

## ATTACHMENT 71121.02

INSPECTABLE AREA: ALARA Planning And Controls

CORNERSTONE: Occupational Radiation Safety

INSPECTION BASIS: This inspectable area verifies aspects of the Occupational Radiation Safety cornerstone for which there are no indicators to measure performance. The stochastic risk effect of exposure is based on the linear non-threshold exposure model. Increasing individual or collective exposures equates to increased risk of cancer or genetic effects. Licensees are required to manage these risks to as low as is reasonably achievable (ALARA) levels. 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. 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.

LEVEL OF EFFORT: Inspect biennially

### 71121.02-01 INSPECTION OBJECTIVE

01.01 To assess performance with respect to maintaining individual and collective radiation exposures as low as is reasonably achievable. This inspection will determine whether the licensee has an adequate program, including administrative, operational, and engineering controls, to maintain occupational exposure ALARA.

### 71121.02-02 INSPECTION REQUIREMENTS

NOTE: This inspection may be performed during plant operations, with respect to on-line maintenance (at-power operations), when the ALARA review time frame is compressed. This inspection may also be performed during outage conditions and prior to and following a significant maintenance or refueling outage to evaluate outage planning and post-outage performance results and lessons learned.

### 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 current 3-year rolling average collective exposure<sup>1</sup>. 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 of significance for any resulting inspection finding assessment.
- b. Review outage or on-line maintenance work scheduled during the inspection period and associated work activity exposure estimates or previous work activity history data. Select 5 to 10 work activities which are likely to result in the highest personnel collective exposures.
- c. Determine the site specific trends in collective exposures (using NUREG-0713 and plant historical data) and source-term (average contact dose rate with reactor coolant piping) measurements (using EPRI TR-108737<sup>2</sup> and/or plant historical data, when available).
- d. Review site specific procedures associated with maintaining occupational exposures ALARA. Include a review of processes used to estimate and track work activity specific exposures.

## 02.02 Radiological Work Planning.

- a. Obtain from the licensee a list of work activities ranked by actual/estimated exposure that are in progress or that have been completed during the last outage and select the 3 to 5 work activities of highest exposure significance.
- b. Review the ALARA work activity evaluations, exposure estimates, and exposure mitigation requirements. Determine if the licensee has established procedures, engineering and work controls, based on sound radiation protection principles, to achieve occupational exposures that are ALARA. Determine if the licensee has reasonably grouped the radiological work into work activities, based on historical precedence, industry norms, and/or special circumstances.

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<sup>1</sup>10 CFR Part 20.2206 (c) requires that licensees submit to the NRC an annual report containing the results of individual monitoring carried out by the licensee by April 30<sup>th</sup> of each year for the previous year's collective exposure. The individual plant collective exposures, along with the three-year rolling average collective exposure for each operating commercial nuclear plant, are contained in NUREG-0713, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities". The inspector should use the most recent annual collective exposure data available for calculating the three-year rolling average collective exposure (if the licensee has submitted its 20.2206 (c) report for the previous year, use this data to calculate the three-year rolling average collective exposure if it is more recent than the data contained in the latest NUREG-0713 report).

<sup>2</sup>EPRI TR-108737 (Dec 1998), "BWR Iron Control Monitoring Interim Report" [average BWR source-term based on this report is 220 mrem/hr]. EPRI TR-107566 (Feb 1997), "Evaluation of PWR Radiation Fields: 1991-1996" [average PWR source-term based on this report is 100 mrem/hr]. 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 (SRMP pt C5) for PWRs.

- c. 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. Determine the reasons (e.g., failure to adequately plan the activity, failure to provide sufficient work controls, etc.) for any inconsistencies between intended and actual work activity doses.
- d<sup>\*3</sup>. Evaluate the interfaces between operations, radiation protection, maintenance, maintenance planning, scheduling and engineering groups for interface problems or missing program elements.
- e\*. Review the integration of ALARA requirements into work procedure and RWP documents.
- f\*. 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.
- g\*. Evaluate the radiation protection group generated shielding requests with respect to dose rate reduction problem definition and assigning value (dose savings or dollars). Evaluate engineering shielding responses for follow through.
- h\*. Determine if work activity planning includes consideration of 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.
- i\*. 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. Review the assumptions and basis for the current annual collective exposure estimate. Review applicable procedures to determine the methodology for estimating work activity-specific exposures and the intended dose outcome. Evaluate both dose rate and man-hour estimates for reasonable accuracy.
- b. Review the licensee's method for adjusting exposure estimates, or re-planning work, when unexpected changes in scope or emergent work are encountered. Are adjustments to estimated exposure (intended dose) based on sound radiation protection and ALARA principles or just adjusted to account for failures to control the work? Does the frequency of these adjustments call into question the adequacy of the original ALARA planning process?
- c\*. 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

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<sup>3</sup>An asterisk indicates that this is an optional inspection requirement. (See 71121.02-05)

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.

