INSPECTION PROCEDURE 71125 ATTACHMENT 01

RADIOLOGICAL PERFORMANCE - REFUELING OUTAGES

Effective Date: July 1, 2026

PROGRAM APPLICABILITY: IMC 2515 A

CORNERSTONES: Occupational Radiation Safety

INSPECTION BASES: See IMC 0308 Attachment 2

SAMPLE REQUIREMENTS:

Sample Requirements		Minimum Baseline Sample Completion Requirements		Budgeted Range	
Sample Type	Section(s)	Frequency	Sample Size	Samples	Hours
Radiological Hazard Assessment	03.01	Refueling Outage*	1 per refueling outage	1 per refueling outage	40-44 per refueling outage
Instructions to Workers	03.02	Refueling Outage*	1 per refueling outage	1 per refueling outage	
Contamination and Radioactive Material Control	03.03	Refueling Outage*	1 per refueling outage	1-3 per refueling outage	
Radiological Hazards Control and Work Coverage	03.04	Refueling Outage*	2 per refueling outage	2-5 per refueling outage	
High Radiation Area and Very High Radiation Area Controls	03.05	Refueling Outage*	1 per refueling outage	1-3 per refueling outage	
Radiation Worker Performance and Radiation Protection Technician Proficiency	03.06	Refueling Outage*	1 per refueling outage	1 per refueling outage	
Temporary Ventilation Systems	03.07	Refueling Outage*	1 per refueling outage	1 per refueling outage	
Use of Respiratory Protection Devices	03.08	Refueling Outage*	1 per refueling outage	1 per refueling outage	

* Inspections should be performed during a refueling outage. When appropriately risk-informed samples are not available for inspection follow completion guidance of IMC 0306 Section 06.08.f.3.

71125.01-01 INSPECTION OBJECTIVES

01.01 Review and assess licensee performance in assessing the radiological hazards in the workplace associated with licensed activities and the implementation of appropriate radiation monitoring and exposure controls.

01.02 Verify that the licensee is properly identifying and reporting Performance Indicators (PIs) for the Occupational Radiation Safety Cornerstone and to verify that the practices and use of respiratory protection devices on site do not pose an undue risk to the wearer.

01.03 To conduct a routine review of problem identification and resolution activities per Inspection Procedure (IP) 71152, “Problem Identification and Resolution (PI&R).”

71125.01-02 GENERAL GUIDANCE

Inspections should be scheduled to coincide with refueling outages so as to maximize the opportunities for the inspector to verify licensee performance through direct observation.

Walk-downs and work activity observations required by the procedure should be performed together, to the extent practical.

Review licensee PIs for the Occupational Radiation Safety Cornerstone. For more information on Performance Indicators, see NEI 99-02, “Regulatory Assessment Performance Indicator Guideline” (ML13261A116) and information on changes in Frequently Asked Questions at http://www.nrc.gov/reactors/operating/oversight/program-documents.html#pi.

Review the results of radiation protection program audits and review any condition reports related to occupational radiation safety since the last inspection. The results of the radiation protection program audit (e.g., licensee’s quality assurance audits or other independent audits) and condition report reviews should be used to gain insights into overall licensee performance and focus the inspector’s inspection activities on areas that are most likely to yield safety-significant results, consistent with the principle of “smart sampling.” Annual radiation protection program audits are required by 10 CFR 20.1101(c). NUREG/CR-6204, “Questions and Answers Based on Revised 10 CFR Part 20,” (ML12166A179) provides further guidance on annual program audits in Q&A #118, #134, and #380.

Per IP 71152, it is expected that routine reviews of PI&R activities should equate to approximately 10 to 15 percent of the resources estimated for the associated baseline cornerstone procedures, this is a general estimate only based on the overall effort expected to be expended in each strategic performance area. It is anticipated that the actual hours required to be expended may vary significantly from attachment to attachment, depending on the nature and complexity of the issues that arise at the particular facility. Overall, an effort should be made to remain within the 10 to 15 percent estimate on a strategic performance area basis. Inspection time spent assessing PI&R as part of the baseline procedure attachments should be charged to the corresponding baseline procedure.

