



NUCLEAR ENERGY INSTITUTE

**Ralph E. Beedle**

SENIOR VICE PRESIDENT AND  
CHIEF NUCLEAR OFFICER,  
NUCLEAR GENERATION

June 8, 2001

Mr. Samuel J. Collins  
Director, Office of Nuclear Reactor Regulation  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

Dear Mr. Collins:

Enclosed for NRC's use and information is a paper describing industry's plan to achieve substantive risk-informed improvements to technical specifications. This effort has been underway for over two years, and the paper has been prepared to facilitate wider understanding of the purpose, benefits, elements, and schedule for this project. The risk-informed technical specification project provides an opportunity for NRC and industry to achieve tangible safety enhancements and regulatory improvements in a timely manner, without the need for rulemaking. We request NRC's continuing support of this activity.

Last year's maintenance rule revision established requirements for a risk-informed process to assess and manage plant configuration for maintenance activities. However, the deterministic structure of technical specifications was unaffected, thus creating potential conflicting requirements. Risk-informing technical specifications is a logical followup to the maintenance rule revision, and seeks to reduce conflicting requirements and optimize plant configuration control from a risk perspective.

The project consists of a series of initiatives, several of which are interrelated as described in the enclosure. Two of the initiatives, addressing missed surveillances and mode change restrictions, have already been submitted to NRC. These first two initiatives serve as proof of concept regarding integration of risk management concepts into technical specifications, and NRC's approval will enable sustained momentum as we proceed with the more substantial initiatives.

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We look forward to further dialogue with NRC senior management and the Commission on this activity, and hope the enclosure will assist your understanding of this effort. Please contact Tony Pietrangelo (202-739-8081) or me if you need further information.

Sincerely,

A handwritten signature in black ink, appearing to read "R. Beedle". The signature is fluid and cursive, with a large initial "R" and a long, sweeping underline.

Ralph E. Beedle

Enclosure

c: Brian W. Sheron  
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*Risk-Informed Technical Specifications*

**Project Description**

Nuclear Energy Institute  
June 2001

# **Risk-Informed Technical Specifications Project Description**

## **Purpose of Paper**

Risk-informed improvements to technical specifications have the potential for safety benefits and improved plant performance. This paper serves as a vehicle to communicate the industry's activities to achieve risk-informed improvements to operating plant technical specifications. It is intended to inform various stakeholders in this effort, including industry, NRC, and other parties that may have an interest. The paper serves as a means to coordinate and integrate industry activities, and to provide the status and milestones of the various industry initiatives that make up the improvement project. It will be periodically updated to reflect progress achieved.

## **Need for Change**

Plant configuration control requirements have, until last year, been solely contained in the technical specifications, which are an appendix to the plant operating license. 10 CFR 50.36 provides the general requirements for the content of technical specifications, and changes to the technical specifications are controlled through 10 CFR 50.90 (license amendments) and 50.92 (no significant hazards analysis and opportunity for public participation). Technical specifications address configuration control through specifying time limits for equipment out of service, and actions, generally leading to plant shutdown, when the out of service times are exceeded. Technical specifications are primarily based on the deterministic design basis accidents, and do not consider the plant risk impact as a factor in the action requirements. Further, technical specifications are not intended to consider the synergistic effects of multiple out of service conditions.

Industry has achieved substantial gains in plant capacity factors over the last several years through reduced planned outage duration and increased use of on-line maintenance. Plant maintenance generally involves temporary impacts on equipment availability that are balanced by increased reliability. It is recognized that plant configuration control decisions can have non-negligible temporary impacts on plant risk profiles. Accordingly, in November of 2000, a risk-informed plant configuration control provision was added to the maintenance rule, 10 CFR 50.65, requiring assessment and consideration of risk prior to performance of both online and shutdown maintenance. Industry developed guidance to accompany this rulemaking through a revision to the maintenance rule implementation guideline. That document, NUMARC 93-01, revision 3, provides guidance on the use of quantitative probabilistic safety assessment (PSA), qualitative risk assessment, and plant operating experience to assess plant risk due to maintenance activities. It also provides guidance on actions that may be taken to manage the risk as determined by the assessment. The guidance also incorporates the shutdown risk management approach of NUMARC 91-06, which is based on preservation of key shutdown safety functions.

