U.S. NUCLEAR REGULATORY COMMISSION

August 1998

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 1.175

(Draft was issued as DG-1062)

AN APPROACH FOR PLANT-SPECIFIC, RISK-INFORMED DECISIONMAKING: INSERVICE TESTING

A. INTRODUCTION

Background

During the last several years both the U.S. Nuclear Regulatory Commission (NRC) and the nuclear industry have recognized that probabilistic risk assessment (PRA) has evolved to be more useful in supplementing traditional engineering approaches in reactor regulation. After the publication of its policy statement (Ref. 1) on the use of PRA in nuclear regulatory activities, the Commission directed the NRC staff to develop a regulatory framework that incorporated risk insights. That framework was articulated in a November 27, 1995, paper to the Commission (Ref. 2). This regulatory guide, which addresses inservice testing (IST) of pumps and valves, and its companion regulatory documents (Refs. 3-8) implement, in part, the Commission policy statement and the staff's framework for incorporating risk insights into the regulation of nuclear power plants.

The NRC's policy statement on probabilistic risk analysis encourages greater use of this analysis technique to improve safety decisionmaking and improve regulatory efficiency. One activity under way in response to the policy statement is the use of PRA in support of decisions to modify an individual plant's IST program. Licensee-initiated IST program changes that are consistent with currently approved staff positions (e.g., regulatory guides, standard review plans, branch technical positions) are normally evaluated by the NRC staff using traditional engineering analyses. In such cases, the licensee would not be expected to submit risk information in support of the proposed change. Licensee-initiated IST program change requests that go beyond current staff positions may be evaluated by the staff using traditional engineering analyses as well as the risk-informed approach set forth in this regulatory guide. A licensee may be requested to submit supplemental risk information if such information is not provided in the proposed risk-informed inservice testing (RI-IST) program submitted by the licensee. If risk information on the proposed RI-IST program is not provided to the staff, the staff will review the information provided by the licensee to determine whether the application can be approved based upon the information provided using traditional methods, and the staff will either approve or reject the application based upon the review. For those licensee-initiated RI-IST program changes that a licensee chooses to support (or is requested by the staff to support) with risk information, this regulatory guide describes an acceptable method for assessing the nature and impact of proposed RI-IST program changes by considering engineering issues and applying risk insights. Licensees submitting risk information should address each of the principles of risk-informed regulation discussed in Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (Ref. 3) and repeated in this guide. Licensees should identify how chosen approaches and methods (whether they are quantitative or qualitative, traditional or probabilistic), data, and criteria for considering risk are appropriate for the decision to be made.

IST of snubbers was not addressed in this regulatory guide, however, licensees interested in implementing a RI-IST program for snubbers may submit an alternative to the NRC for consideration.

Relationship to the Maintenance Rule 10 CFR 50.65

The Maintenance Rule, Section 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that licensees monitor the performance or condition of structures, systems, or components (SSCs) against licensee-established goals in a manner sufficient to provide reasonable assurance that such SSCs are capable of fulfilling their intended function. Such goals are to be established, where practicable, commensurate with safety, and they are to take into account industrywide operating experience. When the performance or condition of a component does not meet established goals, appropriate corrective actions are to be taken.

Component monitoring that is performed as part of the Maintenance Rule implementation can be used to satisfy monitoring needs for RI-IST, and for such cases, the performance criteria chosen should be compatible with both the Maintenance Rule requirements and guidance and the RI-IST guidance provided in this guide.

Purpose and Scope

Current IST programs are performed in compliance with the requirements of 10 CFR 50.55a(f) and with Section XI of the ASME Boiler and Pressure Vessel Code (Ref. 9), which are requirements for all plants. This regulatory guide describes an acceptable alternative approach applying risk insights from PRA to make changes to a nuclear power plant's IST program. An accompanying Standard Review Plan (SRP) (Ref. 7) has been prepared for use by the NRC staff in reviewing RI-IST applications. Another guidance document, Regulatory Guide 1.174 (Ref. 3), is referenced throughout this report. Regulatory Guide 1.174 provides overall guidance on the technical aspects that are common to developing acceptable risk-informed programs for all applications such as IST (this guide), inservice inspection, graded quality assurance, and technical specifications.

This regulatory guide provides application-specific details of a method acceptable to the NRC staff for developing RI-IST programs and supplements the information given in Regulatory Guide 1.174. This guide provides guidance on acceptable methods for utilizing PRA information with established traditional engineering information in the development of RI-IST programs that have improved effectiveness regarding the utilization of plant resources while still maintaining acceptable levels of quality and safety.

In this regulatory guide, an attempt has been made to strike a balance in defining an acceptable process for developing RI-IST programs without being overly prescriptive. Regulatory Guide 1.174 identifies a list of high-level safety principles that must be maintained during all risk-informed plant design or operational changes. Regulatory Guide 1.174 and this guide identify acceptable approaches for addressing these basic high-level safety principles; however, licensees may propose other approaches for consideration by the NRC staff. It is intended that the approaches presented in this guide be regarded as examples of acceptable practice and that licensees should have some degree of flexibility in satisfying regulatory needs on the basis of their accumulated plant experience and knowledge.

Organization

This regulatory guide is structured to follow the approach given in Regulatory Guide 1.174. The discussion, Part B, gives a brief overview of a four-element process described in Regulatory Guide 1.174 as applied to the development of an RI-IST program. This process is iterative and generally not sequential. Part C, Regulatory Position, provides a more detailed discussion of the four elements including acceptance guidelines. In Part C, Regulatory Position 1 addresses the first element in the process in which the proposed changes to the IST program are described. This description is needed to determine what supporting information is needed and to define how subsequent reviews will be performed. Regulatory Position 2 contains guidance for performing the engineering evaluation needed to support the proposed changes to the IST program (second process element). Regulatory Position 3 addresses program implementation, performance monitoring, and corrective action (third element). Regulatory Position 4 addresses documentation requirements (fourth element) for licensee submittals to the NRC and identifies additional information that should be maintained in the licensee's records in case later review or reference is needed. The appendix contains additional guidance for dealing with certain IST-related issues such as might arise during the deliberations of the licensee in carrying out integrated decisionmaking.

Relationship to Other Guidance Documents

This regulatory guide provides detailed guidance on approaches to implement risk insights in IST programs that are acceptable to the NRC staff. This application-specific guide makes extensive reference to Regulatory Guide 1.174 (Ref. 3) for general guidance.

Companion regulatory guides (Refs. 4 and 5) address graded quality assurance and technical specifications, and contain guidance similar to that given in this RI-IST guide. SRP chapters associated with the risk-informed regulatory guides are available (Refs. 6-8). The SRP chapters are intended for NRC use during the review of industry requests for risk-informed program changes. SRP Chapter 3.9.7 (Ref. 7) addresses RI-IST and is consistent with the guidance given in this regulatory guide.

In the 1995-1998 period, the industry developed a number of documents addressing the increased use of PRA in nuclear plant regulation. The American Society of Mechanical Engineers (ASME) developed guidelines for risk-based IST (Ref. 10) and later initiated code cases addressing IST component importance ranking and testing of certain plant components using risk insights. The Electric Power Research Institute (EPRI) published its "PSA Applications Guide" (Ref. 11) to provide utilities with guidance on the use of PRA information for both regulatory and nonregulatory applications. The Nuclear Energy Institute (NEI) has also been developing guidelines on risk-based IST (Ref. 12). These documents have provided useful viewpoints and proposed approaches for the staff's consideration during the development of the NRC regulatory guidance documents.

Abbreviations

ASME	American Society of Mechanical Engineers
CCF	common cause failure
CDF	core damage frequency
EPRI	Electric Power Research Institute
FV	Fussell-Vesely risk importance measure
GQA	graded quality assurance
HEP	human error probability
HSSC	high safety-significant component
ISI	inservice inspection
IST	inservice testing
LERF	containment large early release frequency
LSSC	low safety-significant component
MCS	minimal cut set
NEI	Nuclear Energy Institute
NUMARC	Nuclear Utilities Management Research Council
O&M	Operations and Maintenance (ASME committee)
PRA	probabilistic risk assessment
PSA	probabilistic safety assessment
RAW	risk achievement worth risk importance measure
RI-IST	risk-informed IST (e.g., RI-IST programs)
SRP	standard review plan
SSCs	structures, systems, and components
THERP	Technique for Human Error Rate Prediction
USAR	Updated Safety Analysis Report
USNRC	U.S. Nuclear Regulatory Commission

The information collections contained in this regulatory guide are covered by the requirements of 10 CFR Part 50, which were approved by the Office of Management and Budget, approval number 3150-0011. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

Key Safety Principles

Regulatory Guide 1.174 (Ref. 3) identifies five key safety principles to be met for all risk-informed applications and to be explicitly addressed in risk-informed plant program change applications. As indicated in Regulatory Guide 1.174, while these key principles are stated in traditional engineering terminology, efforts should be made wherever feasible to utilize risk evaluation techniques to help ensure and to show that these principles are met. These key principles and the location in this guide where each is addressed for RI-IST programs are as follows:

1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption or rule change. (This principle is addressed in Regulatory Positions 1.1 and 2.1 of this guide.)

