Licensing Modernization Project for Operating Reactors

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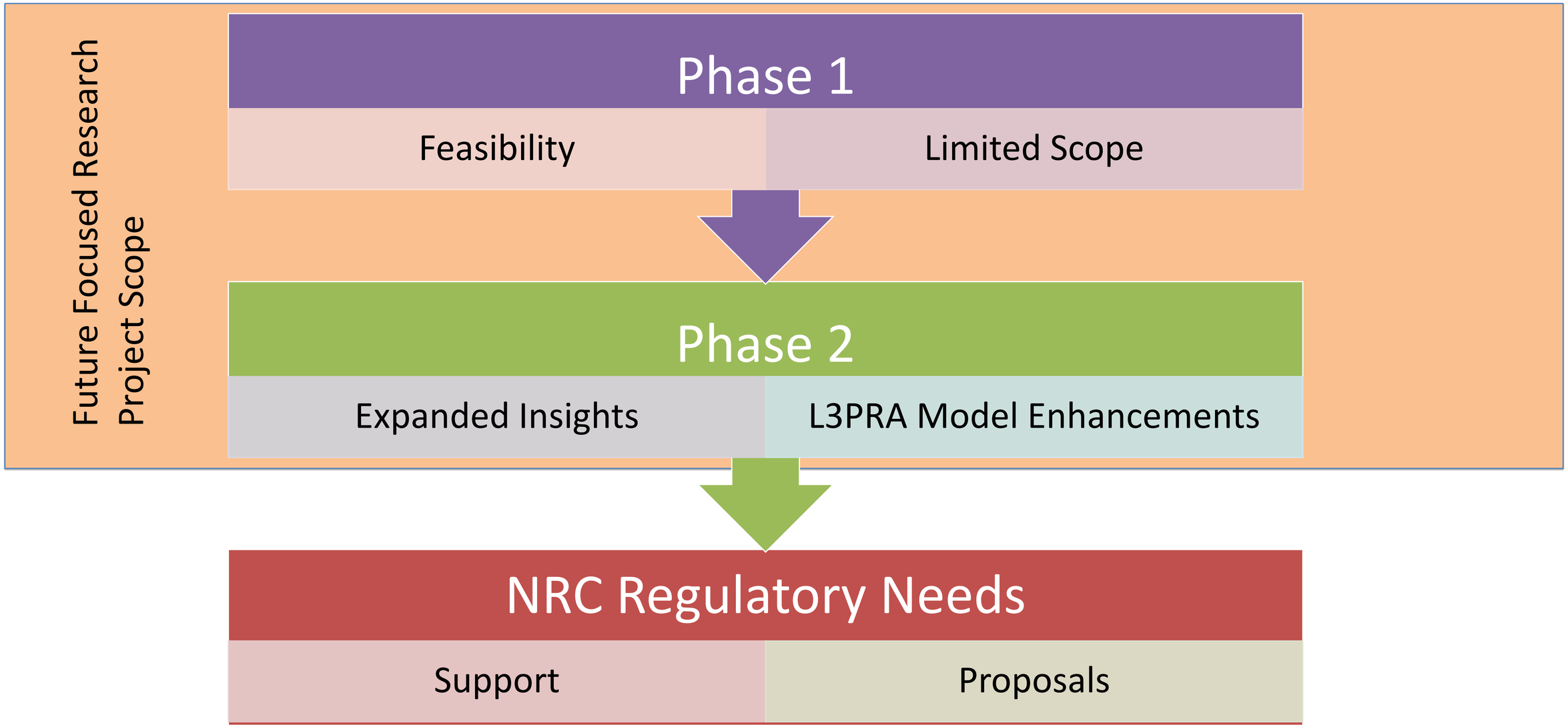
Project Overview

- The Licensing Modernization Project (LMP) for operating reactors leverages the NRC's Level 3 probabilistic risk assessment (PRA) (L3PRA) model to test the feasibility of the LMP methodology for use beyond the original intent.
- LMP methodology
  - Licensing approach for nonlight-water reactors
  - Described in Nuclear Energy Institute (NEI) 18-04 and endorsed by the NRC in Regulatory Guide 1.233
  - Uses L3PRA results
- NRC L3PRA model
  - Pressurized-water reactors
  - Initially had only internal events results available
  - Has expanded to include external hazards and other enhancements


