Integrated Regulatory Review Service Mission to the United States

MODULE 7: INSPECTION

Overview:

The Reactor Oversight Process (ROP) is the U.S. Nuclear Regulatory Commission's (NRC's) program to inspect, measure, and assess the safety performance of commercial nuclear power plants and to respond to any decline in performance. The ROP reflects the Commission's strategic goals of safety and security and the objectives of openness, effectiveness, and operational excellence. Through the ROP, the NRC continuously oversees nuclear power plants to verify that they are in compliance with regulatory requirements and takes appropriate enforcement action when compliance is not achieved.

The ROP calls for the following:

- focusing inspections on activities where the potential risks are greater (i.e., the process is risk informed)
- applying greater regulatory attention to nuclear power plants with performance problems, while maintaining a normal level of regulatory attention to facilities that perform well
- using objective measurements of the performance of nuclear power plants
- giving both the public and the nuclear industry timely and understandable assessments of plant performance
- responding to violations of regulations in a predictable and consistent manner that reflects the potential safety impact of the violations

The ROP uses both inspection findings and performance indicators (PIs) to assess the performance of each plant within a regulatory framework of seven cornerstones of safety. Toward that end, the NRC performs a program of baseline inspections at each plant and may perform supplemental inspections and take additional actions to ensure that the plants address significant issues. The NRC communicates the results of its oversight process by posting plant-specific inspection findings and PI information on the NRC's public Web site. The NRC also conducts public meetings and events to discuss the results of its periodic assessments of licensee performance.

The NRC assesses and evaluates the overall effectiveness of the ROP through achieving its preestablished goals (i.e., performance metrics) and intended outcomes annually. The latest report, SECY-10-0042, "Reactor Oversight Process Self-Assessment for Calendar Year 2009," was issued on April 7, 2010.

Inspection of facilities and activities

The regulatory body shall carry out inspections of facilities and activities to verify that the authorized party is in compliance with the regulatory requirements and with the conditions specified in the authorization. (GS-R-1, Requirement 27)

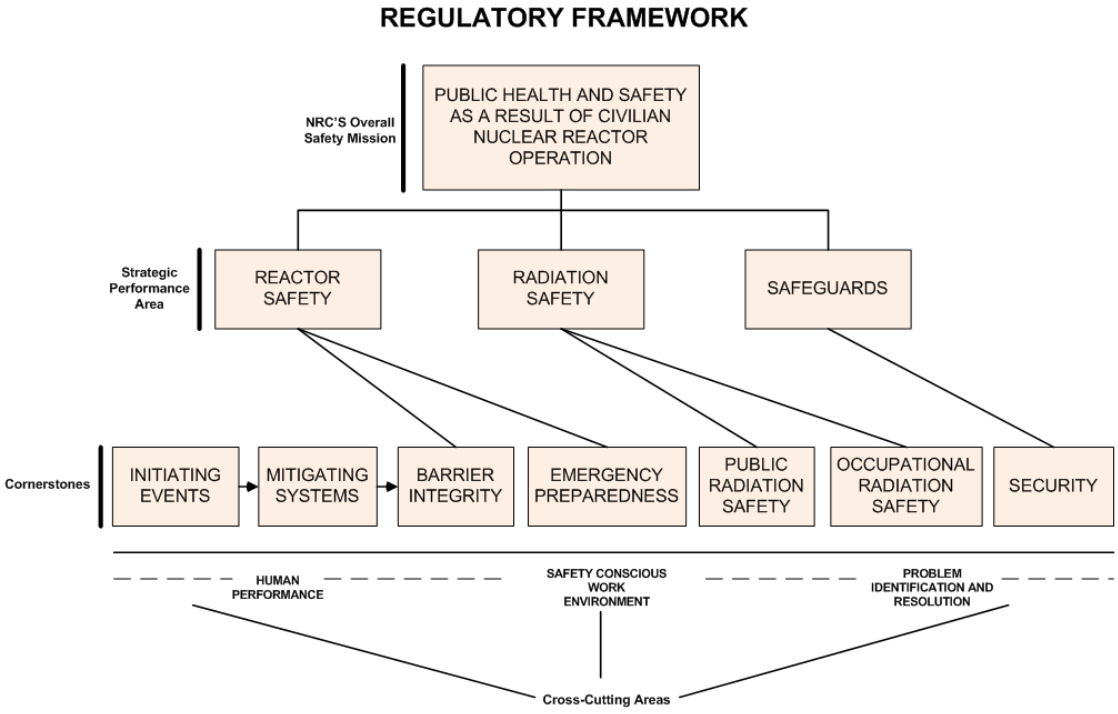
Inspections of facilities and activities shall include programmed inspections and reactive inspections; both announced and unannounced. (GS-R-1, Requirement 28)

