September 12, 2000

MEMORANDUM TO: Thomas L. King, Director
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

FROM: Mark A. Cunningham, Chief
Probabilistic Risk Analysis Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

SUBJECT: TRANSMITTAL OF THE SUMMARY REPORT FOR THE FEBRUARY 24-25, 2000, PUBLIC WORKSHOP ON RISK-INFORMED CHANGES TO THE TECHNICAL REQUIREMENTS OF 10 CFR PART 50

Attached is a summary report of the public workshop on risk-informed changes to the technical requirements of 10 CFR Part 50, held in Rockville Maryland, February 24-25, 2000. This report titled "Summary of Information Presented at an NRC-Sponsored Public Workshop on Risk-Informing the Technical Requirements of 10 CFR Part 50, February 24-25, 2000, Rockville, Maryland," was prepared by Sandia National Laboratories (SNL). It summarizes the presentations given during the workshop, and the discussions held during the general discussion session. It also includes the workshop's agenda, the attendance list, and the view graphs used by the NRC as well as the public.

By copy of this memorandum, the report is being placed in the Public Document Room.

cc: A. Thadani
M. Federline
G.M. Holahan
J.T. Larkins

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Letter Report
May 2000
Revised July 2000

Summary of Information Presented at an NRC-Sponsored Public Workshop on Risk-Informing the Technical Requirements of 10 CFR Part 50, February 24 – 25, 2000, Rockville, Maryland

Donnie W. Whitehead (Editor)

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

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Letter Report
May 19, 2000
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Summary of Information Presented at an NRC-Sponsored Public Workshop on Risk-Informing the Technical Requirements of 10 CFR Part 50, February 24 – 25, 2000 Rockville, Maryland

Donnie W. Whitehead (Editor)
Risk and Reliability Analysis Department
Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185-0748

Abstract

This report summarizes a public workshop that was held on February 24 – 25, 2000, in Rockville, Maryland. The workshop was conducted as part of the United States Nuclear Regulatory Commission's (NRC) efforts to explore changes to the body of the 10 CFR Part 50 regulations, to incorporate risk-informed attributes. During the workshop the NRC staff discussed and requested feedback from the public (including representatives of the nuclear industry, state governments, consultants, private industry, and the media) on risk-informed revisions to the technical requirements of 10 CFR Part 50.

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List of Acronyms and Initialisms

ACRS	Advisory Committee on Reactor Safeguards
CFR	Code of Federal Regulations
DBAs	Design Basis Accidents
EPRI	Electric Power Research Institute
EPZ	Emergency Planning Zone
IPE	Individual Plant Examination
LBLOCA	Large Break Loss-of-Coolant Accident
NEI	Nuclear Energy Institute
NERI	Nuclear Energy Research Initiative
NRC	Nuclear Regulatory Commission
QHOs	Quantitative Health Objectives
RIR	Risk-Informed Regulation
SDP	Significance Determination Process
STP	South Texas Project
STRs	Special Treatment Requirements
WOG	Westinghouse Owners Group

1 INTRODUCTION

1.1 Background

The Office of Nuclear Regulatory Research of the United States Nuclear Regulatory Commission (NRC) has initiated a program to explore changes to Part 50 of the Code of Federal Regulations (CFR) (i.e., 10 CFR 50) to incorporate risk-informed attributes. These changes include: (1) identifying provisions to be added to Part 50 as risk-informed alternatives, (2) revising specific requirements in Part 50 to reflect risk-informed considerations, and (3) deleting unnecessary or ineffective regulations. To support NRC's exploration of risk-informed changes to the technical requirements of Part 50, a public workshop was conducted on February 24–25, 2000, in Rockville, Maryland. The objectives of the workshop were to:

- discuss approach and guidelines to be used in identifying recommended changes to Part 50,
- share preliminary results on risk-informing the technical requirements of 10 CFR 50, and
- solicit and gather information on each topic from stakeholders.

This report summarizes the workshop.

1.2 Workshop Structure

The first day's session consisted of presentations by the NRC and representatives of the public and a brief question and answer session after each presentation. The second day's session consisted of the final public representative presentation and a question and answer session, an open discussion on the major topic areas identified in the NRC's presentation, and a wrap-up discussion where future activities were discussed. The workshop was well attended and very successful in generating significant feedback from interested parties. Most of the feedback was given verbally during the general discussion session; however, some written comments were submitted as well. This report summarizes the comments received in both forms.

1.3 Organization of the Report

The intent of this report is to capture the main points of the presentations and comments offered as well as those of the written comments. A verbatim transcript of the workshop was not recorded. This document was prepared based on notes taken during the workshop. Thus, although it is the intent to provide information as presented and discussed, the possibility exists that some points may have been inadvertently omitted or missed.

Chapters 2 and 3 summarize the various presentations. Chapter 4 summarizes information gathered during the question and answer session following each presentation and the open discussion sessions on the major topics, including information from written comments. Appendix A provides the workshop agenda. Appendix B contains the attendance list of those who completed attendance forms; Appendix C, copies of the viewgraphs used by the NRC; and Appendix D, copies of the viewgraphs used by representatives of the public.

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2. NRC PRESENTATION ON RISK-INFORMING THE TECHNICAL REQUIREMENTS IN 10 CFR 50

The workshop opened with introductory material on the workshop's structure, objectives, and agenda by Tom King (Director of the Division of Risk Analysis and Applications, NRC) and Mary Drouin (Section Leader in the Probabilistic Risk Analysis Branch, NRC). Following this introductory material, Mary Drouin presented an overview of the NRC presentation, including information on:

- program objectives,
- program scope,
- the two phased program approach, and
- the current Phase 1 activities.

Following this overview, Mary Drouin and Allen Camp (Manager of the Risk, Reliability, and Modeling Group, Sandia National Laboratories) presented information on the framework for risk-informing 10 CFR 50 (hereafter referred to as the framework). The presentation is summarized below, and copies of the viewgraphs are provided in Appendix C.

1. The process used to develop the framework for risk-informing 10 CFR 50 was discussed. A major need identified during this process was the need for a working definition of "defense-in-depth."

2. Using information from both the Commission and the Advisory Committee on Reactor Safeguards (ACRS), a working definition of defense-in-depth was presented along with defense-in-depth implementation principles.

3. A pictorial representation of the framework was provided.

4. The use of tactics (i.e., tools embodied in regulations that enable meeting defense-in-depth) was discussed, and examples were provided. Safety margins, one of the most important tactics, was defined and implementation considerations were discussed.

5. The use of quantitative health objectives (QHOs) in risk-informing regulatory requirements was discussed. The concepts of prevention (of core damage) and mitigation (of individual fatality) were discussed in probabilistic terms.

6. A flowchart of the framework implementation process was presented and discussed, and nine key policy issues were identified.

After the discussion on the framework, Alan Kuritzky (Probabilistic Risk Analysis Branch, NRC) presented information on the screening, selection, and prioritization of candidate regulations (requirements) and design basis accidents (DBAs). The presentation is summarized below, and copies of the viewgraphs are provided in Appendix C.

1. The guiding principle in the selection and prioritization process (i.e., that candidate regulations must have some tie to accident prevention or mitigation) was discussed.

2. The overall candidate selection and prioritization approach was presented and discussed.

3. Coarse screening results from applying the approach to 10 CFR 50 and appropriate appendices identified 23 regulations and 9 appendices retained out of a total of 82 regulations and 17 appendices.

4. Examples of candidate regulations were provided.

5. Refined selection criteria for re-examining the coarse screening results were presented, along with an example of the refined prioritization process for identifying candidate regulations.

6. Preliminary results from this re-examination process identified four high priority DBAs (i.e., pipe breaks, rod-ejection accident, rod-drop accident, and ATWS power oscillations) and two high priority regulations (i.e., 50.44 and 50.46).

7. Preliminary options for addressing all except 50.44 were discussed.

8. The identified relationships among PRA accidents and the regulations were presented along with some preliminary observations on potential holes in the regulations.

9. Finally, key issues associated with the entire process were identified and discussed.

Following the presentation on the screening, selection, and prioritization process, John Lehner (Group Leader of the Energy, Economics & Reliability Systems Group, Brookhaven National Laboratory) presented a detailed discussion on using the 50.44 rule to pilot the process of risk-informing Part 50. The presentation is summarized below, and copies of the viewgraphs are provided in Appendix C.

1. The relationship of the rule to the framework was discussed, including the need to assess the rule to eliminate non-risk significant elements, to add missing risk-significant elements, and to simplify the rule to more effectively meet its objective.

2. The technical requirements associated with the rule and the relationship of the rule to risk for each containment type were identified.

3. After describing the preliminary evaluation process used in the pilot, results from the various steps were presented. Additionally, specific findings were presented for each of the containment types.

4. The current status of the 50.44 pilot process was given, including developing recommendations for a risk-informed 50.44 for Commission approval by June 2000.

5. Finally, key issues associated with risk-informing 50.44 were identified and discussed.

After presenting the discussion on 50.44, John Lehner gave a presentation on risk-informing special treatment requirements for structures, systems, and components (SSCs). The presentation is summarized below, and copies of the viewgraphs are provided in Appendix C.

1. A summary of Options 2 and 3 from SECY-98-300 was presented.

2. The categorization and treatment of SSCs in Option 2 was discussed using a four cell matrix to identify the importance of SSCs and their need for special treatment.

3. Existing regulations containing special treatment requirements were listed.

4. The general process for risk-informing special treatment requirements in Option 3 was discussed.

After the presentation on special treatment requirements, Mary Drouin presented a slide identifying future activities.

Following the public presentations, Mary Drouin presented three slides that were used to stimulate the open discussion sessions on proposed implementation issues, risk-informed framework, and risk-informed key issues. After the open discussion session, Tom King presented a slide summarizing the feedback that had been received from the stakeholders.

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3. PRESENTATIONS FROM THE PUBLIC

Representatives of the public also gave presentations, which are summarized below. Viewgraphs are provided in Appendix D.