It is recognized that the configuration control requirements of technical specifications (deterministic) and the maintenance rule (risk informed) may be in conflict; however, the licensee is required to comply with both, resulting in limitations on configuration control flexibility that are unrelated to plant safety. The intent of risk-informed technical specifications is to address the incompatibilities between these methods, and provide a single, consistent approach for plant configuration control.

## **Benefits**

Several benefits would accrue from the successful transition to risk-informed technical specifications. The first benefit would be improved plant capacity factors through avoidance of forced shutdowns due to technical specification requirements. In many circumstances where shutdown is called for, it is not the most risk-effective course of action, and these situations are currently addressed on an as-needed, real time basis through the NRC enforcement discretion process. This process involves the application of risk informed methods to justify a one time avoidance of the shutdown, with NRC review and approval. Avoidance of enforcement discretion would save licensee and NRC resources, eliminate the need to seek "exceptions" to requirements, remove the uncertainty of outcome associated with the current process, and provide enhanced consistency and uniformity of methods.

The second benefit would be optimization of on-line maintenance flexibility, with the attendant benefit of further reduction in outage duration. Currently, plants have generally optimized their on-line maintenance activities to the extent achievable within the existing technical specifications, and have achieved shorter planned outage durations. Some additional improvement could be facilitated through risk-informed technical specifications.

The third benefit would be reduction of licensee and NRC resource requirements following conversion to the risk-informed technical specifications. The need to seek future line item improvements should be substantially eliminated, since the risk-informed technical specifications, if properly designed, should contain inherent flexibility. Processing of license amendment requests currently accounts for a significant portion of NRC's resources, and licensee review fees.

Another benefit is that technical specifications are directly amenable to the use of risk analyses, as they address times (out of service times, action times, and test frequencies) and equipment availabilities that can be quantified in a relatively straightforward manner. Finally, it is anticipated that substantial reforms can be realized under the current regulation, 10 CFR 50.36, without the need for rulemaking.

## **Background**

Most plants have converted to improved standard technical specifications, although some plants still use early custom technical specifications. NRC maintains a NUREG document that represents the improved standard technical specifications (ITS) for each reactor vendor. Revision 2 of these NUREGs was recently issued by NRC. Changes to the ITS NUREGs are coordinated through the NEI technical specification task force (TSTF). Changes are generally proposed by the owners groups, and the TSTF prepares an ITS change package called a "traveler". The traveler is submitted to NRC for approval and incorporation into subsequent revisions of the ITS NUREG.

