NRC INSPECTION MANUAL

IIPB

INSPECTION PROCEDURE 71111

REACTOR SAFETY—INITIATING EVENTS,
MITIGATING SYSTEMS, BARRIER INTEGRITY

PROGRAM APPLICABILITY: 2515

71111-01 INSPECTION OBJECTIVE

To independently gather sufficient information by performing a minimum level of baseline inspection to determine whether licensee performance meets the following cornerstone objectives:

01.01 Initiating Events (I). To limit the frequency of those events that upset plant stability and challenge critical safety functions, during a shutdown as well as power operations.

01.02 Mitigating Systems (M). To ensure the availability, reliability, and capability of systems that mitigate initiating events to prevent reactor accidents.

01.03 Barrier Integrity (B). To ensure that physical barriers protect the public from radionuclide releases caused by accidents.

71111-02 INSPECTION REQUIREMENTS

02.01 Plan and perform inspections in accordance with the following attachments to this procedure:

Attachment 01: Adverse Weather Protection (M)
Attachment 02: Evaluation of Changes, Tests, or Experiments (I,M,B)
Attachment 03: (Reserved)
Attachment 04: Equipment Alignment (I,M,B)
Attachment 05: Fire Protection (I,M)
Attachment 06: Flood Protection Measures (I,M)
Attachment 07: Heat Sink Performance (I,M)
Attachment 08: Inservice Inspection Activities (I,M,B)
Attachment 09: (Reserved)
Attachment 10: (Reserved)
Attachment 11: Licensed Operator Requalification Program (M,B)
Attachment 12: Maintenance Rule Implementation (I,M,B)
Attachment 13: Maintenance Risk Assessments and Emergent Work Control (I,M,B)
Attachment 14: Personnel Performance During Nonroutine Plant Evolutions and Events (I,M,B)
Attachment 15: Operability Evaluations (M)
Attachment 16: Operator Workarounds (M)
Attachment 17: Permanent Plant Modifications (I,M,B)

Attachment 18: (Reserved)
Attachment 19: Post Maintenance Testing (M,B)
Attachment 20: Refueling and Outage Activities (I,M,B)
Attachment 21: Safety System Design and Performance Capability (M,B)
Attachment 22: Surveillance Testing (M,B)
Attachment 23: Temporary Plant Modifications (M,B)

The above listing indicates which cornerstones apply to each inspection procedure. Findings from these inspections must be grouped by the inspector into the cornerstone to which they apply (see inspection guidance tables in the procedures and cornerstone charts in IMC 2515, Appendix A, Attachment 2 for guidance). Each finding must be aligned with only one cornerstone following application of the significance determination process (SDP) described in IMC 0609, to avoid double counting in assessing performance.

02.02 In using the above inspection attachments, the inspector verifies that the licensee has entered the identified problems in its corrective action program and verifies effectiveness of corrective actions for a selected sample of related problems.

02.03 As they occur, review significant site specific Institute of Nuclear Power Operations (INPO) and similar independent, third party evaluation reports. Record the review, but not any of the specific findings, in an inspection report.

71111-03 INSPECTION GUIDANCE

General Guidance

Applicable Performance Indicators:

The inspections conducted under this procedure provide information on licensee performance in areas that are not measured by the following performance indicators (PIs): unplanned scrams, scrams with loss of normal heat removal, and unplanned power changes (Initiating Events); safety system unavailability and safety system functional failures (Mitigating Systems); and reactor coolant system (RCS) specific activity and RCS leak rate (Barrier Integrity). In fulfilling the inspectable inspection requirements of the attachments, the inspector needs to exercise care to not spend time inspecting activities or characteristics that are already covered by a PI, although the PI verification procedure IP 71151 does gather such information.

Risk-Informed Inspection Planning:

This section provides guidance on the risk-informed aspect of planning the performance based inspections in the baseline inspection program.

In accordance with NRC Commission Policy, a “risk-informed” approach to regulatory decision-making represents a philosophy whereby “risk insights” are considered together with other factors to establish requirements that better focus licensee and regulatory attention on design and operational issues commensurate with their importance to public health and safety. This Policy defines the term “risk insights” as the results and findings that come from risk assessments. It is in this context that the terms “risk-informed” and “risk insights” are used in the following discussion of risk-informed inspection planning and in the determination of what to inspect using a risk-informed approach.

