1. PURPOSE/SCOPE/APPLICABILITY

Research Activity Description (Provide a description to include the following):

1. **PROGRAM OBJECTIVES:**

To support numerous programs both on- and off-site as part of the Idaho National Laboratory (INL), Homeland Security (N&HS), Nuclear Nonproliferation Division (NND), where the use of numerous radiological and nuclear materials is employed. The activities to be performed under this laboratory instruction will be assigned by National and Homeland Security personnel unless otherwise specified. These activities may include the following:

- Performing measurements on targets using x-ray, and gamma ray radiation producing equipment such as portable x-ray generators, Betatrons and radioisotope sources.
- Production of radiation fields for training and exercises that emulate pre- and post-radiological dispersal device (RDD) and improvised nuclear device (IND) radiation environments.
- Production of contamination areas (inside facilities) to facilitate instruction on training objectives such as contamination control, donning/doffing, sampling techniques, etc.
- Examination of the effects and influence of radiation on equipment and measurement devices.
- Validation of techniques, procedures and processes that respective teams use in response to events involving radioactive materials.

Activities that are performed to support the above objectives include:

- Using only Category IV or less quantity of Special Nuclear Materials.
- Use of fissionable material in accordance with LRD-18001, “INL Criticality Safety Program Requirements Manual.”
- Storing, and transferring nuclear materials in compliance with PLN-1466, “INL General Physical Security Plan.”
- Providing the resources to receive, transport and return radiological/nuclear materials both on- and off-site.
- Handling and staging radioactive materials and sources.
- Operating radiation generating devices/equipment.
- Provide assistance to achieve training and exercise objectives. This includes demonstration of equipment and supervising activities in a controller/evaluator position.
- Provide Health Physics/Radiation Control supervision for the handling of radiological/nuclear materials and work in radiologically controlled areas that include both staging and supporting the exercise and training and participating in the exercise and training.
- Provide radioactive sources to establish radiation fields for the exercise and emulate radioactive samples collected from the field.

	• Provide dosimetry for training participants, as needed. • A radiation work permit (RWP) that has been approved and issued. This procedure will be used in conjunction with other approved procedures to safely accomplish the desired training activities.
2.	**PROJECT APPROACH:** The project approach is to assemble the equipment, personnel, radiological/nuclear materials and sources, and procedures to be able to transport a training activity or exercise event to locations that are not equipped to otherwise perform such activities. At the end of each training activity the equipment and sources will be returned to the INL or transferred to the next training activity.
3.	**PROJECT/ACTIVITY DESCRIPTION:** The RDD Material Training Course is designed to allow participants to train and exercise in near-real life radiological environments where they are expected to use their training to perform measurements, interrogate materials, perform radiation/contamination surveys and collect radioactive, potentially contaminated samples that might be associated with an IND or RDD. Form 420.21, "Existing Laboratory Instruction Use" will be used to approve the use of this Laboratory Instructions (LI) for the specific activity. It will also designate the Lab Manager, PI and Lab Space Coordinator, as applicable.
4.	**MAJOR EQUIPMENT/MATERIALS USED IN ACTIVITY:** The major equipment used in this activity include: radiation producing equipment such as radioisotopes, x-ray and gamma-ray generating equipment and irradiated materials, such as, uranium and plutonium sources that have been irradiated to provide a source of fission products. Special Nuclear Materials used in this activity will be limited to Category IV or less and will be stored in compliance with PLN-1466. Special Nuclear Materials used in this activity will be controlled in accordance with LRD-18001, "INL Criticality Safety Program Requirements Manual." Special Nuclear Materials used in this activity will be managed per LRD-11500, "Nuclear Materials Management, Control, and Accountability Plan."
5.	**ACTIVITY LOCATION BY AREA, BUILDING NUMBER AND LAB ROOM NUMBER:** This procedure is being prepared to support training and exercise activities that will be performed in locations on and off the INL site.
6.	**ACTIVITY QUALITY LEVEL AND QL DATABASE NUMBER:** QL-3 ALL-000535

7.	**ACTIVITY LAB MANAGER, LABORATORY SPACE COORDINATOR, AND PRINCIPAL INVESTIGATOR:** Activity Laboratory Manager: As assigned in Form 420.21 for the specific activity and location. Lab Space Coordinator: As assigned in Form 420.21 for the specific activity and location. Principle Investigator: As assigned in Form 420.21 for the specific activity and location.

