Letter Report
January 2000

# Summary of Information Presented at an NRC-Sponsored Public Workshop on Options for Risk-Informed Revision to 10 CFR Part 50, September 15, 1999, Rockville, Maryland

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Prepared by
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## Abstract

This report summarizes a public workshop that was held on September 15, 1999, 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 10 CFR Part 50.

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## Acknowledgment

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# List of Acronyms and Initialisms

| | |
|---|---|
| CFR | Code of Federal Regulations |
| DBAs | Design Basis Accidents |
| ECCS | Emergency Core Cooling System |
| EOPs | Emergency Operating Procedures |
| LOCA | Loss-of-Coolant Accident |
| LSS | Low Safety Significant |
| NEI | Nuclear Energy Institute |
| NERI | Nuclear Energy Research Initiative |
| NRC | Nuclear Regulatory Commission |
| NRS | Non-Risk Significant |
| PRA | Probabilistic Risk Assessment |
| RG | Regulatory Guide |
| RIRWG | Risk-Informed Regulation Working Group |
| SRP | Standard Review Plan |
| ST | Systems Thinking |
| STP | South Texas Project |
| UK | United Kingdom |

# 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 the 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 Part 50, a public workshop was conducted on September 15, 1999, in Rockville, Maryland. The objectives of the workshop were to:

- share preliminary plan on risk-informing Part 50, option 3,
- share preliminary results, and
- solicit and gather information to support risk-informing Part 50, option 3 plan.

This report summarizes the workshop.

## 1.2 Workshop Structure

The morning session consisted of presentations by the NRC and representatives of the public. The afternoon session consisted of a general discussion. 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. However, 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 open discussion session and from written comments. Appendix A provides the workshop agenda. Appendix B contains the attendance list; 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 PART 50, OPTION 3

The workshop opened with remarks by Ashok Thadani, NRC Director of the Office of Nuclear Regulatory Research. The presentation summarized below was given by Tom King, NRC Director of the Division of Risk Analysis and Applications, and Mary Drouin, Section Leader, Probabilistic Risk Analysis Branch. The viewgraphs are provided in Appendix C.

1. Introductory material on background, objectives, characteristics of a risk-informed Part 50, work scope and approach, and the Option 3 framework (i.e., the phases and tasks to accomplish the work) was presented.

2. Phase 1, to identify and determine the feasibility of changes to regulations, involves four basic tasks:

    - Identify candidate design basis accidents (DBAs) and requirements to be revised, including developing an understanding of current regulations.
    - Develop basis for improving current requirements.
    - Prioritize candidate DBAs and requirements.
    - Identify proposed changes.

    Recommended changes would be made to the Commission, and once Commission approval is received, final changes would be implemented in Phase 2 of the program.

3. The work associated with each task includes the following:

    - Task 1 involves performing a screening analysis to identify candidate DBAs and requirements and developing an understanding of the current regulations. The screening analysis will consider such factors as reduction in burden, frequency of event, and risk significance, among others. To gain an understanding of the current regulations, the regulations themselves along with the DBAs will be reviewed to identify requirements, the basis for the requirements, the purpose of the requirements, and potential conservatisms and insufficiencies.

    - Task 2 will develop the basis for improving the current regulations/requirements by considering defense-in-depth, safety margin, risk metrics, monitoring and feedback, and treatment of uncertainty and operational occurrences. The principles for risk-informing the regulations to delete unnecessary regulations or requirements and to add safety enhancing regulations or requirements will be identified.

    - Task 3 will prioritize the candidate requirements and DBAs by considering such factors as potential for improving safety decisions, resources needed, and burden reduction.

    - Task 4 will identify the proposed changes by evaluating the different options for revising a specific requirement or DBA and recommend changes to the Commission.

4. Finally, viewgraphs on stakeholder feedback solicitation questions and the proposed project schedule were presented.

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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 NRC Part 50 Workshop – Performance Technology

Bob Christie of Performance Technology, 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. Furthermore, public health risk is different for each nuclear site and changes with time. Major problems with NRC's approach to safety were discussed. Finally, he stated that the desired outcome to any revision of Part 50 would be to replace the historical detailed prescriptive requirements (derived from design basis accidents) with a monitoring process that tracks the relationship of the plant to the Quantitative Health Effects Objectives of the 1986 NRC Policy Statement on Safety Goals

## 3.2 Risk Informed Revisions to 10 CFR Part 50, A Systems Thinking Approach, Methodology and Examples – Advances Systems Technology and Management, Inc.

Yue Guan of Advanced Systems Technology and Management, Inc., presented a Systems Thinking (ST) Analysis approach to risk-informing Part 50 and provided responses to the discussion topics posed in the Workshop Notice. In general, a ST Analysis approach models and simulates non-linear and dynamic organizational functions, business processes, and operational practices to identify inter-relationships between sub-functions, sub-processes, and overall system performance. This allows leverage points to be found, improvements to be made, and solutions to be tested so that efficient and effective organizations and healthy systems/processes can be created. Examples of preliminary information from an ST Analysis of risk-informing Part 50 included:

- identifying the need to risk inform guidance documents associated with Part 50, not just Part 50 itself, and
- identifying the original technical bases and logic thinking and assumptions used in the existing rules and guidance documents.

Responses to the first four discussion topics were presented and are summarized as follows:

- **Topic 1: Which regulations of 10 CFR Part 50 are candidates for risk-informed revisions; What are the bases for choosing these candidates; and What are the purposed changes to these candidate regulations?** In addition to Part 50, all governing documents (e.g., regulatory guides, standard review plans, branch technical positions, standard technical specifications, and codes and standards) should be examined during this risk-informed effort. The original technical bases and the original logic thinking and assumptions should be examined to identify any inadequacies or excessive conservatisms. Revisions should be made if it supports the goals of the risk-informed effort, it is technically achievable, and is economically viable.

- **Topic 2: Are there problems with the regulations themselves or with their implementation (e.g., regulatory guides, standard review plans, branch technical positions)?** A better linkage is needed between the rules and the governing documents in specifying where and how the implementation of each rule is recommended. Guidance should not add an excessive amount of financial burden to the user. When the documents implementing the rules do not follow the guidance, the incurred additional time and cost for the review and approval of such documents should be minimized.

- **Topic 3: Are any of the regulations inconsistent or contradictory with other regulations?** None found at this time. However, implementation methods contained in guidance documents can unintentionally result in inconsistencies or contradictions with the purposes or other regulations and governing documents.

- **Topic 4: Is the current set of design basis accidents appropriate, are any modifications needed?** The current set of design basis accidents lacks technical basis and reasonable engineering judgment; thus, modifications are needed.

## 3.3 Application of Risk Informed Regulation to Future Nuclear Plants – ABB Combustion Engineering Nuclear Power, Inc.

George Davis of ABB Combustion Engineering Nuclear Power, Inc., indicated that three projects associated with the Nuclear Energy Research Initiative (NERI) for future nuclear technologies were ongoing. The projects include: 1) Risk-Informed Assessment of Regulatory & Design Requirements, 2) Smart Equipment, and 3) Advanced Technologies for Design, Procurement, Construction, Installation, and Testing. Common objectives of the NERI projects include:

- To be viable in a deregulated environment, costs of future nuclear plants must be economically competitive with other generating technologies.

- While current plants are competitive on a production cost basis, new plants are not likely to be competitive in the long term unless capital costs are reduced by 35%or more.

- To develop a next-generation plant design that can be competitive requires a long-term (up to 10 years) research and development program.

- The three NERI projects will lay the foundation for such a program.

The project applicable to this workshop, the first one (i.e., the Risk-Informed Assessment of Regulatory & Design Requirements Project), was described as follows:

- Methodologies for using probabilistic risk analyses to risk inform NRC requirements and industry standards for new plants will be developed. This will eliminate or reduce the requirements that are costly, but do not significantly contribute to safety.

- Plant designs can then be simplified by applying these new risk-informed requirements.

- The project will be coordinated with ongoing industry and regulatory activities, but will focus on issues affecting the design and construction of new plants.

## 3.4 Risk-Informed Revisions to 10 CFR Part 50, Option 3 – South Texas Project

Wayne Harrison of the South Texas Project (STP) began by indicating that risk significance determination will be a valuable decision-making tool in the operation, maintenance, and regulation of nuclear facilities to enhance safety while efficiently utilizing resources because it's a common sense approach to operation and it allows truly important components and activities to be determined, allowing business approaches to be adjusted accordingly.

Next, an overview of the current STP exemption request was presented. In summary, this exemption request is a scope issue–the regulations will not be changed. Exemptions will be limited to low safety significant (LSS) or non-risk significant (NRS) components for which Special Treatment Requirements and Associated Process Changes are applicable. STP is not seeking an exemption from functional requirements–the LSS and NRS components will still be available to perform their function. The effects of applying the exemption will be that no wholesale component changeout or reclassification will occur–it will be applied in a controlled approach as needs arise. Furthermore, the exemption will enhance safety. In addition, the request (see the viewgraphs in Appendix D) will assist the NRC in risk-informing Part 50.

Finally, examples of cost savings resulting from application of risk informed results were presented.

## 3.5 Risk-Informed Improvements to NRC Regulations – NEI

Stephen Floyd of the Nuclear Energy Institute (NEI) presented the industry's four-part approach to incorporating risk-informed information into the regulatory process. The objective of this activity is to change 10 CFR 50 and other associated NRC regulations and regulatory guidance to provide an option for implementing the regulations in a more effective and efficient manner. The four-part approach involves:

- improving NRC oversight process,
- identifying the appropriate scope of system, structures, and components to be governed by NRC requirements,
- improving NRC technical requirements, and
- implementing administrative and process improvements.

To support this activity, a Risk-Informed Regulation Working Group (RIRWG) has been formed, consisting of 24 senior managers and executives. The RIRWG receives input from a multitude of industry working groups (e.g., Fire Protection Working Group and License Renewal Working Group) and task forces (e.g., Part 50 Task Force and Maintenance Rule Task Force).

Issues associated with improving NRC technical requirements were discussed. They included:

- the need to build on recent regulatory improvements,
- to incorporate new information, insights, and 30 plus years of operating and regulatory experience,
- resolving cultural issues,
- identifying candidate regulations,
- assessing the benefit of amending the regulations and guidance,
- assessing alternatives,
- prioritizing the list of candidate regulations, and
- initiating individual rulemaking proceedings for voluntary and selective implementation.

In the area of implementation guidance it was pointed out that many regulations are general engineering statements and that rigidity in interpretation is an issue. As such, implementation guidance must be reviewed and, if necessary, changed. It was also pointed out that in assessing the regulations one may find that only minimal changes to the regulations are needed.

Criteria were proposed for identifying candidates, both regulations and technical requirements, for improvement. These criteria included:

- use of risk insights not permitted,
- focus is not on safety significant attributes,
- burden is excessive for safety benefit achieved,
- not efficient or effective for the regulator,
- minimizes need for exemptions,
- inconsistent with revised source term, and
- change required to ensure consistency with another change.

Examples of candidate regulations for risk informing were provided.

In conclusion, Stephen Floyd stated that industry supports NRC's initiatives to improve the regulatory regime through a risk-informed, performance-based approach. He stated that this initiative is important to the industry's long term future, but recognized that change is not easy.

