

### PART 52, MAINTAINING OCCUPATIONAL EXPOSURES ALARA

PROGRAM APPLICABILITY: 2504

#### 83537-01 INSPECTION OBJECTIVE

01.01 Title 10 of the Code of Federal Regulations (10 CFR) Section 20.1101(b) requires licensees to use, to the extent practicable, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses that are as low as is reasonably achievable (ALARA). The purpose of this inspection procedure is to evaluate licensee 10 CFR Part 20 programs for maintaining occupational exposures ALARA. Specifically, the objective of this inspection activity is the following:

- a. To provide assurance that the licensee has established procedures and program activities to effectively implement reasonable efforts to ensure that occupational radiation exposures will be maintained as low as is reasonably achievable.
- b. To determine how the licensee has implemented their program objectives from their functional program description provided to the NRC staff during the application review process, related to maintaining occupational radiation exposures ALARA.

#### 83537-02 INSPECTION REQUIREMENTS AND INSPECTION GUIDANCE

The ALARA program is evaluated with respect to whether the licensee has taken appropriate measures to track and if necessary reduce exposures, rather than whether the licensee has used all possible methods to reduce exposures. For those licensees who have committed in their combined license application (COL) to following the guidance in NEI 07-03A<sup>1</sup> key aspects of the ALARA program such as implementation, organization, facilities, instrumentation and equipment, training, and procedures are implemented by the radiation protection program procedures described. In addition, NEI 07-08A<sup>2</sup> presents an acceptable template for assuring that the ALARA program meets applicable NRC regulations and guidance, provided it is used in conjunction with

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<sup>1</sup>NEI-07-03A, "Generic FSAR Template Guidance for Radiation Protection Program Description."

<sup>2</sup>NEI 07-08A, "Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures are as Low as is Reasonably Achievable (ALARA)"

NEI 07-03A. NEI 07-03A 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.

NEI 07-08A in conjunction with NEI 07-03A fully describes the ALARA program. 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 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 COL stage.

02.01 Inspection Planning. Review the originating documents submitted by the licensee to determine correlations to maintaining exposures ALARA:

- a. Review Agency resources to locate the most current versions of the applicable functional program description and any updates or commitments made to meet licensing requirements, and COL licensee information required to be provided in accordance with the NEI 07-03A and NEI 07-08A templates.
- b. Determine any license requirements that must be met prior to fuel load, and review the Manual Chapter for Program Applicability.
- c. Determine the specific measurements or tests that will be needed to verify the readiness and acceptability of the program as developed and implemented, in comparison with the program description provided in the application. Review inspections of other licensees with the same or similar designs to determine if ongoing issues at those plants could inform the scope of this inspection. ALARA is not design-specific, so if there are ongoing issues at plants of similar design, consider the applicability of those issues in developing the scope of the inspection.
- d. The COL Action Items incorporated by reference from the design or as otherwise committed to, as part of the application.
- e. For commitments made with respect to national standards and other guidance incorporated by reference, determine whether there have been any changes or revisions to those documents, and to any amendment proposals, impact

evaluations or other remedial or compensatory actions by the licensee, that affect adequacy of the program, or have not already been reviewed by NRC staff.

- f. Review the corrective action program for related entries that could have an impact on operational radiation exposure (e.g. defects with structural materials that could impact radiation shielding, installation or design problems with systems or components that are expected to contain radioactive material).
- g. Review any departures by the licensee from the certified design committed to by the licensee, consistent with the provisions of 10 CFR 52.63(b)(2), to identify those changes to the plant design that may affect public or occupational radiation exposure.

02.02 Management Policy. Determine whether there is an appropriate documented management policy on ALARA.

- a. The policy should be documented.
- b. The policy should be approved by a corporate officer.
- c. The policy should be integrated with the licensee's design, including updates or modifications installed during construction as a result of construction or generic operating experience.
- d. The policy should embody the concept that ALARA is everyone's responsibility, from highest level managers to the most junior workers.

02.03 Assignment of Responsibilities and Authorities. Determine whether assigned responsibilities and authorities are adequate for ALARA implementation.

- a. Examine specific responsibilities assigned to each management and supervisory level.
  - 1. Are lines of authority clearly specified?
  - 2. Is there support for personnel to participate in formulation of program goals and objectives?
  - 3. Is an effective measurement system specified to determine success in implementation, and is there a process to embody corrective measures to address problems?
  - 4. Review the processes for establishing goals and objectives, and the associated measurement systems.

