INSPECTION PROCEDURE 71124 ATTACHMENT 05

RADIATION MONITORING INSTRUMENTATION

Effective Date: January 1, 2018

INSPECTABLE AREAS: Radiation Monitoring Instrumentation

CORNERSTONES: Occupational Radiation Safety 80%
Public Radiation Safety 20%

INSPECTION BASIS: Title 10 of the Code of Federal Regulations (10 CFR) Part 20, "Standards for Protection Against Radiation," Subpart F, "Surveys and Monitoring," requires, in part, that surveys be made as necessary to comply with 10 CFR Part 20; are reasonable under the circumstances to evaluate the magnitude and extent of radiation levels and concentrations or quantities of residual radioactivity; and the potential radiological hazards. In addition, paragraph (b) of Subpart F requires that instruments and equipment used for quantitative radiation measurements be calibrated periodically for the radiation measured.

Monitoring for radioactivity that may be released from normal operations, including anticipated operational occurrences, and postulated accidents is required, in part, by 10 CFR 20.1302, "Compliance with dose limits for individual members of the public," and 10 CFR 50.36a, "Technical specifications on effluents from nuclear power reactors." Proper operation of radiation monitoring systems ensures adequate protection of members of the public against an unmonitored, unanticipated, and unplanned discharge of radioactive material to the environment. This inspectable area verifies aspects of the Radiation Protection Program for which there are no indicators to measure performance.

LEVEL OF EFFORT: Inspect Biennially

PROGRAM APPLICABILITY: IMC 2515 App A

71124.05-01 INSPECTION OBJECTIVES

01.01 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.

01.02 To conduct a Routine Review of problem identification and resolution activities per Inspection Procedure (IP) 71152, “Problem Identification and Resolution.”

71124.05-02 INSPECTION REQUIREMENTS

02.01 Walk Downs and Observations (1 Sample)

a. For 5-10 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.

b. Select 3 different types of portable survey instruments for the source check demonstration and observe licensee staff perform source checks for the instruments. Determine whether high-range instruments are source checked on all appropriate scales.

c. Walk down 5-7 area radiation monitors (ARMs) and continuous air monitors (CAMs) to determine whether they are appropriately positioned relative to the radiation source(s) or area(s) they are intended to monitor and compare monitor response (via local or remote indication) with actual area conditions for consistency.

d. Select 3-5 personnel contamination monitors (PCMs), portal monitors (PMs), and small article monitors (SAMs) and verify that the periodic source checks are performed in accordance with the manufacturer’s recommendations and licensee procedures.

02.02 Calibration and Testing Program (1 Sample)

a. Laboratory Instrumentation

1. For each type of laboratory instrument used for radiological analyses, verify that daily performance checks and calibration data indicate that the frequency of the calibrations is adequate and there are no indications of degraded instrument performance.
2. Review the results of the inter-laboratory comparison program to verify the quality of the radioactive effluent sample analyses, and that the inter-laboratory comparison program includes hard-to-detect isotopes as appropriate.

b. Whole Body Counting (WBC)

1. Review the methods and sources used to perform WBC functional checks before use of the instrument. Determine whether check source(s) are appropriate for the plant’s isotopic mix.

2. Review WBC calibration reports completed since the last inspection to verify that calibration sources were appropriate for the plant source term and that

appropriate calibration phantoms were used. Look for anomalous results or other indications of instrument performance problems.

c. Post-Accident Monitoring Instrumentation

1. Select at least one of the drywell/containment high-range monitors and review the calibration documentation since the last inspection.

2. Verify that 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. Determine 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 to verify conformity with the licensee's calibration and test protocols.

d. PMs, PCMs and SAMs

1. Select 1-2 of each type of these instruments used on site, and verify that the alarm set point values are reasonable under the circumstances to ensure that licensed material is not released from the site.

2. Review calibration documentation for each instrument selected in 02.02.d.1 above, and discuss the calibration methods with the licensee to determine consistency with the manufacturer's recommendations.

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

1. Review calibration documentation for at least one of each type of instrument (minimum of four instruments total). For portable survey instruments and ARMs, review detector measurement geometry and calibration methods, plus have the licensee demonstrate use of its instrument calibrator (if applicable).

2. As available, select 1-4 portable survey instruments that did not meet acceptance criteria during calibration or source checks (including at least one portable hand-held survey instrument and one personal monitoring device, such as an electronic alarm dosimeter, breathing-zone air sampler, etc.). Verify that the licensee has taken appropriate corrective action for instruments found significantly out of calibration (greater than 50 percent). Verify that the licensee has evaluated the possible consequences of instrument use since the last successful calibration or source check.

f. Instrument Calibrator

1. Verify that the licensee periodically measures calibrator output over the range of the instruments used through measurements by ion chamber/electrometer (or equivalent measuring devices).

