Risk-Informing the Technical Requirements in 10 CFR 50 Public Workshop

Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

February 24, 2000

Workshop Structure

- Morning presentations given without interruption, some time allowed for brief discussion, more detailed questions and comment period will be held in afternoon discussion session
- Individuals are to speak at a microphone, state their name and affiliation
- Blank forms are available in each package and at each table for written comments
- All presentations, questions and comments (whether verbal or written) will be summarized in a workshop proceeding
- Workshop agenda times may be adjusted to match questions, comments and discussions
- Blank registration form in package, please complete and turn in

Workshop Objectives

- Discuss approach and guidelines to be used in identifying recommended changes to Part 50
- Share preliminary results on risk-informing the technical requirements of 10CFR50
- Solicit and gather information on each topic from stakeholders

Workshop Agenda

Thursday, February 24, 2000

NRC Presentations:

8:00	-	8:30	Introduction (Background and Objectives)
8:30	-	9:30	Framework for Risk-Informing Regulatory Requirements and DBAs
9:30	-	10:10	Screening, Selection and Prioritization Criteria and Preliminary Results
10:10	-	10:30	BREAK
10:30	-	11:15	10 CFR 50.44 Preliminary Results
11:15	-	11:40	Special Treatment Requirements
11:40	-	12:00	Future Activities
12:00	-	1:15	LUNCH

Stakeholder Presentations:

1:15	-	1:45	Bob Christie (Performance Technology)
1:45	-	2:15	Rick Grantom (South Texas Project)
2:15	-	2:45	Adrian Heymer (NEI)
2:45	-	3:00	BREAK
3:00	-	3:30	Stanley Ritterbusch (ABB C-E Nuclear Power, Inc.)
3:30	-	4:30	Open Discussion: Framework

Friday, February 25, 2000

8:00	-	8:10	Opening remarks
8:10	-	8:30	Wayne Harrison (So. Texas Project/Westinghouse Owners Group)

Open Discussion:

8:30	-	9:00	Framework for Risk-Informing Regulatory Requirements and DBAs
9:00	-	9:45	Screening, Selection and Prioritization Criteria and Preliminary Results
9:45	-	10:00	BREAK
10:00	-	10:45	10 CFR 50.44 Preliminary Results
10:45	-	11:15	Special Treatment Requirements
11:15	-	12:00	Future Activities and Wrap-Up
12:00			ADJOURN

Outline

- Introduction
  - Objective
  - Scope
  - Approach
  - Current Activities
- Framework
- Screening, Selection and Prioritization of Regulations and DBAs
- 50.44 Preliminary Results
- Special Treatment Rule Preliminary Results
- Summary of Key Issues
- Future Activities

Program Objectives

- Enhance safety by focusing NRC and licensee resources in areas commensurate with their importance to health and safety
- Provide NRC with the framework to use risk information to take action in reactor regulatory matters
- Allow use of risk information to provide flexibility in plant operation and design, which can maintain safety and can result in unnecessary burden reduction

Scope

- Adding or modifying provisions to Part 50 allowing staff to approve risk-informed alternatives to current requirements, including
  - Revising specific requirements to reflect risk-informed considerations (regulations, regulatory guides, standard review plans)
  - Adding new requirements or expanding current requirements to address risk-significant issues not currently covered
  - Deleting unnecessary or ineffective regulations
- Not covering Fire Protection or EP
- Focus on requirements that have the most significant potential for improving safety and efficiency and reducing unnecessary burden
- Focus on revising technical requirements (regulations, regulatory guides, standard review plan)
- Retain design basis concept (i.e., risk-informed design basis)

Approach Involves Two Phases:

- Phase 1: Identify and prioritize candidate design basis accidents (DBAs) and regulations (including their associated regulatory guides and standard review plans) for risk-informing, and identify proposed changes to requirements
- Phase 2: For proposed changes that are approved by the Commission, develop detailed technical basis and proceed with rulemaking

Current Phase 1 Activities Include:

- Development of a framework for risk-informing regulations (including guidelines for defense-in-depth and safety margins)
- Selection of candidate regulations and DBAs
- Trial implementation: Risk-informing 10 CFR 50.44
- Trial implementation: Risk-informing special treatment requirements

Framework for Risk-Informing 10CFR50

Framework Development:

- Maintain ***goal*** of "Protect Public Health and Safety"
- Develop an ***approach*** that builds upon defense-in-depth philosophy
- Implement ***strategies*** of defense-in-depth that maintain concept of prevention and mitigation and that are consistent with the safety goals and with the cornerstones
- Implement ***regulations*** that are risk-informed to ensure the strategies are met
- Define ***tactics*** for carrying out the strategies and defining the requirements in the regulations

