

## **Management Control Procedure**

# **Radioactive Source Accountability and Control**

**Idaho  
Cleanup  
Project**

CH2M ♦ WG Idaho, LLC is the Idaho Cleanup Project contractor for the U.S. Department of Energy

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## 1. INTRODUCTION

### 1.1 Purpose

This procedure defines and implements the Idaho Cleanup Project (ICP) *sealed radioactive source* (see def.) accountability and control program requirements.

### 1.2 Scope and Applicability

All *sealed radioactive sources* (see def.) are subject to accountability and control requirements, and are used, handled, and stored in a manner commensurate with the hazards associated with operations involving the sources. All sealed radioactive sources are stored in accordance with Management Control Procedure (MCP) -121, “Areas Containing Radioactive Materials.”

Class I *consumer products* (see def.) are defined in Appendix A and are exempt from the requirements of this procedure. Radioactive sources that do not meet the definition of a sealed radioactive source are exempt from the requirements of this procedure and are handled in accordance with Program Requirements Document (PRD) -183, “Radiological Control Manual.”

Some sealed radioactive sources also may be classified as:

- *Radiation generating devices* (see def.), and have additional controls administered by MCP-138, “Control and Registration of Radiation-Generating Devices”
- Accountable sealed nuclear material sources being tracked and controlled by the nuclear material program may be exempted from control under this procedure after the contractor radioactive source coordinator (RSC) makes a documented determination of the equivalency and adequacy of the nuclear material program.

The remainder of this procedure describes the training, acquisition, receipt, labeling, and storage for all sealed radioactive sources. In addition, Accountable Sealed Radioactive Sources have registration, inventory, *source leak testing* (see def.), usage, *transfer* (see def.), *movement* (see def.), disposal, and record-keeping requirements.

Each activity described in this procedure is considered an operations related task (ORT) for which the activity hazards are adequately mitigated by the training or qualification of the individual performing the activity.

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## 2. RESPONSIBILITIES

**NOTE:** *The title “Line/Program Management,” as used in this procedure, refers to the individual who is responsible for the program or project in which a sealed radioactive source(s) is used.*

Performer	Responsibilities
Radiological Engineering Manager	Ensure that the contractor sealed radioactive source accountability and control program complies with all applicable requirements, and designate the RSC and alternate to coordinate the sealed radioactive source accountability and control program implementation.
Radioactive Source Coordinator	Coordinate the implementation of the sealed radioactive source accountability and control program, and revise this procedure according to approved program changes.
Line/Program Management	Ensure that sealed radioactive sources are accounted for and controlled by qualified sealed source custodians and users, and ensure that RSC approval is obtained for new sealed radioactive source acquisitions and for bringing all other sealed radioactive sources to contractor facilities.
Project Radiological Control (RadCon) Management	Provide radiological control technician (RCT) assistance to sealed source custodians for sealed radioactive source receipt, shipments, and semiannual inventories.
Site RadCon Training	Provide qualification training to sealed source custodians, sealed source users, and RCTs, maintain auditable training records, and evaluate training exemptions.
Sealed Source Custodian	Maintain accountability and control of assigned sealed sources, and ensure the semiannual sealed source inventory is performed and documented.
Sealed Source Requestor	Ensure RSC approval is obtained for new sealed source acquisitions.
Sealed Source User	Check out, use, control, and return sealed sources. Sources that are used in place (for example, large sources) and are not moved from their storage locations are not required to be checked out (use of Form 441.65, “Source Checkout LogSheet,” is not required).
Radiological Control Technician	Perform and document radiological surveys of, and label, sealed radioactive sources.

## 3. PREREQUISITES

None.

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## 4. INSTRUCTIONS

### 4.1 General

- 4.1.1 Radiological Engineering Manager: Provide overall coordination and implementation of the contractor radioactive sealed source accountability and control program to meet the requirements of existing state and federal regulations and directives.
- 4.1.1.1 Designate, in writing to the ICP RadCon program director, the RSC and an alternate who will coordinate the contractor sealed radioactive source accountability and control program.
- 4.1.2 RSC: Help the Radiological Engineering manager with the overall coordination and implementation of the contractor sealed radioactive source accountability and control program.
- 4.1.3 Project RadCon Management: Ensure that qualified RCTs perform and document radiological surveys in support of sealed source custodians at receipt and for semiannual inventories of sealed radioactive sources at ICP facilities.
- 4.1.4 Line/Program Management: Retain ultimate responsibility for accountability and control of sealed radioactive sources used within the organization.
- 4.1.4.1 If delegating responsibilities for assigning the *sealed radioactive source custodian(s)* (see def.), notify the RSC in writing.
- 4.1.4.2 Designate a qualified sealed radioactive source custodian(s) (qualified to QCSOURCC) in writing to the project RadCon management and the RSC for accountable sealed radioactive sources.
- 4.1.4.3 Ensure that personnel who use or handle accountable sealed radioactive sources are qualified *sealed source users* (qualified to QCSOURCU) (see def.).
- NOTE:** *No sealed radioactive source, including radiography sources, may be brought onsite without prior RSC approval.*

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- 4.1.4.4 Contact and obtain approval from project RadCon management, the facility Site area director, and the RSC when planning to bring a sealed radioactive source(s) to the contractor facility by a subcontractor, vendor, or visiting scientist. Discuss personnel training, source handling, and source storage plans with the RSC.
- 4.1.4.5 Ensure that personnel involved in the procurement, transfer, and disposal of sealed radioactive sources follow the instructions and complete their responsibilities specified in pertinent sections of this and referenced procedures.
- 4.1.5 Sealed Source Custodian: Control assigned sealed radioactive sources within the organization, and ensure that each semiannual inventory is completed within the established time frame.

## 4.2 Training

**NOTE:** *If dealing with sealed radioactive sources that are an integral part of an instrument and do not present a radiological hazard, General Employee Radiological Training (GERT) will suffice in lieu of Radiological Worker I or Radiological Worker II training. Personnel who operate these instruments are exempt from source user training (for the sealed radioactive sources in the instrument) if the instrument is immobile and in a nonradiological area.*

- 4.2.1 Site RadCon Training: Provide initial training to sealed source custodians and sealed sources users. Include, as a minimum:
  - A. This procedure, pertinent Department of Energy (DOE) orders and standards, applicable portions of 10 Code of Federal Regulations (CFR) 835, “Occupational Radiation Protection.”
  - B. Safe-handling techniques for sealed radioactive sources.
- 4.2.2 Site RadCon Training: Maintain auditable training records, and make available the following:
  - A. A list of trained sealed source custodians to the RSC and to appropriate project RadCon management
  - B. A list of trained sealed source users to the appropriate sealed source custodians.

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- 4.2.3 Site RadCon Training: Review subcontractor personnel training records to help RadCon management determine whether they can exempt the subcontractor personnel from ICP sealed source user and/or sealed source custodian training on a case-by-case basis.

### 4.3 Procurement/Acquisition

**NOTE 1:** *No sealed radioactive source, including radiography sources, may be procured without prior RSC approval.*

**NOTE 2:** *Category 1 or 2 radioactive sealed sources, as defined in DOE O 231.1B Chg 1, "Environment, Safety and Health Reporting," Attachment 5, Appendix A, "Table of Radioactive Sealed Sources," may not be procured without prior ICP RadCon program director approval.*

- 4.3.1 Sealed Source Requestor: Before initiating steps to acquire a new sealed radioactive source, contact the RSC to determine whether a suitable sealed radioactive source is already available at the ICP.

- 4.3.2 Sealed Source Requestor: If the RSC cannot locate a suitable sealed radioactive source, initiate the acquisition (purchase or manufacture) of a sealed radioactive source or equipment containing a sealed radioactive source in accordance with MCP-1185, "Material Acquisitions."

4.3.2.1 Contact the RSC or sealed source custodian for sealed source accountability determination.

4.3.2.2 Determine where the radioactive sealed source will be stored and how it will be controlled.

4.3.2.3 Consider the eventual disposal of the sealed radioactive source (for example, returned to the vendor or placed in radioactive waste).