2. RISK AND CONTROLS

Table 2.01. Table format for risk and controls.

Task	Skill of Performer	Hazard	Engineering Control	Administrative Control	Personal Protective Equipment (PPE)
1. Working in a radiation area (RA) or high radiation area (HRA).	☐	1. Excessive personal dose	Use of shielding	1. Maintaining personal dose As Low As Reasonably Achievable (ALARA). 1.1. Time, Distance and Shielding 2. RWP. 3. Health Physics Technician (HPT)/ Radiation Control Technician (RCT) coverage per the RWP. 4. Personal dosimeter (OSL or OSL-Neutron) and electronic dosimeter per the RWP. 5. Facility Radiological Control Manager approval required for escorting non-trained employees or visitors into an RA or Radiological Buffer Area (RBA). 6. ALARA review of work activities as required per LWP-15021. 7. Verify Personnel accountability prior to source exposure or generator operations. 8. Access to the training area is controlled. 9. Routine area radiation surveys, surveys of radiological source material and source holding devices/containers.	

Task	Skill of Performer	Hazard	Engineering Control	Administrative Control	Personal Protective Equipment (PPE)
2. Working in a contamination area (CA).	☐	1. Potential personal, equipment or environmental contamination.		1. Maintaining personal dose As Low As Reasonably Achievable (ALARA). 2. RWP. 3. HPT/RCT coverage per the RWP. 4. Facility Radiological Control Manager approval required for escorting non-trained employees or visitors into an CA or Radiological Buffer Area (RBA). 5. ALARA review of work activities as required per LWP-15021. 6. Access to the training area is controlled. 7. Routine area contamination surveys, surveys of radiological source material and source holding devices/containers. 8. Review of CX for training activities conducted on-site to ensure proposed contamination levels are within the approved limits. For off-site training activities, coordinate with the appropriate environmental and RadCon personnel for the selected facility/area.	Personal Protective Equipment (PPE) and/or respiratory protection as described in the RWP.
3. Manual lifting of heavy objects.	☐	2. Sprains or pulled muscles		1. Cover the proper lifting, stretching and repetitive stress reduction techniques during the job brief.	

Task	Skill of Performer	Hazard	Engineering Control	Administrative Control	Personal Protective Equipment (PPE)
				2. Contact Industrial Hygiene to determine appropriate weight limits above the nominal 50 lb or one-third of lifter's body weight, whichever is less, and proper lifting techniques. 3. Industrial Hygiene has evaluated and approved lifting of the Delta 880 Radiography Device (nominal weight is 52 pounds) by a single lifter. Provisions include that the camera is not lifted above shoulder height and is maintained within 12 inches of the body, the torso of the body is not twisted during the lift and the person performing the lift is physically capable, weighing at least 160 lbs.	
4. Use of radioactive sources.	☐	4a. Excessive personal dose		1. Minimize exposure to the source. 2. Use source handling tool to maximize distance from the source. 3. Source User must maintain control of the sealed radioactive source(s) per LWP-15006. Notify the Source Custodian immediately for lost or misplaced sources.	
		4b. Potential contamination from a damaged source		1. Source leak checks performed per LWP-15006.	

Task	Skill of Performer	Hazard	Engineering Control	Administrative Control	Personal Protective Equipment (PPE)
				2. In the event of a radioactive material contamination/spill, INL personnel will follow the procedures identified in LWP-15015.	
		4c. Fire -Structural or Wildland		In the event of fire, the fire department for the respective facility will be briefed that radioactive/nuclear material is being stored temporarily in an area at their location (which will be included in the definition of the Laboratory Space). The fire department is trained on response to hazardous material.	
5. Nuclear Material Handling (use handling and shipment).	☐	5a. Fire-Structural or Wildland		In the event of fire, the fire department for the respective facility will be briefed that radioactive/nuclear material is being stored temporarily in an area at their location (which will be included in the definition of the Laboratory Space). The fire department is trained on response to hazardous material.	
	☐	5b. Contamination/spill		In the event of a nuclear material contamination/spill, INL personnel will follow the procedures identified in LWP-15015.	
	☐	5c. Loss or Diversion of Nuclear Material		1. NM being transferred will be subject to transfer check requirements per MCP-2752. 2. Transfers will be made per PLN-1466.	

