

NUCLEAR INDUSTRY STANDARD PROCESS

Radiological Protection

Level 3 – Information Use

Radiological Job Coverage

NISP-RP-010

Revision: 1

Industry Approval Date: November 9, 2018

This is an industry document for standardizing radiation protection processes. Standard processes and requirements are established to eliminate site-specific radiation protection procedures. The Institute for Nuclear Power Operations (INPO) maintains current procedures on the INPO website. Approval authority is granted by the industry contingent on a structured review and approval process by representatives of utility radiation protection organizations.

Nuclear Industry Standard Process Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

Table of Contents

1.0	Purpose	1
2.0	Scope.....	1
3.0	Definitions	2
4.0	Responsibilities	2
5.0	General Requirements.....	2
6.0	Process Instructions	2
6.1	Prepare for Job Coverage.....	3
6.2	Survey Work Areas	4
6.3	Monitor and Verify Protective Measures	5
6.4	Track Stay Time.....	7
6.5	Respond to Unexpected Conditions.....	8
6.6	Exercise Stop Work Authority	10
7.0	Records/Documentation	10
8.0	References	10
8.1	Commitments.....	10
8.2	General.....	10
9.0	Attachments.....	10
9.1	Attachment 1: Job Coverage Responsibilities.....	13
9.2	Attachment 2: Stay Time Log – Sample.....	15
9.3	Attachment 3: Protective Measures for Work in Contaminated Areas	16
9.4	Attachment 4: Protective Measures for Work in High Contamination Areas	18
9.5	Attachment 5: Protective Measures for Discrete Radioactive Particles	20
9.6	Attachment 6: Protective Measures for Transuranic Nuclides	23
9.7	Attachment 7: Protective Measures for Airborne Radioactivity	25
9.8	Attachment 8: Protective Measures for Gradients in Radiation Fields	27

1.0 Purpose

- 1.1 This procedure describes the processes and instructions for monitoring radiological work based on the radiological risk and the types of radiological hazards that may be present. Protective measures are described for each type of radiological hazard to guide job coverage technicians in minimizing personnel dose and the potential spread of contamination.

2.0 Scope

- 2.1 The processes described in this procedure are based on common approaches used in the US nuclear power industry to provide job coverage by radiation protection personnel. The radiological concerns addressed by this procedure are based on the common radiological hazards for the PWRs and BWRs operating in the US.
- 2.2 The forms referenced by this procedure are examples used to describe the pertinent information that should be recorded for future reference. Plant procedures may specify the use of equivalent forms or the use of electronic media for the same purposes.
- 2.3 Common industry requirements and good practices are described to enable supplemental technicians to understand the bases for site-specific requirements. This procedure is not intended to replace job-specific instructions that may be in site procedures, job coverage guidelines, RWPs, ALARA Plans, etc.
- 2.4 This procedure includes generic instructions for remote monitoring but does not include instructions for operating the specific equipment that may be used for telemetry, cameras, and communications. The operation of remote monitoring equipment is governed by site procedures and site-specific training.
- 2.5 The forms referenced by this procedure are examples used to describe the pertinent information that should be recorded for future reference. Plant procedures may specify the use of equivalent forms or the use of electronic media for the same purposes.
- 2.6 Member utilities are expected to use this standard to enable supplemental workers to transition between nuclear power plants with minimal site-specific training. Compliance with these instructions is expected without additional site requirements or process deviations being imposed that may require additional training or challenge the performance of supplemental workers.
- 2.7 This procedure will be used to train and instruct supplemental radiological protection technicians. Member utilities will implement these process requirements in site procedures and update site procedures whenever requirements or process steps in this Nuclear Industry Standard Process (NISP) are revised. Current revisions are maintained on the INPO website.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

3.0 Definitions

- 3.1 Terms, acronyms, and definitions not described in this procedure are provided in NISP-RP-013, *Radiation Protection Standard Glossary of Terms*.

4.0 Responsibilities

- 4.1 Radiation Protection is responsible for the implementation of the requirements of this procedure per Efficiency Bulletin 17-01 and the Nuclear Industry Standard Process Initiative.

4.2 Radiation Protection Supervision (RPS)

- 4.2.1 Responsible for review and effective implementation of the RWP program including the designation of individuals authorized to initiate, review, and approve RWPs.

4.3 Radiation Protection Manager or designee

- 4.3.1 Authorize the restriction of an individual from a Radiologically Controlled Area.
- 4.3.2 Authorize the reinstating of an individual for entry into a Radiologically Controlled Area.

