ATTACHMENT 71124.01

INSPECTABLE AREA: Radiological Hazard Assessment and Exposure Controls

CORNERSTONE: Occupational Radiation Safety 70%
Public Radiation Safety 30%

EFFECTIVE DATE: January 1, 2010

INSPECTION BASIS: Title 10 of the *Code of Federal Regulations* (10 CFR) Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," and 10 CFR Part 20, "Standards for Protection against Radiation," have regulatory requirements to ensure that licensees provide adequate protection of occupational workers from the exposure to radiation and radioactive materials during the normal operation, including anticipated operational occurrences, of a nuclear power plant. In general, adequate protection from routine exposures is demonstrated by maintaining the resultant doses below the applicable limits and as low as reasonably achievable (ALARA). This inspectable area is partially covered by the Occupational Radiation Safety Performance Indicator (PI) in terms of controlling access to radiologically significant areas and maintaining control over occupational radiation exposures. However, the PI may not reflect situations where the radiological hazards are not adequately identified, or where the risk to the workers' health and safety from the exposure situation is not necessarily reflected by the dose outcome (i.e., substantial potential exists for an overexposure or substantial release of radioactive materials). The identification and control of radioactive materials that have a potential for release outside the restricted area, and the resultant risk of radiation exposures to members of the public, are not reflected in the Public Radiation Safety PI.

LEVEL OF EFFORT: Inspect Annually

71124.01-01 INSPECTION OBJECTIVES

01.01 To review and assess licensee performance in assessing the radiological hazards in the workplace associated with licensed activities and the implementation of appropriate

radiation monitoring and exposure control measures for both individual and collective exposures.

01.02 To verify that the licensee is properly identifying and reporting PIs for the Occupational Radiation Safety Cornerstone.

01.03 To identify those performance deficiencies that were reportable as a PI and which may have represented a substantial potential for overexposure of the worker.

71124.01-02 INSPECTION REQUIREMENTS

02.01 Inspection Planning. Review all licensee PIs for the Occupational Exposure Cornerstone for followup. Review the results of radiation protection program audits (e.g., licensee's quality assurance audits or other independent audits). Review any reports of operational occurrences related to occupational radiation safety since the last inspection. The results of the audit and operational report reviews should be used to gain insights into overall licensee performance and focus the inspector's inspection activities on areas that are most likely to yield safety-significant results, consistent with the principle of "smart sampling."

02.02 Radiological Hazard Assessment.

a. Determine if, since the last inspection, there have been changes to plant operations that may result in a significant new radiological hazard for onsite workers or members of the public. Verify that, consistent with 10 CFR 20.1501, "General," the licensee has assessed the potential impact of these changes and has implemented periodic monitoring, as appropriate, to detect and quantify the radiological hazard.

b. Review the last two radiological surveys from three to six selected plant areas. Verify that the thoroughness and frequency of the surveys is appropriate for the given radiological hazard.

c. Conduct walkdowns of the facility, including radioactive waste processing, storage, and handling areas to evaluate material conditions and potential radiological conditions (radiological control area (RCA), protected area, controlled area, contaminated tool storage, or contaminated machine shops). This assessment should include selective facility walkdowns and independent radiation measurements to verify conditions.

d. Select three to five radiologically risk-significant work activities that involve exposure to radiation. Verify that appropriate prework surveys were performed (type of survey, sensitivity of survey technique), which were appropriate to identify and quantify the radiological hazard and to establish adequate protective measures. Evaluate the radiological survey program to determine if hazards are properly identified, including the following:

1. identification of hot particles

2. the presence of alpha emitters

3. the potential for airborne radioactive materials, including the potential presence of transuranics and/or other hard-to-detect radioactive materials (This evaluation may include licensee planned entry into nonroutinely entered areas subject to previous contamination from failed fuel.)

