

# Risk-informed Decision-making: Greater Than the Sum of its Parts

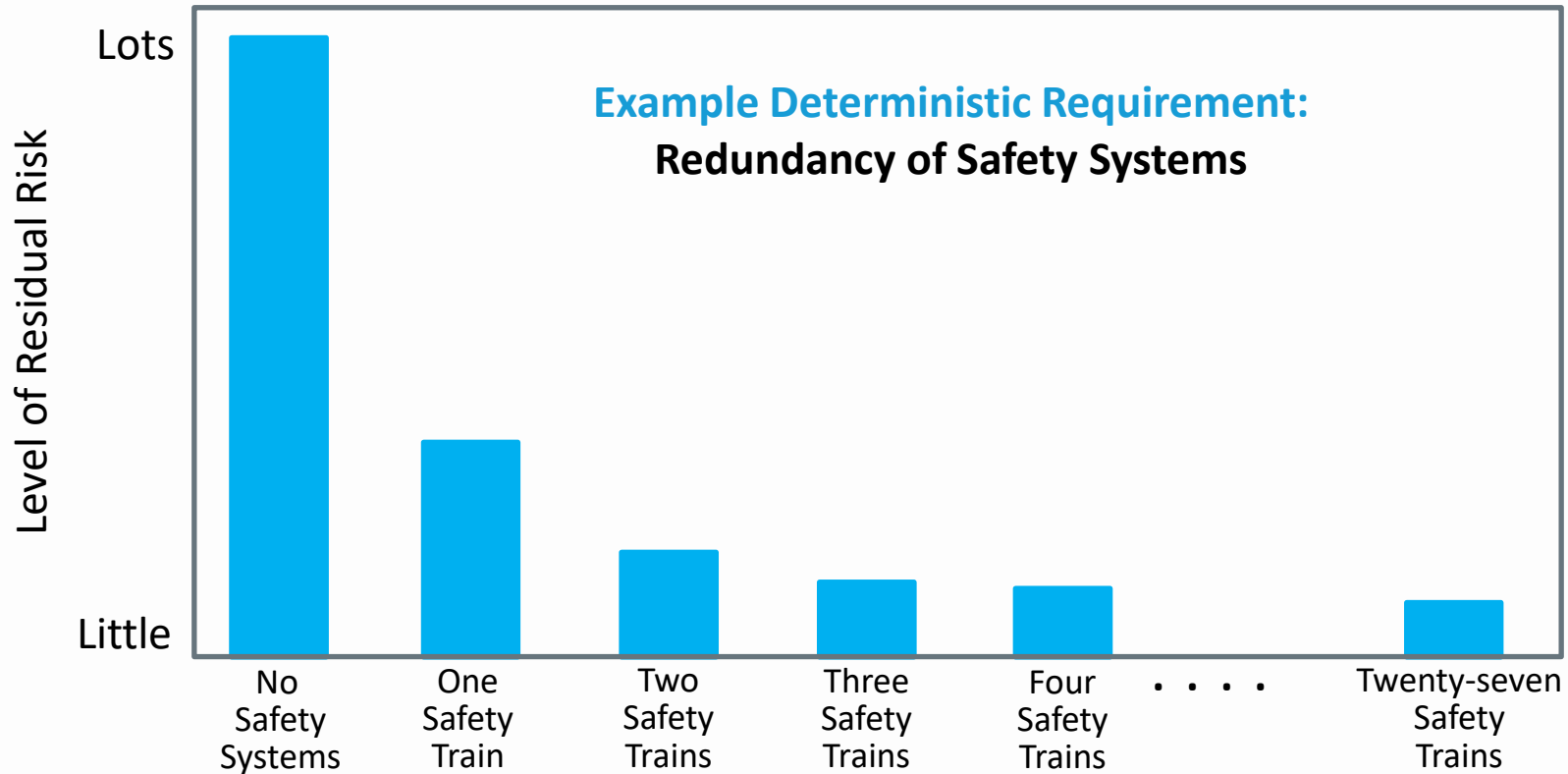
Doug True  
Sr. Vice President  
Nuclear Energy Institute  
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# Safety vs. Risk

- Regulations based on **deterministic requirements** provide the **foundation** for assuring the safety of nuclear power plants
- Risk Analysis provides a tool to assess the risk that remains **even when regulations are followed**
  - The residual risk is **never zero**
- Risk Analysis provides an **estimate of the residual risks** (aka level of safety) associated with the deterministic requirements
- Risk Analysis can also assess the **risk increment of changes to requirements and/or non-compliances**

# Conceptual Relationship Between Safety & Risk



# Risk-informing Improves Safety

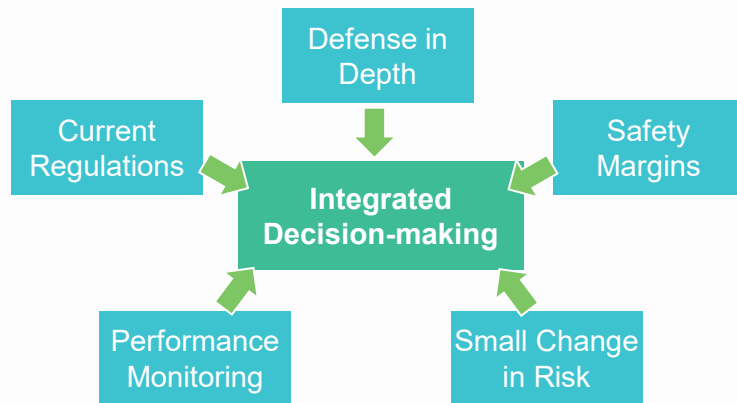


- Focus on the safety significant issues:
  - Allows allocation of resources in the manner that most effectively improves safety
  - Incentivizes licensee focus on issues important to safety
  - Reduces resources applied to issues of low importance
  - Stimulates a net improvement in safety
  
- Must account for limitations in risk analysis models (e.g., PRA)
  - PRA is a tool that must be used appropriately
  - PRA is neither omnipotent, nor omniscient
    - Neither is a deterministic approach

# Risk-informing Addresses Uncertainty

- PRA results are the product of a model that contains uncertainties
  - PRA does not create those uncertainties, it simply illuminates them
- RG 1.174 outlines an integrated decision-making framework, in part to address uncertainties in PRA results
  - PRA is one input
  - The elements should not be treated separately
- Addressing uncertainties:
  - Identify uncertainties that are important to the decision
  - Consider implications for defense-in-depth & safety margins
  - Example: FLEX for post-Fukushima response

## Risk-informed Decision-making



*All safety impacts of the proposed licensing basis changes are evaluated in an integrated manner<sup>1</sup>*

# Examples of Risk Insights Improving Safety

## ■ Regulatory Changes:

- ATWS Rule
- Station Blackout Rule
- Severe accident vents and water addition for BWR Mark I & II

## ■ Voluntary Changes:

- Fire protection pipe failure impacts all divisions of AC/DC power
- Addition of non-safety feedwater pump
- Procedural changes to enable novel uses of systems
- Operator training on important human actions