UCS Views on Risk-Informed Regulation

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Overview

- UCS position on risk-informed regulation
- A “single-edged sword”
- A cautionary tale
- Use and misuse of Level-3 PRA

UCS Position

- UCS is not opposed to the concept of risk-informed regulation in principle
- But its application must be consistent, appropriate and rooted in sound science and engineering

PRA

- A prerequisite for any regulatory use of risk information (including backfits, SAMAs, SAMDAs) should be a complete PRA that includes
  - all LPSD modes and external events (including seismic)
  - Level-3 analysis
  - a rigorous uncertainty analysis

PRA

- And is
  - executed in accordance with the highest quality assurance standards
  - comprehensively peer-reviewed (not only by industry but also by NRC and qualified independent groups)
  - fully validated with data from experiment and operating experience (i.e. reactors based on new designs should NOT be allowed to pursue risk-informed initiatives until significant operating experience is acquired)

PRA

- To this end, efforts to develop standards for PRA technical adequacy (DG-1200) and treatment of uncertainties (NUREG-1855) are crucial
- Until these standards are fully developed and ready for use, risk-informed activities should be suspended except *to address excessively high risks*

A “single-edged sword”

- The credibility of risk-informed regulation depends on its use not only to reduce “unnecessary” regulatory burden but also to identify and reduce undue severe accident risks
- On this score, risk-informed regulation has failed
  - Industry will not voluntarily adopt risk-informed procedures that increase regulatory burden
  - NRC staff are constrained by backfit rule for mandatory enhancements

Case in point: 10 CFR 50.44

- In 2000, Staff proposed risk-informing 50.44 (“Combustible gas control”) by
  - Reducing unnecessary burden (e.g. eliminating hydrogen recombiners)
  - Enhancing safety (requiring backup power for hydrogen igniters at plants with ice condenser and Mark III containments)
- The safety benefit of the backup power was seen as significant enough to warrant consideration of mandatory action (GSI-189)

GSI-189

- What is at stake? A 20 to 100% likelihood of early failure in the event of a SBO for ice condenser and Mark III containments
- Failure of defense-in-depth (which cannot be quantified and should not be subject to the vagaries of cost-benefit analyses)

10 CFR 50.44

- In 2001, the staff presented two rulemaking options to the Commission
  - 1. Go forward with only the parts of the rule change that reduced regulatory burden
  - 2. Demonstrate a “balanced approach” by deferring rule change pending resolution of GSI-189 for affected plants
- The Commission chose the “unbalanced approach” but required “expeditious resolution” of GSI-189

The sad tale of GSI-189

- Analysis indicated that backup power to the igniters was cost-beneficial
- In 2003, the ACRS recommended rulemaking to resolve GSI-189, and the staff agreed
- Licensees strenuously protested
- In 2005, NRR reversed its decision, based on a questionable revision of the cost-benefit analysis that assessed the incremental benefits relative not to the status quo but to the implementation of voluntary measures by the licensees

GSI-189

- Said voluntary measures are still not fully implemented at all ice condensers and Mark IIIs, nearly a decade after the first technical report was issued calling attention to the danger
- And because the measures are “voluntary,” licensees are not obligated to provide official documentation of their effectiveness

Watts Bar Inspection Report, 7/08

- “The inspector was unable to determine, by official record, that the movement of the power supply and connection of necessary fittings and cables to provide backup power to the igniters could be completed within three hours. Additional information was received that showed training and timing achievements gathered in 2004 when the 2MW diesel generator was first procured ...was part of the personal notebook belonging to the project manager ... The licensee responded that because this issue was beyond the design basis, components and activities were not treated as safety-related or under the quality assurance program. Hence, no official documentation was required, and none was generated.”

A cautionary tale

- Don’t “risk-inform” a rule if you don’t fully understand all the risks
- Example: Effort to risk-inform 10 CFR 50.46 to remove excess conservatism
- We now know that the LOCA acceptance criteria in 50.46(b) are not conservative for high-burnup fuels
  - No information is publicly available that demonstrates that high-burnup fuel in U.S. nuclear plants will be able to withstand a LOCA without embrittlement of the cladding

10 CFR 50.46

- Thus it is unknown whether the current rule provides margin that would allow for “more demanding reactor operating conditions that may further stress the fuel” (SECY-07-0082)
- In light of this, UCS does not agree with the Commission’s decision to reject the opinion of the ACRS and the staff that the 50.46(b) rulemaking should be finalized before risk-informing 50.46(a)

Use and misuse of Level 3 PRA

- To fully and accurately assess severe accident risks to the public, quality Level III PRAs must be performed
- Level III PRA information is currently being used in a variety of applications, including the cost-benefit analyses in SAMAs, SAMDAs and backfit evaluations

Level 3 PRA

- But regulatory guidance for use of Level 3 PRA information, based on mean values, does not properly account for the large uncertainties inherent in such analyses
- Example: variations in meteorological conditions can result in significant variations consequences such as total number of latent cancer fatalities
  - 95% percentile consequences can be 3-4 times mean value

Level 3 PRA

- For example, the 2005 revised regulatory analysis for GSI-189 found for Mark IIIs that the cost of mitigation exceeded the benefit (based on mean-value meteorology) by as little as a factor of 2
- If the benefit corresponding to the 95th percentile had been used, the cost-benefit analysis would have given a different answer

List of acronyms

- ACRS: Advisory Committee on Reactor Safeguards
- GSI: Generic safety issue
- LOCA: Loss-of-coolant accident
- LPSD: Low-power and shutdown
- NRR: Office of Nuclear Reactor Regulation

Acronyms (cont.)

- PRA: Probabilistic risk assessment
- SAMA: Severe accident mitigation alternative
- SAMDA: Severe accident mitigation design alternative
- SBO: Station blackout
- UCS: Union of Concerned Scientists