Therefore,

➪ ***Need working definition for "defense-in-depth"*** ⇦

Defense-in-Depth

- ***Commission:*** *"Defense-in-depth is an element of the NRC's Safety Philosophy that employs successive compensatory measure to prevent accidents or mitigate damage if a malfunction, accident, or naturally caused event occurs at a nuclear facility. The defense-in-depth philosophy ensures that safety will not be wholly dependent on any single element of the design, construction, maintenance, or operation of a nuclear facility."*
- **ACRS:** May 19, 1999 Letter to the Commission
  - Current view (structuralist)
    - Defense-in-depth embodied in the structure of the regulations and facility designs
    - Requirements based on repeating the question, "what if this barrier fails?"
  - Risk-based views (rationalist)
    - Base regulations on risk information, with defense-in-depth employed only where necessary to compensate for uncertainty or incompleteness in knowledge
  - Recommendation: Use a structuralist view at a high level and a rationalist view for implementation , that is:
    - Maintain defense-in-depth principles
    - Use risk information to assess the effectiveness of defense-in-depth layers

Defense-in-Depth: working definition

- *The application of multiple measures to prevent or mitigate accidents using the following four strategies to protect the public:*

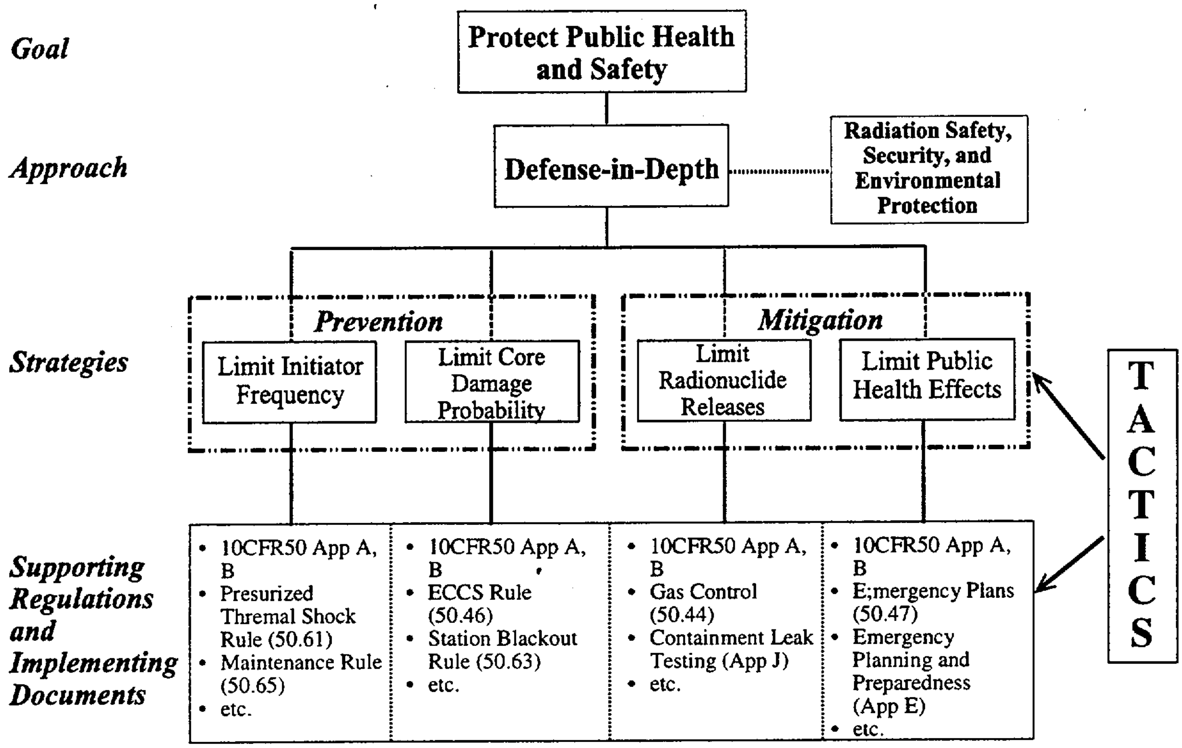
Preventive
(1) limit the frequency of accident initiating events
(2) limit the probability of core damage given accident initiation

Mitigative
(3) limit radionuclide releases during core damage accidents
(4) limit public health effects due to core damage accidents

Defense-in-Depth Implementation Principles

- Contains deterministic and probabilistic elements
- Retain single failure criteria concept
  - Apply to active and passive components?
- Degree of defense-in-depth will be dependent upon degree of uncertainty
- Preserve a reasonable balance between the four strategies
- Maintain high integrity of barriers
- Maintain good engineering practices
- Maintain emergency planning

Framework:



Use of Tactics

Tactics are tools embodied in regulations that enable meeting the defense-in-depth strategies