Task	Skill of Performer	Hazard	Engineering Control	Administrative Control	Personal Protective Equipment (PPE)
				3. A qualified Nuclear Material Custodian (NMC) will be assigned to each project (qualified NMC does not have to be Safeguards personnel, may designate a project person). 4. Contact the WCC (208-526-1515).	
6. Fissionable material handling/ storage.	☐	6. Criticality Safety		1. Fissionable material greater than 15 g will be handled and stored in a Criticality Control Area (CCA) per LRD-18001. 2. Fissionable material will not exceed 700 g U-235 equivalent. 3. Handling and control of fissionable material will be by INL qualified fissionable material handlers (FMHs) in accordance with the INL Criticality Safety program. 4. A qualified NMC will be assigned to each project (qualified NMC does not have to be Safeguards personnel, may designate a project person).	

Table 2.02.

Hazard scenarios that require mitigation.

Radioactive sources and x-ray devices produce high radiation fields. The hazard associated with the use of these devices is mitigated by compliance with the required training, procedures referenced in this document, and compliance with the RWP. Personnel accountability is verified prior to source exposure or x-Ray device operation.

Sealed sources and radioactive materials have the potential for leaking. Contamination surveys will be obtained from suspect surfaces to check for contamination during routine leak checks or when damage to the source is suspected. In the event of a radioactive/nuclear material contamination/spill, INL personnel will follow the procedures identified in LWP-15015, "Response to Abnormal Radiological Situations." Notify the Laboratory Manager, Lab Space Coordinator, HPT/RCT Supervisor and others in the area of the contamination/spill (using stop, warn, isolate, mitigate processes).

Table 2.03. Waste generation.

Type of Waste	Generation Location	Anticipated Volume	Container Type	Disposal Method
Household and industrial debris (no wood nor metal in overhead dumpsters)	Field exercise location	Indeterminate but not expected to be significant	Dumpster	Per established processes of the particular facility.
Low level, radioactive waste	Field exercise location	Indeterminate, but not expected to be significant	Poly bags	Per established process of the particular facility. Coordinate with RadCon and WGS for delivery of LLW to approved collection area. Complete form 435.42. Assist with Radiological surveys and characterization.

List any special needs/requirements for storage and handling wastes.

Any suspect-radioactive waste generated will be bagged and returned to the INL for disposal with coordination with RadCon and WGS.

Contamination/spill response – Initial Actions:

In the event of a radioactive/nuclear material contamination/spill, INL personnel will follow the procedures identified in LWP-15015. Notify the Laboratory Manger, Lab Space Coordinator, HPT/RCT Supervisor and others in the area of the contamination/spill (using stop, warn, isolate, mitigate processes). Notify the BEA spill notification team at 208-241-6400, or at pager 6400.

Describe anything else that may be relevant for waste disposal purposes.

None.

2.1 Training Required

- QN00RAD1, INL Radworker I – *For activities in Radiation Areas*
  OR
  QN00RAD2, INL Radworker II – *For activities in Radiation or Contamination Areas*
  OR
  QNRCT001, HPT/RCT – *For activities in either Radiation or Contamination Areas*
  OR escorted by a Radiation Worker employee (as approved by RadCon Management) – *For activities in either Radiation or Contamination Areas*

- QLRGD042, "RGD Operator Training for RDD Sources" - *RGD source users*

- 00INL189, "INL Criticality Safety Principles" – *Fissile Material Handlers*

- RDPBNS03, "Criticality Safety Requirements for Procedure CCAs established for RDD Materials Training Program Activities" – *Fissile Material Handlers*

- QNBCTFMH, "BCTC Fissile Material Handler (for activities at the Bonneville County Technology Center, Bay 6)" – *Fissile Material Handlers*

- QNIRTFMH, "CITRC Fissile Material Handler (for activities at the Critical Infrastructure Test Range Complex, CITRC)" – *Fissile Material Handlers*

- 00TRN838, Industrial Ergonomics – *All personnel*

3. PREREQUISITES

3.1 This procedure is used to document the evaluation and approval of work conducted at the INL and non-INL locations. Use of this LI requires that the Lab Manager review the materials and processes for proposed activities and ensure that a Hazard Categorization is completed.