4. the hazards associated with work activities that could suddenly and severely increase radiological conditions (e.g., in-core detector movement, impact of fuel moves in affected areas of drywell/aux building, movement of irradiated materials in the spent fuel pool)

5. severe radiation field dose gradients that can result in nonuniform exposures of the body

e. Select three to five air sample survey records and verify that samples are collected and counted in accordance with licensee procedures. Observe work in potential airborne areas, and verify that air samples are representative of the breathing air zone. If the licensee uses continuous air monitors to monitor real-time airborne conditions, verify that they are located in areas with low background to minimize false alarms. If the licensee uses skid-mounted particulate, iodine, and noble gas (PING)-type instruments to monitor airborne conditions, verify that the air being monitored is representative of the actual work areas. Verify that the licensee has a program for monitoring levels of loose surface contamination in areas of the plant with the potential for the contamination to become airborne.

02.03 Instructions to Workers.

a. Select three to five containers holding nonexempt licensed radioactive materials that may cause unplanned or inadvertent exposure of workers, and verify that they are labeled and controlled in accordance with 10 CFR 20.1904, "Labeling Containers," or meet the requirements of 10 CFR 20.1905(g). Emphasis should be on the review of containers that have the potential for containing the most significant radiological hazard (i.e., containers that provide shielding of the source, or that contain significant amounts of loose contamination that could become an airborne hazard).

b. Review three to five radiation work permits (RWPs) used to access high radiation areas (HRAs) and identify what work control instructions or control barriers have been specified. Use plant-specific technical specification HRA requirements as the standard for the necessary barriers. Verify that allowable stay times or permissible dose (including from the intake of radioactive material) for radiologically significant work under each RWP is clearly identified. Verify that electronic personal dosimeter (EPD) alarm setpoints are in conformance with survey indications and plant policy.

c. As available, select one to two occurrences where a worker's EPD noticeably malfunctions or alarms. Verify that workers responded appropriately to the off-normal condition. Verify that the issue was included in the corrective action program and dose evaluations were conducted as appropriate.

d. For those work activities selected in 02.02(d)(4) above, verify that the licensee has established a means to inform workers of changes that could significantly impact their occupational dose.

02.04 Contamination and Radioactive Material Control.

a. Observe several locations (if there are several release points from the RCA, or if there are several RCAs on site) where the licensee monitors potentially contaminated material leaving the RCA, and inspect the methods used for control, survey, and release from these areas. When possible, observe the performance of personnel surveying and releasing material for unrestricted use to verify that the work is performed in accordance with plant procedures and the procedures are sufficient to control the spread of contamination and prevent unintended release of radioactive materials from the site. Verify that the radiation monitoring instrumentation has appropriate sensitivity for the type(s) of radiation present.

b. Review the licensee's criteria for the survey and release of potentially contaminated material. Verify that there is guidance on how to respond to an alarm that indicates the presence of licensed radioactive material.

c. Review the licensee's procedures and records to verify that the radiation detection instrumentation is used at its typical sensitivity level based on appropriate counting parameters (i.e., counting times and background radiation levels). Verify that the licensee has not established a de facto "release limit" by altering the instrument's typical sensitivity through such methods as raising the energy discriminator level or locating the instrument in a high-radiation background area.

d. Select two to three sealed sources from the licensee's inventory records that present the greatest radiological risk. Verify that sources are accounted for and have been verified to be intact (i.e., they are not leaking their radioactive content).

e. Verify that any transactions (since the last inspection) involving nationally tracked sources were reported in accordance with 10 CFR 20.2207.