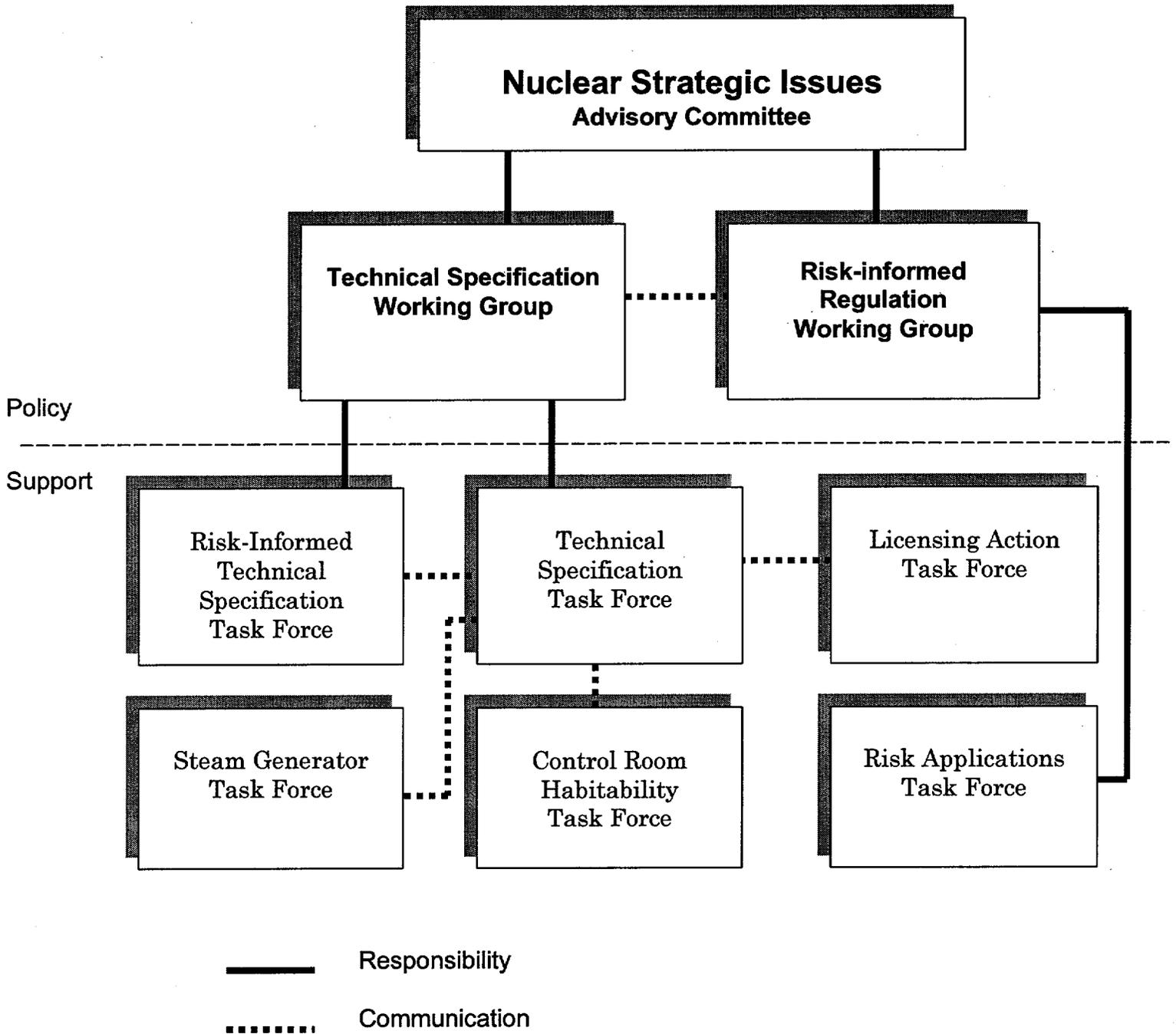
NRC has recently developed the consolidated line item improvement process (CLIIP) for regulatory approval of travelers incorporating proposed changes to ITS. Initiatives developed under the risk-informed technical specifications effort will be treated through this process, which is described in NRC Regulatory Information Summary 2000-06.

NRC Regulatory Guides 1.174 and 1.177 provides the general considerations and approach for licensees to develop risk informed allowed outage time extensions for specific equipment in technical specifications. Over the past several years, most plants have requested such changes using risk-informed approaches. These changes have been developed by individual plants or by owners groups, and are generally not reflected in the revised ITS NUREGs. NRC has approved these changes on the basis of individual reviews, including focused NRC review of the PRA models used to develop the risk insights supporting the change.

In 1999, NEI formed the risk informed technical specifications task force (RITSTF) to develop consistent industry approaches to apply risk insights to technical specification reform, and build on the previous ad-hoc activities of the owners groups. In 2000, NEI formed the technical specification working group (TSWG) to provide oversight and policy direction relative to technical specifications issues. Figure 1 depicts the industry organizational structure. The TSWG coordinates closely with the NEI risk-informed regulation working group, which oversees NEI's risk-informed Part 50 efforts and related PRA issues.

Figure 1 includes industry task forces addressing control room habitability, and steam generator issues, because these groups are developing revised technical specifications relative to these systems. There is a potential for risk insights to be used in the development of these specifications.

**Figure 1 – Industry Structure**



## Initiatives

The program encompasses eight separate initiatives to improve existing technical specification configuration control requirements through use of risk insights. Risk-informed approaches consider a spectrum of initiating events, and their probabilities of occurrence, as opposed to deterministic approaches, which assuming the occurrence of specific design basis events. For technical specifications, risk-informed approaches can provide significant improvements in safety, because they consider dependencies, support systems, and other elements important to plant configuration control.

