NRC INSPECTION MANUAL

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 (I,M)
Attachment 02: (Reserved)
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 Effectiveness (I,M,B)
Attachment 13: Maintenance Risk Assessments and Emergent Work Control (I,M,B)
Attachment 14: (Reserved)
Attachment 15: Operability Evaluations and Functionality Assessments (M,B)
Attachment 16: (Reserved)
Attachment 17: Evaluations of Changes, Tests, or Experiments and Permanent Plant Modifications (I,M,B)
Attachment 18: Plant Modifications (I,M,B)
Attachment 19: Post Maintenance Testing (M)
Attachment 20: Refueling and Other Outage Activities (I,M,B)
Attachment 21: Component Design Bases Inspection (M)
Attachment 22: Surveillance Testing (M,B)

Attachment 23: (Reserved)

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 in accordance with OEDO Procedure – 0220, "Coordination with the Institute of Nuclear Power Operations (INPO)" and document the review in accordance IMC 0612, "Power Reactor Inspection Reports."

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, unplanned power changes, and unplanned scrams with complications (Initiating Events); safety system functional failures and mitigating system performance indices (Mitigating Systems); and reactor coolant system (RCS) specific activity and RCS identified leak rate (Barrier Integrity). In fulfilling the 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,"Performance Indicator Verification" 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 Probabilistic Risk Assessment (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 Risk Achievement Worth (RAW), Risk Reduction Worth (RRW), Birnbaum, Fussell-Vesely (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 Significance Determination Process (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 Phase 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 their IPEs. 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" or "Plant Risk Information eBook" issued by the NRC for use with the SDP as appropriate. 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/CR-6093, "An Analysis of Operational Experience During Low Power and Shutdown").

Reactor Safety Cornerstone Team Inspection Planning Example

The baseline program includes four team inspections: fire protection, component design bases, modifications/10 CFR 50.59, and problem identification and resolution. 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 Individual Plant Examination of External Events (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 Division of Reactor Projects (DRP) branch chief should review each calendar quarter the completion status of the attachments to this procedure for their assigned inspections.

Specific Guidance

03.01 No specific guidance.

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

03.03 IMC 0612 provides guidance on documenting the NRC review of INPO evaluations, accreditations reports, or other third party reviews. NRC personnel should not take possession of INPO evaluation documents, make copies for NRC internal distribution absent extraordinary circumstances, or use these documents to form a basis for regulatory action. Inspectors should normally review hardcopies of INPO evaluations on licensee-owned property outside of the Resident Inspector's Office or electronically using the licensee's information system to preclude taking possession of confidential commercial information. These restrictions do not apply to INPO Event Reports (IER) or INPO Significant Event Evaluation and Information Network (SEE-IN) reports, which are covered in the NRC/INPO Memorandum of Agreement and are available on the NRC's intranet.

71111-04 REFERENCES

OEDO Procedure – 0220, "Coordination with the Institute of Nuclear Power Operations (INPO)" (http://www.internal.nrc.gov/oedo/procedures-guidance/)

IMC 0609, "Significance Determination Process"

IMC 0612, "Power Reactor Inspection Reports"

IMC 2515, Appendix A, "Risk-Informed Baseline Inspection Program"

IMC 2515, Appendix D, "Plant Status"

IP 71151,"Performance Indicator Verification"

IP 71152, "Problem Identification and Resolution"

NUREG-1449, "Shutdown and Low Power Operation at Commercial Nuclear Power Plants" (http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1449/)

NUREG/CR-6093, "An Analysis of Operational Experience during Low Power and Shutdown" (ML072410503)

Memorandum of Agreement between the Institute of Nuclear Power Operations and the U.S. Nuclear Regulatory Commission, Effective Date: December 6, 2010 (ML103550544)

End

Attachment 1 – Revision History for IP 71111

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
	04/03/00 CN 00-003	Initial Issue			
N/A	12/11/00 CN 00-024	Revised to add requirements and guidance for reviewing major INPO reports to satisfy EDO Field Policy Manual on the topic. Guidance was also added about using SDP, when applicable, to evaluate the significance of INPO findings. No change in IP resources or effort.	NO	N/A	N/A
N/A	05/06/03 CN 03-015 ML031550187	Revised to include pilot program procedure attachments developed to consolidate baseline inspection procedures. This pilot program will be implemented at two power reactor sites in each region for a period of one year.	NO	N/A	N/A
N/A	05/16/08 CN 08-015 ML080701033	This document is being revised to reflect changes resulting from the 2007 ROP Realignment, update the list of performance indicators, and remove reference to a pilot program that was conducted in 2003. Completed 4 year historical CN search.	NO	N/A	N/A
N/A	10/28/11 CN 11-025 ML111511016	Added a reference to OEDO-0220 which contains additional guidance and direction for the review of INPO reports. Added additional guidance related to protection of confidential commercial information. This resolves FF 71111-1674.	NO	N/A	ML112140265