NRC INSPECTION MANUAL

ARCB

INSPECTION PROCEDURE 71125 ATTACHMENT 03

OCCUPATIONAL RADIATION SAFETY ONSITE INSPECTION

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
Permanent Ventilation	03.01	Triennial	1 per site	1 per site	36-40 per site
SCBA	03.02	Triennial	1 per site	1 per site	
External Dosimetry	03.03	Triennial	1 per site	1 per site	
Instrumentation Walkdown and Observation	03.04	Triennial	5 per site	5-7 per site	
Occupational Calibration and Testing Program	03.05	Triennial	3 per site	3-5 per site	

71125.03-01 INSPECTION OBJECTIVES

01.01 To verify that in-plant airborne concentrations are being controlled as required to validate plant operations as reported by the performance indicator (PI) and to verify that the practices and use of respiratory protection devices on site do not pose an undue risk to the wearer.

01.02 Determine the accuracy and operability of personal monitoring equipment.

01.03 Determine the accuracy and effectiveness of the licensee’s methods for determining total effective dose equivalent.

01.04 Verify that occupational dose is appropriately monitored.

01.05 To verify that the licensee is ensuring the accuracy and operability of radiation monitoring instruments that are used to monitor areas, materials, and workers to ensure a radiologically safe work environment. The instrumentation subject to this review includes equipment used to monitor radiological conditions related to normal plant operations, including anticipated operational occurrences, and conditions resulting from postulated accidents.

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

71125.03-02 GENERAL GUIDANCE

Inspectors should review the plant final safety analysis report (FSAR) and surveys to identify areas of the plant that have the potential to be airborne radioactivity areas. Inspectors should review the FSAR description of the respiratory protection program and any associated ventilation systems or airborne monitoring instrumentation. Inspectors should review FSAR, technical specifications, and emergency planning documents to identify the locations and quantity of respiratory protection devices stored for emergency use. Instrumentation may include continuous air monitors, particulate-iodine-noble-gas-type instruments, or other monitors used to identify changing airborne radiological conditions.

Inspectors should review the licensee's procedures for maintenance, inspection, and use of respiratory protection equipment including self-contained breathing apparatus (SCBA). Additionally, review procedures for breathing air quality maintenance. Inspectors should review and understand the licensee's basis for the use of SCBAs in emergencies; e.g., plant-specific application of General Design Criteria 19.

Review the results of radiation protection program audits related to internal and external dosimetry. The results of the reviews should be used to gain insights into overall licensee performance in the area of dose assessment and focus the inspector's activities consistent with the principle of "smart sampling." Consider reviewing documents such as licensee's quality assurance (QA) audits, self-assessments, or other independent audits.

Review the most recent National Voluntary Laboratory Accreditation Program (NVLAP) accreditation report on the licensee or, if dosimetry is provided by a vendor, review the vendor's most recent results.

Review the licensee procedures associated with dosimetry operations. Inspectors should consider 1) issuance/use of external dosimetry (routine, multibadging, extremity, neutron, etc.); 2) assessment of internal dose (operation of whole body counter, assignment of dose based on DAC-hours, urinalysis, etc.); and 3) evaluation of and dose assessment for radiological incidents (distributed contamination, hot particles, loss of dosimetry, etc.).

Review licensee procedures for determining when external and internal dosimetry is required. Unless there is a documented prospective evaluation that individual monitoring was not required (i.e., planned exposure or intakes would not meet any of the criteria in 10 CFR 20.1502(a) or (b)), the fact that monitoring was provided is considered de facto evidence that the licensee had previously determined the monitoring was required by 10 CFR 20.1502.

Review the plant final safety analysis report (FSAR) to identify radiation instruments associated with monitoring radiological conditions including airborne radioactivity, process streams, materials/articles, and workers. The review of portable and stationary instrumentation should consider the following: 1) instruments used for monitoring transient high gamma and neutron radiological conditions, 2) air monitors associated with work generating airborne radioactivity, 3) area radiation monitors (ARMs) used to monitor conditions associated with in-core instrumentation, containment sump areas, and radwaste resin transfers, and 4) instruments that determine worker external and internal contamination. Additionally, consider small article monitors/tool equipment monitors (SAMs/TEMs) and instruments used for underwater surveys.