3.1 Risk-Informing the Technical Requirements of 10CFR50 – Performance Technology

Bob Christie of Performance Technology, stated what he believed the objective of risk-informed pilot programs to be. He then described what he termed a whole plant integrated approach to regulation. He indicated that the primary responsibility for the public health and safety resides with the people who are operating the plant while ensuring adequate protection of public health and safety is the responsibility of the regulatory process. In addition, he stated that public health risk is different for each nuclear site and changes with time. Major problems with NRC's approach to safety were discussed. Issues associated with a deregulated electric utility industry were discussed along with excerpts from the San Onofre Task Zero Safety Evaluation Report. He then presented key points associated with public health risk with regard to combustible gas control. He presented his proposals for revised 10 CFR 50, Appendix A, General Design Criteria 41 and 10 CFR 50.44. This was followed by a discussion of the important parameters associated with containment integrity. He summarized his presentation by stating that sufficient knowledge exists to change 50.44, that the focus must be on severe accidents, and that changes to 10 CFR 50 must be a combination of retaining what is effective and efficient, adding where necessary, and deleting what is not effective and efficient.

3.2 Issues Associated With Option 2/3 Interface– South Texas Project N.O.C.

Rick Grantom of the South Texas Project (STP) N.O.C began his presentation by stating its purpose, to identify possible interface alternatives between Option 2 and Option 3 efforts, and its desired outcome, awareness of how Option 2 can impact and influence Option 3 efforts and to prompt guidance from NRC on which alternative is recommended. He set the stage for three questions associated with SSCs categorized as RISC-3. He then identified two possible alternative approaches to deal with these SSCs and discussed the pros and cons associated with each.

3.3 Risk-Informing NRC Technical Requirements – NEI

Adrian Heymer of the Nuclear Energy Institute (NEI) opened his presentation by summarizing what risk-informing the regulations can accomplish, what information can be used, and the importance of communication between the industry and the regulators. Information from an industry survey was presented and discussed. Several current improvement activities were briefly discussed, with a detailed discussion on potential improvements to 50.46 and the impacts of such improvements. Following the detailed discussion, a multitude of other regulatory improvements were listed. He ended his presentation by summarizing option activities.

3.4 Development of Risk-Informed Design and Regulatory Process – ABB Combustion Engineering Nuclear Power, Inc.

Stanley Ritterbusch of ABB Combustion Engineering Nuclear Power, Inc., began his presentation by describing the Nuclear Energy Research Initiative (NERI), the need to reduce the capital cost of new construction by 35% or more, and the need for a long-term research and development program to develop

the next generation of nuclear power plants. He identified the three NERI projects submitted by a team organized by ABB, the team members, the relationships among the projects and the NRC's current and future risk-informed program, and the status of NERI program milestones. He then presented NERI's risk-informed principles and discussed NERI's risk-informed regulatory framework. This was followed by a comparison of the NRC and NERI risk-informed regulatory processes, including a time-dependent comparison amongst the three generations of plants–current, advanced light water reactors, and generation IV. Potential design and regulatory changes were identified, and his presentation concluded with a summary of the favored design and regulatory approach for the generation IV plants and the advantages of a risk-based process.

3.5 Westinghouse Owners Group LBLOCA Design Basis Redefinition– WOG

Wayne Harrison of the Westinghouse Owners Group (WOG) discussed WOG's program to redefine the licensing basis of the large break loss-of-coolant accident (LBLOCA). He described the four phases of the program and provided details on the status of the two initial phases. He then discussed the expected benefits and costs of the program. Finally, he discussed in detail the program direction, including information on licensing strategy, technical justification, industry involvement, and interaction with the NRC.

4. DISCUSSIONS

This section summarizes the discussions that took place after each presentation, presented first, the open discussion that occurred after all presentations were completed, presented next, and the written comments received at the Workshop, presented last. In order to facilitate feedback during the open discussion session, NRC focused the discussion on four key issues:

1. Proposed implementation issues,
2. Risk-informed framework,
3. Risk-Informed key issues, and
4. Feedback received.

The summaries in the ensuing three sections include both verbal and written comments and are ***not*** verbatim transcripts of the discussions that took place.

4.1 Summaries of the Discussion After Each Presentation

4.1.1 Framework for Risk-Informing 10 CFR 50–NRC

Public: It is unclear how safety goals are being used. Safety goals are a measure of safe enough and you should not have to do any thing. Will the role of cost-benefit, as defined in 50.109, be changed?

NRC: You are correct, safety goals are a measure of safe enough. Currently, this Risk-Informed Regulation (RIR) program is completely voluntary, so this puts a different twist on the backfit rule. The question is, if we find something missing in the regulations that can be justified by the backfit rule, do we impose this on licensees, given that RIR is voluntary.

Public: Will NRC provide an option where licensee's that don't meet safety goals can do RIR?

NRC: Currently, RIR will meet safety goals and will be consistent with the intent of the Significance Determination Process (SDP) and cost-benefit analysis.

NRC Contractor: RIR is not intended to mimic ALARA principles.

Public: The roles of the SDP and the framework could be inconsistent. Have you looked at the SDP to ensure that a plant meeting the framework targets does not get "flagged" in the SDP?

NRC/NRC Contractor: That is a good point. We have not explicitly looked at that. We will have to look into it.

Public: Are you looking at the Individual Plant Examination (IPE) submittals? Not all IPE's are created equal. How are you bench-marking?

NRC/NRC Contractor: Yes, we are aware of the variability. We are looking at both IPEs and other PRAs.

Public: The Scope slide indicated that you will not cover fire protection and emergency preparedness. Why?

NRC: We do not have enough risk information in these areas at this time to make changes; however, the areas are not untouchable, given additional information.

Public: Industry is doing work here that the NRC should consider in the future.

Public: There is a concern that if safety margin is designed into the regulations, the regulations will still look deterministic. We need to consider that failure rates may change. Risk monitoring programs at plants can address changing failure rates. The NRC should allow the utilities to address safety margin, instead of building it into regulations.

NRC: We will try to make the regulations performance-based, as well as being risk-informed.

Public: NRC can take the lead from utilities on blending deterministic and probabilistic, with defense-in-depth built in. Utilities have blended safety monitors such as ORAM/Sentinel and EOOS.

NRC Contractor: We are aware of these.

NRC: On March 1, there will be a workshop on performance based regulations.

Public: Have you given any thought to the dependencies of regulations on each other and how you will identify the relationships? You need an overview of the entire change to the regulations.

NRC Contractor: Yes there will probably be some. We are going through regulations to identify them. There are some contradictions, interfaces with other parts. We don't have an exact answer at this point on how to handle this, but some packaging of regulations will likely be required.

NRC: We have created a list of the overlap in the regulations and their relationship to Regulatory Guides, Branch Technical Positions, and General Design Criteria. This is also a step in our flowchart for risk-informing. We have a data base. Anything done on a specific regulation can have tracked effects–we will look at this in a holistic manner.

Public: Doesn't the assessment of regulations have to be performed before prioritization?

NRC Contractor: This is an iterative process and not a serial process.

Public: Level III PRAs indicate the emergency planning zone (EPZ) can be reduced to 2 miles. This requirement results in burden without a probabilistic impact on risk.

Public: If it is determined that a requirement can be deleted, why not eliminate it from the existing set of regulations, instead of requiring utilities to select it as a risk-informed alternative?

NRC: This is a legitimate question. We don't have the answer. The Commission will have to decide this. It is possible that this will be used as a carrot for inducing licensees to select RIR.

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

Public: Have you developed a list of candidate regulations for risk-informing? How will you communicate your findings on Part 50 to other parts of Title 10? To other government agencies and their regulations?

NRC: We do not have a complete list a this time. We will provide one at a later date. We will consider impact on other parts of Title 10 besides Part 50; however, we are not currently planning to consider impacts on other government agency requirements.

Public: Will other groups involved in the regulations, like the Electric Power Research Institute (EPRI) Robust Fuel group, follow your lead on things like using best estimate calculations, etc?

NRC: People dealing with robust fuels program are aware of what is happening. Information transfer is essential. Those communications will have to occur.

Public: By focusing on CDF/LERF you are only looking at public protection, you are not considering worker risk. How is this being considered in the framework?

NRC: We will not do anything to increase worker risk. Eventually this will be addressed.

Public: When you are talking about options for 50.46, specifically eliminating large LOCAs, is this elimination based on the initiating event frequency or the contribution to core damage frequency.

NRC Contractor: It is based on the initiating frequency.

Public: Option 3 focuses on accident prevention and mitigation. What about reporting requirements in LERs? This is a significant burden. Chapter 15 will be impacted by risk-informing. This is something to consider.

4.1.3 50.44 Preliminary Results–NRC

Public: You retain measuring hydrogen concentration in containment as one of the requirements, why is this important for large dry containments?

NRC: This measurement can provide important confirmatory information in making core damage assessment. It also impacts accident management strategies. Other means of assessing the level of core damage are under review (four topical reports).

Public: The need for hydrogen monitoring must have measurable benefit. Why do you feel it has any measurable impact on risk? It needs to have a quantitative benefit, otherwise you can't just throw it back into the regulation because someone thinks it's a good idea. Hydrogen measurement has no real impact on emergency management decisions.

NRC Contractor: We may want to consider late containment failure, therefore it could have long-term impacts. However, we do have to demonstrate a direct relationship.

Public: The presentation had a tone that implied that if something may be useful or it is a good idea, you will keep it. Hydrogen monitoring does not have an impact on defense-in-depth. What would you do differently in accident management if you didn't know amount of core damage? Do you believe hydrogen purge/vent systems have any benefit? Can they be removed? Do the recombiners have any value?

NRC Contractor: Provides information necessary to implement severe accident management. Their only benefit may be for long term issues related to containment, and removal is one option.

Public: Hydrogen burns do not contribute at ice condensers plants. Who is performing additional analysis?

NRC: Recent reports related to ice condenser containments indicate that two plants have a high conditional probability of containment failure in station blackout sequences with high hydrogen levels. Hydrogen monitoring is beneficial in assessing the extent of core damage in these containments, and it is used extensively in emergency drills.