2. Verify that the measuring devices have been calibrated by a facility using NIST traceable sources and that correction factors for these measuring devices were properly applied by the licensee in its output verification.

g. Calibration and Check Sources

Determine if the calibration sources used are representative of the types and energies of radiation encountered in the plant.

h. Electronic Alarming Dosimeters

Verify routine calibrations are being performed according to manufacturer's recommendations.

02.03 Problem Identification and Resolution

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

71124.05-03 INSPECTION GUIDANCE

Inspection Planning

To the extent possible, perform in-office preparation before the onsite effort, as indicated below and complete the remaining inspection planning and follow-up actions during the onsite aspects of the inspection.

a. Review the plant final safety analysis report (FSAR) to identify radiation instruments associated with monitoring area radiological conditions including airborne radioactivity, process streams, materials/articles, and workers. The review of occupational radiation safety instrumentation should include the following:

1. Fixed instrumentation including ARMs, criticality monitors, and the WBC.

2. In-plant airborne monitors including CAMs, portable air samplers and unique instrument setups for determining the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident, such as self-contained portable air sampler.

3. Portable survey instruments, particularly those used to identify changing radiological conditions (gamma, neutron, and alpha measuring instrumentation) and for diving operations such that actions to prevent an overexposure may be taken.

4. PCMs, PMs, and SAMs.

Note: Focus should be on portable instrumentation used for monitoring transient high gamma and neutron radiological conditions; air monitors associated with work generating airborne radioactivity; ARMs used to monitor conditions

associated with in-core instrumentation, containment sump areas, and radwaste resin transfers; and for determining worker external and internal contamination.

Note: Do not repeat any NRC inspection activity for aspects of radiation monitor instrumentation that is included under the Maintenance Rule program and reviewed under other corresponding baseline inspection procedures.

b. Identify instrumentation and associated technical specification requirements for post-accident monitoring instrumentation, including those instruments used for remote emergency assessment. If the post-accident sampling system has been eliminated from the technical specifications, this review is not necessary.

Post-accident monitoring and containment isolation instrumentation consists of the high-range containment/drywell radiation monitors. If the post-accident sampling system has been eliminated from the technical specifications as required instrumentation, its review is not necessary. In this case, review the licensee's post-accident sampling method.

c. Review the list of in-service survey instrumentation to determine whether an adequate number and type of instruments are available to support operations.

Consider including air samplers and SAMs, along with instruments used for detecting and analyzing workers' external contamination (PCMs) and workers' internal contamination (PMs, WBCs, etc.), as well as neutron monitoring instrumentation.

d. 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").

Guidance on instrument calibrations and source checks is provided in American National Standards Institute (ANSI) N323A-1997 and ANSI N323D-2002, "American National Standard for Installed Radiation Protection Instrumentation," for portable and fixed radiation monitoring instruments, respectively. Guidance for laboratory instrumentation used for onsite isotopic and effluent analyses (e.g., gamma spectroscopy equipment) is contained in ANSI N42.14-1991, "Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emission Rates of Radionuclides."

e. Review the instrument calibration and source check procedures for adequacy and as an aid to smart sampling in preparation for the onsite inspection. Focus on instruments used for monitoring transient high radiological conditions, including instruments used for underwater surveys.

f. Review the area radiation monitor (ARM) alarm set point values and set point bases as provided in the technical specifications and the FSAR in preparation for the onsite inspection.

03.01 Walk Downs and Observations

a. 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. Teledose, remote alarming ARMs, and survey and dose alarm devices used for diving activities should be high-priority items for inspection.

For instruments and equipment used for radiological controls for diving, evaluate the adequacy of the licensee's calibration of the underwater radiation monitoring instruments and equipment to ensure adequate detection and measurement of dose (e.g., shifts in gamma energy levels, neutron exposure).

b. ANSI 323-1978, "Radiation Protection Instrumentation Test and Calibration," and ANSI 323A-1997, "Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments," provide additional guidance on instrument source checks.

c. No inspection guidance.

d. 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.

03.02 Calibration and Testing Program

a. Laboratory Instrumentation (e.g., gross alpha, gross beta, proportional counters, gamma spectroscopy [including germanium-lithium, high purity-intrinsic germanium] and liquid scintillation counters).

1. Guidance on periodic efficiency calibrations for a spectroscopy system is provided in ANSI N42.14-1991, "American National Standard for Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emission Rates of Radionuclides."