- There are numerous tactics that can be employed
- An optimum set, as opposed to a complete set, is desired
- Many tactics are applicable to more than one of the defense-in-depth strategies
- Current regulations employ most of the tactics to be considered, though not always in an optimal way
- Generally, tactics are employed to:
  - Improve the reliability/availability of SSCs (or reduce uncertainties)
  - Improve the likelihood that the success criteria will be met (improved confidence)
- One of the most important tactics is the use of ***safety margins*** to provide confidence in the regulations that are produced

Examples of Tactics and Related Regulatory Documents

■ Safety Margin	Embedded in many regs
■ Single Failure Criteria	Pt. 50 App A
■ Redundancy	GDC 34, 35, 41, 44, 55
■ Diversity	GDC 17, 55
■ Emergency Planning Drills	50.47

Safety Margin

- A measure of the conservatism employed in a design or process to assure a high degree of confidence that it will work to perform a needed function
- Regulatory Requirements and Guidance
  - Acceptance Criteria (often qualitative)
  - Acceptance Methods for Demonstrating Compliance

Safety Margin: Implementation

Risk-Informed Change Considerations

- Preserve key function goals, e.g.,
  - Prevent clad failure for AOOs
  - Prevent core melting and containment failure for DBAs
- Apply safety margin to acceptance criteria and use best-estimate code calculations
- Use quantitative approach for safety margin when possible (e.g., 95th percentile acceptance criteria based on best-estimate code calculations).
- Consider
  - Impact of change on quantative goals for high-level strategies
  - Probabilities of other failure modes
  - Significance of SSCs in an overall systems context

Quantitative Goals for Risk-Informing Regulatory Requirements

Quantitative Health Objectives (QHOs)	
Early Fatality Safety Goal $\leq$5E-7/year	Latent Cancer Fatality Goal $\leq$2E-6/year

(1) Prevention-MitigationAssessment: Consider the Strategies in Pairs

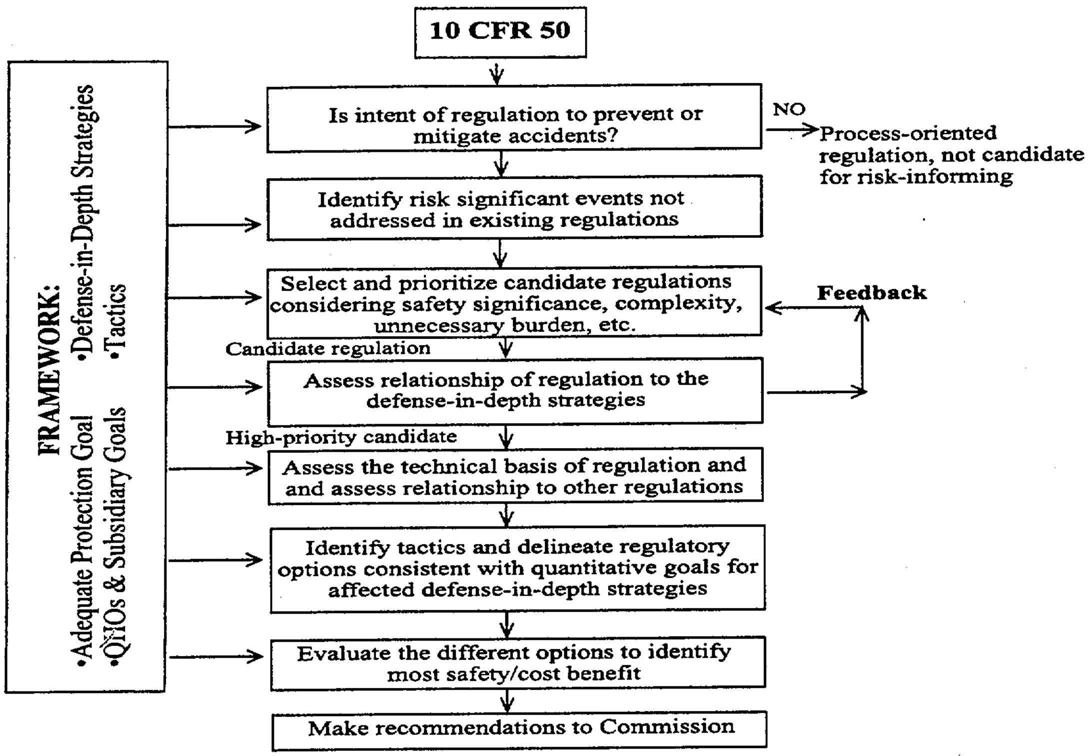
Prevent	Mitigate
Core Damage Frequency $\leq 10^{-4}$/year	Conditional Probability of Individual Fatality $\leq 10^{-2}$

(2) Initiator-DefenseAssessment: Consider the Strategies Individually (Preferred)

	Limit the Frequency of Accident Initiating Events (Initiators)	Limit the Probability of Core Damage Given Accident Initiation	Limit Radionuclide Release During Core Damage Accidents	Limit Public Health Effects Due to Core Damage Accidents
	Initiator Frequency	Conditional Core Damage Probability	Conditional Early Containment Failure Probability	Conditional Individual Fatality Probability
Anticipated Initiators	$\leq$ 1/year	$\leq 10^{-4}$	$\leq 10^{-1}$	$\leq 10^{-1}$
Infrequent Initiators	$\leq 10^{-2}$/year	$\leq 10^{-2}$	$\leq 10^{-1}$	$\leq 10^{-1}$
Rare Initiators	$\leq 10^{-5}$/year	≤ 1	≤ 1	$\leq 10^{-1}$

Notes: The product across each row gives $\leq 10^{-6}$/year. Responding systems and procedures are not designed for rare events.

