

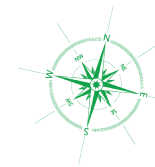


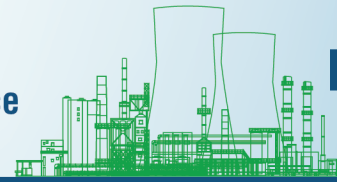
Advances in RIDM: Past, Present, Future

Technical Session T5

Michael X. Franovich

Director, Division of Risk Assessment
Office of Nuclear Reactor Regulation





Agenda

History of Risk-Informed Decision-Making



Risk-Informed Guidance Development/A Graded Approach



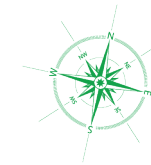
International Cooperation

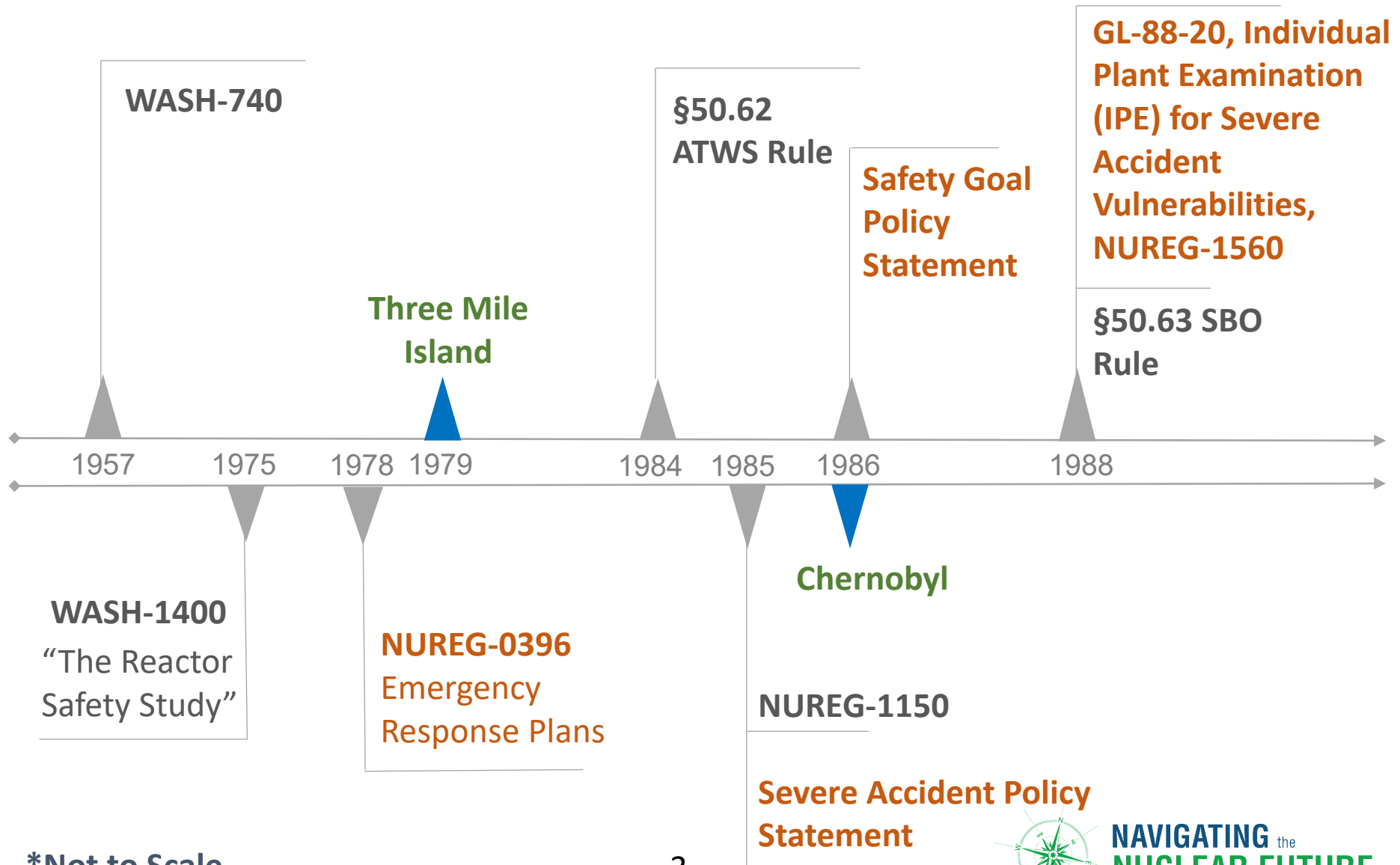
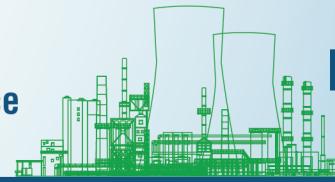