# 4. OPEN DISCUSSION

In order to facilitate feedback, NRC focused the general discussion on five major topics:

- Identification of candidate requirements and DBAs to be revised,
- Role of pilot plants,
- Top candidate for risk-informing,
- Metrics and criteria for changing requirements, and
- Factoring human/operator actions into risk-informed requirements.

This summary includes both verbal and written comments.

## 4.1 Identification of Candidate Requirements and Design Basis Accidents to be Revised

NRC opened the discussion with questions on whether a new set of deterministic requirements should be developed and whether a new set of DBAs should be generic and/or risk-based.

The discussions that took place are summarized below (this is *not* a verbatim transcript).

Public: Would the new DBA scenarios be used the same as the current set?

NRC: The new set of DBAs will be light water reactor specific. They would be risk-informed.

Public: Probabilistic risk assessment (PRA) is used to evaluate severe accidents while Chapter 15 analysis looks at DBAs. A minimum set of new regulations could be developed using risk-based information. Both approaches are needed. However, the cost of a new plant cannot be reduced without implementing risk-based regulations.

NRC: Thus, we need risk-based regulations plus some deterministic requirements.

Public: With the new DBAs, will utilities be required to do new Chapter 15 analyses? Would the deterministic requirements for these new DBA be based on risk insights?

NRC: Yes to both questions.

Public: The DBA concept is used in the United Kingdom; however, there the DBAs are proposed by the operators and agreed upon by the regulator.

Public: Concern was expressed regarding regenerating analyses. Why should we be limited by the two options (i.e., risk-based and deterministic)? We could have risk-informed options that are in between the two. What is to be the end state of the RI Part 50 process? Is it to be prescriptive?

NRC: Answers to these questions are what we are seeking.

Public: Safety evaluations of plants have always had probabilistic elements. The basic questions are how far does one go in the regulatory arena to establish requirements and what do you leave to the licensee. For new reactors we may want functional rather than systemic requirements.

Are these revisions of Part 50 limited to water reactors?

NRC: Yes.

Public: Why is it necessary to pursue either of the options? One could just apply risk insights to existing DBAs. For example, many components are not susceptible to DBAs; thus, one could eliminate the special treatment these components receive.

NRC: What you have described is option 2, not option 3 which is what we are examining during this workshop.

Public: Since plants have similar features, hopefully we would want the same set of DBAs. What is meant by risk-based regulations?

NRC: Regulations where decisions are based solely on risk information. This would require more precise models and more complete understanding of phenomena. This is why we prefer risk-informed. This allows us to use risk information plus non risk criteria (fundamental engineering information) to account for uncertainties.

Public: Will operating experience be considered in this process?

NRC: Yes. Operating experience is important.

NRC Contractor: We are struggling with what we mean by DBAs. Even if some scenario is not, or no longer is, a DBA, some regulation may still be needed. For example, if we eliminate large loss-of-coolant accident (LOCA) as a DBA, this does not mean that one can now use plastic pipes.

Public: Here are three examples of deterministic versus probabilistic approach.

(1) Fire protection is not a DBA; however, regulations dealing with fire are numerous. We should apply a risk-informed approach.
(2) Operator training is a problem area for plants. Implementation guidelines are very rigorous. Do we have better training as a result?
(3) Part 21 was intended as a reporting requirement, but has become a very rigorous and burdensome program. STP effort is appropriate.

NRC: Part 21 is being looked at in option 2. Operator training is a good candidate. Fire protection is not in the scope of options 2 or 3. There is a separate effort by NRC and industry to make it risk-informed.

Public: New DBAs may be the goal for new plants; however, existing plants are not interested in a new set since the plant design is set. For existing plants, the goal is to modify or eliminate some from the existing set.

Public: Has the NRC staff or NEI looked at which regulations incur the most costs?

NRC: No. NRC would like to obtain this information from the industry.

Public: The Westinghouse Owners Group sent a letter to Commissioner Diaz stating that the double guillotine break is something that needs to be changed. Plans have been made to visit the NRC on this issue in December. We do not believe that new DBAs are needed. However, risk-informed regulations are needed.

NRC: The San Onofre request regarding hydrogen recombiners falls into this category. We have more than just DBAs in mind.

Public: As far as estimating cost are concerned, we tried to do this for certain types of things like new capital costs for pilot plants. We had more difficulty with operation and maintenance costs as to where costs were going versus public risk and health. We did find that some plants were spending dollars on non-risk significant equipment. We will share this information.

NRC: We would like to get this information. We need to know what requires a lot of resources (i.e., cost) vs. risk significance. We want to target things that will have the most payoff. Licensees are in the best position to indicate where their burden is.

Public: Need to look at a plant from the entire perspective. Looking at a single system at a time is the wrong approach given the complex interactions. Simulations should be performed to determine how interactions impact results.

Public: For large LOCA, despite ECCS design employing redundant injection, we must assume fuel melting and design other mitigation systems. This fuel failure assumption could be handled in a risk-informed manner.

NRC Contractor: What about defense-in-depth?

Public: Still support defense-in-depth, but a smaller version.

Public: Another burdensome area is what guidance is given to staff on exercise of judgment. If evidence is uncertain, regulators typically take conservative approach. For example, when fuel clad perforates, escaping species is particulate, with some Iodine. NRC always assumes 100% elemental Iodine release. This is an example where NRC judgment hurts. What is the policy for qualitative judgments in risk-informed regulations?

NRC: Issues of judgment come up with application of Regulatory Guide (RG) 1.174. The Office of Nuclear Reactor Regulation established a panel to address these judgmental issues. If you feel that things are being unfairly treated by NRC, bring them to the attention of this panel.

Public: What is the schedule for this program?

NRC: Phase 1 is to be completed by December 2000. Actual changes will require 3 to 4 years to implement.

## 4.2 Role of Pilot Plants

The NRC opened the discussion with questions on what, if any, role pilot plants would play in this process, would it be useful to have a web site, and what interactions should there be with ongoing industry activities.

The discussions that took place are summarized below (this is *not* a verbatim transcript).

Public: The use of pilot plants depends on the scope of the changes. If we are looking at a new set of DBAs, then we need pilot plants. If we are targeting a few regulatory changes, then we do not need pilot plants.

NRC: Agree. The use of pilot plants depends on the complexity or depth of change that is being recommended.

Public: NRC has had risk information from Arkansas Nuclear One-1 and San Onofre for the last two years. Has this helped? Do you want to continue?

NRC: Yes. These pilots were straight forward. What we are looking at now is more complicated. For example, we would like to work with a plant on 50.46.

Public: Pilot plants are useful both during the study phase and the implementation phase. A web site would also be useful.

NRC: OK.

Public: There are some known problems with current regulations. For example, why assume 102% power for calculations or why assume maximum containment pressure? A large number of these conservatisms have no basis.

NRC: Provide us a list of these so we can take a look at them.

Public: What is the time frame for submitting information for consideration in this process?

NRC: We need industry information as soon as possible within the next few months.

## 4.3 Top Candidate for Risk-Informing

The discussions that took place are summarized below (this is *not* a verbatim transcript).

Public: Deleting Hydrogen recombiners should be a top priority. The San Onofre submittal and work done on 50.44 indicate we would be better off without 50.44. Deleting 50.44 entirely would not impact risk. We should focus on hydrogen for severe accidents, not for DBAs.

NRC: We cannot say that yet.

Public: The only possible benefit of 50.44 to public health risk is the inerting of Mark I containments, all else should go.

Public: Large break LOCA should go. In addition, the emergency core cooling system (ECCS) analysis assumptions that cascades into Technical Specifications should be examined. These are areas that drive a lot of the cost.

Public: Procurement regulations (e.g., quality assurance requirements) also drive cost without necessarily contributing to safety.

Public: Recent NUREGs show that containment leak rate test types A and C (from Appendix J) are not beneficial (i.e., risk important). Standard Review Plan (SRP) 6.24 should also be examined.

Public: If the large break LOCA is maintained, we should at least look at the single failure criterion.

Public: Fracture mechanics information on large breaks (i.e., the likelihood of leak before break) has been shared.

NRC Contractor: Removing ECCS requirements implies that we must reexamine the set of accidents to be considered. For example, what other accidents could be affected? What other accidents could this have been a surrogate for? The accident being removed could have been enveloping other accidents, requiring these other accidents to be reexamined.

NRC: 50.46 was revised 10 years ago to include an option to do best estimate evaluations with uncertainty analysis. Experience has shown that peak clad temperature is lower if you did that. To date, very few people have taken advantage of this option, probably because it is difficult to do.

Public: This option is not available to all utilities, and it needs considerable in-depth analysis. Cost and schedule are problems. It costs more than an Appendix K analysis. This uncertainty approach is different than a risk-informed approach.

NRC: Removing conservatisms is not risk-informed; however, removing off-site power requirements would be.

Public: The main reason for removing (eliminating) the large double-ended break scenario is the elimination of a high cost analysis.

Public: On slide 12 of the morning presentation by NRC, the screening criteria appear to allow the addition of new requirements (e.g., DBAs). Is this correct.

NRC: Yes they can.

Public: Typically, conservatisms are added by different interests (organizations) at each layer of an analysis to cover uncertainties in their area. Suggest using realistic analyses (i.e., eliminating the conservatisms) with conservative acceptance criteria.

NRC: We have considered changing intermediate assumptions.

Public: Use of conservative acceptance criteria can cover a lot of uncertainties.

NRC Contractor: The uncertainty analysis question is important. How much should be done? How does one address the need for defense-in-depth, e.g., the containment?

Public: Containments are good, but should be designed for severe accidents, not DBAs.

Public: On page 7 of the NRC presentation, the second requirement indicates that is should be performance based to the extent possible. What does this mean?

NRC: We mean that instead of a requirement for 3 pumps or 2 trains, we could have a requirement based on some measurable parameter.

## 4.4 Metrics and Criteria for Changing Requirements

The discussions that took place are summarized below (this is *not* a verbatim transcript).

NRC: What metrics and criteria should be used in changing a requirement? Should we use definitions of defense-in-depth and safety margin as defined in Reg Guide 1.174, or should we modify the 1.174 definitions, and how?

Small changes in risk, like those in Reg Guide 1.174, could be used, or we could set an absolute baseline for everyone to meet.

Public: Each of the choices has problems, e.g., to determine whether a small change in risk occurs requires plant specific analyses, requiring everyone to meet (or have) the same core damage frequency is not appropriate. There should be something in between.

Public: The NEI RIRWG has addressed this issue. The consensus is that the current industry safety level should be maintained and that small incremental changes should be allowed. Going to a common core damage frequency for each plant is not the way to go.

Public: The situation in the United Kingdom (UK) is that 75% of regulations are from the utility's own safety department and 25% are from the equivalent of the NRC. We found a lot of trouble in the UK from a too rigid interpretation of instructions (e.g., the plant operator makes one interpretation while the NRC equivalent makes another). To deal with this situation we have an ombudsman in the safety department. Maybe something like this would work here.

NRC: If there are regulations that do not have a large impact on safety and are not burdensome, these will not be high priority candidates. The most cost effective ones will be reviewed.

Public: With regards to defense-in-depth, in the UK we use a semi quantitative system. One line of defense is a qualified system with automatic actuation or plenty of operator time, with redundant trains. We want two strong lines plus one weak line of defense against large release. Must have a minimum score of 2. The other requirement is that the 2 lines must be quite different. One cannot claim 4 trains of the same system as two defense lines.