Framework Implementation:



Key Policy Issues

- Need general agreement on quantitative goals for high-level defense-in-depth strategies
- Need to let guidance regarding safety margins and other tactics evolve during study
- Need to demonstrate that risk-informed requirements will focus attention on risk-significant accident scenarios
- Need to address the relationship between the proposed approach and the backfit rule
- Need to define the need for and implementation of single failure criterion

Key Policy Issues (cont'd)

- Is there a need to reconcile requirements in 50.34(f) with proposed risk-informed requirements in other Sections of Part 50?
- What should be the role of cost-benefit analyses in evaluating some of the options?
- Can some requirements be added/modified without justification from the backfit rule?
- How should the risk from other than full power operational states be addressed?

Screening, Selection and Prioritization of Candidate Regulations (Requirements) and Design Basis Accidents

Guiding Principle in Selection and Prioritization

- Candidate regulation must have some tie to accident prevention or accident mitigation

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- Candidate regulation addresses some aspect of plant design, operation, maintenance or emergency planning

Candidate Selection and Prioritization Approach:

1. Perform coarse screening of regulations based on guiding principle
2. Develop and refine selection and prioritization criteria
3. Review regulations to identify potential "holes"
4. Select and prioritize candidate regulations (and DBAs) based on developed criteria

Coarse Screening Results:

- Criteria applied to Part 50 and appendices
- Of the total 82 regulations and 17 appendices of Part 50
  - 59 regulations and 8 appendices screened out
    - Consists of legal, procedural, financial or enforcment-related regulations
  - 23 regulations and 9 appendices retained as potential candidates

Examples of Candidate Regulations

- 50.44 Standards for combustible gas control system in light-water-cooled power reactors.
- 50.46 Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors.
- 50.47 Emergency plans.
- 50.49 Environmental qualification of electric equipment important to safety for nuclear power plants.
- 50.60 Acceptance criteria for fracture prevention measures for lightwater nuclear power reactors for normal operation.
- 50.61 Fracture toughness requirements for protection against pressurized thermal shock events.
- 50.62 Requirements for reduction of risk from anticipated transients without scram (ATWS) events for light-water-cooled nuclear power plants.
- 50.63 Loss of all alternating current power.
- Appendix K to Part 50 -- ECCS Evaluation Models Criteria for Nuclear Power Plants (Partly relevant)

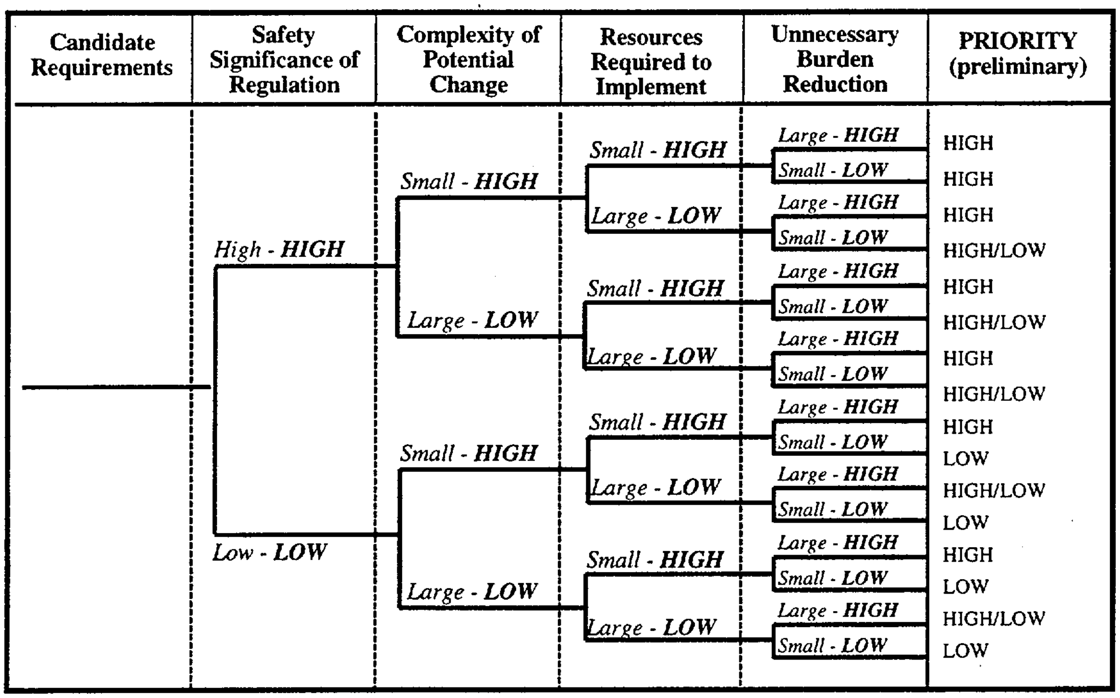
Selection Criteria for Candidate Regulations and DBAs

