# PRA Technology and Applications Update

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# *STAGES FOR IMPLEMENTATION OF PSA INTO REGULATORY DECISION MAKING*

- Develop Methods
  - WASH-1400, NUREG-1150
- Search For Vulnerabilities
  - IPE, IPEEE, SBO Rule, ATWS Rule
- Allow Application of PSA in Regulatory Actions
  - License Amendments, Tech Specs, IST, ISI, Graded QA, Inspection and Oversight
- Revise Fundamental Regulations
  - 10 CFR 50.44, 10 CFR 50.46, 10 CFR 50.69

# PRA Policy Statement (60 FR 42622)

- Use of PRA insights should be increased in all regulatory matters and be used in a manner that complements the traditional deterministic approach and supports defense-in-depth
- Use of PRA technology should be increased to the extent supported by the state of the art
- PRA should be used to reduce unnecessary conservatism in NRC practices
- PRA evaluations in support of decisions should be as realistic as practicable

# *OBJECTIVES OF RISK-INFORMING?*

- Enhance Safety Decisions
  - Configuration control & accident management
- Efficient Use of NRC Resources
  - IPE insights
  - Risk-informed inspections
- Reduce Unnecessary Industry Burden
  - Risk-informed TS changes (e.g., AOT extensions)
  - Risk-informed ISI
  - Risk-informed IST

# *ADVANTAGES*

- Refocus Regulatory Requirements to be Risk Effective
- Identify New Requirements
- Reduce Unnecessary Requirements that do not Contribute to Safety
- Provide Process for Addressing Uncertainties
- Permit Analysis of Competing Risks
- Permit Analysis of Issues by Sensitivity Studies
- Provide Quantitative Measure of Overall Risk

# *CHALLENGES*

- Incomplete Coverage of Contributors to Risk
  - Many PSAs do not address external events, shutdown/transition risk, uncertainties, etc.
- For Same Designs/Operations PSA Results Vary
  - Due to different assumptions, level of detail, different HRA approaches, different thermal hydraulic codes
- Development of Risk Insights can be Resource Intensive

# *APPLICATIONS*

PAST RULEMAKING

- Backfit Rule - Use of Regulatory Analysis Guidelines
- Maintenance Rule

CURRENT AND RECENT RULEMAKING

- Hydrogen Recombiners 10 CFR 50.44
- Special Treatment Requirements 10 CFR 50.69
- Emergency Core Cooling System Requirements 10 CFR 50.46

# 10 CFR 50.44

## DEFINES REQUIREMENTS FOR COMBUSTIBLE GAS CONTROL IN CONTAINMENT

Rulemaking Effort Involved:

- Retaining Existing Requirements for a Mixed Atmosphere, Inerting Mark I and II Containments, and Providing H2 Control Systems to Handle 75% Fuel Cladding Metal-water Reaction
- Eliminated Design Bases LOCA H2 Release Requirements, Relaxes Safety Classifications of Certain and Licensee Commitments on Certain Design and Qualification Criteria
- Specifies Combustible Gas Requirements for Future Reactors

# *WHY DID THE COMMISSION WANT TO CHANGE 10 CFR 50.44?*

Since 1987 There Have Been Significant Advances in our Understanding of Risk at Nuclear Power Plants Regarding Production of H2

H2 Recombiners and H2 Purge Systems Were Found to be not Useful for Severe Accidents and the Design Bases Accident for Which They Protected Against H2 Burns Was Found to Have Insignificant Risk