Future Focused Research Project Scope
Phase 1
Feasibility
Limited Scope
Phase 2
Expanded Insights
L3PRA Model Enhancements
NRC Regulatory Needs
Support
Proposals

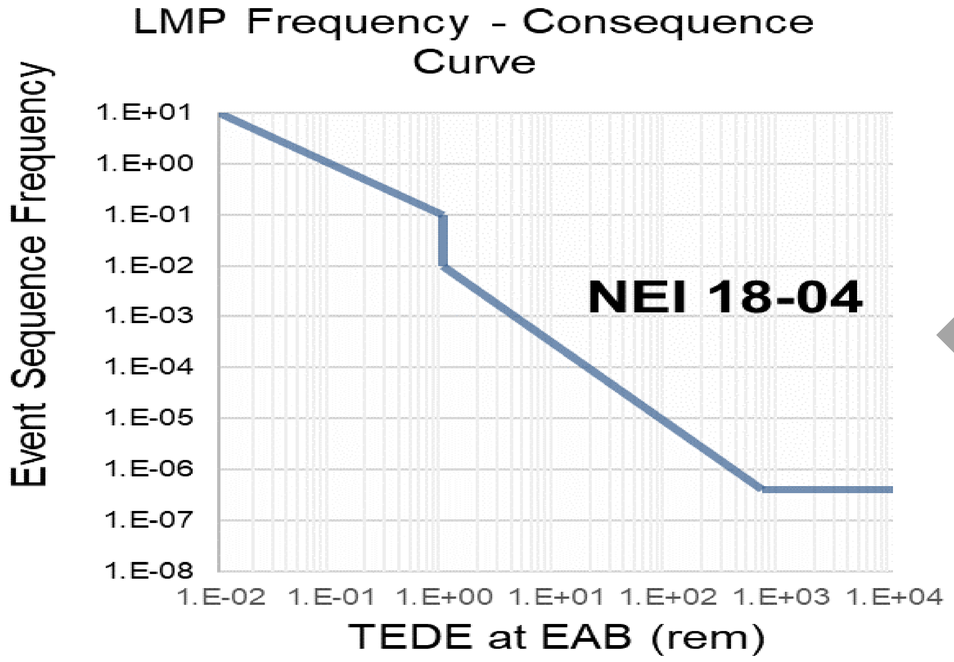
Objectives

Study LMP Feasibility	The LMP methodology is feasible for light-water reactors (LWRs)
Pilot LMP	Used the L3PRA model results to pilot the LMP
Identify Issues/Challenges	Identified insights on implementation of the LMP
Use L3PRA Results	Used L3PRA results for Phase 1 and Phase 2
Glean LWR Risk Insights	LWR “safety profile” consistent with NRC expectations
Communication	Shared progress/results