- Risk (safety) importance of regulation
  - Frequency of initiating events
  - CDF and LERF for event scenarios
  - Risk contribution of systems, structures or components
- Regulation poses unnecessary burden to NRC or licensee relative to its risk significance
  - Methods, assumptions or acceptance criteria have excessive conservatism (e.g., excess safety margin)

Individual Criteria for Prioritizing Candidate Regulations

- Potential for improving safety; example:
  - High priority because substantial improvement is anticipated due to risk significance of the requirement and the large number of plants affected
- Complexity of the regulation; example:
  - High priority because minor change needed and no other related regulations impacted (i.e., easy to implement)
- Resources required for risk-informing the regulation; example:
  - High priority because small resources needed (both short and long term) and because of the large number of plants affected
- Potential for reducing licensee and NRC unnecessary burden; example:
  - High priority because implementation will significantly reduce unnecessary burden

Prioritization of Candidate Regulations -- Example



Preliminary Results

- High priority DBAs
  - Spectrum of pipe-breaks (50.46)
  - Rod-ejection accident (PWR)
  - Rod-drop accident (BWR)
  - ATWS power oscillations (BWR)

- High priority 50.44 and 50.46

Options (preliminary): 50.46 and LOCA DBA

- Relax simultaneous failure assumptions
  - Double-ended large break
  - Loss of offsite power
  - Failure of one emergency AC power train
- Relax Appendix K conservatisms, e.g.
  - Use current ANS decay-heat standard
  - Replace Baker-Just oxidation model
  - Problems:
    - high-burnup fuel has more pre-existing oxidation
    - margin hard to quantify (vendor-specific codes)

Options (preliminary): 50.46 and LOCA DBA (Cont'd)

- Modify acceptance criteria
  - Replace high-temperature and oxidation limits with embrittlement criterion
- Make best-estimate analysis with uncertainty propagation less burdensome
  - Hybrid approaches (e.g. SECY-83-472)
  - Automate audit analyses
  - Use more efficient uncertainty analysis schemes
- Treat break size and location probabilistically
  - Propagate this uncertainty with others
- Eliminate very large breaks as DBAs
  - Frequency would have to be demonstrably < 1e-6/yr
  - Might still retain as design basis event for containment

Options (preliminary): Control-Rod Ejection (PWR) and Drop (BWR)

- GDC 28 and RG 1.77
- Control-Rod Ejection (PWR) not a risk-dominant sequence
  - Low probability of initiating housing rupture
  - Not all housing failure would cause ejection
  - Central rod assumed fully inserted then ejected
- Control Rod Drop (BWR) low risk event
  - frequency <1.0E-7/RY
  - not expected to cause unacceptable fuel damage on current criteria
- Phenomenological uncertainties regarding high-burnup fuel performance

Options (preliminary): ATWS Power Oscillations (BWR)

- BWR ATWS is risk-significant reactivity-related accident
  - High-capacity low-pressure injection flows initiate power oscillations
  - Limiting injection flow would eliminate oscillations
- Phenomena Identification and Ranking Table (PIRT) panel examining the high priority DBAs for high-burnup fuel

Relationship of PRA Accidents to Regulations

Accident Classes Important to CDF or LERF	Regulations in Part 50
Station Blackout	50.63, 50.34(f)(ix)
Anticipated Transients without Scram	50.62
Loss of Coolant Accidents	50.34(f)(iv), 50.46, App K, App J
Transients with DHR Loss	50.34(f)(i)
Transients with Injection Loss	50.34(f)(v)(vii)(viii)(x)(xi)
Early Containment Failure	50.34(f)(xii), 50.44, App A
Containment Bypass (ISLOCA, SGTR)	App A (indirectly)
Loss of Containment Isolation	App A
Internal Fire	App R
Internal Flood	
External Events	Part 100 for siting, App S

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Preliminary Observations on Potential Holes in Regulations

- Many of the risk significant accident classes are only covered by 50.34(f)
- 50.34 does not apply to current set of operating plants
- Some accident types are not addressed in current regulations:
  - Seal LOCAs
  - Direct impingment of core debris (e.g., shell melt-through)
- Some accident types addressed only indirectly by current regulation:
  - Containment bypass accidents in Appendix A