02.05 Radiological Hazards Control and Work Coverage. This section should be performed in concert with Section 02.02 of this procedure.

a. During tours of the facility and review of ongoing work selected in 02.02 (above), evaluate ambient radiological conditions (e.g., radiation levels or potential radiation levels). Verify that existing conditions are consistent with posted surveys, RWPs, and worker briefings, as applicable.

b. During job performance observations, verify the adequacy of radiological controls, such as required surveys (including system breach radiation, contamination, and airborne surveys), radiation protection job coverage (including audio and visual surveillance for remote job coverage), and contamination controls. Evaluate the licensee's means of using EPDs in high noise areas as HRA monitoring devices.

c. Verify that radiation monitoring devices (thermoluminescent (TLD) dosimeters, optically stimulated luminescence (OSL) dosimeters, etc.) are placed on the individual's body consistent with the method that the licensee is employing to monitor dose from external radiation sources. Verify that the dosimeter is placed in the location of highest expected dose or that the licensee is properly employing an NRC-approved method of determining effective dose equivalent.

d. For high-radiation work areas with significant dose rate gradients (a factor of 5 or more), review the application of dosimetry to effectively monitor exposure to personnel. Verify that licensee controls are adequate.

e. Review three to five RWPs for work within airborne radioactivity areas with the potential for individual worker internal exposures. Evaluate airborne radioactive controls and monitoring, including potentials for significant airborne levels (e.g., grinding, grit blasting, system breaches, entry into tanks, cubicles, reactor cavities). For these selected airborne radioactive material areas, verify barrier (e.g., tent or glove box) integrity and temporary high-efficiency particulate air (HEPA) ventilation system operation. Focus on any work areas with a history of, or the potential for, airborne transuranics or other hard-to-detect radionuclides.

f. Examine the licensee's physical and programmatic controls for highly activated or contaminated materials (nonfuel) stored within spent fuel and other storage pools. Verify that appropriate controls (i.e., administrative and physical controls) are in place to preclude inadvertent removal of these materials from the pool.

g. Conduct selective inspection of posting and physical controls for HRAs and very high radiation areas (VHRAs), to the extent necessary to verify conformance with the Occupational PI.

02.06 Risk-Significant High Radiation Area and Very High Radiation Area Controls. Focus on verifying aspects of the licensee PI activities for high-risk HRAs (greater than 25 rem in 1 hour at 30 centimeters from the source) and for all VHRAs. These areas provide the potential for significant worker overexposures, and in some cases, potentially lethal acute exposures.

a. Discuss with the Radiation Protection Manager (RPM) the controls and procedures for high-risk HRAs and VHRAs. Focus on any procedural changes since the last inspection. Discuss methods employed by the licensee to provide stricter control of VHRA access as specified in 10 CFR 20.1602, "Control of Access to Very High Radiation Areas," and Regulatory Guide 8.38, "Control of Access to High and Very

High Radiation Areas of Nuclear Plants." Verify that any changes to licensee procedures do not substantially reduce the effectiveness and level of worker protection.

b. Discuss with no more than two first-line health physics (HP) supervisors (or equivalent positions having backshift HP oversight authority) the controls in place for special areas that have the potential to become VHRAs during certain plant operations. Determine if these plant operations (e.g., pressurized-water reactor (PWR) thimble withdrawal into the reactor cavity sump; boiling-water reactor (BWR) traversing in-core probe movement; BWR drywell fuel transfer slot area; spent fuel pool, cavity, or pit diving) require communication beforehand with the HP group, so as to allow corresponding timely actions to properly post, control, and monitor the radiation hazards including re-access authorization.

c. Verify that licensee controls for all VHRAs, and areas with the potential to become a VHRA, ensure that an individual is not able to gain unauthorized access to the VHRA.

02.07 Radiation Worker Performance.

a. During job performance observations, observe radiation worker performance with respect to stated radiation protection work requirements. Determine if workers are aware of the significant radiological conditions in their workplace and the RWP controls/limits in place and that their performance reflects the level of radiological hazards present.

b. Review up to 10 radiological problem reports since the last inspection that find the cause of the event to be human performance errors. Determine if there is an observable pattern traceable to a similar cause. Determine if this perspective matches the corrective action approach taken by the licensee to resolve the reported problems. Discuss with the RPM any problems with the corrective actions planned or taken.