71125.01-03 INSPECTION REQUIREMENTS

03.01 Radiological Hazard Assessment Sample.

Verify that the licensee is identifying the magnitude and extent of radiation levels; concentrations and quantities of radioactive materials; and is adequately assessing radiological hazards.

Specific Guidance

a. Survey protocol should consider the current and historical isotopic mix and isotopic percent abundance, including current and historical presence of hard-to-detect radionuclides and potential alpha hazards. See IP 71125.02 for further guidance on source term determination.

b. Consider if, since the last inspection, there have been changes to plant operations that may result in a significant new radiological hazard for onsite personnel. If a new hazard is identified, consider if the licensee has assessed the potential impact of these changes and has implemented adequate surveys to detect and quantify the radiological hazard.

   Changes in plant operations that may result in changes to the scope of radiological hazards include but are not limited to the following:

   1. Degraded reactor fuel integrity that can result in hot particle contamination, or the presence of transuranic nuclides (or other hard-to-detect radionuclides), for work activities previously unaffected,

   2. Changes in reactor water chemistry (e.g., hydrogen injection in a BWR) that can result in significant changes to the in-plant radiation source term,

   3. Significant onsite spills, or contamination of uncontaminated systems,

   4. Storage of radioactive materials in the owner-controlled area (e.g., remote or satellite RCAs within the plant site).

c. Consider if the thoroughness and timing of the surveys is appropriate for the provided radiological hazard. The results of the audit and condition report reviews should be used to gain insights into overall licensee performance and focus the inspector's inspection activities on areas that are most likely to yield safety-significant results, consistent with the principle of "smart sampling." An appropriate survey should be of the right type, sensitivity and technique and the survey should enable adequate quantification of the radiological hazard and establishment of protective measures.

d. During walkdowns of the radiological control area (RCA)—including temporary radioactive material processing, storage, and handling areas—and other areas of the facility, evaluate material conditions and potential radiological conditions. Other areas to evaluate during walkdowns can include the protected area, restricted area, contaminated tool storage, contaminated machine shops, satellite RCAs, and infrequently accessed HRAs of the plant.

e. For systems used to monitor and warn of changing airborne concentrations in the plant consider if alarms and set points are sufficient to prompt licensee/worker action to

ensure that doses are maintained within the limits of 10 CFR Part 20 and determine whether they are appropriately positioned relative to the radiation source(s) or area(s) they are intended to monitor.

Continuous air monitors positioned throughout the power plant are often used as initial trending indicators of increasing airborne radioactive material levels. While identified increases in airborne levels may not be dose significant (as indicated by the directly measurable beta- and gamma-emitting radionuclides), power plants with known transuranic contamination problems should consider and assess this transuranic component when appropriate. This focus is especially vital during certain maintenance activities in known transuranic-contaminated areas.

General area air samples are typically used by licensees to verify the effectiveness of engineering controls to mitigate airborne radiological hazards at the work site. Breathing zone air samples are necessary when the licensee assigns individual internal doses from airborne concentrations of radioactive material.

f. Consider reviewing licensee evaluations of inconsistent or incongruent results from the licensee's intended radiological outcomes for radiologically significant work activities.

03.02 Instructions to Workers Sample

Verify that workers are instructed in plant-related radiological hazards and the radiation protection requirements intended to protect workers from those hazards.

Specific Guidance

a. Review radiation work permits (RWPs) and other documentation the licensee uses to control access to radiological hazards and evaluate instructions and controls. Note, the radiological controls (e.g., RWPs) for entry into high radiation areas (HRAs) may be plant specific. Review plant technical specifications to determine the requirements for entry and work in HRAs (e.g., authorization to enter into HRAs, electronic alarming dosimeter (EAD) set points, pre-job briefings, continuous job coverage, and stay time limitation).

b. Consider reviewing survey maps and attending pre-job briefings to observe instructions to workers. Workers should be able to remember their work restrictions established on the RWPs and as instructed in pre-job briefs (i.e., where they are allowed to work, what they are allowed to do and what they are not allowed to do). In addition, workers should be knowledgeable of stop work conditions (e.g., contact HP prior to system breach or worker actions that may cause a change in radiological conditions) and location of low-dose waiting areas.

c. During tours of the facility and review of ongoing work, evaluate if ambient radiological conditions are consistent with radiological postings.

d. Consider if the licensee informs workers of changes in plant operations/conditions that could significantly impact radiological hazards.

e. Select containers holding nonexempt, licensed radioactive materials that may cause unplanned or inadvertent exposure of workers. Consider if they are labeled and controlled in accordance with 10 CFR 20.1904, or meet the requirements of 10 CFR 20.1905(g).

