
INSPECTION PROCEDURE 83534

PART 52, INTERNAL EXPOSURE CONTROL AND ASSESSMENT

PROGRAM APPLICABILITY: IMC 2504 B

83534-01 INSPECTION OBJECTIVE

Regulatory Basis and Background. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, such as Sections 20.1202, 20.1502 and Subpart H, requires licensees to monitor and control internal personnel exposure from radionuclides. Performance in this area is judged on whether the licensee has taken appropriate measures to track, and if necessary, to reduce exposures and not whether the licensee has used all possible methods to reduce exposures. Key aspects of the internal exposure control program, such as: implementation, organization, facilities, instrumentation and equipment, training, and procedures may be fulfilled by the radiation protection program procedures described in NEI 07-03A, “Generic FSAR Template Guidance for Radiation Protection Program Description” and NEI 07-08A, “Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA).” These processes provide an acceptable template for assuring that the radiation protection program meets applicable NRC regulations and guidance for controlling internal exposure to radionuclides. NEI 07-03A, in conjunction with NEI 07-08A, describes a radiation protection program that will be implemented in stages consistent with the following milestones:

- Prior to initial receipt of by-product, source, or special nuclear materials (excluding Exempt Quantities as described in 10 CFR 30.18)
- Prior to receiving reactor fuel
- Prior to initial loading of fuel in the reactor
- Prior to initial transfer, transport or disposal of radioactive materials

For those licensees that have elected to demonstrate compliance to the requirements of 10 CFR **Part 20** via alternate methods, SECY-04-0032, “Programmatic Information Needed for Approval of a Combined License Application Without Inspections, Tests, Analyses, and Acceptance Criteria” noted that in the absence of **inspection, test, analysis, and acceptance criteria** (ITAAC), “fully described” should be understood to mean that the program is clearly and sufficiently described in terms of the scope and level of detail to allow a reasonable assurance finding of acceptability at the **combined license (COL)** stage.

01.01 Plant Readiness. To inspect for readiness of the plant with respect to 10 CFR **Part 20** based on the licensee’s programs for internal exposure control and assessment.

01.02 Internal Exposure Controls. To determine whether the programs for controlling internal occupational exposure and to assess individual intakes of radioactive material during normal operations meet the program objectives. This inspection procedure focuses on the program's readiness for use by plant personnel.

01.03 Preparation for Emergencies. To provide assurance that licensees have the capability to effectively control the internal exposure of onsite emergency workers during accident conditions.

83534-02 INSPECTION REQUIREMENTS AND INSPECTION GUIDANCE

General Inspection Guidance

If the unit being constructed is at a site with existing operational units for which the same program will be used at all units, then this program may not require the same level of inspection as that required for units being constructed at sites with no operational units. This is consistent with the Baseline Inspection Program requirements identified in Inspection Manual Chapter (IMC) 2506, "Construction Reactor Oversight Process General Guidance and Basis Document." At sites with an operating unit where the licensee has chosen to take credit for similar operational programs as those that are already in use, the inspectors shall focus on the differences between the program already in use and the newly developed program. The operational program inspection should focus on those steps in the IMC 2504 inspection procedures where the inspectors cannot verify that the operational program, equipment, and components are the same, or substantially similar to, that of the operating unit. If the operational program, equipment, and components are the same, or substantially similar to, the operating unit, then the following minimum inspection requirements should be completed, and all other inspection requirements may be omitted:

Part 52 Licensees Collocated with an Existing Operational Unit

Minimum Inspection Requirements:

- a. Verify that the 10 CFR Part 52 licensee has incorporated the operational plant's procedures for Internal Exposure Control, Internal Dose Assessment, Radiological Respiratory Protection, and Airborne Radioactivity Monitoring into their program.
- b. Verify that engineering controls designed to limit internal exposure are adequate to protect occupational workers during normal operations and onsite emergency workers during accident conditions, using Section 02.02, Engineering Controls, as guidance. (Walkdowns).
- c. Verify that sufficient respiratory protection equipment is available as required by the Final Safety Analysis Report (FSAR) and the Emergency Plan (Walkdowns).
- d. Verify that sufficient air sampling and airborne monitoring equipment is available (Walkdowns).
- e. Verify that sufficient instrumentation and equipment is available to evaluate intakes of radioactive material (whole body counter, bioassay kits, exit portal monitors, etc.) (Walkdowns).