Do not repeat any NRC inspection activity for aspects of radiation monitoring instrumentation that have been reviewed under other corresponding baseline inspection procedures.

Review copies of licensee and third-party (independent) evaluation reports of the radiation monitoring program since the last inspection, including audits of the licensee's offsite calibration facility (if applicable) for insights into the licensee's program and to aid in selecting areas for review ("smart sampling").

For each sample, conduct a routine review of problem identification and resolution activities using Inspection Procedure (IP) 71152, "Problem Identification and Resolution (PI&R)." 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.

71125.03-03 INSPECTION REQUIREMENTS

03.01 Permanent Ventilation Systems Sample

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

Specific Guidance

a. Walk down permanently 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 licensing basis documents and licensee procedures.

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. Review procedural guidance for use and maintenance of installed air recirculating systems. Consider, to the extent practical, when these systems are used to mitigate airborne radioactivity. Inspectors should focus on work activities likely to result in airborne radioactivity areas in the event of a deficiency that impacts this ventilation equipment.

d. 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.

e. Consider if the licensee has established trigger points for evaluating levels of airborne beta-emitting and alpha-emitting radionuclides. The licensee’s program for airborne radioactivity controls should consider alpha emitters that have been incorporated into plant piping corrosion layers or other areas of the plant from a previous failed fuel event and may be released during grinding, welding, or other work activities generating airborne radioactivity. See the Electric Power Research Institute’s “Alpha Monitoring Guidelines for Operating Nuclear Power Stations

03.02 Self-Contained Breathing Apparatus for Emergency Use Sample

Verify that personnel who are required to use SCBAs are properly fitted, trained and qualified in their use and that the licensee has the capability to properly stock and maintain the SCBAs.

Specific Guidance

a. Review the status and surveillance records of SCBAs staged in-plant for use during emergencies. The inspection should focus on SCBAs used for radiological emergency response. SCBAs may be used for other emergency response situations in addition to radiological emergency response. For example, fire brigade or response in toxic environments. Any issues that arise that are outside the scope of this inspection should be discussed with the resident inspector.

b. If required by the licensee’s emergency preparedness procedures, evaluate the licensee’s capability for refilling and transporting SCBA air bottles to and from the control room and operations support center during emergency conditions. Determine if personnel assigned to refill bottles are trained for that task.

c. Consider if selected individuals are trained and qualified to use SCBAs. Selected individuals should be from control room shift crews or the emergency response organization (e.g., onsite search and rescue duties). The individuals’ training should include SCBA bottle change-out.

d. SCBA fit-testing is more safety significant than respirator fit-testing in general. Use of a poorly fitting SCBA can result in excessive air leakage from the face covering. Such leakage can significantly reduce the service life of the SCBA bottled air supply and jeopardize the mission of the wearer, as well as his or her personal safety.

   Items to consider include:

   1. That fit testing of these respirators is performed appropriately. Observations may be made, as available, of the fit-testing process or a review of the process may be conducted if observations are not performed.

2. That appropriate mask sizes and types are available for use (in-field mask size and type should match what was used in fit-testing).

3. That on-shift operators have no facial hair that would interfere with the sealing of the mask to the face.

4. That vision correction that does not penetrate the face seal (e.g., glasses inserts or corrected lenses) is available as appropriate.

e. Consider if the control room(s) is/are stocked with an adequate variety of respirator face-piece sizes to accommodate the expected variation in shift crew compositions.

f. Review maintenance records (to include hydrostatic testing and air cylinder markings) for SCBAs staged for support of operator activities during accident conditions and designated as “ready for service.”

The respirator manufacturer (or vendor) provides information to ensure continued unit operability. This information can include information such as SCBA use, maintenance/repair, and required surveillances. Discuss any differences between the vendor and the licensee procedures and practices, especially procedures governing maintenance of vital components, and determine the potential impact of these differences on unit operability and NIOSH certification.

> Consider if maintenance or repairs on an SCBA unit’s vital components were performed by an individual, or individuals, certified by the manufacturer of the device to perform the work. These vital components typically include the pressure-demand air regulator and the low-pressure alarm. See pertinent sections of Regulatory Guide 8.15 (Revision 1) and NUREG-0041 (Revision 1) for current staff guidance on acceptable maintenance training, practices, and activities for vital respirator components.