Public: Defining defense-in-depth is a good idea. It has been misused over the years, partially because there is no firm definition. Often results in additional conservatisms–assumptions in RGs and SRPs. Need to look at specific design criteria but remove arbitrary addition of defense-in-depth conservatisms.

Public: Looking only at single active failure is troublesome. We should look at PRA to see if there are reasonable multiple failures that should be examined.

## 4.5 Factoring Human/Operator Actions into Risk-Informed Requirements

The discussions that took place are summarized below (this is *not* a verbatim transcript).

Public: Programs for informing operators on risk insights, emergency operating procedures (EOPs), and training programs have been successful. Why would we need more regulations in this area?

NRC: We are not suggesting we have regulations on human performance. We are trying to establish how to capture in the regulations the fact that a PRA may say a human action is important.

Public: At one plant we are going through an EOP validation effort that involves reviewing whether actions can be taken within time frames allowed. We found some things to improve in the EOPs–actions that could not be performed in the time frame. If risk-informed regulation is used in this arena, it should be to assure that risk-significant actions are reviewed.

Public: We do not need regulations to do this. Programs already exist. Training is certified by the Institute of Nuclear Power Operations. Risk-significant actions are used in training of operators.

Public: A lot of non-safety significant regulations are still being pushed on the utilities.

## 4.6 Additional Public Comments

This section summarizes written public comments that were not addressed in the previous sections (this is *not* a verbatim transcript).

Public: Are there any regulations or assumptions that are "off limit" (i.e., will not be considered during the risk-informed review process)? If so, what are they?

Response: No.

Public: To avoid the abuse of PRA, results from PRA should correlate sensibly with deterministic insights.

Response: This is one reason why the process is risk-informed rather than risk-based.

Public: The risk-informing process should not be limited solely to risk-informing selected issues (e.g., specific rules). Rather, a systematic process should be developed to examine the interrelationships among all aspects of rule development (e.g., bases and assumptions) and implementation to identify the potential for unintentionally created adverse conditions. Identification and remediation of such will ensure safety is maintained.

Response: The comment is well founded. Interrelationships among regulations are being considered.

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# APPENDIX A. WORKSHOP AGENDA

## Workshop Agenda

| | |
|---|---|
| 7:45 am to 9:05 am | Introduction.<br>NRC Presentation on Risk-Informed Part 50<br>▸ Background<br>▸ Objective – Option 3<br>▸ Characteristics of a Revised Risk-Informed Part 50<br>▸ Scope and Approach<br>▸ Framework<br>▸ Objectives of Workshop<br>▸ Discussion Topics<br>▸ Approach<br>▸ Schedule |
| 9:05 am to 9:25 am | Stakeholder Presentation: Performance Technology |
| 9:25 am to 9:40 am | BREAK |
| 9:40 am to 11:30 am | Stakeholder Presentations |
| 9:40-10:00 | University of Maryland |
| 10:00-10:20 | ABB |
| 10:20-10:50 | South Texas |
| 10:50-11:30 | NEI |
| 11:30 am to 12:45 pm | LUNCH |
| 12:45 pm to 4:15 pm | General Discussion of Issues/Topics |
| 2:15 pm to 2:30 pm | BREAK |
| 4:15 pm to 4:45 pm | Wrapup |

# APPENDIX B. WORKSHOP REGISTRATION LIST

LIST OF ATTENDEES

**Table B.1 Workshop Registration**

| Name | Affiliation |
|---|---|
| J. J. Akers | Westinghouse Electric Company. |
| Francis Akstulewicz | Nuclear Regulatory Commission (NRR/DRIP/RGEB) |
| Jim Andrachek | Westinghouse Electric Company |
| Gerald André | Westinghouse Electric Company |
| Biff Bradley | Nuclear Energy Institute |
| H. Duncan Brewer | Duke Power Company |
| Tony Brooks | Nuclear Energy Institute |
| Allen Camp | Sandia National Laboratories |
| Bob Christie | Performance Technology |
| George A. Davis | ABB Combustion Engineering Nuclear Power |
| Mary Drouin | Nuclear Regulatory Commission (DRAA/PRAB) |
| Gene Eckholt | Northern States Power |
| Margaret Federline | Nuclear Regulatory Commission (RES/OD) |
| Răducu Gheorghe | Atomic Energy Control Board Canada |
| Kim Green | NUSIS |
| Yue Guan | Advanced Systems Technology and Management, Inc. (President and CEO) |
| Wayne Harrison | STP Nuclear Operating Company |
| Eric Haskin | ERI Company |
| Lara Helfer | Hopkins & Sutter |
| Adrian Heymer | Nuclear Energy Institute |
| Nigel J. Holloway | Atomic Weapons Establishment |
| Roger Huston | Licensing Support Services |
| James A. Hutton | PECO Energy |
| Yehia F. Khalil | Northeast Utilities (Supervisor, PRA Group) |
| Tom King | Nuclear Regulatory Commission (DRAA) |
| Jeffrey L. LaChance | Sandia National Laboratories |
| John Lane | Nuclear Regulatory Commission (RES/DRAA/PRAB) |
| Norman Lauben | Nuclear Regulatory Commission (RES/DSARE/SMSAB) |
| John Lehner | Brookhaven National Laboratory |

Table B.1 Workshop Registration

| Name | Affiliation |
|---|---|
| Stanley Levinson | Framatome Technologies, Inc. |
| Erasmia Lois | Nuclear Regulatory Commission (RES/DRAA/PRAB) |
| Michael E. Mayfield | Nuclear Regulatory Commission (RES/DET/MEB) |
| Parviz Moieni | Southern California Edison<br>San Onofre Nuclear Generating Station |
| Paige T. Negus | GE |
| Kenneth E. Peveler | IES Utilities (Manager, Regulatory Performance) |
| James Riccio | Public Citizen's Critical Mass Energy Project |
| Stanley E. Ritterbusch | ABB Combustion Engineering Nuclear Power |
| Zoltan R. Rosztoczy | Zeetech, Inc. |
| Marjorie Rothschild | Nuclear Regulatory Commission (OGC) |
| Jon R. Rupert | Tennessee Valley Authority–Nuclear |
| Glen E. Schinzel | South Texas Project |
| A. W. Serkiz | Nuclear Regulatory Commission (RES/DET/ERAB) |
| Thomas B. Silko | Vermont Yankee |
| Lenny Sueper | Alliant Energy<br>Duane Arnold Energy Center |
| Bill Sugnet | Polestar Applied Technology |
| Getachew Tesfaye | Baltimore Gas & Electric Company<br>Calvert Cliffs Nuclear Power Plant |
| Ashok Thadani | Nuclear Regulatory Commission (Director of the Office of Nuclear Regulatory Research) |
| Lawrence A. Walsh | North Atlantic Energy Service Corporation<br>Westinghouse Owners Group |
| Everett Whitaker | Tennessee Valley Authority<br>Senior Licensing Project Manager |
| Kathy Work | STP Nuclear Operating Company |
| Altheia Wyche | Bechtel Power Corp.<br>SERCH Licensing |
| Daniel Yasi | Vermont Yankee NPC |
| Robert Youngblood | SCIENTECH, Inc. |

# APPENDIX C. NRC PRESENTATION MATERIAL

# Public Workshop on Risk-Informing Part 50, Option 3

Presented by
Tom King
Mary Drouin

Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

September 15, 1999

# WORKSHOP STRUCTURE

- Morning presentations given without interruption, questions and comments will be held in afternoon discussion sessions
- 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 questions and comments, whether verbal or written will be summarized in a workshop proceeding
- Workshop agenda times may be adgusted to match questions, comments and discussions
- Blank registration form in package, please complete and turn in

Page 2

# WORKSHOP AGENDA

| | |
|---|---|
| 7:45 am to 9:05 am | Introduction.<br>NRC Presentation on Risk-Informed Part 50<br>▸ Background<br>▸ Objective – Option 3<br>▸ Characteristics of a Revised Risk-Informed Part 50<br>▸ Scope and Approach<br>▸ Framework<br>▸ Objectives of Workshop<br>▸ Discussion Topics<br>▸ Approach<br>▸ Schedule |
| 9:05 am to 9:25 am | Stakeholder Presentation: Performance Technology |
| 9:25 am to 9:40 am | BREAK |
| 9:40 am to 11:30 am | Stakeholder Presentations |
| 9:40-10:00 | University of Maryland |
| 10:00-10:20 | ABB |
| 10:20-10:50 | South Texas |
| 10:50-11:30 | NEI |
| 11:30 am to 12:45 pm | LUNCH |
| 12:45 pm to 4:15 pm | General Discussion of Issues/Topics |
| 2:15 pm to 2:30 pm | BREAK |
| 4:15 pm to 4:45 pm | Wrapup |

Page 3

# Outline

- Introduction
  - Background
  - Objective -- Option 3
  - Characteristics of a Revised Risk-Informed Part 50
  - Scope and Approach
  - Framework
  - Objectives of Workshop
- Approach
- Schedule

Page 4

# BACKGROUND -- SECY-98-300

- Option 1: Continue ongoing rule changes only (e.g., 50.65)
- Option 2: Make changes to the overall scope of systems, structures and components covered by those sections of Part 50 requiring special treatment...by formulating new definitions of safety related and important-to-safety
- Option 3: Study changes to specific technical requirements in the body of regulations, including general design criteria

Page 5

# OBJECTIVE -- RISK-INFORMED REVISIONS TO PART 50

- Enhance safety by focusing NRC and licensee resources in areas commensurate with their importance to health and safety
- Provide NRC with a 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 result in burden reduction without compromising safety

Page 6

# DESIRED CHARACTERISTICS OF A RISK-INFORMED REVISED PART 50

- Continue to provide reasonable assurance of adequate protection of public health and safety.
- Contain requirements on specific attributes of nuclear power plant design and operations commensurate with their safety significance.
- Safety significance would be assessed using principles of risk-informed regulation including the following:
  - consistency with the defense-in-depth philosophy
  - maintenance of sufficient safety margins
  - consistency with the intent of the Safety Goal Policy Statement
- Requirements would accommodate the plant-specific nature of the safety significance of design and operational attributes.
- Provide a clear, consistent, and coherent set of requirements that would also facilitate consistency in treatment among the assessment, inspection, and enforcement programs.
- Provide a regulatory basis for all NRC reactor-related activities, including licensing, inspection, enforcement, and assessment.
- Performance-based to the extent practical.
- Practical to implement for both licensees and the NRC.

