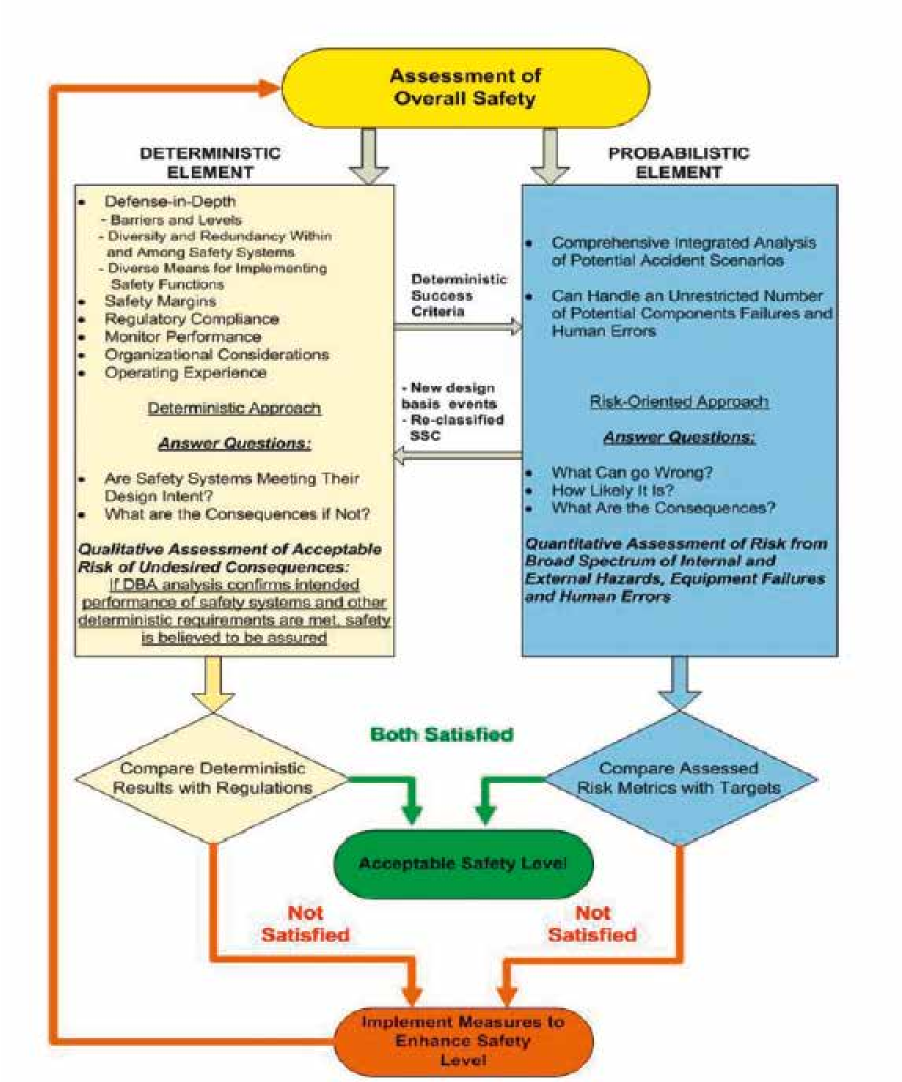
International Guidance on the Application of RIDM



Available at:
http://www-pub.iaea.org/books/IAEABooks/8577/A-Framework-for-an-Integrated-Risk-Informed-Decision-Making-Process

- Guidance for achieving a balance of deterministic and probabilistic considerations.
- Explicit consideration of all effects because improvements in one area may have adverse effects in other areas.
- Multidisciplinary teams should be involved in the decision process to reconcile diverse inputs with different measures, thereby balancing different risks.
- Combine results from deterministic analyses with risk information to ensure all relevant factors are appropriately evaluated

