University of Maryland, Baltimore

Radiation Safety Procedure

Procedure Number: 2.3

Title: Sealed Radioactive Source Use, Inventories, and Leak Tests

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_____ **Date:**_____
Chair, Radiation Safety Committee

PROCEDURE 2.3, SEALED RADIOACTIVE SOURCE USE, INVENTORIES AND LEAK TESTS

1.0 Purpose:

This procedure provides instructions for using sealed radioactive sources and for scheduling, conducting and documenting periodic sealed radioactive source inventories and leak tests as required by UMB's radioactive materials licenses and by COMAR Section D.401, D.1206, and G.19.

2.0 Scope:

2.1. This procedure applies to all uses of sealed radioactive sources and to inventories and leak tests on all sealed radioactive sources possessed by UMB under its various radioactive material licenses issued by the Maryland State Department of the Environment.

2.2. As used in this procedure, the term "sealed radioactive source" (or "sealed source" or "source") means radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions that are likely to be encountered in normal use and handling [A.2]. Radioactive materials in UMB's possession that do not meet this definition (e.g., containers of radioactive waste, various sample media, unsealed radioactive material containers) are not subject to the requirements of this procedure.

2.3. The following sealed radioactive sources are excepted from these leak test requirements:

- Sealed radioactive sources containing 3.7 MBq (100 μCi) or less of beta-gamma-emitting radioactive material [D.401(a)(iv)];
- Sealed radioactive sources containing 370 KBq (10 μCi) or less of alpha-emitting radioactive material [D.401(a)(iv)];
- Sealed radioactive source containing only H-3 (Tritium) [D.401(a)];
- Sealed radioactive sources containing only material with a half life of 30 days or less [D.401(a)];
- Sealed radioactive sources containing only gaseous radioactive material [D.401(a)];
- Sealed radioactive sources that are possessed only for medical use and contain only seeds of Iridium-192 encased in nylon ribbon [G.19(f)(4)]; and

- Sealed radioactive sources that are possessed only for medical use and are in storage and not in use [G.19(f)(5)].

3.0 Procedure:

3.1. General Requirements for Sealed Radioactive Sources

3.1.1. EHS shall maintain an inventory of all sealed radioactive sources possessed by UMB and develop a schedule for performance of required inventories and leak tests.

3.1.2. Sealed radioactive sources shall not be opened under any condition [MD-07-014-01.17].

3.1.3. If contamination of the accessible source surface is suspected, wear appropriate protective clothing, such as lab coat and gloves, when handling the source.

3.1.4. If the activity of the source(s) is such that significant exposure to the whole body or extremities is possible, take appropriate precautions, such as use of a long-handled tool to acquire the sample.

3.1.5. When working with or in the vicinity of sealed radioactive sources, wear individual monitoring devices, including extremity dosimeters, as required by Procedure 3.1, *Individual Monitoring*.

3.1.6. In addition to the requirements of this procedure, all sealed radioactive sources and brachytherapy sources shall be used, handled, and stored in accordance with any radiation safety and handling instructions provided by the manufacturer or equivalent instructions approved by MDE [G.19(a)]. These handling instructions will be maintained in a legible form that is convenient for individuals using or handling the source(s) [G.19(a)].

3.1.7. Sealed radioactive sources shall be labeled and the affected storage and use areas shall be posted as necessary in accordance with Procedure 2.2, *Posting and Labeling for Radiation Safety*.

3.2. Scheduling of Inventories for Sealed Radioactive Source Possessed for Medical Use

3.2.1. EHS shall establish a tracking system to ensure that physical inventories of sealed radioactive sources (including brachytherapy

sources) possessed for medical use are performed no less frequently that once every three months [G.19(g)].

3.2.2. EHS shall conduct a physical inventory of all sealed radioactive sources possessed under MD License MD-07-014-01 no less frequently than once every six months. EHS shall document the quantities, kinds, and locations of the sealed radioactive sources and the date of the inventory [MD-07-014-01.18].

3.3. Scheduling of Leak Tests

Leak Tests shall be performed as follows:

- Prior to initial use, unless accompanied by a certificate documenting a satisfactory leak test by the previous owner in the last six months) [D.401(a), MD-07-014-01.16.A];
- At intervals not to exceed 6 months or other interval specifically approved by MDE, the USNRC, or another Agreement or Licensing State [D.401(a), G.19(b)(2), MD-07-014-01.16.A];
- Whenever there is reason to suspect the source might have been damaged or might be leaking (e.g., involvement in fire or mishandling, unexpected discovery of contamination in surrounding area) [D.401(a), MD-07-014-01.16.A].