Preliminary Observations on Potential Holes in Regulations

- Revised DBAs may need to include new accident types,e.g., seal LOCAs (PWRs)
- Evaluate risk-significant accidents in the context of the Backfit Rule
- Screening/Prioritization process is in early stages, further work may change initial findings

Key Issues

- Criteria used in the selection and prioritization of candidate regulations
- Any excessive conservatism or unnecessary burden imposed by candidate regulations
- Any regulatory requirements that may have a negative impact on safety, is contradictory to another requirement, or is redundant to another requirement
- The regulations selected as high priority candidates for risk-informing
- What factors should be considered when evaluating different risk-informed options for implementation
- What risk-significant areas are not covered by the current set of regulations

50.44 Preliminary Results

50.44: *"Standards for Combustible Gas Control System in Light Water Cooled Reactors"*

- Selected as a trial regulation for piloting the process of risk-informing Part 50
- Promulgated to provide a means for the control of hydrogen gas that could evolve following a LOCA DBA and reduce the risk of a hydrogen deflagration or detonation that could threaten containment
- Identified by licensees as a regulation containing non-risk significant requirements that pose unnecessary burden
- Basis for staff's approval of SONG's exemption request, not plant-specific; application on a wider, generic bases

50.44: Relationship to Framework

- Framework seeks to both *prevent* core damage accidents, and ***mitigate*** the public impact should a core damage accident occur
- Rule promotes the mitigative strategy of *"containing fission products released in core damage accidents"*

→ regulation supports the strategy concerned with fission product containment by reducing the conditional probability of cotainment failure from hydrogen combustion

- Rule fits framework by evolution, not by design:
  - Original rule emphasized mitigation of LOCA phenomena
  - Revisions focused on mitigation of degraded core accident phenomena
- Assess rule to:
  - Eliminate any non-risk significant elements
  - Add missing risk-significant elements
  - Simplify to more effectively meet objective

50.44: Technical Requirements

50.44 Requirement	Containment Type		
	Mark I and II	Mark III and Ice Cond	Large Dry
▪ Measure hydrogen concentration in containment	X	X	X
▪ Insure a mixed containment atmosphere	X	X	X
▪ Control combustible gas following LOCA (5% clad metal/water or 0.00023 in)	X	X	X
▪ Add high point vents	X	X	X
▪ Inert containment	X		
▪ Hydrogen control system to handle 75% clad metal/water reaction		X	

Relationship of 50.44 to Risk -- PWR Large Dry Containments

- Largest source of hydrogen produced in a severe accident arises from in-vessel generation by the oxidation of the clad due to the metal/water reaction
- Risk studies have demonstrated that hydrogen combustion not a significant threat to the short term containment survivability
  - NUREG-1150: mean conditional probability of early containment failure ($CPCF_E$) estimated at ~1% with only a fraction attributed to hydrogen explosion
  - IPEs: $CPCF_E$ range from negligible to ~0.3
- Generic Issue 121 (hydrogen control in large, dry containments): resolution was that hydrogen combustion not an early failure threat and no basis for requiring new, generic hydrogen control measures, such as igniters

Relationship of 50.44 to Risk -- Mark I and Mark II Containments

- Analyses include the fact that 50.44 requires inerted containments, therefore, failure due to hydrogen not found to be significant
- Mark I: IPE $CPCF_E$ range from 0.03 to 0.6, and NUREG-1150 $CPCF_E$ of ~0.5, with shell melt-through as the major contributor
- Mark II: IPE $CPCF_E$ range from 0.01 to 0.4, with hydrogen combustion not a significant contributor
- Periods with Mark I and Mark II not inerted
  - Risk from potential accidents while the reactor shutdown for refueling, maintenance, etc. needs to be assessed

Relationship of 50.44 to Risk -- Mark III and Ice Condenser Containments

- Hydrogen combustion found to be significant contributor to early containment failure, mainly from station blackout accidents
- Mark III:
  - IPE results: $CPCF_E$ range from 0.03 to 0.5 with hydrogen burns to be the main cause
  - NUREG 1150: $CPCF_E$ of ~0.4 with hydrogen to be the main cause
- Ice Condenser:
  - IPE results: $CPCF_E$ range from 0.01 to 0.02 with hydrogen burns at/shortly before vessel breach important contributor to two of the five plants
  - NUREG 1150: $CPCF_E$ of ~0.06 with hydrogen negligible contribution

50.44 -- Preliminary Evaluation

- Review requirements
- Identify licensee implementation
- Evaluate safety significance
- Identify options for consideration and evaluation

50.44 -- Preliminary Evaluation (Cont'd)