03.03 Contamination and Radioactive Material Control Sample

Verify the licensee controls radioactive material and prevents the spread of contamination.

Specific Guidance

a. Observe locations where the licensee monitors potentially contaminated material leaving the RCA. Consider if the work is performed in accordance with plant procedures and whether the procedures are sufficient to control the spread of contamination and prevent the unintended release of radioactive materials from the site. 10 CFR Part 20 does not contain release limits for the release of contaminated material to unrestricted areas; thus, the licensee's criteria should be that no detectable licensed radioactive material (radioactive gaseous and liquid effluents excepted) is released for unrestricted use or as waste into an unrestricted area.

b. Review the licensee's criteria for the survey and release of personal items (e.g., using small article monitors (SAMs)).

c. Observe workers exiting the RCA and performing contamination monitoring. Consider if the applicable guidance is adequate and if workers are knowledgeable on how to respond to an alarm that indicates the presence of radioactive material. If workers are permitted to frisk personal items on their own, consider observing one or two control points to ensure that workers are complying with applicable guidance and training.

d. During plant walk-downs, consider background dose rates; they should not excessively interfere with the sensitivity of contamination monitoring equipment (e.g., friskers, personnel contamination monitors). Contamination monitoring equipment for free release of equipment and materials should be in a low background area. The licensee should not have established an artificial release threshold by degrading the instrument's detection sensitivity through such methods as raising the energy discriminator level or locating the instrument in a high-radiation background area.

e. Evaluate the licensee's physical and programmatic controls for highly activated or contaminated materials (non-fuel) stored within spent fuel pool and other storage pools. Consider if appropriate controls (i.e., administrative and physical controls) are in place to preclude unintended doses from materials stored in pools and the inadvertent movement of these materials.

03.04 Radiological Hazards Control and Work Coverage Sample

Verify the licensee controls radiological hazards during radiological work.

Specific Guidance

a. Consider if radiological controls are implemented commensurate with the radiological hazard. Adequate radiological controls include performing required surveys (e.g.,

radiation, contamination and airborne), radiation protection job coverage (e.g., audio and visual surveillance for remote job coverage), contamination controls and stop work criteria.

b. Consider if the licensee has integrated radiological work controls into work packages, work procedures and/or RWP documents.

c. Consider if EAD dose and dose rate alarm set points are based on current radiological survey data and plant procedures. Initial EAD set points (e.g., pre-outage) for EAD dose and dose rate alarms are commonly set based on historical data. The EAD alarm set points should be adjusted as needed based on actual dose rates and for changes in radiological conditions (e.g., during an outage).

d. During job performance observations, consider if personnel radiation monitoring devices are placed on the individual's body consistent with the method the licensee is employing to monitor dose from external radiation sources and applicable regulatory requirements.

e. If available, evaluate the work controls and dosimetry used for activities where dose rate gradients can be severe (i.e., underwater diving, steam generator entries, work under the reactor head, etc.), thereby increasing the necessity of providing multiple dosimeters and/or enhanced job controls.

f. When possible, observe work in potential airborne areas, and consider if air samples are representative of the breathing air zone when used to assess dose. As available, review RWPs for work within airborne radioactivity areas to guide inspection scope. Consider airborne radioactivity controls and monitoring, for jobs with the potential for significant airborne levels (e.g., grinding, grit blasting, system breaches, entry into tanks, cubicles, reactor cavities).