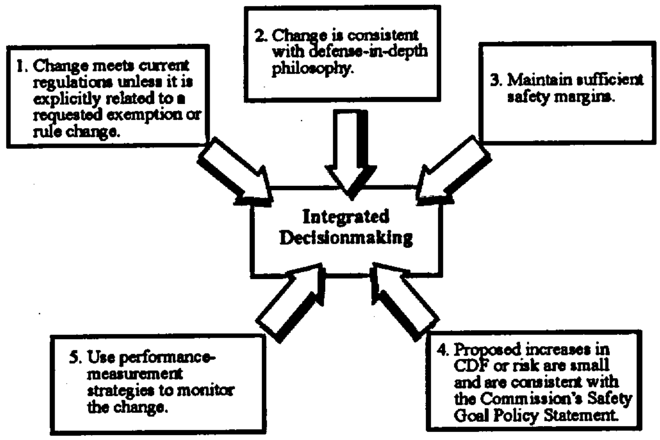

Figure 1 Principles of Risk-Informed Regulation

2. The proposed change is consistent with the defense-in-depth philosophy. (Regulatory Position 2.2.1)

3. The proposed change maintains sufficient safety margins. (Regulatory Position 2.2.2)

4. When proposed changes result in an increase in core damage frequency or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement. (Regulatory Positions 2.3, 2.4)

5. The impact of the proposed change should be monitored using performance measurement strategies. (Regulatory Position 3.3)

Regulatory Guide 1.174 gives additional guidance on the key safety principles applicable to all risk-informed applications. Figure 1 of this guide, repeated from Regulatory Guide 1.174, illustrates the consideration of each of these principles in risk-informed decision making.

A Four-Element Approach to Risk-Informed Decisionmaking for Inservice Testing Programs

Regulatory Guide 1.174 (Ref. 3) describes a four-element process for developing risk-informed regulatory changes. The process is highly iterative. Thus, the final description of the proposed change to the IST program as defined in Element 1 depends on both the analysis performed in Element 2 and the definition of the implementation of the IST program performed in Element 3. The Regulatory Position of this guide provides guidance on each element.

While IST is, by its nature, a monitoring program, it should be noted that the monitoring referred to in Element 3 is associated with making sure that the assumptions made about the impact of the changes to the IST program are not invalidated. For example, if the test intervals are based on an allowable margin to failure, the monitoring is performed to make sure that these margins are not eroded. An overview of this process specifically related to RI-IST programs is given in this section. The order in which the elements are performed may vary or occur in parallel, depending on the particular application and the preference of the program developers.

Element 1: Define Proposed Changes to the Inservice Testing Program.

The purpose of this element is to identify (1) the particular components that would be affected by the proposed changes in testing practices, including those currently in the IST program and possibly some that are not (if it is determined through new information and insights such as the PRA that these additional components are important in terms of plant risk) and (2) specific revisions to testing schedules and methods for the chosen components. Plant systems and functions that rely on the affected components should be identified. Regulatory Position 1 gives a more detailed description of Element 1.

Element 2: Perform Engineering Analysis

In this element, both traditional engineering and PRA methods are used to help define the scope of the changes to the IST program and to evaluate the impact of the changes on the overall plant risk. Areas that are to be evaluated include the expected effect of the proposed RI-IST program on the design basis and severe accidents, defense-in-depth attributes, and safety margins. In this evaluation, the results of traditional engineering and PRA methods are to be considered together in an integrated decision process that will be carried over into the implementation phase described below in Element 3. PRA results should be used to provide information for the categorization of components into groupings of low safety-significant components (LSSC) and high safety-significant components (HSSC). Components in the LSSC group would then be candidates for less rigorous testing when compared with those in the HSSC group. When the revised IST plan has been developed, the plant-specific PRA should be used to evaluate the effect of the planned program changes on the overall plant risk as measured by core damage frequency (CDF) and containment large early release frequency (LERF).

During the integration of all the available information, it is expected that many issues will need to be resolved through the use of a well-reasoned judgment process, often involving a combination of different engineering skills. This activity has typically been referred to in industry documents as being performed by an "expert panel." As discussed further at the end of this section and in the appendix, this important process is the licensee's responsibility and may be accomplished by means other than a formal panel. In any case, the key safety principles discussed in this guide must be addressed and shown to be satisfied regardless of the approach used for RI-IST program decisionmaking.

Additional application-specific details concerning RI-IST programs and Element 2 are contained in Regulatory Positition 2 of this guide.

Element 3: Define Implementation and Monitoring Program

In this element, the implementation plan for the IST program is developed. This involves determining both the methods to be used and the frequency of testing. The frequency and method of testing for each component is commensurate with the component's safety significance. To the extent practicable, the testing methods should address the relevant failure mechanisms that could significantly affect component reliability. In addition, a monitoring and corrective action program is established to ensure that the assumptions upon which the testing strategy has been based continue to be valid, and that no unexpected degradation in performance of the HSSCs and LSSCs occurs as a result of the change to the IST program. Specific guidance for Element 3 is given in Regulatory Position 3.

Element 4: Submit Proposed Change

The final element involves preparing the documentation to be included in the submittal and the documentation to be maintained by the licensee for later reference, if needed. The submittal will be reviewed by the NRC according to SRP Chapter 19 and Section 3.9.7 (Refs. 6 and 7). Guidance on documentation requirements for RI-IST programs is given in Regulatory Position 4 of this regulatory guide.

In carrying out this process, the licensee will make a number of decisions based on the best available information. Some of this information will be derived from traditional engineering practice and some will be probabilistic in nature resulting from PRA studies. It is the licensee's responsibility to ensure that its RI-IST program is developed using a well-reasoned and integrated decision process that considers both forms of input information (traditional engineering and probabilistic) in a complementary manner. This important decisionmaking process may at times require the participation of special combinations of licensee expertise (licensee staff), depending on the technical and other issues involved, and may at times also need outside consultants. Industry documents have generally referred to the use of an expert panel for such decisionmaking. The appendix to this guide discusses a number of IST-specific issues such as might arise in expert panel deliberations.

C. REGULATORY POSITION

1. ELEMENT 1: DEFINE PROPOSED CHANGES TO INSERVICE TESTING PROGRAM

In this first element of the process, the proposed changes to the IST program are defined. This involves describing what IST components (e.g., pumps and valves) will be involved and how their testing would be changed. Also included in this element is identification of supporting information and a proposed plan for the licensee's interactions with the NRC throughout the implementation of the RI-IST.

1.1 Description of Proposed Changes

A full description of the proposed changes in the IST program is prepared. This description would include:

(1) Identification of the aspects of the plant's design, operations, and other activities that require NRC approval that would be changed by the proposed RI-IST program. This will provide a basis from which the staff can evaluate the proposed changes.

(2) Identification of the specific revisions to existing testing schedules and methods that would result from implementation of the proposed program.

(3) Identification of the components in the plant that are directly and indirectly involved with the proposed testing changes. Any components that are not presently covered in the plant's IST program

but are determined to be important to safety (e.g., through PRA insights) should also be identified. In addition, the particular systems that are affected by the proposed changes should be identified since this information is an aid in planning the supporting engineering analyses.

(4) Identification of the information that will be used in support of the changes. This will include performance data, traditional engineering analyses, and PRA information.

(5) A brief statement describing the way how the proposed changes meet the objectives of the Commission's PRA Policy Statement (Ref. 1).

1.2 Inservice Testing Program Scope

IST requirements for certain safety-related pumps and valves are specified in 10 CFR 50.55a. These components are to be tested according to the requirements of Section XI of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (the Code) (Ref. 9) or the applicable ASME Operations and Maintenance (O&M) Code (Ref. 13).

For acceptance guidelines, the licensee's RI-IST program would include all components in the current Code-prescribed IST program. In addition, the program should include those non-Code components that the licensee's integrated decisionmaking process categorized as HSSC.

1.3 RI-IST Program Changes After Initial Approval

This section provides guidance on reporting of program activities. The NRC will formally review the changes proposed to RI-IST programs that have already received NRC approval.

The licensee should implement a process for determining when proposed RI-IST program changes require formal NRC review and approval. Changes made to the NRC-approved RI-IST program that could affect the process and results that were reviewed and approved by the NRC staff should be evaluated to ensure that the basis for the NRC staff's prior approval has not been compromised. All changes should be evaluated against the change mechanisms described in the regulations (e.g., 10 CFR 50.55a, 10 CFR 50.59) to determine whether NRC review and approval is required prior to implementation. If there is a question regarding this issue, the licensee should seek NRC review and approval prior to implementation.

For acceptance guidelines, licensees can change their RI-IST programs consistent with the process and results that were reviewed and approved by the NRC staff (i.e., as defined in the approved RI-IST program description). Prior to implementation, a process or procedures should be in place to ensure that any such changes to the previously approved RI-IST program meet the acceptance guidelines of this section.

The cumulative impact of all RI-IST program changes (initial approval plus later changes) should comply with the acceptance guidelines given in Regulatory Position 2.3.3 below.

Examples of changes to RI-IST programs that would require NRC's review and approval include, but are not limited to, the following:

- Changes to the RI-IST program that involve programmatic changes (e.g., changes in the acceptance guidelines used for the licensee's integrated decisionmaking process),
- Component test method changes that involve deviation from the NRC-endorsed Code requirements, NRC-endorsed Code Case, or published NRC guidance.

Examples of changes to RI-IST programs that would not require NRC's review and approval include, but are not limited to, the following:

- Changes to component groupings, test intervals, and test methods that do not involve a change to the overall RI-IST approach that was reviewed and approved by the NRC,
- Component test method changes that involve the implementation of an NRC-endorsed ASME Code or an NRC-endorsed Code Case,
- Recategorization of components because of experience, PRA insights, or design changes, but not programmatic changes when the process used to recategorize the components is consistent with the RI-IST process and results that were reviewed and approved by the NRC.