3.2 The Lab Manager must determine based on the nature of the process argument and the materials used that the activities meet the requirements of less than Hazard Category 3 (LTHC3) Radiological per DOE-STD-1027.92.

3.3 The Lab Manager makes this determination by using MCP-2065, "Management Control of Radiological Inventory for Nuclear Nonproliferation Operations Department (NNOD) Facilities," for off-site activities, MCP-1266, "Facility Management Control of Radiological Inventory" for activities in an established INL facility (other than MFC) or MCP-1989, "Radiological Material Inventory Control at MFC," for an activity in an established facility at MFC. The Lab Manager would also use MCP-2065, MCP-1266 or MCP-1989, as applicable, to approve any changes in radiological/nuclear material inventory required while work is underway. Permission to change the inventory is obtained from the facility radioactive material coordinator for on-site activities.

3.4 The primary method for criticality control is based on limiting the mass of fissionable material. The inventory for each designated facility must be less than 700 grams U-235 equivalent. Prior to handling fissionable material, review the radiological/nuclear material inventory to ensure that the log accurately reflects the existing inventory and that the 700 gram limit is maintained.

3.5 RGD Sources are to be operated and handled by a qualified RGD Operator for RDD Sources (QLRGD042).

3.6 An approved RWP for the activity is available.

3.7 Conduct a briefing prior to performing work.

3.8 Equipment/Tools Needed

- Source handling tools
- PPE, as needed for contamination control activities
- Exposure device cranks
- Guide tubes.

3.9 Source leak checks for the sources to be used are current.

4. FACILITY CONDITIONS

4.1 The posting of the radiologically controlled areas will be verified prior to source or radiation device usage.

4.2 Sources are stored in locked areas that are properly posted.

4.3 Procedural CCA boundaries are established and all fissionable material handler personnel are knowledgeable of the boundary.

5. INSTRUCTIONS

NOTE: *Sections may be performed concurrently to complete the required Training Activities.*

5.1 Source Location/Identification and Equipment Evaluation/Testing

5.1.1 Lab Space Coordinator: Identify the area where the activity will be conducted.

NOTE: *Prior to handling fissionable material, review the radiological/nuclear material inventory to ensure that the log accurately reflects the existing inventory and that the 700 gram limit is maintained.*

5.1.2 Transfer the designated source(s) in its respective storage container(s) to the selected area.

5.1.3 IF using an exposure device,
THEN set up the Model 100A exposure device in accordance with (IAW) Section 5.4.1 and/or the Model 880 exposure device IAW Section 5.4.2.

5.1.4 HPT/RCT: Establish radiation-area boundaries.

5.1.5 IF activities are being performed using an RGD,
THEN complete RGD inspection Form 441.21, "Radiation Generating Device Inspection."

WARNING

To prevent excessive exposure all personnel must be accounted for and verified in the area where the source will be exposed. All locked areas within the boundaries must be visually inspected.

RADIOLOGICAL HOLD POINT

5.1.6 HPT/RCT: Verify accountability of all personnel and ensure all locked areas within the boundary have been visually inspected to make certain

that no one is in the area where the source will be exposed. Record in the lab space notebook that the accountability is complete.

5.1.7 IF using the graded source(s),
THEN remove the graded source(s) from the storage container using source handling tools.

5.1.8 IF using an exposure device,
THEN expose the source for the Model 100A exposure device IAW Section 5.5.1 and/or the Model 880 exposure device IAW Section 5.5.2.

5.1.9 Instructor/HPT/RCT/Trainee(s): The following activities may be performed:

- Measure the radiation levels at the established barriers
- Calculate the dose rate at the target
- Calculate the exposure expected to be received if an attempt was made to perform film radiography on a target with the calculated radiation levels
- Perform operations using portable generator equipment

5.1.10 WHEN the activities are complete or for ALARA exposure control,
THEN perform the following:

5.1.10.1 IF using an exposure device,
THEN retract the source for the Model 100A exposure device IAW Section 5.6.1 and/or the Model 880 exposure device IAW Section 5.6.2.