Technical Approach

NRC L3PRA Model

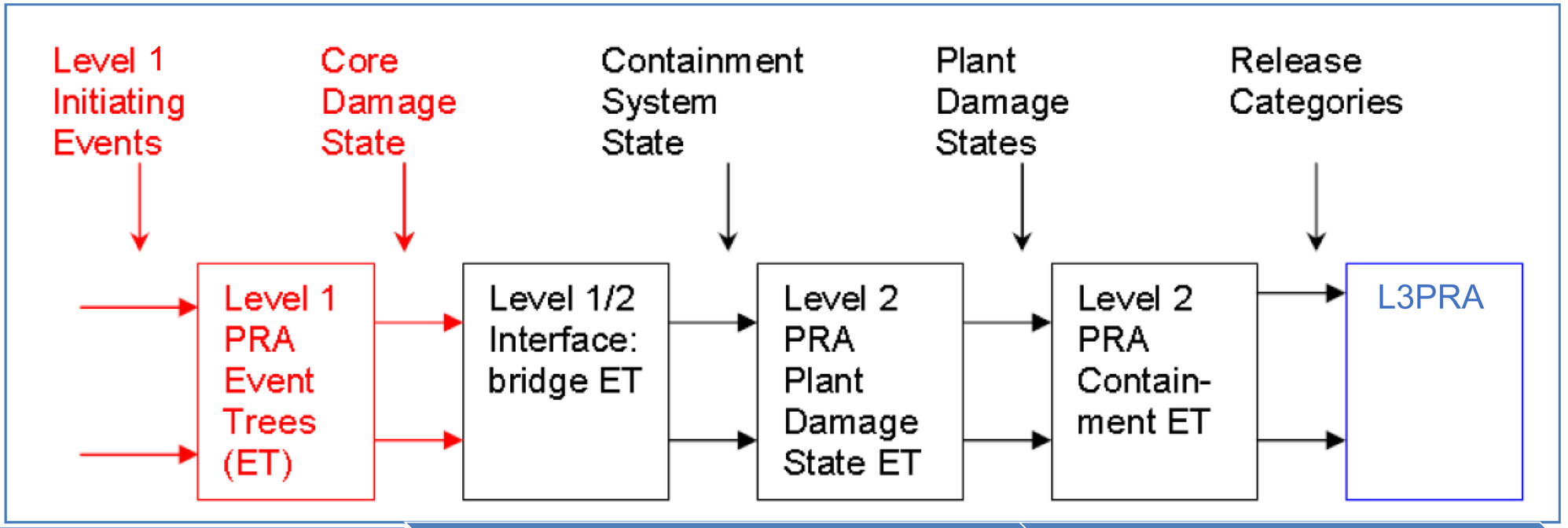
- Severe Accident Research
- LWR Experience