**NOTE:** *The actions of the RSC in the next step may be performed by the RSC, the RSC alternate, or the Radiological Engineering manager.*

- 4.3.3 RSC: Review and approve or disapprove the acquisition (purchase or manufacture) of all contractor sealed radioactive sources.

4.3.3.1 Obtain the ICP RadCon program director's approval prior to purchasing any source that decays by electron capture.

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#### 4.4 Receipt

### WARNING

**The contents of damaged packages may be leaking radioactive material.**

- 4.4.1 Receiving/Warehouse Personnel: Upon receipt of a radioactive source (or equipment containing a radioactive source), request that an RCT perform a radiological survey of the shipping package container in accordance with MCP-139, “Radiological Surveys.”
- 4.4.2 Receiving/Warehouse Personnel: Notify the area/facility shipping coordinator of the arrival of a radioactive source (or equipment containing a radioactive source) to arrange shipment to the area/facility.
- 4.4.3 Area/Facility Shipping Coordinator: Notify the destination RadCon office that the radioactive source or equipment containing a radioactive source is going to be shipped to the source requestor (specify the individual’s name).
- 4.4.4 Sealed Source Custodian: Notify project RadCon management upon receiving the radioactive source(s) and request a receipt survey per Section 4.6.5.
- 4.4.5 Sealed Source Custodian: Maintain control of the sealed radioactive source or equipment per Section 4.6.5.5 (for an *exempt sealed radioactive source* [see def.]) or Section 4.6 (for an *accountable sealed radioactive source* [see def.]).

#### 4.5 Exempt Sealed Radioactive Sources

**NOTE:** *Exempt sealed radioactive sources are radioactive material and should be labeled and controlled per MCP-121 and MCP-187, “Posting Radiological Control Areas.”*

- 4.5.1 Sealed Source Custodian: Control exempt sealed radioactive sources in a manner to prevent loss.
- 4.5.2 Sealed Source Custodian: Ensure that personnel who will use sources have the required training in accordance with Section 4.2.

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4.5.3 Project RadCon Management: Ensure that areas where exempt sealed radioactive sources are handled and stored are surveyed periodically (at least annually).

#### 4.6 Accountable Sealed Radioactive Sources

**NOTE:** *The instructions in Section 4.6 also apply to exempt sealed radioactive sources that are registered by the sealed source custodian or identified by the RadCon organization.*

##### 4.6.1 Registration

4.6.1.1 Sealed Source Custodian: Complete the registration section (top portion) of Form 441.60, “ICP Accountable Radioactive Source Registration or Transfer,” for all accountable sealed radioactive sources.

4.6.1.2 Sealed Source Custodian: Within 1 week from the acquisition of an accountable sealed radioactive source being registered, submit the following to the RSC:

- A. The original Form 441.60
- B. The completed original Form 441.87, “Sealed Radioactive Source Leak Test” (see Section 4.6.5)
- C. A copy of the manufacturer’s calibration certificate, if available
- D. A copy of the shipping papers, if available
- E. A copy of any other manufacturer information, if available.

4.6.1.3 RSC: Assign a unique ICP number to each accountable sealed radioactive source (see 10 CFR 835, Appendix E), and notify the sealed source custodian of each number.

4.6.1.4 RSC: Enter the information for each registered sealed source into the radioactive sealed source database.

4.6.1.5 Sealed Source Custodian: Update the sealed source inventory with the added accountable sealed radioactive source(s), and ensure that the sealed source(s) is labeled.

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## 4.6.2 Labeling

- 4.6.2.1 Sealed Source Custodian: Ensure that all sealed radioactive sources are labeled per MCP-187, “Posting Radiological Areas,” with labels bearing the standard radiation trefoil and the words “Caution, Radioactive Material.”
- 4.6.2.2 Sealed Source Custodian: If a sealed radioactive source(s) is located in an area unsafe for human entry or is otherwise inaccessible (for example, behind a locked door), indicate the presence of the sealed radioactive source(s) at the posted access points.
- 4.6.2.3 Sealed Source Custodian: Label all sealed radioactive sources with the following information (see Appendix C), as a minimum:
- A. Unique ICP identification (ID) number for accountable sources, or “N/A”
  - B. Radionuclide(s)
  - C. Total activity
  - D. Assay date
  - E. Manufacturer model and serial numbers of the radioactive sealed source or device (where available)
  - F. Sealed source custodian name and telephone number for accountable sources, or “N/A”
  - G. Contact radiation levels (taken in the configuration that will result in the most reproducible and measurable radiation levels)
  - H. Beta-gamma and alpha removable contamination levels
  - I. Date surveyed
  - J. RCT signature.
- 4.6.2.4 Sealed Source Custodian: If the sealed radioactive source is too small to label, ensure that its storage container is labeled.

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4.6.2.5 Sealed Source Custodian: If the sealed radioactive source is an integral part of a larger piece of equipment, ensure that the equipment is labeled in lieu of the radioactive source with a label containing the words, “Installed Radioactive Source, Contact RadCon Before Opening,” and also containing the information in Section 4.6.2.1.

4.6.2.6 Sealed Source Custodian: If a sealed radioactive source is in storage (removed from service), ensure that a “Caution: Integrity Test Required Before Use” (see Appendix C, Figure C-5) label is completed and attached on/near the sealed radioactive source or source container.

4.6.2.7 Sealed Source Custodian: If because of special circumstances, the labeling requirements specified above are not suitable, contact the RSC for assistance.

### 4.6.3 Storage

4.6.3.1 Sealed Source Custodian: Select a suitable sealed radioactive source storage area, and ensure that the sealed source storage area is established and posted in accordance with MCP-121 and MCP-187.

4.6.3.2 Sealed Source Custodian: Lock the radioactive sealed source storage area to minimize access as follows:

4.6.3.2.1 Personally control the key(s) to the sealed radioactive source storage area. Lock and unlock the sealed radioactive source storage area each time that a sealed radioactive source is removed or returned.

**NOTE:** *In the following step, the sealed source custodian retains ultimate responsibility for sealed source accountability and control.*

4.6.3.2.2 If personally controlling the key(s) is not feasible (for example, work is performed on the back-shift without a sealed source custodian on shift), control the sealed radioactive source storage area key(s) in one of the following ways:

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- A. Issue serialized keys to those qualified users who require frequent access, and track the serialized keys
- B. Control the key(s) through a responsible person (for example, shift supervisor, security guard, or RCT), with shift key custody turnover
- C. An alternate method approved by line/program management and the RSC.

4.6.3.2.3 If the method in Section 4.6.3.2.2.B is selected, provide the responsible person with a current list of trained sealed source users who may access the sealed radioactive source storage area.

#### 4.6.4 Inventory

4.6.4.1 RSC: Provide each sealed source custodian with a semiannual inventory printout of assigned sealed radioactive sources typically by the first working day of the month in which the inventory is due.

4.6.4.2 Sealed Source Custodian: Exclude sealed radioactive sources located in areas unsafe for human entry or otherwise inaccessible from the physical inventory.

4.6.4.3 Sealed Source Custodian: Verify that required area radiological postings and sealed source labels are in place and are adequate in accordance with Sections 4.6.2.2 and 4.6.3.

4.6.4.4 Sealed Source Custodian: Verify that storage locations, containers, and devices are adequate. Further, verify that the container:

- A. Is appropriate for the type of radiation emitted (for example, borated polyethylene for a neutron sealed source)
- B. Has a positive closing mechanism to prevent inadvertent opening
- C. Has sufficient room for storing the sealed source.