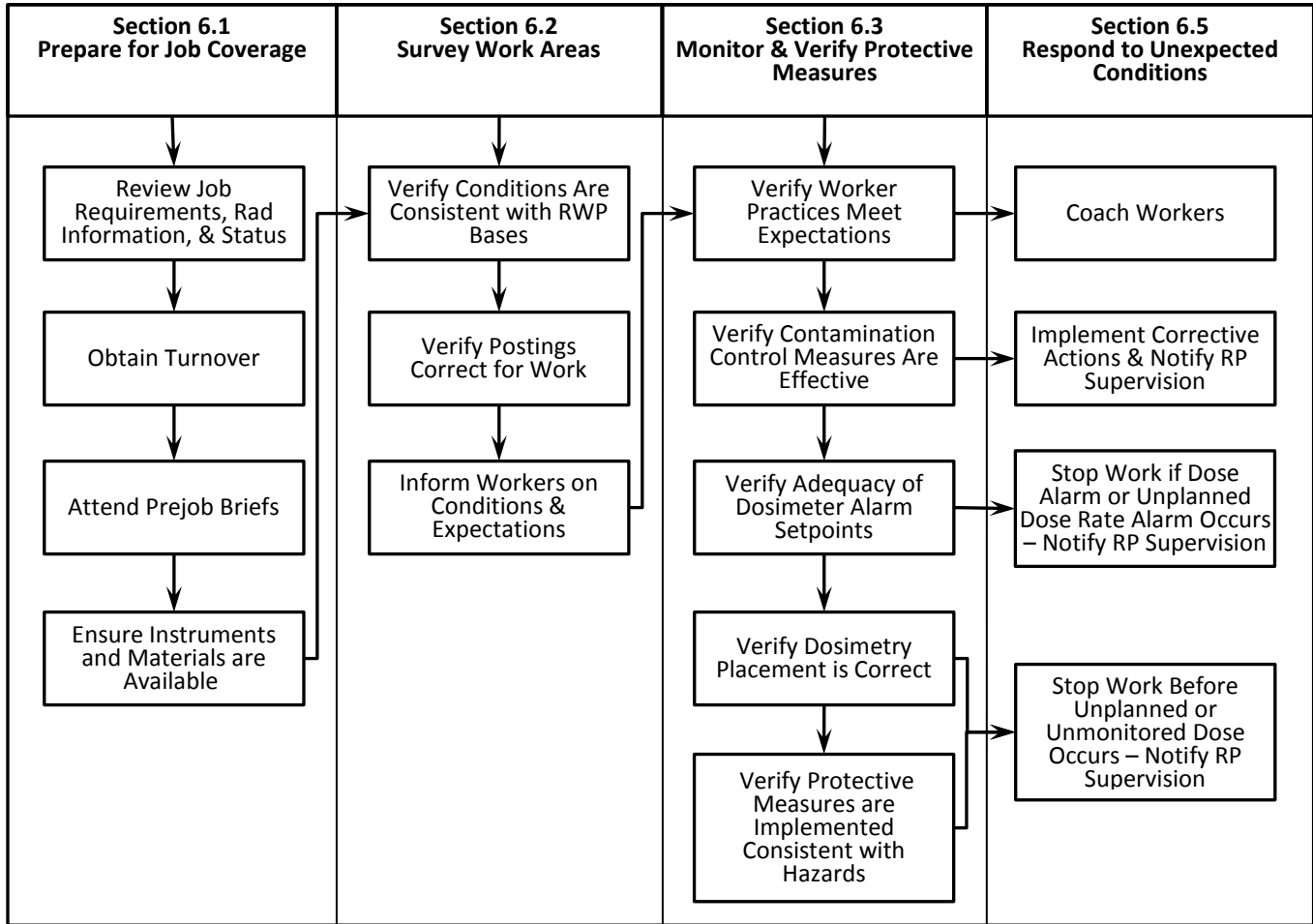
5.0 General Requirements

- 5.1 Review and understand expectations in site procedure(s) for implementing the RWP program, including documents and records required from job coverage technicians.
- 5.2 Ensure work is in compliance with radiological protection requirements as specified in RWPs, ALARA Plans, and approved procedures.

6.0 Process Instructions

- 6.0.1 The following diagram shows the key elements in providing job coverage. Detailed instructions follow the diagram. Arrows are provided to show the relationships among key elements and do not specify requirements for sequencing activities.

Nuclear Industry Standard Process Radiological Job Coverage



6.1 Prepare for Job Coverage

NOTE: Reviews must be thorough enough to ensure job coverage technicians know and understand current radiological conditions, protective requirements, work restrictions, and any issues related to performing the work that could affect radiological protection performance

6.1.1 Obtain a turnover and/or a prejob brief to review the following information that may be applicable:

- a. Most recent radiological surveys.
- b. RWPs, allowed scope of work, and upcoming high risk activities.
- c. ALARA Plans.
- d. RP logs.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

e. Condition Reports.

6.1.2 Review job coverage requirements on the applicable RWP and ALARA Plan and implement coverage requirements consistent with Attachment 1, Job Coverage Responsibilities. Notify RP supervision if a discrepancy is apparent.

6.1.3 Obtain “face-to-face” turnover when relieving for continuous job coverage.

NOTE: Validation of worker understanding can be accomplished by listening to the dialogue, asking questions, and/or observing recent worker performance.

6.1.4 Communicate with workers to ensure they understand radiological conditions, protective requirements, and work restrictions.

a. Verify understanding and compliance with additional dosimetry requirements such as multi-badging, extremity monitoring, or neutron monitoring.

b. Ensure workers understand the need to maintain the body positions assumed during prejob planning and to notify RP if changes in work will invalidate those assumptions. Refer to Attachment 8, *Protective Measures for Gradients in Radiation Fields*.

6.1.5 Ensure the correct equipment is available and operational as needed to perform surveys and collect air samples.

6.1.6 Ensure prejob briefings for workers have been completed per site procedures.

6.2 Survey Work Areas

6.2.1 Perform work area radiation and contamination surveys as needed to ensure the radiological conditions during work activities are consistent with worker briefings and within the ranges specified by the RWP and, if applicable, the ALARA Plan.

a. Survey immediately prior to beginning work if radiological conditions are unknown or potentially unstable.

b. Survey on a frequency as needed to validate conditions are stable; comply with survey frequencies in procedures, RWP, and ALARA Plans when a survey frequency is specified.

c. Survey immediately if changes in conditions are suspected due to anomalies from worker activities or plant conditions, e.g. system breaches, leaks, unexpected alarms, etc.

6.2.2 Obtain air samples per NISP-RP-003, *Radiological Air Sampling*.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- 6.2.3 Pre-post areas prior to performing work that is expected to increase radiation, contamination, and airborne concentrations in accordance with NISP-RP-004, *Radiological Posting and Labeling*.
- 6.2.4 Communicate survey results to workers with emphasis on the following elements.
 - a. Areas where stay time should be minimized.
 - b. Areas where dose rates are the lowest.
 - c. Desired body positioning to minimize TEDE while working in areas with high contact radiation levels or elevated radiation levels.
 - d. Steps or conditions when workers need to stop to allow additional surveys or protective actions before proceeding.
 - e. Where contamination levels are high enough to challenge the effectiveness of workers' protective clothing and the precautions that need to be taken.
 - f. Preventative actions and work practices to minimize the spread of contamination and prevent airborne radioactivity.

