February 13, 2018

Methodist Hospitals

600 Grant Street
Gary, Indiana 46402
Northlake Campus

8701 Broadway
Merrillville, Indiana 46410
Southlake Campus

Re: Amendment of Radioactive Material License 13-16558-01

As the contact for this Radioactive Material License RML, I request our license be amended in the following ways:

In regards to Leak-Testing of Sealed Sources, please:

Add the ability to perform leak testing of sealed sources in-house as well as the ability to send them to other individuals licensed by the NRC, an agreement state or a licensing state to perform leak testing analysis. We will only be testing our own in-house sources. Nuclear Medicine Staff will be performing the analysis using the procedure and paperwork attached to this letter. This analysis is being performed on a Capintec Captus 3000 with a Thallium activated Na I well type crystal PM tube well counter. The calculation demonstrating MDA is on the worksheet. The well counter is sensitive enough to detect below 0,005 microcuries.

Sincerely,

2/14/18

Jesse Pacheco, Radiation Safety Officer DATE

RECEIVED FEB 15 2018

Procedure for Leak-Testing Sealed Sources

☒ Leak testing and sample analysis of sealed sources will be performed by individuals licensed by the U.S. Nuclear Regulatory Commission, an agreement state, or a licensing state to perform leak testing analysis.

RECORDS

Records of leak tests must be maintained for 3 years. The records must include the model number and serial number (if assigned of each source tested), the identity of each source radionuclide and its estimated activity, the measured activity of each test sample expressed in microcuries (becquerels), the date of the test, and the name of the individual who performed the test analysis.

LEAK TEST SAMPLES

1. If testing sources stronger than a few millicuries, a survey meter, preferably with a speaker, will be used to monitor exposure rates.

2. A separate wipe sample for each source is prepared. A cotton swab, injection prep pad, filter paper, or tissue paper is suitable. Number each wipe so you will know for which source it is to be used. Samples should be taken as follows:

   A. For small sealed sources, it may be easier to wipe the entire accessible surface area. Pay particular attention to seams and joints. However, do not wipe the port of beta applications.

   B. For larger sealed sources and devices (instrument calibrator, bone mineral analyzer source), take the wipe near the radiation port and on the activating mechanism.

   C. For teletherapy machines, take the wipe with the source in the off position. Wipe the area near the shutter mechanism, taking care not to touch the field light, mirror or cross hairs. Also wipe the primary and secondary collimators and trimmers.

   D. If you are testing radium sources at the same time, they should also be checked for radon leakage. This can be done by submerging the source in a vial of fine-grained charcoal or cotton for a day. Remove the source and analyze the absorbent sample as described below. A survey should be done to be sure the sources are adequately shielded during the leak test period.

☒ Leak testing of sealed sources will be performed in house following the procedures listed below.

Image 1

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LEAK TEST ANALYSIS

The samples will be analyzed as follows:

1. Select an instrument that is sufficiently sensitive to detect 0.005 microcurie. For beta sources, use a proportional flow counter or liquid scintillation counter. For gamma sources, a NaI crystal with a scaler will be appropriate. Dose calibrators used in nuclear medicine are not sufficiently sensitive.

2. Sensitivity of Instrument

   Determine the minimum sample counting times needed to distinguish 0.005 microcurie from the background for each instrument.

   Measure the background count rate (Rb) in counts per minute (cpm) and record.

   Measure the correction factor (CF) using a known National Institute of Standards and Technology (N.I.S.T.) source and record. Assay a certified check source that has the same isotope as the sealed source being tested. If a certified check source is not available, it will be necessary to use one with a different isotope that has a similar energy spectrum.

   $CF = \frac{Rst-Rb}{A(\mu Ci)}$ Rst = count rate of standard (cpm)

   Example: Background is 30 cpm and a 10 µCi source measures 40,030 cpm on the instrument.

   $CF = \frac{40,030-30}{10\ \mu Ci} = 4000$ cpm/µCi.

   Calculate minimum sample counting time (t_{ms}) in minutes for the instrument.

   $$\text{Lower Limit of Detection (LLD)} = \frac{4.66}{CF}\sqrt{\frac{Rb}{t_{ms}}}$$

   $$t_{ms} = \left(\frac{4.66}{CF(.005)}\right)^2 Rb$$

   $$t_{ms} = \frac{868,624}{CF \times CF} \times Rb \quad \text{(minutes)}$$

Image 1

3. Results:

   Count each wipe at least t_{ms}

   Determine count rate for each sample $R_s = \frac{N_s}{t_s}$ (cpm)

   N_s = number of counts t_s = sample counting time

   Determine activity as follows:

   $A(\mu Ci) = \frac{R_s - R_b}{CF}$ Record in units of microcuries

4. Continue the same analysis procedure for all wipe samples.

5. If the wipe sample activity is 0.005 microcurie or greater, notify the RSO. The source must be withdrawn from use to be repaired or properly disposed. A report shall be filed within 5 days of the test with the department.

6. Sign and date the list of sources, data, and calculations.

Example

Background is 150 counts in 5 minutes or $\frac{150}{5} = 30$ cpm

10 μCi cesium standard measures 40,030 cpm

$CF = \frac{40,030-30}{10\ \mu Ci} = 4000$ cpm/μCi

$CF = 4000$ cpm/μCi $R_b = 30$ cpm

$t_{ms} = \frac{665,674 \times 30}{(4000)(4000)} = 1.63$ minutes

Must count at least 1.63 minutes.

Have chosen to count each sample 5 minutes.

Wipe #1 159 counts in 5 minutes

$R_1 = \frac{159}{5} = 31.8$ cpm

$A_1 = \frac{31.8-30}{4000} = 0.00045\ \mu Ci$

Wipe #2 184 counts in 5 minutes.

$R_2 = \frac{184}{5} = 32.8$ cpm

$A_2 = \frac{32.8-30}{4000} = 0.0007\ \mu Ci$

Both are < 0.005 microcurie.