- ***Measure H2 in Containment***: safety grade instrumentation for H2 and O2 measurement
  - H2 measurement capability has safety value for tracking and managing an accident
  - Some relaxation of the STR imposed on the equipment used
  - No change or allow commercial grade instrumentation
- ***Ensure Well Mixed Containment Atmosphere:*** atmospheric mixing systems (fan coolers, sprays, air return fans, etc.)
  - Keeping a well mixed containment atmosphere without hydrogem stratification important to safety
  - Systems used for mixing are generally used for other functions
  - Changes are unlikely to be defensible, no changes proposed
- ***Add High Point Vents:*** high point vents in RCS
  - Assuring that adequate core cooling is not precluded due to H2 accumulation in the reactor coolant system has a high safety significance
  - High point vents are in place
  - Changes are unlikely to be defensible, no changes proposed

50.44 -- Preliminary Evaluation (Cont'd)

- ***Control Combustible Gas Concentrations in Containment Following a LOCA:*** safety grade H2/O2 recombiners, and safety grade H2 vent and purge systems
  - The safety significance, in terms of CDF and LERF, of control systems designed to deal with slowly evolving H2 subsequent to a LOCA appears to be quite low.
  - These systems are not able to deal with the rapid H2 generation which could occur during a severe accident.
  - The burden of maintaining as safety systems appears unnecessary from a risk-informed perspective.
  - The ability to control more slowly evolving combustible gases may be desirable in the later stages of a core damage accident.
  - Control could be achieved by adapting equipment currently in place for post LOCA H2 control or by using new equipment instead.
  - Unlikely that the equipment would need to be safety grade.

50.44 -- Preliminary Evaluation (Cont'd)

Control Combustible Gas Concentrations in Containment Following a LOCA

- Remove internal recombiners from operation
- Remove internal recombiners from operation, and make provisions for portable external recombiners
- Retain internal recombiners but drop safety grade classification
- Remove internal recombiners from operation and replace with passive autocatalytic recombiners (PARs)
- Remove internal recombiners from operation and rely on igniters for long term H2 control (for Mark IIIs and Ice condenser containments only)

- No change for H2 vent and purge system
- Remove H2 vent and purge system from operation
- Retain H2 vent and purge system but drop safety grade classification
- Remove H2 vent and purge system from operation, but identify other possible vent and purge system (such as for containment pressure control) for H2 control.

50.44 -- Preliminary Evaluation (Mark I and II)

- ***<u>Inert Containment Atmosphere</u>:*** inerting system, containment atmospheric diluton (CAD) system
  - The safety significance of an inerted containment atmosphere in the smaller BWR containments is generally acknowledged to be high
  - Changes to current measures are unlikely to be defensible, no changes proposed

50.44 -- Preliminary Evaluation (Mark III and Ice Condensers)

- ***H2 control system to handle 75% clad metal/water reaction:*** AC powered igniter system
  - The safety significance of the existing H2 igniter systems is considered to be high.
  - Greater emphasis on defense-in-depth and the uncertainties in PRAs could provide a rationale for maintaining all or some igniter operability during station blackout (SBO) accident sequences for one or both of these containment types.
  - No change
  - Ensure availability of all existing igniters during SBO,
  - Ensure availability of a reduced set of existing igniters during SBO

50.44 -- Preliminary Evaluation (Large Dry)

- Large dry containments appear to be robust regarding H2 combustion events
- Demonstrate ability of containment to withstand an H2 combustion event equivalent to H2 from 75% clad metal/water reaction

50.44 -- Current Status

- Accelerate schedule to evaluate different risk-informed options for the various technical requirements
- Recommend to Commission (March 2000) to move forward on an expedited basis
- Develop recommendations for a risk-informed 50.44 for Commission approval by June 2000

Key Issues

- If a Mark III or ice condenser licensee's analysis shows that H2 concerns for SBO are not risk-significant because the SBO contribution to CDF is small, is this acceptable in light of the balanced approach advocated in the Framework for the four high level strategies?
- Is a more risk significant "design basis" or "risk based" accident needed for combustible gas concerns?
- The San Onofre exemption was granted for a plant with a large dry containment. Were there any plant specific issues involved? Which generic issues apply to plants with other containments?
- How should proposed alternatives be packaged to permit the voluntary choosing of options, while limiting unreasonable "cherry picking"?
- How should the risk from other than full-power operational states be addressed, when certain combustible gas control systems may be not operational, (i.e., Mark I or II's deinerted)?

Key Issues (Cont'd)

- Recent studies of Mark III containments have indicated that the chance of a H2 combustion event is extremely low, while a recent study of ice condenser plants indicates that the probability of H2 combustion challenging containment is close to unity in SBO scenarios. This is the reverse of the insights from NUREG-1150 regarding the relative importance of H2 events for these containments. What does this mean for the options related to igniter availability in SBO conditions?
- Are combustible gas concerns for future reactor designs sufficiently covered under Part 50.34?
- Are there difficulties in reconciling the combustible gas control requirements of 50.34 for newer reactors, with risk informing those of 50.44 for the existing reactors?