Page 7

# SCOPE AND APPROACH

## *Scope:*

- Adding 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

## *Current Approach:*

- 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)
- Apply scope definition developed under Option 2 to technical requirements
- Will retain design basis concept (i.e., risk-informed design basis)

Page 8

# OPTION 3 FRAMEWORK

***Phase 1:***
A study of the technical requirements to identify potential candidates for change and preliminary assessment of the feasibility of the proposed changes for presentation to the Commission

***Phase 2:***
Proposed changes endorsed by the Commission, detailed analyses will be performed to support rule making

***Task 1: Identification of Candidate Requirements and Design Basis Accidents to be Revised***
- Develop screening criteria and evaluation factors
- Understanding of Current Requirements

***Task 2: Bases for Improving Current Requirements***
- Basis for Risk-Informed Regulation

***Task 3: Prioritization of Candidate Requirements and Design Basis Accidents to be Revised***
- Develop screening criteria and evaluation factors
- Perform preliminary evaluations

***Task 4: Identification of Proposed Changes***
- Develop Preliminary Set of Proposed Changes

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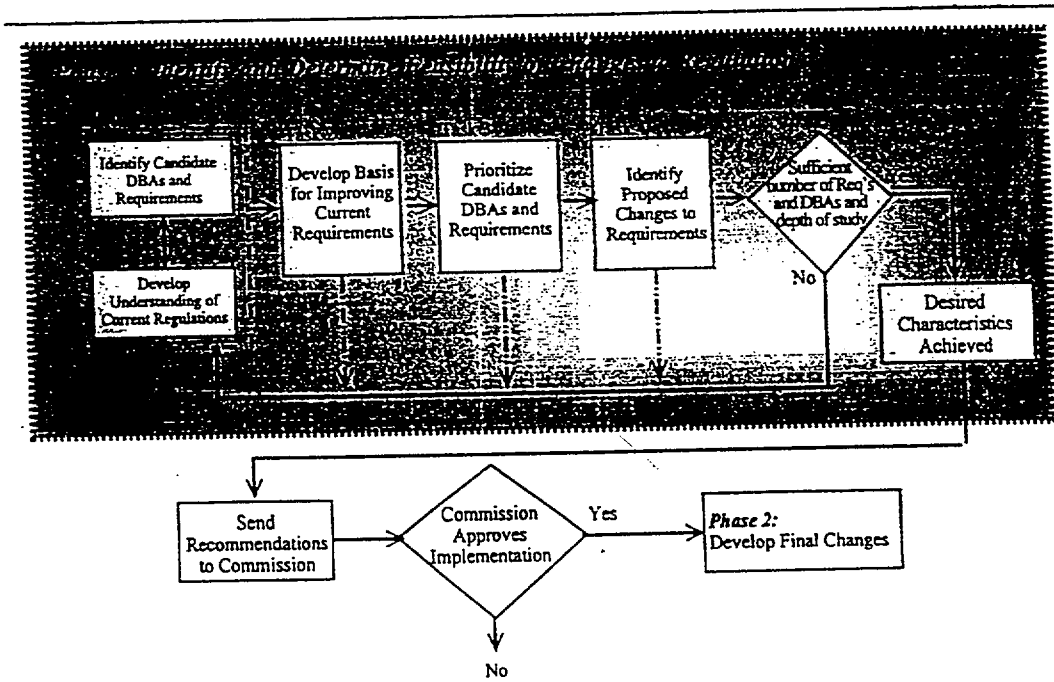
# OBJECTIVES OF WORKSHOP

- Share Preliminary Plan on Risk-Informing Part 50, Option 3
- Share Preliminary Results
- Solicit and gather information to support Risk-Informing Part 50, Option 3 Plan

Page 10

# APPROACH




Page 11

# TASK 1: IDENTIFICATION OF CANDIDATE REQUIREMENTS AND DESIGN BASIS ACCIDENTS TO BE REVISED

Perform Screening Process Considering Such Factors as:

- Substantially reduces unnecessary licensee and NRC burdens
  - excessive conservatisim in methods and criteria
  - unrealistic assumptions
- Frequency of event
  - initiating event: >1E-6/ry
  - core damage: >1E-7/ry
  - large early release: >1E-8/ry
- Risk significance of Design Features

Page 12

# TASK 1: IDENTIFICATION OF CANDIDATE REQUIREMENTS AND DESIGN BASIS ACCIDENTS TO BE REVISED

Understanding of Current Regulations

- Review regulations and the design basis accidents
- Identify the imposed requirements; example:
  - deterministic values of critical parameters such as temperatures, pressures, flow rates, extent of fuel damage
- Identify bases for the requirements; example:
  - analysis methods and assumptions
  - effects of single active failures of SSCs
- Identify the purpose for each requirement
- Identify potential "conservatisms"
- Identify potential "insufficiencies"

Page 13

# TASK 2: BASES FOR IMPROVING CURRENT REGULATIONS

Key Considerations for Risk-Informed Changes

- Defense-in-depth
- Safety margin
- Risk metrics/criteria
- Monitoring and feedback
- Treatment of uncertainties and anticipated operational occurrences
- Identify principles for risk-informing the regulations for:
  - deleting unnecessary or ineffective regulations
  - adding significant safety enhanced regulations
  - revising specific requirements to reflect-risk informed considerations
  - prescriptive versus performance-based

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# TASK 3: PRIORITIZATION OF CANDIDATE REQUIREMENTS AND DESIGN BASIS ACCIDENTS

Perform Prioritization Considering Such Factors as:

- Potential for improving safety decisions:
  - requirement covers dominant risk contributors
- Resources needed (to implement change)
  - NRC and licensee cost and time to implement
- Amount of reduction in unnecessary burden
  - less resources/time used than currently expended on existing process

Page 15

# TASK 4: IDENTIFICATION OF PROPOSED CHANGES TO REQUIREMENTS

- Evaluate the different options for revising a specific requirement
- For Example: *Peak Clad Temperature Limit*
  - — Based on engineering calculations that preclude cladding failures
  - — Based on that no significant public risk occurs
  - — Based on a core damage frequency limit for LOCAs
- Provide recommended changes to Commission

Page 16

# STAKEHOLDER FEEDBACK

- What should be the factors used to screen/select the candidate requirements/DBAs?
- Are the problems with the regulations or with their implementation?
- What are some specific problems? And why?
- Which regulations/requirements causing the most unnecessary burden?
- Are any of the regulations inconsistent or contradictory with other regulations? If so, where and which one?

Page 17

## STAKEHOLDER FEEDBACK

- What candidate regulations should have top priority? What factors should be used in the prioritization?
- Is there data or analyses currently available?
- What are potential candidate requirements and DBAs? For example:
  - *Emergency Core Cooling System (50.46)*
    - Large break LOCA
    - analysis assumptions (e.g., simultaneous loss of offsite power, 120% decay heat)
  - *Fuel Performance (GDC 28)*
    - reactivity insertion DBAs
    - analysis assumptions
  - *Combustible Gas Control (50.44)*
    - hydrogen recombiners

Page 18

## STAKEHOLDER FEEDBACK

- What metrics and criteria should be used in changing a requirement?
- Use RG 1.174 for definitions of defense-in-depth and safety margin?
- Modify RG 1.174 definitions, and how?

Page 19

# PROPOSED SCHEDULE

- Risk-Informing Part 50, Option 3 Plan due to Commission, October 1999
- ACRS Briefing, September 24, 1999
- Additional "topical" workshops, to be scheduled; for example, technical issues:
  - how should uncertainties be treated?
  - how should low power and shutdown risk be considered?
  - how should the risk from temporary plant conditions be considered?
  - how should anticipated operational occurrences be treated?
- Phase 1, estimated completion date December 2000

Page 20

# PROPOSED DISCUSSION TOPICS

- Identification of candidate requirements and DBAs to be considered
- Bases for improving current requirements and DBAs
- Prioritization of candidate requirements and DBAs
- Identification of proposed changes
- Pilot Plant: What should be the role of pilot plant(s) in Option 3:
  - Test each proposed change?
  - Test to support the Option 3 study or wait until rulemaking phase?
  - Success criteria?

Page 21

# AFTERNOON SESSION

# TOPIC DISCUSSIONS

Page 22

## TOPIC 1: Identification of Candidate Requirements and DBAs

- A new set of deterministic requirements?
  - New set of DBAs? (generic set)

OR

- Risk-based, safety goal oriented
  - Plant-specific, full-scope, Level 3 PRA required plus all hazards (beyond reactor core)

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## TOPIC 2: Bases for Improving Current Requirements and DBAs

- Small changes about current plant risk profile *vs* uniform risk levels for plants?
- How to factor the human/operator actions into risk-informed requirements?

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## TOPIC 3: Prioritization of Candidate Regulations and DBAs

Page 25

## TOPIC 4: Identification of Proposed Changes to Requirements and DBAs

Page 26

## TOPIC 5: Pilot Plant Activities

- Role of pilot plants?
  - Purpose
  - When/How
    - Study phase
    - Implementation phase
- Useful to have a web site?
- Interactions with ongoing industry activities?
  - Westinghouse OG?
  - ABB?

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# APPENDIX D. PRESENTATION MATERIAL OF PUBLIC PRESENTATIONS

# NRC Part 50 Workshop

September 15, 1999

Bob Christie

Performance Technology
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Knoxville, TN 37950-1663
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# 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. <u>The Major Problems with NRC's Approach to Reactor Safety</u>

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.

Rogovin Report, TMI2, January 1980
Chapter 8, page 150-151

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- 
- 

What these examples (from TMI2) demonstrate is that we have come far beyond the point at which the existing, stylized design basis accident review approach is sufficient. The process is not good enough to pinpoint many important design weaknesses or to address all the relevant design issues. Some important accidents are outside or are not adequately assessed within the "design envelope"; key systems are not "safety related"; and integration of human factors into the design review is grossly inadequate.

More rigorous and quantitative methods of risk analysis have been developed and should be employed to assess the safety of design and operation. But the Commission and the staff have been slow to adopt these methods, even though they have been used in other disciplines and technologies for some years.

- 
- 
- 

The best way to improve the existing design review process is by relying in a major way upon quantitative risk analyses, and by emphasizing those accident sequences that contribute significantly to risk. The design review can then focus on those plant systems that contribute to risk, identify weak points, and upgrade various requirements (maintenance, for example) to eliminate them.

The present system has been criticized for relying too heavily on "engineering judgment", which is the term often used to hide an inadequate analytical capability. In our view, there is no way to eliminate such judgments, in part because risk assessment techniques are not now well enough developed, and also because there will always be judgments that go beyond whatever results are produced by those techniques. What the use of these methods will do is to put the judgments into the safety review process at a better point, judging which accident sequences are important and why.

We do not suggest here that the existing safety review process be immediately supplanted by a more probabilistic review. What we are suggesting is that it be augmented, and that quantitative methods be used as the best available guide to which accidents are the important ones, and which approaches are best for reducing their probability or their consequences.

We believe that the advantages of such an approach far outweigh the difficulties. We strongly urge that the NRC begin the long and perhaps painful process of converting as much as is feasible of the present review process to a more accident-sequence-oriented approach. This conversion process may be difficult. It could easily take as much as a decade to accomplish. The time to begin is now.

# DESIRED OUTCOME

- The ultimate objective of the nuclear units and the NRC should be to replace the historical detailed prescriptive requirements based on design basis accidents with a monitoring process that determines the relationship of the nuclear unit to the Quantitative Health Effects Objectives (QHO's) of the 1986 NRC Policy Statement on Safety Goals.