Inspection Guidance: Verification of procedure incorporation should include a review of procedure cover sheet information (e.g., procedure titles and site applicability, management

approvals, revision history, etc.), and a limited review of the procedure itself for applicability to the 10 CFR Part 52 site. The licensee may have developed specific procedures due to differences in plant design or layout. If so, review the site-specific design differences for conformance with the FSAR and review procedures for adequate inclusion of the site-specific design differences. Applicable guidance can be found throughout IP 83534. Where applicable, these inspection activities should be reviewed for compliance with 10 CFR Part 20, 10 CFR Part 52, and the FSAR.

02.01 Administrative Controls. Determine whether administrative controls designed to limit and monitor internal exposure are adequate to protect occupational workers during normal operations and onsite emergency workers during accident conditions.

Focus should be on the ability to implement the applicable portions of the program for controlling exposure from airborne radioactive materials. The following controls should be evaluated for effectiveness:

- a. Plans and procedures for control of airborne radioactivity and high contamination levels, such as work procedure control, ALARA planning, and radiation work permits (RWP).
- b. Access controls for areas with high potential for airborne radioactivity.
- c. Posting of airborne radioactivity areas.
- d. Contamination controls to minimize the generation of airborne radioactivity.
- e. Provisions to detect, control, and promptly repair leaks in radioactive systems.
- f. In addition to administrative controls for normal operations, consider the following for emergency or abnormal operations:
 1. Provisions for the authority to authorize and written criteria to invoke planned special exposures.
 2. Compatibility of site exposure limits with Environmental Protection Agency (EPA) Protective Action Guidelines (PAG) for emergency workers.
 3. Adequacy of radiological control provisions for contractor or other persons or agencies augmenting the onsite emergency organization. These may include, but not be limited to, contractor health physics (HP) technicians, local fire departments and rescue squads, industry representatives, and reactor plant system vendors.
 4. Adequacy of radiological control provisions for controlling exposures of security personnel.
 5. Where respiratory protection equipment is assumed to be used by operators responding to anticipated operational occurrences (AOO) or emergency conditions, that the specified types of equipment are available, and can be issued and donned rapidly enough to support minimum operator response times.

- g. Processes have been established to periodically evaluate and assess areas of the plant to ensure that personnel exposure to transuranic isotopes are anticipated and controlled (i.e. alpha monitoring program).

02.02 Engineering Controls. Determine whether engineering controls designed to limit internal exposure are adequate to protect occupational workers during normal operations and onsite emergency workers during accident conditions.

Engineering controls that may be evaluated include but are not limited to:

- a. Ventilation systems with air flows from areas of low potential airborne radioactivity to areas of higher potential airborne radioactivity, including processes and methods for:
 - 1. Monitoring and controlling ventilation pressure gradients during normal operation and expected maintenance.
 - 2. Monitoring and controlling ventilation pressure differentials during outages (i.e., ensuring the air flow direction is into the containment building when equipment hatches are open).
 - 3. Identifying and controlling pressure between buildings connected by process systems to minimize the spread of contamination (e.g., potential air flow through floor drain piping between the liquid waste processing system building and the turbine building).
- b. Provisions for use of auxiliary ventilation systems to provide local control of airborne contamination.
- c. Provisions for evaluating use of engineering controls:
 - 1. For specific jobs before authorizing the use of respiratory equipment.
 - 2. For use in lieu of administrative controls and procedures, including administrative controls such as radiation work permits and tag-out processes.

02.03 Respiratory Protective Equipment. Aspects of protective equipment programs that should be examined include:

- a. Assessment of the licensee's commitments, in particular with respect to maintenance and use consistent with 10 CFR 20.1703 and license conditions:
 - 1. Equipment maintenance, including testing, cleaning, inspection, repair, normal storage conditions, and return of equipment
 - 2. Equipment usage controls, including fitting, issuance, use, medical evaluations of users, and training. See Regulatory Guide 8.15 and NUREG-0041.
 - 3. Contingency equipment storage and environmental controls (e.g., maximum moisture content for SCBA air cylinders stored in unheated areas).