   When possible, observe work in Alpha Level II and III areas as these areas are more risk significant from an internal exposure perspective. Substantial internal dose may be received from alpha contamination prior to detection by instrumentation designed to detect betta and gamma radiation, which is typically in use. Procedures and work instructions should address if/when contamination surveys and airborne radioactivity surveys require alpha analysis, respiratory protection requirements, internal monitoring requirements, and contamination/airborne radioactivity minimization controls (i.e. grinding in an alpha II area may require more controls than a work evolution not expected to create an airborne hazard and work instructions may require wiping down of the area frequently to prevent buildup of contamination).

03.05 High Radiation Area and Very High Radiation Area Controls Sample

Verify the licensee controls HRAs and VHRAs per applicable requirements.

Specific Guidance

a. Review the circumstances of Technical Specification High Radiation Area Occurrences, as defined by NEI 99-02. Focus on verifying aspects of the licensee PIs associated with high-risk HRAs (greater than 25 rem in 1 hour at 30 centimeters from the source) and for all VHRAs.

b. Inspect posting and physical controls for all VHRAs and for a risk-informed selection of HRAs.

c. The intent of this limited inspection oversight/requirement is to maintain continued NRC vigilance of the licensee's program and procedural controls and plant staff awareness of these special, accessible areas where the potential for overexposure exists.

d. Review procedural changes since the last inspection to determine the adequacy of access controls for HRAs/VHRAs, consider if changes to licensee procedures will result in inadequate controls of these areas (i.e., violation of T.S. or site-specific alternate controls requirements).

03.06 Radiation Worker Performance and Radiation Protection Technician Proficiency Sample

Verify adequate radiation worker and radiation protection technician performance with respect to radiation protection requirements.

Specific Guidance

a. Consider if workers observe applicable radiation protection requirements and are knowledgeable of instructions provided by the licensee (e.g., Part 19 instructions and information relayed during pre-job briefs).

b. Consider if radiation workers and radiation protection technicians are implementing prescribed practices to keep doses below regulatory limits during work activities; focus on work activities that present the greatest radiological risk to workers.

c. Consider if workers are aware of their EAD dose and dose rate set points, and allowable stay times or permissible dose for radiologically significant work under each RWP.

d. Consider if workers are aware of how to respond to EAD alarms in accordance with plant procedures. Note, some EAD alarms are anticipated (e.g., for workers traversing a high dose rate work area).

e. Consider if radiation protection technicians are aware of the radiological conditions in their workplace, including applicable RWP controls/limits, and if their performance is consistent with the licensee's training and procedures

f. Consider if appropriate pre-work and job coverage surveys were performed for radiologically risk significant work activities.

g. Observe radiation protection technicians performing radiation surveys and consider if the instruments are being used correctly (i.e., surveyor technique and correct instrument for application). Consider discussing with radiation protection staff (supervisors and technicians) the procedures, equipment, and performance of radiation surveys for both routine and non-routine activities. Technicians should be knowledgeable about when and how to survey areas for:

1. Hot particles,

2. Alpha emitters,

3. Loose surface contamination,

4. Neutron radiation,

5. Airborne radioactivity, including the potential presence of transuranic radionuclides and/or other hard-to-detect radionuclides,

6. Work activities that could suddenly and significantly increase radiological conditions such as in-core detector movement, fuel moved in affected areas of drywell or auxiliary building, movement of irradiated materials in the spent fuel pool, and

7. Severe radiation field dose gradients that can result in non-uniform exposures.

03.07 Temporary Ventilation Systems Sample

Verify temporary ventilation systems used to mitigate the potential for airborne radioactivity are correctly configured to perform their intended function.

Specific Guidance

a. Walk down temporarily installed ventilation systems and consider if the use of these systems, including features and components (e.g., flow paths, air flow capacity, alarms and set points), is consistent with licensee procedures.

   Temporary ventilation system setups include high-efficiency particulate air (HEPA)/charcoal negative pressure units, downdraft tables, tents, metal “Kelly buildings,” and other enclosures).

b. During plant tours, be alert to plant ventilation flow problems that may result in airborne radioactivity moved by incorrect flows from elevated airborne radioactivity areas to non-airborne radioactivity areas.

c. Consider if ventilation airflow capacity, flow path (including the alignment of the suction and discharges), and filter/charcoal unit efficiencies are consistent with maintaining concentrations of airborne radioactivity in work areas below the concentrations of an airborne area to the extent practicable.

d. Consider reviewing the adequacy of other licensee engineering control implementation and actions to mitigate airborne radioactivity (e.g., vacuums, wetting, using a bandsaw instead of a grinder). Improperly maintained and controlled vacuum cleaners have been the source of elevated airborne radioactivity events. Consider how the licensee ensures that the vacuum cleaners are maintained and do not present an unevaluated source of airborne radioactivity.