NRC Contractor: Sandia National Laboratories is analyzing the DCH issue. A Hydrogen burn at vessel breach gives high pressures. A report will be published soon.

Public: The scenario was probably identified in NUREG 1150 and IPEs?

NRC Contractor: Yes it was.

Public: The hydrogen recombiner issue was judged to be an easy issue to resolve. If we cannot resolve this, how are we going to resolve anything else? Are we going to see some definite recommendations by June 2000?

NRC: Yes, that is the plan. Detailed evaluations (regulatory analysis) to support rule making would follow this.

NRC Contractor: The Hydrogen recombiner issue may be relatively easy to address, but the entire 50.44 regulation is not an easy issue.

4.1.4 Special Treatment Requirements–NRC

[Editor's Note: No discussion specific to this issue was recorded; however one comment/question was identified in the notes. The comment is presented below.]

Public: A couple of things being done by staff have industry on the sideline. The cost for reviewing an initiative by the staff has been a factor keeping licensees from playing. Can the NRC post on the website information on experience associated with submittals (e.g., San Onofre)?

4.1.5 Future Activities–NRC

NRC: If 50.44 is expedited, then a Commission paper will be prepared in June.

Public: NRC should provide a means to post experience on reviewing items (e.g., SONGS exemption), including information on time of review, number of staff questions, etc.

Public: Equipment re-classified to commercial standards should still be designed to operate under its expected conditions.

4.1.6 Risk-Informing the Technical Requirements of 10CFR50–Performance Technology

Question: DBAs are not important to risk by design. What should be done about severe accidents? Are you suggesting a new set of regulations based on severe accidents?

Response: We already have a quantitative evaluation of risk for each plant in the US. If we determine what is meant by adequate protection, we can work in the risk space between safety goals and adequate protection.

Comment: Your presentation implied that there was an option to leave hydrogen recombiners as is, i.e. as safety grade in many cases. That is a misunderstanding. We did not include that as an option.

Response: Sorry, I misunderstood.

Question: Your conclusions and recommendations are only based on San Onofre. Is this reasonable?

Response: It is supported for large drys by IPE results.

Comment: The reason for granting San Onofre was generic in nature.

4.1.7 Issues Associated with Option 2/3 Interface–STP N.O.C.

Presenter: I want Option 2 scope changes implemented before moving on to Option 3.

Response: Ignore the boxes from the Option 2 diagram. Consider three categories RISC-1, RISC-2 and RISC-3. RISC-1 contains safety significant SSCs which will be subject to special treatment requirements (STRs). RISC-2 contains safety significant SSCs which will require some STRs where a "new" 50.69 would specify the requirements. RISC-3 contains SSCs which are not safety-significant, but were formerly subjected to STRs. Again, the "new" 50.69 whould specify their requirements, i.e., maintain function.

Presenter: This helps, but what will 50.69 say? SSCs that are classified as RISC-3 are of low safety significance, so no part of 10 CFR 50 should apply to them (including tech. specs., etc.).

Presenter: How will Option 2 and Option 3 interface? I would like a written NRC opinion/response.

Comment: The Illinois Department of Nuclear Safety supports performance based regulation. We have said that NRC should require PRAs for all plants. In light of this, we need standards for PRA. We would expect industry voluntary efforts in this area.

Response: There are PRA standard efforts underway by ASME and ANS. Whether it should be voluntary, there is a wait and see attitude. Some utilities did not maintain their IPEs for possible use in RIR. There are others, STP and San Onofre for example, who have used PRA. I think it should be voluntary so other stations are not forced into the RIR option.

Comment: Risk-informing Part 50 should be required for all plants.

Response: The industry has a general wait-and-see attitude.

Response: The issue of whether RIR should be voluntary was addressed in SECY-98-300. A decision was made. To make it mandatory would require backfit analysis.

4.1.8 Risk-Informing NRC Technical Requirements–NEI

Comment: One point of clarification, the NRC is aware of the industry certification process but has not reviewed it or accepted it as a process.

Presenter: I would like further clarification on what NRC will be doing on STR issues in Option 3.

Presenter: The NRC needs to pick up administrative issues (regulations). It needs to set and stick to some time-table, and needs a success to get industry behind the program.

4.1.9 Development of Risk-Informed Design and Regulatory Processes–ABB Combustion Engineering Nuclear Power, Inc.

Comment: One needs to define adequate protection in order to determine safety margin.

Response: Not sure how probabilistic criteria will be used, but they will be established. The NERI work may move away from the single failure criterion in some instances.

Comment: You should talk to Sun Desert, what is now San Diego P&L, to benefit from their experience in the risk-based approach area you describe.

Comment: The 35% cost reduction is referenced to what?

Response: Estimates from EPRI show that this is with reference to gas and coal plants.

4.1.10 Westinghouse Owners Group LBLOCA Design Basis Redefinition–WOG

Comment: Do you intend to address issues associated with high burn-up fuel?

Response: Have not thought about such issues.

Comment: Do you plan any changes on peak clad temperature, 2200°F , or per cent oxidation limit acceptance criteria requirements?

Response: Scope currently does not addressed changing 2200°F and 17% oxidation limits.

Comment: Any containment leakage changes?

Response: Would like to see if some changes to leakage are possible. It may be possible to lower pressure consideration.

Comment: The CE Owners Group is interested in your proposals. Do you have any Option 2 comment? Are you feeding back relationship between eliminating LBLOCA to impacts on Option 2?

Response: We want to resolve conflict between STRs and SSCs needed for DBAs. We think elimination of STR to components that are not risk significant is possible.

Comment: Have you thought of putting DBAs into probabilistic terms? That is, eliminate some DBAs on frequency arguments?

Response: There are opportunities for this. We are a lot smarter now, and we know that the LBLOCA is not credible. Such DBAs could be eliminated. Still need DBAs, but it should be known if they are credible.

Comment: PRAs already consider frequency. Double-ended guillotine breaks are incredible events. DBAs serve a purpose, but more realistic events impact operation and maintenance.

4.2 Summary of Open Discussions

4.2.1 Key Issues for 50.44

Public: Why isn't elimination of 50.44 an option?

NRC: There is such an option.

NRC Contractor: Some of the elements may be eliminated. Elimination (of 50.44) is always an option.

Public: The comment on page 7, top paragraph of the 50.44 document concerning the questionability of benefit to operators is disturbing. There was no question about safety benefit. A 50.12 exemption requires no increase in risk. Approximately one-third of the submittal dealt with the issue of safety significance. Furthermore, Item 6 on p. 28 (the requirement for large, dry containments) is unwarranted (The SER for San Onofre, page 4, states there is no basis for hydrogen ignitors for large drys). If NRC is concerned with subatmospheric containments, then it should be specific, and not apply the requirement to all large, dry containments.

NRC: Questionable is not the right word. Not able to quantify would be more appropriate. With regard to p.28, hydrogen may be important for subatmospheric containments.

NRC: Distinction is rarely made between large, dry containments and subatmospheric containments; also, Item 6 is very similar to the wording in Bob Christie's proposed rule.

Public: What is the time frame for feedback on the 50.44 document?

NRC: Comments needed by April 15.

NRC: Would it be beneficial to have a workshop on 50.44 in the April or May time frame?

Public: Will get back to NRC about workshop.

Public: Will the revision address the petition for rule-making?

NRC: A "qualified" yes.

Public: Will Bob Christie's petition for rulemaking be incorporated into this?

NRC: You will have to ask Tom King when he returns.

Public: NEI will caucus and get back to the NRC in a few days with their feedback on the 50.44 and framework documents. Initial impression of the framework is positive.

NRC Contractor: It would be good to get industry input on some of the more controversial issues, especially on Mark IIIs and ice condensers (given SBOs).

Public: Has the NRC put together criteria for weighing options, specifically how they impact risk?

NRC Contractor: Anything that does not meet defense-in-depth would be a candidate for elimination. However, other factors would have to be considered.

Public: It is better to state requirements at a high level with multiple ways of getting there, rather than being very prescriptive.

NRC Contractor: We do not want to be very prescriptive, we need to tie the regulations to our goals.

4.2.2 Key Issues for Framework

Public: Are there criteria for evaluating regulations; particularly, for identifying regulations, or parts of regulations, that only impact non-risk-significant areas, and which would be candidates for elimination.

NRC Contractor: Yes. These criteria do exist, and if a regulation does not impact any of the four strategies in the framework (the risk targets), then burden will be on the NRC to justify keeping the regulation.

Public: The change in failure rates can be monitored, through preventive maintenance, and its impact on CDF as measured in PRA could be calculated. This could be used as a measure of safety margin.

NRC Contractor: What do you mean by safety margin? Which one? Agree that preventive maintenance is a means to measure reliability.

Public: Margin could be how close you are to safety goals or doubling of CDF. This is not unprecedented. NRC sets ALARA but utilities set administrative controls below this.

Public: PRAs do a much better job than DBAs of addressing uncertainties; at least for parameter uncertainties, though not necessarily modeling or completeness uncertainties.

Public: On long term containment issue, we are uncertain what would happen. There would be a lot of resources to bare, but it is uncertain what would happen. Must be careful when setting this goal. How do you address uncertainty, particularly in modeling?

NRC Contractor: If we don't have a containment long term goal, what about specifying that instrumentation (e.g., hydrogen monitoring) must be available for diagnosis?

Public: Should not be prescriptive. Should allow plants flexibility to accomplish monitoring by any reasonable means. Requirement should be written to say that the licensee will be able to assess containment conditions after an accident, then licensee can determine what equipment to use (which allows them to use existing equipment); rather than writing a prescriptive requirement, which eliminates licensee flexibility.

NRC Contractor: IPEs show late releases are important and must be considered.

Public: On page 9 of the Framework Document, a statement is made that the subsidiary goals are consistent with the QHOs. Not sure a CDF of 1E-4 is consistent.

NRC Contractors: Agree that 1E-4 CDF is not consistent with QHO. The product of 1E-4 and 1E-2 is consistent.