6.3 Monitor and Verify Protective Measures

- 6.3.1 Monitor dose rates and work activities to assess the potential for unplanned dosimeter alarms to occur. Inform RP supervision about observed conditions that may result in any one of the following:
 - a. Work area dose rates may exceed 80% of dose rate setpoints and personnel have not been briefed that dose rate alarms may occur.
 - b. Cumulative dose to an individual may exceed 80% of the dose setpoint.
 - c. Calculated stay times are not sufficient for the work scope and may be challenged.
- 6.3.2 Monitor worker compliance with RWP requirements and coach workers to correct behaviors as needed.
 - a. Exercise Stop Work Authority and notify RP supervision if behaviors are not corrected.
- 6.3.3 Fulfill job coverage responsibilities as described in Attachment 1, *Job Coverage Responsibilities*.
- 6.3.4 Verify individual doses are monitored per the RWP and, if applicable, the ALARA Plan.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- 6.3.5 Instruct a worker to leave the area if the cumulative dose exceeds 80% of the dosimeter dose setpoint or a worker is approaching the maximum calculated stay time.
- a. Allow workers to place systems and equipment in a safe condition prior to leaving the area.

- 6.3.6 Monitor worker practices in relation to gradients in dose rates to determine if dosimetry requirements need to be reassessed. Notify RP supervision if any assumptions used in the RWP evaluation for dosimetry placement appear to be invalid or suspect. Protective measures are discussed in Attachment 8, *Protective Measures for Gradients in Radiation Fields*.

NOTE: The RWP should recognize the potential for worker intakes and evaluate if the intake is acceptable for maintaining TEDE ALARA or if respiratory protection equipment is required. Ensure RP supervision is aware of any invalid or suspect assumptions and conclusions in the RWP evaluation.

- 6.3.7 Determine if work activities present a potential for a worker intake of radioactivity that has not been evaluated by the RWP or applicable ALARA Plan. Notify RP supervision if protective actions need to be reassessed. Protective measures are discussed in Attachment 7, *Protective Measures for Airborne Radioactivity*.
- 6.3.8 Monitor worker practices and contamination levels to determine if protective actions are sufficient to prevent worker intakes, personnel contamination and the spread of contamination. Notify RP supervision if protective actions may need to be reassessed. Protective measures are discussed in the following attachments:
- a. Attachment 3, *Protective Measures for Work in Contaminated Areas*
 - b. Attachment 4, *Protective Measures for Work in High Contamination Areas*
 - c. Attachment 5, *Protective Measures for Discrete Radioactive Particles*
- 6.3.9 Determine the potential for the work to generate highly radioactive items, e.g. bags of trash or removed system components, and ensure protective measures are in place to maintain worker dose ALARA such as:
- a. Instruct workers not to pick up or handle items in drained pools, e.g. sumps, tanks, cavity, etc., until RP surveys have been performed and appropriate handling methods have been established.
 - b. Place highly radioactive items in a shielded or distant location so the items do not contribute to work area dose rates.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- c. Survey trash and materials as they are collected and dispose or store the materials to prevent increases in work area dose rates.
- d. Ensure area postings and labeling are in compliance with NISP-RP-004, Radiological Posting and Labeling.

- 6.3.10 Determine if the work will likely generate discrete radioactive particles and monitor the work area for early detection and mitigation. Ensure survey methods and protective measures detect and contain the particles and prevent unplanned skin dose. Protective measures are discussed in Attachment 5, *Protective Measures for Discrete Radioactive Particles*.
- 6.3.11 Determine if exposed surfaces are contaminated with transuranic nuclides at levels that require additional alpha monitoring during contamination surveys and air sample analyses. Protective measures are discussed in Attachment 6, *Protective Measures for Transuranic Nuclides*.

6.4 Track Stay Time

- 6.4.1 Establish and track the stay time of workers if any one of the following conditions exists.
- a. Work area dose rates exceed 1,500 mrem per hour (deep dose equivalent).
 - b. A worker's dose for a single entry into the work area is expected to exceed 500 mrem.
 - c. As otherwise required by the RWP or ALARA Plan.
- 6.4.2 Use Attachment 2, *Stay Time Log* (or equivalent) to track stay times.
- a. Manually track stay times when required even if telemetry is in use.
 - b. Ensure direct communications with (or to) workers are in place to enable timely intervention when stay times are approached or exceeded.
- 6.4.3 The technician tracking stay time shall provide continuous attention to stay time tracking and have no other duties with the following exception:
- a. A technician may use Attachment 2 to track stay time while performing remote monitoring/telemetry to control individual doses.
- 6.4.4 Instruct workers to exit the area before the dose limit is exceeded, allowing sufficient time to place the work area in a safe condition.
- 6.4.5 Instruct workers to relocate to a low dose rate area before exceeding stay times if an evaluation is needed for a stay time extension.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- a. Allow sufficient time to place the work area in a safe condition.
- 6.4.6 Ensure any extension of a stay time is documented and approved by RP supervision in compliance with the following:
- a. Personnel are moved to a low dose area while the stay time extension is evaluated.
 - b. The initial stay time has not been exceeded.
 - c. Accumulated dose is less than 80% of the SRD dose setpoint.
 - d. Radiological conditions are stable.
 - e. RP supervision has reviewed work scope, effective dose rates, and the remaining margin to the SRD dose setpoint.
 - f. The revised stay time will not result in exceeding the SRD dose setpoint and still enable placing equipment in a safe condition prior to exiting the area.
 - g. Workers have been briefed on the revised stay time requirement.
 - h. Approval for the extension is documented on Attachment 2, Stay Time Log - Sample.

6.5 Respond to Unexpected Conditions

- 6.5.1 Notify RP supervision whenever unexpected conditions challenge implementation of requirements established for the radiological protection of personnel.
- 6.5.2 Maintain awareness of work area radiation levels and how they could be affected by system operations or maintenance activities. Survey areas whenever dose rates may be potentially affected to provide timely evaluation and intervention if needed.
- 6.5.3 Exercise Stop Work Authority as described below.

6.6 Exercise Stop Work Authority

- 6.6.1 Instruct an individual worker to exit the work area if the worker's behaviors or practices result in any one of the following:
 - a. An unplanned, unanticipated dose rate alarm.
 - b. An SRD dose alarm.
 - c. A worker refuses to comply with or disregards radiation protection standards and procedures or personnel instructions, either written or verbal.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

d. An increased potential for an intake due to work practices.