#### 02.04 Job Site Inspections and ALARA Control

NOTE: Job site inspection activities may be combined with Section 02.04 of 71121.01, "Access Control to Radiologically Significant Areas."

- a. Based on scheduled work activities and associated exposure estimates, select about 3 to 5 work activities in radiation areas, airborne radioactivity areas, or high radiation areas for observation. Concentrate on work activities that present the greatest radiological risk to workers. For example, observe work that is estimated to result in the highest collective doses, involves diving activities in or around spent fuel or highly activated material, or that involves potentially changing (deteriorating) radiological conditions. Evaluate the licensee's use of ALARA controls for these work activities by performing the following:
  1. Evaluate the licensee's use of engineering controls to achieve dose reductions. Are the procedures and controls consistent with the licensee's ALARA reviews? Is sufficient shielding of radiation sources provided for? Did the dose expended to install/remove the shielding exceed the dose reduction benefits afforded by the shielding?
  - 2\*. Determine if workers are utilizing the low dose waiting areas and are effective in maintaining their doses ALARA (e.g., do they remain in the work area or move to the low dose waiting area when subjected to temporary work delays).
  - 3\*. Determine if workers receive appropriate on-the-job supervision to ensure the ALARA requirements are met. Determine if the first-line job supervisor ensures the work activity is conducted in a dose efficient manner (e.g., work crew size minimized, workers properly trained, proper tools and equipment available at start of job, etc.).
- b\*. Review exposures of individuals from selected work groups. Evaluate any significant exposure variations which may exist among workers and determine whether these significant exposure variations are the result of worker job skill differences or whether certain workers received higher doses because of poor ALARA work practices.

#### 02.05 Source-Term Reduction and Control

- a. Utilizing licensee records, determine the historical trends and current status of tracked plant source terms. Determine if the licensee is making allowances or developing contingency plans for expected changes in the source term due to changes in plant fuel performance issues or changes in plant primary chemistry.

- b\*. Determine if the licensee has developed an understanding of the plant source-term, including knowledge of input mechanisms to reduce the source term. 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.
- c\*. 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. During the current 12 month 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.

02.06 Radiation Worker Performance. Observe radiation worker and RP 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 (see section 02.04). Determine if workers demonstrate the ALARA philosophy in practice (e.g., are workers familiar with the work activity scope and tools to be used, are workers utilizing ALARA low dose waiting areas) and whether there are any procedure compliance issues (e.g., are work activity controls being complied with). Also, observe radiation worker performance to determine whether the training/skill level is sufficient with respect to the radiological hazards and the work involved.

02.07 Declared Pregnant Workers. Determine if there have been any declared pregnant workers during the current assessment period. Review the exposure results and monitoring controls employed by the licensee with respect to requirements of 10 CFR 20.

02.08 Problem Identification and Resolutions

- a. Review the licensee's self assessments, audits, and Special Reports related to the ALARA program since the last inspection. Determine if the licensee's overall audit program's scope and frequency (for all applicable areas under the Occupational Cornerstone) meet the requirements of 10 CFR 20.1101(c).
- b\*. Determine if identified problems are entered into the corrective action program for resolution. Review dose significant post-job (work activity) reviews and post-outage ALARA report critiques of exposure performance. Determine if identified problems are properly characterized, prioritized, and resolved in an expeditious manner.
- c\*. Review corrective action reports related to the ALARA program. Interview staff and review documents to determine if the follow-up activities are being conducted in an effective and timely manner commensurate with their importance to safety and risk:

1. Initial problem identification, characterization, and tracking.
2. Disposition of operability/reportability issues.
3. Evaluation of safety significance/risk and priority for resolution.
4. Identification of repetitive problems.
5. Identification of contributing causes.
6. Identification and implementation of effective corrective actions.
7. Resolution of non-cited violations (NCVs) tracked in the corrective action system.
8. Implementation/consideration of risk significant operational experience feedback.

Emphasis should be placed on ensuring problems are identified, characterized, prioritized, entered into a corrective action program, and resolved.

- d. For repetitive deficiencies or significant individual deficiencies in problem identification and resolution identified above, determine if the licensee's self-assessment activities are also identifying and addressing these deficiencies.