The first three initiatives apply risk-informed concepts to limited, specific configuration control provisions of existing specifications. The remaining initiatives will seek more comprehensive reforms to the structure and approach of technical specifications. The first three initiatives are well underway. They are expected to be achieved through general qualitative risk insights derived for the various reactor types, developed by the NSSS owners groups, and through reference to the existing maintenance rule (a)(4) programs. The initiatives' descriptions and schedules for submittal are as follows:

Initiative	Schedule for NRC submittal
1. Change end states for action requirements from cold shutdown to hot shutdown	CE and BWR topical reports submitted. TSTF will initially apply to CE and BWRs only.
2. Eliminate requirement for unit shutdown in event of unintentionally missed surveillance	Submitted in September 2000.
3. Increase flexibility in mode restraints	Submitted in March 2001
4. Replacement of allowed outage times with configuration risk management approach	Submit TSTF by end of 2001
5. Replacement of specific surveillance intervals with risk informed methodology	Submit methodology by end of 2001
6. Modify LCO 3.0.3, which calls for rapid plant shutdown if outside scope of existing LCOs	CEOG topical submitted to NRC. CEOG responding to RAI.
7. Non technical specification design features impact on technical specification LCO	Submit TSTF by end of 2001
8. Remove/relocate all non safety systems and non risk significant systems out of scope of technical specifications	TBD

## **Discussion of Initiatives**

### **Initiative 1: Revise action requirements, where appropriate, to specify hot shutdown versus cold shutdown as endstate.**

Current technical specification action requirements generally require that the unit be brought to cold shutdown when the limiting condition for operation for a technical specification system has not been met. Depending on the system, and affected safety function, the requirement to go to cold shutdown may not represent the most risk effective course of action. For example, steam driven equipment that could be used as a source of injection or makeup is rendered nonfunctional during cold shutdown, thus removing a potential success path for mitigation of initiating events. To address this situation, each owners group will prepare a qualitative risk analysis providing the basis for changes to this action requirement where appropriate (generally changing the end state from cold shutdown to hot shutdown). The CEOG and BWROG analyses have already been submitted to NRC. The revised technical specification pages (traveler) will be submitted following issuance of NRC safety evaluations on these reports. The remaining owners groups will develop technical bases to support their inclusion in this initiative later this year.

### **Initiative 2: Revise requirement to shutdown in event of missed surveillance**

Existing technical specifications require that the limiting condition for operation be entered, potentially leading to a plant shutdown requirement, if a missed surveillance cannot be performed within a specified grace period following discovery. In certain cases, a missed surveillance cannot be performed without a mode change, and the risk impact of a mode change is generally greater than that involved in deferring the surveillance. In most cases, the equipment remains capable of performing its function even though a surveillance has been missed. The proposed change allows that a missed surveillance may be treated as an emergent condition and rescheduled through the licensee's 10 CFR 50.65(a)(4) configuration risk management program for performance at the appropriate opportunity, up to the time of the next schedule surveillance. The change is not intended to allow intentional missing of surveillances, and all missed surveillances must be entered into the plant's corrective action program, which is subject to NRC inspection.

### **Initiative 3: Increased flexibility in mode restraints**

LCO 3.0.4 specifies that the plant cannot go to higher modes (move towards power operation) unless all technical specification systems normally required for the higher mode are operable. (There are some existing exceptions to this requirement). In contrast, if already in the higher mode, and the same system is inoperable, plant operation is allowed to continue for the duration of the allowed outage time. The purpose of this initiative is to

resolve this discrepancy, by allowing entrance into the higher mode with the system inoperable, and entering the LCO applicable to the higher mode. This provides additional operational flexibility and, for the majority of systems, does not represent a risk increase from the current requirements. Each owners group has prepared a generic qualitative risk analysis comparing the at-power risk with the risk in lower modes. These evaluations have identified a limited number of systems that should retain the restriction on entering the mode of applicability, unless justified by plant specific analysis. A plant mode change, with equipment out of service, is also required to be evaluated under 10 CFR 50.65(a)(4), with regard to the prevailing plant configuration, and this evaluation must be taken into account in addition to the above qualitative risk analyses.