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- 4.6.4.5 Sealed Source Custodian: Perform a physical inventory of all remaining sealed radioactive sources semiannually and as directed by the RSC. This time interval may be extended up to 30 days to accommodate scheduling needs. Visually verify the physical location and condition of each sealed radioactive source, or use one of the following methods to verify the physical location of a source:
- A. Positive equipment operation for installed sealed source(s) (an integral part of a piece of equipment)
  - B. Positive reading with a radiation detection instrument near an in-storage sealed source
  - C. Verification that no entry was made into the area where the sealed source is in storage
  - D. Verification that the tamper-proof seal on the container is unbroken and the seal number is unchanged for an in-storage source.
- 4.6.4.6 Sealed Source Custodian: Verify or record the date of the last programmatic operational use of the sealed source on the semiannual inventory paperwork. Record the last date or year that the sealed source was used for its intended purpose. If the date is unknown, record “UNK”.
- 4.6.4.7 Sealed Source Custodian: Notify line/program management, project RadCon management, and the RSC immediately upon determining that a sealed radioactive source is missing, and initiate comprehensive efforts to locate the missing sealed source.
- 4.6.4.7.1 Line/Program Management: If a sealed radioactive source is reported missing, refer to MCP-190, “Event Investigation and Occurrence Reporting,” for the appropriate investigation, notification, and reporting instructions.
- 4.6.4.8 Sealed Source Custodian: Ensure that assigned sealed radioactive sources are leak tested per Section 4.6.5.
- 4.6.4.9 Sealed Source Custodian: Update the data on the semiannual inventory printout.

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- 4.6.4.10 Sealed Source Custodian: Ensure that each source label is properly filled out.
- 4.6.4.11 Sealed Source Custodian: Ensure that the current source dose/count rate is within  $\pm 20\%$  of the “Last Dose Rate/Count Rate Information” where recorded on the semiannual inventory printout.
- 4.6.4.11.1 For isotopes with half lives less than 5 years, factor radioactive decay into the change in the reading.
- 4.6.4.11.2 For readings outside the  $\pm 20\%$  range, record the rationale for the readings being different.
- 4.6.4.12 Sealed Source Custodian: Ensure that the following information is recorded on the semiannual inventory printout:
- A. RCT signature(s) and/or initials, RadCon review signature(s), and date(s)
  - B. Sealed source information, including location and status
  - C. Sealed source number circled, if lacking future programmatic use
  - D. Inventory date and (if applicable) the leak test date.
- 4.6.4.13 Sealed Source Custodian: Review the inventory cover page statements, and circle responses accordingly. Sign and date every page of the inventory printout to indicate that the assigned sealed radioactive sources are accounted for and that the sealed source leak-testing requirements were met.
- 4.6.4.14 Sealed Source Custodian: Submit the original inventory printout to the RSC by the date due or as directed on the inventory notification memo (if attached), and retain a copy of the inventory printout.
- 4.6.4.15 RSC: If any inventory printouts are not received in a timely manner, contact the line/program management for resolution.
- 4.6.4.16 Review the inventory results, and update the sealed radioactive source database.

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4.6.4.17 Submit an annual source inventory to the DOE centralized database repository: the Radiological Source Registry and Tracking (RSRT) database per DOE O 231.1B Chg 1.

**NOTE:** *Incidents of loss or theft of radioactive sealed sources must be addressed and managed. (See DOE O 232.2, "Occurrence Reporting and Processing of Operations Information," dated 8-20-11, and DOE O 470.4B, "Safeguards and Security Program.")*

4.6.4.18 RSC: Submit an annual update of the ICP accountable sealed radioactive sources to the ICP RadCon program director by September 15<sup>th</sup> of each year, including radioactive sealed sources that have been identified for disposal, but have not yet been disposed of.

4.6.4.19 Sealed Source Custodian: Notify the ICP RadCon program director when an accountable source is to be disposed of during the year prior to the annual update.

4.6.4.20 Sealed Source Custodian: Notify the ICP RadCon program director when a source is lost or has been stolen.

4.6.4.21 ICP RadCon Program Director: Submit an annual update to the RSRT by September 30<sup>th</sup> of each year of the ICP accountable sealed radioactive source inventory, including radioactive sealed sources that have been identified for disposal, but have not yet been disposed of.

4.6.4.22 Send intermediate updates to the RSRT when sources are disposed or lost during the year prior to the annual update.

#### **4.6.5 Source Leak Testing**

4.6.5.1 Sealed Source Custodian: Exclude from this section the following:

- A. Sealed radioactive sources consisting solely of gaseous radioactive material or tritium
- B. Sealed sources located in areas that are unsafe for human entry or otherwise inaccessible

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- C. Sealed sources that are “in storage” (removed from service) if the sealed sources are one of the following:
1. Isolated from active sealed sources
  2. Adequately packaged to prevent the spread of contamination and stored in a controlled location (see Section 4.6.3)
  3. Labeled “Caution: Integrity Test Required Before Use” (see Appendix C).
- 4.6.5.2 Sealed Source Custodian: Ensure that sealed radioactive sources are source leak tested at the following times:
- A. After receipt at an area or a facility
  - B. Before initial use, or when changed from “in storage” (removed from service) to “active” status, except the sources excluded in Section 4.6.5.1
  - C. At intervals not to exceed 6 months. This time interval may be extended up to 30 days to accommodate scheduling needs.
  - D. If dropped and damage is suspected, or other damage may have occurred
  - E. If any unexpected measurable radioactive contamination is detected on the sealed source storage container or equipment
  - F. If removed from an installed system or instrument
  - G. If requested by the RSC.
- 4.6.5.3 Sealed Source Custodian: Supervise or assist the RCT performing radiation or radioactivity measurements and source leak tests.
- 4.6.5.4 RCT: Follow the instructions in Appendix D, and record the results on Form 441.87 or the semiannual inventory paperwork.

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**NOTE:** *Although 10 CFR 835 uses a leak test value of 0.005  $\mu\text{Ci}$  (11,100 dpm) for a detection level, the RadCon organization has chosen to use more conservative values (PRD-183, Table 2-2, values).*

4.6.5.5 Sealed Source Custodian and RCT: If the removable contamination on the sealed radioactive source exceeds the values in PRD-183, Table 2-2, perform the following:

4.6.5.5.1 Wear protective gloves (for example, rubber or leather) when surveying or handling leaking sealed sources.

4.6.5.5.2 Remove the leaking sealed source from service.

4.6.5.5.3 Control the sealed source in a manner that prevents the escape of radioactive material to the workplace (such as wrapping).

4.6.5.5.4 Notify project RadCon management and the RSC.

4.6.5.5.5 Determine whether to decontaminate, repair, or dispose of the sealed source, with RSC concurrence.

4.6.5.6 Project RadCon Management: Review the leak test results and survey results (dose/count rate) to ensure that it is correctly recorded. If properly recorded (for example, with the RCT initials and semiannual inventory dose/count rates), then sign for a completed RadCon review.

4.6.5.7 Sealed Source Custodian: Review the sealed source leak test results to ensure that the sealed source leak testing requirements have been met, and sign the form.

4.6.5.8 Sealed Source Custodian: Complete applicable portions of a new Form 441.87 or new semiannual inventory paperwork, submit to the RSC, and retain a copy.

4.6.5.9 RSC: Review the sealed source leak test results, and update the sealed radioactive source database.

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#### 4.6.6 Usage

4.6.6.1 Sealed Source User: Follow procedures, radiological work permits, and established radiological controls when using sealed radioactive sources.

4.6.6.2 Sealed Source Custodian: Report to the RSC any change in the status of each sealed radioactive source, such as:

- A. Relocation
- B. Disposal
- C. Loss
- D. Damage
- E. Custodian change
- F. In storage or inaccessible to active status.

4.6.6.3 Sealed Source Custodian: Maintain a current inventory of assigned sealed radioactive sources. Include the following information, as a minimum:

- A. Unique ICP ID number
- B. Radionuclide(s) and activity(ies)
- C. Assay date of the activity(ies)
- D. Storage location
- E. Date of last physical inventory
- F. Date of last source leak test (if applicable)
- G. Instrument response (identify whether the ion chamber window is open or closed) with units, distance, and instrument used.

**NOTE 1:** *A barcode system may be used instead of completing Form 441.65 if the barcode system can provide equivalent information listed below.*

**NOTE 2:** *Sources that are used in place (for example, large sources) and are not moved from their storage locations are not required to be checked out on Form 441.65.*

4.6.6.4 Sealed Source Custodian: Provide a Form 441.65 or an RSC-approved equivalent form, at/near each sealed radioactive source storage area.

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4.6.6.5 Maintain with Form 441.65 a list of authorized sealed source users, and ensure that only authorized sealed source users have access to the sealed radioactive sources.