2. RG 1.33, RG 1.21 and/or RG 4.15, provide the regulatory basis for the licensee participating in an inter-laboratory comparison program to verify the quality of radioactive effluent sample analyses.

b. WBC

1. No inspection guidance.

3. No inspection guidance.

c. Post-Accident Monitoring Instrumentation

Refer to the licensee's FSAR, Approved Emergency Action Level 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 PARs, ensure that the regional EP staff is aware of any monitoring issues that could impact the monitors' function.

1. No inspection guidance.

2. No inspection guidance.

3. No inspection guidance.

4. No inspection guidance.

d. PMs, PCMs, and SAMs.

1. Guidance on the minimum sensitivity and alarm set points for PCMs, SAMs, and PMs is provided in Office of Inspection and Enforcement Circular 81-07, "Control of Radioactively Contaminated Material," dated May 14, 1981, and Information Notice 85-92, "Surveys of Wastes before Disposal from Nuclear Reactor Facilities," dated December 2, 1985. The alarm set points should also align with more restrictive industry standards to ensure that significant variability does not exist between sites.

2. No inspection guidance.

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

1. Conduct comparison of instrument readings versus an NRC survey instrument if problems are suspected.

2. No inspection guidance.

Note: the ERO may use different survey instruments than are used for daily radiological control operations.

f. Instrument Calibrator.

1. No inspection guidance.

2. No inspection guidance.

g. Calibration and Check Sources.

Review the licensee's 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," source term inspection guidance. If scaling factors are used for calibrations, the 10 CFR Part 61 data may be used as a reference to determine if the licensee is properly scaling (e.g., for hard-to-detect radionuclides).

h. Electronic Alarming Dosimeters

Routine calibrations should be performed according to manufacturer's recommendations 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).

03.03 Problem Identification and Resolution

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.

71124.05-04 RESOURCE ESTIMATE

For planning purposes, it is estimated to take 32 hours, on average (with a range of 28 to 36 hours) to perform the requirements of this attachment.

71124.05-05 COMPLETION STATUS

Inspection of the minimum sample size will constitute completion of this procedure in the RPS. The minimum sample size for this attachment is two, defined as the completion of the activities contained in sections 02.01 and 02.02.

If any of the sample inspection requirements cannot be completed, the procedure should be closed in accordance with IMC 0306, “Planning, Tracking and Reporting of the Reactor Oversight Process (ROP).” For example, if certain steps could not be completed due to sample unavailability, the procedure attachment should be declared “Complete – full sample not available” with a comment addressing the specific steps or activities that could not be completed.

71124.05-06 REFERENCES

10 CFR Part 20, “Standards for Protection Against Radiation,”

10 CFR Part 61, “Licensing Requirements for Land Disposal of Radioactive Waste,”

American National Standards Institute (ANSI) N323-1978, “Radiation Protection Instrumentation Test and Calibration,”

ANSI 323A-1997, “Radiation Protection Instrumentation, Test and Calibration, Portable Survey Instruments,”

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

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

Enforcement Circular 81-07, “Control of Radioactively Contaminated Material,” Information Notice 85-92, “Surveys of Wastes Before Disposal from Nuclear Reactor Facilities,” IMC 0306, “Planning, Tracking and Reporting of the Reactor Oversight Process (ROP),” and NUREG-0737, “Clarification of TMI Action Plan Requirements.”

END

Attachment 1: Revision History for
IP 71124.05

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public)
N/A	12/02/09 CN 09-030	Conducted four year search for commitments and found none. This new procedure is being issued as a result of the 2009 ROP IP Realignment. It supersedes inspection requirements in IP 71121 and 71122.	Yes 09/09/2009	ML092810406
N/A	ML15344A508 04/01/16 CN 16-010	Revisions to the IP 71124.05 procedure attachment were made in response to the 2013 ROP Enhancement Project. This change moved some items and added samples but did not change the content of the IP. The revision changes how inspection samples are counted.	N/A	IP revised only to include new sample sizes. There is no valid comment resolution at this time.
N/A	ML17286A289 12/21/17 CN 17-031	Major editorial revision of IP 71124.05. Section 02 was audited and modified to move guidance to Section 03 and concisely state actions necessary to complete each requirement Added requirement and guidance to perform inter-lab comparison from IP71124.06. PI&R was transitioned from an independent sample to a requirement that would be completed as part of each sample. Guidance section updated to reflect resource estimates for routine review of PI&R activities per IP 71152 Section 04.01.	Verbal discussion of changes during 2017 HP Counterpart meeting, 09/06/2017	ML17300A474