#### Initiative 4: Use of configuration risk management to extend allowed outage times

Current technical specifications contain equipment-specific outage times, limiting conditions for operation, and action statements (e.g., if the diesel generator is inoperable, restore within 7 days. If not restored, take actions to proceed to plant shutdown within 24 hours.) Current technical specifications address systems that directly support other systems, but otherwise do not generally account for the combined risk impact of multiple concurrent out of service conditions. The maintenance rule configuration risk assessment requirement was added to address this consideration, but does not obviate compliance with current technical specifications requirements. These current requirements may present inconsistencies with the maintenance rule requirement, and may require plant shutdown, or other actions, that are not the most risk-effective actions given the specific plant configuration. The overall objective of this initiative is to modify the technical specifications to reflect a configuration risk management approach that is more consistent with the maintenance rule (a)(4) approach.

The scope of this initiative is limited to those action requirements and limiting conditions for operation that address configuration and operability of plant equipment, and are thus amenable to a risk assessment process. Existing technical specification actions and limiting conditions relative to plant parameters, such as fuel limits, pressure limits, or power-flow distribution maps, would not be affected. Further, this initiative applies to systems, components, and equipment that are explicitly addressed by technical specifications. Initiative 7 addresses the treatment of design features that are implicitly captured into technical specifications through the definition of OPERABILITY.

The intent of this initiative is to address situations where the equipment's primary safety function is not available. Initiative 7 is intended to address situations where design features required for low probability initiating events are degraded, but the system's primary safety function is maintained.

Under the current technical specifications, if the licensee encounters an equipment out of service condition resulting in a shutdown requirement that is contrary to the actual risk

significance, the licensee would likely contact NRC and request expedited notification of enforcement discretion, using the risk analysis to support a one-time deferral of the shutdown requirement for an agreed-upon time frame. This initiative can be viewed as establishing a uniform action for this process, and codifying it into the technical specifications themselves.

A fundamental consideration is the scope and quality of the risk analysis necessary to support adaptation. Analysis scope (e.g., the need or expectation to quantitatively address fire and other external events, shutdown risk, and transition risk) is of particular importance, as there are currently few plants with full scope risk analyses. A related issue involves the degree to which the approach can be tailored to accommodate different levels of risk analysis scope and/or quality. A final issue involves the need to delineate risk management actions (based on the risk assessment results) in a more explicit fashion than currently allowed through the (a)(4) implementation guidance. However, the basic philosophy and approach of the (a)(4) guidance should provide an appropriate foundation for this activity.

The configuration risk management approach can be adopted to the existing format and content of technical specifications, without the need for rulemaking to 10 CFR 50.36. This is effected through the following modifications:

1. Develop a "backstop" allowed outage time (beyond the current AOT), that would provide the maximum risk-informed outage time for a specific system. The intent is to preserve the design basis and not allow de facto permanent plant changes through extended equipment outages for low risk significant systems. The existing allowed outage time would also be maintained as an option, should the plant not wish to use the configuration management approach (see item 2 below) for a given situation. However, even in this case a maintenance rule (a)(4) assessment would always be required.
2. Provide an alternative action requirement, upon entry into an LCO, to perform a configuration risk assessment and determine an appropriate allowed outage time, up to the backstop, reflective of the existing plant configuration (and subject to change based on emergent conditions).
3. Delineate requirements for timely performance of the assessment and performance of risk management actions, up to plant shutdown, based on the assessment result.
4. Add a programmatic description of the configuration risk management program to the administrative controls section.

In addition to the above, a longer-term approach is under consideration to provide more significant changes to the fundamental structure of technical specifications. This would require rulemaking to 10 CFR 50.36, and would replace the current system of allowed

outage times, limiting conditions for operation, action requirements, and surveillance requirements in its entirety. The new structure would include requirements to manage and maintain risk metrics (e.g., core damage, large early release) within specified values, addressing instantaneous risk, integrated risk, and cumulative risk.