6.6.2 Instruct all workers to exit the work area when the following job conditions exist:

- a. Unexpected or unplanned changes in dose rates have increased as follows:
 - Postings must be changed to a High Radiation Area from a Radiation Area.
 - Postings must be changed to a Locked High Radiation Area from a Radiation Area or High Radiation Area.
 - Dose rates are > 50% above the dose rates for which the workers were briefed and the dose rates are > 100 mrem/hour.
- b. Unexpected airborne radioactivity occurs that requires a posting change per NISP-RP-004, *Radiological Posting and Labeling*.
- c. Unexpected airborne concentrations occur outside the bounds of the TEDE ALARA evaluation.
- d. Multiple workers exiting a work area alarm a gamma sensitive portal monitor.
- e. Dosimetry is not in place to measure extremity dose when required per Attachment 8, *Protective Measures for Gradients in Radiation Fields*.
- f. The whole body compartment that will receive the highest dose is not being monitored when required per Attachment 8, *Protective Measures for Gradients in Radiation Fields* due to conditions such as:
 - Changes in job scope or work methods have altered worker orientation to radiation sources.
 - Radiation sources have been added or removed from the work area.
 - Telemetry failure.
- g. Telemetry failures have limited the ability to monitor dose as prescribed by site procedures.
- h. Two or more workers experience dose alarms.
- i. Multiple unplanned personnel contaminations occur on a single job during a shift (e.g. more than three).
- j. An EPRI Level 3 personnel contamination event has occurred (non-discrete particle in a clean area) and the cause is unknown.

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- k. Contamination levels have spread affecting other work groups or activities, e.g. more than 100 square feet in a clean area.
 - l. Contamination levels have increased such that established controls may not be adequate and are outside the bounds of the TEDE ALARA evaluation.
 - m. Radiological engineering controls have degraded such that the radiological conditions described above could occur.
 - n. Any other conditions that may jeopardize the safety of the worker.
- 6.6.3 When stopping work, instruct workers to place systems and equipment in a safe condition prior to leaving the work area and then report to the nearest RP control point.
- 6.6.4 Immediately notify RP supervision whenever work has been stopped, a worker has been instructed to leave a work area, or if a worker has been prevented from entering a work area.
- a. Provide support as requested by RP supervision for documentation, evaluation, and use of the plant corrective action program.
 - b. RP supervision is responsible for implementing site administrative procedures for stopping work.

7.0 Records/Documentation

- 7.1 Retain copies of documentation generated as a result of implementing this procedure in accordance with the provisions of the station records management program References.
- 7.2 Computer generated equivalents may be used in place of the Attachments provided that, at a minimum, the appropriate information contained on the Attachment is contained on the equivalent.

8.0 References

- 8.1 Commitments
- NONE
- 8.2 General
- 8.2.1 NISP-RP-002, Radiation and Contamination Surveys
 - 8.2.2 NISP-RP-003, Radiological Air Sampling
 - 8.2.3 NISP-RP-004, Radiological Posting and Labeling

Nuclear Industry Standard Process

Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- 8.2.4 NISP-RP-005, Access Controls for High Radiation Areas
- 8.2.5 NISP-RP-006, "Personnel Contamination Monitoring"
- 8.2.6 NISP-RP-007, Radioactive Material Control
- 8.2.7 NISP-RP-008, Use and Control of HEPA Filtration and Vacuum Equipment
- 8.2.8 NISP-RP-013, Radiological Protection Glossary
- 8.2.9 INPO 05-008, Radiological Protection at Nuclear Power Stations, Rev 3, February 2017
- 8.2.10 INPO IER 15-23, Ineffective Dose Monitoring Resulted in Workers Exceeding Administrative Limits, June 2015.
- 8.2.11 CONFIRMATORY ORDER ASSOCIATED WITH OI REPORT 3-2004-009 (CM-1)
- 8.2.12 INPO SOER 2001-1, "Unplanned Radiation Exposures"
- 8.2.13 INPO Radiological Protection Department Evaluator How-To RP 1-4, Contamination Control and Monitoring
- 8.2.14 INPO Radiological Protection Department Evaluator How-To RP 1-5, Control and Storage of Radioactive Material and Radioactive Waste
- 8.2.15 EPRI Alpha Monitoring and Control Guidelines for Operating Nuclear Power Stations, Revision 2, GS-48, GS-50"
- 8.2.16 EPRI "Remote Monitoring Technology Guidelines for Radiation Protection" Field Implementation of Remote Monitoring
- 8.2.17 10 CFR 19, Notices, Instructions, and Reports to Workers
- 8.2.18 10 CFR 20, Standards for Protection Against Radiation
- 8.2.19 SER 1-04 Continued Problems with Unplanned External Radiation Exposures.
- 8.2.20 SEOE 01-1 Unplanned Radiation Exposures

9.0 Attachments

- 9.1 Attachment 1: Job Coverage Responsibilities
- 9.2 Attachment 2: Stay Time Log – Sample
- 9.3 Attachment 3: Protective Measures for Work in Contaminated Areas

Nuclear Industry Standard Process Radiological Job Coverage

Document #: NISP-RP-010

Revision: 1

- 9.4 Attachment 4: Protective Measures for Work in High Contamination Areas
- 9.5 Attachment 5: Protective Measures for Discrete Radioactive Particles
- 9.6 Attachment 6: Protective Measures for Transuranic Nuclides
- 9.7 Attachment 7: Protective Measures for Airborne Radioactivity
- 9.8 Attachment 8: Protective Measures for Gradients in Radiation Fields

ATTACHMENT 1
Job Coverage Responsibilities
Page 1 of 2

A job coverage technician is responsible for performing surveys to assess radiological hazards and providing the necessary direction and support to implement protective measures as described in this procedure, the applicable RWP, and ALARA Plan, if required. The lead job coverage technician provides overall direction to supporting technicians, decontamination personnel, and working crews to ensure protective measures are effectively implemented.

Continuous job coverage is required when the radiological conditions and work activities present a significant potential for adverse consequences if protective measures are not effectively implemented. Such activities require constant monitoring to:

- Ensure protective measures are implemented as planned and
- Identify potential anomalies that may challenge the effectiveness of planned protective measures.

Continuous coverage does not necessarily mean continuous physical presence of the radiological protection technician at the work site; rather, it means one or more technicians are given sole responsibility to cover a job. IF using remote monitoring for continuous coverage, THEN remote camera surveillance, effective audio communication with the work area, and telemetry are required to provide continuous coverage and minimize the dose to job coverage technicians.