LIC-504: High Energy Arcing Faults



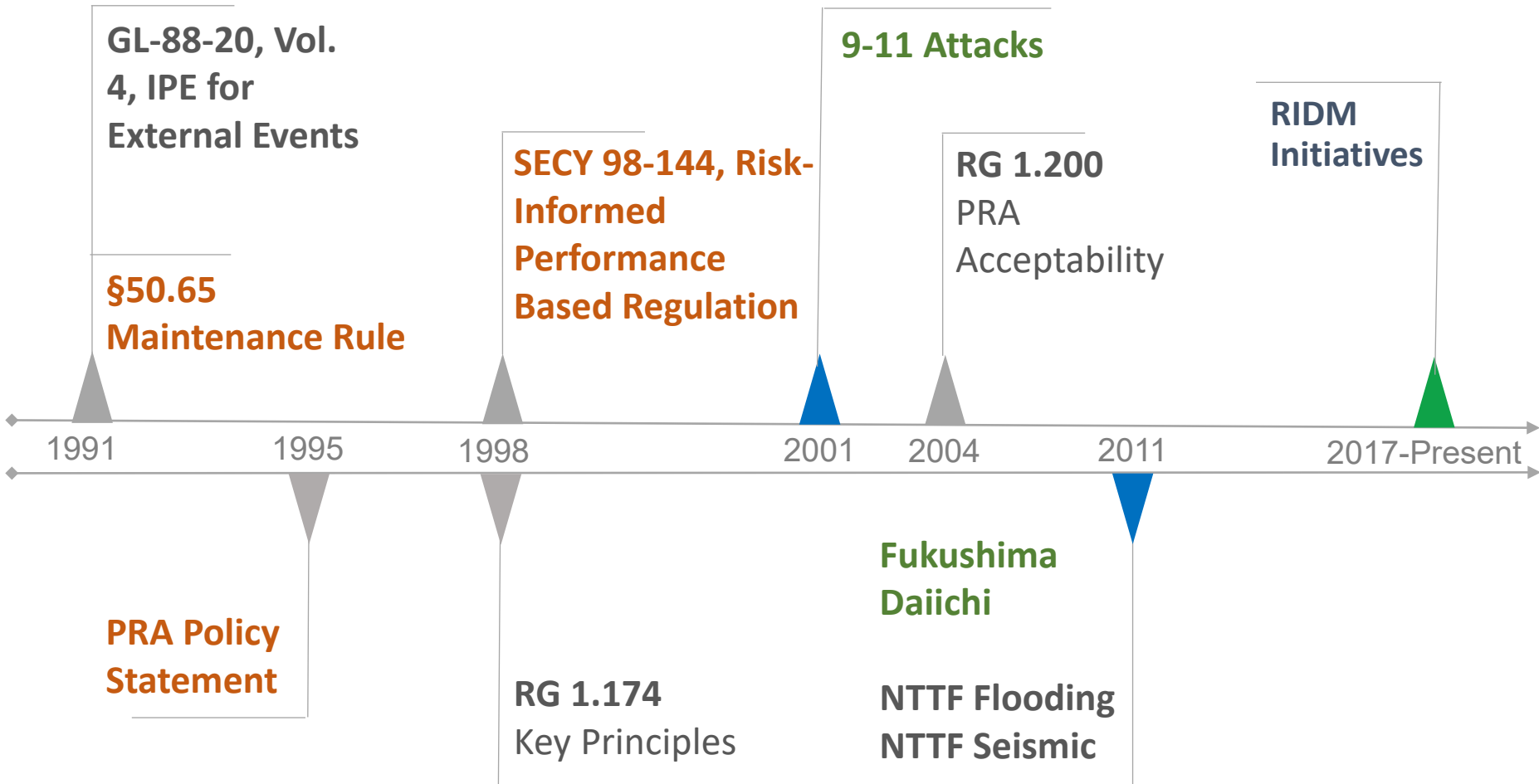
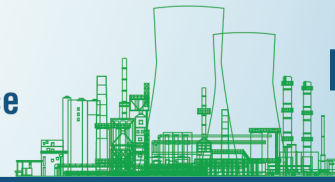
Emergency Planning Zone Sizing - SMRs



