

Risk-informed Decision-making for Advanced Reactors: Combining Risk and Determinism

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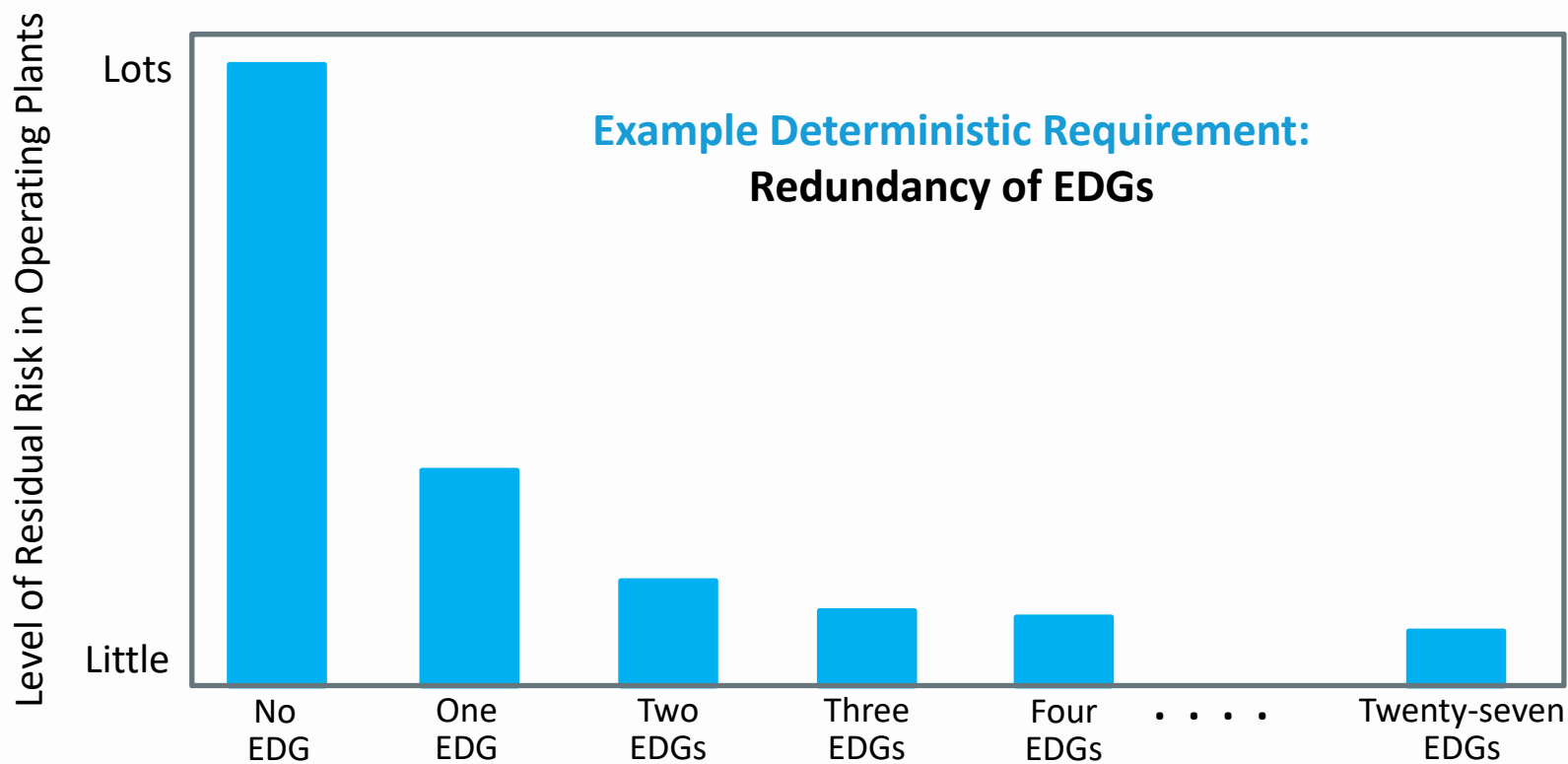
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Risk and Determinism for Operating Plants