Activities identified as having high radiological risk are assigned continuous job coverage. Activities identified as having medium radiological risk may be assigned continuous job coverage. INPO 05-008 defines radiological risk and provides examples of work activities considered to have high and medium radiological risk. Radiation work permits specify when continuous or intermittent job coverage is required.

Activities identified as having low or medium radiological risk may be assigned intermittent coverage. Intermittent coverage means a job coverage technician may be assigned several jobs to monitor and periodically monitors each activity in progress to provide support as needed.

Responsibilities

The lead job coverage technician and supporting technicians are responsible for the following.

- 1.0 Ensure technicians assigned to track stay times continuously provide full attention to stay time tracking without ancillary duties other than tracking worker dose using stay time tracking, telemetry, and/or remote monitoring
- 2.0 Establish a means of communication when required for the following:
 - 2.1 Instructing a worker to exit an area when approaching a stay time.
 - 2.2 Informing a worker of accumulated dose when protective clothing requirements or multi-badging prevents the worker from periodically reading issued dosimetry.
 - 2.3 Informing a worker when body positions are causing increased dose.
- 3.0 Perform timely surveys when contaminated systems are breached to assess:
 - 3.1 Contamination levels on exposed surfaces, including the presence of transuranics as required.
 - 3.2 Shallow and deep dose rates from the exposed surfaces.
 - 3.3 Airborne concentrations, including the presence of transuranics as required.

ATTACHMENT 1
Job Coverage Responsibilities
Page 2 of 2

- 3.4 Potential exposure to discrete radioactive particles.
- 4.0 Identify work activity evolutions that present a potential for airborne radioactivity and obtain air samples and/or personal air samples as needed to comply with this procedure and NISP-RP-003, *Radiological Air Sampling*.
- 5.0 Implement timely protective measures when contaminated systems are breached as needed to minimize the potential for intakes and personnel contamination. Examples include:
 - 5.1 Using covers or containment devices.
 - 5.2 Decontamination.
 - 5.3 Using substances to fix the contamination in place.
 - 5.4 Installation of HEPA ventilation per NISP-RP-008, *Use and Control of HEPA Filtration and Vacuum Equipment*.
- 6.0 Ensure work area postings are in compliance with NISP-RP-004, *Radiological Posting and Labeling* during all evolutions of a work activity.
- 7.0 Establish contamination controls commensurate with the contamination levels in the work area as required for:
 - 7.1 Contaminated Areas
 - 7.2 High Contamination Areas
 - 7.3 Discrete Radioactive Particle Areas
 - 7.4 Alpha Level 2 or 3 Areas
- 8.0 Implement measures to maintain work area contamination below levels that present a significant potential for airborne radioactivity. Examples include:
 - 8.1 Periodic decontamination.
 - 8.2 Periodically changing floor coverings.
- 9.0 Perform surveys as items are raised or removed from spent fuel pools or refueling cavities and oversee handling of such items to ensure compliance with this procedure.
- 10.0 Ensure materials and items removed from a work area are controlled to minimize personnel exposures and prevent the spread of contamination per NISP-RP-007, *Control of Radioactive Material* and NISP-RP-004, *Radiological Posting and Labeling*.

ATTACHMENT 3
Protective Measures for Work in Contaminated Areas
Page 1 of 2

Purpose

This attachment explains concerns and protective measures for work in contaminated areas. Additional concerns for the presence of higher contamination levels, transuranic nuclides or discrete radioactive particles are discussed in subsequent attachments. The protective measures discussed below assume radiation workers have been trained on the use of a standard set of protective clothing as specified by the RWP. A standard set typically consists of a single set of outer boots, booties, coveralls, hood, cloth glove liners, rubber gloves, and a hard hat cover.

Protective Measures

- 1.0 Concern: Personnel can track contamination to clean areas after leaving a contaminated area. Protective measures include:
 - 1.1 Direct workers to the nearest contamination monitor or frisker.
- 2.0 Concern: Contamination can potentially pass through coveralls if rubbed on surfaces > 10,000 dpm/100 cm². Protective measures may include one or more of the following:
 - 2.1 Decontaminate surfaces that will be contacted.
 - 2.2 Place clean barrier on the contaminated surface.
 - 2.3 Wear knee and/or elbow pads.
 - 2.4 Wear coveralls made of a material that mitigates the potential for pass through.
 - 2.5 Use work practices to avoid contact with contaminated surfaces.
- 3.0 Concern: Contamination may pass through the clothing due to contact with contaminated water or clothing becomes saturated with sweat. Protective measures may include one or more of the following:

CAUTION

Use appropriate judgment to prevent injury, recognizing that the consequences from skin contamination are much less than an injury from heat exposure.

- 3.1 Wear clothing that does not absorb water such as plastic or a similar material.
- 3.2 If heat exposure and the scope of work limit the use of specialized clothing to prevent skin contamination, protective measures may include:
 - a. Use air supplied suits to keep the body cool during work.
 - b. Wear ice vests under the protective clothing.
 - c. Limit stay times to prevent coveralls from becoming too saturated.
- 4.0 Concern: Contamination can become airborne when welding, burning, or grinding surfaces. Protective measures may include one or more of the following:

ATTACHMENT 3
Protective Measures for Work in Contaminated Areas
Page 2 of 2

- 4.1 Decontaminate the affected area or component to reduce to possibility of creating an airborne area.
 - 4.2 Set up ventilation and/or containment structures to isolate any airborne contamination that occurs.
 - 4.3 Isolate and post the area potentially affected as an Airborne Radioactivity Area and restrict access.
 - 4.4 Require the use of respiratory protection in potentially affected areas.
 - 4.5 Obtain air samples per NISP-RP-003.
- 5.0 Concern: Contamination can spread to clean areas when removing Items from contaminated areas. Protective measures may include:
- 5.1 Provide RP support to survey a large item while in the Contaminated Area and then transfer the large item to a clean bag or container outside the Contaminated Area using lift equipment providing direction to:
 - a. Provide direction on wrapping or boxing the item without spreading contamination.
 - b. Exercise precautions to survey and/or decontaminate lifting equipment.
 - c. Ensure the container is labeled per NISP-RP-004, *Radiological Posting and Labeling*.