3.4. Performance of Leak Tests

3.4.1. Leak tests shall be performed only be individuals who are specifically authorized by EHS, in accordance with COMAR D.401(b).

3.4.2. If the sealed radioactive source is contained in a device equipped with an “On/Off” (or similar) control that exposes the source, the leak test shall be performed with the control in the “Off” position [G.19(c)(3)].

3.4.3. Smear accessible surfaces of the sealed radioactive source, taking care not to damage the exposed surface. If the source is enclosed in a container that makes the source inaccessible, smear accessible surfaces that one would expect to become contaminated if the source was leaking. If the source retainer is extremely delicate (as is common with alpha-emitting sources), do not smear the surface of the source directly; smear only the perimeter of the source holder rather than the exposed surface of the radioactive material [MD-07-014-01.16.B].

3.4.4. Perform an analysis of the smear in an appropriate counting system.

3.4.5. For sources other than those manufactured to contain radium, the analysis must be capable of detecting contamination at 185 Bq (0.005 μCi) or less [MD-07-014-01.16.B].

3.4.6. For sources manufactured to contain radium, the collection efficiency for the method, volume, and time for Rn-222 and its daughters must be determined and the analysis must be capable of detecting an absolute leakage rate of 37Bq (0.001 μCi) or less of Radon-222 in a 24 hour period [D.401(a)(ii)]. In addition, test samples shall be taken from the interior surfaces of the container in which the radium-containing sources are stored. These samples shall be analyzed using a method that is capable of detecting the presence of 185 Bq (0.005 μCi) of any radium daughter having a half life exceeding four days [D.401(a)(iii)].

3.5. Leak Test Criteria

3.5.1. A sealed radioactive source that has not been manufactured to contain radium shall be considered to be leaking if the leak test reveals the presence of 185 Bq (0.005 μCi) or more of removable contamination [D.401(c)(i & ii), MD-07-014-01.16.D].

3.5.2. A sealed radioactive source manufactured to contain radium shall be considered to be leaking if the source leaks 37 Bq (0.001 μCi) or more of Radon-222 per 24 hours or the test reveals the presence of removable contamination resulting from the decay of 185 Bq (0.005 μCi) or more of Radium-226 [D.401(c)(i & ii)].

3.6. Corrective Actions for Leaking Sealed Radioactive Sources

If a sealed radioactive source is found to be leaking radioactive material at levels exceeding the specified criteria, EHS shall:

- Remove the source from use and store it in an appropriate storage area [D.401(c)(i & ii), G.19(e)(1), MD-07-014-01.16.D];
- Implement actions to prevent the spread of contamination (e.g., isolation of the source in a sealed container) [D.401(c)(i & ii)];
- Arrange to have to source decontaminated and repaired or disposed of in accordance with UMB radioactive waste disposal procedures [D.401(c)(i & ii), MD-07-014-01.16.D].

4.0 Records and Reports:

4.1. Records

4.1.1. All records shall meet the applicable requirements of Procedure 1.2, *Radiation Safety Records*.

4.1.2. EHS shall develop and maintain records of:

4.1.3. Initial and periodic sealed radioactive source inventories and periodic leak tests. The records shall include:

- The model number, if assigned [G.19(d & g)].
- The serial number, if assigned. [G.19(d & g)];
- The radionuclide(s) [G.19(d & g)];
- The estimated activity [G.19(d & g)];
- The measured test sample activity in units of microcuries [D.401(d), G.19(d & g), MD-07-014-01.16.C];
- A description of the method used to measure each test sample (e.g., a standardized procedure or desk instruction) [G.19(d & g)]; and
- The signature of the RSO [G.19(d & g)].

4.1.4. EHS shall maintain records of sealed radioactive source and brachytherapy source use and handling instructions provided by the source manufacturer or any equivalent instructions approved by MDE [G.19(a)].

4.1.5. EHS shall maintain records of reports filed with MDE pursuant to Section 4.2, Reports, of this procedure.

4.2. Reports

4.2.1. EHS shall report to MDE any leak test that indicates sealed radioactive source leakage exceeding the specified criteria. The report shall include:

- A description of the equipment involved;
- The test results; and
- Actions taken.

4.2.2. Required reports shall be submitted within five days of discovery of the leaking sealed radioactive source [D.401(e), D.1206, G.19(e)(2), MD-07-014-01.16.D].

4.2.3. Reports shall be developed and submitted in accordance with Procedure 1.3, *Radiation Safety Reporting*.

5.0 References:

COMAR 26.12.01.01
Maryland Radioactive Material License MD-07-014-01
USNRC Regulatory Guide 10.8, “Guide for the Preparation of Applications for Medical Use Programs”
UMB Radiation Safety Program