Public: On page 14, under 3.3, second paragraph, I agree with paragraph. When you set subsidiary goals, they have to be set consistent with these.

Public: Per preventive maintenance issue, common cause failures and dramatic changes in failure rates can be monitored through maintenance rule requirements. I think the 95% confidence level is unachievable. I think 80% is the best that can be done and that is what should be used. Encourage use of non quantitative measure of uncertainty. Per long term containment performance, don't think we need this. Emergency planning would be in effect and adequately meet requirements.

Public: If you are not going to use QHO numbers, you need to set up criteria. Putting numbers in the framework, but then claiming that they are not going to be used in the regulations, puts us in a trap. Things that don't impact any of the four strategies will still be considered. Some criteria are needed to determine whether regulations will be kept, so the process does not appear capricious or arbitrary. It should be made clear that there have to be specific reasons for keeping regulations, and not just because they seem like "a good idea." I also agree with the statement about not using long term effects.

NRC: Other things that the regulations cover (e.g., security, worker protection, environment) need to be addressed, they are not arbitrary. Numbers will be used by us in decision making but they will not appear in regulations.

Public: Single failure criterion has added to robustness of plants. However, this was a surrogate for evaluating risk assuming multiple failures. Think there is room in RIR to replace or compliment single failure criterion.

NRC: We would appreciate any suggestions.

Public: Do we have enough reliable data to allow use of PRA rather than single failure criterion.

Public: From my experience, the answer is yes. If single failure means no diversity to prevent core damage, then that is unallowable, but eliminating single failure in one system may be acceptable.

Public: The question is, should a probabilistic criterion be used instead of the single failure criterion?

Public: Should always require more than one failure to result in core damage.

Public: General Design Criteria say you have to have redundancy and diversity. We use those concepts. Believe that operating experience would be used to adjust those concepts.

Public: Single failure criterion is reflected in PRA quantification. Plus, there is sufficient data to calculate component failures, if the question was "Is there enough data to specify."

Public: Include, for example, a 1E-2 failure probability for an allowable failure(s) in addition to the initiating event.

Public: Single failure of a component is what is addressed in the Regulations. Focus should be changed to risk significant function, not on a component.

NRC Contractor: If you look at four defense-in-depth strategies, the numbers were meant to be looked at on average. Is everyone comfortable with the use of these average values, or should they be accident specific? Use of averaging can have its downfalls since some plants may have bad contributors. For example, would you say that for SBO < 1E-6 containment is unnecessary?

Public: No, I would not go that far. You have to look at it in a scenario specific way. I would think SBO is something you would focus on. Prefer to have flexibility in prevention versus mitigation, but there should be a balance. Focusing mitigation on 1E-9/year events is not a good idea.

NRC Contractor: Focus should be placed on risk-significant accidents?

Public: Yes.

Public: Are you talking about design or about the regulatory side?

NRC Contractor: The regulatory side.

Public: Look at the framework targets in an aggregate fashion; subdivision will make the regulations too detailed. Should focus on higher level (e.g., identify what dominates containment performance, and focus on that). Need to manage risk. Plants should be able to handle AOOs, but don't necessarily need mitigative systems for rare events, including very large LOCA (there will be some prevention for these events through the way the plants are designed and operated). In managing risk, operator training and drills should focus on realistic accident response (e.g., getting power back), as opposed to large LOCA drills (or other low probability DBAs, such as ATWS). Training programs should make operators aware of these possibilities, but not focus on them.

Public: Keep targets at a high level, don't want 0.1 containment failure probability at each sequence level.

4.2.3 Key Issues for Implementation

Public: Why is voluntary vs. mandatory an issue, since this was already decided by the Commission?

NRC: Yes it is voluntary, but the details about implementation need to be addressed. Based on discussion yesterday, we have to address how to delete, add, or define alternative requirements. We need to go to the commission to make the call on some of these issues.

Public: Any additional requirements that pass the backfit test should be adopted. I don't understand the second bullet (distinguished?).

NRC: 50.109 applies.

Public: If alternative requirements are voluntary, why shouldn't selectivity be allowed.

NRC: For example, removal of hydrogen combiners is set out in an alternative 50.44. Licensees would have to change FSAR.

Public: There may be a reflex withdrawal reaction, since many licensees who are taking a wait-and-see attitude may back out if they see the word "mandatory."

Public: Bullet on "addition of new requirements" may scare off a lot of the industry. To reiterate, need a success on the board, and need to keep the program voluntary.

Public: I agree with Rick. The Westinghouse Owners Group strongly feels requirements should be voluntary.

Public: The back-fit test will always apply regardless of where the change originated, even if the change is not directly related to this program. Similarly, unnecessary requirements should be eliminated regardless of whether they are packaged as a risk-informed alternative.

NRC: We will not tie different regulations together but could package within the same rule.

Public: If you believe that RIR is good for safety, you have to show benefit. If you want to encourage RIR, it has to be voluntary. Benefits such as removal of regulations or components in the scope of STRs will encourage participation. Strongly recommend voluntary participation. Proceed with Option 2 and some Option 3 in parallel. Everything should be voluntary and fall in the scope of the risk-informed program (even generally applicable changes); otherwise, other licensees will get the benefits for no effort.

Public: If you have a 50.44 issue (e.g., alternate power supply for igniters in Mark III containments), is it more efficient to go through the 50.109 (backfit) process, or use the risk-informed program to effect the change?

Public: Even if additional requirements don't have to meet the back-fit test because they are voluntary, it is possible that the NRC will want industry to commit to some action on their own, and then the NRC will want to regulate compliance (through inspections, etc.). Requirements should not be loaded into packages with changes that the industry wants; additional requirements should still have some formal 50.109-type arguments. Discipline needs to be applied when adding new requirements; otherwise, this will kill industry participation.

NRC: Things are being read into this slide that were not intended. There is no intention to have additional requirements during the RIR process. Clearly, if there is a safety issue that meets the

backfit rule, it has to be applied thorough out the industry. What we are hearing is that everything should stay voluntary (even to the point of removing unnecessary requirements), in order to get participation from industry in the risk-informing program.

NRC Contractor: We believe the framework will provide the discipline to keep us in line.

Public: TVA will be a big player in the risk-informed process. The safety benefits alone are reason enough. Burden reduction is also a safety benefit. Statement in 50.44 document regarding "questionable" safety significance of SONGS exemption displays lack of knowledge of how power plants are run. There is also a dichotomy in the statements regarding special treatment requirements as affected by Option 2 and Option 3. Is Option 2 a stand-alone program?

NRC: Yes. Option 2 is looking at STR safety grade versus commercial. Option 3 goes further and determines if function of component is required.

Public: Option 2 and Option 3 can be worked on concurrently to the benefit of all plants. It is my understanding that the results of Option 2 determine what goes into Option 3. What is the NRC position (guidance) on this? What are the special treatment requirements being considered (STP provided a list of special treatment requirements in its exemption request). If SSCs do not need special treatment requirements because they are not risk-significant (RISC-3), then can we exempt them from all other requirements? I want to make sure that the first thing out of this program is not that the NRC is "using PRA to add requirements."

NRC: We intend to use Option 2 scoping as a sanity check on the Option 3 work. I agree that most RISC-3 items would probably not require any design requirements or other technical requirements. There would have to be a special reason why something in the RISC-3 box still needs to be addressed anywhere in Part 50.

Public: I am not in general agreement with the approach, specifically on how to use the numbers. I feel it would not be practical to use. Lots of reservations exist among people, and the "devil is in the details." There is general agreement that it is time to move away from the single failure criterion.

Public: I request an NRC response specifically to my Alternative 1 or 2 for interaction between Options 2 and 3. I request a written response; maybe something could be posted on the web site.

NRC: Not prepared to address this now. Should be submitted as an Option 2 question.

NRC: NRC needs to resist the temptation to tack add-ons to a voluntary change which involves burden reduction. This issue came up with the new source term rule. Initially, NRC was going to tack on new more stringent requirements (specifically, EQ); luckily, these add-ons were ultimately dropped.

Public: Another concern is how single failure criterion will be implemented. Now is the time to eliminate the single failure criterion.

4.2.4 Feedback Received

Public: There seems to be a dichotomy between Option 2 and 3 for special treatment.

NRC: Option 3 would go beyond Option 2 by removing function as well as special treatment requirements.

Public: We need to clarify, are you going to risk-inform the scope of SSCs that are carried over to Option 3, or are you going to carry over all SSCs? Using Option 2 to reduce scope is vital. Otherwise it will appear that PRA is used to impose requirements. Efforts on 50.36 are going on, you should coordinate.

NRC: RISC3 things should, with some corrections, not be needed to be included in Part 50 any more.

Public: Glad we agree, I would like to see this agreement reflected from this workshop.

Public: I have many exceptions to your approach. Also, I feel the single failure issue has not been adequately addressed.

Public: I still would like a response as to what we are doing. Is it alternative 1 or 2 of my presentation yesterday, or something else?

NRC: There is a tendency to write more stringent requirements into new voluntary regulations meant to reduce burden (the new source term is an example).

4.3 Additional Public Comments

This section presents the three written public comments that were received. The comments are organized by topic.

50.44 Preliminary Evaluation

The fact that information is used today in drills, etc. (e.g., hydrogen monitoring for long-term accident assessment) should not be a criterion in decision making. Current procedures and practices make use of whatever is available. Thus, everything gets used and nothing would ever be removed. The evaluation needs to be on the basis of an assumed elimination–now what would the effect be? That effect should be quantified. Otherwise, this program is not going to find anything to be relaxed and we should just fold our tent and quit.

Special Treatment Requirements

It is not clear what Option 3 is doing with respect to special treatment requirements. SECY-99-264 indicated this was to be an early trial, with some results by this time. The abbreviated presentation in the AM portion of this workshop was largely a summary of what Option 2 is doing and provided little information regarding the added value of Option 3 working in the same area. As Rick Grantom suggested, the industry is anxiously awaiting information regarding what new or revised special treatment requirements will be established for RISC-3. Is that what Option 3 will address? A concise written description of what is intended in this area would be useful on the web site. If there is no concise view of what Option 3 can do in this area, then the concept of an Option 3 trial implementation should be dropped to avoid confusion that already exists.