02.08 Radiation Protection Technician Proficiency.

a. During job performance observations, observe the performance of the radiation protection technician with respect to all radiation protection work requirements. Determine if technicians are aware of the radiological conditions in their workplace and the RWP controls/limits and if their performance is consistent with their training and qualifications with respect to the radiological hazards and work activities.

b. Review a maximum of 10 radiological problem reports since the last inspection that find the cause of the event to be radiation protection technician error. Determine if there is an observable pattern traceable to a similar cause. Determine if this perspective matches the corrective action approach taken by the licensee to resolve the reported problems.

02.09 Problem Identification and Resolution. Verify that problems associated with radiation monitoring and exposure control 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. (optional) In addition to the above, verify the appropriateness of the corrective actions for a selected sample of problems documented by the licensee that involve radiation monitoring and exposure controls. Because a licensee's evaluation of industry operating experience can be critical, determine whether licensees are assessing the applicability of operating experience to their respective plants.

71124.01-03 INSPECTION GUIDANCE

03.01 Inspection Planning. To the extent practicable, inspections should be scheduled to coincide with refueling outages or other radiologically significant plant modifications so as to maximize the opportunities for the inspector to verify licensee performance through direct observation.

03.02 Radiological Hazard Assessment.

No guidance provided.

03.03 Instructions to Workers.

a. Changes in plant operations that may result in changes to the scope of radiological hazards include but are not limited to the following:

   1. degraded reactor fuel integrity that can result in hot particle contamination, or the presence of transuranic nuclides (or other hard to detect radionuclides), for work activities previously unaffected

   2. changes in reactor water chemistry (e.g., hydrogen injection in a BWR) that can result in significant changes to the in-plant radiation source term

   3. significant onsite spills, or contamination of uncontaminated systems, that can result in a new pathway for the release, or potential release, of radioactive materials off site

   4. storage of radioactive materials in the owner-controlled area (e.g., remote or satellite RCAs within the plant site)

   5. degraded material conditions of radwaste systems or other plant components containing radioactivity

b. No guidance provided.

c. Verify the adequacy of the licensee's method for evaluating anomalous electronic dosimeter (ED) readings. Verify that the licensee reviews histogram and/or radiological survey data as appropriate to validate readings. Determine if sufficient information is documented in reports of unusual dosimetry occurrence to substantiate either the dose assignment or determination that the ED reading/alarm was invalid.

d. Areas that have a potential for sudden changes in radiological conditions include BWR turbine building access during power changes, in-core detector areas, initial primary containment entries, and radwaste transfer operations.

Continuous air monitors positioned throughout the power plant are often used as initial trending indicators of increasing airborne radioactive material levels. While identified increases in airborne levels may not be dose significant (as indicated by the directly measurable beta- and gamma-emitting radionuclides), power plants with known transuranic contamination problems should consider and assess this transuranic component when appropriate. This focus is especially vital during certain maintenance activities in known transuranic-contaminated areas. See Information Notice (IN) 97-36, "Unplanned Intakes by Worker of Transuranic Airborne Radioactive Materials and External Exposure Due to Inadequate Control of Work," dated June 20, 1997, for a discussion of previous problems and guidance in this area.

03.04 Contamination and Radioactive Material Control.

a. If workers are permitted to self-survey personal items, selectively verify by review of one or two controls points that workers are complying with applicable guidance and training.

b. The regulation in 10 CFR Part 20 does not contain release limits for the release of contaminated material to unrestricted areas; thus, the licensee's criteria should be that no detectable licensed radioactive material (radioactive gaseous and liquid effluents excepted) is released for unrestricted use or as waste into an unrestricted area.

Review the licensee's equipment to ensure that the radiation detection sensitivities are consistent with the NRC guidance contained in Office of Inspection and Enforcement (IE) Circular 81-07, "Control of Radioactively Contaminated Material," and IN 85-92, "Surveys of Wastes Before Disposal from Nuclear Reactor Facilities," dated December 2, 1985, for surface contamination and Health Physics Position (HPPOS) 221 from NUREG/CR-5569, Revision 1, "Health Physics Positions Data Base," dated May 1, 1992, for volumetrically contaminated material. If applicable, as discussed in HPPOS 250, verify that the licensee performs radiation surveys to assess radionuclides that decay via electron capture.

c, d, and e. No guidance provided.