5.1.10.2 IF using the graded source(s),
THEN return the graded source(s) to the storage container using source handling tools.

5.1.10.3 IF more training activities are to be performed,
THEN repeat steps 5.1.6 through 5.1.9 as necessary to complete the training activities.

5.1.11 IF using an exposure device,
THEN disassemble the Model 100A exposure device IAW Section 5.7.1 and/or the Model 880 exposure device IAW Section 5.7.2.

NOTE: *Prior to handling fissionable material, review the radiological/nuclear material inventory to ensure that the log accurately reflects the existing inventory and that the 700 gram limit is maintained.*

5.1.12 IF the sources are not needed for further activities,
THEN return the sources to locked storage.

5.1.13 IF more training activities are to be performed,
THEN repeat Steps 5.1.1 through 5.1.12 as necessary to complete the training activities.

5.1.14 HPT/RCT: IF used, remove radiation barriers if daily activities are complete,
AND attach the completed Form 441.21 to the survey map when completed.

5.2 Generator Characterization

5.2.1 Lab Space Coordinator: Identify the area where the characterization will be conducted.

WARNING

To prevent excessive exposure all personnel must be accounted for and verified in the area where the source will be exposed. All locked areas within the boundaries must be visually inspected.

RADIOLOGICAL HOLD POINT

5.2.2 HPT/RCT: Verify accountability of all personnel and ensure all locked areas within the boundary have been visually inspected to make certain that no one is in the area where the source will be exposed. Record in the lab space notebook that the accountability is complete.

5.2.3 HPT/RCT: Establish radiation-area boundaries around the area.

5.2.4 Instructor/HPT/RCT/Trainee(s): Set up Detection Equipment as required and perform generator characterizations.

5.2.5 HPT/RCT: After characterizations have been completed, remove radiation barriers if the daily activities are complete.

5.3 Generator Operations

5.3.1 Lab Space Coordinator: Identify the area where the activity will be conducted.

5.3.2 Position the target.

5.3.3 HPT/RCT: Establish radiation-area boundaries around the target.

5.3.4 Transfer the designated source(s) in its respective storage container(s) to the selected area.

5.3.5 IF activities are being performed using an RGD,
THEN complete RGD inspection Form 441.21, "Radiation Generating Device Inspection."

5.3.6 IF using an exposure device,
THEN set up the Model 100A exposure device IAW Section 5.4.1 and/or the Model 880 exposure device IAW Section 5.4.2.

WARNING

To prevent excessive exposure all personnel must be accounted for and verified in the area where the source will be exposed. All locked areas within the boundaries must be visually inspected.

RADIOLOGICAL HOLD POINT

5.3.7 HPT/RCT: Verify accountability of all personnel and ensure all locked areas within the boundaries have been visually inspected to make certain that no one is in the area where the source will be exposed. Record in the lab space notebook that the accountability is complete.

5.3.8 IF using the graded source(s),
THEN remove the graded source(s) from the storage container using source handling tools.

5.3.9 IF using an exposure device,
THEN expose the source for the Model 100A exposure device IAW Section 5.5.1 and/or the Model 880 exposure device IAW Section 5.5.2.

5.3.10 Instructor/HPT/RCT/Trainee(s): The following activities may be performed:

- Measure the radiation levels at the established barriers
- Calculate the dose rate at the target
- Calculate the exposure expected to be received if an attempt was made to perform film radiography on a target with the calculated radiation levels
- Perform operations using portable generator equipment.

5.3.11 WHEN the activities are complete or for ALARA exposure control, THEN perform the following:

5.3.11.1 IF using an exposure device,
THEN retract the source for the Model 100A exposure device IAW Section 5.6.1 and/or the Model 880 exposure device IAW Section 5.6.2.

5.3.11.2 IF using the graded source(s),
THEN return the graded source(s) to the storage container using source handling tools.

5.3.11.3 IF more training activities are to be performed,
THEN repeat steps 5.3.7 through 5.3.10 as necessary to complete the training activities.

5.3.12 IF using an exposure device,
THEN disassemble the Model 100A exposure device IAW Section 5.7.1 and/or the Model 880 exposure device IAW Section 5.7.2.