Framework/Strategy

The slide depicting the framework/strategy is good. You might add 50.36.

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APPENDIX A. WORKSHOP AGENDA

Workshop Agenda

Thursday, February 24, 2000	
NRC Presentations:	
8:00am - 8:30am	Introduction (Background and Objectives)
8:30am - 9:30am	Framework for Risk-Informing Regulatory Requirements and DBAs
9:30am - 10:10am	Screening, Selection and Prioritization Criteria and Preliminary Results
10:10am - 10:30am	Break
10:30am - 11:15am	10 CFR 50.44 Preliminary Results
11:15am - 11:40am	Special Treatment Requirements
11:40am - 12:00pm	Future Activities
12:00pm - 1:15pm	Lunch
Stakeholder Presentations:	
1:15pm - 1:45pm	Bob Christie (Performance Technology)
1:45pm - 2:15pm	Rick Grantom (South Texas Project)
2:15pm - 2:45pm	Adrian Heymer (NEI)
2:45pm - 3:00pm	Break
3:00pm - 3:30pm	Stanley Ritterbusch (ABB C-E Nuclear Power, Inc.)
3:30pm - 4:30pm	Open Discussion: Framework
Friday, February 25, 2000	
8:00am - 8:10am	Opening Remarks
8:10am - 8:30am	Wayne Harrison (South Texas Project/Westinghouse Owners Group)
Open Discussion:	
8:30am - 9:00am	Framework for Risk-Informing Regulatory Requirements and DBAs
9:00am - 9:45am	Screening, Selection and Prioritization Criteria and Preliminary Results
9:45am - 10:00am	Break
10:00am - 10:45am	10 CFR 50.44 Preliminary Results
10:45am - 11:15am	Special Treatment Requirements
11:15am - 12:00pm	Future Activities and Wrap-Up
12:00pm	Adjourn

APPENDIX B. WORKSHOP REGISTRATION LIST

LIST OF ATTENDEES

Table B.1 Workshop Registration

Name	Affiliation
Jim Basilio	PECO Energy
H. Duncan Brewer	Duke Power Company
Allen Camp	Sandia National Laboratories
Mike Cheok	Nuclear Regulatory Commission (NRR/DSSA)
Bob Christie	Performance Technology
Jeff Circle	New York Power Authority
Mary Drouin	Nuclear Regulatory Commission (RES/DRAA/PRAB)
John Gaertner	Altran Corporation
Daniel W. Gallagher	Science Application International Corporation
Răducu Gheorghe	Atomic Energy Control Board Canada
C. R. (Rick) Grantom	South Texas Project N.O.C.
Don J. Green	Tennessee Valley Authority
Yue Guan	Advanced Systems Technology and Management, Inc.
Syed S. Haider	Tennessee Valley Authority
Wayne Harrison	South Texas Project N.O.C./Westinghouse Owners Group
Eric Haskin	ERI Consulting
Adrian Heymer	Nuclear Energy Institute
Neill Howey	Illinois Department Nuclear Safety
Roger Huston	Licensing Support Services
Bob Jaquith	ABB Combustion Engineering
N. P. Kadambi	Nuclear Regulatory Commission (RES/REAHFB)
Jim Kenny	PP&L/Vice Chairman BWROG
Alan Kuritzky	Nuclear Regulatory Commission (RES/DRAA/PRAB)
Tom King	Nuclear Regulatory Commission (DRAA)
Jeffrey L. LaChance	Sandia National Laboratories
John Lehner	Brookhaven National Laboratory
Stanley Levinson	Framatome Technologies, Inc.
Dave Lochbaum	Union of Concerned Scientists
Deleah Lockridge	Westinghouse Electric Company LLC

Table B.1 Workshop Registration

Name	Affiliation
Gary D. Miller	Virginia Power
Parviz Moieni	Southern California Edison
Vinod Mubayi	Brookhaven National Laboratory
Paige T. Negus	GE Nuclear Energy
Gareth Parry	Nuclear Regulatory Commission (NRR/DSSA)
Jim Petro	Winston & Strawn
Trevor Pratt	Brookhaven National Laboratory
Tim Reed	Nuclear Regulatory Commission (NRR/DRIP/RGEB)
James Riccio	Public Citizen's Critical Mass Energy Project
Stanley E. Ritterbusch	ABB Combustion Engineering Nuclear Power
Zoltan R. Rosztoczy	Zeetech, Inc.
C. Wesley Rowley	ASME/consultant
Glen E. Schinzel	South Texas Project N.O.C.
E. Robert Schmidt	Scientech, Inc.
Mike Snodderly	Nuclear Regulatory Commission (NRR/DSSA/SPSB)
Leonard Sueper	Alliant Energy
Charlie Tinkler	Nuclear Regulatory Commission (RES/DSARE/SMSAB)
Gary Vine	Electric Power Research Institute
S. Visweswaran	GE Nuclear Energy
Erin Whiting	Westinghouse Electric Company LLC
Joe Williams	Nuclear Regulatory Commission (NRR/DLPM)
See-Meng Wong	Nuclear Regulatory Commission (NRR/DSSA)

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APPENDIX C. NRC PRESENTATION MATERIAL

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

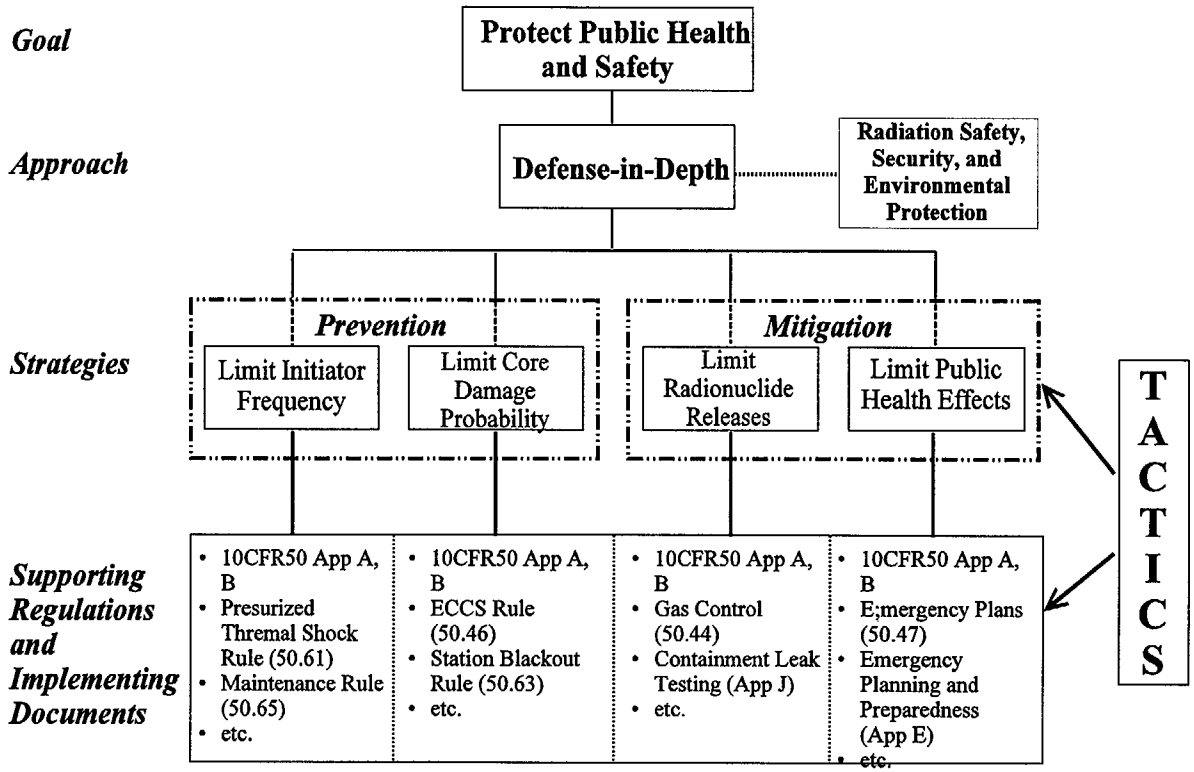
(3) limit radionuclide releases during core damage accidents

(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:


Goal
Protect Public Health and Safety
Approach
Defense-in-Depth
Radiation Safety, Security, and Environmental Protection
Strategies
Prevention
Limit Initiator Frequency
Limit Core Damage Probability
Mitigation
Limit Radionuclide Releases
Limit Public Health Effects
TACTICS
Supporting Regulations and Implementing Documents
• 10CFR50 App A, B
• Presurized Thremal Shock Rule (50.61)
• Maintenance Rule (50.65)
• etc.
• 10CFR50 App A, B
• ECCS Rule (50.46)
• Station Blackout Rule (50.63)
• etc.
• 10CFR50 App A, B
• Gas Control (50.44)
• Containment Leak Testing (App J)
• etc.
• 10CFR50 App A, B
• E;mergency Plans (50.47)
• Emergency Planning and Preparedness (App E)
• etc.