Initiative 5: Removal of surveillance test intervals to licensee controlled risk-informed program

Current technical specifications provide specific surveillance requirements and surveillance test intervals. Compliance with these requirements is necessary to retain operability of the equipment, and avoid entrance into action requirements. The surveillance requirements address function of the primary safety systems as well as instrumentation and control logic, etc.

The goal of this initiative is to develop a risk-informed process that would establish surveillance intervals based on risk insights, equipment availability and reliability factors, performance history, etc. Upon development and approval of this process, the intent would be to retain the existing surveillance requirements in the technical specifications, but to remove the equipment-specific surveillance test intervals. Test intervals would be controlled through the above process and described in a licensee controlled document. Fundamental considerations for the methodology to derive risk-informed surveillance intervals should not differ substantially from those previously addressed in the development of risk-informed inservice testing, as approved by NRC.

Initiative 6: Modify limiting condition for operation 3.0.3

This LCO provides for immediate action to initiate plant shutdown if a specific LCO is not met, and its associated actions are not met. This LCO covers many potential situations, and for some of these, immediate plant shutdown is not the most risk effective course of action for the specific configuration. A configuration risk management approach, similar to that described in initiative 4 above, can be employed to determine more appropriate allowed outage times. Additionally, configuration-specific AOTs could be developed for certain configurations that currently result in entrance into Technical Specification 3.0.3 (this is essentially a pre-evaluated risk analysis). The same general considerations apply to this initiative as to initiative 4.

Initiative 7: Provide deferred entry into LCO for degraded conditions involving design features that are not specifically addressed by technical specifications

Currently, the definition of OPERABILITY requires that a system or device be capable of performing its specified safety functions, and if not met, the limiting condition for

operation (LCO) must be entered, often leading to plant shutdown requirements. The specified safety functions are derived from the accident analyses described in the updated final safety analysis report. Currently, the LCO may be entered because the ability to function in a postulated design basis event is temporarily affected by a maintenance activity, or other condition in the plant. Often, the postulated event is a very low probability occurrence, and the overall safety function is still available for the vast majority of anticipated challenges. As an example, an injection system may be fully capable of delivering design flow and pressure, but its ability to function following a high-energy line break may be affected because barriers pertinent to that function are temporarily affected by maintenance activities.

NRC generic letter 91-18 provides general guidance on the treatment of degraded conditions with respect to operability; however, this guidance is limited with respect to treatment of maintenance activities, is not risk-informed, and predates the promulgation of the maintenance rule configuration assessment requirement. Implementation guidance for this section of the maintenance rule discusses the need to address temporary plant alterations through risk analysis and management, but the use of the (a)(4) approach does not relieve technical specification compliance issues. Thus, the intent of this initiative is to reduce existing inconsistency with the maintenance rule relative to design features not contained directly in the technical specifications. A similar issue exists relative to component lists (e.g., snubbers, containment penetration overcurrent protection, and motor thermal overloads) that were removed from the body of technical specifications through the improved standard technical specifications, but whose function is implicit to operability. Initiative 7 could not address these items, as they will be handled through a separate effort.

The goal of this initiative is to develop a risk-informed approach that allows for deferred entry into an LCO for situations involving temporary degradation of design features. The deferral time would be a function of the frequency of the initiating event for which the design feature provides protection. The maintenance rule (a)(4) assessment would be controlling, since it addresses the specific plant configuration at the time of the degradation, but the deferral time would be expected to be consistent with the (a)(4) approach for most situations.

The proposed change would be effected through a new limiting condition for operation, 3.0.9, which would reference a basis listing of the deferral times. Simplified risk analysis, based on initiating event frequencies, would be used to determine the deferral times. Some restrictions may be necessary relative to simultaneous treatment of redundant trains.

Initiative 8: Remove/relocate non-safety systems and non-risk significant systems out of scope of technical specifications

This initiative would reform the scope of technical specifications to address systems that truly meet the current 50.36 scoping criteria. Some systems in existing standard technical specifications are not believed to meet the three deterministic criteria, nor to be risk significant. A more fundamental consideration for long term technical specification reform, should rulemaking be considered, would be to modify the scope to address only risk significant systems.