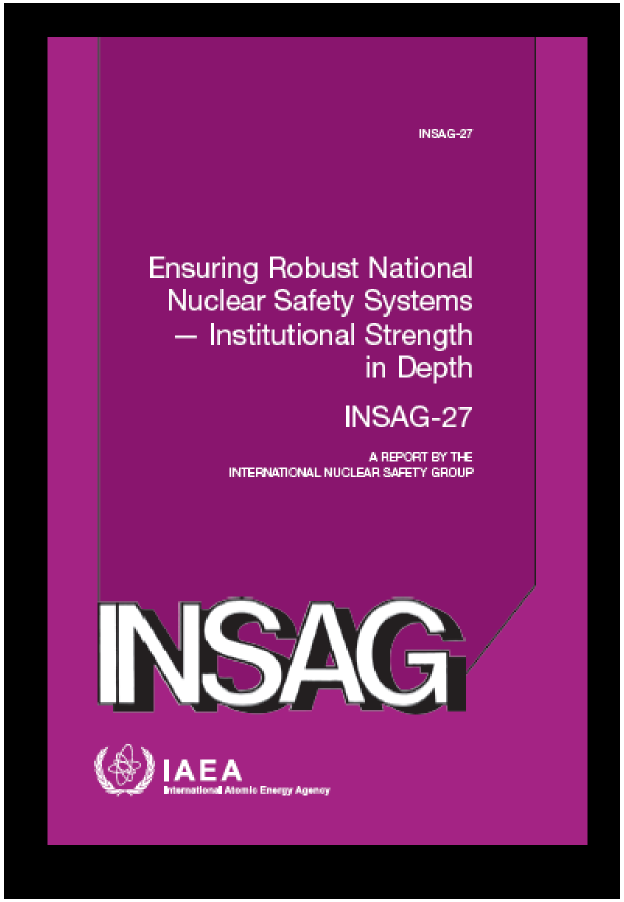
INSAG 25: The Process



External Events – a Special Challenge

- All engineered structures, including NPPs, are vulnerable to natural external events – typhoons, earthquakes, tsunamis, volcanism, and the like.
- External events have large uncertainties as to frequency/magnitude of threat.
- External events may wipe away layers of defense in depth – consider Fukushima accident.
- Some external events have cliff-edge effects – non-linear increase in risk from slight changes in circumstances.
- Special challenge for both deterministic and probabilistic analyses.

Institutional Strength in Depth



Available at:
http://www-pub.iaea.org/books/IAEABooks/11148/Ensuring-Robust-National-Nuclear-Safety-Systems-Institutional-Strength-in-Depth

- INSAG Guidance on the building a robust nuclear safety system.
- Recognize and build on interactions among and within subsystems (regulators, operators, and stakeholders) to reinforce safety obligation
- Build interfaces to reinforce safety obligation within and among subsystems.
- Complementary to Defense in Depth
- Should be component of the implementation of RIDM

Elements of Strength in Depth

Example: Industry Sub-system

1. Components of a Strong Nuclear Industry Sub-System			
*Layer 1.1 Licensee/Operator level	Layer 1.2 Peer Pressure at State/Region Industry level	Layer 1.3 Peer pressure/ review at International Industry level	Layer 1.4 Review at International Institutional level
Suitably qualified and experienced staff who effect safety Technical/Design/operational capability including sub-contractors and TSOs	National/regional industrial high level fora/associations.	WANO/INPO/JANSI Missions and Requirements	IAEA OSART Missions
Strong management systems with multiple checks and balances	Other organisations involved in emergency preparedness and response	Bilateral/Multilateral Organizations e.g. BWR and PWR Owners' Groups	
Company Nuclear Safety Committee with external members			
Company board that holds the Executive to account			
Vibrant safety culture led from the top with all encouraged to point out potential deficiencies or concerns			
Independent Nuclear Safety Assessment Review and Inspection (assurance function internal to the company independent of the executive chain of command)			

Nuclear Leadership/Culture/Values

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** The licensee is the lead for this level of the Industry Sub-System. The licensee has the prime and enduring legal responsibility for the safety of the facility. This sub-system can be split further to include designer, vendor, constructor, etc.*

Elements of a Positive Safety Culture

- Leaders demonstrate commitment to safety in behaviors and decisions
- Issues impacting safety are promptly identified, analyzed, and addressed
- All individuals take personal responsibility for safety
- Engage in continuous learning to improve safety
- Personnel are free to raise safety concerns without retaliation
- Communications focus on safety
- Trust and respect each other
- Individuals avoid complacency and maintain a questioning attitude

Conclusion

RIDM provides an integrated means to improve safety, enhance decision making, and build confidence.