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	Latent Cancer Fatality Goal
$\leq$5E-7/year	$\leq$2E-6/year

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

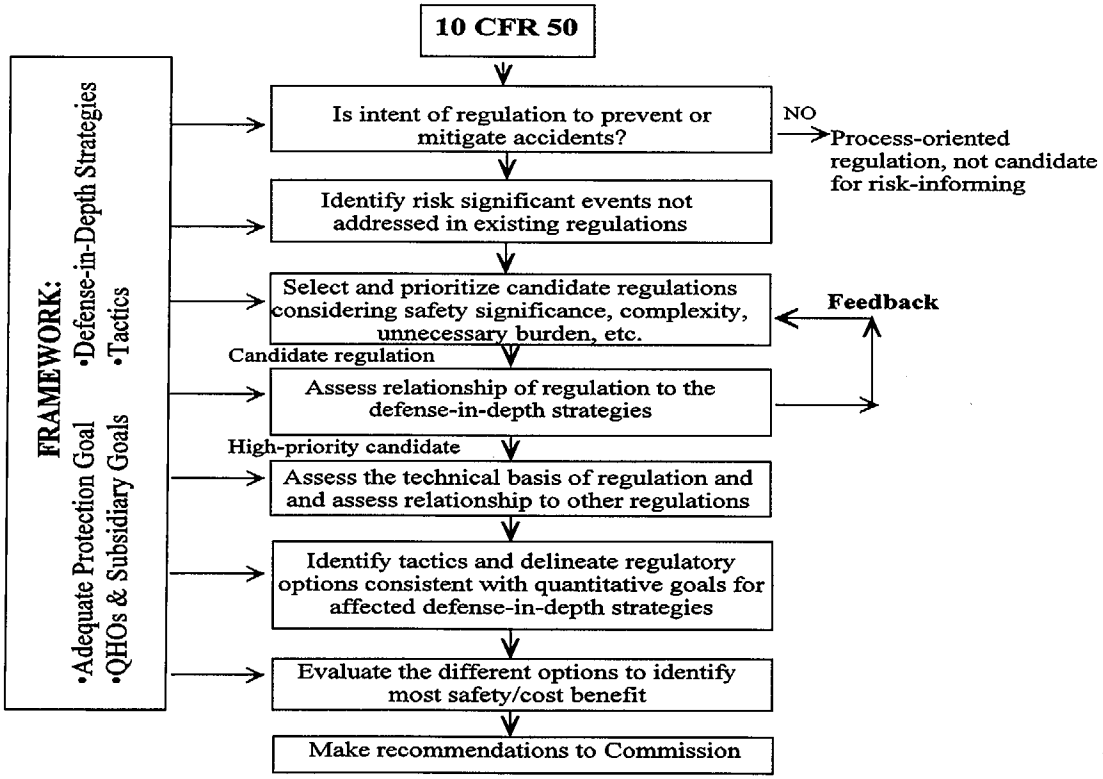
Prevent	Mitigate
Core Damage Frequency $\leq 10^{-4}$/year	Conditional Probability of Individual Fatality $\leq 10^{-2}$

(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	$\leq$1	$\leq$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

⇓

- 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)

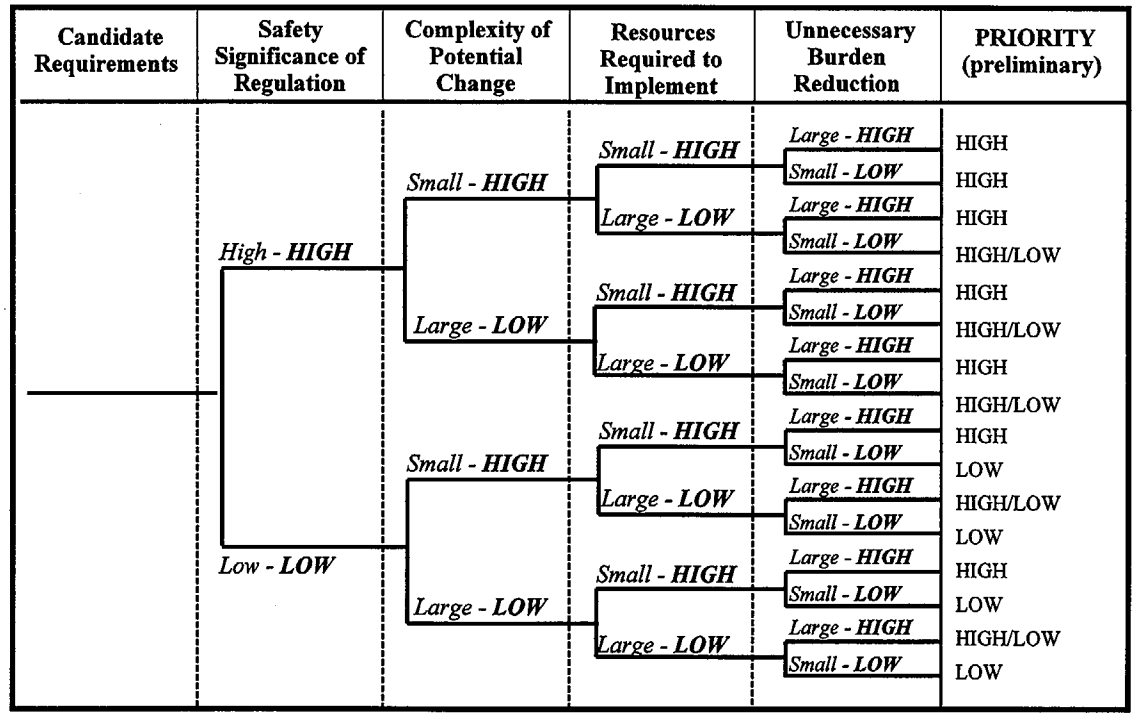
Selection Criteria for Candidate Regulations and DBAs

- 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 approachs (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

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)

- ***Inert Containment Atmosphere:*** 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
Risk-Informed ↓	**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

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)

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
- Keep voluntary basis

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APPENDIX D. PUBLIC PRESENTATION MATERIAL

Public Workshop

Risk-Informing The Technical Requirements of 10CFR50

February 24, 2000
One White Flint - NRC Auditorium

Bob Christie

Performance Technology
P. O. Box 51663
Knoxville, TN 37950-1663
(865) 588-1444
FAX (865) 584-3043
performtech@compuserve.com

AGENDA

1. Introduction/Background

2. San Onofre Task Zero Safety Evaluation Report

3. Key Points from Safety Evaluation Report

4. Petition for Rulemaking
   a. 10CFR50, Appendix A, GDC 41
   b. 10CFR50.44

5. Summary

OBJECTIVE - PILOT PROGRAMS

- The objective of the pilot programs will be to demonstrate a more objective and efficient way to maintain adequate protection of public health and safety, to promote the common defense and security, and to protect the environment than the present detailed prescriptive regulatory process.

Integrated Approach

"Whole Plant"

Cost

Generation

Risk

BASIS

- The primary responsibility for the "public health and safety" of a nuclear unit lies with the people at the site who are running the nuclear unit.
- The regulatory process that oversees the nuclear unit must ensure "adequate protection of public health and safety."

PUBLIC HEALTH RISK

1. Is different for each nuclear unit.
2. Changes with time.

Dr. Thomas Pigford, Kemeny Report, October 1979, Separate views.

16. The Major Problems with NRC's Approach to Reactor Safety

The Commission (Kemeny) report has identified many mistakes by NRC personnel in their handling of the TMI-2 accident and deficiencies in NRC's regulatory practices. However, this criticism does not reach some essential elements of the problem. I believe that the following are some of the more important problems at NRC:

... Lack of quantified safety goals and objective. When a safety concern is postulated, there is no yardstick to judge the adequacy of mitigating measures.

... Inability to set priorities and to allocate resources in proportion to the estimated risk to the public. In my view, a disproportionate effort is being required for some issues which have only a marginal impact upon risk to the public.

... Lack of experienced staff. An undesirably large proportion of NRC staff and management have little or no practical experience in designing or operating the equipment which they regulate.

... Arbitrary requirements. Too many of the NRC requirements are mandated without valid technical back-up and value-impact analysis.

... A stifling adversary approach. The existing process inhibits the interchange of technical information between the NRC and industry. It discourages innovative engineering solutions.

... Ineffective evaluation of operations. NRC has no effective system for evaluating data from operating plants. Data should be analyzed systematically to identify trends and patterns.

... Lack of a comprehensive system approach to the whole plant. A large percentage of the NRC staff are specialists focusing upon narrow topics. There are relatively few systems engineers within NRC who can integrate individual safety features into an overall concept and who can place issues into perspective.

... An overwhelming emphasis on conservative models and assumptions. Realistic analyses are needed to identify the margins of safety and to aid competent decisions.

ISSUES FOR NUCLEAR PLANTS IN A DEREGULATED ELECTRIC UTILITY INDUSTRY

by

J. D. SHIFFER
Executive Vice President (Retired)
PACIFIC GAS & ELECTRIC COMPANY

AMERICAN NUCLEAR SOCIETY

INTERNATIONAL TOPICAL MEETING ON
SAFETY OF OPERATING REACTORS
SAN FRANCISCO, CALIFORNIA

OCTOBER 11-14, 1998

Exerpt from the San Onofre Task Zero Safety Evaluation Report:

"The overall public risk and radiological consequences from reactor accidents is dominated by the more severe core damage accidents that involved containment failure or bypass."

Excerpts from the San Onofre Task Zero Safety Evaluation Report:

"Subsequent risk studies have shown that the majority of risk to the public is from accident sequences that lead to containment failure or bypass, and that the contribution to risk from accident sequences involving hydrogen combustion is quite small."

"As mentioned in the previous section, the risk associated with hydrogen combustion is not from design-basis accidents but from severe accidents."

Excerpts from the San Onofre Task Zero Safety Evaluation Report:

"Although the recombiners are effective in maintaining the Regulatory Guide 1.7 hydrogen concentration below the lower flammability limit of 4 volume percent, they are overwhelmed by the larger quantities of hydrogen associated with severe accidents which are typically released over a much shorter time period (e.g., 2 hours)."

"From this information, the NRC staff concludes that the quantity of hydrogen, prescribed by 10CFR50.44(d) and Regulatory Guide 1.7, which necessitates the need for hydrogen recombiners and its backup the hydrogen purge system is bounded by the hydrogen generated during a severe accident. The NRC staff finds that the relative importance of hydrogen combustion for large, dry containments with respect to containment failure to be quite low. This finding supports the argument that the hydrogen recombiners are insignificant from a containment integrity perspective."

Excerpt from the San Onofre Task Zero Safety Evaluation Report:

"In a postulated Loss of Coolant Accident, the San Onofre Nuclear Generating Station Units 2 and 3 Emergency Operating Instructions direct the control room operators to monitor and control the hydrogen concentration inside the containment after they have carried out the steps to maintain and control the higher priority critical safety functions. The key operator actions in controlling the hydrogen concentration are to place the hydrogen recombiners or hydrogen purge system in operation which involves many procedural steps. These hydrogen control activities could distract operators from more important tasks in the early phases of accident mitigation and could have a negative impact on the higher priority critical operator actions."