4.6.6.6 Close out Form 441.65, and start a new Form 441.65 when an authorized user is removed from the list of authorized users.

4.6.6.7 Sealed Source User: Record information on Form 441.65 each time you remove a sealed radioactive source from or return it to its storage area.

**NOTE:** *Sources being used in a counting instrument may be left unattended for extended periods provided that the room with the instrument is locked and properly posted (for example, "Radiation Area"), and access to the room is controlled.*

4.6.6.8 Sealed Source User: If a sealed source is used in an instrument or test configuration for an extended period in which direct custody would be impractical (such as during an extended efficiency test), complete the following:

4.6.6.9 Notify the sealed source custodian.

4.6.6.10 Ensure that the correct location is identified on Form 441.65.

4.6.6.11 Maintain responsibility for the sealed source during the extended period.

4.6.6.12 Sealed Source User: Maintain positive control of sealed radioactive sources (in your possession or locked up) while the sealed sources are checked out.

**NOTE:** *The responsibility and liability remains with the user taking possession of the sealed source while it is checked out.*

4.6.6.12.1 If the work area must be evacuated while a sealed source is checked out and it is safe to do so, return the sealed source to its storage area. Do not delay emergency response to return a sealed source to its storage area, unless allowed to by the evacuation order.

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4.6.6.12.2 If you cannot return the sealed source to its storage area during an evacuation, decide whether it is safe to maintain possession of the sealed source or leave the sealed source behind. In either case, minimize radiation exposure to yourself and surrounding personnel and notify the Emergency Response Organization of the location and condition of the sealed source.

4.6.6.13 Sealed Source User: If it is necessary to hand off a sealed source to another sealed source user to meet operational requirements, complete the following:

4.6.6.13.1 Verify that the next sealed source user is currently qualified.

4.6.6.13.2 Verify that the next sealed source user is on the list of authorized sealed source users for the sealed source storage area.

4.6.6.13.3 Close out the current Form 441.65 entry and initiate a new Form 441.65 entry.

**NOTE:** *The Form 441.65 entry may be completed by a third person, and confirmed and recorded “via telecom” (for example, by telephone or radio) when both users are in the field.*

4.6.6.14 Sealed Source Custodian: Review Form 441.65 at least monthly for correctness and sign the completed log pages. Increase the review frequency based on the number of sealed source users and on how fast the sealed source checkout log is filled out.

4.6.6.15 Sealed Source Custodian: Retain completed Form 441.65 per Section 5.

#### 4.6.7 Transfer

**NOTE 1:** *Section 4.6.8 addresses sealed source movements, where the sealed source custodian changes.*

**NOTE 2:** *No accountable radioactive sealed source, including any DOE O 231.1B Chg 1 Category 1 or 2 radioactive sealed sources, will be transferred to or from the ICP without written authorization from the ICP RadCon program director.*

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- 4.6.7.1 Sealed Source Custodian (current): If the sealed source will physically change locations, ensure that each sealed radioactive source is leak tested (see Section 4.6.5) prior to transfer.
- 4.6.7.2 Sealed Source Custodian (current): Complete the source transfer section (bottom portion) of Form 441.60.
- 4.6.7.3 Sealed Source Custodian (current): Submit Form 441.60 to the new sealed source custodian for signature along with any paperwork pertaining to each sealed radioactive source (for example, the calibration certificate and original shipping papers).
- 4.6.7.4 Sealed Source Custodian (current): If the sealed source is being moved to a new storage area outside the facility boundary, move it using PLN-556, “Transport Plan for the Movement of RCT Materials at the INEEL,” or contact Packaging and Transportation to initiate the shipment.
- 4.6.7.5 Sealed Source Custodian (new): If the sealed source has physically changed locations, notify project RadCon management upon receiving the sealed source(s) and request a receipt (radiation and contamination) survey.
- 4.6.7.6 Sealed Source Custodian (new): Sign the new sealed source custodian part of Form 441.60, and submit the original Forms 441.60 and 441.87 (if applicable) to the RSC.
- 4.6.7.7 Sealed Source Custodians (current and new): Update the sealed source custodian inventories to reflect the transfer of sources.
- 4.6.7.8 RSC: Update the sealed radioactive source database.
- 4.6.7.9 ICP RadCon Program Director: Submit a transaction report to the RSRT database for DOE O 231.1B Category 1 and 2 radioactive sealed sources, as defined in DOE O 231.1B Chg 1.

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#### 4.6.8 Movement

**NOTE:** *This section applies to sealed radioactive sources being sent away for calibration (for example, to the Health Physics Instrument Laboratory [HPIL], vendor, or the National Institute for Standards and Technology [NIST]) or on temporary loan (less than 60 calendar days) to another site, facility, or storage area. The sealed source custodian retains ultimate responsibility for controlling and accounting for the sealed sources.*

- 4.6.8.1 Sealed Source Custodian: If the sealed radioactive source is leaving the site, facility, or storage area, check the sealed source out on Form 441.65, identifying the destination.
- 4.6.8.1.1 If the sealed source is moved to another contractor facility for 60 or more calendar days, complete a sealed source transfer (see Section 4.6.7).
- 4.6.8.1.2 Prior to all sealed source movements, coordinate or conduct a source leak test (see Section 4.6.5).
- 4.6.8.2 Sealed Source Custodian: Move the sealed source to the temporary destination in accordance with PLN-556 or coordinate with Packaging and Transportation.
- 4.6.8.2.1 Ensure that the sealed source is positively controlled until it leaves the facility boundary.
- 4.6.8.2.2 Notify the RSC of the source movement.
- 4.6.8.3 Sealed Source Custodian (temporary): For onsite movements, enter the sealed source in the temporary storage location Form 441.65, and update the inventory.
- 4.6.8.4 Sealed Source Custodian (temporary): For onsite movements, return the sealed source to the original sealed source custodian in accordance with PLN-556 or coordinate shipment with Packaging and Transportation. Close out the Form 441.65 entry by documenting that the sealed source was returned to the custodian, and update the inventory.

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4.6.8.5 Sealed Source Custodian: Upon return of the sealed source, complete the receipt entry on Form 441.65, and notify the RSC by e-mail that the sealed source has returned.

4.6.8.5.1 For off-Site movements, coordinate receipt surveys (see Section 4.4).

#### 4.6.9 Disposal

**NOTE:** *Disposal options include (a) permanent off-Site transfer, (b) return to the vendor or manufacturer, (c) placement in an appropriate waste stream, (d) another method agreed upon by the source custodian, facility RadCon supervisor, and the RSC.*

4.6.9.1 Sealed Source Custodian: Initiate the disposal of sealed radioactive sources that are no longer needed.

4.6.9.1.1 Notify the contractor property management specialist if the sealed radioactive source is of value and could be used by others.

4.6.9.1.2 Contact the area or facility waste coordinator for assistance in determining whether a waste stream exists or can be created for the sealed radioactive source.

4.6.9.1.3 Contact the RSC for assistance in identifying disposal options for sealed radioactive sources that cannot be disposed of by the area or facility waste coordinator.

4.6.9.2 Sealed Source Custodian: Notify the RSC of the planned disposal of a sealed radioactive source. Include the unique ID number of the sealed source identified for disposal and the proposed disposal method.

4.6.9.3 RSC: Review and approve the disposal of the sealed radioactive source.

4.6.9.4 Waste Generator Services: Within 2 business days of disposal of the sealed radioactive source, complete the source transfer section of Form 441.60 and include any pertinent information in the comments section (for example, the waste stream, waste manifest number, waste container ID number, vendor name, disposal date, and method of disposal).

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4.6.9.5 Sealed Source Custodian: Submit the original Form 441.60 to the RSC within 2 business days.

4.6.9.6 RSC: Update the sealed radioactive source database.

4.6.9.7 Sealed Source Custodian: Ensure control of disposed sealed sources until the sealed source leaves the facility boundary.