2. ELEMENT 2: PERFORM ENGINEERING ANALYSIS

As part of defining the proposed change to the licensee's IST program, the licensee should conduct an engineering evaluation of the proposed change using a combination of traditional engineering methods and PRA. The major objective of this evaluation is to confirm that the proposed program change will not compromise defense in depth and other key safety principles described in this guide. Regulatory Guide 1.174 (Ref. 3) provides general guidance for the performance of this evaluation, to be supplemented by the RI-IST-specific guidance in this guide.

2.1 Licensing Considerations

2.1.1 Evaluating the Proposed Changes

On a component-specific basis, the licensee should determine whether there are instances in which the proposed IST program change would affect the design, operations, and other activities at the plant, and the licensee should document the basis for the acceptability of the proposed change by addressing the key principles. In evaluating proposed changes to the plant, the licensee should consider other licensing basis documents (e.g., technical specifications, Final Safety Analysis Report (FSAR), responses to NRC generic letters) in addition to the IST program documentation.

The principal focus should be on the use of PRA findings and risk insights in support of proposed changes to a plant's design, operation, and other activities that require NRC approval. Such changes include (but are not limited to) license amendments under 10 CFR 50.90, requests for use of alternatives under 10 CFR 50.55a, and exemptions under 10 CFR Part 12. However, the reviewer should note that there are certain docketed commitments that are not related to regulatory requirements (e.g., commitments made by the licensee in response to NRC Generic Letter 89-10 or 96-05) that may be changed by licensees via processes other than as described in NRC regulations (e.g., consistent with Reference 14).

A broad review of the plant's design, operations, and other activities may be necessary because proposed IST program changes could affect requirements or commitments that are not explicitly stated in the licensee's FSAR or IST program documentation. Furthermore, staff approval of the design, operation, and maintenance of components at the facility have likely been granted in terms other than probability, consequences, or margin of safety (i.e., the 10 CFR 50.59 criteria). Therefore, it may also be appropriate to evaluate proposed IST program changes against other criteria (e.g., criteria used in either the licensing process or to determine the acceptability of component design, operation and maintenance).

The Director of the Office of Nuclear Reactor Regulation is allowed by 10 CFR 50.55a to authorize alternatives to the specific requirements of this regulation provided that the proposed alternative will ensure an acceptable level of quality and safety. Thus, alternatives to the acceptable RI-IST approaches presented in this guide may be proposed by licensees so long as supporting information is provided that demonstrates that the key principles discussed in Chapter 2 of this guide are maintained.

For acceptance guidelines, the licensee should review applicable documents to identify proposed changes to the IST program that would alter the design, operations, and other activities of the plant. On a component-specific basis, the licensee should (1) identify instances in which the proposed RI-IST program change would affect the design, operations, and other activities of the plant, (2) identify the source and nature of the requirements (or commitments), and (3) document the basis for the acceptability of the proposed requirement changes, e.g., by addressing the key principles.

The licensee must comply with 10 CFR 50.59, 50.90, and 50.109 as applicable. The staff recognizes that there are certain docketed commitments that are not related to regulatory requirements that can be changed by licensees via processes other than described in NRC regulations (e.g., consistent with Reference 14).

2.1.2 Relief Requests and Technical Specification Changes

The licensee should have included in the RI-IST program submittal the necessary exemption requests, technical specification amendment requests, and relief requests necessary to implement their RI-IST program.

Individual component relief requests are not required for adjusting the test interval of individual components that are categorized as having low safety significance (because the licensee's implementation plans for extending specific component test intervals should have been reviewed and approved by the NRC staff as part of the licensee's RI-IST program submittal). Similarly, if the proposed alternative includes improved test strategies to enhance the test effectiveness of components, additional relief to implement these improved test strategies is not required.

For acceptance guidelines, the following are to be approved by the NRC before implementing the RI-IST program:

- A relief request for any component, or group of components, that is not tested in accordance with the licensee's ASME Code of record or NRC-approved ASME code case.
- A technical specification amendment request for any component, or group of components, if there are changes from technical specification requirements.

2.2 Traditional Engineering Evaluation

This part of the evaluation is based on traditional engineering methods (not probabilistic). Areas to be evaluated from this viewpoint include the potential effect of the proposed RI-IST program on defense-in-depth attributes and safety margins. In addition, defense in depth and safety margin should also be evaluated, as feasible, using risk techniques (PRA).

2.2.1 Defense-in-Depth Evaluation

Because of its importance, both historically during the evolution of reactor safety practice and for the continuation of public health and safety, the concept of defense in depth has been included in Regulatory Guide 1.174 (Ref. 3) as one of the five key principles. In referring to a proposed risk-informed program change, Section 2 of Regulatory Guide 1.174 states that the proposed change should be consistent with the defense-in-depth philosophy. Furthermore, as stated in Section 2.2.1.1,

> Consistency with the defense-in-depth philosophy is maintained if:
>
> - A reasonable balance is preserved among prevention of core damage, prevention of containment failure, and consequence mitigation.
> - Over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided.
> - System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties (e.g., no risk outliers).
> - Defenses against potential common cause failures are preserved, and the potential for the introduction of new common cause failure mechanisms is assessed.
> - Independence of barriers is not degraded.
> - Defenses against human errors are preserved.
> - The intent of the General Design Criteria in 10 CFR Part 50, Appendix A is maintained.

These defense-in-depth objectives apply to all risk-informed applications, and for some of the issues involved (e.g., no over-reliance on programmatic activities and defense against human errors), it is fairly straightforward to apply them to the RI-IST program evaluation. Some specific examples of how certain other of these objectives may be met for RI-IST applications are as follows. The use of the multiple risk metrics of CDF and LERF and controlling their change resulting from the RI-IST program will maintain a balance between prevention of core damage, prevention of containment failure, and consequence mitigation. Redundancy, diversity, and independence of safety systems should be considered after the initial choice is made in the categorization of components to ensure that these qualities are not degraded by the categorization. Independence of barriers and defense against common cause failures should also be considered in the review of the categorization. The improved understanding of the relative importance of plant components to risk resulting from the development of the RI-IST program should promote an improved overall understanding of how the components in the IST program contribute to a plant's defense in depth, and this should be discussed in the application.

2.2.2 Safety Margin Evaluation

The maintenance of safety margins is also a very important part of ensuring continued reactor safety and is included as one of the key safety principles in Section 2 of Regulatory Guide 1.174 (Ref. 3). This principle states that the proposed change maintains sufficient safety margins.

In addition, in Section 2.2.1.2, it is stated that with sufficient safety margins:

> - Codes and standards or alternatives approved for use by the NRC are met.
> - Safety analysis acceptance criteria in the licensing basis (e.g., FSAR, supporting analyses) are met, or proposed revisions provide sufficient margin to account for analysis and data uncertainty.

It is possible that the categorization process will identify components that are currently not included in the IST program, and their addition as HSSCs will clearly improve safety margin in terms of CDF and LERF. It is also important that the performance monitoring program be capable of quickly identifying significant degradation in performance so that, if necessary, corrective measures can be implemented before the margin to failure is significantly reduced. The improved understanding of the relative importance of plant components to risk resulting from the development of the RI-IST program should promote an improved understanding of how the components in the IST program contribute to a plant's margin of safety, and this should be discussed in the application.

2.3 Probabilistic Risk Assessment

Issues specific to the IST risk-informed process are discussed in this section. Regulatory Guide 1.174 (Ref.

3) contains much of the general guidance that is applicable for this topic.

In RI-IST, information obtained from a PRA should be used in two ways: First, to provide input to the categorization of SSCs into HSSC and LSSC groupings; and second, to assess the impact of the proposed change on CDF and LERF. Regulatory Position 2.3.1 discusses, in general terms, issues related to the quality, scope, and level of detail of a PRA that is used for IST applications. More specific considerations are given in Regulatory Positions 2.3.2, and 2.3.3, which address the use of PRA in categorization and in the assessment of the impact on risk metrics respectively.

2.3.1 Scope, Level of Detail, and Quality of Probabilistic Risk Assessments for Inservice Testing Applications

For the quantitative results of the PRA to play a major and direct role in decision making, there is a need to ensure that they are derived from "quality" analyses, and that the extent to which the results apply is well understood. Section 2.2.3 of Regulatory Guide 1.174 (Ref. 3) addresses in general terms the issues related to scope, level of detail, and quality of the PRA applied to risk-informed applications.

While a full scope PRA that covers all modes of operation and initiating events is preferred, a lesser scope PRA can be used to provide useful risk information. However, it must then be supplemented by additional considerations as discussed below.

For the PRA to be useful in the development of a RI-IST program, it is necessary that the PRA model be developed to the component level for the systems, including non-safety systems, considered important for prevention of core damage and release of radioactivity.

A PRA used in RI-IST should be performed correctly and in a manner that is consistent with accepted practices. The PRA should reflect the actual design, construction, operating practices, and operating experience of the plant. The quality required of the PRA is commensurate with the role it plays in the determination of test intervals or test methods and with the role the integrated decisionmaking panel plays in compensating for limitations in PRA quality. Regulatory Guide 1.174 and SRP Chapter 19 (Refs. 3 and 6) further discuss the requirements of PRA quality.

To be acceptable for application to RI-IST, PRA models must reflect the as-built, as-operated plant, and they must have been performed in a manner that is consistent with accepted practices. The quality of the PRA has to be shown to be adequate, commensurate with the role the PRA results play in justifying changes to the test intervals or strategies. The PRA model should be developed to the component level for the systems important to safety.