03.03 <u>External Dosimetry Sample</u>

Verify the licensee processes, stores and uses external dosimetry such that assigned occupational doses are representative of actual plant exposures.

<u>Specific Guidance</u>

a. Obtain the NVLAP certification documentation and determine if the dosimeters are processed by a NVLAP accredited processor and consider if the approved irradiation test categories for each type of personnel dosimeter used are consistent with the types and energies of the radiation present, and the way that the dosimeter is being used.

Relevant test categories are Categories I (accident photons), Category II (Photon mixture), Category III (betas), and Category IV (photon/beta mixtures), Category V.C (moderated Cf-252 neutrons and photons), and possibly Categories V.A (neutron/photon mixtures) and possibly Category V.B (unmoderated Cf-252 neutrons and photons). Note: The test categories for low energy photon exposure is not important for the radiation spectrum in nuclear power plants.

b. Passive Dosimeters (e.g. thermoluminescent dosimeter (TLD), optically stimulated luminescence (OSL))

1. Storage of dosimeters prior to issuance and after the monitoring period (prior to processing) should be in a low dose rate area.

2. Evaluate whether personnel dosimeters stored at the plant during the monitoring period are stored in a low dose rate area alongside control dosimeters.

3. For issued dosimeters not stored on-site during the wear period, guidance should be provided to workers on acceptable storage conditions.

c. Active Dosimeters (e.g. Electronic Alarming Dosimeters)

1. Determine if and how bias has been determined to correct the response of the electronic alarming dosimeter (EAD) as compared to TLD/OSL and consider if the correction factor is based on sound technical principles.

   A bias is normally established for EADs to adjust readings to account for a geometric bias and a conservative factor (conservative with respect to TLD/OSL measurements). The geometry correction factor is typically a 5–10 percent positive bias to account for the fact that the EAD physical size and geometry is larger than the passive dosimeter. The EAD batteries and electronics provides some self-shielding, since the instrument response is directionally dependent (i.e., when the exposure angle is not perpendicular to the face of the EAD). A conservative factor of about 5 percent is commonly used to ensure the real-time dose tracking used for worker exposure control is conservative (i.e., the EAD measurements will be higher than the TLD/OSL dose measurements normally used for dose of legal record).

2. Consider if correlations between EADs and passive dosimeter measurements are being performed, and if substantial discrepancies are investigated

   The evaluations of discrepancies between active and passive dosimeters may identify the cause of differences in measured values, such as due to passive dosimeter handling, storage, or processing errors, or due to electronic dosimeter misuse or other causes. Justifiable differences can occur even for the same exposure conditions, even if the active and passive dosimeters were co-located on the monitored individual. For example, the active dosimeter may have been calibrated with a positive bias as described in c.1 above. Investigations may indicate that that one or both of the dosimeters were not used correctly, or were not working correctly, or that one or both of the dosimeters may have been subject to unexpected radiation exposure, or that the required dosimeter was not appropriately placed at the highest exposed part of the whole body.

   EADs used for underwater diving may be subject to different (lower) energy radiation due to scattering (water). This may also impact the passive dosimetry response.

d. Neutron Dose Assessment

1. As appropriate, evaluate the licensee’s neutron dosimetry program, including dosimeter type(s) and/or survey instrumentation.

Situations to consider include independent spent fuel storage installation operations and at-power containment entries. Consider whether (a) dosimetry and/or instrumentation is appropriate for the expected neutron spectra; (b) there is sufficient sensitivity for low dose and/or dose rate measurement; (c) neutron dosimetry is properly corrected for the associated spectrum; (d) interference by gamma radiation has been accounted; and (e) time and motion evaluations are representative of actual neutron exposure events, as applicable

03.04 Instrumentation Walkdowns and Observations Sample

Verify, using walkdowns and observations, that a radiation detection instrument in use, or available for use, can fulfill its intended function.

Specific Guidance

a. Review the list of in-service survey instrumentation to select a radiation detection instrument that is available and used to support operations.

b. Instrument selection should include portable instruments used for radiation and contamination surveys, ARMs, instrumentation used to release personnel and equipment (i.e. PCMs and SAMs), and instrumentation used to screen for intakes (PMs).