5.3.13 IF the sources are not needed for further activities,
THEN return the sources to locked storage.

5.3.14 IF more training activities are to be performed,
THEN repeat Steps 5.3.1 through 5.3.13 as necessary to complete the training activities.

5.3.15 HPT/RCT: IF used, remove radiation barriers if daily activities are complete,
AND attach the completed Form 441.21 to the survey map when completed.

5.4 Exposure Device Setup

5.4.1 Model 100A RGD

5.4.1.1 Obtain the Model 100A RGD key from the responsible individual.

5.4.1.2 HPT/RCT: Perform a radiation survey of the exposure device.

CAUTION

Restricted movement of the drive cable can be caused by too many bends of the drive cable or by the bends of the drive cable being too tight.

NOTE: *Steps 5.4.1.3 through 5.4.1.9 are taken from the Gamma Industries Instruction Manual for the Gammatron Model 100A RGD.*

5.4.1.3 Place the exposure device in the desired location and lay out the control cable and guide tube as straight as possible.

5.4.1.4 Remove the safety plug from the lock box.

5.4.1.5 Turn the control crank forward (clockwise) to expose about 8 in. of the drive cable.

5.4.1.6 Connect the control cable to the source pigtail, matching the keyway to the key on the male and female Saf-T-Key connector.

5.4.1.7 Attach the control cable by cranking in the drive cable (counter clockwise) so that the male thread on the swivel connector can be screwed into the lock box.

5.4.1.8 Remove the safety plug from the outlet nipple on the front of the shield.

5.4.1.9 Connect the source guide tube by pulling back the sleeve on the quick disconnect and sliding the fitting over the outlet nipple. Slide the sleeve toward the shield and turn it to lock in place.

5.4.2 Model 880 RGD

5.4.2.1 Obtain the Model 880 RGD key from the responsible individual.

5.4.2.2 HPT/RCT: Perform a radiation survey of the exposure device.

WARNING 1

Precaution must be taken to prevent crushing the guide source tube and remote control cables.

WARNING 2

Precautions must be taken to ensure that the source guide tube and remote control cables do not come into contact with heated surface >140°F.

5.4.2.3 Layout the source guide tube as straight as possible, with no bend radius less than 20 in. to avoid restricting the movement of the source assembly.

5.4.2.4 Layout the remote control cable tube as straight as possible, with no bend radius less than 36 in.

5.4.2.5 Inspect the remote control cable for damaged fittings, cuts, inward dents, and heat damage.

5.4.2.6 Inspect the control cable connector as follows:

- Verify the connector is not bent or at an angle exceeding 15 degrees relative to the control cable centerline
- Verify that the stem and ball of the connector is not bent or cracked.

5.4.2.7 Unlock the plunger.

5.4.2.8 Turn the selector ring from LOCK to CONNECT.

5.4.2.9 Remove the protective cover.

CAUTION

Following removal of the protective cover, ensure that dirt and debris do not get in the cover itself.

NOTE: *Any component that does not pass the below listed criteria must be taken out-of-service and the responsible individual informed.*

5.4.2.10 Verify the control cable and source assembly connector using the Go-No-Go gauge as follows (reference Appendix A).

- Ensure the ball at the end of the control cable does NOT go into the hole of the gauge
- Ensure the shank or stem of the control cable connector does NOT go into the smaller of the two notches located on the side of the gauge
- Ensure that the width of the gauge does NOT go into the female slot of the source assembly connector.

5.4.2.11 Press back the spring-loaded locking pin of the source assembly connector and engage the male and female portions of the connectors.

5.4.2.12 Use the Go-No-Go gauge, verify that the large notch on the side of the gauge will NOT go in the gap between the joined connectors (reference Appendix A). Push and hold the remote control connector assembly collar flush against the exposure device's locking mechanism and rotate the selector ring from CONNECT to LOCK.

5.4.2.13 Depress the plunger lock and remove the key.

CAUTION

The length of the source guide tube must be shorter than the length of the remote control cable.

5.4.2.14 Evaluate the source guide tube for damaged fittings, cuts, inward dents, and heat damage.

5.4.2.15 Pull and rotate the spring-loaded outlet port cover a quarter of a turn in a clockwise direction.

5.4.2.16 Insert the bayonet fitting of the source guide tube into the exposed outlet port and align the GREEN MARKINGS on the bayonet fitting and the outlet port.