Inspections of facilities and activities shall be commensurate with the radiation risks associated with the facility or activity, in accordance with a graded approach. (GS-R-1, Requirement 29)

Reactor Oversight Process Framework

The NRC inspection program for operating power reactors is a risk-informed program, developed with stakeholder input and based on the performance of reactor facility licensees. The ROP allocates and schedules inspection resources based, in part, on performance. Facility performance is determined by the risk-informed history of facility events, inspection findings, and PIs. Extensive documentation of the ROP and the detailed inspection program procedures are publicly available through the NRC Web site.

The regulatory framework for the ROP consists of three key strategic performance areas: reactor safety, radiation safety, and safeguards. Within each strategic performance area are cornerstones, each of which contains inspection procedures and PIs to ensure that their objectives are being met, and which reflect the essential safety aspects of facility operation. The overall ROP framework is shown below. Satisfactory licensee performance in the cornerstones provides reasonable assurance that the facility is operating safely and that the NRC is accomplishing its safety mission.



The ROP uses the significance determination process (SDP) to determine the safety significance of most inspection findings identified at commercial nuclear power plants. Additional inspections or other enforcement actions are implemented based on the safety significance of inspection findings and PIs. After an initial screening, those inspection findings with the potential to affect plant risk are subjected to a more thorough risk assessment. Under the SDP, this more detailed assessment may involve NRC risk experts from the appropriate regional office and further review by the utility's plant staff. The SDP uses the following color scale to characterize the significance of inspection findings:

- green—very low safety significance
- white—low-to-moderate safety significance
- yellow—substantial safety significance
- red—high safety significance

The final outcome of the SDP review is used to determine further NRC actions that may be needed. The same color scale is also used to characterize the significance of PI data.

Legal Authority

Title 10 of the *Code of Federal Regulations* (10 CFR) 50.70, "Inspections," establishes the legal authority for the conduct of inspections to verify the requirements of the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974, as amended. The regulation in 10 CFR 50.70 requires licensees to grant free and open access to NRC personnel and provide them with the equipment and support necessary to inspect the facility. The NRC staff, reactor licensee personnel, and the public have access to the legal basis documents, program level material, the detailed inspection procedures, and the ROP assessment data on the NRC Web site. The NRC holds public meetings with the nuclear industry to promulgate changes in the program and also conducts training for its employees. The NRC has signed memoranda of understanding with various other governmental bodies and other interested parties to allow for information and resource exchange. An annual report to the U.S. Congress summarizes the conduct of the program.

Management of Inspection

Inspection Program Structure

The NRC is headquartered near Washington, D.C., in Rockville, MD, and maintains regional satellite offices in four key cities throughout the country. Because of the size of the program and the many reactor sites, the responsibility for the inspection program is shared between the Headquarters program office and each of the four regional offices. Headquarters staff in the Division of Inspection and Regional Support within the Office of Nuclear Reactor Regulation is responsible for overall management of the reactor inspection program. This includes development of policies, practices, procedures, and the necessary infrastructure to support implementation and continuous enhancement of the ROP. Each regional office is responsible for executing established NRC policies and assigned programs within its regional boundary.

The NRC has a planned and systematic inspection program. The power reactor inspection program consists of several elements to indicate licensee performance and is described in

Inspection Manual Chapter (IMC) 2515, “Light Water Reactor Inspection Program—Operations Phase.” Other chapters of the Inspection Manual detail the inspection program through other periods of a reactor facility’s life cycle.