1. For portable survey instruments, in use or available for issuance, check calibration and source check stickers are up-to-date, and assess instrument material condition and function. Observe licensee staff perform a source check for the instrument. Determine whether high-range instruments are source checked on all appropriate scales. Risk-informed insights should be a key factor in the selection of which instruments are examined by the inspector. For example, instruments used in areas of high dose rates should be of higher priority than personal friskers.

2. For in-field ARMs, determine if they are appropriately positioned and, if possible, compare monitor response (via local or remote indication) with actual area conditions for consistency. Review ARM alarm set point values and set point bases as provided in the technical specifications, the FSAR, or plant procedures.

3. For in-field continuous air monitors (CAMs) determine whether they are appropriately positioned relative to the radiation source(s) or area(s) they are intended to monitor.

4. For personnel contamination monitors (PCMs), portal monitors (PMs), and SAMs/TEMs, consider if the periodic source checks are performed in accordance with the manufacturer's recommendations and licensee procedures. Verification of instrument operability should be done by inspector observation of licensee source checks. If no opportunity for observation is available, verification can be made by reviewing the source check documentation

03.05 Occupational Calibration and Testing Program Sample

Verify that the calibration and testing of a radiation detection instrument is adequate.

Specific Guidance

a. Laboratory Instrumentation

Consider evaluating the methodology and results of calibrations and performance checks. Review the results of the inter-laboratory comparison program to assess the quality of the sample analyses, and that the inter-laboratory comparison program includes hard-to-detect isotopes as appropriate.

b. Whole Body Counting (WBC)

1. Consider reviewing the methods and sources used to perform WBC functional checks before use of the instrument and consider whether check source(s) are appropriate for the plant's source term.

2. Consider reviewing WBC calibration reports and consider whether calibration sources were appropriate for the plant source term and if appropriate calibration phantoms were used. Look for anomalous results or other indications of instrument performance problems.

c. Post-Accident Monitoring Instrumentation

1. For technical specification (T.S.) drywell/containment high-range monitors observe calibration if available, or review calibration documentation if observations are not feasible.

2. Consider if an electronic calibration was completed for all range decades above 10 rem/hour and that at least one decade at or below 10 rem/hour was calibrated using an appropriate radiation source.

3. Consider if the calibration acceptance criteria are reasonable, accounting for the large measuring range and the intended purpose of the instruments.

4. As available, observe electronic and radiation calibration of these instruments consider if the observation reflects conformity with the licensee's calibration and test protocols.

   For observations, consider whether the calibration is being performed in accordance with plant procedures. Calibrations for containment high-range area monitors should use a fixed, reproducible, source-to-detector geometry (e.g. using a calibration source with a rigid hanger). If they do not, then the methods should be evaluated to ensure the licensee has not introduced additional errors in instrument read out. If direct observations are limited, consider discussing in-situ isotopic calibration methodologies with the responsible licensee staff.

   Refer to the licensee's T.S., FSAR, Approved Emergency Action Level (EAL) Scheme and NUREG-0737, "Clarification of TMI Action Plan Requirements," issued November 1980, for guidance on post-accident monitoring instrumentation.

Note: Since these monitors may be used for EALs and protective action recommendations (PARs), ensure that the regional EP staff is aware of any monitoring issues that could impact the monitors' function.

d. PMs, PCMs and SAMs/TEMs

1. For selected PMs, PCMs and SAMs/TEMs consider if the alarm set point values are reasonable under the circumstances to ensure that licensed material is not released from the site.

2. Consider observing calibration of or reviewing calibration documentation for each instrument selected for review and evaluate inconsistencies between the licensee's method of calibration and the manufacturer's recommendations.

e. Portable Survey Instruments, ARMs, and Air Samplers/CAMs

1. Consider observing calibration of or reviewing calibration documentation for each selected instrument. For portable survey instruments and ARMs, that are calibrated at the site, consider reviewing detector measurement geometry and calibration methods and observing the licensee demonstrate use of its instrument calibrator.

   Consider, if the licensee periodically measures calibrator output over the range of the instruments used through measurements by ion chamber/electrometer (or equivalent measuring devices and if these measuring devices have been calibrated by a facility using National Institute of Standards and Technology (NIST) traceable sources and that correction factors for these measuring devices were properly applied by the licensee in its output verification.