03.08 Use of Respiratory Protection Devices Sample

Verify that the licensee’s use of respiratory protection devices to limit the intake of radioactive material meets the requirements of a respiratory protection program.

Specific Guidance

a. It is the NRC’s position that any respiratory protection device used in a contaminated area or potentially contaminated area (i.e., inside the radiologically controlled area) is, by

definition, being used to limit intake of radioactive material. This is true regardless of whether the licensee is taking credit for the respirators' applied protection factor.

b. As available, review work activities where respiratory protection devices are used to limit the intake of radioactive materials and consider if the licensee performed an evaluation concluding that further engineering controls are not practical and that the use of respirators maintains doses within regulatory limits.

   The level of detail and scope of the licensee's evaluations should be commensurate with the radiological hazards (both airborne and external, direct radiation exposure). These evaluations may also consider factors other than the exposure to radioactive materials (e.g., worker acceptance, contamination control, heat stress, and exposure to other Occupational Safety and Health Administration hazards).

c. Consider how the licensee determines that the level of protection provided by the respiratory protection devices during use is at least as good as that assumed in the licensee's work controls and dose assessment. For example, consider if the licensee has established adequate air sampling, surveys and bioassays, as necessary, to estimate doses and evaluate actual intakes.

d. Consider if devices are used consistent with their NIOSH/MSHA certification or any conditions of their NRC approval and that their use in the field does not interfere with their proper operation.

   NIOSH certification (or NRC approval) is required for all respiratory protection devices used to limit intake of radioactive material (10 CFR 20.1703). Respirators and equipment (e.g., filter canisters) certified by NIOSH must have a label attached with a certification number (TC-#). The TC-# is unique to the specific configuration and application of the respirator. Use of replacement parts not listed under the NIOSH published TC-# voids the certification, even if those parts are certified for use for another respirator.

   Several licensees have obtained NRC approval to use non-NIOSH-approved respiratory protection devices. Examples of these include the Mine Safety Appliance GRM-I canister for radioiodine adsorption/filtration, and several models of the Delta Protection air-supplied and powered air purifying suits. If the licensee has non-NIOSH approved devices, consider referring to the NRC approvals.

e. Consider if the test results of air used in supplied air devices meets or exceeds applicable requirements (i.e., Grade D). Also, consider if plant breathing air supply systems meet the minimum pressure and airflow requirements for the devices used. Grade D air is defined in 10 CFR 20.1703(g).

   The air intake for compressors servicing breathing air supplies should be controlled and/or monitored by the licensee to ensure that fumes or other contaminants cannot be introduced into the supplied breathing air systems.

f. Consider if individuals qualified to use respiratory protection devices have been deemed fit to use the device(s) by a physician. Medical physicals and tests can be administered by a non-physician medical practitioner. The medical practitioner may even sign the documentation that the subject has passed the physical. However, the tests administered, acceptance criteria, and the basis for judging the individual fit to use a respirator should be established by a licensed physician.

Note: Only review records used by a physician or non-physician medical practitioner documenting the individual is medically fit to use respiratory protection equipment. Do not request or review workers' personal medical records unless the licensee has the physician's judgement records comingled with these medical records.

g. As available, consider observing respirator fit-testing. If observation opportunities are not available, consider reviewing fit-testing procedures.

h. Consider sampling individuals assigned to wear respiratory protection devices and observe them donning, doffing, and functionally checking the device as appropriate. If the opportunity for observations is not available, consider conducting interviews with these individuals to determine if they know how to safely use the device and how to properly respond to any device malfunction or unusual occurrence (loss of power, loss of air, etc.). Additionally, if in-field observations are limited, review training curricula for users of the devices.

