Risk Informed Applications – A Utility Perspective

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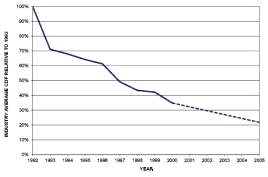
Risk-Informed Applications

- Deployment of risk informed applications can result in significant safety and operational benefits
  - Focus on safety significant issues and equipment
  - Achieve cost-effective improvement in plant safety
  - Increase operational flexibility
- Quote from the 2008 EPRI White Paper on the Safety and Operational Benefits of Risk Informed Initiatives:



"PRA has come out of the cubicle of a few analysts and into the mainstream of plant operations and regulation"

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Risk Considerations are Embedded in Site Culture

Risk Informed Decision Making & Continuous Improvement Ensure **Nuclear Safety**

Magnitude of Core Damage Risk: Fire | Seismic | Plant Transient | Flood

How Can I Reduce the **Risk**?

	Fire	Plant Transients	Seismic / Flood
Operations	• Identify fire hazards during rounds • Control fire system impairments	• Reduce plant trips • Control protected equipment	• Ensure reliable flood and seismic response actions
Maintenance	• Adhere to hot work and combustible control procedures	• Ensure configuration control	• Maintain seismic supports and flood barriers
Engineering	• Identify and correct degraded equipment	• Equipment monitoring and reliability	• Ensure robust design and control
All Site Personnel	• Report oil leaks and burning odors	• Maintain 2-foot zone around equipment	• Report degraded supports and flood barriers

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Regulatory Guide 1.174 Fundamental

- Applications are risk-informed NOT risk-based
- Decisions involve more than a PRA driven risk calculation

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PRA Models – Tools to Identify Risk Insights

- A PRA model is a quantitative tool that can be manipulated to help identify risk insights . The integration of system design, procedural and spatial information contribute to the strength of the tool.
  - Risk contributors can be discriminated by use of the metrics of Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) and subsidiary importance measures
  - Functional mitigation information can be investigated to understand relationships between systems and operator actions
  - Spatial insights provide an additional layer of information when identifying compensatory measures
  - Interpretation of the results (failure combinations) help identify actions or sensitivities that could be performed to strengthen a specific application.

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Risk Insight Considerations

PRA models provide a measure (calculation) of risk

- PRA models identify insights that can provide an alternate perspective on the design and operation of the plant
- Insights from different PRA hazard models are additive
  - Simply adding numbers may mask or skew the decision
- Relative risk comparison across hazards can provide insight
  - Existing internal event PRA models provide substantial risk insight opportunities
    - ✓ Increased application of existing insights should be pursued
    - ✓ Focus solely on the numbers may inappropriately influence actions or conclusions
    - ✓ Spatial insights from external hazard studies can provide valuable information in addressing risk

Risk Measurement ≠ Risk Management

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Why Risk-Inform Surveillance Frequencies?

- Surveillance requirements can impact equipment reliability

Example data over 5 years at a dual unit site

MSPI Data Totals (2009 through 2013)		
	Total 2 Units (2009-2013)	
System/Components	Demands	Run Time
EDG (4)	446	1096
HPCI Pump (2)	99	47
HPCI MOV's	602	N/A
HPSW Pumps (8)	1006	7262
ESW Pumps (2)	888	1205
RCIC Pump (2)	94	49
RCIC MOV's	702	N/A
RHR Pumps (8)	826	6690
RHR MOV's	540	N/A

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Examples of Safety and Operational Value

Initiative	Safety Benefits	Operational Benefits
Risk-Informed Programs (50.69)	Focus on significant SSCs Improved Safety Culture	Simpler procurement Focused quality controls
Surveillance Test Intervals (SFCP)	Reduction in plant trip Less radiation exposure	Limit unnecessary tests Reduced SSC wear/tear
Flexible AOTs (RICT)	Controls on configuration Less stress on Station	Right-size work windows Avoid plant shutdown
Configuration Risk Management- a4	Shorter unavailability Net risk reduction	Improved maintenance Less complex outages
Missed Surveillance	Focus on significance	Avoids emergent outage

- Provide operators with insights into both plant design and operation
- Risk-informed; not risk-based, not just a number
- Each initiative involves a *process* that assures low risk, maintains safety margins, and is consistent with defense-in-depth principles
- Safety benefit accrues simply by performing the work during the most opportune window

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Risk Informed Programmatic Framework

- The framework developed for implementation of risk informed initiatives is a key element
- The PRA model input provides a check that risk is appropriate
- Compensatory measures taken and program feedback influence the risk associated with implementation
- Additional regulatory and operational considerations may limit the theoretical calculated benefit
  - Potential SDP and MSPI impacts considered when assessing Surveillance Frequency changes
  - System unavailability accumulation and Operational Control Center (OCC) staffing assessed
  - Maintenance and testing delays of other equipment resulting from extended Tech Spec Completion Times

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Conclusions

- Use of PRA insights for regulatory and operational considerations are congruent with other consequential risks considered within utility processes
- Risk informed applications reduce risk by:
  - Focusing on safety significant issues and equipment
  - Identifying cost-effective improvements in plant safety
  - Increasing operational flexibility
- A well-balanced consideration and implementation of the fundamental integrated decision-making framework provided in RG 1.174 is key for risk informed applications

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Acronyms

- EDG - Emergency Diesel Generator
- EPRI – Electric Power Research Institute
- ESW – Emergency Service Water
- HPCI – High Pressure Coolant Injection
- HPSW – High Pressure Service Water
- MSPI – Mitigating System Performance Index
- PRA – Probabilistic Risk Assessment
- RCIC – Reactor Core Isolation Cooling
- RHR – Residual Heat Removal
- RICT – Risk Informed Completion Time
- SDP – Significance Determination Process
- SFCP- Surveillance Frequency Control Program

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