If less than a full-scope PRA is used to support the proposed RI-IST program, supplemental information (deterministic and qualitative) must be considered during the integrated decisionmaking process.

Acceptance guidelines for the required PRA quality and scope are further defined in Regulatory Guide 1.174.

2.3.2 Categorization of Components

The categorization of components is important in the implementation of the RI-IST program since it is an efficient and risk-informed way of providing insights in the areas in which safety margin can be relaxed without unacceptable safety consequences. Thus, categorization of components, in addition to the traditional engineering evaluation described in Regulatory Position 2.2 and the calculation of change in overall plant risk described in Regulatory Position 2.3.3, will provide significant input to the determination of whether the IST program is acceptable or not.

The determination of safety significance of components by the use of PRA-determined importance measures is important for several reasons.

- When performed with a series of sensitivity evaluations, it can identify potential risk outliers by identifying IST components that could dominate risk for various plant configurations and operational modes, PRA model assumptions, and data and model uncertainties.
- Importance measure evaluations can provide a useful means to identify improvements to current IST practices during the risk-informed application process.
- System- or functional-level importance results can provide a high level verification of component-level results and can provide insights into the potential risk significance of IST components that are not modeled in the PRA.

General guidelines for risk categorization of components using importance measures and other information are provided in Regulatory Guide 1.174 (Ref. 3). These general guidelines address acceptable methods for carrying out categorization and some of the limitations of this process. Guidelines that are specific to the IST application are given in this section. As used here, risk categorization refers to the process for grouping IST components into LSSC and HSSC categories.

Components are initially categorized into HSSC and LSSC groupings based on threshold values for the importance measures. Depending on whether the PRA is performed using the fault tree linking or event tree linking approach, importance measures can most easily be provided at the component or train level. In either case, the importance measures are applicable to the items taken one at a time, and therefore, as discussed in Regulatory Guide 1.174, while a licensee is free to choose the threshold values of importance measures, it will be necessary to demonstrate that the integrated impact of the change is such that Principle 4 is met. One acceptable approach is discussed in the next section.

PRA systematically takes credit for non-Code components as providing support, acting as alternatives, and acting as backups to those components that are within the current Code. Accordingly, to ensure that the proposed RI-IST program will provide an acceptable level of quality and safety, these additional risk-important components should be included in licensees' RI-IST proposals. Specifically, the licensee's RI-IST program should include those ASME Code Class 1, 2, and 3 and non-Code components that the licensee's integrated decisionmaking process categorized as HSSC and thus determined these components to be appropriate additional candidates for the RI-IST program.

Although PRAs model many of the SSCs involved in the performance of plant safety functions, other SSCs are not modeled for various reasons. However, this should not imply that unmodeled components are not important in terms of contributions to plant risk. For example, some components are not modeled because certain initiating events may not be modeled (e.g., low power and shutdown events, or some external events); in other cases, components may not be directly modeled because they are grouped together with events that are modeled (e.g., initiating events, operator recovery events, or within other system or function boundaries); and in some cases, components are screened out from the analysis because of their assumed inherent reliability; or failure modes are screened out because of their insignificant contribution to risk (e.g., spurious closure of a valve). When feasible, adding missing components or missing initiators or plant operating states to the PRA should be considered by the licensee. When this is not feasible, information based on traditional engineering analyses and judgment is used to determine whether a component should be treated as an LSSC or HSSC. One approach to combining these different pieces of information is to use what has been referred to as an expert panel. Appendices B and C of Standard Review Plan Chapter 19 (Ref. 6) contain staff expectations on the use of expert panels in integrated decisionmaking and SSC categorization respectively.

In classifying a component not modeled in the PRA as LSSC, the expert panel should have determined that:

- The component does not perform a safety function, or does not perform a support function to a safety function, or does not complement a safety function.
- The component does not support operator actions credited in the PRA for either procedural or recovery actions.
- The failure of the component will not result in the eventual occurrence of a PRA initiating event.
- The component is not a part of a system that acts as a barrier to fission product release during severe accidents.
- The failure of the component will not result in unintentional releases of radioactive material even in the absence of severe accident conditions.

For acceptance guidelines, when using risk importance measures to identify components that are low risk contributors, the potential limitations of these measures have to be addressed. Therefore, information to be provided to the licensee's integrated decisionmaking process (e.g., expert panel) must include evaluations that demonstrate the sensitivity of the risk importance results to the important PRA modeling techniques, assumptions, and data. Issues that the licensee should consider and address when determining low risk contributors include truncation limit used, different risk metrics (i.e., CDF and LERF), different component failure modes, different maintenance states and plant configurations, multiple component considerations, defense in depth, and analysis of uncertainties (including sensitivity studies to component data uncertainties, common-cause failures, and recovery actions).

While the categorization process can be used to highlight areas in which testing strategy can be improved and areas in which sufficient safety margins exist to the point that testing strategy can be relaxed, it is the determination of the change in risk from the overall changes in the IST program that is of concern in demonstrating that Principle 4 has been met. Therefore, no generically applicable acceptance guidelines for the threshold values of importance measures used to categorize components as HSSC or LSSC are given here. Instead, the licensee should demonstrate that the overall impact of the change on plant risk is small as discussed in Regulatory Position 2.3.3.

As part of the categorization process, licensees must also address the initiating events and plant operating modes missing from the PRA evaluation. The licensee can do this either by providing qualitative arguments that the proposed change to the IST program does not result in an increase on risk, or by demonstrating that the components significant to risk in these missing contributors are maintained as HSSC.

2.3.3 Use of a PRA To Evaluate the Risk Increase from Changes in the IST Program

One of the important uses of the PRA is to evaluate the impact of the IST change with respect to the acceptance guidelines on changes in CDF and LERF as discussed in Section 2.2.2 of Regulatory Guide 1.174 (Ref. 3). In addition, the PRA can provide a baseline risk profile of the plant, and the extent of analysis of the baseline CDF and LERF depends on the proposed change in CDF and LERF. As discussed in Regulatory Guide 1.174, if the PRA is not full scope, the impact of the change must be considered by supplementing the PRA evaluation by qualitative arguments or by bounding analyses.

2.3.3.1 Modeling the Impact of Changes in the IST Program. In order for the PRA to support the decision appropriately, there should be a good functional mapping between the components associated with IST and the PRA basic event probability quantification. Part of the basis for the acceptability of the RI-IST program is a quantitative demonstration by use of a PRA that established risk measures are not significantly increased by the proposed changes to the IST for selected components. To establish this demonstration, the PRA includes models that appropriately account for the change in reliability of the components as a function of the IST program changes. In general, this will include not only changes to the test interval but also the effects of an enhanced testing method. Enhanced testing might be shown to improve or maintain component availability, even if the interval is extended. That is, a better test might compensate for a longer interval between tests. Licensees who apply for substantial increases in test interval are expected to address this area, i.e., as appropriate, consider improvements in testing that would compensate for the increased intervals under consideration.

One model for the relationship between the component unavailability on demand and the test interval is given in NUREG/CR-6141 (Ref. 16), which assumes a constant rate (λ) of transition to the failed state. Reference 16 also describes how to account for various test strategies.

In addition to transitions to a failed state that occur between component demands or tests, there is also a demand-related contribution to unavailability, corresponding to the probability that a component will fail to operate when demanded, even though for some purposes it would have been considered "good" before being subjected to the stress of the demand itself. This would have the effect of adding a constant to the test-interval-dependent contribution to the component unavailability on demand. The assumption that the total unavailability scales linearly with the test interval (i.e., doubles when test interval doubles) is conservative in the sense that it scales the test-interval-independent contribution along with the test-interval-dependent contribution, and in that respect tends to overstate the effect of test interval extension. This approximation is therefore considered acceptable; however, it should be noted that guidance aimed at improving the capability of tests to identify loss of performance margin is aimed partly at reducing the "demand" contribution as well, so that improved modeling in this area would appear to have the potential to support further improvements in allocation of safety resources.

This model essentially assumes that failures are random occurrences and that the frequency of these occurrences does not increase as the test interval is increased. However, as test intervals are extended, there is some concern that the failure rate, λ, may increase. This failure rate, generally assumed constant, is based on data from current IST test intervals and therefore does not include effects that may arise from extended test intervals. It is possible that insidious effects such as corrosion or erosion, intrusion of foreign material into working parts, adverse environmental exposure, or breakdown of lubrication, which have not been encountered with the current shorter test intervals, could significantly degrade the component if test intervals become excessively long. Therefore, unless it can be demonstrated that either degradation is not expected to be significant or that the test would identify degradation before failures are likely to occur, use of the constant failure rate model could be nonconservative.

One way to address this uncertainty is to use the PRA insights to help design an appropriate implementation and monitoring program, for example, to approach the interval increase in a stepwise fashion rather than going to the theoretically allowable maximum in a single step, or to stagger the testing of redundant components (test different trains on alternating schedules) so that the population of components is being sampled relatively frequently, even though individual members of the population are not. By using such approaches, the existence of the above effects can be detected and compensatory measures taken to correct the testing of the remaining population members. However, it is important that the monitoring includes enough tests to be relevant, and that the tests are capable of detecting the time-related degradation (performance monitoring is discussed in Regulatory Position 3.3).