03.05 Surveys and Radiation Work Coverage/Controls.

a and b. No guidance provided.

c. Dosimeter selection and placement criteria: The review should include the adequacy of the licensee's criteria for utilization and placement of whole body and extremity dosimeters, including their use in nonuniform radiation fields. In 10 CFR 20.1201(c), no work areas are exempt from the requirement to measure deep dose equivalent (DDE) at the part of the body receiving the highest exposure. However, while not a focus of this inspection, the licensee's procedure should have reasonable criteria for complying with 10 CFR 20.1201(c) for workers where dose rates are greater than 10 millirem (mrem) per hour. Additionally, assuming a dose gradient of 1.5 or more, it would not be reasonable to move the personal dosimeter (or provide for additional dosimeters), unless an individual's dose missed by not moving the dosimeter was "significant" (e.g., 30 mrem for an individual for the work shift). From a collective dose perspective (assuming a dose gradient of 1.5 or more), a "missed" collective dose of 250 mrem or more for a job is a reasonable threshold action criterion for the licensee to provide additional personal monitoring (or move the dosimeter) to measure the highest DDE, consistent with 10 CFR 20.1201(c). The licensee may be using an NRC-approved method of measuring effective dose equivalent. The dosimeter placement should be consistent with the approved method.

d. Focus on any underwater diving activities, where the dose rate gradients are severe, thereby increasing the necessity of providing multiple dosimeters and/or enhanced job controls.

e. No guidance provided.

f. Licensees may store highly activated materials (e.g., fuel channels and irradiated low power range monitors) underwater on short-hangers, which could be inadvertently raised to the pool surface. If unshielded, these materials could create an HRA or VHRA. For applicable guidance and a history of previous events, see Regulatory Guide 8.38, Section C.4.2; IN 90-33, "Sources of Unexpected Occupational Radiation Exposure at Spent Fuel Storage Pools," dated May 9, 1990; HPPOS 016 and 245 in NUREG/CR-5569 and HPPOS 333 (memorandum, Miller to Joyner et al., January 30, 1995, at ADAMS Accession No. ML040760364); and Questions and Answers 447 and 448 in NUREG/CR-6204, "Questions and Answers Based on Revised 10 CFR Part 20," dated May 1, 1994.

g. The standard of performance is the technical specifications, 10 CFR Part 20, and Regulatory Guide 8.38, as regards administrative controls, barrier enhancements, and key controls.

03.06 Risk-Significant High Radiation Area and Very High Radiation Area Controls. The intent of this limited inspection oversight/requirement is to maintain continued NRC

vigilance of the licensee's program and procedural controls and plant staff awareness of these special, accessible areas where the potential for lethal overexposure exists.

a. Do not repeat this HP inspection requirement during the sitewide annual PI verification team inspection.

b. Determine if entries are made into areas controlled as VHRAs. For example, PWRs can control primary containments as VHRAs during power operations, and BWRs may control traversing in-core probe areas or fuel transfer slot areas in the drywell as VHRAs. Discuss with licensee management the required procedural controls and HP technician coverage during such entries.

c. See Regulatory Guide 8.38, Section C.4, Appendices A and B, for guidance for specific work areas and activities that have documented histories of worker overexposures.

See applicable parts of NUREG/CR-6204 and NUREG/CR-5569.

03.07 through 03.9 No guidance provided.

71124.01-04 RESOURCE ESTIMATE

For planning purposes, it is estimated to take 32 hours on average (with a range of 26 hours to 38 hours) annually to perform the requirements of this attachment.

71124.01-05 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 lack of samples, the procedure should be closed with comment.

END

Revision History for
IP71124.01

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	ML092810383