5. Examine how performance indicators, based on expected plant operations involving fuel receipt, fuel loading and initial startup testing, have been established.
- b. Examine the responsibilities of those with direct responsibility over the radiation protection program and staff, to verify that their responsibilities and authority are adequate to meet the commitments made by the licensee, and to meet license conditions and the Final Safety Analysis Report or other controlling documents. Consider the following:
1. Participation in design and equipment reviews, procedure development, and in identification of conditions and operations that may cause significant exposures.
    - (a) Examine design modification packages issued during construction for equipment installed in the Radiologically Controlled Area (RCA), to determine how the engineering staff evaluated the review for ALARA considerations, and the subsequent involvement of the Radiological Protection staff.
    - (b) Examine design modification packages expected to be installed following fuel loading to determine the extent of involvement of the Radiation Protection staff.
  2. Development of surveillance programs to collect, analyze, and evaluate data and information related to maintaining exposures ALARA.
  3. Implementation of the exposure control program, and the processes for identifying and reacting to deviations from expected values.
  4. Training and qualification of radiation protection personnel.
  5. The processes used to identify the types and quantities of resources needed to provide coverage of plant personnel conducting activities with the potential for significant radiation exposure.
- c. Examine the processes and methods used to incorporate plant specific and generic operating experience into the radiation protection program, including:
1. Coordinating reviews of facility and equipment designs and modifications that involve radiation exposure.
  2. Conducting audits of the effectiveness of station ALARA programs.
  3. ALARA efforts in support of operations that could result in substantial individual and collective doses.

- d. Review how the ALARA program stresses that all station workers should be actively involved in seeking new and better ways to perform work with less exposure.

02.04 Procedures and Standards. Examine the written procedures for implementing ALARA policies and programs. Review the licensee's administrative processes and the mechanisms for communication and feedback with facility personnel, and with contractors or other suppliers of components and services affecting potential radiation exposures. Determine how procedures address aspects of the radiation protection programs such as:

- a. Setting of program goals and objectives; for example, establishment of collective dose objectives for the year, for outages, and for specific jobs, such as fuel receipt, fuel loading, initial criticality and start up testing.
- b. Methods for job planning; for example, health physics review of other plant procedures and work practices, as appropriate; consideration of dose-saving methods (shielding, special tools); pre-work briefings; monitoring job progress; post-work debriefings and evaluations; methods to incorporate lessons learned into future jobs.
- c. Measurement of success of ALARA efforts; for example, an exposure monitoring program with provisions for timely, periodic feedback on the status of meeting program goals and objectives.
- d. Measures to effect corrective actions, as appropriate, when feedback information indicates program failures and shortcomings; for example, problems are identified, causes determined, corrective actions taken, follow up actions executed or planned.
- e. Processes used by the licensee for assessing the resources provided for meeting ALARA program goals and objectives; for example, the quantity and qualification of personnel (consistent with the guidance of Regulatory Guide (RG) 1.8) for implementation and maintenance of the program.
- f. Determine whether procedures for planning work in RCAs incorporate the requirements specified in the radiation protection basis documents (e.g. NEI Templates or other program description, FSAR Chapter 12 COL Items and Technical Specifications).
- g. Examine procedures and processes established for the use of temporary shielding, temporary Radiation Protection (RP) services, such as ventilation, communications and temporary station services, such as power, lighting and fluids, including the methods for identifying the need, methods for evaluating the installation (e.g. pipe weight load limits), the method for allocating installation and removal resources, and the methods for tracking installation and removal of temporary services. Determine how organizations other than radiation

protection staff have integrated ALARA into their work group procedures and processes, which may include practices such as:

1. Work group procedures reflect required interfaces with RP staff, procedures and processes, (e.g. mechanical engineering procedures clearly identify when RP staff review of design changes are required, work planning processes clearly identify when RP review of work activities are required, operations procedures identify when RP technician support is required).
2. Procedures identify where specific worker actions or an equipment configuration is required to reduce personnel exposure (e.g. the use of special tools, equipment water level for shielding purposes, ventilation configuration for airborne activity control, use of methods for draining equipment that minimize facility contamination).
3. Procedures for operating and maintaining equipment provided to reduce occupational radiation exposure have been implemented (e.g., operation of maintenance exhaust ventilation systems, operation of equipment provided for flushing crud like hydro-lasing pumps and system connections).