A key feature of the inspection program for operating reactors is the baseline inspection program of planned inspections, which defines the minimum level of inspection that each plant will receive regardless of performance. The inspection program also includes special inspections which are performed during certain special or unique operations at a plant (i.e., power uprate, steam generator replacement). IMC 2515, Appendix C, “Special and Infrequently Performed Inspections,” presents a complete list of the inspections in this category. Reactive inspections are performed in response to significant plant events. Supplemental inspections are performed to provide additional oversight and independently evaluate the root causes of performance deficiencies when the inspection and PI programs indicate declining licensee performance.

Plant events are also inspected to determine their significance and to determine the agency’s necessary response. According to 10 CFR 50.73, “Licensee Event Report System,” licensees are required to report the occurrence of unusual events to the NRC. As described in IMC 0350, “Oversight of Reactor Facilities in a Shutdown Condition Due to Significant Performance and/or Operational Concerns,” the NRC uses a separate inspection and assessment process for a plant in an extended shutdown because of performance problems since many of the PIs and much of the baseline inspection program would not be applicable.

Role of Inspectors

The region-based and resident inspectors assigned to each region carry out the reactor inspection program described in IMC 2515. Resident inspectors are assigned to each operating reactor site where they perform the routine daily inspections at each facility across a broad range of technical areas and maintain an awareness of plant status through direct observation and review of plant documentation. Region-based specialist inspectors who work out of one of the four NRC regional offices generally perform indepth periodic inspections, conducted as part of the baseline and supplemental inspections scheduled by the ROP. In general, the resident inspector staffing policy is to assign two resident inspectors at single- and dual-unit sites and three resident inspectors at triple-unit sites. Additionally, to ensure the right blend of experience and objectivity, IMC 0102, “Oversight and Objectivity of Inspectors and Examiners at Reactor Facilities,” stipulates required tour lengths for resident inspectors. Resident inspectors are normally expected to spend a minimum of 4 years and a maximum of 7 years at a facility. All NRC inspectors go through the training and qualification process described in IMC 1245, “Qualification Programs for the Office of Nuclear Reactor Regulation Programs.” Inspectors are held to the standards of conduct discussed in IMC 1201, “Conduct of Employees.”

The NRC conducts both announced and unannounced inspections. Resident inspectors conduct the majority of baseline inspections and many are conducted without an announcement of which activities are to be observed. To ensure that an accurate representation of licensee activities is observed and inspected, IMC 2515 provides guidance on when the resident inspectors should conduct some of their inspection activities. A portion of the baseline inspection program is performed outside of normal working hours, including at least 50 hours of direct inspection effort during “deep backshift,” between the hours of 10 p.m. and 5 a.m. In contrast, all region-based inspections are planned and announced. The power reactor licensee is generally informed of the NRC schedule for inspections at the facility. The NRC will withhold

information about a planned or pending inspection from the facility licensee only if the NRC believes that providing the information will compromise the inspection.

Types of Inspections

Planned Inspections

The risk-informed baseline and performance-based inspection program described in IMC 2515, Appendix A, "Risk Informed Baseline Inspection Program," defines the minimum level of planned inspections to evaluate power reactor licensee performance over a 12-month period. The overall objective of the program is to monitor each power reactor licensee at a defined level of effort to ensure that the NRC receives sufficient information to determine whether plant performance is acceptable by verifying that a licensee's performance meets the objectives for each cornerstone of safety. These cornerstones support the agency's performance goals in the NRC's Strategic Plan. Verifying that the objectives of each cornerstone are met ensures that the NRC's mission is achieved.