4. Training and qualification for equipment maintenance, including vendor required training.
 5. Respiratory Protection Program Administrator training and qualification requirements.
 6. Fit-testing equipment, fit test operator training and qualification, and procedures for performing respirator fit testing.
- b. Assessment of the licensee's actions consistent with their program through document review, communications with personnel, and direct observations:
1. Procedures and selected records.
 2. Discussions with cognizant individuals.
 3. Observation of samples of equipment such as equipment in emergency kits, in designated control centers, and storage/issuance control points.
- c. In addition to the applicable factors for normal operations, consider the following:
1. Availability and accessibility of sufficient supplies of approved self contained breathing apparatus (SCBA). If cascade or manifold systems will be used under accident conditions, the licensee should have a program to periodically check the air purity and operability of the power supply. At a minimum, the air quality and system integrity should be checked after each major maintenance evolution on the compressors.
 2. The licensee's capability to ensure continuity of air supplies for emergency operations. Consider provisions for timely replacement of air bottles.
 3. Availability of full-face respirators with appropriate filtering media for the class of service required. Half-mask respirators are not acceptable for emergency operations
- d. For compressed breathing air systems consider the following:
1. Determine how the program addresses the maintenance and calibration of instruments and alarm, and acquisition and processing of local samples, provided for ensuring air quality.
 2. How the program addresses the acquisition and use of commercially available compressed air.
 3. For facilities using installed breathing air compressed gas systems, evaluate:
 - (a) Where dual service air systems are used to directly provide breathing air to personnel, determine how the program addresses personnel protection uses, particularly under transient load conditions.

- (b) Air quality maintenance for SCBA cylinder charging systems, where the SCBA cylinders may be used for protection of personnel from non-radiological hazards encountered in the **Radiological Controlled Area (RCA)** (e.g. fire fighting in the RCA, or toxic chemical protection in the Main Control Room). See NFPA guidance and ANSI-Z88.2 for additional information.
4. Assessment of the processes for specifying and selecting respiratory protection equipment including processes for:
- (a) Ensuring only qualified equipment and parts are acquired.
 - (b) Adopting and using equipment that has not been certified by NIOSH, in accordance with 10 CFR 20.1703(b).
 - (c) Ensuring that only NIOSH approved devices are used for industrial safety applications for those facilities where dual use (i.e., industrial safety and radiological safety) respiratory protection programs are established.
 - (d) Acquisition and use of air-purifying filtration media.
 - (e) Identifying and controlling equipment service life (e.g., pressure regulator testing intervals, hydrostatic testing, fit-testing, equipment calibration), and other time or operational duration limitations.
 - (f) Performance of compressed cylinder hydrostatic tests.

02.04 Air Sampling, Monitoring, and Bioassay. Determine whether procedures and equipment for assessing individual internal exposure from air sampling data are adequate, and whether the bioassay program is adequate to monitor and/or assess internal exposure. Determine whether the respiratory protection program is adequate to protect occupational workers during normal operations and onsite emergency workers during accident conditions.

Evaluate the adequacy of procedures and equipment for sampling and monitoring airborne radioactivity and intakes/uptakes of radioactive materials. Aspects that may be considered include:

- a. Air sampling:
 - 1. Capability for representative sampling of air in a zone occupied by workers. See ANSI N13.1 and NUREG-1400.
 - 2. Provisions for review and evaluation of air sampling data.
 - 3. Calibration and configuration of air sampling equipment, including:
 - (a) Selection and control of flow measuring devices. See IE Information Notice No. 82-49, "Correction for Sample Conditions for Air and Gas Monitoring."

- (b) Processes established for monitoring equipment that ensure the displayed concentrations represent the actual airborne activity concentrations at the sample point. See NUREG/CR-4757 PNL-7597, "Line-Loss Determination for Air Sampler Systems" and ANSI/ANS-10.4-1987 (R1998), "Guidelines for the Verification and Validation of Scientific and Engineering Computer Programs for the Nuclear Industry.")
 - (c) Processes established for determining and controlling the alarm set points of monitoring equipment provided for occupational personnel protection and indication.
 - (d) Processes provided for the identification, classification and control, in accordance with **Regulatory Guide (RG)** 1.97 and IEEE 497, of portable sampling equipment provided to meet NUREG-0737, Item III.D.3.3.
4. Adequacy of written procedures for collecting and analyzing air samples and for evaluating, reporting, and reviewing air sampling data.
 5. Air samplers for use with particulate filters and iodine collection devices (such as charcoal cartridge or equivalent filters) and airborne radioactivity monitors, and provisions for collecting noble gas samples. See NUREG-0737, Item III.D.3.3 regarding in-plant iodine monitoring instrumentation for accident conditions.
 6. For those plants using recycled water in the Reactor Coolant System, determine how plant processes evaluate and address personnel protection for systems containing tritium with expected tritium concentrations greater than the values listed in NUREG-0938 Table 1, Column 3.
 7. Adequacy of the processes used to establish the initial radiation detection counting efficiency values and the processes for verifying and adjusting counting efficiencies, as isotopic concentrations change as a result of startup initial testing and power ascension, including potential AOO such as unexpected fuel defects or forced outages.
- b. Bioassay:
1. Calibration and quality control checks for whole body/thyroid/lung (in vivo) counters. See ANSI/HPS N13.30-1996, "Performance Criteria for Radiobioassay."
 2. Provisions for estimating internal exposures from whole body counting data.
 3. Use of in vitro or indirect bioassay (e.g., measurements of radioactive material in excreta) to complement in vivo measurements and quality assurance for these measurements.
 4. Adequacy of written procedures for bioassays.
 5. Provisions for comparing bioassay data with data from air sampling.