A check should also be performed to determine whether non-IST manipulation has been credited either in IST basic events or in compensating-component basic events. If a component is stroked or challenged between instances of IST, and if these activities are capable of revealing component failure, the effective fault exposure time can be less than the RI-IST interval. It can be appropriate to take credit for this shortening of fault exposure time in the PRA quantification, provided that there is assurance that the important failure modes are identified by the stroking or the system challenges. This is not always trivial: If a functional success can be achieved by any one of *n* components in parallel, so that the function succeeds even if n-1 of the components fail, then merely monitoring successful functional response does not show whether all components are operable unless verification of each component's state is undertaken. In addition, some instances of revealing a component fault through challenge have adverse consequences, including functional failure, and if credit is taken for shortening fault exposure time through functional challenges, it is necessary to account for this downside in the quantification of accident frequency.

2.3.3.2 Evaluating the Change in CDF and LERF. Once the impact on the individual basic event probabilities has been determined, the change in CDF and LERF can be evaluated. There are some issues that must be carefully considered, which become more important the larger the change in basic event probabilities. When using a fault tree linking approach to PRA, it is preferable that the model be re-solved rather than simply requantifying the CDF and LERF cutset solutions. In addition, it is important to pay attention to the parametric uncertainty analysis, especially if the change is dominated by cutsets that have multiple LSSCs. The "state of knowledge" correlation effect (Ref. 16) could be significant if there are a significant number of cutsets with similar SSCs contributing to the change in risk. Regulatory Guide 1.174 (Ref. 3) discusses the parametric uncertainty analysis in more detail.

In addition, model and completeness uncertainties should be addressed as discussed in Regulatory Guide 1.174. In particular, initiating events and modes of plant operations whose risk impact are not included in the PRA need additional analyses or justification that the proposed changes do not significantly increase the risk from those unmodeled contributors.

2.3.3.3 Acceptance Guidelines. The change in risk from proposed changes to the IST program should be consistent with the guidelines provided in Section 2.2.4 of Regulatory Guide 1.174. In comparing the calculated risk to the guidelines, the licensee should address the model and completeness uncertainty as discussed in Regulatory Guide 1.174 (Ref. 3). In addition, the licensee should address parameter uncertainty either by propagating the uncertainty during sequence quantification or by demonstrating that the "state-of-knowledge correlation" effect is not significant, especially in cutsets in which the RI-IST changes affect multiple components that are similar.

In evaluating the change in plant risk from proposed changes in the IST program, the licensee should perform the following.

- Evaluate the risk significance of extending the test interval on affected components. This requires that the licensee address the change in component availability as a function of test interval. The analysis should include either a quantitative consideration of the degradation of the component failure rate as a function of time, supported by appropriate data and analysis, or arguments that support the conclusion that no significant degradation will occur.
- Consider the effects of enhanced testing to the extent needed to substantiate the change.

Other issues that should be addressed in the quantification of the change in risk include the following.

- The impact of the IST change on the frequency of event initiators (those already included in the PRA and those screened out because of low frequency) should be determined. For applications in RI-IST, potentially significant initiators include valve failure that could lead to interfacing system loss-of-coolant accidents (LOCAs) or to other sequences that fail the containment isolation function.
- The effect of common cause failures (CCFs) should be addressed either by the use of sensitivity studies or by the use of qualitative assessments that show that the CCF contribution would not become significant under the proposed IST program (e.g., by use of phased implementation, staggered testing, and monitoring for common cause effects).
- Justification of IST relaxations should not be based on credit for post-accident recovery of failed components (repair or ad hoc manual actions, such as manually forcing stuck valves to open). However, credit may be taken for proceduralized implementation of alternative success strategies. For each human action that compensates for a basic event probability increasing as a result of IST re-

laxation, there should be a licensee commitment to ensure performance of the function at the level credited in the quantification. Excessively low human failure probabilities (less than 10^{-3}) cannot be accepted unless there is adequate justification and there are adequate training programs, personnel practices, plant policies, etc., to ensure continued licensee performance at that level.

- The failure rates and probabilities used for components affected by the proposed change in IST should appropriately consider both plant-specific and generic data. The licensee should determine whether individual components affected by the change are performing more poorly than the average associated with their class; the licensee should avoid relaxing IST for those components to the point that the unavailability of the poor performers would be appreciably worse than that assumed in the risk analysis. In addition, components that have experienced repeated failures should be reviewed to see whether the testing scheme (interval and methods) would be considered adequate to support the performance credited to them in the risk analysis.

- The evaluation should be performed so that the truncation of LSSCs is considered. It is preferred that solutions be obtained from a re-solution of the model, rather than a requantification of CDF and LERF cutsets.

- The cumulative impact of all RI-IST program changes (initial approval plus later changes) should comply with the acceptance guidelines given in this section.

2.4 Integrated Decisionmaking

This section discusses the integration of all the technical considerations involved in reviewing submittals from licensees proposing to implement RI-IST programs. General guidance for risk-informed applications is given Regulatory Guide 1.174 (Ref. 3) and in the new SRP sections, Chapter 19 (Ref. 6) for general guidance, and Section 3.9.7 (Ref. 7) for IST programs. These documents discuss a set of regulatory findings that form the basis for the staff to prepare an acceptable safety evaluation report (SER) for a licensee's risk-informed application. Specifically, Section 2 of Regulatory Guide 1.174 identifies a set of "expectations" that licensees should follow in addressing the key safety principles. Because of the importance of these expectations, they will be repeated here.

- All safety impacts of the proposed change are evaluated in an integrated manner as part of an overall risk management approach in which the licensee is using risk analysis to improve operational and engineering decisions broadly by identifying and taking advantage of opportunities for reducing risk, and not just to eliminate requirements the licensee sees as undesirable. For those cases when risk increases are proposed, the benefits should be described and should be commensurate with the proposed risk increases. The approach used to identify changes in requirements should be used to identify areas where requirements should be increased,[1] as well as where they could be reduced.
- The scope and quality of the engineering analyses (including traditional and probabilistic analyses) conducted to justify the proposed licensing basis change should be appropriate for the nature and scope of the change, should be based on the as-built and as-operated and maintained plant, and should reflect operating experience at the plant.
- The plant-specific PRA supporting licensee proposals has been subjected to quality controls such as an independent peer review or certification.[2]
- Appropriate consideration of uncertainty is given in analyses and interpretation of findings, including using a program of monitor-

[1]The NRC staff is aware of but does not endorse guidelines that have been developed (e.g., by NEI/NUMARC) to assist in identifying potentially beneficial changes to requirements.

[2]As discussed in Section 2.2.3.3 of Regulatory Guide 1.174 (Ref. 3) in its discussion of PRA quality, such a peer review or certification is not a replacement for NRC review. Certification is defined as a mechanism for assuring that a PRA, and the process of developing and maintaining that PRA, meet a set of technical standards established by a diverse group of personnel experienced in developing PRA models, performing PRAs, and performing quality reviews of PRAs. Such a process has been developed and integrated with a peer review process by, for example, the BWR Owners Group and implemented for the purpose of enhancing quality of PRAs at several BWR facilities.

ing, feedback, and corrective action to address significant uncertainties.

- The use of core damage frequency (CDF) and large early release frequency (LERF)[3] as bases for probabilistic risk assessment acceptance guidelines is an acceptable approach to addressing Principle 4. Use of the Commission's Safety Goal qualitative health objectives (QHOs) in lieu of LERF is acceptable in principle and licensees may propose their use. However, in practice, implementing such an approach would require an extension to a Level 3 PRA, in which case the methods and assumptions used in the Level 3 analysis, and associated uncertainties, would require additional attention.
- Increases in estimated CDF and LERF resulting from proposed changes will be limited to small increments. The cumulative effect of such changes should be tracked and considered in the decision process.
- The acceptability of proposed changes should be evaluated by the licensee in an integrated fashion that ensures that all principles are met.[4]
- Data, methods, and assessment criteria used to support regulatory decisionmaking must be well documented and available for public review.

These expectations apply to both probabilistic and traditional engineering considerations, which are addressed in more detail in this chapter and in Regulatory Guide 1.174 (Ref. 3).

Licensees are expected to review commitments related to outage planning and control to verify that they are appropriately reflected in the licensee's component grouping. This should include components required to maintain adequate defense in depth as well as components that might be operated as a result of contingency plans developed to support the outage.

Licensees are also expected to review licensing basis documentation to ensure that the traditional engineering related factors mentioned above are adequately modeled or otherwise addressed in the PRA analysis.

When making final programmatic decisions, choices must be made based on all the available information. There may be cases when information is incomplete or when conflicts appear to exist between the traditional engineering data and the PRA-generated information. It is the responsibility of the licensee in such cases to ensure that well-reasoned judgment is used to resolve the issues in the best manner possible, including due consideration to the safety of the plant. This process of integrated decisionmaking has been discussed in various industry documents (Refs. 10 through 12) with reference to the use of an expert panel. The appendix to this regulatory guide includes some detailed guidance on certain aspects of integrated decisionmaking specific to RI-IST programs. As discussed in the appendix, it is not intended that an administrative body such as an expert panel must always be formed by the licensee to fulfill this function. Some general acceptance guidelines for this important activity follow, with more specific details given in the appendix.