4.6.9.8 Sealed Source Custodian: Update the source inventory to reflect the source disposal.

#### **4.6.9.9 Reporting Radioactive Sealed Source Information**

4.6.9.9.1 RSC: Report as inventory to the DOE RSRT database, accountable radioactive sealed sources that meet the criteria of 10 CFR 835, Subpart M and Appendix E, including sources that meet the criteria of 10 CFR 835, Appendix E, that have been identified for disposal but have not yet been disposed of.

4.6.9.9.2 Report as transactions to the RSRT radioactive sealed sources that meet the criteria of International Atomic Energy Agency (IAEA) Category 1 or 2 radioactive sealed sources (see Appendix A, Item 4).

4.6.9.9.3 Waste Generator Services: Ensure that aggregation of individual radioactive sealed sources is taken into account in the protection during transfer (shipment).

4.6.9.9.4 RSC: Ensure that classified data or information that would divulge a classified program is not reported to DOE RSRT, which is maintained as Official Use Only (OUO/Controlled Unclassified Information (CUI).

#### **4.6.9.10 General Requirements**

**NOTE 1:** *Information regarding specific radioactive sealed sources will remain on the active DOE RSRT inventory until transferred (shipped), disassembled or disposed of from the DOE site.*

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**NOTE 2:** *Radioisotope decay will be taken into account in the transaction reporting of Category 1 and 2 radioactive sealed sources.*

**NOTE 3:** *For Category 1 and 2 radioactive sealed sources, any missed transaction or errors found in previously filed inventory or transaction reports will be corrected or a new report will be filed within 5 business days of the discovery of the error or missed transaction.*

#### **4.6.9.11 Verification of Book Inventory Records**

4.6.9.11.1 RSC: Verify the ICP database inventory of radioactive sealed sources annually against the site/facility operator's listing in the RSRT.

**NOTE:** *The book inventory verification may be satisfied at each DOE site in conjunction with existing inventory requirements under 10 CFR 835.*

#### **4.6.9.12 Transaction Reporting to the RSRT of IAEA Category 1 and 2 Radioactive Sealed Sources**

4.6.9.12.1 RSC: Complete a Sealed Source Transaction Report and submit it to the RSRT database for IAEA Categories 1 and 2 solid radioactive sealed per DOE O 231.1B Chg 1 sources as identified in Appendix A of the order for each of the following types of transactions:

- A. Manufacture (a new or initially identified source)
- B. Transfer (shipment)
- C. Receipt
- D. Disassembly
- E. Disposal (e.g. final end-of-life action).

**NOTE:** *For shipments, disassembly and disposal, it is assumed that the baseline (initial) information for the sources has been reported to the RSRT database already.*

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4.6.9.12.2 For each DOE site/facility operator that manufactures (or initially identifies), ships, receives, disassembles, or disposes of a Category 1 or 2 radioactive sealed sources, include in the transaction report the data fields as specified in Appendix B.

Submit the transaction reports discussed in Steps 4.6.9.12.1 and 4.6.9.12.2 to the RSRT within 5 business days after the transaction by using one of the following modes in accordance with site and DOE data transmission requirements for the protection of the information:

- A. The on-line system at such time as one is established and available to DOE sites
- B. Electronic format, pre-defined, computer-readable format
- C. Facsimile or e-mail using a pre-defined format.

#### **4.6.9.13 Annual Reconciliation of Category 1 and 2 Radioactive Sealed Sources Information**

**NOTE:** *Each DOE site/facility operator must reconcile and verify Categories 1 and 2 radioactive sealed source physical inventories annually against the site/facility operator's data in the DOE RSRT.*

4.6.9.13.1 RadCon Program Director: Submit modifications to the RSRT inventory as transactions via the reports identified in Steps 4.6.9.12.1 and 4.6.9.12.2 or as inventory corrections as defined below.

- A. Inventory corrections for Category 1 or 2 radioactive sealed sources will be made within 5 business days of the discovery of the error or missed inventory.

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- B. Reconciliation and verification must be based on December 31 inventories and submitted to the RSRT within 3 weeks after the end of each calendar year.

#### **4.6.9.14 Verification of Authorities for Receipt of Accountable Radioactive Sealed Sources**

**NOTE 1:** *Accountable radioactive sealed sources must not be transferred from a DOE organization or from a DOE contractor except as authorized.*

**NOTE 2:** *Except as otherwise provided in this section and subject to the provisions of Paragraphs 8(c) of this section, an accountable radioactive sealed source may be transferred as follows:*

- A. *To another authorized DOE organization or DOE contractor*
- B. *To the agency in any Nuclear Regulatory Commission (NRC) agreement state (see def.) that regulates radioactive material pursuant to an agreement under Section 274(b) of the Atomic Energy Act of 1954 (as amended) (42 USC § 2011 et seq.)*
- C. *To any person authorized to receive such radioactive material under terms of a specific license or a general license or their equivalents issued by the NRC or an agreement state*
- D. *To a person abroad pursuant to an export license issued under DOE requirements or NRC regulations as applicable*

OR

- E. *As otherwise authorized by DOE in writing.*

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4.6.9.14.1 RSC: Before transferring an accountable radioactive sealed source to a DOE organization or contractor, a specific licensee of the NRC, or an agreement state—or to a general licensee who is required to register with the NRC or with an agreement state prior to receipt of the material—obtain written verification that the transferee’s DOE-approved radiation protection program or license encompasses or authorizes the receipt of the type, form, and quantity of material to be transferred. Verification methods include:

- A. A current copy of the transferee’s specific license or registration certificate, or DOE authorization
- B. Other sources of information obtained by the transferor and compiled by a reporting service from official records of the NRC, the licensing agency of an agreement state, or DOE.

#### **4.6.9.15 Sealed Source Accounting**

4.6.9.15.1 RSC: Follow inventory and accountability reporting procedures for all accountable radioactive sealed sources as defined by DOE O 231.1B Chg 1.

4.6.9.15.2 Follow additional documentation and record-keeping requirements for accountable radioactive sealed sources (<http://www.hss.energy.gov/healthsafety/wshp/radiation/>), as applicable, in 10 CFR 835.

## **5. RECORDS**

Radioactive source custodian and source custodian appointment letter

Semiannual inventory paperwork

Source Custodian Inventory and Authorized Source User List

Form 441.60, “ICP Accountable Radioactive Source Registration and Transfer”

Form 441.65, “Source Checkout Log Sheet”

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Form 441.87, “Sealed Radioactive Source Leak Test”

Radioactive source certification

**NOTE:** *MCP-557, “Records Management,” the INL Records Schedule Matrix, and associated record types list(s) provide current information on the storage, turnover, and retention requirements for these records.*

## 6. DEFINITIONS

*Accountable sealed radioactive source.* A sealed radioactive source having a half-life equal to or greater than 30 days and an isotopic activity equal to or greater than the corresponding value provided in 10 CFR 835, Appendix E.

*Agreement state.* Any state with which the Atomic Energy Commission or the NRC has entered into an effective agreement under Subsection 274b of the Atomic Energy Act of 1954, as amended.

*Class I consumer products.* *Consumer products* (see def.) consisting of static elimination devices, ion generation tubes, smoke detectors, and other consumer products not listed in *Class II consumer products* (see def., Appendix A).

*Class II consumer products.* Consumer products consisting of gas chromatographs and other instruments containing byproduct material used for gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition, or for producing light or an ionized atmosphere. See Appendix A.

*Consumer products.* For the purposes of this procedure, products that are covered by NRC licenses issued according to 10 CFR 31, “General Domestic Licenses for Byproduct Material” (Sections 2 and 5) (see Appendix A).

*Exempt sealed radioactive source.* A sealed radioactive source with a half-life less than 30 days or with activity less than the corresponding value provided in 10 CFR 835, Appendix E.

*Movement.* The sealed source is sent to another location without a change in sealed source custodianship. Examples include sending the sealed source to a calibration laboratory or loaning a source to another custodian temporarily.

*Nuclear material.* Material defined by DOE order that requires safeguards accountability and reporting to the Nuclear Material Management and Safeguards System (NMMSS), which includes americium-241 (Am-241), curium (Cm), berkelium (Bk), californium (Cf-252), deuterium (D), tritium (H-3), lithium-6 (Li-6), neptunium-237 (Np-237), plutonium-238 through -242 (Pu-238 through Pu-242), thorium (Th), uranium-233 (U-233), depleted uranium (DU), enriched uranium (U-235), or normal uranium (U).