02.05 Indoctrination and Instruction. Determine whether there are adequate provisions for informing and instructing workers in the ALARA program. A program of indoctrination and instruction for workers should include:

- a. Indoctrination of management to ensure their understanding and support.
- b. Job-related ALARA training at the craftsman level.
- c. Incorporation of basic ALARA philosophy and management's support of ALARA into the basic radiation protection training, and ALARA "awareness training" for design, engineering, and construction personnel.
- d. Selection, training and qualification of staff consistent with RG 1.8 and RG 1.206 Section C.I.12.1, as well as any proposed alternatives to the RG guidance or other guidance documents referenced by the licensee.

02.06 Reviews of Design and Equipment Selection. Determine the provisions for review of design and equipment selection by the RP staff. Determine how variations from the standard design not captured in the functional program have been addressed in the licensee's program with respect to ALARA considerations. Plant design modification and equipment selection processes should include:

- a. Review and oversight of the incorporation of ALARA considerations in the work of the architect-engineer and construction organization.

- b. Where appropriate, ALARA reviews of, and input into, plant modifications in design, construction, preoperational, and operating phases, and ALARA input into plant equipment reliability studies.
- c. Assess how the ALARA program evaluates industry operating experience associated with effluent, waste handling and monitoring systems reliability and how the program identifies and assesses the impact of potential additional exposures.
- d. Assessment by the licensee regarding any design changes, amendment proposals, impact evaluations, or other remedial or compensatory action to address adequacy of ALARA program implementation.

02.07 Source Term Identification and Control. The radiation source term, in the context of maintaining exposures ALARA, is the level of radiation emitted by, or quantity of radioactive material contained in, plant systems, structures or components that result in occupational radiation exposure from routine operation, including anticipated operational occurrences. The radiation source term can result from activated components in the primary containment; corrosion and wear products activated in the reactor and distributed to plant systems; or sealed sources maintained on site to support operations.

Source term reduction measures include chemistry controls to reduce corrosion rates (e.g. pH regimen); methods to reduce deposition rates (e.g. filter media selection, zinc injection); selection criteria for materials in contact with RCS fluids; methods of facilitating activity removal (e.g. shut down purification systems, hydro-lasing equipment and fittings).

- a. Determine if the licensee understands the expected source terms for the plant:
  - 1. Assess the licensee's knowledge of the potential sources of RCS fluid contaminants, and their expected introduction rates (see for example EPRI TR-108737, "BWR Iron Control Monitoring Interim Report," EPRI Report 1018371, "BWR Source Term Reduction - Estimating Cobalt Transport to the Reactor," and EPRI TR-103296, "Cobalt Reduction Guidelines Revision 1").
  - 2. Assess the licensee's understanding of the characteristics of their plant design that could lead to extended neutron irradiation of material that is subsequently released into the RCS (see EPRI Report 1008102, "PWR Axial Offset Anomaly [AOA] Guidelines, Revision 1").
  - 3. To reduce decommissioning costs, some new plant designs minimize the amount of piping imbedded in structural concrete. Review how the licensee identified as potential sources of exposure, areas where previously shielded piping may be exposed (e.g., floor drain lines, filter housing drain lines).

- b. Assess the licensee's understanding of the features provided in plant for reducing source terms, and how they are to be implemented:
  - 1. Design specifications for conditioning of primary system surfaces to reduce the deposition of radioactive material, and how the conditioning regime is implemented.
  - 2. Design features (e.g. zinc injection, ion exchange and filtration media) that have been provided to reduce plant source term, and how these features are to be utilized during initial power operation.
- c. Review the processes the licensee has established for monitoring actual plant radiation fields versus expected radiation fields.
  - 1. Have Standard Radiation Monitoring Points (SRMP) been established and labeled for routine surveys of the primary coolant system (see EPRI Report 1003390 "Radiation Field Control Manual" for sample BRAC monitoring points and EPRI Report 1015119, "Application of the EPRI Standard Radiation Monitoring Program for PWR Radiation Field Reduction," for sample PWR monitoring points)?
  - 2. The methods for reviewing operating experience of similar plants, for the purpose of identifying the need for and location of standard points for monitoring source term trends in supporting systems.
  - 3. Where available, assess the licensee's established process for comparing plant source term performance to other plants utilizing a similar design.

02.08 Radiological Work Planning. A radiological work activity is one or more closely related tasks that the licensee has reasonably grouped together as a unit of work for the purpose of ALARA planning and work controls. The effectiveness of an operating reactor ALARA program is assessed by comparing the outcomes (in terms of collective dose) to the dose that was intended for individual work activities. However, for a facility beginning or preparing for initial operations, actual occupational exposure data for the plant will be limited or unavailable. The startup survey program and the need to respond to startup support activities may require personnel entries into radiologically significant areas of the plant. Since the radiation type and exposure rate data will be limited or not fully characterized for some of these areas or plant conditions, processes for assessing plant conditions and radiological controls will need to be well-developed, in order to assure adequate personnel protection.