Key Points - Combustible Gas Control

Public Health Risk

Severe Accidents - Not Design Basis Accidents

Containment integrity when fission products present

Existing hydrogen recombiners and purge ineffective

Existing procedures can distract operators

My proposed revised 10CFR50, Appendix A, General Design Criteria 41, Containment atmosphere cleanup, is as follows:.

As necessary, systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment shall be provided, consistent with the functioning of other associated systems, to assure that reactor containment integrity is maintained for accidents where there is a high probability that fission products may be present in the reactor containment.

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

a.) An inerted reactor containment atmosphere shall be provided for each boiling light-water nuclear power reactor with a Mark I or Mark II type containment.

b.) Each licensee with a boiling light-water nuclear power reactor with a Mark III type of containment and each licensee with an ice condenser type of containment shall provide its nuclear power reactor containment with a hydrogen control system. The hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume).

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

c.) All light water reactors with other types of containment than in (a) or (b), must demonstrate that the reactor containment (based on realistic calculations) can withstand, without any hydrogen control system, a hydrogen burn for accidents with a high probability of causing severe reactor core damage. If such an evaluation of reactor containment capability can not be demonstrated, then the licensee shall provide a hydrogen control system per the backfit process. This hydrogen control system must be capable of handling (based on realistic calculations) the hydrogen equivalent to that generated from a metal-water reaction involving 75% of the fuel cladding surrounding the active fuel region (excluding the cladding surrounding the plenum volume)

My proposed revised 10CFR50.44, Standards for combustible gas control system in light-water-cooled power reactors, is as follows:

d.) Each light-water nuclear power reactor shall be provided with high point vents for the reactor coolant system, for the reactor vessel head, and for other systems required to maintain adequate reactor core cooling if the generation of noncondensible gases in these systems would realistically lead to severe reactor core damage during an accident. High point vents are not required, however, for the tubes in U-tube steam generators.

Containment Integrity

Important Parameters

1. Containment capability during severe accidents
   a. Dry containment
   b. Suppression containment

2. Containment heat removal during severe accidents
   a. Suppression systems
   b. Containment fan coolers
   c. Containment spray systems
   d. Residual Heat Removal
   e. Other

3. Containment air mixing during severe accidents

SUMMARY

Sufficient knowledge exists to change the regulations for Combustible Gas Control

Focus must be on severe accidents

Proposed 10CFR50 Changes are a combination of

- Retain what is effective and efficient
- Add where necessary
- Delete what is not effective and efficient

RIP50, Option 3 Public Workshop

"Issues Associated with Option 2/3 Interface"

C.R. Grantom P.E.
South Texas Project N.O.C.

February 24, 2000

PURPOSE

- To identify possible interface alternatives between Option 2 and Option 3 efforts

DESIRED OUTCOME

- For workshop participants to be aware of how Option 2 (i.e., scope of 10CFR50) can impact and influence Option 3 efforts relative to regulated scope of SSCs
- To prompt NRC guidance to the industry on which alternative approach is recommended

DISCUSSION

- Per SECY 99-264, the staff indicates that its Phase 1 work will build upon and be consistent with SECY 99-256 (SECY 98-300, Option 2 work)
- Per SECY 99-264, risk informing Part 50 is closely related to the staff's work to make changes to the overall scope of SSCs covered the Part 50 special treatment requirements. Staff indicates this is an important first step.

DISCUSSION

- Stakeholder point-of-view: Establishing the scope of a risk informed Part 50 is crucial input for efficient Option 3 activities
- Important for stakeholder buy-in
- Important for proper development of Option 3 strategies

DISCUSSION

- Per SECY 99-256, Appendix T will categorize SSCs into the following:
  - RISC1, Safety Significant, Safety Related
  - RISC2, Safety Significant, Non-Safety Related
  - RISC3, Not Safety Significant, Safety Related
  - RISC4, Not Safety Significant, Non-Safety Related
- STPNOC experience shows the vast majority of safety related components reside in RISC-3

QUESTIONS

- Do RISC-3 SSCs stay within the scope of regulatory processes?
- If so, then what processes are applicable to RISC-3 SSCs?
- If not, then what regulatory mechanism will be used to exempt RISC-3 SSCs from 10CFR50?

POSSIBLE APPROACHES

- Alternative 1 - Only safety significant SSCs (assuming only two significance categories are used) are within the scope of 10CFR50 per Option 2 processes
- Alternative 2 -Both Safety Significant and Not Safety Significant, Safety Related SSCs are within the scope of 10CFR50 per Option 2 processes and specific exemptions are issued

POSSIBLE APPROACHES

- Alternative 1
  - Only safety significant SSCs proceed to Option 3 processes; all other SSCs are explicitly excluded from 10CFR50 scope.
  - Revises 10CFR50 scope prior to risk informing individual regulations per Option 3
  - Prevents applying deterministic strategies for safety related SSCs which have little or no safety significance

POSSIBLE APPROACHES

- Alternative 2
  - All Safety related SSCs, whether safety or not safety significant, proceed to Option 3 processes unless specific exemptions are issued.
  - No revision in 10CFR50 scope prior to risk informing individual regulations per Option 3
  - Potential exists for requiring risk informed strategies for safety related SSCs with very little or no safety significance

CONCLUSIONS

- Either alternative will work, but alternative 1 is more effective and efficient
- Alternative 1 removes not safety significant SSCs from 10CFR50 scope. Option 3 efforts are then performed on a reduced scope of SSCs
- Alternative 2 retains safety related SSCs within 10CFR50 scope and, therefore must contain documented and unambiguous allowances to exempt not safety significant SSCs from regulations within the scope of Option 3

CONCLUSIONS

- Currently, it is not clear which alternative the staff is working towards. Option 2 was originally intended to be a risk informed approach to determine safety significant SSCs
- Appendix T discusses Reliability Programs for RISC-3 SSCs. It is unclear as to what this means in regulatory space
- Significantly reduced numbers of SSCs within the scope of Part 50 with Alternative 1
- Large numbers of SSCs within the scope of Part 50 with Alternative 2

Risk-Informing NRC Technical Requirements

Adrian Heymer, NEI

202-739-8094, aph@nei.org

NEI

Risk-Informed Regulation

- **Improve the efficiency and effectiveness of the NRC regulatory regime in a manner that increases the focus on safety-significant matters while reducing unnecessary resource burden**
- **Incorporate new information, insights & 30+ years of operating & regulating experience**
- **Communication & coordination important elements**
  - Resolution of industry & NRC cultural issues

NEI

Industry Survey

- **59% response**
- **Reinforced September 1999 workshop statements**
  - Only minimal changes to regulations may be necessary
  - Rigidity in interpretation & compliance with regulatory guidance
  - need to develop alternative approaches
  - Codes & Standards -- an integral element -- need for industry consistency and coordination

NEI

Industry Survey

- **Build on recent regulatory improvements**
- **Focus on and complete current regulatory improvement activities**
- **Initiate rulemaking on §50.44 based on existing regulatory analysis**
- **Assess and implement improvements to §50.46**
  - Work has started in specific areas

NEI

Current Improvement Activities

- **Implementation of new oversight process**
- **Fire protection**
- **Security**
- **Technical Specifications**
  - Tech. Specs. should be considered synergistically with §50.65 requirements -- configuration control and performance monitoring
  - Elimination of duplicative requirements
- **§50.44 rulemaking**

NEI

§50.46/Appendix K Potential Improvement Areas

- **Improvements to fuel cladding requirements**
- **Update and adjustment of decay heat curves**
- **Alternative break size**
  - A mature WOG activity -- enables an early start on §50.46 interactions
  - NEI/WOG interacting with other owners' groups
- **Coincident loss of offsite power with LOCA**
- **Analytical methodologies & modeling**

NEI

Potential §50.46/Appendix K Impact

- Emergency Diesel Generators
- Systems inspection & testing
- Piping & piping support inspections
- Containment heat removal
- Containment testing
- Containment environmental envelope
- Debris & internal missile issues
- Coolable fuel geometry & improved fuel designs
- Electrical coordination & sequencing
- Coolant injection requirements (timing and flow)
- Reactivity insertion events
- Source term and early release prevention criteria
- Technical specifications
- FSAR
- Regulatory change process
- Onsite EP requirements

NEI

Other Regulatory Improvements

- Develop a plan for improving other regulations based on §50.46 & Appendix K insights
- Appendix A, to Part 50, GDC 17, 18, 19,...
- §50.49, technical requirements
- §50.55a
- Part 21
- Part 54

NEI

Other Regulatory Improvements

- **§50.61, §50.62, §50.68**
- **Appendices E, G and J**
- **Administrative -- §50.71, §50.72, §50.73 & (§50.59)**
- **Regulatory consistency**
  - §50.34 and §50.54
- **Part 52 and requirements for Generation IV commercial nuclear power plants**

NEI

Option Activities Summary

- **Complete existing activities**
- **Use §50.46 assessments as the basis for planning other improvements**
- **Keep Generation IV and existing plant activities separate**
  - Need to plan for Generation IV support -- long term
- **Need for defined near term schedules for:**
  - Completing current activities
  - §50.46 assessments and improvements

NEI

Development of Risk-Informed Design and Regulatory Processes

February 24-25, 2000

Stanley E. Ritterbusch
Project Engineering Manager

ABB

Outline

- Background
- Project status
- Comparison to current NRC/NEI risk-informed program

ABB

Background

- Department of Energy (DOE) has started the NERI research program for future nuclear technologies
- Although currently operating nuclear plants are competitive on production cost basis (fuel plus O&M), new nuclear plants are not likely to be competitive in the long-term deregulated U.S. market unless capital costs are reduced by 35% or more.
- A long-term R&D program is needed in order to develop a next-generation nuclear plant design that can be economically competitive in a deregulated U.S. power market.