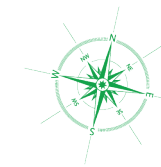


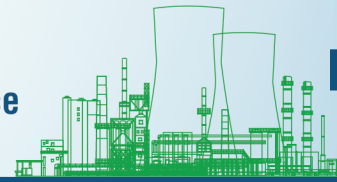
*Not to Scale





*Not to Scale





Risk-informed Operating Reactor Programs Have Informed New and Advanced Reactor Guidance Development (A Graded Approach)

10 CFR 50.69 Risk-Informed Categorization

RISC-I: Safety-Related, Safety Significant

RISC-II: Nonsafety-Related, Safety Significant

RISC-III: Safety-Related, Low Safety Significant

RISC-IV: Nonsafety-Related, Low Safety Significant

NuScale SSC Classification

A1: Safety-Related, Risk-Significant

A2: Safety-Related, Not Risk-Significant

B1: Nonsafety-Related, Risk-Significant

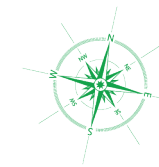
B2: Nonsafety-Related, Not Risk-Significant

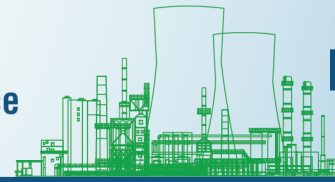
LMP Safety Classification

Safety-Related

Non-Safety-Related with Special Treatment

Non-Safety-Related with No Special Treatment





NRC International Strategy



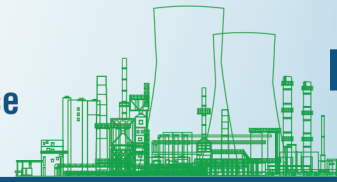
Advance risk management concepts through international standards and guidance for graded approaches in licensing and oversight of operating and new reactors

IAEA No. SSR-2/1, "Safety of Nuclear Power Plants: Design"

IAEA No. SSG-3, "Development and Application of Level 1 Probabilistic Safety Assessment for Nuclear Power Plants"

IAEA TECDOC-1980, "Application of a Graded Approach in Regulating Nuclear Installations"

