

POLICY ISSUE  
(INFORMATION)

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FOR: The Commissioners  
FROM: William D. Travers  
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SUBJECT: STATUS REPORT ON RISK-INFORMING THE TECHNICAL REQUIREMENTS OF 10 CFR PART 50 (OPTION 3)

- **PURPOSE:**
- **BACKGROUND:**
  - *Risk-Informed Framework:*
  - *Trial Implementation:*
  - *Stakeholder Communication:*
  - **CONCLUSIONS:**

## **PURPOSE:**

To provide the first status report on the work done to date by the staff to study risk-informing the technical requirements of [10 CFR Part 50](#), as described in [SECY-99-264](#) (OPTION 3), and to inform the Commission of the staff's intent to expedite completion of its recommendations for risk-informed changes to certain parts of [10 CFR 50.44](#) ("Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors").

## **BACKGROUND:**

In a June 8, 1999, [SRM on SECY-98-300](#), the Commission approved proceeding with a study of risk-informing the technical requirements of 10 CFR Part 50. The Commission specifically directed the staff to pursue the *"study on an aggressive timetable and provide, for Commission approval, a schedule for this activity. The staff should periodically inform the Commission on progress made in the study...if the staff identifies a regulatory requirement which warrants prompt revision..., the Commission should be...provided with a recommended course of action. ....the staff should provide...a detailed plan...."*

The staff provided its plan and schedule for the study phase of its work to risk-inform the technical requirements of 10 CFR Part 50 (i.e., option 3 of [SECY-98-300](#)), in [SECY-99-264](#), "Proposed Staff Plan for Risk-Informing Technical Requirements in 10 CFR Part 50," dated November 8, 1999. The plan consists of two phases: an initial study phase (Phase 1), where recommendations to the Commission on proposed changes will be made; and an implementation phase (Phase 2), where recommended changes resulting from Phase 1, and approved by the Commission, will be made. The Commission paper ([SECY-99-264](#)) discussed Phase 1 of the plan. In Phase 1, the staff is studying the ensemble of technical requirements contained in 10 CFR Part 50 to (1) identify candidate changes to requirements and design basis accidents (DBAs), (2) prioritize candidate changes to requirements and DBAs, and (3) identify recommended changes to requirements.

The Commission approved proceeding with the plan for risk-informing the Part 50 technical requirements in a February 3, 2000, SRM. In addition, the Commission directed the staff to highlight any policy issues for Commission resolution as early as possible during the process, particularly those related to the concept of defense-in-depth, and to develop a communication plan that facilitates greater stakeholder involvement and actively seeks stakeholder participation.

This paper provides the first periodic status report, as called for in [SECY-99-264](#), on progress made to date by the staff on studying risk-informing the Part 50 technical requirements.

## **DISCUSSION:**

Since initiating the study in November 1999, the staff has accomplished a number of activities, including:

- Developed an initial framework for risk-informing Part 50, including (1) a process for identifying candidate regulations and DBAs based on their risk-significance and their potential for safety benefit or unnecessary burden reduction, and (2) guidelines for application of defense-in-depth and safety margin concepts.
- Performed a trial implementation to test the process described in [SECY-99-264](#).
- Met with stakeholders (both external and internal) to obtain their input on this work.

A summary of the status on each of these tasks follows.


### ***Risk-Informed Framework:***


The staff has developed an initial framework to more clearly define and guide the work to be performed under the three tasks


of Phase 1 described in SECY-99-264. While this preliminary framework has evolved from elements of the safety goal and ongoing risk informed programs, it contains components that could be considered (in their application here) new technical and policy implementation approaches. Risk informed definitions of safety margin and defense in depth, use of risk allocation metrics and application of subsidiary goals for core damage and containment performance are a few of the areas which were developed and included for this preliminary framework. The preliminary framework is an important vehicle for refining our recommended strategies among internal and external stakeholders, and is attached for general Commission information. This framework represents work in progress and it is anticipated that it may change as it is further evaluated and trial implementation proceeds.