6. Provisions for whole body counting of emergency workers during accident conditions.
7. Provisions for reviewing in vivo measurements to detect trends
8. Where facilities are using RCA exit gamma detectors, or exit whole body contamination monitoring equipment for the purpose of assessing internal depositions of radioactive material, review the processes and methods used to determine, maintain and assess the capability of the equipment to quantify internal depositions, and limit personnel exposures in accordance with 10 CFR 20.1204(a).

02.05 Dose Assessment. Determine whether the internal exposure assessment program is adequate to provide feedback to exposure control processes and for assessment of effective dose. Aspects of the program that should be evaluated include:

- a. Provision for calculation of internal doses, for both effective dose and committed effective dose.
- b. Provision for summation of internal exposure with external exposure, for total dose determinations.
- c. Controls over total dose.

02.06 Programs. Determine the licensee's actions to address and properly document development of the program from the functional program description provided to NRC staff during the application review process. Focus is on readiness for **operation consistent with 10 CFR Part 20**.

Review the originating documents submitted by the licensee to determine the affected aspects of their program related to internal exposure control and assessment:

- a. Review Agency resources to locate the most current versions of the applicable documents and functional program description.
- b. Determine the specific measurements that will be needed to verify the readiness and acceptability of the program as implemented, in comparison with the program description provided in the application. Review inspections of other licensees of similar design. If there are ongoing issues at plants of similar design, consider the applicability of those issues in developing the scope of the inspection.
- c. Determine from the licensee's submissions regarding what commitments to or incorporation by reference were made with respect to national standards or other guidance documents, and whether there have been any changes, amendment proposals, impact evaluations, or other remedial or compensatory actions by the licensee that affect adequacy of the program, or that have not already been reviewed by NRC staff.
- d. Review any corrective action programs to determine if problem identification occurs at a sufficiently low significance level to address negative performance trends and other problems before they result in inadvertent exposures:

1. Determine whether corrective actions address root causes.
 2. Determine whether causes are appropriately identified and corrective actions effectively implemented
- e. Determine whether a periodic review of radiation protection program content and effectiveness has been developed and implemented.
 - f. Determine whether a performance indicator program or equivalent for internal radiation exposure has been developed and implemented.
 - g. Determine how the respiratory protection program addresses IN 88-100, the OSHA/NRC MOU, Attachment 1 Section 3.d, for non-radioactive airborne hazards present in radiologically controlled areas of the plant.

83534-03 RESOURCE ESTIMATE

The staff estimates that approximately 40 hours of direct inspection effort will be required to implement this procedure. An inspection of the program and related procedures and records will require health physicists trained in internal exposure control and assessment and in inspection techniques as they relate to nuclear power facilities.

The actual hours required to complete the inspection may vary from this estimate. The inspection hours allocated for this inspection are an estimate for budgeting purposes. The hours expended for this inspection should consider plant specific design features and operational programs. The level of effort expended in such inspections should be recorded for the purpose of planning future inspections and updating budget allocations. **If this inspection procedure is performed at a 10 CFR Part 52 licensee collocated with an existing operational unit and the operational program, equipment, and components are the same, or substantially similar to, that of the operating unit, inspection effort is expected to require approximately 20 hours of direct inspection effort.**

83534-04 REFERENCES

NRC Inspection Manual Chapters 2501, 2502, 2503, and 2504

Regulatory Guide 1.97, Rev. 4, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," June 2006, U.S. Nuclear Regulatory Commission, Washington, DC.

Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," June 2007, U.S. Nuclear Regulatory Commission, Washington, DC.

Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection," October 1999, U.S. Nuclear Regulatory Commission, Washington, DC.