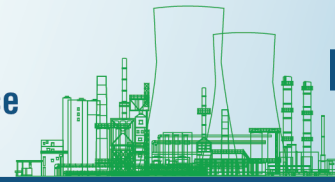




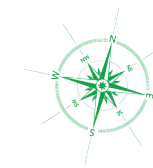
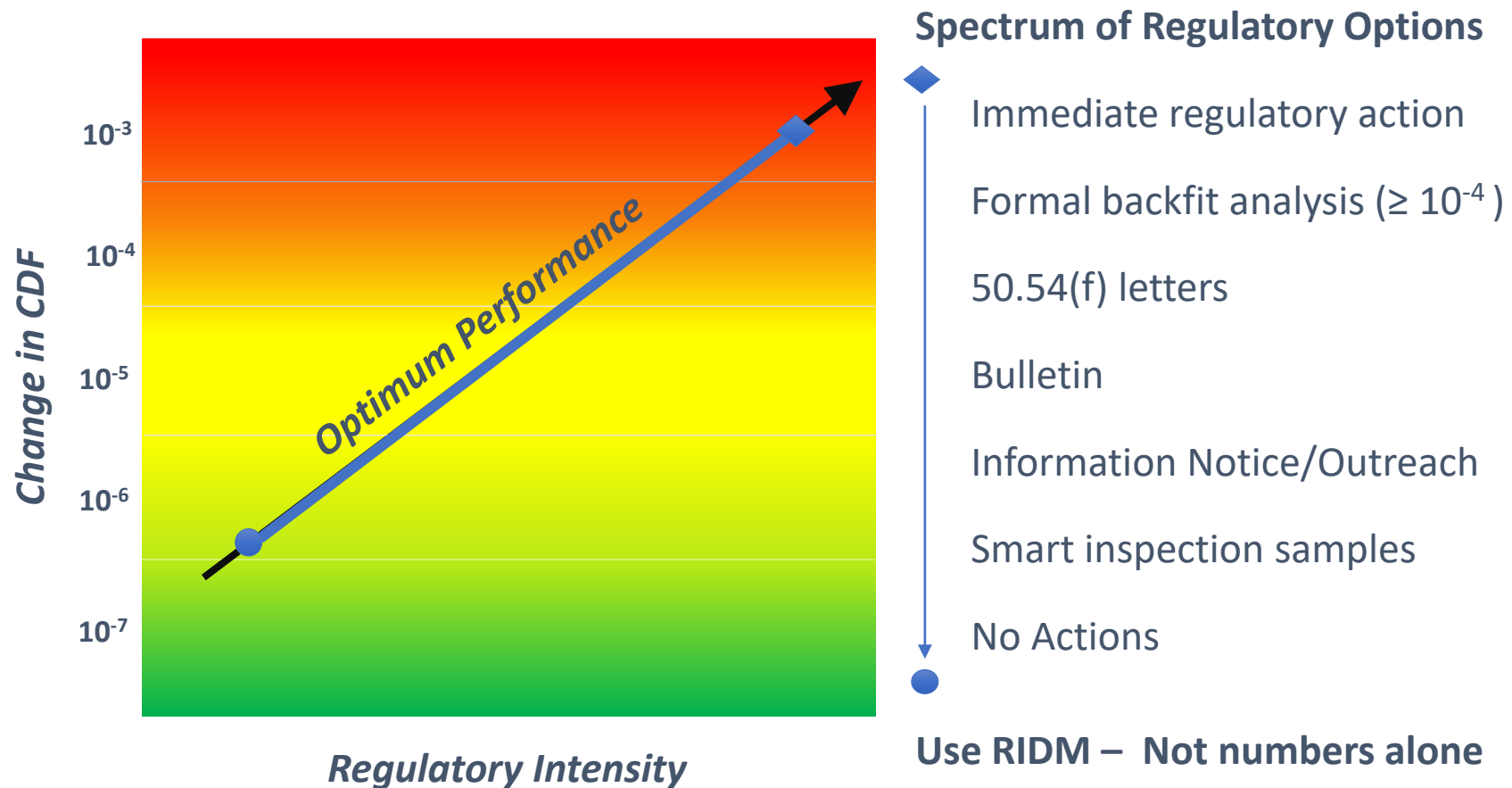
LIC-504: Integrated Decision-Making Process for Emergent Issues

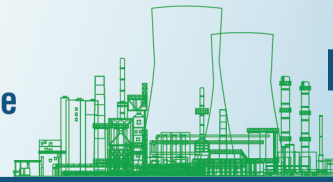
- Developed as a lessons learned from Davis-Besse reactor vessel head degradation
- Provides a structured process to document decisions for issues that may warrant prompt regulatory actions
- Provides guidance to apply integrated decision-making including risk, defense-in-depth, and safety margins considerations
- Has been used frequently for a range of emergent plant-specific and generic issues





LIC-504 Graded Recommendations - examples





LIC-504: High Energy Arcing Faults (HEAF)

2007-2008: First international examination

2013: NEA/OECD FIRE program

- HEAFs are often risk significant with complicated shutdowns

2014-2016: International Test Program

- NRC observed potential for new failure mechanisms and larger damage states

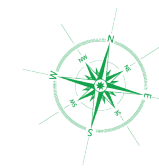
2021: Integrated Decision-Making Process for Emergent Issues

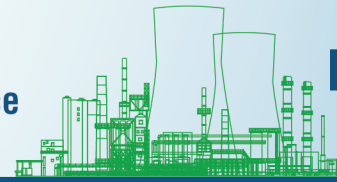
- NRC used the LIC-504 process for disposition using new methods
- Risk Insights Informed NRC Actions
 - Final Regulatory Decision – no new requirements
 - Extensive Outreach to Stakeholders: public webinar, industry forums, and NRC Information Notice (pending)
 - Incorporation of Insights into NRC Oversight Activities