LMP Methodology

- Risk-Informed, Performance-Based
- Non-LWR licensing

L3PRA Process

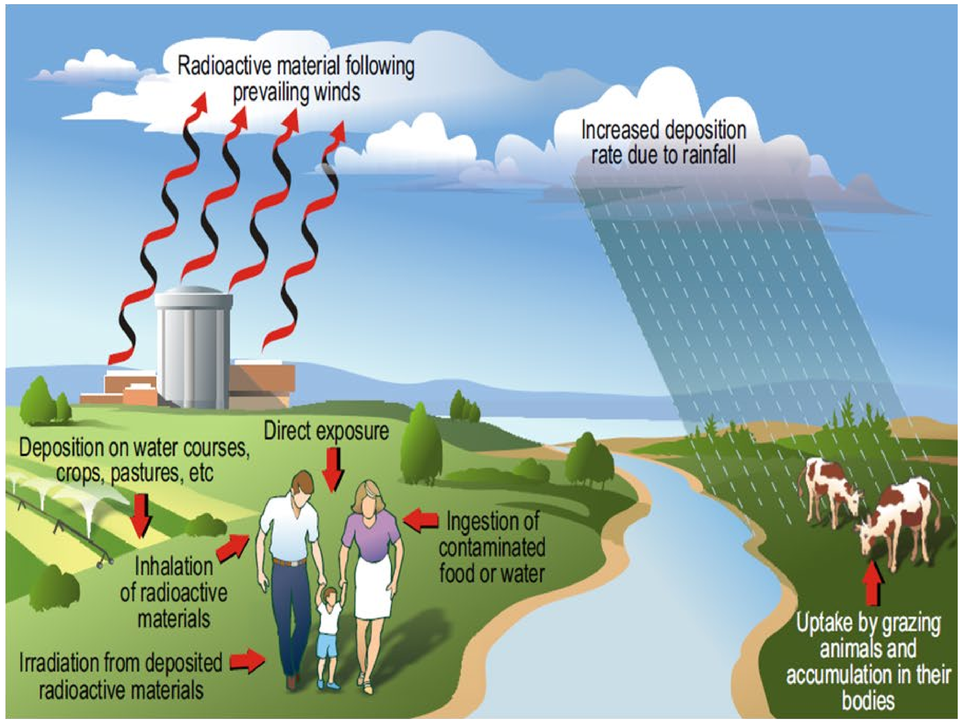


Cutsets ~50,000

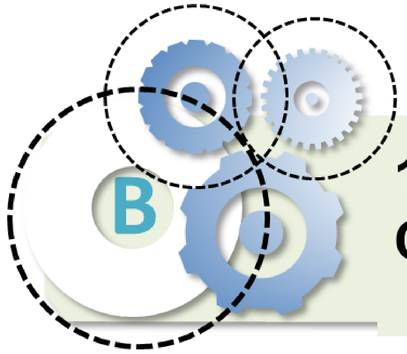
Plant Damage States (PDS): 368

Release Categories: 16


Severe Accidents at Nuclear Power Plants
01
Consequence Analysis
02
Source Term and Radionuclide release
03
Transport and Dispersion
04
Dosimetry and Health Effects
05
Risk and Uncertainty
06
MELCOR Accident Consequence Code System (MACCS)


Radioactive material following prevailing winds
Increased deposition rate due to rainfall
Deposition on water courses, crops, pastures, etc
Direct exposure
Ingestion of contaminated food or water
Inhalation of radioactive materials
Irradiation from deposited radioactive materials
Uptake by grazing animals and accumulation in their bodies