In developing the baseline inspection program, the NRC used a risk-informed approach (in which safety significance is considered) to determine a comprehensive list of areas for inspection within each cornerstone of safety. These inspection areas were selected for their safety significance and their impact on meeting a cornerstone objective. They were derived from a combination of probabilistic risk analysis insights, operational experience, deterministic analysis insights, and regulatory requirements. The NRC used the same risk-informed approach to determine the scope of inspection within each inspection area. The scope of inspection was also determined by considering the applicability of a PI. The more fully a PI measures an area, the less extensive is the scope of inspection. Three working groups consisting of internal and external stakeholders developed the current baseline inspection program. Their efforts included developing the regulatory oversight structure and identifying the PIs and appropriate thresholds that could be used to measure performance; developing the scope, depth, and frequency of a risk-informed baseline inspection program that would be used to supplement and verify the PIs; and developing the methods used in the assessment process for integrating PI and inspection data, determining NRC action based on those results, and communicating results to licensees and the public. The enforcement program was coordinated with these efforts to ensure that enforcement process changes were properly evaluated in the framework structure and that changes to the inspection and assessment programs were integrated with changes to the enforcement program. The baseline inspection program must be completed each year at each plant. NRC inspectors also focus on activities performed infrequently, such as refueling.

Reactive Inspections

The NRC conducts a reactive inspection in response to an event or degraded conditions at a reactor facility. The NRC's policy, detailed in Management Directive 8.3, "NRC Incident Investigation Program," is to ensure that significant operational events involving reactor and materials facilities are investigated in a timely, objective, systematic, and technically sound manner; that the factual information pertaining to each event is documented; and that the cause or causes of each event are ascertained. A significant operational event is defined as radiological, safeguards, or other safety-related operational event at an NRC-licensed facility that poses an actual or potential hazard to public health and safety, property, or the environment. At power reactors, these events include significant unplanned, degraded conditions identified by the licensee or the NRC. In accordance with 10 CFR 50.72, "Immediate

Notification Requirements for Operating Nuclear Power Reactors," licensees are required to report such events and occurrences to the NRC. The level of agency response is intended to be commensurate with the increase in risk associated with the event or occurrence. The three reactive team inspections in decreasing level of risk severity are Incident Investigation Team (IIT), Augmented Inspection Team (AIT), or Special Inspection (SI) Team.

Following notification of an event, or during an event, the onsite inspectors provide information about plant status and the performance of equipment and personnel to NRC management, event review staff, and regional and Headquarters risk analysts. That information is used to determine the level of agency response, investigatory response if any (i.e., IIT, AIT, or SI) and any special resources and expertise needed for event followup. The decision criteria associated with implementing a reactive inspection and a description of the scope of each inspection are described in Management Directive 8.3; IMC 0309, "Reactive Inspection Decision Basis for Reactors"; Inspection Procedure (IP) 93800, "Augmented Inspection Team"; and IP 93812, "Special Inspection." Although the reactive inspection may be announced to the public and to the facility licensee, it is usually started on site promptly with very little notice. If a reactive inspection is not warranted, the event is followed through the applicable ROP baseline inspection procedure(s).

Supplemental Inspections

A regional office conducts supplemental inspections to verify the adequacy of corrective actions taken by a licensee in response to inspection findings or PIs with increased significance (greater-than-green inspection findings or PIs that have crossed the green-to-white thresholds). The scope and breadth of these inspections are based on the guidance provided in the assessment program's Action Matrix and described in the "Supplemental Inspection Selection Table" in IMC 2515, Appendix B, "Supplemental Inspection Program." The supplemental inspections provide a graded response based on the risk significance and breadth of the identified performance issues. The lowest level of supplemental inspection focuses on oversight of the licensee's root cause evaluation of the issues. Inspection at the next level expands the baseline inspection sample or implements a focused team inspection, as necessary, to evaluate the extent of the condition. At the final level of supplemental inspection, a broad-scope, multidisciplinary team examines multiple cornerstone areas and crosscutting issues. Any new issues identified during the supplemental inspections are evaluated using the SDP. The Action Matrix governs the need for additional NRC actions, including additional supplemental inspections.