ASTM

# RISK INFORMED REVISIONS TO 10 CFR PART 50 A SYSTEMS THINKING APPROACH METHODOLOGY AND EXAMPLES

**Yue Guan, P.E., Ph.D.**

**ASTM**

**Advanced Systems**

**Technology and Management, Inc.**

This Presentation Was Developed with Limited Resources and It Demonstrates ONLY the Preliminary and Not-Yet Completed Systems Thinking Approach, Risk Informed Part 50 Methodology, and the Selective Examples which Can Address Most of the Discussion Topics Listed by the USNRC

ASTM

# OUTLINE

- Definitions
- Purposes of Risk Informed Part 50 (RI50)
- A Systems Thinking (ST) Analysis
- RI50 Methodology and Examples
- Addressing Topics
- In Summary
- About ASTM

ASTM

# DEFINITIONS

- Codified Federal Regulations (CFRs):
  10 CFR Part 20 10 CFR Part 50 10 CFR Part 100

- Governing Documents (GD) Include But Not Limited to:
  Regulatory Guides (RG)
  Standard Review Plans (SRP)
  Branch Technical Positions (BTP)
  Standard Technical Specifications (STS)
  Codes and Standards (C&S)

ASTM

# PURPOSES OF RISK INFORMED REVISIONS TO PART 50 (RI50)

- Safety Concerns:
  - To Ensure Safety Is Maintained
  - To Ensure Risk Is Reduced
- Economical Concerns:
  - To Reduce Safety Margins
  - To Enhance Operating Efficiency
  - To Reduce Industrial Burden

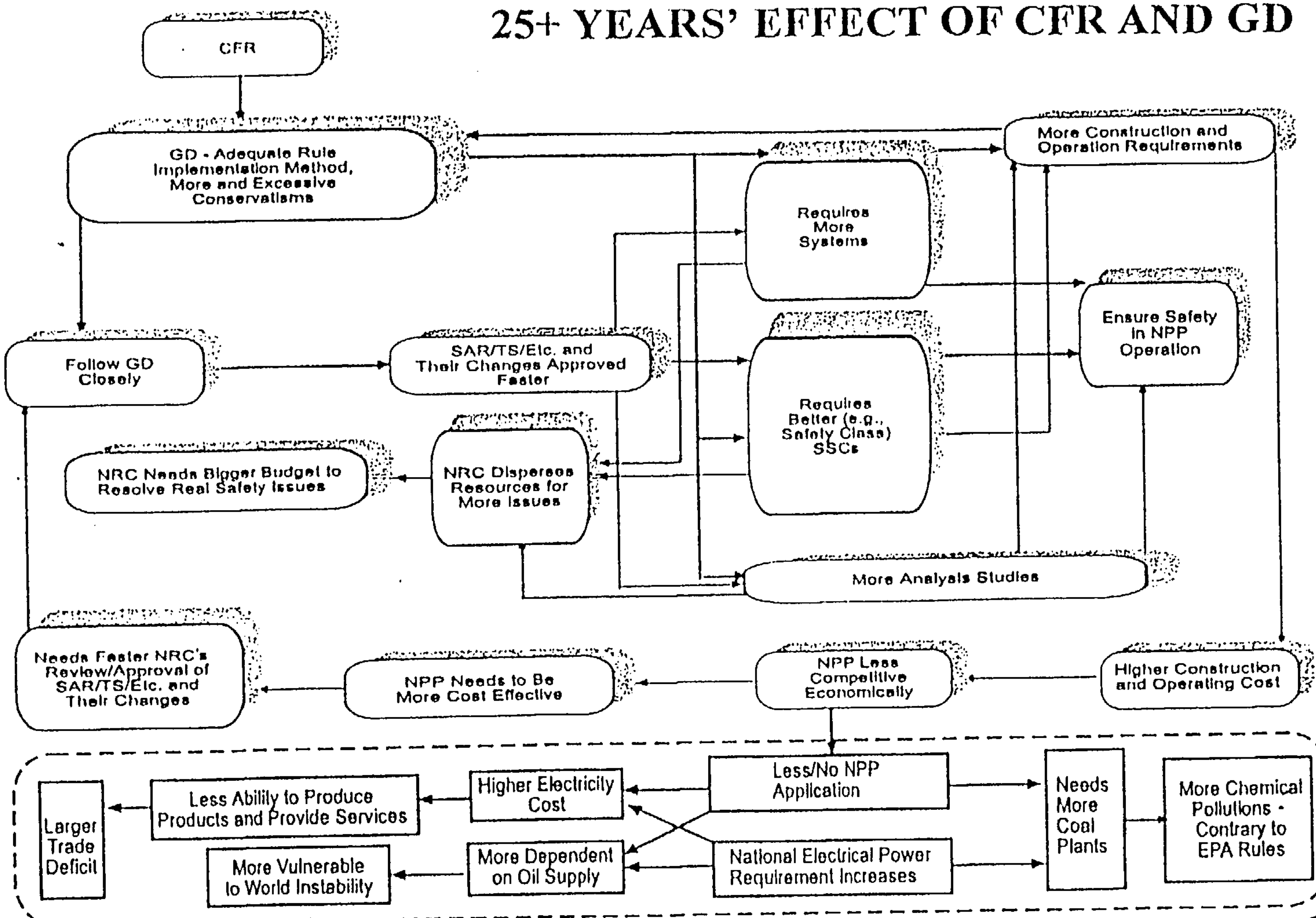
ASTM

# SYSTEMS THINKING ANALYSIS

- Models and Simulates Non-linear and Dynamic Organization Functions, Business Process, and Operational Practices
- Identifies Inter-relationships between Sub-functions, Sub-process, and the Overall System Performance
- Finds Leverage Points, Makes Improvements, Tests Solutions, Creates Efficient and Effective Organizations and Healthy Systems/Process

ASTM

# ST ANALYSIS — CAUSAL LOOP DIAGRAM TO MODEL 25+ YEARS' EFFECT OF CFR AND GD



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# SYSTEMS THINKING PRELIMINARY SUMMARY

- Not Only Risk Inform Part 50, Need to Also Risk Inform GD
- Continue to Maintain Safety Integrity in CFR/GD
- Remove Excessive Conservatisms
- Treat All Items on the CLD as An Integrated System, Identify Inter-Relationships Between Rules/GD, Understand One Change Leads to Propagating Effects on Other Rules/GD
- Need to Identify the Original Technical Bases (TB), Logic Thinking and Assumptions (LTA) Used in the Existing Rules/GD
- Revisions Need to Be Made at the Level of OTB and LTA (Primary Level) Within the CFR/GD
- Properly Derive the Effect of Changes on the Secondary Level – e.g., Re-categorization of Specific SSCs, Re-analyze MSLB Incorporating Risk Information
- Carry On a Systematic and Effective Effort, Minimize Surface Re-Finish Activities
- Perform Realistic Cost/Benefit Analysis Considering Both NRC and Utilities, Determine Revision Action at the Leverage Areas
- Accurate and Thorough Documentations

Sept. 15, 1999

Workshop on Risk-Informed Revisions to
10 CFR Part 50, Option 3, USNRC

Page 7 of 17

ASTM

# RI50 METHODOLOGY

1. Categorize CFR and GD
2. Uncover OTB and LTA for the CFR and GD
3. Determine Which OTB or LTA Is Not Adequate
4. Use Integrated Method (IM) of PRA and Deterministic Analysis (DA) to Establish New Technical Basis (NTB) to Remove the Inadequacy and to Identify the Propagating Effect
5. Determine Which OTB or LTA Is Excessively Conservative
6. Where Possible and Achievable, Use IM to Establish NTB to Reduce the Excessive Conservatism and to Identify the Propagating Effect of Revisions to Other Rules/GD – The Propagating Effect Can Result in Secondary Reduction of Conservatism (e.g., Reduction in Percent Iodine Available for Leakage Can Result in Reduced Requirements on Containment Spray System and Leak Rate Testing Program) or Can Lead to Newly Induced Inadequacies in Other Rules/GD

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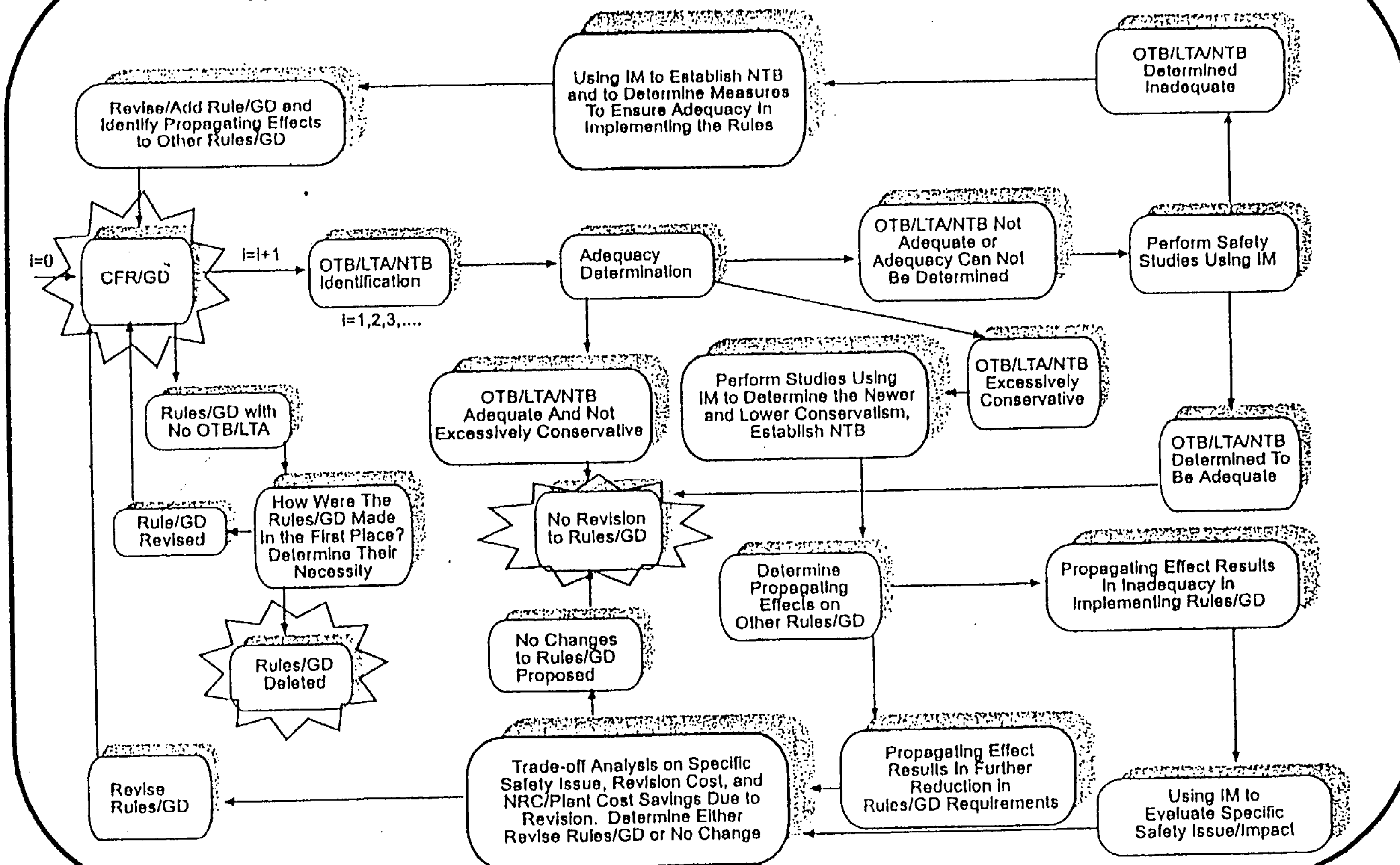
# PRA/DA Integrated Method

PRA/DA Integrated Method Treats Each Rule/GD, Each Sub-Function, and Each Sub-Process as the Integral Parts of the Overall System. It Considers Inter-relationships Between Each Part of the System and Identifies the Induced/Propagated Effects. It Is Efficient and Effective. It Is Consistent and Systematic. It Uses Information From

- NPP Operating Experiences
- Testing Data and Code Calculation Results
- Risk Information (e.g., from IPE)
- Expert Panel on Specific Knowledge Subject
- New Technology (e.g., on Testing and Computation)

ASTM

# RI50 METHDOLOGY IN A GLANCE



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# EXAMPLE – CHALLENGE the OTB

## RG 1.3 – Radiological Consequences of a LOCA

- 25% of Iodine Immediately Available for Leakage
- Atmospheric Diffusion Model for Iodine
- Spray Effectiveness of Removing Iodine

Using risk information, operating experience, new technology in testing and calculation, and better understanding, we ask the question: what should the above values or model be in the economic reality while plant safety is maintained ?

