ATTACHMENT 71124.02

INSPECTABLE AREA: Occupational ALARA Planning and Controls

CORNERSTONE: Occupational Radiation Safety

EFFECTIVE DATE: January 1, 2010

INSPECTION BASIS: 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). 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 each individual exposure and dose represent an absolute minimum or whether the licensee has used all possible methods to reduce exposures. The stochastic risk effect of exposure is based on the linear nonthreshold exposure model. Increasing individual or collective exposures equates to increased risk of cancer or genetic effects. Licensees are required to manage these risks to ALARA levels. This inspectable area verifies aspects of the Occupational Radiation Safety Cornerstone for which there are no indicators to measure performance.

LEVEL OF EFFORT: Inspect biennially

71124.02-01 INSPECTION OBJECTIVE

01.01 To assess performance with respect to maintaining individual and collective radiation exposures ALARA. This inspection will determine whether the licensee's ALARA program, including administrative, operational, and engineering controls, is effectively maintaining occupational exposure ALARA.

71124.02-02 INSPECTION REQUIREMENTS

02.01 Inspection Planning.

a. Review pertinent information regarding plant collective exposure history, current exposure trends, and ongoing or planned activities in order to assess current performance and exposure challenges. Determine the plant's 3-year rolling average (TYRA) collective exposure. The overall collective exposure performance will be used as an input to establish the resources required to complete this inspection attachment and to provide a perspective on significance for any resulting inspection finding assessment.

b. Determine the site-specific trends in collective exposures (using NUREG-0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities," and plant historical data) and source term (average contact dose rate with reactor coolant piping) measurements (using Electric Power Research Institute (EPRI) TR-108737, "BWR Iron Control Monitoring Interim Report," issued December 1998, and/or plant historical data, when available).

c. Review site-specific procedures associated with maintaining occupational exposures ALARA. Include a review of processes used to estimate and track exposures from specific work activities.

02.02 Radiological Work Planning.

a. Obtain from the licensee a list of work activities ranked by actual or estimated exposure that are in progress or that have been completed during the last outage, and select three to five work activities of the highest exposure significance, preferably those activities projected to result in a dose of 5 person-rem or greater.

b. Review the ALARA work activity evaluations, exposure estimates, and exposure mitigation requirements. Determine if the licensee has reasonably grouped the radiological work into work activities, based on historical precedence, industry norms, and/or special circumstances.

c. Verify that the licensee's planning identified appropriate dose mitigation features; considered, commensurate with the risk of the work activity, alternate mitigation features; and defined reasonable dose goals. Verify that the licensee's ALARA assessment has taken into account decreased worker efficiency from use of respiratory protective devices and or heat stress mitigation equipment (e.g., ice vests). Determine if the licensee's work planning considered the use of remote technologies (such as teledosimetry, remote visual monitoring, and robotics) as a means to reduce dose and the use of dose reduction insights from industry operating experience and plant-specific lessons learned. Verify the integration of ALARA requirements into work procedure and radiation work permit (RWP) documents.

d. Compare the results achieved (dose rate reductions, person-rem used) with the intended dose established in the licensee's ALARA planning for these work activities. Compare the person-hour estimates provided by maintenance planning and other groups to the radiation protection group with the actual work activity time requirements, and evaluate the accuracy of these time estimates. Determine the reasons (e.g., failure to adequately plan the activity, failure to provide sufficient work controls) for any inconsistencies between intended and actual work activity doses. Focus on those work activities with planned or accrued exposure greater than 5 person-rem.

e. Determine if post-job (work activity) reviews were conducted and if identified problems were entered into the licensee's corrective action program.

02.03 Verification of Dose Estimates and Exposure Tracking Systems.

a. Select three to five ALARA work packages and review the assumptions and basis (including dose rate and man-hour estimates) for the current annual collective exposure estimate for reasonable accuracy. Review applicable procedures to determine the methodology for estimating exposures from specific work activities and the intended dose outcome.

b. Verify for the selected work activities that the licensee has established measures to track, trend, and if necessary to reduce, occupational doses for ongoing work activities. Verify that trigger points or criteria are established to prompt additional reviews and/or additional ALARA planning and controls.

c. Evaluate the licensee's method of adjusting exposure estimates, or re-planning work, when unexpected changes in scope or emergent work are encountered. Determine if adjustments to exposure estimates (intended dose) are based on sound radiation protection and ALARA principles or if they are just adjusted to account for failures to control the work. Determine whether the frequency of these adjustments call into question the adequacy of the original ALARA planning process.

02.04 Source Term Reduction and Control. Using licensee records, determine the historical trends and current status of significant tracked plant source terms known to contribute to elevated facility aggregate exposure. Determine if the licensee is making allowances or developing contingency plans for expected changes in the source term as the result of changes in plant fuel performance issues or changes in plant primary chemistry.