Performance of Regulatory Inspections

Inspection Manual

The NRC Inspection Manual, which is publicly available, documents the ROP. IMCs state the purpose, objectives, responsibilities, authorities, and basic requirements for an inspection program. IPs describe the activities performed by an inspector or technical staff to implement the inspection program described in the IMC. IPs are linked to an inspection program, state the objective of the inspection, list the inspection requirements, and give inspection guidance including identifying appropriate methods, such as observations, interviews, or reviews, for achieving the inspection objectives. IMC 2515 and its appendices describe the content of the operating power reactor inspection program. Other IMCs describe the inspection programs used in other phases of a reactor's life cycle, including construction, preoperational testing, startup, and decommissioning. A separate IMC describes the program used to determine that

vendors are complying with applicable NRC and industry requirements, that licensees and applicants are adequately overseeing vendors, and that sufficient interfaces exist between licensees/applicants and vendors. Inspection samples are focused using the regulatory requirements as documented in the IP, information obtained from operating experience, and performance history of the individual licensee.

Inspector Conduct

In accordance with IMC 1201, all NRC inspectors are required to conduct themselves on the site in a manner that inspires confidence in and respect for their competence and integrity. Inspectors are expected to prepare for inspections by becoming familiar with the requirements stated in each IP and by gathering and reviewing all relevant information and data before proceeding. Inspectors are also expected to maintain an appropriate level of objectivity and independence. IMC 0102 provides guidance to ensure that the agency's expectations are clearly communicated to inspectors.