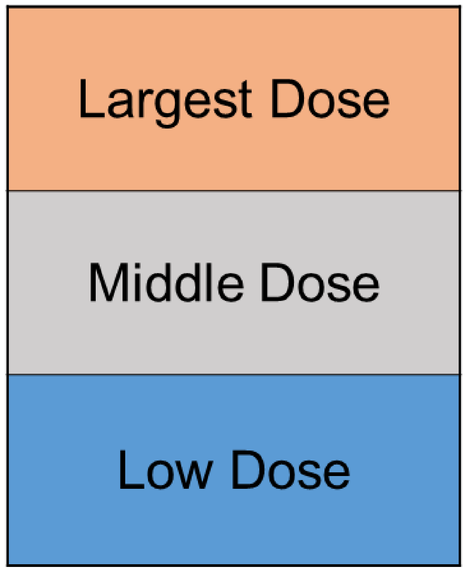
Release Category

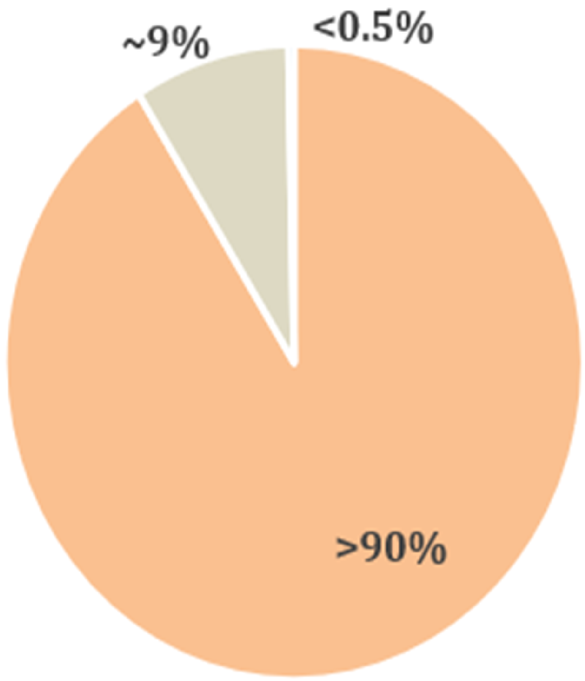


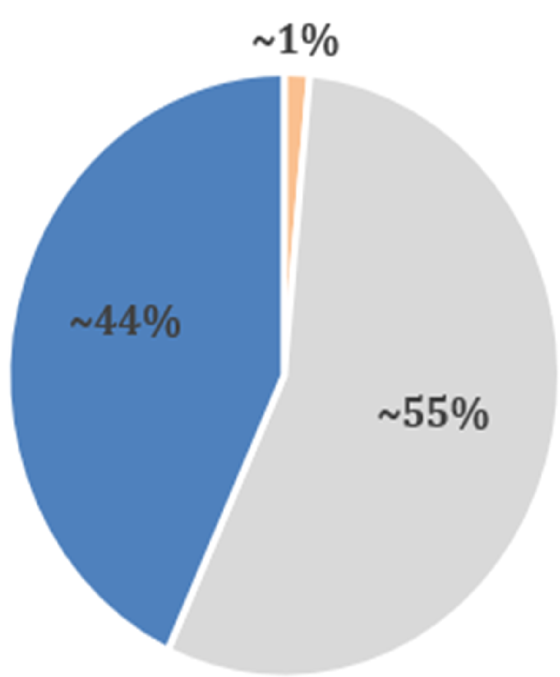
16 Release Categories

- 5 Largest Dose Categories (orange)