Special Treatment Requirements

Rulemaking Plan for Risk-informing Special Treatment Requirements

- Option 2 of SECY-98-300
  - Develop an alternative risk-informed approach to special treatment requirements of structures, systems, and components (SSCs)
  - May change the categorization of the SSCs but not the actual treatments of the SSCs requiring special treatment
  - NRC rulemaking plan for Option 2 discussed in SECY-99-256
    - New rule, 10 CFR 50.69
    - New Appendix T
- Option 3 of SECY-98-300
  - Explore changes to the body of the Part 50 regulations incorporating risk-informed attributes
  - Special treatment requirements of SSCs suggested in SECY-99-264 for trial implementation
  - May change, in a consistent manner, both categorization and treatment of SSCs

Special Treatment Requirements of Structures, Systems, and Components (SSCs)

- Existing regulation requires that "special treatment" be applied to SSCs that are safety-related (including "safety-related", "important to safety" SSCs, and "basic components" discussed in SECY-99-256)

- Risk-Informed regulation categorizes SSCs and determines their treatments based on their risk-significance

Categorization and Treatment of SSCs in Option 2

Risk-Informed		
↑	**1** **"RISC-1" SSCs** Safety-Related Safety Significant Special Treatment + 50.69 Requirements	**2** **"RISC-2" SSCs** Non Safety-Related Safety Significant 50.69 Requirements
↓	**3** **"RISC-3" SSCs** Safety-Related Low Safety Significant 50.69 Requirements to Maintain Functions	**4** **"RISC-4" SSCs** Non Safety-Related Low Safety Significant

← →

Deterministic

Categories of Existing Regulations for Special Treatment Requirements

- Design Considerations (Pt 50 App A, 50.55a)
- Qualification (GDC 4, 50.49)
- Change Control (50.59)
- Documentation (50.34, 50.71)
- Reporting (50.71, 50.72, 50.73)
- Maintenance (50.65)
- Testing (GDC 37, 40, 43, 46, Pt 50 App J)
- Surveillance/Inspection (GDC 18, 32, 36, 39, 42, 45)
- Quality Assurance (GDC 1, Pt. 50 App B)

Risk-Informing Special Treatment Requirements

- Identify from existing rules (i.e, the body of Part 50 and those of other applicable parts) the requirements and their basis (e.g., from Regulatory Guides and industry standards)
  - trend, redundancies, and inconsistencies
  - consolidate/simplify them using risk-informed approach
- Determine the use of a new set of "Design Basis Accidents", consistent with the risk-informed approach, for environmental conditions used for equipment qualification
- Use a categorization scheme similar to that used in Option 2 (but may have more risk-significant layers) and the lessons learned from Option 2 to assist Option 3 development and assure consistency

Summary of Key Issues

Summary of Key Issues: Proposed Implementation Issues

- Deletion of unnecessary requirements:
  - Should be made available to all affected licensees, unless plant-specific risk information indicates otherwise
- Addition of new requirements:
  - If they pass the backfit test, shold be mandatory for all affected licensees, unless plant-specific risk information indicates otherwise
  - Should pass the backfit test
- Alternative requirements:
  - Voluntary
  - May tie changes in related areas together
  - No backfit test

Summary of Key Issues: Risk-Informed framework

- Quantitative goals for high-level defense in-depth strategies
- Define the need for and implementation of single failure criterion
- Address the risk from other than full power operational states
- Definition of safety margin
  - How to address uncertainties
  - Use best-estimate calculations with 95% confidence that occurrence will occur
- How to use performance monitoring as a surrogate for safety margin
- Need to look at long term containment performance (late large release)

Summary of Key Issues: Risk-Informed Key Issues

- A more risk significant "design basis" or "risk based" accident needed for combustible gas concerns
- Risk-Informed Rule:
  - A complete rewrite of the requirements using risk insights
  - A revision or modification of the requirements using risk insights
- Elements of a risk-informed rule:
  - Monitoring
  - Purging
  - Recombiners
  - Igniters
  - Mixing
- Need to consider shutdown conditions

Stakeholder Feedback Received During Workshop

- General agreement with approach and guidelines
- Approach also needs to consider
  - Consistency with plant oversight process
  - Impact on workers
  - Option 2 scope should be a key factor in deciding what a risk-informed part 50 should address
- Need to ensure good communication with owner's groups and industry programs
- Do not prohibit looking at emergency planning in the future
- Move ahead, on an expedited basis, with changes to 50.44
- Option 3 role with respect to "special treatment" rules needs clarification

Future Activities

Future Activities Include:

- Meet with ACRS (March and October)
- Prepare status report, including any policy issues, to Commission (March 2000)
- Consider stakeholder feedback, completion of review to identify candidate regulations and DBAs and develop preliminary recommendations (August 2000)
- Hold additional public workshop (September 2000)
- Provide final recommendations to Commission (December 2000)