In summary, acceptability of the proposed change should be determined by using an integrated decisionmaking process that addresses three major areas: (1) an evaluation of the proposed change in light of the plant's licensing basis, (2) an evaluation of the proposed change relative to the key principles and the acceptance criteria, and (3) the proposed plans for implementation, performance monitoring, and corrective action. As stated in the Commission's Policy Statement on the increased use of PRA in regulatory matters (Ref. 1), the PRA information used to support the RI-IST program should be as realistic as possible, with reduced unnecessary conservatisms, yet include a consideration of uncertainties. These factors are very important when considering the cumulative plant risk and accounting for possible risk increases as well as risk benefits. The licensee should carefully document all of these kinds of considerations in the RI-IST program description, including those areas that have been quantified through the use of PRA, as well as qualitative arguments for those areas that cannot readily be quantified.

The following are acceptance guidelines.

[3]In this context, LERF is being used as a surrogate for the early fatality quantitative health objective (QHO). It is defined as the frequency of those accidents leading to significant, unmitigated releases from containment in a time frame prior to effective evacuation of the close-in population such that there is a potential for early health effects. Such accidents generally include unscrubbed releases associated with early containment failure at or shortly after vessel breach, containment bypass events, and loss of containment isolation. This definition is consistent with accident analyses used in the safety goal screening criteria discussed in the Commission's regulatory analysis guidelines. An NRC contractor's report (Ref. 15) describes a simple screening approach for calculating LERF.

[4]One important element of integrated decisionmaking can be the use of an "expert panel." Such a panel is not a necessary component of risk-informed decisionmaking; but when it is used, the key principles and associated decision criteria presented in this regulatory guide still apply and must be shown to have been met or to be irrelevant to the issue at hand.

- The licensee's proposed RI-IST program should be supported by both a traditional engineering analysis and a PRA analysis.
- The licensee's RI-IST program submittal should be consistent with the acceptance guidelines contained throughout this regulatory guide, specifically with the expectations listed in this section, or the submittal should justify why an alternative approach is acceptable.
- If the licensee's proposed RI-IST program is acceptable based on both the deterministic and probabilistic analyses, it may be concluded that the proposed RI-IST program provides "an acceptable level of quality and safety" [see 10 CFR 50.55a(a)(3)(i)].

3. ELEMENT 3: DEFINE IMPLEMENTATION AND MONITORING PROGRAM

Upon approval of an RI-IST program, the licensee should have in place an implementation schedule for testing all HSSCs and LSSCs identified in their program. This schedule should include test strategies and testing frequencies for HSSCs and LSSCs that are within the scope of the licensee's IST program and components identified as HSSCs that are not currently in the IST program.

3.1 Inservice Testing Program Changes

This section discusses the test strategy changes (i.e., component test frequency and methods changes) that licensees should make as part of a RI-IST program.

For acceptance guidelines, the RI-IST program should identify components for which the test strategy (i.e., frequency, methods or both) should be more focused as well as components for which the test strategy might be relaxed. The information contained in, and derived from, the PRA should be used to help construct the testing strategy for components. To the extent practicable, components with high safety significance should be tested in ways that are effective at detecting their risk-important failure modes and causes (e.g., ability to detect failure, to detect conditions that are precursors to failure, and predict end of service life). Components categorized LSSC may be tested less rigorously than components categorized as HSSC (e.g., less frequent or informative tests).

In some situations, an acceptable test strategy for components categorized HSSC may be to conduct the existing approved Code IST test at the Code-prescribed frequency. In some situations, an acceptable test strategy for components categorized LSSC may be to conduct the existing approved Code IST test at an extended interval.

An acceptable strategy for testing components categorized HSSC and LSSC may be defined in NRC-approved ASME risk-informed Code Cases. Licensees who choose to pursue RI-IST programs should consider adopting test strategies developed by ASME and endorsed by the NRC. Deviations from endorsed Code Cases must be reviewed and approved by the NRC staff as part of the RI-IST program review.

In establishing the test strategy for components, the licensee should consider component design, service condition, and performance, as well as risk insights. The proposed test strategy should be supported by data that are appropriate for the component. The omission of either generic or plant-specific data should be justified. The proposed test interval should be significantly less than the expected time to failure assumed in the PRA of the components in question (e.g., an order of magnitude less).[5] In addition, the licensee should demonstrate that adequate component capability (margin) exists, above that required during design-basis conditions, such that component operating characteristics over time do not result in reaching a point of insufficient margin before the next scheduled test activity.

The IST interval should generally not be extended beyond once every 6 years or 3 refueling outages (whichever is longer) without specific compelling documented justification available on site for review. Extensions beyond 6 years or 3 refueling outages (whichever is longer) will be considered as component performance data at extended intervals is acquired. This is not meant to restrict a licensee from fully implementing NRC-approved component Code Cases.

Components categorized HSSC that are not in the licensee's current IST program should (where practical) be tested in accordance with the NRC-approved ASME risk-informed Code Cases, including compliance with all administrative requirements. When ASME Section XI or O&M Code testing is not practical, alternative test methods should be developed by the licensee to ensure operational readiness and to detect component degradation (i.e., degradation associated with failure modes identified as being important in the licensee's PRA). As a minimum, a summary of these components and their proposed testing should be included in the RI-IST program.

For components categorized as HSSC that were the subject of a previous NRC-approved relief request (or an NRC-authorized alternative test), the licensee

[5]For example, the MOV exercise requirement (which is comparable to the current stroke time test) should be performed at intervals considerably smaller than the expected time to failure.

should discuss the appropriateness of the relief in light of the safety significance of the component in their RI-IST submittal.

If practical, IST components (with the exception of certain check valves and relief valves) should, as a minimum, be exercised or operated at least once every refueling cycle. More frequent exercising should be considered for components in any of the following categories, if practical:

- Components with high risk significance,
- Components in adverse or harsh environmental conditions, or
- Components with any abnormal characteristics (operational, design, or maintenance conditions).

The testing strategy for each component (or group of components) in the licensee's RI-IST program should be described in the RI-IST program description. The RI-IST program description should summarize all testing to be performed on a group of components (e.g., MOV testing in response to NRC Generic Letter 96-05, Ref. 18). The specific testing to be done on each component (or group of components) should be delineated in the licensee's IST program plan and is subject to NRC inspection.

3.2 Program Implementation

The applicable ASME Code generally requires that safety-related components within the program scope as defined in the current ASME Code be tested on a quarterly frequency regardless of safety significance. The authorization of a risk-informed inservice testing program will allow the extension of certain component testing intervals and modification of certain component testing methods based on the determination of individual component importance. The implementation of an authorized program will involve scheduling test intervals based on the results of probabilistic analysis and deterministic evaluation of each individual component.

The RI-IST program should distinguish between high and low safety-significant components for testing intervals. Components that are being tested using specific ASME Codes, NRC-endorsed Code Cases for RI-IST programs, or other applicable guidance should be individually identified in the RI-IST program. The test intervals of the HSSC should be included in the RI-IST program for verification of compliance with the ASME Code requirements and applicable NRC-endorsed ASME Code Cases. Any component test interval or method that is not in conformance with the above should have specific NRC approval. Plant corrective action and feedback programs should be appropriately referenced in the IST program and in the implementing and test procedures to ensure that testing failures are re-evaluated for possible adjustment to the component's grouping and test strategy.

It is acceptable to implement RI-IST programs on a phased approach. Subsequent to the approval of a RI-IST program, implementation of interval extension for LSSC may begin at the discretion of the licensee and may take place on a component-, train-, or system-level. However, it is not acceptable to immediately adjust the test intervals of LSSC to the maximum proposed test interval. Normally, test interval increases will be done step-wise, with gradual extensions being permitted consistent with cumulative performance data for operation at the extended intervals. The actual testing intervals for each component in the RI-IST program should be available at the plant site for inspection.

It should be noted that the test described in the current ASME Code may not be particularly effective in detecting the important failure modes and causes of a component or group of components. A more effective test strategy may be to conduct an enhanced test at an extended test interval.

HSSCs that are not in the current IST program should be tested, where practical, in accordance with the ASME Code, including compliance with all administrative requirements. When ASME Section XI or O&M testing is not practical, alternative test methods should be developed by the licensee to ensure operational readiness and to detect component degradation (i.e., degradation associated with failure modes identified as being important in the licensee's PRA). As a minimum, a summary of these components and their proposed testing should be provided to the NRC as part of this review and prior to implementation of the risk-informed IST program at the plant.

An acceptable method to extend the test interval for LSSC is to group like components and stagger their testing equally over the interval identified for a specific component based on the probabilistic analysis and deterministic evaluation of each individual component. Initially, it would be desirable to test at least one component in each group every refueling outage. For example, component grouping should consider valve actuator type for power operated valves and pump driver type, as applicable. With this method, generic age-related failures could be identified while allowing immediate implementation for some components. For component groups that are insufficient in size to test one component every refueling outage, the implementation of the interval should be accomplished in a more gradual step-wise manner. The selected test frequency for LSSC that are to be tested on a staggered basis should be justified in the RI-IST program.

The following implementation activities are acceptable:

- For components that will be tested in accordance with the current NRC-approved Code test frequency and method requirements, no specific implementation schedule is required. The test frequency and method should be documented in the licensee's RI-IST program.
- For components that will employ NRC-endorsed ASME Codes or Code Case methods, implementation of the revised test strategies (i.e., interval extension plan) should be documented in the licensee's RI-IST program.
- For any alternative test strategies proposed by the licensee (i.e., for components within the scope of the current ASME code), the licensee should have specific NRC approval.