- 6 Middle Dose Categories (gray)
- 5 Lowest Dose Categories (blue)

Release Category Contributions







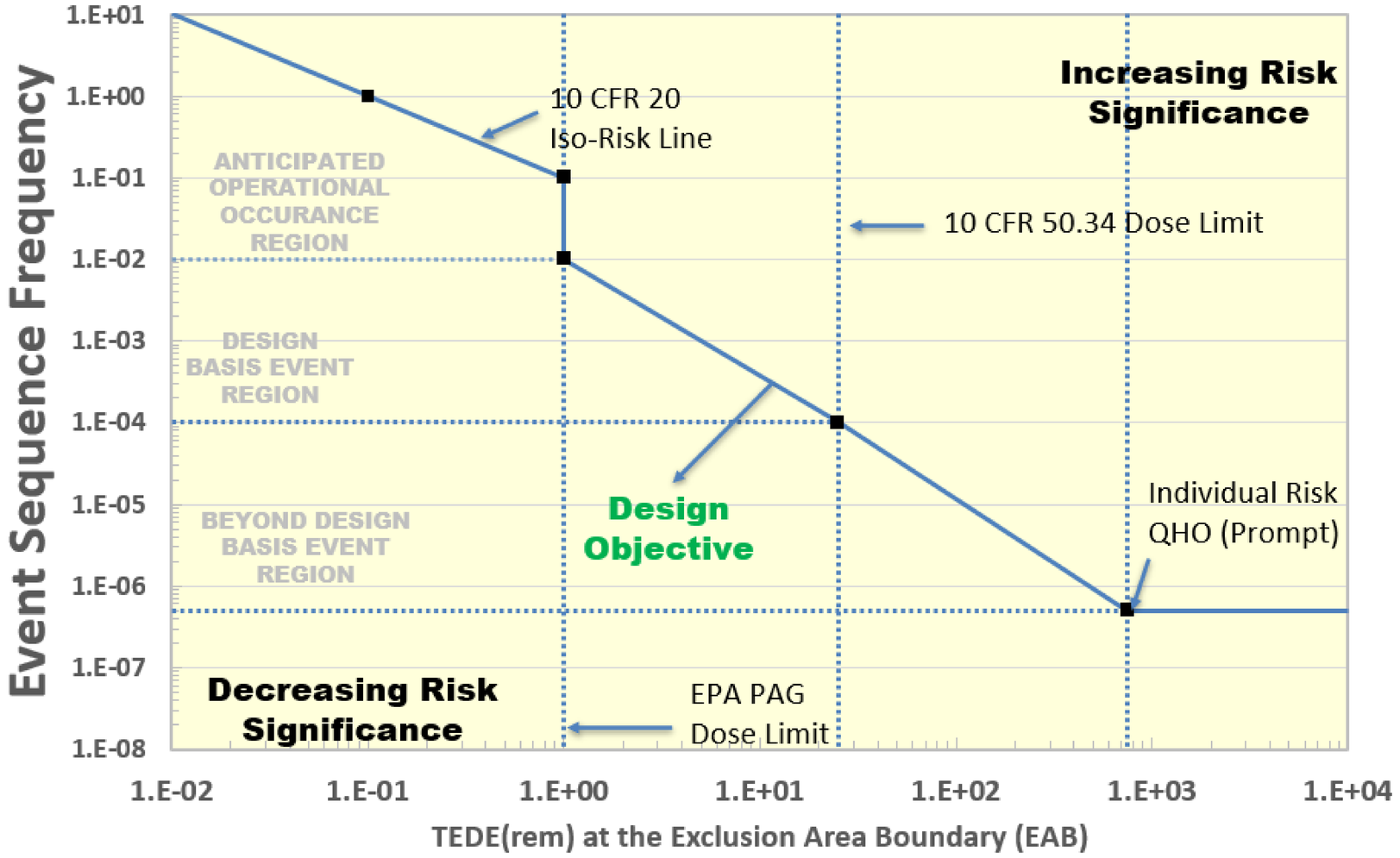
Largest 5 categories Middle 6 categories Lowest 5 categories