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# ADDRESSING THE WORKSHOP DISCUSSION TOPICS-1

QUESTIONS: Which regulations of 10 CFR Part 50 are candidates for risked-informed revisions; What are the bases for choosing these candidates; and what are the proposed changes to these candidate regulations ?

DISCUSSIONS: Not only the rules in 10 CFR Part 50, but also the NRC Governing Documents (see Definitions on page 3) should be systematically and logically considered in this risk informed effort. The basis should start with the evaluation of the original technical bases and the original logic thinking and assumption to identify any inadequacies or excessive conservatisms within the rules and the governing documents. Proposed revision should be made if it

- supports the goals of this risk informed effort,
- is technically achievable, and
- is economically viable

See earlier discussions on RG1.3

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# ADDRESSING THE WORKSHOP DISCUSSION TOPICS-2

QUESTIONS: Are there problems with the regulations themselves or with their implementations (e.g., regulatory guides, standard review plans, branch technical positions) ?

DISCUSSIONS: There could be a better linkage between the rules and the governing documents (defined on page 3) in specifying where and how the implementation of each rule are recommended. There should be a clear distinction between a Federal Regulation and Guidance in which the first is mandated and the second is the recommended methods for implementing the mandated rules. The detailed content of the guidance, while meeting the requirements of the rules, should not add excessive amount of financial burdens to the users. When the documents implementing the rules (e.g., SAR) does not follow the guidance, the incurred additional time and cost for the review and approval of such documents should be minimized.

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# ADDRESSING THE WORKSHOP DISCUSSION TOPICS-3

QUESTIONS: Are any of the regulations inconsistent or contradictory with other regulations ?

DISCUSSIONS: At this time, there is no regulation found to be inconsistent or contradictory with other regulations. However, the implementation methods recommended in the Guidance Documents (defined on page 3) can unintentionally result in inconsistencies or contradictions with the purposes of other regulations and governing documents. For example, additional piping and structural support have to be added to ensure piping and structural integrity during a double ended pipe break. These additional supports interfere with the ALARA within App. I of 10 CFR Part 50 and 10 CFR Part 20. In addition, the routine test (either tested on-site in a radiologically controlled environment or been sent and tested off-site after decon.) creates additional radiological exposure. On a broader perspective, the none-competitiveness of nuclear electricity generation, partly caused by the excessive conservatisms in the regulations and GD, drives the power industry towards more fossil power which can result in more chemical pollutions that is contradictory with the goals of EPA regulations.

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# ADDRESSING THE WORKSHOP DISCUSSION TOPICS-4

QUESTIONS: Is the current set of design basis accidents appropriate, are any modifications needed ?

DISCUSSIONS: First No, Second Yes. The determination of the current set of design basis accident lacks technical basis and reasonable engineering judgment. Leak Before Break (LBB) is the appropriate scenario regarding coolant loss from piping systems (this, however, does not imply that LBB shall be the BDA). Since double ended cold leg break puts more strict requirements on accident mitigating systems and on NPP operation (e.g., requirements on ECCS systems and programs on containment leak rate test), the modification to BDA is necessary in order to realistically reduce the unnecessary burden. Similarly, some other accident analyses recommended to be performed also lack technical basis and reasonable engineering judgment. These also are the areas where risk informed effort can improve.

ASTM

# IN SUMMARY

**Risk Informed Regulation Effort Can Be Accomplished in a Logical, Systematic, Efficient, and Effective Way To Make Revisions to10 CFR Part 50, Regulatory Guides, Standard Review Plans, Branch Technical Positions, Standard Technical Specifications, and the Use of Codes and Standards In Order To Achieve the Goals of Maintaining Safety and Reducing Burden**

# ASTM

## ADVANCED SYSTEMS TECHNOLOGY AND MANAGEMENT, INC.

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Recipient of

DOE-EM's "Commendation on Performance Indicator Development"
--- Technical Excellence
Assistant Secretary of the Navy's "Certificate of Excellence"
--- Acquisition Reform, Systems Thinking BPR

GSA/BPA Schedules and Partnerships with IT Firms to Realize IT Solutions

## Specialized in Providing Supports & Services in

### Logistics Management Support

Systems Thinking BPR
Program Management
Acquisition Logistics
Staffing and Training
Cost/Performance Analysis
Conduct of Operations Support
Strategic Planning
Project Management
Operations & Maintenance
Resource/Schedule Control
Event/Occurrence Analysis
Regulatory Compliance

### System Engineering

Design and Modeling
Testing and Simulation
Thermal-Hydraulics
Structural Analysis
Software Reliability
Quality Assurance
Procedures and Standards
Life Extension
Probabilistic Risk Analysis
Deterministic Analysis
Fluid Flow & Aerodynamics
Radiation Dose and Shielding
Digital I&C Requirement & Reliability
System Safety/Risk Assessment
Occupational/Public Safety/Health
Decommission & Decontamination

### Research and Development

PRA/DA Integrated Method
Mechanical/Nuclear Research
Standards Development
Software Development
Experimental and Analysis Studies
Performance Indicator Development
Methods on Software Development
Software Validation/Verification Method

### Technology Application

Satellite Technology
Network Systems
Wireless Solutions
Service and Maintenance
High Performance Computer Products
Sound and Multimedia Systems
Advanced Telecommunications
Remote and On-Site Help Desk Support

## Application of Risk Informed Regulation to Future Nuclear Plants

George A. Davis
Director, Government Programs
ABB Combustion Engineering Nuclear Power, Inc.
Windsor, CT

ABB



## ABB CENP Research Projects Under Nuclear Energy Research Initiative (NERI)

- Department of Energy (DOE) has started new nuclear research program for future nuclear technologies
- ABB CENP organized team to submit 3 related proposals, aimed at reducing the costs of future nuclear plants in the U.S.
- The projects, spanning the next 2-1/2 year period, include:
  - **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

## ABB CENP Projects Under NERI

- Team consists of:
  - 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



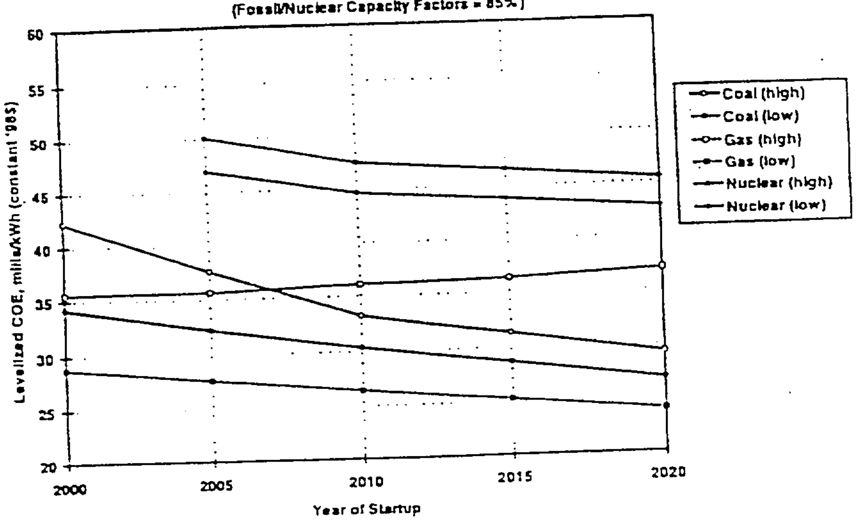
## Common Objective of the 3 DOE NERI Projects

- Deregulation of power industry requires that costs of future nuclear plants be economically competitive with other generating 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 long term U.S. market unless capital costs are reduced by 35% or more

## COE for Coal, Nuclear, and Gas vs Year of Startup

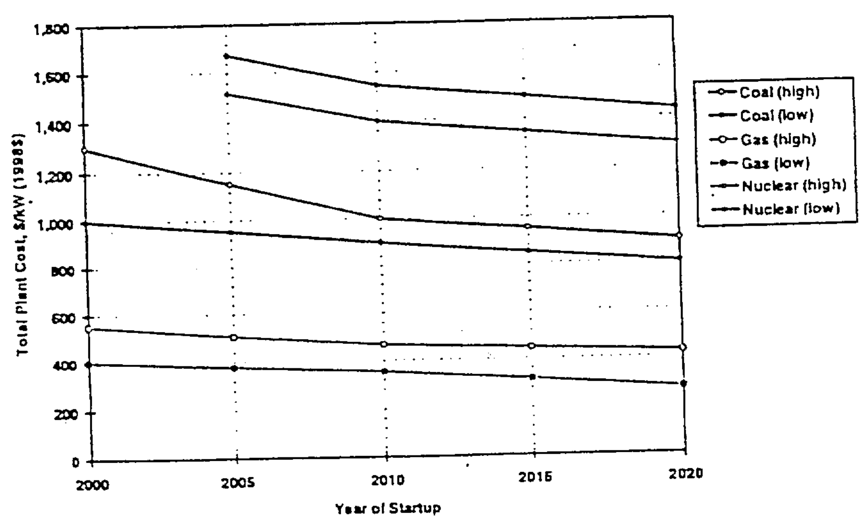
**Based on 20 year book life, EIA fuel cost projections, and no carbon tax**
**(Fossil/Nuclear Capacity Factors = 85%)**




Source: Electric Power Research Institute, 1998 Presentation



## Total Plant Cost for Coal, Nuclear, and Gas vs Year of Startup




Source: Electric Power Research Institute, 1998 Presentation

## Common Objective of the 3 DOE NERI Projects (continued)

- A long-term R&D program (up to 10 years) is needed, to develop a next-generation nuclear plant design that can be economically competitive in a deregulated U.S. power market
- The 3 DOE NERI projects are intended to lay the foundation for such a program

ABB



## NERI Project: Risk-Informed Assessment of Regulatory Requirements

- Project will develop methodologies for using probabilistic risk analyses to "risk inform" NRC requirements and industry standards for new nuclear plants – eliminating or reducing requirements that are costly, but do not significantly contribute to safety
- Nuclear plant designs can then be simplified, by applying new "risk-informed" requirements
- Project will be coordinated with already ongoing programs by NEI, NRC and utilities, for operating plant issues – but, will focus on issues affecting design & construction of new nuclear plants

ABB

## Risk-Informed Work Breakdown Structure

- Task 1: Development of Risk-Informed Methodologies
  - 1A: Identify all applicable current regulatory requirements and industry standards
  - 1B: Identify systems, structures, and components (SSCs) and their associated costs for a typical plant
  - 1C: Develop methodology for risk-informing requirements and standards
  - 1D: Develop methodology for simplifying SSCs
  - 1E: Identify high priority requirements, standards, and SSCs
  - 1F: Apply methodologies from Subtasks 1C and 1D to a sample SSC
  - 1G: Evaluate regulatory processes and develop recommended improvements
  - 1H: Coordinate activities with ongoing efforts of NEI, NRC, and industry