The licensee should increase the test interval for components in a step-wise manner (i.e., equal or successively smaller steps, not to exceed one refueling cycle per step). If no significant time-dependent failures occur, the interval can be gradually extended until the component is tested at the maximum proposed extended test interval. An acceptable approach is to group similar components and test them on a staggered basis. Guidance on grouping components is contained in Position 2 of NRC Generic Letter 89-04 (Ref. 19) for check valves; Supplement 6 to NRC Generic Letter 89-10 (Ref. 20), and Section 3.5 of ASME Code Case OMN-1 (Ref. 21) for motor-operated valves, or other documents endorsed by the NRC.

3.3 Performance Monitoring

Performance monitoring in RI-IST programs refers to the monitoring of inservice test data for components within the scope of the RI-IST program (i.e., including both HSSC and LSSC). The purpose of performance monitoring in a RI-IST program is twofold. First, performance monitoring should help confirm that no insidious failure mechanisms that are related to the revised test strategies become important enough to alter the failure rates assumed in the justification of program changes. Second, performance monitoring should, to the extent practicable, ensure that adequate component capability (i.e., margin) exists, above that required during design-basis conditions, so that component operating characteristics over time do not result in reaching a point of insufficient margin before the next scheduled test activity. Regulatory Guide 1.174 (Ref. 3) provides guidance on performance monitoring when testing under design basis conditions is impracticable. In most cases, component-level monitoring will be expected.

Two important aspects of performance monitoring are whether the test frequency is sufficient to provide meaningful data and whether the testing methods, procedures, and analysis are adequately developed to ensure that performance degradation is detected. Component failure rates cannot be allowed to rise to unacceptable levels (e.g., significantly higher than the failure rates used to support the change) before detection and corrective action take place.

The NRC staff expects that licensees will integrate, or at least coordinate, their monitoring for RI-IST program with existing programs for monitoring equipment performance and other operating experience on their sites and, when appropriate, throughout the industry. In particular, monitoring that is performed as part of the Maintenance Rule (10 CFR 50.65) implementation can be used in the RI-IST program when the monitoring performed under the Maintenance Rule is sufficient for the SSCs in the RI-IST program. As stated in Regulatory Guide 1.174, if an application requires monitoring of SSCs not included in the Maintenance Rule, or involves SSCs that need a greater resolution of monitoring than the Maintenance Rule (e.g., component-level vs. train- or plant-level monitoring), it may be advantageous for a licensee to adjust the Maintenance Rule monitoring program rather than to develop additional monitoring programs for RI-IST purposes. Therefore, it may be advantageous to adjust the Maintenance Rule performance criteria to meet the acceptance guidelines below.

For acceptance guidelines, monitoring programs should be proposed that are capable of adequately tracking the performance of equipment that, when degraded, could alter the conclusions that were key to supporting the acceptance of the RI-IST program. Monitoring programs should be structured such that SSCs are monitored commensurate with their safety significance. This allows for a reduced level of monitoring of components categorized as having low safety significance provided the guidance below is still met.

The licensee's performance monitoring process should have the following attributes:

- Enough tests are included to provide meaningful data,
- The test is devised such that incipient degradation can reasonably be expected to be detected, and
- The licensee trends appropriate parameters as required by the ASME Code or ASME Code Case and as necessary to provide reasonable assurance

that the component will remain operable over the test interval.

Assurance must be established that degradation is not significant for components that are placed on an extended test interval, and that failure rate assumptions for these components are not compromised by test data. It must be clearly established that those test procedures and evaluation methods are implemented that reasonably ensure that degradation will be detected and corrective action will be taken.

3.4 Feedback and Corrective Action

The licensee's corrective action program for this application should contain a performance-based feedback mechanism to ensure that if a particular component's test strategy is adjusted in a way that is ineffective in detecting component degradation and failure, particularly potential common cause failure mechanisms, the RI-IST program weakness is promptly detected and corrected. Performance monitoring should be provided for systems, structures, and components with feedback to the RI-IST program for appropriate adjustments when needed.

If component failures or degradation occur at a higher rate than assumed in the basis for the RI-IST program, the following basic steps should be followed to implement corrective action.

- The causes of the failures or degradation should be determined and corrective action implemented.
- The component's test effectiveness should be reevaluated, and the RI-IST program should be modified accordingly.

The following are acceptance guidelines.

The licensee's corrective action program evaluates RI-IST components that either fail to meet the test acceptance criteria or are otherwise determined to be in a nonconforming condition (e.g., a failure or degraded condition discovered during normal plant operation).

The evaluation:

(1) Complies with Criterion XVI, "Corrective Action," of Appendix B to 10 CFR Part 50.

(2) Promptly determines the impact of the failure or nonconforming condition on system/train operability and follows the appropriate technical specification when component capability cannot be demonstrated.

(3) Determines and corrects the apparent or root cause of the failure or nonconforming condition (e.g., improve testing practices, repair or replace the component). The root cause of failure should be determined for all components categorized as having high safety significance, as well as for components categorized as having low safety significance when the apparent cause of failure may contribute to common cause failure.

(4) Assesses the applicability of the failure or nonconforming condition to other components in the RI-IST program (including any test sample expansion that may be required for grouped components such as relief valves).

(5) Corrects other susceptible RI-IST components as necessary.

(6) Considers the effectiveness of the component's test strategy in detecting the failure or nonconforming condition. Adjust the test interval and/or test methods, as appropriate, when the component (or group of components) experiences repeated or age-related failures or nonconforming conditions.

The corrective action evaluations should periodically be provided to the licensee's PRA group so that any necessary model changes and re-grouping are done as might be appropriate. The effect of the failures on overall plant risk should be evaluated as well as a confirmation that the corrective actions taken will restore the plant risk to an acceptable level.

The RI-IST program documents should be revised to document any RI-IST program changes resulting from corrective actions taken.

3.5 Periodic Reassessment

RI-IST programs should contain provisions whereby component performance data periodically gets fed back into both the component categorization and component test strategy determination (i.e., test interval and methods) process. These assessments should also take into consideration corrective actions that have been taken on past IST program components. (This periodic reassessment should not be confused with the 120-month program updates required by 10 CFR 50.55a(f)(5)(i), whereby the licensee's IST program must comply with later versions of the ASME Code that have been endorsed by the NRC.)

The assessment should:

- Review and revise as necessary the models and data used to categorize components to determine whether component groupings have changed.
- Reevaluate equipment performance to determine whether the RI-IST program should be adjusted (based on both plant-specific and generic information).

The licensee should have procedures in place to identify the need for more emergent RI-IST program updates (e.g., following a major plant modification or following a significant equipment performance problem).

Licensees may wish to coordinate these reviews with other related activities such as periodic PRA updates, industry operating experience programs, the Maintenance Rule program, and other risk-informed program initiatives.

The acceptance guideline is that the test strategy for RI-IST components should be periodically assessed to reflect changes in plant configuration, component performance, test results, and industry experience.

4. ELEMENT 4: DOCUMENTATION

The recommended content of an RI-IST submittal is presented in this Regulatory Postion. The guidance provided below is intended to help ensure the completeness of the information provided and should aid in shortening the time needed for the review process. The licensee should refer to the appropriate section of this regulatory guide to ascertain the level of detail of the documentation that should either be submitted to the NRC staff for review or retained onsite for inspection. To the extent practical the applicable sections of the regulatory guide have been identified on each list of documents.

4.1 Documentation That Should Be in The Licensee's RI-IST Submittal

- A request to implement a RI-IST program as an authorized alternative to the current NRC-endorsed ASME Code pursuant to 10 CFR 50.55a(a)(3)(i).
- A description of the change associated with the proposed RI-IST program (see Regulatory Position 1.1 above).
- Identification of any changes to the plant's design, operations, and other activities associated with the proposed RI-IST program and the basis for the acceptability of these changes (see Regulatory Position 2.1.1).
- A summary of key technical and administrative aspects of the overall RI-IST program that includes:
  - A description of the process used to identify candidates for reduced and enhanced IST requirements, including a description of the categorization of components using the PRA and the associated sensitivity studies (see Regulatory Position 2.3.2 above),
  - A description of the PRA used for the categorization process and for the determination of risk impact, in terms of the process to ensure quality and the scope of the PRA, and how limitations in quality, scope, and level of detail are compensated for in the integrated decision-making process (see Regulatory Position 2.3.1 above),
  - A description of how the impact of the change is modeled in the IST components (including a quantitative or qualitative treatment of component degradation) and a description the impact of the change on plant risk in terms of CDF and LERF and how this impact compares with the decision guidelines (see Regulatory Position 2.3.3),
  - A description of how the key principles were (and will continue to be) maintained (see Regulatory Positions 2.2, 2.3, and 2.4),
  - A description of the integrated decisionmaking process used to help define the RI-IST program, including any decision criteria used (see Regulatory Position 2.4),
  - A general implementation approach or plan (see Regulatory Positions 3.1 and 3.2),
  - A description of the testing and monitoring proposed for each component group (see Regulatory Position 3.2),
  - A description of the RI-IST corrective action plan (see Regulatory Position 3.4),
  - A description of the RI-IST program periodic reassessment plan (see Regulatory Position 3.5 above).
- A summary of any previously approved relief requests for components categorized as HSSC along with any exemption requests, technical specification changes, and relief requests needed to implement the proposed RI-IST Program (see Regulatory Position 2.1.2).
- An assessment of the appropriateness of previously approved relief requests.