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*Radiation generating device.* For the purposes of categorizing a sealed radioactive source as a radiation generating device, the radiation intensity of the unshielded source must equal or exceed 1 rem (10 mSv) in 1 hour when measured at 30 cm from the source.

*Sealed radioactive source.* A radioactive source manufactured, obtained, or retained for the purpose of utilizing the emitted radiation. The sealed radioactive source consists of a known or estimated quantity of radioactive material contained within a sealed capsule, sealed between layer(s) of nonradioactive material, or firmly fixed to a nonradioactive surface by electroplating or other means intended to prevent leakage or escape of the radioactive material.

*Sealed radioactive source custodian.* An individual who is trained (QCSOURCC) and designated by line/program management to maintain cognizance over accountability and control of assigned sealed radioactive sources.

*Sealed source users.* Personnel who are trained (QLSOURCU) to physically handle accountable sealed radioactive sources or portable equipment or devices containing accountable sources. Personnel operating fixed consumer products (see Appendix A) in nonradiological areas in accordance with the manufacturer's instructions are exempt from source user training.

*Source leak testing.* Testing to determine whether a sealed radioactive source is leaking radioactive material.

*Transfer.* Source custodianship changes, whether or not the sealed source is physically moved.

## 7. REFERENCES

10 CFR 835, "Occupational Radiation Protection"

42 USC § 2011 et seq., "Atomic Energy Act of 1954," *United States Code*.

DOE O 231.1B Chg 1, "Environment, Safety and Health Reporting"

DOE O 232.2, "Occurrence Reporting and Processing of Operations Information"

DOE O 441.1-1C Admin Chg 1, "Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection"

DOE O 470.4B, "Safeguards and Security Program"

Form 441.60, "ICP Accountable Radioactive Source Registration or Transfer"

Form 441.87, "Sealed Radioactive Source Leak Test"

MCP-121, "Areas Containing Radioactive Materials"

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MCP-138, “Control and Registration of Radiation-Generating Devices”

MCP-139, “Radiological Surveys”

MCP-187, “Posting Radiological Control Areas”

MCP-190, “Event Investigation and Occurrence Reporting”

MCP-1185, “Material Acquisitions”

PLN-556, “Transport Plan for the Movement of RCT Materials at the INEEL”

PRD-183, “Radiological Control Manual”

## **8. APPENDIXES**

Appendix A, Consumer Products

Appendix B, Sealed Radioactive Source Numbering System

Appendix C, Sealed Radioactive Source Labels

Appendix D, Source Leak Test and Dimension Check Methods

Appendix E, Table of Radioactive Sealed Sources

Appendix F, Procedure Basis

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## Appendix A

### Consumer Products

Class I consumer products are static elimination devices, ion generation tubes, smoke detectors, and other consumer products not listed in Class II consumer products below (10 CFR 31.3).

1. The device(s) and its radioactive source(s) are not subject to Management Control Procedure (MCP) -137, "Radioactive Source Accountability and Control."
2. No sealed source leak tests or special surveys are required as long as the sealed radioactive source(s) is used for its intended purpose and according to the manufacturer's recommendations.
3. No additional labeling other than that attached by the manufacturer is required.
4. Once the device(s) is no longer needed, it must be treated as radioactive waste and disposed of according to the appropriate waste acceptance criteria or returned to the manufacturer.
5. When used as intended, the device(s) does not require Department of Energy (DOE) approval prior to storage or use at facilities located within the City of Idaho Falls. In addition, it is not counted as part of the isotopic limits established between DOE and the Idaho National Laboratory (INL) Research Center (IRC) for operation of that facility.
6. Additional requirements from 10 Code of Federal Regulations (CFR) 31.3, "Certain devices and equipment," may apply.

Class II consumer products are gas chromatographs and other instruments containing byproduct material used for gauging or controlling thickness, density, level, interface location, radiation, leakage, or qualitative or quantitative chemical composition or for producing light or an ionized atmosphere (10 CFR 31.5).

1. The device(s) and its sealed radioactive source(s) must comply with MCP-137.
2. Source leak tests, special surveys, and disposal are performed according to the manufacturer's recommendations.
3. Maintain all labels affixed to the device at the time of receipt.
4. When used as intended, the device(s) requires DOE approval prior to storage or use at facilities located within the City of Idaho Falls. In addition, it is counted as part of the isotopic limits established between DOE and the IRC for operation of that facility.
5. Additional requirements from 10 CFR 31.5 may apply.

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General criteria that apply to Classes I and II consumer products below (10 CFR 31.5):

1. When used in accordance with the manufacturer's recommendation, the equipment identified is not required to be stored in a Radioactive Material Area.

If the sealed radioactive source(s) is removed from the device or the device is not used according to the manufacturer's recommendations, then the appropriate training, sealed radioactive source, and radioactive material instructions from MCP-137 and MCP-121, "Areas Containing Radioactive Materials," apply.

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## Appendix B

### Sealed Radioactive Source Numbering System

Each accountable sealed radioactive source is identified by a unique identification number. This number may consist of an alphabetic letter(s) for the area identification, a number for the source type, the symbol of the primary or most restrictive radionuclide, and up to four additional numbers for identification of the sealed source within its nuclide classification (for example, I-3Ni032). The unique identification number is provided by the radioactive source coordinator (RSC). Transferring a sealed source to another facility does not require issuing a new sealed source number (the only requirement is that the identification number be unique). Sources assigned numbers under a previous numbering system may retain their numbers until further notice.

Area ID Letters <sup>a</sup>		Source Type Numbers <sup>b</sup>	
CP	INTEC	1	Laboratory Standard <sup>c</sup>
W	RWMC	2	Working Standard <sup>d</sup>
		3	Installed/Inaccessible
		4	Neutron-Emitter
		5	Gamma Radiography
		6	Mixed Radionuclide
		7	Performance Check/Miscellaneous

- a. Additional area identification letters that are not listed may be used as the need arises.
- b. If a source falls into more than one source type, the RSC will decide which type is most appropriate from the information received.
- c. A “Laboratory Standard” is a source calibrated by a comparison directly to a national standard.
- d. A “Working Standard” is a source calibrated by comparison to a source or standard other than a national standard.

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**Appendix C**

**Sealed Radioactive Source Labels**

Labels for sealed radioactive sources are shown below in Figures C-1 through C-7, and are available from the radioactive source coordinator (RSC). The color scheme is black lettering on a yellow background except for Figure C-5, which has a white background. Other labels (for example, designed to fit source dimensions/area, or an industry standard design) having equivalent information and approved by the RSC may be used.



**CAUTION:**  
Radioactive Material

INL ID #: \_\_\_\_\_  
 Radionuclide(s): \_\_\_\_\_  
 Total Activity: \_\_\_\_\_  
 Assay Date: \_\_\_\_\_  
 Mfgr. Model #: \_\_\_\_\_  
 Mfgr. Serial #: \_\_\_\_\_  
 Source Custodian: \_\_\_\_\_  
 Telephone #: \_\_\_\_\_

Contact Rad. Level: \_\_\_\_\_  
 Beta/Gamma dpm: \_\_\_\_\_  
 Alpha dpm: \_\_\_\_\_  
 Survey Date: \_\_\_\_\_  
 RCT Sig.: \_\_\_\_\_

Figure C-1. Large label.



**CAUTION:**  
Radioactive Material  
Installed Radioactive  
Source, Contact RadCon  
Before Opening

INL ID #: \_\_\_\_\_  
 Radionuclide(s): \_\_\_\_\_  
 Total Activity: \_\_\_\_\_  
 Assay Date: \_\_\_\_\_  
 Mfgr. Model #: \_\_\_\_\_  
 Mfgr. Serial #: \_\_\_\_\_  
 Source Custodian: \_\_\_\_\_  
 Telephone #: \_\_\_\_\_

Contact Rad. Level: \_\_\_\_\_  
 Beta/Gamma dpm: \_\_\_\_\_  
 Alpha dpm: \_\_\_\_\_  
 Survey Date: \_\_\_\_\_  
 RCT Sig.: \_\_\_\_\_

Figure C-2. Installed source label.