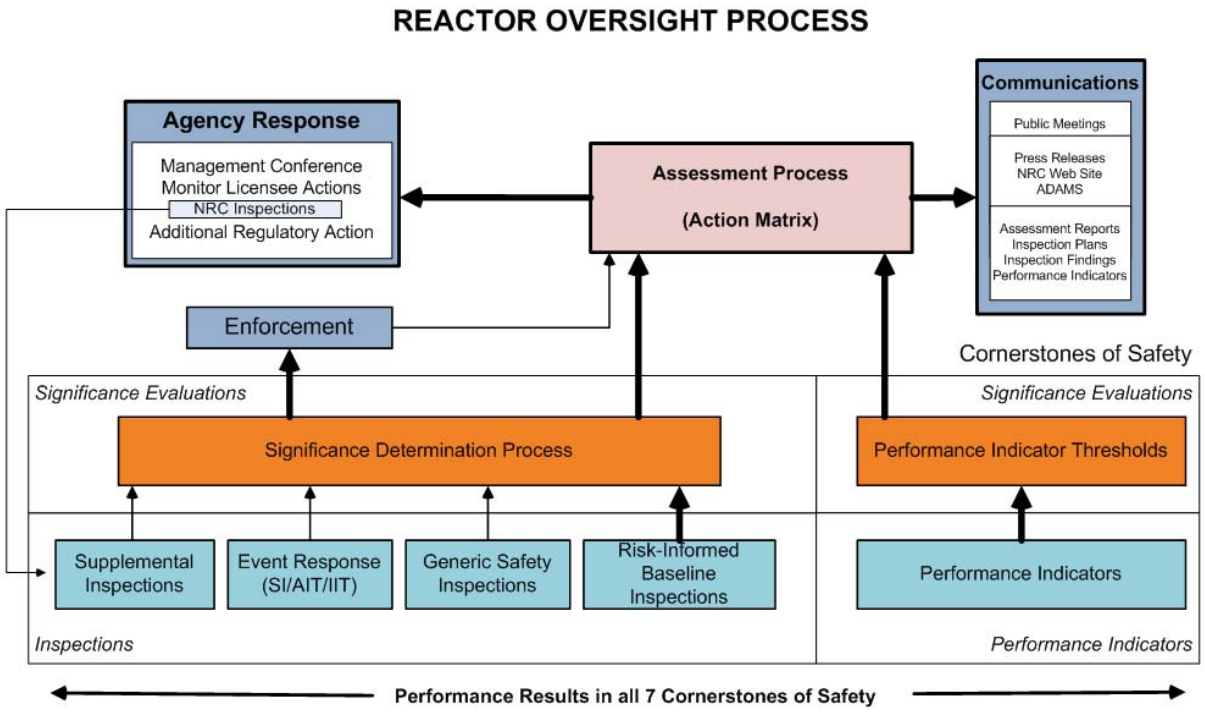
Inspection Reports and Findings

The ROP requires inspectors to document inspection findings. IMC 0612, "Power Reactor Inspection Reports," and associated ROP inspection procedures contain guidance for documenting inspection results. These results include findings identified through planned and reactive inspections. All ROP inspection reports follow the format and guidance in IMC 0612. Inspection reports communicate significant inspection findings in a consistent manner to licensees, the NRC staff, and, where applicable, the public. In addition, they document the basis for the determination of the significance of an issue and its related enforcement action. Inspectors who performed the inspection prepare the report and ensure that it includes information on the objective of the inspection, what was inspected, how the inspection was conducted, and criteria that were used to determine if a licensee was in compliance with the regulations. Following management review, inspection reports are sent from the applicable NRC official (Branch Chief, Division Director, or Regional Administrator) to a designated licensee executive for appropriate corrective actions. All nonsecurity inspection reports are made available to the public. If the scope of an inspection included issues with high public interest, the NRC will make the final inspection exit meeting open to the public. For example, public meetings are normally held at the completion of SIT or AIT inspections following operational events or when the NRC has completed its inspection of a licensee's response to a demand for information.

Performance Assessment

The NRC continuously assesses plant performance. Each calendar quarter, the resident inspectors and regional inspection staff assess the performance of each nuclear power plant in that region. The review focuses on the PIs and inspection findings. Every 6 months, this review is expanded to a more detailed assessment of plant performance and includes staff from NRC Headquarters, the regions, and resident inspectors. The result of the review is a performance letter communicating the agency's assessment of the plant's performance to the licensee, with a proposed inspection plan for the next 15 months of operation.
The NRC determines its regulatory response in accordance with an Action Matrix, which provides for a range of actions commensurate with the significance of the PI and inspection results. The Action Matrix is intended to provide consistent, predictable, and understandable agency responses to licensee performance. The actions defined by the Action Matrix are

graded such that the NRC becomes more engaged as licensee performance declines. The actions reflect the basic tenet of the ROP: a licensee's corrective action program should be relied on to correct identified issues that do not result in safety performance thresholds being crossed. For a plant where all of the PIs and inspection findings are characterized as green, the NRC will implement only its baseline inspection program and applicable IMC 2515, Appendix C, inspections, but the inspection plan will be based on plant performance trends. For plants that do not have all green PIs and inspection findings, the NRC will perform additional inspections beyond the baseline program and initiate other actions commensurate with the safety significance of the issues. The ROP guidance recognizes that, in rare instances, the regulatory actions dictated by the Action Matrix may not be appropriate. In these instances, the agency may deviate from the Action Matrix to either increase or decrease agency action with the approval of the Executive Director for Operations. The following diagram illustrates the relative relationship of each of the parts of the ROP.



Assessment of Inspection Activities

The inspection program is periodically reviewed and updated through the process described in IMC 0307, "ROP Self-Assessment Program." The assessment is performed annually, and the results are reported to the Commission. The ROP self-assessment program evaluates the overall effectiveness of the ROP by evaluating its success in meeting preestablished goals and intended outcomes in key program areas. A more indepth review of the program is conducted every 2 years, as detailed in IMC 0307, Appendix B, "ROP Realignment Process." The ROP realignment evaluates the effectiveness of each baseline IP through a review of past inspection results, industry events, and other inspection activities to determine if any change to the IP is warranted. Inspection resources are realigned biennially.

Additionally, the ROP feedback program described in IMC 0801, “Reactor Oversight Process Feedback Program,” provides ongoing feedback. Under this program, NRC staff members are encouraged to recommend changes to individual IPs or to a broader portion of the inspection program. New technical issues are often introduced to the inspection program through this process.

Assessment Summary

As part of the Complementary Self-Assessment, the NRC staff reviewed its programs against the goals and objectives of the International Atomic Energy Agency and found them to be consistent.

The NRC’s ROP is a very large, formal, and effective program for independently monitoring compliance with regulatory requirements at nuclear power plants.

An important element of the ROP is its self-assessment process, described in IMC 0307. This process objectively evaluates the effectiveness of the ROP; provides information used for program planning; develops recommended improvements; and informs internal and external stakeholders of the results of the self-assessment, including any conclusions and resultant improvement actions.