ABB

Background....

- ABB CENP organized a team to submit 3 related proposals aimed at reducing the costs of future nuclear plants in the U.S.
  - Risk-Informed Assessment of Regulatory & Design Requirements (ABB Prime)
  - Smart Equipment (Sandia Prime)
  - Advanced Technologies for Design, Procurement, Construction, Installation, and Testing (Duke Engineering & Services Prime)

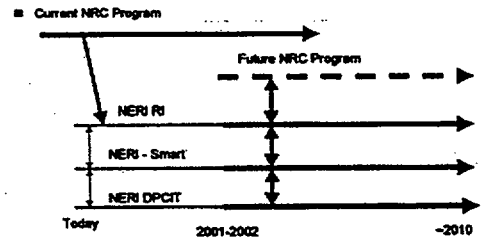
ABB

Background....

- Team includes:
  - ABB CENP
  - Duke Engineering & Services (DE&S)
  - Massachusetts Institute of Technology (MIT)
  - Pennsylvania State University (PSU)
  - North Carolina State University (NCSU)
  - Sandia National Laboratory (SNL)
  - Idaho National Engineering & Environmental Lab. (INEEL)
  - Egan & Associates

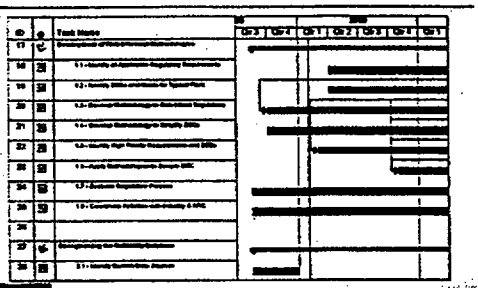
ABB

Risk-Informed Program Relationships



ABB

Milestone Status



ABB

NERI Risk-Informed Principles

- Maintain basic regulatory concepts:
  - adequate protection
  - safety margin
  - defense-in-depth
- Follow current NRC/NEI risk-informed program to the extent practical
- Review complete design and regulatory process
  - re-validate basic design and regulatory assumptions
  - retain use of "high confidence" equipment and methods, but consider all current knowledge and scientific advances

ABB

NERI Risk-Informed Principles....

- Start with risk-based methods:
  - establish firm probabilistic acceptance criteria
  - safety margins and defense-in-depth will be used to address uncertainties when current knowledge and PSA models are not adequate
- Do what is technically correct and justifiable, not necessarily what is easy (both design and licensing)

ABB

NERI Risk-Informed Regulatory Framework

- Compliance with regulations provides presumption of adequate protection
- Adequate protection is the minimum level of safety
- Safety goals are used to define a margin of safety above that required for adequate protection
- Defense-in-depth will communicate caution and conservatism to stakeholders
  - containment and emergency planning
- Defense-in-depth will be used only when necessary
  - address uncertainties in design methods, equipment performance, and PSA modeling
  - not applied "arbitrarily" by individuals

ABB

NERI Risk-Informed Regulatory Framework....

- Uncertainties throughout the design and analysis of a nuclear plant will be identified and resolved
  - to the extent justified, addressed in the PSA model
  - otherwise, resolved using defense-in-depth
- New regulations are envisioned:
  - remove requirements no longer justifiable given the current level of scientific knowledge
  - codify some aspects of PSA methods and some acceptance criteria

ABB

Comparison of NRC and NERI Risk-Informed Regulatory Processes

Operating Plants	Future Plants
Deterministic	Probabilistic
Traditional Approach	Risk-Based Approach
• Start with current designs and regulatory approvals. • Risk-informed changes justified. • Defense-in-depth remains as primary means to assure safety.	• Re-evaluate complete design and regulatory process. • Use firm probabilistic criteria to assure safety; • Use defense-in-depth as needed.

ABB

Time-Dependent Comparison of Regulatory Processes

Generation II (Current Plants)	Generation III (ALWRs)	Generation IV
Deterministic design and regulation.	Deterministic design and regulation, supplemented by PSA lessons learned.	PSA based design and regulation; deterministic methods used where appropriate.
Defense-in-depth is primary means for assuring safety.	Defense-in-depth is primary means for assuring safety.	Defense-in-depth used when uncertainties cannot be resolved by PSA.
CDF = 1.0E-4 events/year used as general measure of "safe enough."	CDF = 1.0E-5 and LERF = 1.0E-6 events/year used as design goals to get "warm feeling" of overall plant safety.	Will attempt to use probabilistic criteria as more than just goals.

ABB

Potential Design and Regulatory Changes

- Based on new data and PSA results, evaluate complete set of accidents used as design basis
  - reduce the size of the pipe break assumed for design of containment and ECCS
- Based on PSA modeling and improved SSCs
  - include only necessary equipment in plant design
  - use "safety-grade" classification only when justified
- Based on the development of more highly monitored or "smart" equipment, use normally operating equipment to perform safety functions
- Perform integrated structures-systems analysis

ABB

Potential Design and Regulatory Changes....

- Use passive components and systems where technically justified
- Evaluate signature analyses to decrease the limits of testing (e.g., full flow testing may not be required)
- Develop health monitoring systems to decrease quantity of equipment needed for plant operation and to provide up-to-date performance data into plant-specific PSA
- Propose revisions to regulations which may not be required given current knowledge and design & operating experience
- Pursue technical consistency in design and regulation

ABB

Summary

- Favored approach for a new design and regulatory process for Generation IV plants
  - use risk-based methods to the extent possible
  - use defense-in-depth only when necessary to address uncertainties or public policy
- Advantages of a significantly risk-based process:
  - provides designers with the ability to significantly reduce plant cost while maintaining safety
  - provides the opportunity to introduce advanced technology and more efficient plant operations

ABB

Summary....

- Advantages of a significantly risk-based process....
  - provides a method for an integrated assessment of uncertainties in design and regulation
    - avoids the need for item-by-item justification of the "thousands" of existing deterministic criteria
    - provides a self-consistent method for evaluating changes
  - provides a process that is readily applicable to non-LWR technologies
- The complete design and regulatory process must be revamped using risk-based methods to the extent practical to meet the 35% cost reduction goal

ABB

Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Overview

  WOG Project Authorization for Phase I:
  - **Phase Ia** **Definition and Scoping of Regulatory Impact**
  - **Phase Ib** **Industry Participation (OGs, NEI & NRC)**
  - **Phase II** **Analysis (Risk Informed, LBB, LBLOCA, etc.)**
  - **Phase III** **Rule-Making and Licensing (Topical Reports Submittals & Implementation)**

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Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Status - Phase 1a
  - Core Team Formation - ***completed***
  - Develop Program Plan -*draft report completed and issued for review*
    - Conduct Expert Solicitation Sessions - ***completed***
    - Review Existing Regulations - ***completed***
    - Assess PRA and Deterministic Evaluations Needed - ***completed***
    - Decision and Cost/Benefit Analysis - ***completed***
    - Develop Program Approach - ***being developed***
  - Final Report and Phase II & III Program Plans - ***being developed***

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Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Status - Phase 1b (Industry Participation)
  - Initiate industry interfaces with the OGs and NEI - *initiated and ongoing*
  - Initiate dialogue/meeting with the NRC- *planned for March 17, 2000*

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Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Substantial Benefits (vary by plant)
- Safety Benefit from better allocation of resources
- Operational benefit to plants:
  - Elimination of 10 sec. diesel start time
  - Increases in peaking factors
  - Potential for uprating
  - Reduced analysis costs
  - Accumulator
  - Baffle barrel bolting one-time benefit
  - Avoided LBLOCA-related generic letters
- Costs to be incurred:
  - Plant-specific:
    - LOCA & LOCA M/E analyses
    - PRA
    - Leak-before-break
    - License document changes
  - WOG per share costs

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Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Direction
  - Licensing Strategy
    - Proposed Rule Change
      - Will support pilot plant applications
  - Technical Justification
    - Leak Before Break
    - Probabilistic Risk Informed Analyses (RG 1.174)
      - with structural reliability
    - ECCS LOCA Analyses
  - Industry Involvement
    - Work within the framework of the NEI Risk-Informed Part 50 effort

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Westinghouse Owners Group
LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Direction (continued)
  - Licensing Strategy - Rule Change consistent with Risk-Informed Part 50
    - SECY 99-264 (plan for risk-informing technical requirements of 10CFR50)
      - Phase 1: identify candidate regulations for change
        - considers safety, benefit, and burden reduction
        - expect to retain a DBA concept, but some DBAs may be eliminated or modified and others established
      - Risk-informing the technical requirements complements risk-informing the special treatment requirements and adds clarity to the regulations
      - Changes needed to 10CFR Part 50
        - 50.46 Acceptance Criteria for ECCS
        - Appendix A GDC (LOCA definition)
        - Part 50, Appendix K (I. C. 1.)

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NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Direction (continued)
  - Technical Justification
    - Use PRAs/IPEs to show low risk associated with LBLOCA
      - Use the framework contained in Regulatory Guides 1.174
    - Use Leak Before Break Analysis to justify breaks down to and including 6"
      - Maintain CLB for RCS leakage monitoring
      - Define new limiting break size (<6") & analysis as necessary
      - Proposed rule would not prescribe the size

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LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Direction (continued)
  - Industry Involvement
    - Nuclear Energy Institute (NEI) Risk-Informed Regulation Working Group
    - CE, BWR, and B&W Owners Groups
    - NEI Risk-Informed Part 50 Task Force

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LBLOCA Design Basis Redefinition
NRC Option 3 Workshop, February, 2000

Redefinition of Large Break LOCA Licensing Basis

- Program Direction (continued)
  - NRC Meeting
    - Meet with NRC to present and discuss proposed program strategy
      - Show that proposed program will:
        - Maintain and possibly enhance safety
        - Reducing unnecessary burden
        - Increasing efficiency and effectiveness
      - Use Risk-informed TS Task Force as a template for coordinating with NRC to accomplish the objectives of SECY 99-264
      - Revise strategy based on NRC feedback

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