02.05 Radiation Worker Performance. Observe radiation worker and radiation protection technician performance during work activities being performed in radiation areas, airborne radioactivity areas, or high radiation areas. Concentrate on work activities that present the greatest radiological risk to workers (this review can be performed in concert with the inspection of exposure controls and work coverage in Inspection Procedure 71124.01). Determine if workers demonstrate the ALARA philosophy in practice (e.g., workers are

familiar with the work activity scope and tools to be used, workers use ALARA low-dose waiting areas) and whether there are any procedure compliance issues (e.g., workers are not complying with work activity controls). Also, observe radiation worker performance to determine whether the training and skill level is sufficient with respect to the radiological hazards and the work involved.

02.06 Problem Identification and Resolution. Verify that problems associated with ALARA planning and controls are being identified by the licensee at an appropriate threshold and are properly addressed for resolution in the licensee corrective action program. See Inspection Procedure 71152, "Identification and Resolution of Problems," for additional guidance.

71124.02-03 INSPECTION GUIDANCE

03.01 Inspection Planning. The level of inspection resources and the number of onsite inspections needed to complete this attachment should be commensurate with the radiological challenge that the licensee is experiencing. The quartile standing of the licensee's TYRA is used to assess the current level of challenge to the licensee's program. In general, licensees whose TYRA collective dose is in the lowest quartile, when compared to reactors of the same type (e.g., PWR or BWR), should be assigned the minimum inspection hours. The Office of Nuclear Reactor Regulation will calculate and disseminate plant quartile information for both pressurized-water reactors (PWRs) and boiling-water reactors (BWRs) to the regions on an annual basis. Licensees in the highest quartile should be assigned the maximum inspection hours. However, factors such as the anticipated scope of upcoming radiological work and noted trends in performance may also be considered in determining the level of inspection resources.

a. The regulation in 10 CFR 20.2206(c) requires that, by April 30 of each year, licensees submit to the NRC an annual report containing the results of individual monitoring carried out by the licensee for the previous year's collective exposure. The individual plant collective exposures, along with the TYRA collective exposure for each operating commercial nuclear plant, are contained in NUREG-0713. The inspector should use the most recent annual collective exposure data available for calculating the TYRA collective exposure (if the licensee has submitted its 10 CFR 20.2206(c) report for the previous year, the inspector should use these data to calculate the TYRA collective exposure if the report is more recent than the data contained in the latest NUREG-0713 report). For single-unit sites on a 24-month refueling outage cycle, the TYRA used to schedule inspection hours should be for the most recent year in which the plant had a refueling outage.

b. Based on Electric Power Research Institute (EPRI) TR-108737, the average BWR source term is 220 millirem/hour (mrem/h). Based on EPRI TR-107566, "Evaluation of PWR Radiation Fields: 1991–1996," issued February 1997, the average PWR source term is 100 mrem/h. "Source term" as defined by EPRI means average contact dose rate with the vertical recirculation piping (for BWRs)

and with the crossover loop elbow near the reactor coolant pump piping (Standard Radiation Monitoring Point C5) for PWRs.

03.02 Radiological Work Planning.

a. A 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 a licensee's ALARA program is assessed by comparing the outcomes (in terms of collective dose) to the dose that was intended (i.e., determined to be ALARA) for individual work activities.

b. Focus on work activities that accrued dose significantly greater than projected and approached or exceeded the ALARA significance determination process thresholds (5 rem collective with 50 percent overage).

c. A work activity may have benefited from proper ALARA radiological work planning, yet exceeded its intended dose outcome because of unplanned and/or unexpected conditions or emergent work. Although the pressures of outage scheduling may impact the determination of what additional controls and other measures are reasonably achievable, the licensee is still required to manage these activities such that the resulting doses are ALARA. Occurrences of this type should be entered into the licensee's corrective action program for a determination of whether these dose overruns were avoidable, and the appropriate licensee organization(s) should be held accountable for these breakdowns in work planning. Although 10 CFR Part 20, "Standards for Protection against Radiation," does not require licensees to make every possible effort to demonstrate optimized exposure performance, a high frequency of these ALARA deficiencies may indicate a deficiency in the licensee's overall ALARA program in terms of the ability of different work groups (e.g., operations, radiation protection, maintenance, outage planning) to interface effectively with each other.

d. For licensees in the high collective dose quartile with work activity dose that significantly exceeds projections, consider evaluating the following:

    1. the interfaces between operations, radiation protection, maintenance, maintenance planning, scheduling and engineering groups for interface problems or missing program elements

    2. the shielding requests generated by the RP group with respect to dose rate reduction problem definition and assigning value (dose savings or dollars); engineering shielding responses for follow through

    3. whether work activity planning considers the benefits of dose rate reduction activities such as shielding provided by water-filled components/piping, job scheduling, and shielding and scaffolding installation and removal activities

03.03 Verification of Exposure Estimate and Exposure Tracking Systems.

a. The ability to determine if doses for a work activity are ALARA, or whether they need to be reduced further, will often depend on the accuracy of exposure estimates made in the planning process. These exposure estimates should be based on good assumptions and correct calculations with some flexibility allowed for the expected variability caused by the limits of forecasting.