ABB


9 CAD Risk-informed

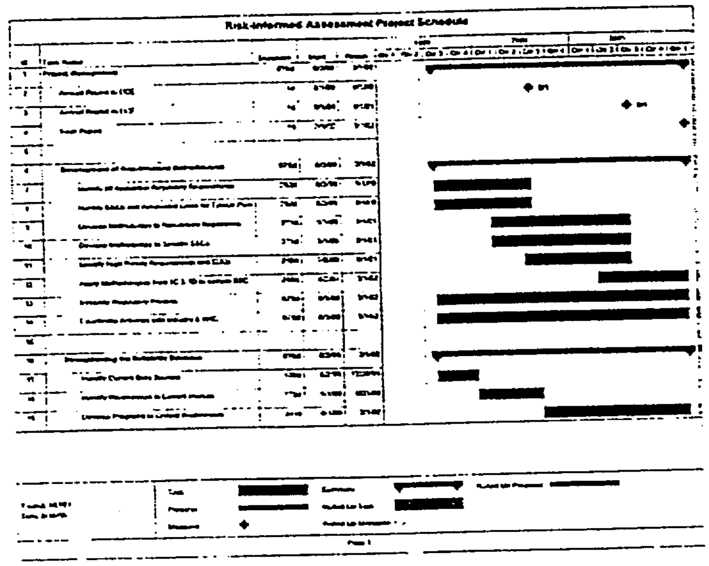
## Risk-Informed Work Breakdown Structure (continued)

- Task 2: Strengthening the Reliability Database
  - 2A: Identify current sources of reliability for SSCs
  - 2B: Identify weaknesses in sources
  - 2C: Develop industry/government programs for correcting the weaknesses

ABB


10 CAD Risk-informed

## Risk-Informed Assessment Project Schedule





## Project Deliverables

- Each subtask will result in a report to DOE that should be publicly available
- A website for this project and the other 2 related NERI projects will soon be set up to provide information to the public on the projects' status, deliverables, and related issues

## Risk-Informed Work Breakdown Structure

- Task 1: Development of Risk-Informed Methodologies
  - 1A: Identify all applicable current regulatory requirements and industry standards
  - 1B: Identify systems, structures, and components (SSCs) and their associated costs for a typical plant
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ABB

## Risk-Informed Work Breakdown Structure (continued)

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SOUTH TEXAS PROJECT

# Risk-Informed Revisions to 10 CFR Part 50, Option 3

September 15, 1999
Rockville, MD

## VISION

**Risk Significance Determination** will be a valuable, decision-making tool in the operation, maintenance, and regulation of nuclear facilities to enhance nuclear safety while efficiently allocating available business resources.

- It's a common sense approach to nuclear power operations.
- It allows the "truly important" components and associated activities to be determined, and the business approach to be adjusted accordingly.

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## OVERVIEW OF EXEMPTION REQUEST

- This request is a scope issue- the regulations will not be changed, only the scope to which the regulations apply will be changed
- Exemption Limited to Low Safety Significant (LSS) or Non-Risk Significant Components (NRS)
- Exemption Limited to the scope to which Special Treatment Requirements and Associated Process Changes are applicable
- STP is Not Seeking an Exemption from Functional Requirements
- LSS or NRS components will still be available to perform their functions
- Effects of Applying the Exemption
  - No wholesale component changeout or reclassification will occur
  - Will be applied in a controlled approach as needs arise
- Exemption Will Enhance Nuclear Safety

3

## OVERVIEW OF EXEMPTION REQUEST

- Exemption Request Will Assist the NRC in Risk-Informing 10 CFR Part 50
  - Request will not adversely impact any of the safety cornerstones in SECY 99-007
  - Request is consistent with SECY 98-300
  - Request corresponds with Option 2 in SECY 98-300
  - Grant of the exemption will provide a template for Option 2 and set the stage for Option 3

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# LIST OF REGULATIONS FOR WHICH AN EXEMPTION IS REQUESTED

| Regulation Request | Scope of Exemption | Justification for Exemption |
|---|---|---|
| **10 CFR 21.3** – Request an exemption to exclude safety-related LSS and NRS components from the scope of the definition of "basic component." | Would not apply procurement, dedication, and reporting requirements in Part 21 to safety-related LSS and NRS components. | Part 21 imposes procurement and dedication requirements and requires the reporting of defects and noncompliances involving components whose failure could cause a "substantial safety hazard." Reporting of defects and noncompliance involving safety-related LSS and NRS components is not necessary to meet the intent of Part 21, because failure of such components would not result in a substantial safety hazard. |
| **10 CFR 50.34(b)(6)(ii)** Request an exemption to the extent that it incorporates provisions from 10 CFR Part 50, Appendix B. | Refer to request for exemption from Appendix B. | Refer to request for exemption from Appendix B. |
| **10 CFR 50.34(b)(11)** – Request an exemption to the extent that it incorporates seismic qualification requirements in Part 100. | Refer to request for exemption from Part 100 | Refer to request for exemption from Part 100. |
| **10 CFR 50.49(b)** – Request an exemption to exclude safety-related LSS and NRS components from the scope of electric equipment important to safety. | ♦ Would not maintain documentation and files specified in Section 50.49 for safety-related LSS and NRS components.<br>♦ Would not maintain such components in a qualified condition.<br>♦ Could replace such a component with an unqualified one.<br><br>Note: Safety-related LSS and NRS components will still be designed to function in installed environment. | Section 50.49 ensures that electrical components important to safety can perform their safety function in a harsh environment during and following a design basis event. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, it is not necessary to maintain such equipment in a qualified condition or to replace such components with qualified components in order to meet the intent of Section 50.49. |

# LIST OF REGULATIONS FOR WHICH AN EXEMPTION IS REQUESTED

| Regulation Request | Scope of Exemption | Justification for Exemption |
|---|---|---|
| **10 CFR 50.54(a)(3)** – Request an exemption from the requirement to seek prior NRC approval for reductions in the commitments in the QA program description involving safety-related LSS and NRS components. | Would not seek prior NRC approval for reductions in commitments in the QA program description related to safety-related LSS and NRS components. | It would be extremely burdensome and prohibitively costly to seek prior NRC approval for each such change. NRC's approval of this exemption request serves the samepurpose as the approval required by this section of the regulations. |
| **10 CFR 50.59(a)(1) and 50.59(b)(1)** – Request an exemption to perform a written safety evaluation of changes in special treatment requirements for safety-related LSS and NRS components. Also request an exemption to seek prior NRC approval for such changes to the extent that they involve an unreviewed safety question. | Would not perform safety evaluations for changes in the special treatment requirements for safety-related LSS and NRS components, and would not seek prior NRC approval for those changes involving an unreviewed safety question. | It would be extremely burdensome and prohibitively costly to perform a 50.59 evaluation and seek prior NRC approval for each such change. NRC's approval of this exemption request serves the same purpose as the approval required by this section of the regulations. |
| **10 CFR 50.65(b)** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs covered by the Maintenance Rule. | Would not perform preventive maintenance or monitor performance for safety-related LSS and NRS components.<br><br>Note: Would still be required to monitor performance on a system/train level with respect to such components. | Section 50.65 monitors the effectiveness of maintenance activities for "safety significant plant equipment" to minimize the likelihood of failures and events caused by lack of effective maintenance. Safety-related LSS and NRS components do not fall within the intent of Section 50.65. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, it is not necessary to perform preventive maintenance (or to monitor the effectiveness of maintenance) for such components in order to meet the intent of Section 50.65. |

# LIST OF REGULATIONS FOR WHICH AN EXEMPTION IS REQUESTED

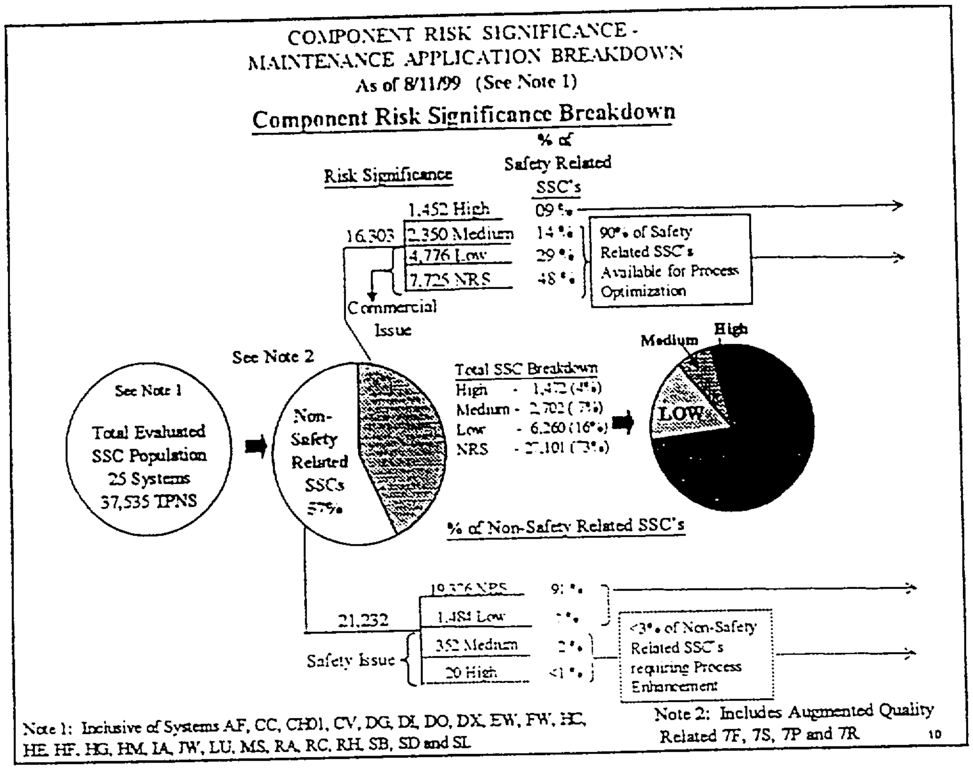
| Regulation Request | Scope of Exemption | Justification for Exemption |
|---|---|---|
| **10 CFR Part 50 Appendix A, GDC 1** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs important to safety under GDC 1. | Would not provide quality assurance for safety-related LSS and NRS components. | Quality assurance provides adequate confidence that SSCs, which prevent or mitigate the consequences of accidents that could cause undue risk to the public health and safety, will perform satisfactorily in service. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, exclusion of such components from the scope of the QA program is consistent with the intent of these regulations. Furthermore, this exemption will not affect any of the functional requirements for the components. |
| **10 CFR Part 50, Appendix A, GDC 2** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs important to safety under GDC 2, to the extent that GDC 2 requires tests, inspections, and documentation to demonstrate that SSCs are designed to withstand the effects of natural phenomena without loss of capability to perform their safety functions. | ♦ Would not maintain safety-related LSS and NRS components in a qualified condition.<br>♦ Could replace safety-related LSS or NRS components with a component that is not qualified.<br><br>Note: Will still satisfy the functional requirements in GDC 2. | These qualification requirements ensure that components important to safety can perform their safety function during and following a design basis event. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. It is unnecessary to maintain the qualification of such components or to replace them with qualified components to meet the intent of these regulations. |