NUREG/CR-0041, Rev. 1, "Manual of Respiratory Protection Against Airborne Radioactive Materials," January 2001, Radiation Safety Associates, Hebron, CT.

NUREG-0938 "Information for Establishing Bioassay Measurements and Evaluations of Tritium Exposure," June 1983, U.S. Nuclear Regulatory Commission, Washington, DC.

NUREG-1400, "Air Sampling in the Workplace," September 1993, U.S. Nuclear Regulatory Commission, Washington, DC.

NUREG/CR-4757 PNL-7597, "Line-Loss Determination for Air Sampler Systems," February 1991, Pacific Northwest National Laboratory, Richland, WA.

SECY-06-0114, "Description of the Construction Inspection Program for Plants Licensed under 10 CFR Part 52," May, 2006, U.S. Nuclear Regulatory Commission, Washington, DC.

SRM-SECY-04-0032, "Programmatic Information Needed for Approval of a Combined License Without Inspections, Tests, Analyses, and Acceptance Criteria," May 2004, U.S. Nuclear Regulatory Commission, Washington, DC.

IE Information Notice No. 82-49, "Correction for Sample Conditions for Air and Gas Monitoring," December 16, 1982.

Information Notice 88-100, "Memorandum of understanding between NRC and OSHA relating to NRC-licensed facilities," (53 FR 43950, October 31, 1988) (ADAMS Accession No. ML0311406410).

IE Information Notice No. 92-75, "Unplanned Intakes of Airborne Radioactive Material by Individuals at Nuclear Power Plants," November 12, 1992.

ANSI/ANS-10.4-1987 (R1998), "Guidelines for the Verification and Validation of Scientific and Engineering Computer Programs for the Nuclear Industry," [May 1987], American Nuclear Society, La Grange Park, IL.

ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities." May 1999. Health Physics Society, McLean, VA.

ANSI/HPS N13.30-1996, "Performance Criteria for Radiobioassay," May 1996, Health Physics Society, McLean, VA.

ANSI/HPS N13.39-2001, "Design of Internal Dosimetry Programs," May 2001, Health Physics Society, McLean, VA.

ANSI N343-1978 (R1984), "American National Standard for Internal Dosimetry for Mixed Fission and Activation Products," August 1978, American National Standards Institute, Inc., New York, NY.

ANSI Z88.2, 1992, "American National Standard Practices for Respiratory Protection," American National Standards Institute, Inc., New York, NY.

CGA G-7.1 – Revision 5 (2004), "Commodity Specification for Air," Compressed Gas Association, Chantilly, VA.

IEEE Std 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," February 2002, Institute of Electrical and Electronics Engineers New York, NY.

NFPA 1500 "Standard on Fire Department Occupational Safety and Health Program," National Fire Protection Association, Quincy, MA.

NFPA-1981 "Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services," National Fire Protection Association, Quincy, MA.

NFPA-1989 "Standard on Breathing Air Quality for Fire and Emergency Services Respiratory Protection," National Fire Protection Association, Quincy, MA.

EPRI Technical Report 1013509, "EPRI Alpha Monitoring Guidelines for Operating Nuclear Power Stations," November 2006, Electric Power Research Institute, Palo Alto, CA.

NEI 07-03A [Revision 0], "Generic FSAR Template Guidance for Radiation Protection Program Description" and the associated NRC Safety Evaluation Report, ML0914906841.

NEI 07-08A [Revision 0], "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)" and the associated NRC Safety Evaluation Report, ML0932201780.

83534-05 PROCEDURE COMPLETION

This procedure will be closed upon satisfactory inspection results verifying that an adequate program exists and processes are in place to control and assess internal exposure. The inspection should demonstrate the program can be inspected under the ROP.

END

Attachment 1: Revision History for Construction Inspection Procedure 83534

ATTACHMENT 1

Revision History for Construction Inspection Procedure 83534

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)
	ML081820705 10/27/10 CN 10-022	<p>Initial issue to support inspections of operational programs described in IMC 2504, Construction Inspection Program – Inspection of Construction and Operational Programs.</p> <p>Derived from original procedure 83525 of 01/01/1984 to address 10 CFR 52, ITAAC, updates of NRC guidance, including risk-informed, performance-based inspection and enforcement policies.</p> <p>Completed search of CNs for previous 4 years and no commitments were found.</p>	N/A	ML102660539
	ML20036D946 03/04/20 CN 20-013	Revises guidance for units being constructed at a site with existing operational units for which the same program will be used at all units and conditionally lowers the Resource Estimate.		ML20036E555