GSI-189 - Backup power for Ice Condenser Mark III containments

# 10 CFR 50.69

## *OBJECTIVES*

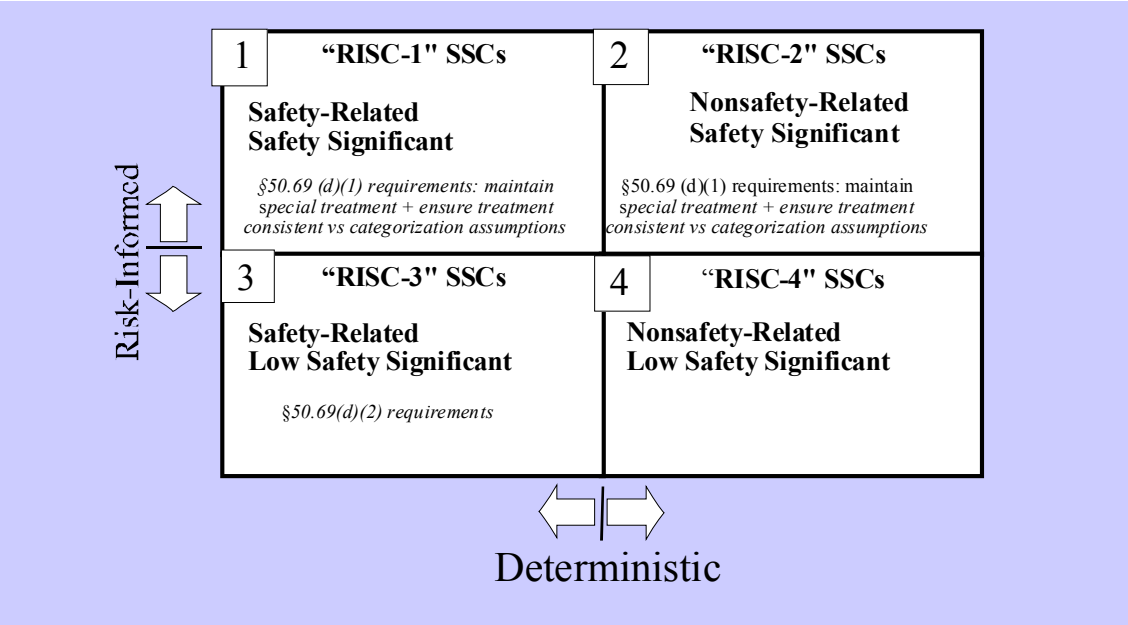
- Risk- inform the scope of special treatment requirements (“assurance requirements”)

- Not changing design basis or technical functional requirements (Risk- informed changes to these requirement are to be addressed in “Option 3")

**Final Rule is now under consideration by the Commission**

# CHARACTERISTICS OF PROPOSED RULE

Apply treatment requirements as a function of Risk-Informed Safety Class Category (RISC)



# 10 CFR 50.46 DEFINES THE ACCEPTANCE CRITERIA FOR ECCS

Broad Rulemaking Effort Involves:

A. Redefinition of Design Bases Large Break LOCA Maximum Size

B. Developing Performance Based ECCS Acceptance Criteria

C. Relaxation of the Requirement for Postulated Coincident Loss of Offsite Power with Large Break LOCA

In July 2004, the Commission Issued additional guidance for development of a draft proposed rule to redefine the Large Break by the end of this year.

Draft Rule to revise LOCA/LOOP requirement will follow.

**Preliminary information on the draft rule approach on the NRC WEB**

# *SO, WHAT WILL POSSIBLY CHANGE?*

Power Uprates or Core Thermal Limit Increases

Emergency Diesel Generator Start Times May Be Increased

Possible reduction in single failure requirements for breaks in this new transition break area.

Reductions in some safety systems capability, such as number of accumulators, may be reduced.

Emergency Diesel Generator Load Sequencing May Be Optimized for Smaller Break Sizes, Where the Loads on the Generator Are Not So High and Can Be Spread out over a Longer Period

Valve Operator Speeds Can Be Reduced - Valve operators Can Be Replaced With Ones That Close More Slowly, Which May Result in Lower Valve Operator Failure Rates

# But any changes would have to demonstrate at most small increases in risk (CDF/LERF)

## WHAT WILL NOT CHANGE?

- Fundamental Defense in Depth Capability including Containment Capability and Requirements
- Other programmatic requirements should not be changed that would lead to introduction of new degradation mechanisms.

## ADDITIONAL MITIGATION REQUIREMENT

- For breaks larger than the new LBLOCA size, even given a single failure, significant core damage resulting in vessel failure and containment challenge would not occur

# *Basis for Redefinition of the LBLOCA*

**LOCA Frequencies** are Being Re-estimated Through Use of Expert Panel Elicitation

The approach used and status of the work will be discussed in next presentation.

# Conclusions

- NRC Is Committed To Increased Use Of PSA
- Many Initiatives Ongoing That Use PSA
  - Need to harmonize methodologies and results
- Approach Demands Strong Technical Basis
- Nuclear Safety Is Still Bottom Line
- Continue to Look for Opportunities to Further Risk Inform Our Regulations