San Onofre 4160 V (2001)



Be riskSMART





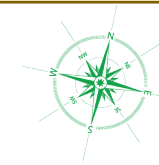
RIDM in Emergency Planning Zone Sizing

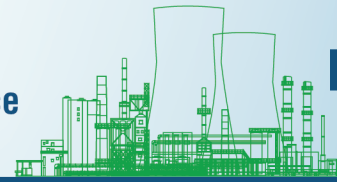
Emergency Planning Zones (EPZs)

- EPZ = area within which prompt protective actions may be necessary in the event of a radiological release
- NRC regulation on size of plume exposure pathway:
 - 10 miles for light-water reactors >250 MWth
 - Case-by-case basis for reactors <250MWth

Drivers for Risk-Informed EPZ Sizing

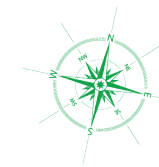
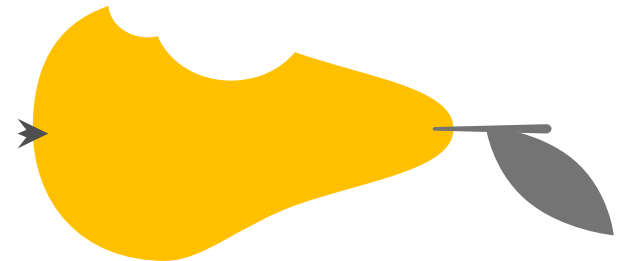
- Maturity of PRA technical acceptability guidance
- Different risk profile compared to operating reactors
- Emergency Plans for 10-mile EPZ can include many states, counties, townships, schools, hospitals, Coast Guard, evacuation plans, emergency drills, etc.

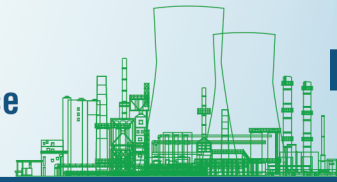




Conclusions from Risk-Informed Approach for Emergency Planning Zone Sizing (SMRs)

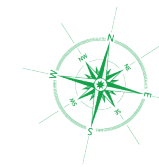
- Novel approach provides regulatory stability
- Provides design- and site-specific seismic screening threshold value(s) consistent with technical basis in NUREG-0396
 - Results in a complete spectrum of accidents and avoids extremely unlikely seismic accelerations
- Addresses multi-module risk
- Uses quantified seismic sequences because they can be dominant contributor to plant risk and EPZ sizing
- Compatible with risk metrics other than CDF or LERF

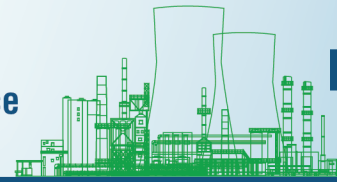




Key Messages

- NRC supports and advances risk-informed decision making (RIDM) through its programs and activities to help enhance safety and focus resources on what is most safety significant. Additional opportunities exist for future initiatives.
- NRC is leveraging the use of risk assessment approaches in RIDM in a manner that complements Defense-in-Depth, Safety Margins, Engineering Judgment, and Enterprise Risk.
- The NRC has built a strong foundation in risk-informed guidance and tools and is continuing to develop innovative approaches, including leveraging international cooperation, to increase the use of risk-informed decisionmaking.





Technical Session T5

Building on a Strong Foundation: A Voyage through Risk Informed Decision-Making

Advances in RIDM: Past, Present, Future

Points of Contact

Stacey.Rosenberg@nrc.gov

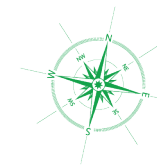
Senior Reliability and Risk Analyst

Division of Risk Assessment, NRR

Alissa.Neuhausen@nrc.gov

Reliability and Risk Analyst

Division of Risk Assessment, NRR





Acronyms

CDF	Core Damage Frequency
LERF	Large Early Release Frequency
LMP	Licensing Modernization Project
NTTF	Near Term Task Force
SSC	Structures, Systems, Components
SMR	Small Modular Reactor