A detailed description of the framework is attached ([Attachment 1](#) ); key features include:

- The framework employs an approach that builds upon the defense-in-depth philosophy and the concept of safety margins. Strategies are proposed that delineate the course of action needed to accomplish the goal of protecting public health and safety.
- In defining the proposed strategies, the staff used (1) the concepts of prevention and mitigation (as discussed in the Commission's White Paper on risk-informed and performance-based regulation, dated March 11, 1999), (2) the reactor safety cornerstones (as delineated in the new NRC reactor inspection and oversight program), and (3) the Advisory Committee on Reactor Safeguards (ACRS) recommendations regarding defense-in-depth (as discussed in the ACRS letter to former Chairman Jackson, dated May 19, 1999).
- As a working definition, for use in the study, defense-in-depth is assessed by the application of the following strategies to protect the public:
  - (1) limit the frequency of accident initiating events
  - (2) limit the probability of core damage given accident initiation
  - (3) limit radionuclide releases during core damage accidents
  - (4) limit public health effects caused by core damage accidents
- In implementing the defense-in-depth approach, both deterministic and probabilistic considerations are applied to preserve a reasonable balance among the four strategies, while maintaining the integrity of barriers. The deterministic considerations include addressing what role the single failure criterion should have, for both active and passive components.
- The framework includes quantitative objectives that will be used as guidelines in risk-informing technical requirements to achieve a balance among the four strategies. Quantitative objectives are defined for each strategy and are generally based upon the core damage frequency (CDF) and large early release frequency (LERF) guidelines in Regulatory Guide (RG) 1.174.
- For risk significant accidents in which one or more of the high-level strategies are precluded (e.g., containment bypass accidents), the remaining strategies may be more tightly regulated; that is, regulations should provide a very high confidence in the remaining strategies. Similarly, more stringent requirements may be imposed in the presence of large uncertainties regarding the effectiveness of one of the strategies.
- A working definition for safety margin, for use in the study, is under development. Safety margin is generally imposed to account for uncertainties in data and models used to demonstrate compliance with acceptance criteria.

The framework is used for identifying candidate regulations and DBAs that are candidates for a risk-informed evaluation, for performing the evaluations, and for identifying proposed changes. The staff has performed an initial screening of the regulations and DBAs of 10 CFR Part 50 considering their potential for affecting the reactor safety cornerstones. As a result of this screening, the staff identified 23 regulations and 9 appendices from 10 CFR Part 50 as potential candidates for change (see [Attachment 1](#) .

In the process of risk-informing existing regulations, it is also important to identify risk-significant events not explicitly addressed in current regulations. An initial attempt has been made to find "holes" in the current Part 50 regulations on issues that are important to accident risks (see [Attachment 1](#) ). Some risk-significant accident types and related events do not find any mention in the current regulations. Examples include seal loss of coolant accidents (LOCAs), which are important contributors to pressurized water reactor (PWR) core damage frequencies, and liner melt-through, which can be a significant contributor to LERF for boiling water reactors (BWRs) with Mark I containments. Wherever possible, an attempt will be made to address any identified "holes" in the process of risk-informing related, existing regulatory requirements, rather than propose new regulations.

The staff has been meeting with stakeholders to obtain input regarding the selection and prioritization of candidate regulations to be risk-informed. The Nuclear Energy Institute (NEI) has also surveyed the nuclear industry to identify candidate regulations for risk-informing. The results of this survey, which were provided in a January 19, 2000, letter from Mr. Joe Colvin to Chairman Meserve ([Attachment 2](#) ) , indicated that there are 7 prime candidates for assessment and change, defined as regulations that were identified by at least 5 units, with an estimated potential benefit in excess of \$50,000/unit/year. An additional 15 regulations were identified as possible candidates for improvement. The prime candidates included, among

others, [10 CFR 50.46](#) and 10 CFR 50.44, and a number of general design criteria (GDCs) from Appendix A to Part 50.

