



# Advances in RIDM: Past, Present, Future

Technical Session T5

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# 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





WASH-740

§50.62  
ATWS RuleSafety Goal  
Policy  
StatementGL-88-20, Individual  
Plant Examination  
(IPE) for Severe  
Accident  
Vulnerabilities,  
NUREG-1560§50.63 SBO  
Rule

1957

1975

1978

1979

1984

1985

1986

1988

WASH-1400  
“The Reactor  
Safety Study”Three Mile  
IslandNUREG-0396  
Emergency  
Response Plans

Chernobyl

NUREG-1150

Severe Accident Policy  
StatementNAVIGATING the  
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\*Not to Scale



**GL-88-20, Vol.  
4, IPE for  
External Events**

**§50.65  
Maintenance Rule**

1991

1995

1998

2001

2004

2011

2017-Present

**PRA Policy  
Statement**

**RG 1.174  
Key Principles**

**SECY 98-144, Risk-  
Informed  
Performance  
Based Regulation**

**9-11 Attacks**

**RG 1.200  
PRA  
Acceptability**

**Fukushima  
Daiichi**

**NTTF Flooding  
NTTF Seismic**

**RIDM  
Initiatives**





# 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"



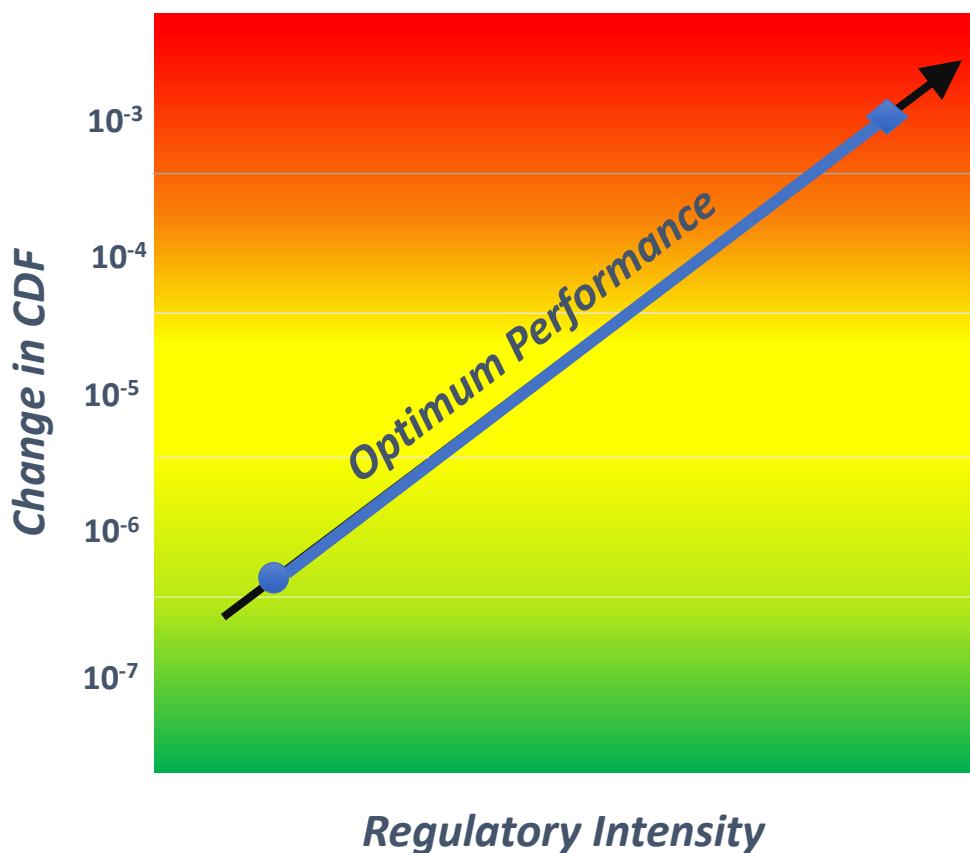
## LIC-504: Integrated Decision-Making Process for Emergent Issues

- 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



### Spectrum of Regulatory Options

- ◆ Immediate regulatory action
- Formal backfit analysis ( $\geq 10^{-4}$ )
- 50.54(f) letters
- Bulletin
- Information Notice/Outreach
- Smart inspection samples
- No Actions

Use RIDM – Not numbers alone





## 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**



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## 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

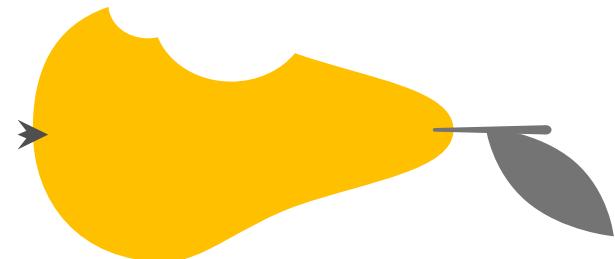
- Maturity of PRA technical acceptability guidance
- Different risk profile compared to operating reactors
- Emergency Plans for 10-mile EPZ can include many states, counties, townships, schools, hospitals, Coast Guard, evacuation plans, emergency drills, etc.





# 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.





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

#### Advances in RIDM: Past, Present, Future

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## 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