**ATTACHMENT 4
Protective Measures for Work in High Contamination Areas
Page 1 of 2**

Purpose

This attachment explains concerns and protective measures for work in a High Contamination Area where the extent and magnitude of the contamination levels require additional protective measures beyond those described in Attachment 3.

Protective Measures

- 1.0 Concern: Same concerns exist as for a Contaminated Area. Employ the same protective measures.
- 2.0 Concern: Dry loose surface contamination can become airborne from wind currents or simply walking or rubbing the surface. Protective measures may include one or more of the following:
 - 2.1 Keep surfaces wet.
 - 2.2 Set up HEPA ventilation equipment to contain any airborne radioactivity.
 - 2.3 Use a “fixing” agent on surfaces such as paint or an adhesive.
 - 2.4 Cover the high contamination with oil cloth or equivalent material.
 - 2.5 Maintain the integrity of boundary walls or structures to isolate the airborne radioactivity.
 - 2.6 Wear respiratory protection while in the area as determined by a TEDE ALARA evaluation.
 - 2.7 Control ventilation flow rates and direction.
 - 2.8 Decontaminate the surfaces to lower the removable contamination levels.
- 3.0 Concern: Contamination on protective clothing may not be easily contained when exiting the area. Protective measures may include one or more of the following:
 - 3.1 Contain the high contamination to a small area, e.g. the internal surface of a system component, by wiping down and frequently changing gloves that contact highly contaminated surfaces before contacting surfaces with lower contamination levels.
 - 3.2 Establish a two step-off-pad (SOP) arrangement to remove highly contaminated outer protective clothing prior to traversing to the next SOP to remove the remaining protective clothing. Consider the following when evaluating the use of two SOPs:
 - a. Maintain a sufficient distance, if available, between the SOP from the High Contamination Area to the SOP for the Contaminated Area to provide containment and routine decontamination in the Contaminated Area.
 - b. Instruct workers to wear two sets of outer boots, two pairs of coveralls, and two sets of rubber gloves or as directed by the RWP.
 - c. Instruct workers to exit the High Contamination Area by removing, in order, the outer gloves, the outer coveralls, and the outer boots, stepping on the SOP while removing each outer boot.
 - 1) Deviations should be specified by the RWP.

**ATTACHMENT 4
Protective Measures for Work in High Contamination Areas
Page 2 of 2**

- 2) The process for removing protective clothing at the next SOP is the same as taught in radiation worker training.
 - d. If sufficient room is not available for a two SOP arrangement, decontaminate the area where the protective clothing is removed at a frequency that prevents the spread of contamination outside the posted boundary.
- 4.0 Concern: Removable contamination on items removed from High Contamination Areas may be difficult to contain. Protective measures may include:
- 4.1 Wipe down or decontaminate the items inside the High Contamination Area to acceptable contamination levels before they are taken across the boundary to the Contaminated Area. The item can then be removed using normal practices for Contaminated Areas.
 - 4.2 Use double containers; remove the item to a container in the Contaminated Area and then remove that container outside the Contaminated Area into a container that is clean on the outside.

ATTACHMENT 5
Protective Measures for Discrete Radioactive Particles
Page 1 of 3

Purpose

This attachment explains the concerns and protective measures for work when discrete radioactive particles (DRP) are present in a work area. Per NISP-RP-004, *Radiological Posting and Labeling* areas are posted with an insert stating "Discrete Radioactive Particles Present" when DRPs are present with an activity greater than 50,000 CPM. Special measures are necessary because DRPs are small (< 1mm), loose, highly radioactive particles that are very transportable because of their small size and electrostatic charge. DRPs originating from irradiated fuel emit high-energy betas and low-yield photons, resulting in high beta dose rates. DRPs originating from activated corrosion products emit low-energy betas and high-yield, high-energy gammas, resulting in high gamma dose rates. As a result, DRPs can deliver high localized doses when present on protective clothing or the skin.

Protective Measures

- 1.0 Concern: DRPs can be difficult to locate while scanning a surface due to a rapid increase and subsequent decrease in instrument response when the detector passes over a particle. Protective measures require surveying at a low velocity using the techniques described in NISP-RP-002, *Radiation and Contamination Surveys*.
- 2.0 Concern: The potential dose to a worker from a DRP requires capture of the DRP to enable additional analyses to determine the potential shallow-dose and deep-dose to a worker. When a DRP is detected on a worker that has a contact reading > 50,000 cpm with a pancake GM detector or > 5 mrem/hour with an open window ion chamber (correction factor not applied), capture the DRP using one of the following techniques:
 - 2.1 Apply the sticky side of tape to the particle, remove the tape, and survey the tape to see if the DRP is captured on the tape. Fold the tape over the DRP to completely encapsulate the DRP.
 - 2.2 Apply the sticky side of tape to the particle to keep it from being mobile and leave it in place. Take actions as needed to encapsulate the DRP.
 - 2.3 If the DRP is discovered on a worker's clothing or skin, refer to NISP-RP-006, *Personnel Contamination Monitoring*. Store the particle at the site designated location to enable further analyses as required.
 - 2.4 Follow site-specific procedures for documenting the required information and initiating further analysis as required.
- 3.0 Concern: Standard dry-smear techniques are not sufficient to collect DRPs because particles frequently will not adhere to the smear and may be dispersed over a larger area than the area sampled by the smear. Protective measures include:
 - 3.1 Frequently use large area smears or wipes, mopping, tape, tacky rollers, or similar devices.
- 4.0 Concern: If the potential for DRPs exist, then sources of DRPs must be controlled to mitigate the migration of particles into larger areas and increasing the potential dose to workers. Protective measures include:

ATTACHMENT 5
Protective Measures for Discrete Radioactive Particles
Page 2 of 3

- 4.1 Survey for DRPs when:
 - a. Systems are breached that contained reactor coolant water.
 - b. Removing items from a reactor vessel, spent fuel pool, or reactor cavity.
 - c. Handling irradiated materials.
 - d. Handling equipment used to work with irradiated fuel.
 - e. When transporting scaffolding that has been used to access system components containing reactor coolant water.
- 4.2 Exercise measures to contain DRPs until surveys confirm the absence of DRPs. Examples of containment measures include:
 - a. Applying water or an adhesive to the surface.
 - b. Using wet decon methods to wipe surfaces.
 - c. Using containments and HEPA ventilation.
 - d. Restoring containment integrity of the system component or package until smears or wipes have been evaluated.
- 5.0 Concern: In some cases, DRPs cannot be totally contained at the source due to the work that has to be performed. Examples of protective measures include:
 - 5.1 Establish a buffer zone to exit the DRP area, i.e. a posted contaminated area that must be traversed after removing an outer set of protective clothing in the DRP area. The outer set normally consists of additional coveralls, rubber shoe covers, and rubber gloves. Disposable coveralls are normally used as outer garments to prevent spreading the particles during laundry operations and to reduce the potential for the entrapment of particles in laundered clothing.
 - 5.2 Use structural barriers as much as possible to minimize DRP migration out of the DRP area such as walls, glove bags, temporary walls, curtains, etc.
 - 5.3 Use local HEPA ventilation.
 - 5.4 Decontaminate potential sources of particles to the extent practical.
 - 5.5 Use tacky mats for exiting the DRP area and the buffer zone area to provide additional protection against spreading the DRPs.
 - 5.6 Segregate materials, including respirators, taken from a DRP area and tag the materials to denote:
 - a. DRPs may be present.
 - b. The source of the materials, i.e. the area or system.
 - c. The potential contact radiation levels from the DRPs.

ATTACHMENT 5
Protective Measures for Discrete Radioactive Particles
Page 3 of 3

6.0 Concern: DRPs can reside on the outside of a worker's protective clothing and deliver a deep-dose and/or a shallow-dose potentially exceeding 10% of 10 CFR 20 limits, requiring monitoring and recording of the dose. Protective measures include:

6.1 Establish survey frequencies in work areas to require periodic surveys on the outer layer of protective clothing. Survey frequencies are based on the highest known or potential dose rate from a DRP in the work area using an approximate one inch reading with an open window ion chamber without applying a beta correction factor. Survey frequencies are established by the RWP and are typically applied as shown below to ensure a potential dose from a discrete radioactive particle does not exceed 10% of 10 CFR 20 limits.

DRP Dose Rate	Survey Frequency
≤ 20 mrem/hour	Not Required
> 20 mrem/hour to 1,200 mrem/hour	≤ 3 hours
> 1,200 mrem/hour to 2,500 mrem/hour	≤ 1.5 hours
> 2,500 mrem/hour to 5,000 mrem/hour	≤ 40 minutes
> 5,000 mrem/hour	≤ 10 minutes

- 6.2 Track worker staytimes in the DRP area using site-specific forms to ensure each worker is surveyed within the time intervals specified on the RWP and upon exit from the area. Survey workers as follows:
- a. Designate a low dose rate area for performing the survey that is accessible from the DRP area without removing protective clothing. Survey areas should be set up and designated by site RP supervision.
 - b. Using an open window ion chamber, slowly scan the hands, feet, and potentially affected body areas.
 - c. Capture DRPs > 5 mrem/hour and notify RP supervision for further instructions.

ATTACHMENT 6
Protective Measures for Transuranic Nuclides
Page 1 of 2

Purpose

This attachment explains the concerns and protective measures for work when transuranic nuclides are present. Mixtures of transuranic nuclides are difficult to evaluate because DAC values are 3 or 4 orders of magnitude less than corrosion and fission products and the gamma spectroscopy systems at power plants are not designed to accurately quantify activities of transuranic nuclides.

The radiological risk of work involving transuranics may be classified as having high or medium radiological risk as follows:

- Entry into or work in an Alpha Level 3 Area.
- Work in an Alpha Level 2 Area.
- Abrasive or aggressive mechanical action on surfaces with potentially fixed transuranics.

ALARA planning tools and/or the RWP should specify the applicable protective measures as described below.

Protective Measures

- 1.0 Concern: The presence of transuranic nuclides in surface contamination must be measured to understand the potential dose from worker intakes. For protective measures, Alpha Level 1, 2, and 3 Areas are posted per NISP-RP-004, *Radiological Posting and Labeling*.
- 2.0 Concern: Contamination surveys are needed during job coverage to verify that the transuranic hazards have been properly evaluated. Protective measures include analyzing smears for alpha emitters per NISP-RP-002, *Radiation and Contamination Surveys*.
 - 2.1 If a work area has not been characterized properly and the transuranic hazard is greater than posted, the take the following actions:
 - a. Notify RP supervision.
 - b. Determine if established radiological controls are adequate to prevent unplanned worker dose and, if not, stop work.
- 3.0 Concern: Worker intakes of transuranics cannot be measured using plant equipment for in vivo bioassays. Protective measures to monitor for potential intakes require the use of personal air samplers unless appropriate alternatives are specified in the RWP such as scaling transuranics with other nuclides that may be present. Personal air samplers are used per NISP-RP-003, *Radiological Air Sampling* to identify when in vitro bioassays may be needed or to calculate internal dose.
- 4.0 Concern: Transuranics may be embedded in lower oxide layers inside piping and components due to fuel failures during earlier fuel cycles. Smears may not collect the transuranics when the system is breached. Protective measures include the following:
 - 4.1 Plant RP staffs are responsible for characterizing plant areas and systems based on the presence of transuranics and historical fuel performance.
 - 4.2 Plant RP staffs are responsible for identifying when work will be performed in an Alpha Level 2 Area or Alpha Level 3 Area.

ATTACHMENT 6
Protective Measures for Transuranic Nuclides
Page 2 of 2

- 4.3 Use respiratory protection and personal air samplers per NISP-RP-03, *Radiological Air Sampling* when performing aggressive work, e.g. grinding, that could disturb lower oxide layers containing transuranics.
- 5.0 Concern: The potential internal dose from transuranics in plant contamination mixtures increases in proportion to the corrosion and fission products as the mixture decays. Protective measures require periodic monitoring of $\beta\gamma/\alpha$ ratios to ensure areas are properly posted and evaluated for potential internal dose if surface contamination becomes airborne. NISP-RP-002, *Radiation and Contamination Surveys* and NISP-RP-003, *Radiological Air Sampling* provide instructions for determining $\beta\gamma/\alpha$ ratios.
- 6.0 Concern: Equipment and materials removed from areas with transuranics may be handled outside the posted Alpha Level Area. As a protective measure, ensure equipment and materials removed from an Alpha Level 3 are packaged and labeled to alert personnel handling the package that significant transuranic contamination may be present. Labeling requirements are described in NISP-RP-004, *Radiological Posting and Labeling*.
- 7.0 Concern: The abundance of transuranic nuclides can be high enough to result in unplanned intakes if personnel and materials are not monitored for alpha radiation. Protective measures include:
- 7.1 Require personnel to frisk using an alpha detector when exiting an Alpha Level 3 area where the $\beta\gamma/\alpha$ ratio is ≤ 50 .
 - 7.2 Segregate equipment and materials that have been exposed to contamination with a $\beta\gamma/\alpha$ ratio ≤ 50 until surveys can be performed to release an item from alpha controls.
 - 7.3 Ensure postings for areas with a $\beta\gamma/\alpha$ ratio ≤ 50 contain the insert "Alpha Frisking/Monitoring Required Upon Exit" per NISP-RP-004, *Radiological Postings and Labeling*.