5.4.2.17 Rotate the bayonet fitting a quarter of a turn in the counter-clockwise direction.

5.4.2.18 Rotate the spring-loaded outlet port cover an additional 60 degrees in the clockwise direction until it stops.

5.5 Exposure Device Source Exposure

WARNING

To prevent excessive exposure all personnel must be accounted for and verified in the area where the source will be exposed. All locked areas within the boundaries must be visually inspected.

5.5.1 Model 100 A Source Exposure

RADIOLOGICAL HOLD POINT

5.5.1.1 HPT/RCT: Verify accountability of all personnel and ensure all locked areas within the boundaries have been visually inspected to make certain that no one is in the area where the source will be exposed. Record in the lab space notebook that the accountability is complete.

5.5.1.2 Unlock the unit by using the key,
IF the lock does not release,
THEN turn the operator handle counter clockwise to remove pressure from the lock.

5.5.1.3 HPT/RCT: Monitor the radiation levels while the source is exposed.

5.5.1.4 Crank the source out smoothly (clockwise), slowing the cranking speed near the end of travel so as not to cause the source to strike the end piece with undue force.

5.5.2 Model 880 Source Exposure

RADIOLOGICAL HOLD POINT

5.5.2.1 HPT/RCT: Verify accountability of all personnel and ensure all locked areas within the boundaries have been visually inspected to make certain that no one is in the area where the source will be exposed. Record in the lab space notebook that the accountability is complete.

5.5.2.2 If engaged, unlock the device's plunger lock.

5.5.2.3 Rotate the selector ring to the OPERATE position.

5.5.2.4 Push the lock slide GREEN MARKING laterally until the lock slide RED MARKING fully appears and you hear or feel the sleeve snap into the slide.

NOTE: *Each section of the guide tube is 7 ft (2.1 m) long.*

5.5.2.5 If an odometer is fitted, adjust the reset knob to zero, if required.

5.5.2.6 Verify the brake is in the OFF position.

5.5.2.7 Rapidly rotate the control crank in the counter-clockwise (EXPOSE) direction until the source is fully extended.

5.6 Exposure Device Source Retraction

CAUTION

If the post survey indicates that the source is not in the safe position, Section 7, "Abnormal Operations," must be performed.

5.6.1 Model 100A

5.6.1.1 Crank the source back in (counter clockwise).

5.6.1.2 HPT/RCT: Verify the source has been returned to the safe position by performing a radiation survey.

5.6.1.3 Depress the lock plunger.

5.6.2 Model 880

5.6.2.1 Verify the brake is in the OFF position.

5.6.2.2 Rapidly rotate the control crank in the clockwise (RETRACT) direction until fully retracted.

5.6.2.3 Verify the GREEN MARKING on the slide bar.

5.6.2.4 HPT/RCT: Verify the source has been properly stored by performing a radiation survey.

5.6.2.5 Rotate the selector ring from OPERATE to LOCK.

5.6.2.6 IF source exposure is not imminent
THEN depress the plunger lock and remove the key.

5.7 Exposure Device Disassembly

5.7.1 Model 100A RGD

5.7.1.1 Disconnect the source tube and insert the safety plug.

5.7.1.2 Disconnect the control cable and insert the safety plug.

5.7.2 Model 880 RGD

5.7.2.1 Rotate the spring-loaded outlet cover 60 degrees in the counter-clockwise direction.

5.7.2.2 Rotate the guide tube fitting a quarter turn in the clockwise direction and remove the guide tube.

5.7.2.3 Pull and rotate the spring-loaded outlet port a quarter of a turn in the counter-clockwise direction.

5.7.2.4 Unlock the device's plunger lock.

5.7.2.5 Rotate the selector ring from LOCK to CONNECT.

5.7.2.6 Disengage the remote-control cable connector from the source assembly connector.

5.7.2.7 Reinstall the locking mechanism's protective cover and rotate the selector ring from CONNECT to LOCK.

5.7.2.8 Depress the plunger lock and remove the key.

5.8 Contamination Control

NOTE: *The activities described in this section may be performed in conjunction with other activities in this procedure (i.e., Section 5.1 Source Location/Identification and Equipment Evaluation/Testing.*

5.8.1 **Lab Space Coordinator**: Identify the area where the activity will be conducted.