Contact Rad. Level: \_\_\_\_\_  
 Beta/Gamma dpm: \_\_\_\_\_  
 Alpha dpm: \_\_\_\_\_  
 Survey Date: \_\_\_\_\_  
 RCT Sig.: \_\_\_\_\_

Figure C-3. Large survey update label.



Figure C-4. Trefoil label.

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<b>CAUTION:</b> Integrity Test Required Before Use  Source Custodian: _____ Telephone #: _____
--

Figure C-5. Integrity test required label.

	<b>CAUTION, Radioactive Material</b> ICP ID #: _____ Nuclide(s): _____ Activity: _____ Assay Date: _____ Mfgr Model #: _____ Mfgr Serial #: _____ Source Custodian: _____ Phone #: _____ Contact Rad. Level: _____ Beta/Gamma dpm: _____ Alpha dpm: _____ Date Surveyed: _____ RCT Sig.: _____
---	---

Figure C-6. Small source label.

Contact Rad. Level: _____ Beta/Gamma dpm: _____ Alpha dpm: _____ Date Surveyed: _____ RCT Sig.: _____
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Figure C-7. Small survey update label.

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## Appendix D

### Source Leak Test and Dimension Check Methods

#### 1. GENERAL RCT INSTRUCTIONS

**NOTE:** *Radiation exposures incurred during source leak testing should be kept as low as reasonably achievable (ALARA).*

- 1.1 Measure the sealed source dose/count rate. The dose/count rate information may be composed of one or more of the sources below, so that the next RCT can reproduce the configuration in which these measurements were taken.

**NOTE:** *For many sealed sources, the dose/count rate is not above the background dose/count rate. For these sources, it is preferred to have a non-zero result (the background dose/count rate) rather than a zero result.*

- A. Open the window (“bg” or “βγ”) ion chamber meter (mR/h) reading, uncorrected beta
  - B. Closed the window (“g” or “γ”) ion chamber meter (mR/h) reading
  - C. Neutron (“n” or “η”) meter (mrem/h) reading
  - D. Alpha (“a” or “α”) count rate meter (cpm) readings
  - E. Beta (“b” or “β”) count rate meter (cpm) readings
  - F. Distance from the detector to the sealed source, sealed source container, etc.
  - G. Instrument model and identification numbers
  - H. Sealed source configuration (what is between the source and the detector).
- 1.2 Minimize exposures by using the following techniques, as deemed necessary:
- A. Minimize the handling time
  - B. Use remote-handling devices such as handles or tongs
  - C. Use shielding.
- 1.3 Use indirect test methods (such as swiping the exhaust port or sample pathway) for accountable sealed radioactive sources that exceed:
- A. 100-mrem/hr whole body radiation dose rate
  - B. 500-mrem/hr extremity radiation dose rate.

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- 1.4 Use special care when sealed source leak testing electroplated sources. Damage could occur to the source and/or activity could be removed because of rough handling. For these sealed sources, a wipe test may be made of the interior of the container and/or around the perimeter of the active source surface.
- 1.5 For sealed radioactive sources located in an inactive sealed source container, shield, or device, perform the source leak test where the contamination is most likely to occur from a failure of the sealed source (for example, at exhaust ports of gas chromatography devices).
- 1.6 Do not disassemble an inactive sealed source container, complex device, or instrument for the sole purpose of source leak testing.
- 1.7 Perform a leak test of the sealed radioactive source when the sealed container, instrument, or device is next opened.

**NOTE:** *Although 10 Code of Federal Regulations (CFR) 835, “Occupational Radiation Protection,” uses a leak test value of 0.005  $\mu$ Ci (11,100 dpm) for a detection level, the RadCon organization has chosen to use more conservative values (Program Requirements Document [PRD] -183, “Radiological Control Manual,” Table 2-2, values).*

- 1.8 Ensure that the counting instrument used for the source leak test is capable of verifying removable contamination less than the values specified in PRD-183, Table 2-2. If counting electron capture decay sources that have been purchased by approval of the RadCon program director, ensure that the counting systems are capable of counting these source(s) to less than the values specified in PRD-183, Table 2-2.
- 1.9 If the removable activity exceeds the values specified in PRD-183, Table 2-2, contain the sealed source and notify the sealed source custodian, project RadCon management, and the RSC immediately.
- 1.10 Record the dose or count rate information on Form 441.87, “Sealed Radioactive Source Leak Test,” or the semiannual inventory paperwork. Examples include:
  - A. 3.5 mR/h bg @ position 2 (30 cm) w/RO-20, 801813
  - B. 48 mR/h  $\eta$ , 5 mR/h  $\gamma$  @ 3 ft in line with the plug removed from a 12-in. diameter shielding pig w/E-600, 801892, RSO-50e, 801803
  - C. “N/C” (no change) or “same” w/2A, 800040, Electra, 801631 – for a reading that has not changed from the one provided on the semiannual inventory paperwork

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- D. “N/A” (not applicable) for sealed sources identified in Section 4.9.1.
- 1.11 Record the sealed source leak test results (in net counts per minute) and the counter information on Form 441.87 or the semiannual inventory paperwork. Include the following items on the semiannual inventory paperwork:
- A. Source leak test date (understood to be the dose/count rate reading date)
  - B. “N/A” in the leak test date and in the leak test results when the source is inaccessible or in storage because it has been removed from service.
- 1.12 When two swipe counters are listed on the semiannual inventory paperwork, record the counter used (“A” or “B”) with the source leak test results.
- 1.13 Attach laboratory counter results to the semiannual inventory paperwork.
- 1.14 Sign and date Form 441.87 or initial the dose/count rate information and sign and date the counter information on the semiannual inventory paperwork. The leak test date on the semiannual inventory paperwork also is the dose/count rate reading date.
- 1.15 Have RadCon supervision review the radiological information on Form 441.87 or the semiannual inventory.
- 1.16 Record/update the radiological information on the sealed radioactive source label. Ensure that the sealed source custodian information is recorded/updated.
- 1.17 If a sealed source is inaccessible or the sealed source was removed from service, ensure that an “Integrity Test Required Before Use” label is attached on/near each sealed source or sealed source location.
- 1.18 If the sealed source leak test methods discussed in this appendix do not apply to a particular sealed source, contact the RSC for direction.

**NOTE:** *Appendix A of American National Standards Institute (ANSI) N43.6-1997, “Sealed Radioactive Sources - Classification,” contains additional source leak test methods.*

## 2. DIMENSION CHECKS

- 2.1 If a dimension check is to be performed, pass the sealed source through its “test ring” (this metal ring is a source measuring device provided by the manufacturer for some sources and should be kept in the sealed source storage container). Passing through the “test ring” indicates no appreciable swelling.

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- 2.2 Notify the sealed source custodian, RadCon foreman, and RSC when the sealed source does not pass through the “test ring.”

### 3. RADIUM SEALED SOURCES

- 3.1 When practical, keep a “Microsorban” filter in the sealed source storage container next to the sealed source.
- 3.2 If it is not possible to leave the “Microsorban” filter and the radium sealed source in contact, swiping the sealed source with the filter will suffice, (unless the sealed source is electroplated and should not be contacted directly).
- 3.3 At the time of the leak test, remove the filter and count it with an alpha counter. Place a fresh “Microsorban” filter in the sealed source storage container.

### 4. PLUTONIUM-BERYLLIUM, AMERICIUM-BERYLLIUM, AND POLONIUM BERYLLIUM SEALED SOURCES

- 4.1 Swipe the inside of the sealed source storage container and the barrel (sealed source path) with the same swipe material. Use a separate swipe to wipe the sealed source (where accessible).
- 4.2 Count the swipes with an alpha counter.

### 5. GAMMA RADIOGRAPHY SOURCES

#### WARNING

**Gamma radiography sources produce high radiation fields.**

- 5.1 Swipe the inside of the guide tubes and the ends of the cameras using a cotton-tipped swab.