4.2 Documentation That Should Be Available Onsite For Inspection

- The overall IST Program Plan
- Administrative procedures related to RI-IST
- Component or system design basis documentation
- Piping and instrument diagrams for systems that contain components in the RI-IST program

- PRA and supporting documentation (see Regulatory Position 2.3)
- Categorization results, including the RI-IST process summary sheet for each component or group of components (see Regulatory Position 2.3.2)
- Integrated decisionmaking process procedures, expert panel meeting minutes (if applicable) (see Regulatory Position 2.4)
- Detailed implementation plans and schedules (see Regulatory Position 3.2)
- Completed test procedures and any supplemental test data related to RI-IST (see Regulatory Position 3.3)
- Corrective action procedures (see Regulatory Position 3.4)
- Plant-specific performance data (e.g., machinery history) for components in the RI-IST program (see Regulatory Positions 2.3.3 and 3.1)
- A description of individual changes made to the RI-IST program after implementation (see Regulatory Position 1.3)

REFERENCES

1. USNRC, "Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities: Final Policy Statement," *Federal Register*, Vol. 60, p 42622, August 16, 1995.
2. USNRC, "Framework for Applying Probabilistic Risk Analysis in Reactor Regulation," SECY-95-280, November 27, 1995.[1]
3. USNRC, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Regulatory Guide 1.174, July 1998.[2]
4. USNRC "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Graded Quality Assurance," Regulatory Guide 1.176, August 1998.[2]
5. USNRC, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," Regulatory Guide 1.177, August 1998.[2]
6. USNRC, "Standard Review Plan for Risk-Informed Decision Making," Standard Review Plan, NUREG-0800, Chapter 19, July 1998.[2]
7. USNRC, "Standard Review Plan for Risk-Informed Decision Making: Inservice Testing," Standard Review Plan, NUREG-0800, Chapter 3.9.7, August 1998.[2]
8. USNRC, "Standard Review Plan for Risk-Informed Decision Making: Technical Specifications," Standard Review Plan, NUREG-0800, Chapter 16.1, August 1998.[2]
9. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section XI, ASME.[3]
10. American Society of Mechanical Engineers, "Risk-Based Inservice Testing—Development of Guidelines," Research Report (CRDT-Vol. 40-2, Volume 2), 1996.[3]
11. Electric Power Research Institute, "PSA Applications Guide," EPRI TR-105396, August 1995.[1]
12. Nuclear Energy Institute Draft (Revision B), "Industry Guidelines for Risk-Based Inservice Testing," March 19, 1996.[1]
13. American Society of Mechanical Engineers (ASME) Code for Operations and Maintenance of Nuclear Power Plants, OM Code-1995.[3]
14. Nuclear Energy Institute, "Guidelines for Managing NRC Commitments," Revision 2, December 19, 1995.[1]
15. W.T. Pratt et al., "An Approach for Estimating the Frequencies of Various Containment Failure Modes and Bypass Events," Draft NUREG/CR-6595, December 1997.[2]
16. P.K. Samanta et al., "Handbook of Methods for Risk-Based Analyses of Technical Specifications," NUREG/CR-6141, December 1994.[4]
17. G.E. Apostolakis and S. Kaplan, "Pitfalls in Risk Calculations," *Reliability Engineering*, Vol. 2, pages 135-145, 1981.
18. USNRC, "Periodic Verification of Design-Basis Capability of Safety-Related Power-Operated Valves," Generic Letter 96-05, September 18, 1996.[1]
19. USNRC, "Guidance on Developing Acceptable Inservice Testing Programs," Generic Letter 89-04, April 3, 1989.[1]
20. USNRC, "Safety-Related (1) Motor-Operated Valve Testing and Surveillance," Generic Letter 89-10, June 28, 1989.[1]
21. American Society of Mechanical Engineers (ASME) Alternative Rules for Preservice and Inservice Testing of Certain Electric Motor Operated Valve Assemblies in LWR Power Plants, Code Case OMN-1, OM Code-1995; Subsection ISTC.[3]

[1]Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

[2]Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction and Distribution Services Section, OCIO, USNRC, Washington, DC 20555-0001, or by fax to (301)415-2289, or by email to GRW1@NRC.GOV. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161. Copies of active and draft guides are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

[3]Copies may be obtained from ASME, 345 East 47th Street, New York, NY 10017.)

[4]Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202)512-2249); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW., Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

APPENDIX A
DETAILED GUIDANCE FOR INTEGRATED DECISIONMAKING

A.1 Introduction

The increased use of probabilistic risk assessment (PRA) in nuclear plant activities such as in risk-informed inservice testing (IST) programs will require a balanced use of the probabilistic information with the more traditional engineering (sometimes referred to as "deterministic") information. Some structured process for considering both types of information and making decisions will be needed that will allow improvements to be made in plant effectiveness while maintaining adequate safety levels in the plant. This will be particularly important during initial program implementation and also for the subsequent early phases of the program. In some instances, the physical data from the PRA and from the deterministic evaluations may be insufficient to make a clearcut decision. At times, these two forms of information may even seem to conflict. In such cases, it is the responsibility of the licensee to assemble the appropriate skilled utility staff (and in some cases consultants) to consider all the available information in its various forms and to supplement this information with engineering judgment to determine the best course of action. The participants involved in this important role have generally been referred to in various industry documents as an "expert panel." In this appendix, this function will be described as being an engineering evaluation without specifying how the evaluation is to be performed administratively. It is not the intention of this guidance to indicate that a special administrative body needs to be formed within the utility to satisfy this role. It is the function that is important and that must be performed in some well-organized, repeatable, and scrutable manner by the licensee. This function is all-pervasive in the implementation phase of such activities as inservice inspection (ISI) and IST, and accordingly, the licensee has the responsibility to see that this function is done well.

A.2 Basic Categories of Information To Be Considered

Risk-importance measures may be used together with other available information to determine the relative risk ranking (and thus categorization) of the components included in the evaluation. Results from all these sources are then reviewed prior to making final decisions about where to focus IST resources.

Although the risk ranking of components can be used primarily as the basis for prioritizing IST at a plant, additional considerations need to be addressed (e.g., defense in depth, common cause, and the single failure criterion), which may be more constraining than the risk-based criteria in some cases. Consideration must be given to these issues and component performance experience before the IST requirements for the various components are determined.

IST experience should contribute an understanding of the important technical bases underlying the existing testing program before it is changed. The critical safety aspects of these bases should not be violated inadvertently in changing over to a RI-IST, and important plant experience gained through the traditional IST should be considered during the change.

The plant-specific PRA information should include important perspectives with respect to the limitations of PRA modeling and analysis of systems, some of which may not be explicitly addressed within the PRA analysis. An understanding should also be provided as to how the proposed changes in pump and valve testing could affect PRA estimates of plant risk.

Plant safety experience should provide insights associated with the traditional analyses (Chapter 15 of the plant Final Safety Analysis Report) and any effect that proposed changes in testing might have on the traditional perspective of overall plant safety.

Plant operational input should supplement the insights of plant safety with additional information regarding the operational importance of components under normal, abnormal, and emergency conditions. There should also be input on operating history, system interfaces, and industry operating experience to supplement information from the IST.

Maintenance considerations should provide perspectives on equipment operating history, work practices, and the implementation of the maintenance rule.

Systems design considerations should include the potential effect of different design configurations (e.g., piping, valves, and pumps) on planning for a risk-informed IST, particularly if future plant modifications are contemplated or if systems are temporarily taken out of service for maintenance or replacement or repair.

A.3 Specific Areas To Be Evaluated

This section addresses some technical and administrative issues that are currently believed to be particularly important for RI-IST applications. Additional issues of a more general nature that may arise in expert panel deliberations are given in SRP Chapter 19.

- It should be confirmed that proper attention has been given to component classifications in systems identified in emergency operating procedures (and other systems) depended upon for operator recovery actions, primary fission product barriers excluded from the PRA due to their inherent reliability (such as the RPV), passive items not modeled in the PRA (such as piping, cable, supports, building or compartment structures such as the spent fuel pool), and systems relied upon to mitigate the effects of external events in cases where the PRA considered only internal events.
- Failure modes modeled by the PRA may not be all-inclusive. Consideration should be given to the failure modes modeled and the potential for the introduction of new failure modes related to the IST application. For example, if valve mispositioning has been assumed to be a low-probability event because of independent verification and therefore is not included in the PRA assumptions, any changes to such independent verifications should be evaluated for potential impact on the PRA results.
- Other qualitative or quantitative analyses that shed light on the relative safety importance of components, such as FMEA, shutdown risk, seismic risk, and fire protection should be included in the resource information base.
- Attention should be given to the fact that component performance can be degraded from the effects of aging or harsh environments, and this issue will need to be addressed and documented.
- The engineering evaluation should include the choice of new test frequencies, the identification of compensatory measures for potentially important components, and the choice of test strategies for both HSSCs and LSSCs.
- Until the ASME recommendations for improved test methods are available, the existing IST test methods should be evaluated prior to choosing the test methods to be used for the HSSCs and LSSCs, depending on their expected failure modes, service conditions, etc.
- Because of the importance of maintaining defense in depth, particular attention should be given to identifying any containment systems involving IST components.
- Step-wise program implementation, as discussed in Regulatory Position 3.2, should be included as part of the licensee's integrated decisionmaking process.
- The licensee's performance monitoring approach, as discussed in Regulatory Position 3.3, should be included as part of the licensee's decisionmaking process.

Value/Impact Statement

A draft value/impact statement was published with the draft of this guide (DG-1062) when it was issued for public comment in June 1997. No significant changes were necessary from the original draft, so a separate value/impact statement for this final guide has not been prepared. A copy of the draft value/impact statement is available for inspection or copying for a fee in the Commission's Public Document Room at 2120 L Street NW, Washington, DC.

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