The staff is continuing to evaluate and prioritize the list of candidate regulations, based on the potential for safety benefit and unnecessary burden reduction. While continuing to do this, the staff considers 10 CFR 50.46 as a high priority candidate and has initiated work to provide a basis for a staff recommendation to risk-inform this regulation.

For each high priority candidate regulation or DBA, an assessment will be made of the quantitative relationship between the technical concerns and any impacted defense-in-depth strategies. This quantitative assessment focuses on determining the relative importance to the impacted strategies of the specific accident sequences affected by the technical concerns (e.g., for 10 CFR Part 50.44, are the accident sequences affected by the requirements significant contributors to large early release frequency, based on current knowledge and understanding of the various threats to the different containment types?). If the quantitative evaluation indicates that the technical concerns are not important to the impacted strategies, then the technical requirements (concerns) can be examined for possible elimination. The examination for possible elimination would necessarily include consideration of possible interface with other regulatory requirements. However, if the technical concerns of the regulation do significantly impact one or more of the high-level defense-in-depth strategies, then the staff examines how the associated technical requirements are implemented and determines whether or not the potential exists for making risk-informed changes to the requirements. Considering factors such as the relative complexity of the requirements (and their implementation), their impact on other regulatory requirements, the results of more recent analyses, and the potential for safety benefit and/or unnecessary burden reduction, the staff decides either to leave the requirements unchanged or to develop one or more options for risk-informing the requirements and recommends a preferred option to the Commission.

Some preliminary issues have been identified in implementing the framework. These issues, which may require Commission decision in the future, include the following:

- There is a need to address the relationship between the proposed approach and the backfit rule. If, as a result of this study, additional (more stringent) requirements are identified for a particular regulation, should an attempt be made to package these requirements together with relief from unnecessary burden from other requirements associated with the subject regulation, or should the additional requirements be subjected to the backfit rule, and be addressed separately?
- There is a need to address the issue of selective implementation. Should proposed alternatives for different requirements of a regulation be packaged together in order to limit complete selectivity?
- There is a need to address the impact that risk-informing the technical requirements of 10 CFR Part 50 will have on the margin that currently exists between the averaged industry risk profile and safety goal policy. Specifically, as excessive conservatisms are removed from the current regulations, the averaged industry risk profile will move closer to the safety goals.

### ***Trial Implementation:***

As part of the trial implementation, 10 CFR 50.44 ("Standards for Combustible Gas Control System in Light-Water-Cooled Power Reactors") and the regulations associated with special treatment requirements were selected as "test cases" for piloting the process of risk-informing 10 CFR Part 50. Part 50.44 was also identified by some licensees as a good example of a regulation containing non-risk significant requirements that pose unnecessary burden. Part 50.44 involves six technical requirements:

- (1) measuring hydrogen concentrations in containment
- (2) insuring a mixed containment atmosphere
- (3) controlling combustible gas following a LOCA
- (4) adding high point vents
- (5) inerting Mark I and Mark II containments
- (6) adding hydrogen control system to Mark III and Ice Condenser containments

In parallel with the staff's work on risk-informing the technical requirements of 10 CFR Part 50, the staff has recently approved an exemption request for Southern California Edison's San Onofre Nuclear Generating Station (SONGS). The exemption removed the hydrogen recombiners and the hydrogen purge subsystem (which are used for controlling combustible gas concentration) from the SONGS design basis. The staff's approval appears to apply generically to large, dry containments, and is not restricted to the plant-specific design of

SONGS. The SONGS' exemption has made the staff aware that rulemaking is necessary to avoid numerous exemptions that would violate the intent of the rulemaking process.