Risk-informed inspection planning (i.e. the selection of risk-informed inspection samples) is based on the following:

- Extracting risk insights from a risk model;

- Using these insights to select structures, systems, components (SSCs), and activities for inspection; and

- Using insights from plant-specific and industry operational experience to add SSCs into the inspection sample.

Frequently used risk insights that are normally available for inspection planning can be obtained from Individual Plant Examinations (IPEs). If available, it is preferable to use an updated plant-specific PRA to extract risk insights. The types of information that are normally available from the IPEs include:

- lists of dominant accident sequences and their contribution to core damage frequency (CDF) and large early release frequency (LERF),

- lists of accident initiators, components, systems, and operator actions ranked by importance measures, such as RAW, RRW, Birnbaum, F-V (in some PRAs importance measures, such as system importance are not provided because system-level cutsets may not have been determined),

- lists of accident sequence cutsets and system level cutsets (can be deleted unless the inspector wants to review the PRA model in detail), and

- lists of potential severe-accident vulnerabilities.

These PRA insights are useful in selecting SSCs, but are only a first step in a risk-informed approach to inspection. As plant configurations change from on-line maintenance or plant modifications, the relative importance of an SSC or an accident sequence may change. Because plant risk changes dynamically from operational activities (e.g., surveillance testing) in combination with ongoing maintenance, inspection planning needs to be flexible and consider changes in SSC importance for inspection priority.

In addition to the frequently used risk insights listed above, the following items are considered general guidance for developing and using other risk insights throughout the inspection process.

- Inspectors should consider the inputs to the SDP throughout the inspection process, both planning and implementation. For example, the SDP screens as very low significance (green) inspection findings that affect only one train of mitigating system for a single initiating event. Therefore, inspectors should consider planning inspections that target combinations of SSCs that are related within an accident sequence and affect more than one train.

- Inspectors should consider the SDP during plant status tours (IMC 2515, Appendix D) to identify potential SDP candidates (i.e, single train failure during testing), and plan inspections to determine if the SDP level 1 screening criteria are satisfied.

- Inspectors are encouraged to use resources in addition to the plant-specific IPEs. Although the IPEs are generally the most valuable resource in extracting risk insights, they have not been reviewed or approved by the NRC, and some licensees may not be updating theirs. Therefore, inspectors may need to use other resources to evaluate certain PRA assumptions regarding system success criteria or operator actions/human errors. Insights from industry operational experience can be an excellent resource for planning and focusing inspections. Because many licensees are maintaining updated plant-specific PRAs as “living PRAs”, these PRAs should be used when available.

- Inspectors should review the site’s “Risk-Informed Inspection Notebook” issued by the NRC for use with the SDP. These notebooks provide site-specific information on pertinent core damage scenarios and sequences, systems that perform mitigating functions, and the number of trains required for each class of initiators.

Risk-informed inspection planning is expected to vary depending on the type of inspection being conducted. Listed below are some examples of risk-informed inspection planning techniques with some examples in capturing risk insights.

Refueling Outage Inspection Planning Example

Refueling and shutdown activities generally are periods of high activity with less defense-in-depth because equipment is out of service, and are potentially high risk periods. The inspection attachment for refueling and outage activities, and other inspection procedures, will be used to inspect during these periods. Inspections should be planned before the outage and the planning should include the licensee's outage plan, schedule, and risk assessment. The inspection planning should identify the following:

- Major maintenance and modification activities during the refueling outage;

- Periods of heightened risk in the outage risk profile including mid-loop configuration, open containment configuration, electrical equipment outages, and switchyard activities; and

- Mitigating system availability and operator compensatory measures, including temporary modifications, for maintaining key plant safety functions.

Using this information, the risk-informed inspection plan can be developed to evaluate the effectiveness of the licensee's program practices such as post-maintenance testing for modifications that, if improperly installed or implemented, could affect the function of mitigating system equipment, temporary modifications used as backup electrical power supplies, and aligning electrical power supplies during switchyard activities.