5.8.2 Transfer the designated source(s) in its respective storage container(s) to the selected area.

5.8.3 **HPT/RCT:** Perform baseline contamination survey of area(s) to be contaminated for training objectives.

5.8.4 **Source Handler:** Disperse radiological source material to be used to contaminate area, equipment, etc.

NOTE

Dispersal methods may include dry dispersal, wet dispersal via non-aerosolizing spray, syringe, etc. Additionally, other techniques may be evaluated on a case-by-case basis.

5.8.5 **HPT/RCT:** Perform contamination survey, establish boundary and access control points.

5.8.6 **Instructor/HPT/RCT/Trainee(s)**: The following activities may be performed:

- Measure the radiation and contamination levels at the established barriers
- Calculate the dose rate at the target
- Calculate the exposure expected to be received if an attempt was made to perform film radiography on a target with the calculated radiation levels
- Perform operations using portable generator equipment
- Conduct contamination survey; collect samples

5.8.7 HPT/RCT: IF used, remove radiation/contamination barriers when daily activities are complete, as applicable,
AND complete post-training activity survey map.

6. POST-PERFORMANCE ACTIVITIES

6.1 HPT/RCT: Verify all sources are secured and remove all radiation and contamination boundaries established for the training activities.

7. ABNORMAL OPERATIONS

7.1 Unable to Secure Radiation Source

7.1.1 HPT/RCT: Instruct personnel to relocate to a low dose area and restrict access to the exposed source.

7.1.2 Contact the Warning Communications Center (WCC) 208-526-1515 and local Radiation Safety Officer (RSO), Nuclear Regulatory Commission (NRC), HPT/RCT supervisor and the appropriate state agency as applicable to determine recovery actions

7.2 Damaged Source

7.2.1 HPT/RCT: Instruct personnel to relocate to a low dose area and restrict access to the damaged source.

7.2.2 Contact the WCC 208-526-1515 and local RSO, NRC, HPT/RCT supervisor and appropriate state agency as applicable to determine the recovery actions.

7.2.3 A judgment by the Laboratory Manager or Lab Space Coordinator concerning adverse -environmental conditions (Lightning storms, excessive rain, etc.) may require work stoppage.

7.3 Personnel Contamination

7.3.1 Notify HPT/RCT.

7.3.2 HPT/RCT: Follow requirements per LRD-15001, Radiation Control Manual.

8. RECORDS

8.1 HPT/RCT: Maintain dose records for participants per LWP-15012, "Issuing Dosimeters and Obtaining Personnel Dose History."

8.2 NMC: Maintain a hardcopy of the nuclear material inventory.

8.3 Executed copies of:

- Form 420.21, "Existing Laboratory Instruction Use"
- Form 441.21, "Radiation Generating Device Inspection."

9. REFERENCES

ECAR-565, "Hazard Categorization of Generic Off-Site Training Exercises"

ECAR-733, "Hazard Categorization of Generic On-Site Training Exercises"

Form 420.21, "Existing Laboratory Instruction Use"

Form 441.21, "Radiation Generating Device Inspection"

LWP-15005, "Control and Registration of Radiation Generating Devices"

LWP-15012, "Issuing Dosimeters and Obtaining Personnel Dose History"

LWP-15015, "Response to Abnormal Radiological Situations"

LWP-15021, "ALARA Program and Implementation"

MCP-2065, "Management Control of Radiological Inventory for Nuclear Nonproliferation Operations Department (NNOD) Facilities"

MCP-1266, "Facility Management Control of Radiological Inventory"

MCP-1989, "Radiological Material Inventory Control at MFC"

MCP-2752, ""Shipments, Receipts, and Transfers of Nuclear Materials"

PLN-1466, "INL General Security Plan"

LRD-11500, "Nuclear Materials Management, Control and Accountability Plan"

LRD-18001, "INL Criticality Safety Program Requirements Manual"

10. APPENDIXES

Appendix A, Go-No-Go Inspection

Appendix A

Go-No-Go Inspection