- Regulations based on **deterministic requirements provide the foundation** for assuring the safety of operating nuclear power plants
- Risk Analysis provides a tool to assess the risk that remains **even when regulations are followed**: residual risk is **never zero**
- Risk Analysis provides an **estimate of the residual risks** associated with the deterministic requirements
 - SBO rule reduced residual risk significantly
 - Filtered vents did not reduce residual risk enough
- Risk Analysis combined with determinism improves safety

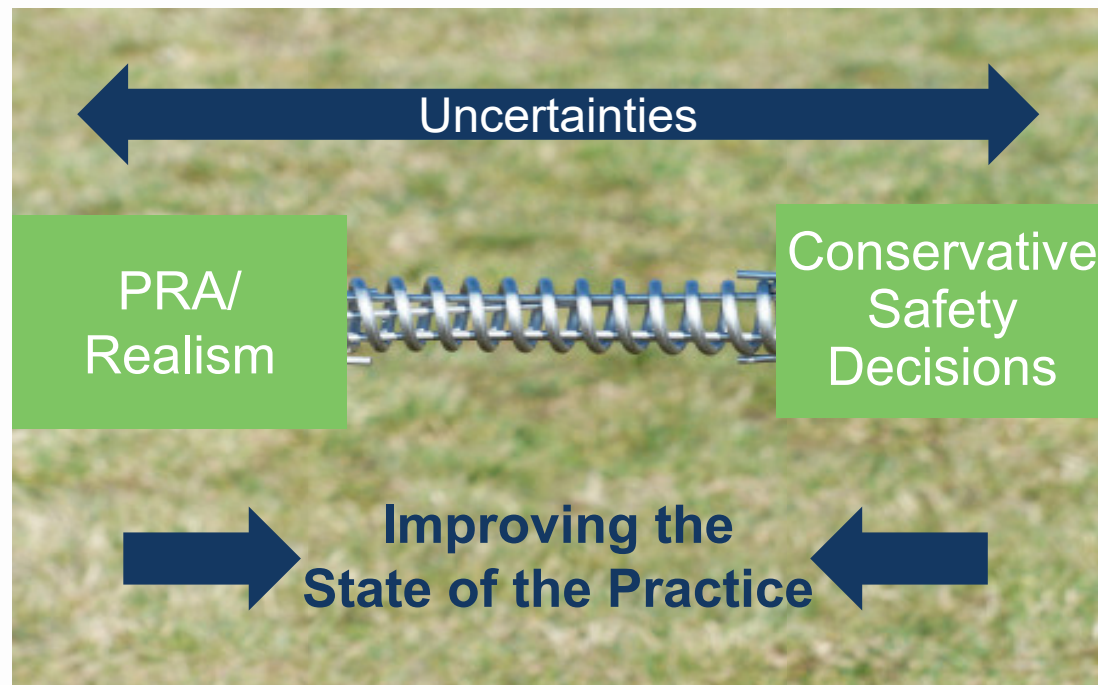
Residual Risk Can Never Be Zero Due to CCF



Safety of Advanced Reactors

- **Operating Plants are Safe Using Determinism and Risk**
 - Reliance on ac power (for the most part)
 - Redundancy of safety systems with margin
 - Diverse means to perform some safety functions
 - Defense-in-depth through multiple barriers
 - Human factors to reduce human error probability
 - Knowledge-base benefits from vast operating experience
- **Advanced Reactors are Safer and Will Use Risk and Determinism**
 - Passive safety systems with margin
 - Diverse means to perform some safety functions
 - Defense-in-depth through multiple barriers
 - Human factors to reduce human error probability
 - Uncertainties are larger and addressed with more margin
 - Existing knowledge-base will grow with time

Risk-informed Regulatory Decision-making



Key Take-aways

- RIDM has served us well and will continue to do so
- Advanced reactors offer enhanced safety
 - Removal of failure modes through passive safety systems
 - Natural processes reduce source term
 - Uncertainty is accounted for through additional margin
 - Residual risk is not zero – seismic risk
- NRC must efficiently determine reasonable assurance of adequate protection
- An efficient, right-sized regulatory framework is needed for wide-scale deployment
- The Atomic Energy Act indicates that the U.S. should use nuclear power to “make the maximum contribution to the general welfare” – nuclear power needs to play a key role in carbon reduction