- a. Evaluate interactions between operations, maintenance, maintenance planning, scheduling, engineering, and radiation protection groups for interface problems or missing program elements:
- b. Evaluate how work planning activities have incorporated measures for:

1. Identifying and controlling abnormal or unexpected sources of radiation exposure.
  2. Assessing and establishing personnel access controls during or as a result of transient plant conditions.
  3. Controls for special pre-operational or start up testing, such as BADGER testing (fuel storage rack neutron transmission rate), structural shielding integrity tests, initial radiation monitor calibrations, Main Steam line moisture carry over testing, etc.
- c. Evaluate the processes established for identification and resolution of abnormal or unexpected individual personnel exposure, occupational radiation exposure for evolutions or plant conditions, and area radiation dose rates or radiation types.

#### 83537-03 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 ALARA principles, and in inspection techniques as they relate to nuclear power facilities.

It is expected that 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 take into account 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.

#### 83537-04 REFERENCES

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

Regulatory Guide 1.8, Rev. 3, "Qualification and Training of Personnel for Nuclear Power Plants." May 2000. U.S. Nuclear Regulatory Commission, Washington, DC.

Regulatory Guide 1.68, "Initial Test Programs for Water Cooled Nuclear Power Plants." March 2007. 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 8.8, Rev. 3, "Information Relevant to Ensuring That Occupational Radiation Exposures Will Be As Low As Is Reasonably Achievable." June 1978. U.S. Nuclear Regulatory Commission, Washington, DC (see also Draft OP 618-4, Second Proposed Rev 4, 05/1982)

Regulatory Guide 8.10, Rev. 1-R, "Operating Philosophy for Maintaining Radiation Exposures As Low As Is Reasonably Achievable." May 1977. U.S. Nuclear Regulatory Commission, Washington, DC

Regulatory Guide 8.19, Rev. 1, "Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants - Design Stage Man-Rem Estimates." June 1979. U.S. Nuclear Regulatory Commission, Washington, DC

RG 8.27, "Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants." March 1981. U.S. Nuclear Regulatory Commission, Washington, DC

NUREG-0800, Rev. 3, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." Chs. 11, "Radioactive Waste Management," and 12, "Radiation Protection." March 2007. U.S. Nuclear Regulatory Commission, Washington, DC (Rev. 4 for Section 11.5, "Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems.")

NUREG-1736, "Consolidated Guidance: 10 CFR Part 20- Standards for Protection Against Radiation." October 2001. U.S. Nuclear Regulatory Commission, Washington, DC

NUREG/CR-5569, ORNL/TM-12067, Rev. 1, "Health Physics Positions Database", HPPOS-001 "Proposed Guidance for Calibration and Surveillance Requirements to Meet Item II.F.1 of NUREG-0737." April, 1994. Oak Ridge National Laboratory, Oak Ridge, TN

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

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

SECY-07-0047, "Staff Approach to Verifying the Closure of Inspections, Tests, Analyses, and Acceptance Criteria Through a Sample-Based Inspection Program." March 8, 2007. U.S. Nuclear Regulatory Commission, Washington, DC

SECY-05-197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses and Acceptance Criteria." October 28, 2005. 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

ASME NQA-1-2008, "Quality Assurance Requirements for Nuclear Facility Applications." March 2008. The American Society of Mechanical Engineers, New York, NY

NCRP Report No. 162, "Self Assessment of Radiation-Safety Programs." 2009. National Council on Radiation Protection & Measurements, Bethesda, MD

NEI 07-03A [Revision 0] "Generic FSAR Template Guidance for Radiation Protection Program Description" and the associated NRC SER, 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 SER, ML0932201780

NEI 06-13A, "Template for an Industry Training Program Description" ML0909105542

NEI 99-02 Revision 6 "Regulatory Assessment Performance Indicator Guideline" ML0929311230 [the latest NEI approved revision]

#### 83537-05    PROCEDURE COMPLETION

This procedure will be closed upon satisfactory inspection results verifying that an adequate program exists and processes are in place to maintain occupational exposures ALARA. The inspection must demonstrate the program can be inspected under the ROP.

END

Attachment 1: Revision History for Construction Inspection Procedure 83537

ATTACHMENT 1

Revision History for Construction Inspection Procedure 83537

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	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 83528 of 01/01/1984 to address 10 CFR 52, initial test program, 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>	None	N/A	ML102660656