Accurate exposure estimates usually require a detailed task analysis of the work activity. However, in cases of routine activities, the licensee may rely on previous experience to establish the intended dose and reasonable work controls, in lieu of detailed analysis. Look for bottom-up (aggregation of individual task estimates) exposure estimates corroborated by top-down (historical work activity dose rate times work activity duration) estimating methods. Use of past outage experience combined with additional industry experience can provide a reasonable exposure estimate approach.

If exposure estimates appear questionable, use site-specific experience as the primary standard of comparison, and utilize industry data (as available) or actual work activity exposure data as a secondary standard of comparison to determine the reasonableness of licensee exposure estimates.

b. For licensees in the high collective dose quartile with a work activity dose that significantly exceeds projections, review the licensee's exposure tracking system. Determine whether the level of exposure tracking detail, exposure report timeliness, and exposure report distribution is sufficient to support control of collective exposures. For example, do RWPs cover too many work activities to allow work activity specific exposure trends to be detected and controlled? During the conduct of exposure-significant maintenance work, look for evidence that licensee management was aware of the exposure status of the work and would intervene if exposure trends increased beyond exposure estimates.

03.04 Source Term Reduction and Control.

a. Radiation source term is the level of radiation, or radioactive material, given off by, or contained in, plant systems, structures, or components that results in occupational radiation exposure from the routine operation, including anticipated operational occurrences, of the plant. The radiation source term can result from activated components in primary containment; corrosion and wear products (CRUD) 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 CRUD; proper shutdown/cooldown evolution to control CRUD release and cleanup; appropriate work planning to maximize the benefit of radioactive decay of short-lived radionuclides; cleanup of contaminated systems; and the application of

additional shielding afforded either by the system/component (e.g., having system components filled with water where that lowers the dose rates in work areas) or by use of temporary, portable shielding.

b. For licensees in the high collective dose quartile where actions taken to reduce the source term have been ineffective, determine if followup evaluations and additional actions have been planned. If not, look for additional examples to establish whether there is a pattern.

1. Determine if the licensee has developed an understanding of the plant source term, including knowledge of input mechanisms to reduce the source term.

2. Determine whether the licensee has a source term control strategy in place. This should include a cobalt reduction strategy and shutdown ramping and operating chemistry plan (designed to minimize the source term external to the core) as a minimum. Other methods to control the source term would include preconditioning of primary system surfaces, component and system decontamination, and use of shielding. Some source term control strategies may not be applicable to certain plants. If the licensee does not have a source term control strategy in place, look for reasonable justifications for not pursuing such exposure reduction initiatives.

3. If the licensee has a source term control strategy in place, determine if specific sources have been identified by the licensee for exposure reduction actions and what priorities the licensee has established for implementation of these actions. Determine what results have been achieved against these priorities since the last refueling cycle. Review any applicable design modifications (such as hydrogen injection) associated with source term reduction. Determine if modification is achieving the desired source term reduction.

4. During the current biennial assessment period, determine whether source reduction evaluations have been made and actions have been taken to reduce the overall source term compared to the previous year.

5. Review planned or implemented modifications associated with permanent installation of shielding or shielding racks. Verify that controls are in place to measure the effectiveness of dose reduction.

03.05 through 03.06 No inspection guidance provided.

For applicable guidance on 10 CFR 20.1101(c) compliance, see Questions and Answers 118, 134, and 380 in NUREG/CR-6204, “Questions and Answers Based on Revised 10 CFR Part 20,” dated May 1, 1994.

71124.02-04 RESOURCE ESTIMATE

For planning purposes, it is estimated to take, on average, 54 hours biennially to perform the requirements of this attachment. Normally, a minimum of 44 hours should be assessed for plants appearing in the top (lowest dose) quartile of the plant ranking based on TYRA collective dose. A maximum of 64 hours should be assessed for the plants appearing in the bottom (highest dose) quartile. The plants in the second and third quartiles should receive an average of 54 inspection hours biennially. Adjustments to these inspection hours can be made (either an increase or decrease of hours within the range of 44 to 64 hours), based on the source term and overall effectiveness of a licensee's previous and ongoing ALARA and source term reduction efforts.

71124.02-05 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 one, defined as the sum of all the inspection requirements. Therefore, all the inspection requirements of the procedure should be completed. If some of the requirements cannot be performed because of a lack of samples, the procedure should be closed with comment.

END

Revision History for
IP 71124.02

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
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	ML092810389