# LIST OF REGULATIONS FOR WHICH AN EXEMPTION IS REQUESTED

| Regulation Request | Scope of Exemption | Justification for Exemption |
|---|---|---|
| **10 CFR Part 50, Appendix A, GDC 4** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs important to safety under GDC 4, to the extent that GDC 4 requires documentation, inspection, and testing to demonstrate that SSCs are able to withstand environmental and dynamic effects. | ♦ Would not maintain safety-related LSS and NRS components in a qualified condition.<br>♦ Could replace such a component with an unqualified one.<br><br>Note: Will still be required to satisfy the functional requirements in GDC 4. | GDC 4 ensures that components important to safety can perform their safety function during and following a design basis event. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, it is not necessary to maintain such equipment in a qualified condition or to replace such components with qualified components in order to meet the intent of GDC 4. |
| **10 CFR Part 50, Appendix A, GDC 18** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs important to safety under GDC 18, to the extent that GDC 18 requires that such components be designed to permit testing of, and that tests be performed for, individual features, such as wiring, insulation, connections, switchboards, relays, switches, and buses. | ♦ Would not need to inspect or test individual safety-related LSS and NRS components within these systems<br>♦ Would not maintain the design of these components to permit such inspections or testing.<br><br>Note: Would still need to conduct system functional tests. | These provisions ensure that Electric Power Systems and important components within these systems can perform their safety function. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, it is not necessary to inspect or test these components to satisfy the purpose of these provisions. |

# LIST OF REGULATIONS FOR WHICH AN EXEMPTION IS REQUESTED

| Regulation Request | Scope of Exemption | Justification for Exemption |
|---|---|---|
| **10 CFR Part 50 Appendix B, Introduction**–Request an exemption to exclude safety-related LSS and NRS from the scope of safety-related SSCs covered by Appendix B (except for Criterion III pertaining to Design Control and Criterion XV and XVI governing non-conformances and corrective actions). | Would not provide quality assurance for safety-related LSS and NRS components, except for design control, control of nonconformances, and corrective action. | Quality assurance provides adequate confidence that SSCs, which prevent or mitigate the consequences of accidents that could cause undue risk to the public health and safety, will perform satisfactorily in service. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. Therefore, exclusion of such components from the scope of the QA program is consistent with the intent of these regulations. Furthermore, this exemption will not affect any of the functional requirements for the components. |
| **10CFR Part 50, Appendix J, B.III**– Request an exemption to exclude safety-related LSS and NRS components from the scope of components requiring local leak rate tests and containment isolation valve leak rate tests. | Would not need to perform local leak rate tests of LSS containment isolation valves and other safety-related LSS or NRS components. | There are numerous, small outboard containment isolation valves in closed systems that are not safety/risk significant, because they would be needed to perform their function only if all of the following occurred 1) there were an accident, 2) a pipe break inside containment involving the system in question, and 3) the in-board containment isolation valve failed. Given the remote possibility of all three of these situations occurring concurrently, there is little or no safety benefit from testing such outboard containment isolation valves. |
| **10 CFR Part 100, Appendix A.VI(a)(1) and (2)** – Request an exemption to exclude safety-related LSS and NRS components from the scope of SSCs covered by these sections, to the extent that these sections require testing, inspection, and documentation to demonstrate that SSCs are designed to withstand the safe shutdown earthquake and operating basis earthquake. | ♦ Would not need to maintain safety-related LSS and NRS components in a qualified condition.<br>♦ Could replace a safety-related LSS or NRS component with a component that is not qualified.<br><br>Note: Will still comply with the functional requirements in these sections of Part 100. | These qualification requirements ensure that components important to safety can perform their safety function during and following a design basis event. By definition, components that are categorized as LSS and NRS do not involve the performance of any significant safety function. It is unnecessary to maintain the qualification of such components or to replace them with qualified components to meet the intent of these regulations. |




## APPLICATION OF RISK INFORMED RESULTS

- Significant enhancements to safety and cost savings to be seen in:
  - Resources focused on true risk important activities (Maintenance, Engineering, Licensing, etc.)
  - Bolster oversight of risk important tasks
  - Streamline non-risk important tasks
  - Parts procurement
  - Scope optimizations
- Anticipate (with full implementation) a reduction in safety-related parts procurement ($1.3 M/yr.)
- Adjustment of periodic preventive maintenance frequencies - > $300K savings in 1999.
- Adjust amount of detail in planned work packages/ documentation
- Streamline scope of required testing

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# Risk-Informed Improvements to NRC Regulations

NRC Workshop on Risk-Informed Revisions to Part 50

Stephen D. Floyd,
Director, Regulatory Reform & Strategy, NEI

NEI

# Risk-Informed Improvements to NRC Regulations

- Objective
- Industry organization & approach
- List of candidate regulations for assessment
- Benefits and need

2 NEI

## Risk-Informed, Performance-Based Regulation -- Objective

- Change 10 CFR 50 and other associated NRC regulations and regulatory guidance to provide an option for implementing the regulations in a more effective & efficient manner
  - Reduce burden while maintaining a comparable level of safety performance
  - Voluntary & selective implementation

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3

## Industry's Four-Part Approach

- Improving NRC oversight process
  - Industrywide Implementation April 2000
- Scope of SSCs governed by NRC requirements
  - Industrywide Implementation 2002
- Improving NRC technical requirements
- Administrative and process improvements
  - Improvements made consistent with other elements

NEI

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# Industry Organization

- NEI Risk-Informed Regulation Working Group
  - 24 senior managers & executives
- Implementation of Risk-Informed Regulation
  - Specific Option 3 NEI task force being formed
  - Other NEI working groups
  - Numerous NEI task forces
- Coordination vital to expedite successful conclusion

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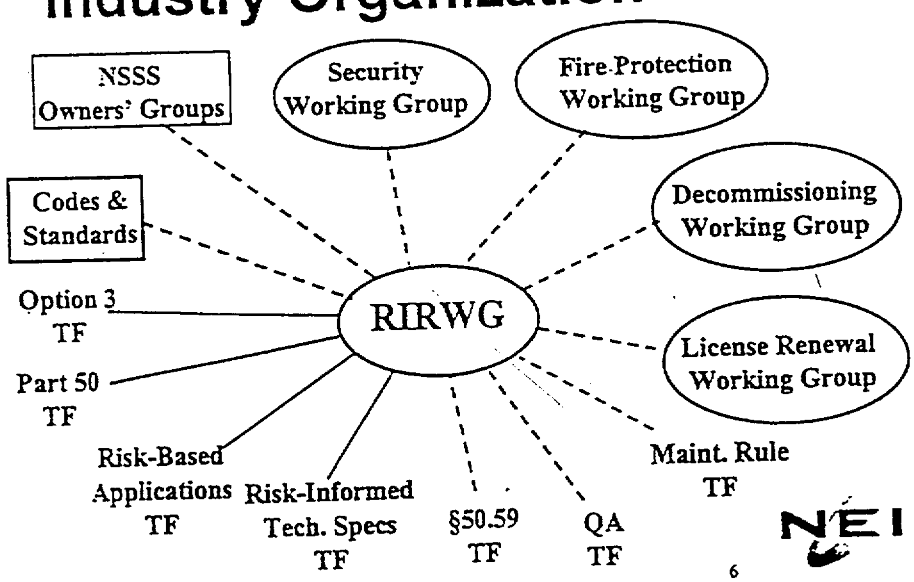
# Industry Organization

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## Improving NRC Technical Requirements

- Build on recent regulatory improvements
  - Improved NRC oversight process
  - Improved Source Term
- Incorporate new information, insights & 30+ years of operating & regulating experience
- Communication & coordination important elements
  - Resolution of cultural issues

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## Improving NRC Technical Requirements

- Identify potential candidate regulations
- Assess the benefit (safety and resource) of amending the regulation & guidance
- Assess alternatives
  - Change can be resource intensive
- Prioritize the list of candidate regulations
- Initiate individual rulemaking proceedings for voluntary and selective implementation

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## Implementation Guidance

- Many regulations are general engineering statements
- Rigidity in interpretation -- an issue
- Implementation guidance must be reviewed and, if necessary, changed
- Assessment phase may conclude that only minimal regulation changes are needed

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## Identification of Candidate Technical Requirements

- Identification Criteria
  - Technical requirements do not permit use of risk insights
  - Regulation does not focus on safety significant attributes
  - Burden in meeting regulation is excessive for achieved safety benefit
  - Regulation is not efficient or effective for regulator

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# Identification of Candidate Technical Requirements

- Identification Criteria Cont'd
  - Changing regulation would minimize need for. exemptions
  - Regulation is inconsistent with revised source term
  - Regulation must be changed to be consistent with another regulation being changed

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# Candidate Regulations Identified to Date for Assessment

- Part 50
  - §50.34
  - §50.36
  - §50.44
  - §50.46
  - §50.47(Onsite Plan)
  - §50.48 (Separate Project)
  - §50.54
  - §50.55a (Lead ASME Code)
  - §50.59
  - Appendix A
- Part 50 cont'd
  - Appendix E (Onsite Plan)
  - Appendix K
  - Appendix R (Separate project – NFPA)
  - Appendix S
- Part 73 (Separate Activity)
- Part 100
  - §100.11
  - Appendix A

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## §50.46 and Appendix K

- Central elements in the process for improving NRC technical requirements through a risk-informed process
- Other regulatory requirements and commitments directly linked to these regulations
- More realistic assumptions, inputs and analyses will impact other regulations and commitments

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## §50.46 and Appendix K Some Options

- Pipe break size?
  - One option – other approaches may be be more cost-beneficial
- Methodology and modeling
- Revised input assumptions and bounding criteria
  - Example: No LOOP

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## Other Candidate Regulations

- §50.36 -- Technical Specifications
  - LCO Criteria
  - Operability vs functionality
- §50.44 -- Hydrogen recombiners
- §50.34 -- Example: TMI requirements
- §50.47 -- Onsite Plan
- §50.49 -- Equipment qualification

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## Other Candidate Regulations

- §50.55a -- Code consistency issues, increased design flexibility, improved testing requirements
- GDCs -- Example of associated topics
  - Diesel generator operating profile
  - Control Room habitability systems & requirements
- Appendix E (Onsite plan)

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## Other Candidate Regulations

- Appendix J
  - Hard-systems within containment -- testing
- Changes to reporting requirements (§50.72 & §50.73)
  - Beyond the current rulemaking proceeding
  - Current rulemaking activity should be completed
- Change process and license conditions
  - §50.59, §50.54,...

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## Benefits

- **Improved focus on those matters that have safety significance**
  - Regulatory scope linked to safety-significant matters
- **Amend and improve NRC regulations using information from:**
  - 30+ years of operating and regulating commercial nuclear power plants
  - New or improved analytical techniques and analyses

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## Benefits

- Increased regulatory flexibility while maintaining safety performance
  - Compatible with the needs of operating in a competitive environment
- More efficient and effective use of resources
- Basis for improvements in new designs

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## Conclusion

- Industry supports NRC initiatives to improve the regulatory regime through a risk-informed, performance-based approach
- Risk-informed, performance-based regulation important to industry's long term future
  - A necessary and natural step forward
- Change is not easy
  - Cultural adjustments & issues
  - Need for constructive interactions
- Change is optional -- so is survival

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