**NOTE:** *Guide tubes and cameras often are used interchangeably with different sources. Contamination in the guide tube or camera could be from any leaking source or from a contaminated area in which the equipment was used.*

- 5.2 If contamination is present on the swipe, submit the swipe for gamma spectrum analysis to identify the radionuclides.

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## 6. ELECTRON CAPTURE DETECTORS

**NOTE:** *Because of the varying nature of electron capture detectors (ECDs) used in gas chromatographs (GCs), the specific manufacturer's sealed source leak test procedure will be followed, provided the instructions meet Department of Energy requirements.*

- 6.1 Radiological Engineer: Review the manufacturer's sealed source leak test instructions to ensure that 10 CFR 31, "General Domestic Licenses for Byproduct Material," requirements are met. Contact the RSC for assistance, if needed.
- 6.2 Radiological Engineer: Submit a reviewed and approved copy of the sealed source leak test procedure to the RSC.
- 6.3 RCT: Notify the GC operator of the intent to perform the sealed source leak test, and obtain assistance from the operator, if necessary.

### WARNING

**Swiping the active surface of the ECD will spread contamination.**

- 6.4 Swipe the accessible portions (inlet and outlet lines) of the ECD housing using swipes and/or cotton swabs.
  - 6.5 Submit the sample(s) for analysis by liquid scintillation (or equivalent) low-energy beta sensitivity techniques.
- ## 7. OTHER SEALED SOURCES NOT LISTED ABOVE
- 7.1 Swipe the surface of the sealed source and/or the sealed source storage container, where practical, using swipes or cotton-tipped swabs.
  - 7.2 Use special care when handling volatile radionuclides (such as iodine), to maximize the probability that the sample will collect any leaking material.
    - 7.2.1 Impregnate the swipe/swab with granulated charcoal, and leave the swipe/swab in the presence of the sealed source for several minutes.
    - 7.2.2 Analyze the swipe or cotton-tipped swab in an appropriate counter or spectrometer capable of detecting the radionuclide(s) of interest.

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**Appendix E**

**Table of Radioactive Sealed Sources**

The table below is provided as an information tool from DOE O 231.1B Chg 1, “Environment, Safety and Health Reporting.” The current revision of the table should be verified against the current version of the table in the order posted at <https://www.directives.doe.gov/directives/current-directives/all-current-directives>.

**TABLE OF RADIOACTIVE SEALED SOURCES\***

Radionuclide	Category 1 <sup>1</sup> [1000 x D] <sup>2</sup>		Category 2 [10 x D]		Category 3 [1 x D]	
	(TBq) <sup>3</sup>	(Ci) <sup>4</sup>	(TBq)	(Ci)	(TBq)	(Ci)
Ac-227	2.E+01	5.4E+02	2.E-01	5.4E+00	2.E-02	5.4E-01
Am-241	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Am-241/Be	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Cf-252	2.E+01	5.4E+02	2.E-01	5.4E+00	2.E-02	5.4E-01
Cm-244	5.E+01	1.4E+03	5.E-01	1.4E+01	5.E-02	1.4E+00
Co-60	3.E+01	8.1E+02	3.E-01	8.1E+00	3.E-02	8.1E-01
Cs-137	1.E+02	2.7E+03	1.E+00	2.7E+01	1.E-01	2.7E+00
Gd-153	1.E+03	2.7E+04	1.E+01	2.7E+02	1.E+00	2.7E+01
Ir-192	8.E+01	2.2E+03	8.E-01	2.2E+01	8.E-02	2.2E+00
Pm-147	4.E+04	1.1E+06	4.E+02	1.1E+04	4.E+01	1.1E+03
Po-210	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Pu-236 <sup>5</sup>	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Pu-238	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Pu-239	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Pu-239/Be	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Pu-240 <sup>5</sup>	6.E+01	1.6E+03	6.E-01	1.6E+01	6.E-02	1.6E+00
Ra-226	4.E+01	1.1E+03	4.E-01	1.1E+01	4.E-02	1.1E+00
Se-75	2.E+02	5.4E+03	2.E+00	5.4E+01	2.E-01	5.4E+00
Sr-90 (Y-90)	1.E+03	2.7E+04	1.E+01	2.7E+02	1.E+00	2.7E+01
Th-228	2.E+01	5.4E+02	2.E-01	5.4E+00	2.E-02	5.4E-01
Th-229	2.E+01	5.4E+02	2.E-01	5.4E+00	2.E-02	5.4E-01
Tm-170	2.E+04	5.4E+05	2.E+02	5.4E+03	2.E+01	5.4E+02
Yb-169	3.E+02	8.1E+03	3.E+00	8.1E+01	3.E-01	8.1E+00

(\*Ac-227, Th-228, and Th-229 are not in the IAEA Code of Conduct on the Safety and Security of Radioactive Sources, IAEA, January 2004. DOE and NRC have determined they will be included in the National System.)

<sup>1</sup> Designates IAEA Category 1, 2, and 3 radioactive sealed sources [IAEA Basic Safety Guide RS-G-1.9]

<sup>2</sup> “D” designate a dangerous source as defined in the NRC Final Rule for National Source Tracking of Sealed Sources and the IAEA Code of Conduct.

<sup>3</sup> “TBq” designates Terabecquerel, a unit of radioactivity.

<sup>4</sup> “Ci” designates Curie, a unit of radioactivity.

<sup>5</sup> Inventory and transaction data on Pu-236 and Pu-240 will not be reported in the NSTS and are included for DOE purposes only.

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## Appendix F

### Procedure Basis

Step	Basis	Source	Citation
1.2	An accountable sealed radioactive source is not subject to periodic inventory and source leak testing if that source is located in an area that is unsafe for human entry or otherwise inaccessible.  Unsealed radioactive source control.	10 CFR 835 PRD-183  PRD-183	§1202 (d) 431.6  Glossary
4.1.4.2	A source custodian is designated to maintain control of accountable sealed radioactive sources.	PRD-183	431.13
4.1.4.4	RSC approval is required of sources brought on-Site.	PRD-183	431.12
4.2	Training must meet regulatory requirements.	DOE G 441.1-1C	Definitions
4.3	Procuring or acquiring sources must be DOE compliant.	PRD-183	431.10
4.4	Receipt survey must be performed of radioactive sources.	PRD-183	431.11
4.6.2.1	Accountable sealed radioactive source must be labeled with trefoil and “Caution, Radioactive Material.”	10 CFR 835 PRD-183	§605 431.9
4.6.2.4	“In addition to performing Section 4.6.2.1, label all sealed radioactive sources with activity greater than or equal to 10% of 10 CFR 835 Appendix E, values or >0.1 Ci with the following source information...”	DOE G 441.1-1C PRD-183-4	Section 15.4 431.2
4.6.3	Storing radioactive sources must be regulatory compliant.	PRD-183	431.8
4.6.4	Each accountable sealed radioactive source must be inventoried at intervals not to exceed 6 months. Items to address during the semiannual inventory (physical location, adequacy of postings and labels, adequacy of storage locations, containers, and devices).	10 CFR 835 PRD-183	§1202 (a) 431.3

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Step	Basis	Source	Citation
4.6.4.5 4.6.5.2	This time interval for performing source inventory and leak tests may be extended up to 30 days to accommodate scheduling needs.	10 CFR 835 PRD-183	Section 3(e) 431.3, 431.4
4.6.5	Accountable sealed radioactive sources removed from service are exempt from source leak test requirements.  Source leak testing of accountable sealed radioactive sources.  Control of accountable sealed radioactive sources leaking radioactive material at levels exceeding 0.005 $\mu$ Ci (PRD-183, Table 2-2, values are conservatively used instead).	10 CFR 835 PRD-183  10 CFR 835 PRD-183  10 CFR 835 PRD-183	§1202 (c) 431.5  §1202 (b) 431.4  §1202 (e) 431.7
4.6.6	Using radioactive sources.	DOE G 441.1-1C	Discussion
4.6.9	Reporting radioactive sealed source information must be DOE compliant.	DOE O 231.1B Chg 1	Attachment 5
5	Records retention requirements.	PRD-183	712.1