In addition to the licensee's outage risk assessment, inspectors are encouraged to use other resources, including shutdown risk insights from similar plants and insights from shutdown risk studies by the NRC (e.g., NUREG-1449,"Shutdown and Low Power Operation at Commercial Nuclear Power Plants," and NUREG/C-6093,"An Analysis of Operational Experience During Low Power and Shutdown").

Reactor Safety Cornerstone Team Inspection Planning Example

The baseline program includes three team inspections: fire protection, safety system design and performance capability, and identification and resolution of problems. The procedures for each of these inspections specifically require senior reactor analyst (SRA) involvement before the inspection. The SRA will review the licensee's IPE or IPEEE before the inspection and provide risk insights to the inspection team.

Resident and Region-Based Inspection Examples

Many of the inspections must be coordinated with the licensee's schedule or specific plant conditions that are not considered during the annual planning meeting. In these cases, inspections should be planned by the inspectors using the licensee's maintenance and surveillance schedule, risk assessments, and the IPE. Inspectors should determine when to conduct inspections based on the plant's work scheduling process but should also factor changes in plant conditions (i.e., emergent work) into the inspection plan. During plant status tours, inspectors will gather real-time plant information that should be used to alter the inspection plans accordingly. Inspection planning should identify the following:

- Periods of heightened risk from on-line maintenance that affects or could affect mitigating systems, or could potentially cause an initiating event. Particular attention should be given to activities that have increased potential for initiating a plant event or transient when mitigating

capability is decreased, such as switchyard maintenance activities when an emergency diesel generator (EDG) or turbine-driven AFW pump is unavailable;

- Planned tests, including surveillance tests, post-modification tests, and post-maintenance tests; and

- Planned on-line installation of modifications.

Using this information, the inspection plan can be developed to implement several inspection attachments during one maintenance activity. For example, during maintenance of an emergency diesel generator (EDG), the following items could be inspected:

- Verification that planned on-line maintenance is properly performed in accordance with maintenance rule requirements (i.e., performing required risk assessments);

- Hours of unavailability are properly captured under the maintenance rule and performance indicators, and those hours are consistent with assumptions of unavailability in the IPE (consistency between the IPE assumptions and actual plant practices is important so that risk ranking and relative importance of the SSC is accurately represented in the IPE);

- Proper alignment or testing of another EDG train or other mitigating system train that is important for a loss of offsite power event; and

- Acceptability of post-maintenance testing of the EDG after maintenance.

These types of verifications would be performed using the maintenance rule implementation, maintenance work risk assessment and emergent work, PI verification, post-maintenance testing, and surveillance testing inspection procedures. If during EDG maintenance, emergent work comes up or the weather turns bad, the inspectors should alter the inspection plan to cover these inspectable areas because combinations of degraded conditions tend to increase risk the most.

To manage progress in completing the baseline inspection program, the senior resident inspector and regional DRP branch chief should review each calendar quarter the completion status of the attachments to this procedure.

<u>Specific Guidance</u>

03.01 No specific guidance.

03.02 The inspector should use the guidance in IP 71152, “Identification and Resolution of Problems,” and IMC 2515, Appendix A, when verifying the effectiveness of corrective actions.

03.03 Resident inspectors should be knowledgeable of the results of all site-specific Institute of Nuclear Power Operations (INPO) evaluations and accreditation reviews or similar independent, third party reviews to identify any safety significant issues that may be contained in them. The resident inspector will read INPO evaluation and accreditation reports to determine if the INPO evaluation results are generally consistent with the results of NRC evaluations. The inspector will document that an INPO report was reviewed, but should not include a recounting or listing of INPO’s findings. No inquiries of the licensee should be made about the INPO final rating. The specifics of any significant differences between NRC and INPO perceptions should be discussed with regional management.

The inspector should use the Significance Determination Process (IMC 0609) to help determine the importance of issues in INPO and third party reports, if the issues are applicable to an SDP evaluation. Issues with the potential to be more significant than very low (green) significance should be documented in an inspection report as a licensee identified issue. Significant issues in third party reports that are not applicable to an SDP evaluation, such as cross cutting issues,

should be used by the inspector in selecting samples for associated baseline inspections, or in orienting problem identification and resolution inspections. If a substantial cross cutting issue is identified in a third party audit, the inspector may record it in section 4OA4 of the inspection report as a licensee identified issue.

End