   Consider conducting a comparison of instrument readings versus an NRC survey instrument if problems are suspected.

2. For portable survey instruments that did not meet "as found" acceptance criteria during calibration or source checks consider if the licensee has taken appropriate corrective action for instruments found significantly out of calibration (greater than 50 percent). Also consider if the licensee has evaluated the possible consequences of instrument use since the last successful calibration or source check.

3. Consider if the licensee's calibration of instruments used during diving activities is adequate (e.g., accounts for differences in attenuation between water and air), as necessary.

f. Electronic Alarming Dosimeters

Consider if routine calibrations are being performed according to manufacturer's recommendations and evaluate any differences. Routine calibrations should be performed to verify dose rate points and dose integration accuracy. Commonly, irradiations are performed using a Cs-137 source over a dose range of intended use (e.g., from 1 mrem to 1 rem).

71125.03-04 REFERENCES

RG 1.181, “Content of the Updated Final Safety Analysis Report in Accordance with 10 CFR 50.71(e)”

RG 1.187, “Guidance for Implementation of 10 CFR 50.59, Changes, Tests, and Experiments”

RG 1.33, “Quality Assurance Program Requirements (Operation)”

RG 4.15, “Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination)”

RG 8.7, “Instructions for Recording and Reporting Occupational Radiation Exposure Data”

RG 8.9, “Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program”

RG 8.13, “Instruction Concerning Prenatal Radiation Exposure”

RG 8.15, “Acceptable Programs for Respiratory Protection”

RG 8.26, “Applications of Bioassay for Fission and Activation Products”

RG 8.32, “Criteria for Establishing a Tritium Bioassay Program”

RG 8.34, “Monitoring Criteria and Methods to Calculate Occupational Radiation Doses”

RG 8.36, “Radiation Dose to the Embryo/Fetus”

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

RG 8.40, “Methods for Measuring Effective Dose Equivalent from External Exposure”

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 2014-05, “Verifying Appropriate Dosimetry Evaluation”

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

NRC Regulatory Issue Summary (RIS) 2003-04, “Use of the Effective Dose Equivalent in Place of the Deep Dose Equivalent in Dose Assessments”, February 13, 2003

RIS 2004-01, “Method for Estimating Effective Dose Equivalent from External Radiation Sources Using Two Dosimeters”, February 17, 2004

RIS 2009-09, “Use of Multiple Dosimetry and Compartment Factors in Determining Effective Dose Equivalent from External Radiation Exposures”, July 13, 2009

NRC, Revision of the Skin Dose Limit, Federal Register, Vol. 67, No. 66, April 5, 2002, pp. 16298–16304 (67 FR 16298)

NEI 96-07, Rev. 1, “Guidelines for 10 CFR 50.59 Evaluations” (ML003686043)

NEI 98-03, Rev. 1, “Guidelines for Updating Final Safety Analysis Reports” (ML003779028)

NEI 07-10A, “Generic FSAR Template Guidance for Process Control Program (PCP)” (ML091460627)

NEI 99-02, “Regulatory Assessment Performance Indicator Guideline”

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

NUREG-0737, “Clarification of TMI Action Plan Requirements”

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”, Questions 447 and 448 (ML12166A179)

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

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)

ANSI N13.30-1996, “Performance Criteria for Radiobioassay”

ANSI N13.52-1999 (Reaffirmed August 2010), ‘Personnel Neutron Dosimeters (Neutron Energies Less Than 20 MeV)’

ANSI N13.11-2009, “Personnel Dosimetry Performance – Criteria for Testing”

ANSI N13.6-2010, “Practice for Occupational Radiation Exposure Records Systems”

ANSI N323-1978, “Radiation Protection Instrumentation Test and Calibration”

ANSI N42.14-1991, “Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emission Rates of Radionuclides”

ANSI N323A-1997, “Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments”

ANSI N323D-2002, “American National Standard for Installed Radiation Protection Instrumentation”

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

NIOSH, Certified Equipment List, January 2018. Available at: https://wwwn.cdc.gov/niosh-cel/. Accessed October 13, 2025

END

Attachment 1: Revision History for IP 71125.03

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)
	ML26113A463 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