ATTACHMENT 7
Protective Measures for Airborne Radioactivity
Page 1 of 2

Purpose

This attachment explains the concerns and protective measures when workers may be exposed to airborne radioactivity. Potential causes of airborne radioactivity include the following:

- System leakage
- Breaching a system component
- Agitating a contaminated surface, i.e. grinding, welding, scrubbing, hammering, etc.
- Air flow over a highly contaminated surface

Respiratory protection may be used to prevent worker intakes. Requirements for using respiratory protection equipment are provided in the radiation work permit. The maintenance and use of respiratory protection equipment are not included in the standardized tasks for supplemental RP personnel; plant procedures govern these activities. Knowledge requirements for the use of respiratory protection are included in orientation training.

A planned exposure to airborne radioactivity without respiratory protection may be allowed if a supporting evaluation concludes the Total Effective Dose Equivalent (TEDE) will be lower due to increasing the work efficiency of a worker, i.e. wearing respiratory protection will increase the external dose to the worker causing the TEDE to be higher as compared to the TEDE without respiratory protection. These evaluations are not included in the standardized tasks for supplemental RP personnel; plant procedures specify how these evaluations are performed.

Protective Measures

- 1.0 NISP-RP-003, *Radiological Air Sampling* specifies when air samples are needed, how to evaluate results, and when stop work authority should be exercised.
- 2.0 Work controls should be implemented to minimize the potential for worker intake by using process and engineering controls that negate the need for respiratory protection. Process and engineering controls may include one or more of the following:
 - 2.1 Decontaminating surfaces to reduce the potential for airborne radioactivity.
 - 2.2 Install a containment device such as a glove bag.
 - 2.3 Use portable ventilation to pull airborne radioactivity through a HEPA filter and prevent airborne radioactivity in a worker's breathing zone.
 - 2.4 Maintain surfaces wet to minimize the potential for contamination to be suspended in the air.
 - 2.5 Spray adhesive on a surface to prevent contamination from becoming suspended in the air.
 - 2.6 Use oil cloth or equivalent material in a work area to prevent contamination from becoming suspended in the air.
 - 2.7 Maintain highly contaminated surfaces covered to prevent air flow over the surface.

ATTACHMENT 7
Protective Measures for Airborne Radioactivity
Page 2 of 2

- 3.0 Use respiratory protection as specified on radiation work permits and in compliance with plant procedures and the applicable TEDE ALARA evaluation.
- 4.0 Use DAC-Hour tracking when personnel enter areas with ≥ 0.3 DAC without respiratory protection.
 - 4.1 DAC-Hours may be calculated using personal air sample results.
 - 4.2 DAC-Hours may be calculated using work area air samples and the measured stay time for each worker. Use plant-specific forms when recording air sample results and stay times of workers.

ATTACHMENT 8
Protective Measures for Gradients in Radiation Fields
Page 1 of 1

Purpose

This attachment describes the concerns and protective measures for work when significant gradients in radiation levels exist. A significant gradient can result in a higher dose to a portion of the whole body other than the chest area which is normally monitored with dosimetry. A gradient can also result in a higher dose to an extremity, requiring additional monitoring. The protective measures described below provide criteria for determining when dosimetry requirements may need to be altered to ensure personnel exposure is monitored per 10 CFR 20.1502.

Supplemental personnel must be able to identify when dosimetry requirements may not conform to the protective measures described below and alert RP supervision that additional evaluation may be needed. Identifying the specific body locations where a dosimeter must be placed is the responsibility of plant personnel for inclusion in the radiation work permit and is not included in the standardized tasks for supplemental personnel. The evaluation of dosimetry results to determine the doses to assign to workers is also the responsibility of plant personnel and is not included in the standardized tasks for supplemental personnel.

Protective Measures

- 1.0 Concern: Radiation levels in a work area vary in intensity and may result in non-uniform irradiation of the whole body considering how the worker is positioned in the work area. Reposition or add dosimeters when both of the following conditions apply:
 - 1.1 Dose rates in the work area exceed 100 mrem/hour at 30 cm.
 - 1.2 A portion of the whole body is anticipated to exceed the chest dose by more than 50 mrem during the RCA entry.
- 2.0 Concern: The combined beta and gamma dose rate to the extremities may exceed twice the gamma dose rate monitored for whole body dose. Extremity dosimetry is required when any of the following conditions apply:
 - 2.1 The shallow dose equivalent to an extremity is likely to exceed twice the whole body dose, AND
 - 2.2 The shallow dose equivalent to an extremity will exceed 500 mrem over the duration of the job.
 - 2.3 Extremity dosimetry shall be worn if the dose is expected to exceed 5,000 mrem.
- 3.0 Concern: An inaccurate understanding of a worker's body position during prejob planning or a change in a worker's body position once work commences may result in not complying with the above criteria. Protective measures include the following:
 - 3.1 Ensure workers understand why additional dosimetry is required and why the specific body locations are being monitored with respect to the dose gradient and the expected body positions during the work.
 - 3.2 Ensure workers understand the need to maintain the body positions assumed during prejob planning and to notify RP if changes in work will invalidate those assumptions.
 - 3.3 Observe worker body positions during the work to ensure the assumptions from prejob planning remain valid.
 - 3.4 Stop work and notify RP supervision if the assumptions from prejob planning for dosimetry placement are no longer valid.