The staff has identified 10 CFR 50.44 as a regulation that "*warrants prompt revision.*" The staff believes that little to no risk significance or benefit may be associated with some of the technical requirements of this regulation, potentially resulting in unnecessary burden. Consequently, the staff is expediting its plans to submit recommendations on changes to certain parts of the technical requirements contained in 10 CFR 50.44 (e.g., controlling combustible gas following a LOCA) for Commission approval in August 2000. The staff will also be looking at potential safety enhancements associated with risk-informing 10 CFR 50.44, including consideration of the need to ensure the availability of hydrogen igniters during station blackouts at plants with Mark III and ice condenser containments, and will submit additional recommendations on changes to other parts of

10 CFR 50.44 later in the year.

The staff is also currently reviewing the requirements contained in 10 CFR Part 50 that are associated with special treatment requirements (e.g., environmental qualification or quality assurance requirements). Under Option 2 of SECY-98-300, the staff is pursuing changes to the categorization of structures, systems and components (SSCs) in terms of the special treatment required (as discussed in [SECY-99-256](#)), but is not addressing changes to the actual special treatment requirements. Under Option 3 of SECY-98-300 (the topic of this paper), the staff may recommend changes to both the categorization and treatment of SSCs (including, for example, elimination of redundancies or inconsistencies in the special treatment requirements, and reconsideration of accident conditions required for equipment qualification). Efforts to risk-inform the special treatment requirements under Option 3 of SECY-98-300 are being closely coordinated with the efforts under Option 2.

### ***Stakeholder Communication:***

The staff held its first public workshop with stakeholders on September 15, 1999. This workshop was attended by approximately 60 people, including representatives from the staff, the nuclear industry, citizens' organizations, consultants, and private industry. Stakeholder feedback included:

- Problems are more with the implementing documents than the regulations.
- No consensus was identified among the stakeholders regarding candidate changes for top priority, although 50.44 and 50.46 were mentioned.
- The design basis concept should be kept although it might result in a new and different set of design basis accidents.
- For future reactors, the staff should consider more comprehensive revision.

A second public workshop was held recently on February 24 and 25, 2000. This workshop was attended by approximately 50 people, including representatives from the staff, the nuclear industry, citizens' organizations, state governments, consultants, and private industry. The main feedback received from stakeholders included:

- General agreement exists with the approach and guidelines (i.e., the framework).
- The approach should also:
  - Maintain consistency with the plant oversight process,
  - Address the impact on workers, and
  - Consider the Option 2 scope as a key factor in deciding what a risk-informed Part 50 should address.
- There is a need to ensure good communication with owner's groups and industry programs.
- Consideration should be given to studying emergency planning in the future.
- A recommendation was made to expedite changes to 10 CFR 50.44.
- Industry wants selective implementation.

In addition, the staff has had several discussions with the ACRS (both the sub- and the full committee) and plans to continue to meet with them on a regular basis. The staff has also created an interactive Web site. (The Web site is accessed via the NRC Web site under the Nuclear Reactors icon, and then selecting the "Risk-Informing Part 50, Option 3" line item.) As information is ready for stakeholder review, it is posted on this Web site (and placed in the public document room for those who do not have internet access). Also, stakeholders can provide comments directly to the staff on this Web site.

Lines of communication have also been established with industry organizations regarding risk-informing 10 CFR 50.46 and 50.44. Coordination between the staff's 10 CFR Part 50 risk-informing activities and related activities that the Westinghouse Owners Group (WOG) is currently pursuing on 10 CFR 50.46 has been initiated by way of a public meeting that was attended by NEI and all of the reactor supplier owners groups. Regarding risk-informing 10 CFR 50.44, a conference call was held with the BWR Owners Group (BWROG) to explore possible coordination between the staff's and the BWROG's activities.

### **CONCLUSIONS:**



The following summarizes the staff's accomplishments to date related to its effort to study risk-informing the technical requirements of 10 CFR Part 50:

- The staff has developed an initial framework for risk-informing Part 50 (which incorporates definitions and guidelines for defense-in-depth and safety margins). This framework is currently undergoing internal review to allow formulation of a staff consensus framework.
- The staff is expediting completion of its recommendations to the Commission for proposed modifications to 10 CFR 50.44.
- The staff has initiated work to risk-inform 10 CFR 50.46.
- The staff is frequently interacting with stakeholders on risk-informing 10 CFR Part 50.

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Attachments: 1. ["Framework for Risk-Informing Regulations"](#)   
2. [Letter from Joe Colvin, NEI, to Chairman Meserve, dated January 19, 2000](#) .