#### 71121.02-03 INSPECTION GUIDANCE

Situations where the unplanned, unintended collective dose for a work activity does not exceed 50% of the planned, intended dose, should normally be considered as minor issues and screened out from SDP consideration (see appendix B to IMC 0612, formerly IMC 0610\*, for a discussion of the screening process). This criterion reflects a reasonable expectation of the accuracy of ALARA planning. In addition, failures that exceed this 50% criterion for work activities where the actual total collective dose is less than 5 person-rem should also generally be considered as minor.

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 licensee is experiencing. In general, licensees whose current three-year rolling average collective dose is in the lowest quartile (NRR will calculate and disseminate plant quartile information for both PWRs and BWRs to the Regions on an annual basis), when compared to reactors of the same type (e.g., PWR or BWR), should be assigned the minimum inspection hours. 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 the performance, may also be considered in determining the level of inspection resources.

03.02 Radiological Work Planning. A work activity may have benefitted from proper ALARA radiological work planning, yet overshoot its intended dose outcome due to unplanned, unexpected conditions or emergent work. Although the pressures of outage scheduling may impact the determination of what additional controls, etc., 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 whether these dose overruns were avoidable, and the appropriate licensee organization(s) should be held accountable for these breakdowns in work planning. Part 20 does not require licensees to make every possible effort to demonstrate optimized exposure performance. However, 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.

03.03 Verification of Exposure Estimate Goal Dose Estimates and Exposure Tracking Systems. 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 given with regard to expected variability due to 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 past experience as the primary standard of comparison and utilize industry data (as available) of actual work activity exposure data as a secondary standard of comparison to determine the reasonableness of licensee exposure estimates.

03.04 Job Site Inspections and ALARA Control. Performing surveys of high collective dose job locations can provide a means to evaluate the results of the licensee's ALARA efforts. If the sources are shielded to essentially background levels, then no significant dose gradients should be detected and review of the licensee's shielding efforts in this area may not be necessary.

Review the individual doses for workers associated with several high exposure work activities or work activities performed in high radiation areas. Notable variations in doses among workers in the same work group (or between workers performing the same or similar work activities at different times) may be due to poor or inconsistent work practices (e.g., use of inadequate shielding, lack of mockup training, excessive re-work rates). If such inconsistencies in worker doses are observed, identify what measures the licensee has taken to improve these practices.

03.05 Source Term Reduction and Control. Consider utilizing a survey instrument to walk down selected accessible areas of the station to verify the accuracy and completeness of the licensee's source tracking program. During plant tours, investigate any sources that may affect collective exposures and which are not tracked by the licensee.

For such radiation sources, determine how long the condition has existed, whether postings and radiation surveys have been deficient, whether any unplanned exposures have occurred or were likely to occur, and whether the licensee has entered this information into its corrective action program.

If a licensee identified radiation source is old (greater than 1 year), determine how long the condition has existed. If this source may have resulted in unnecessary exposures (such

as during an outage), determine how much exposure has resulted from (or was likely to have resulted from) the source and compare those results with the licensee's exposure evaluation assessment to encompass the extended time period.

If actions taken to reduce the source term have been ineffective, determine if follow-up evaluations and additional actions have been planned. If not, look for additional examples to establish whether there is a pattern.

03.06 through 03.07 No inspection guidance provided.

03.08 Problem Identification and Resolution. ALARA program deficiencies noted should be documented consistent with the criteria in IMC 0612 (formerly IMC 0610\*).

For applicable guidance on 20.1101(c) compliance, see Questions and Answers 118, 134 and 380 (NUREG/CR 6204).

#### 71121.02-04 RESOURCE ESTIMATE

For planning purposes, it is estimated to take, on average, 80 hours biennially to perform the requirements of this attachment. A minimum of 64 hours should be assessed for the best performers, as determined by the plants appearing in the top (lowest dose) quartile of the plant ranking based on three-year rolling average collective dose. A maximum of 96 hours should be assessed for the plants appearing in the bottom (highest dose) quartile of three-year rolling average collective doses. The plants in the second and third quartiles should receive an average of 80 inspection hours biennially.

#### 71121.02-05 COMPLETION STATUS

The minimum sample size for this attachment is fifteen (15) inspection requirements (defined as the sum of all the inspection requirements (Section 71121.02-02) without an asterisk). These fifteen non-asterisk inspection requirements are the minimum required for plants which have a three-year rolling average collective dose (TYRA) which is in the top (lowest dose) quartile (NRR will calculate and disseminate plant quartile information for both PWRs and BWRs to the Regions on an annual basis). The inspection requirements with an asterisk following their subsection number are optional and should be added, as deemed appropriate by the Region, for higher quartile TYRA plants such that all required areas (asterisk and non-asterisk inspection requirements) are inspected for those plants in the bottom (highest TYRA) quartile. All other sections of this procedure must be completed at all plants.

END