LMP Frequency-Consequence Curve

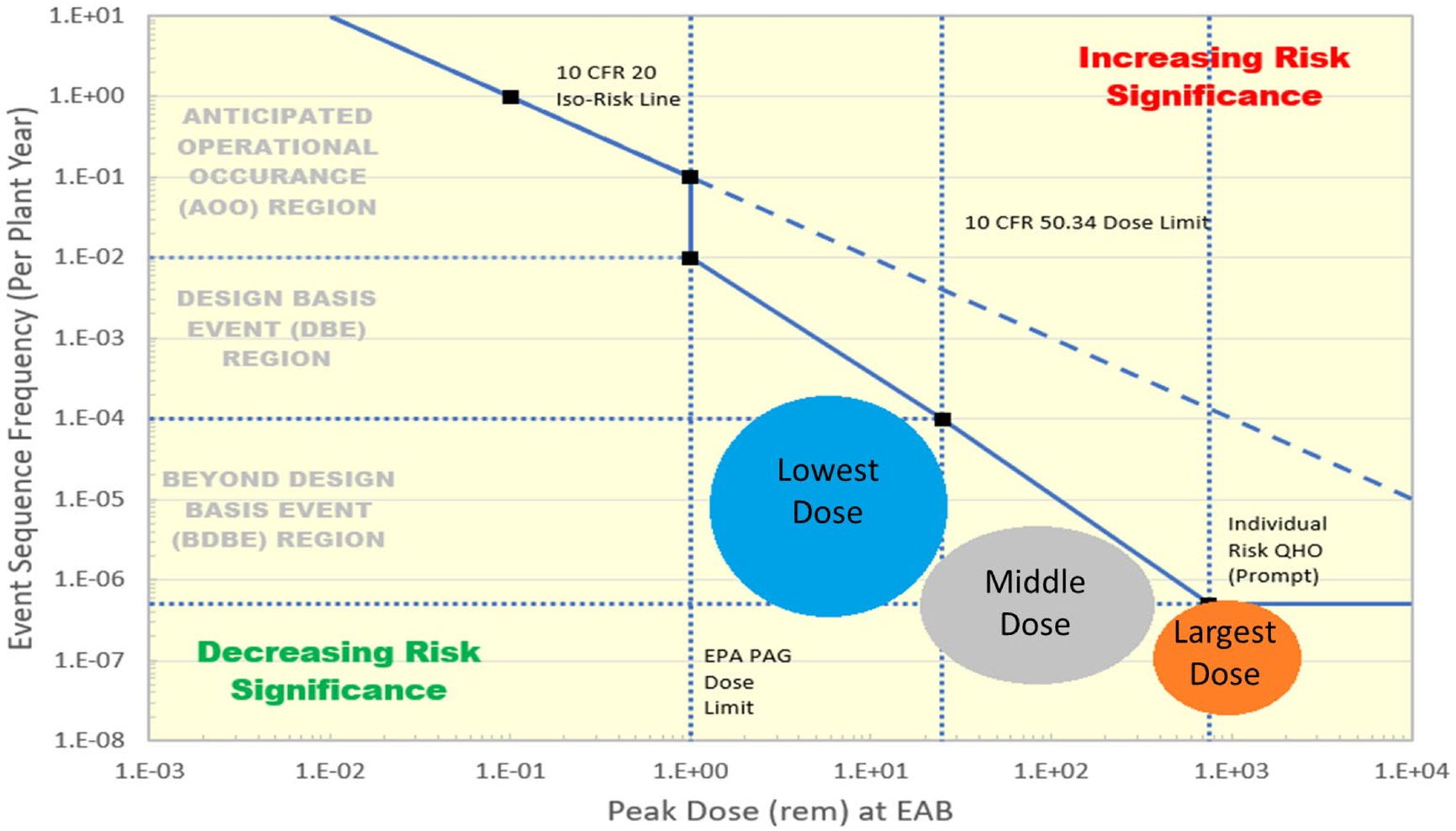
Selection of Licensing Basis Events

Safety Classification of Structures, Systems, and Components

Determination of Defense-in-Depth Adequacy

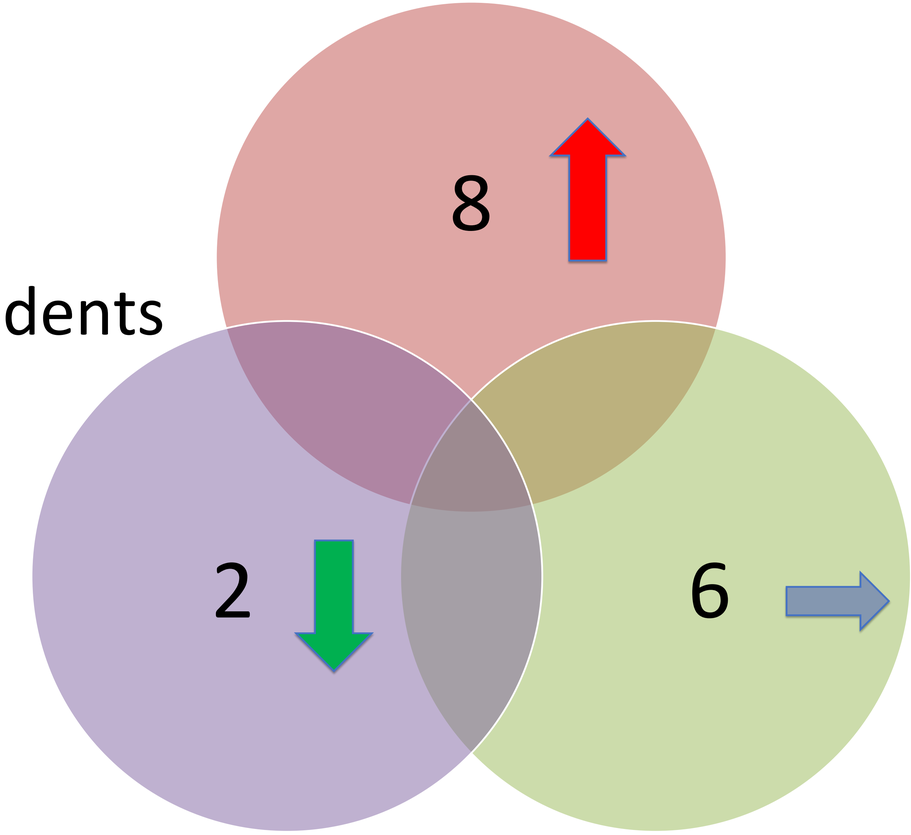


Phase 1 Results

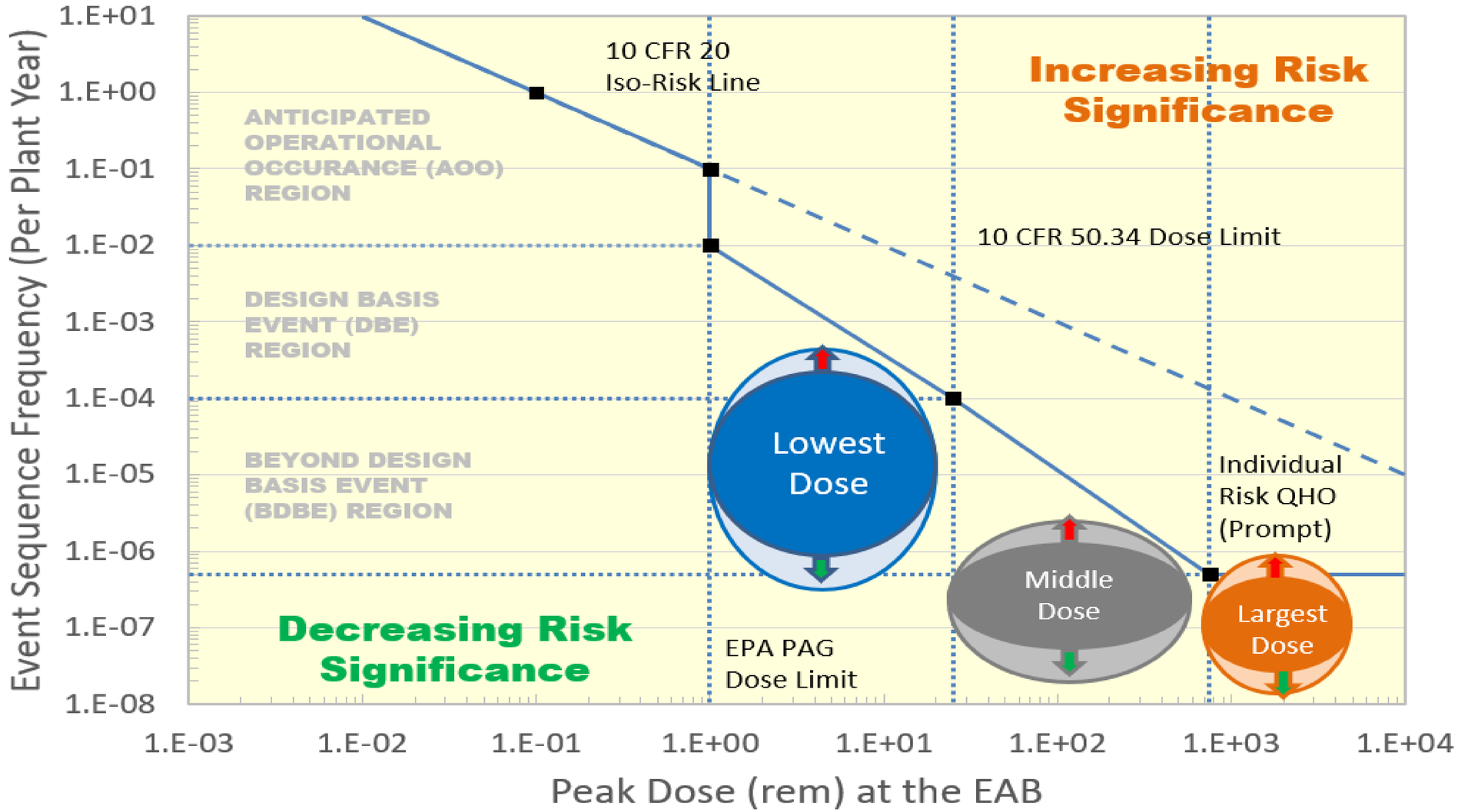


Initial Phase 2 Insights

- Changes to the NRC's L3PRA model results vary
  - External events
  - FLEX credit, etc.
  - No impact
- Different impacts on release categories/accidents
  - Loss-of-coolant accidents
  - Loss of offsite power
  - Station blackout



Phase 2 Results



Conclusions

- LMP methodology is useful beyond the original intent
- Insights gained to support future non-LWR licensing
- Operating reactors safety profile is consistent with current NRC expectations
- Several opportunities are being explored to leverage LMP methods and tools

Next Steps

- Continue Phase 2 research
  - Enhanced model results
  - Accident sequence evaluations
  - Uncertainty impacts
- Engagement with NRC technical staff on future needs
  - Supporting future regulatory work
- Continue communication effort