i. Select a representative sampling of respiratory protection devices that are staged and ready for use in the plant, or stocked for issuance, and evaluate their physical condition and review records of periodic inspection (do not repeat inspections on devices evaluated under section 03.04 of this inspection procedure). Observe the physical condition of the device components (mask or hood, harnesses, air lines, regulators, air bottles, filter cartridges, etc.). Be mindful of the end of service life for the respirator filter medium since indicators for the end of service life may not be obvious (e.g., damaged, misshapen). Licensees should have an estimate of the service life for the filter mediums.

j. Review records of maintenance and/or records of periodic inspection on the vital components (e.g., pressure regulators, inhalation/exhalation valves, hose couplings). Consider whether onsite personnel assigned to repair vital components have received adequate (e.g., vendor-provided) training.

   The level of quality assurance should be commensurate with the safety significance of the respirator application. The inspector should consider whether implementation of safety-significant elements of the respiratory program (e.g., fit-testing, training, providing a standby rescue person, and equipment configuration) for SCBAs and respirators used in low-oxygen or other atmospheres immediately dangerous to life and health is appropriate.

71125.01-04 REFERENCES

Regulatory Guide (RG) 1.21, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste"

RG 8.15, "Acceptable Programs for Respiratory Protection"

RG 8.38, "Control of Access to High and Very High Radiation Areas in Nuclear Power Plants"

NRC Circular 1981-07, "Control of Radioactively Contaminated Material"

NRC Information Notice 1985-92, "Surveys of Wastes Before Disposal from Nuclear Reactor Facilities"

NRC Information Notice 1990-33, “Sources of Unexpected Occupational Radiation Exposures at Spent Fuel Storage Pools”

NRC Information Notice 1997-36, “Unplanned Intakes by Worker of Transuranic Airborne Radioactive Materials and External Exposure Due to Inadequate Control of Work”

NRC Information Notice 1998-20, “Problems with Emergency Preparedness Respiratory Protection Programs”

NRC Information Notice 1999-05, “Inadvertent Discharge of Carbon Dioxide Fire Protection System and Gas Migration”

NRC Information Notice 2014-15, “Inadequate Controls of Respiratory Protection Accessibility, Training, and Maintenance”

NUREG-0041, “Manual of Respiratory Protection Against Airborne Radioactive Material”

NUREG-1736, “Consolidated Guidance: 10 CFR Part 20 – Standards for Protection Against Radiation”

NUREG/CR-5569, Rev. 1, “Health Physics Positions Data Base” (ML093220108)

NUREG/CR-6204, “Questions and Answers Based on Revised 10 CFR Part 20” (ML12166A179)

NUREG/CR-6204, “Questions and Answers Based on Revised 10 CFR Part 20, Question 447” (ML12166A179)

NUREG/CR-6204, “Questions and Answers Based on Revised 10 CFR Part 20, Question 448” (ML12166A179)

HPPOS-016, “Applicability of Access Controls for Spent Fuel Pools” (ML103420144)

HPPOS-221, “Lower Limit of Detection (LLD) for Potentially Contaminated Oil” (ML103470158)

HPPOS-245, “Access Controls for Spent Fuel Pools” (ML11192A127)

HPPOS-250, “Monitoring at Nuclear Power Plants for Contamination by Radionuclides that Decay by Electron Capture” (ML11192A132)

HPPOS-333, “Labeling of Radioactive Materials Stored Under Water” (ML15027A277)

Nuclear Energy Institute (NEI) 99-02, “Regulatory Assessment Performance Indicator Guideline”

EPRI Technical Report 1013509, “EPRI Alpha Monitoring and Control Guidelines for Operating Nuclear Power Stations, Rev. 2”

National Institute for Occupational Safety and Health (NIOSH), Certified Equipment List, December 2024. Available at: https://www.cdc.gov/niosh/ppe/niosh-approved-respirators/ffr-cel.html. Accessed October 16, 2025.

END

Attachment 1: Revision History for IP 71125.01

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
	ML26113A460 05/01/26 CN 26-019	Reissuance and consolidation of IP 71124 series. These revisions were recommended as a result of the ADVANCE Act 507 Report to Congress that discussed the revision of the ROP Baseline Inspection Program.		ML25274A088