OREGON HEALTH & SCIENCE UNIVERSITY

RADIATION SAFETY
OPERATING PROCEDURE
1101

LABORATORY RADIATION SURVEY

I. PURPOSE:

This procedure gives the laboratory worker guidance in performing and documenting the required monthly laboratory radiation surveys.

II. DISCUSSION:

Documented laboratory radiation surveys are required for persons using radioactive materials at Oregon Health & Science University. The surveys consist of directly monitoring the laboratory for radiation contamination and wipe testing for evaluation of removable activity. For laboratories that exclusively use RIA kits, tritium or less than 40 microcuries (received in stock vial) of other nuclides, only wipe tests are required. Documented surveys are not required when radioactive materials have not been used in the lab since the last documented survey. These periods of non-use must be documented in the survey log.

III. EQUIPMENT:

A. Layout diagram of laboratory to be surveyed (form 110SURVY.FRM can be used)
B. Wipes (filter paper)
C. Survey meter(s)
D. Protective gloves (i.e. vinyl, latex)
E. Liquid Scintillation Counter or Gamma Counter
F. "Radioactive Material" tape

IV. PRECAUTIONS:

A. When using a survey instrument:

1. **Do not** contaminate the detector.
2. **Do not** expose the detector to liquids.
3. **Do not** get too close to sharp objects which may puncture and/or damage the probe.

B. Protective gloves must be worn while conducting the wipe survey.

V. PROCEDURE:

A. Preparation

1. Obtain or sketch a laboratory layout diagram. It must include:

   a. The locations of benches, hoods, desks, refrigerators, etc.

   b. All sink locations, including the "Hot Sink" and radioactive material use areas.

2. a. Number the locations on the diagram which are to be wipe tested.

   b. Number wipes (in pencil) to match the layout diagram.

3. Select a survey instrument suitable for the radionuclides used in the laboratory.

4. Perform a battery check on the instrument selected. If the battery check indicates a low battery, replace the batteries.

5. Turn on the instrument to its most sensitive (lowest) setting away from any radioactive material, and record the background reading on the survey form.

6. If the instrument is equipped with a speaker, turn it on. It is easier to pay attention to the surface being monitored if the meter doesn't have to be watched. An increased click rate above background usually indicates contamination.

7. On the laboratory diagram record the following:

   a. Building and room number.
   b. Make and model of the instrument used in the survey (if applicable)
   c. Background count rate of the instrument used
   d. Calibration date of the instrument used
   e. Person performing survey
   f. Date of survey

B. Direct Contamination (Meter) Survey

1. Survey from one side of the lab to the other end of the laboratory with the survey instrument.

2. Survey for surface contamination by moving the detector at a speed that allows you to detect the radionuclide(s) used in the laboratory.

3. Survey at a distance of 1/2 inch to 1 inch from the surface being monitored.

4. Monitor desks, hoods, refrigerator handles, phones, laboratory equipment, etc..

5. Clean areas of contamination with count rates greater than 3x the background count rate. If the contamination is "fixed" (not removable) and the count rate cannot be reduced below 3x background, mark these areas with "RADIOACTIVE MATERIAL" tape and the level of contamination, date, and radionuclide, if known.

6. If no contamination is detected, make note of it on the diagram (such as “no contamination found”, all areas background, etc).

C. Wipe Survey

1. Wipe the locations marked on the laboratory diagram using the numbered wipes. The area wiped should be approximately 100 cm^2 per location.

2. Load an uncontaminated (background) wipe with the survey wipes when prepared for counting.

3. Count the survey wipes and the background wipe with the appropriate instrument (i.e. a liquid scintillation counter or a gamma counter).

4. Results of wipe tests must be reported in disintegrations per minute (dpm) as required by Radiation Protection Services of the Oregon Health Division. To simplify this requirement, determine the minimum detectable activity (MDA) in cpm (counts per minute) and dpm (disintegrations per minute) for each LSC window setting or gamma counter setting.

   MDA[1] in cpm:

$$2.71 + 4.65\sqrt{Background\ (cpm)} + Background$$

   Note: If the counter automatically subtracts background from the results, you do not need to add the background back into the equation.

   Determine MDA in dpm:

$$\frac{2.71 + 4.65\sqrt{Background\ (cpm)}}{(Efficiency)}$$

   Record on Data Sheet:
   a. Efficiency of LSC for the radionuclide counted in each window setting
   b. MDA in cpm for each window used
   c. MDA in dpm for each window used

5. Areas of contamination having count rates greater than 2x the MDA in cpm must be cleaned and resurveyed. The wipes must be recounted and the results documented.

6. Attach the LSC printout and MDA calculations to the survey form. Survey records should be kept in a logbook in the laboratory and retained for two years.

[1]National Council on Radiation Protection, NCRP Report No. 58, "A Handbook of Radioactivity Measurements Procedures;" 1985; p. 309

Example for Calculating MDA in CPM and DPM

Background wipe (uncontaminated wipe) = 20 cpm (for ^{14}C)

Efficiency of LSC or Gamma Counter = 80%(0.80) (for ^{14}C)

To find MDA in cpm:

$$(2.71 + 4.65\sqrt{20}\ (cpm) + 20$$

23 + 20 = 43 = MDA in cpm (for ^{14}C)

To find MDA in dpm:

$$\frac{2.71 + 4.65\sqrt{20}\ (cpm)}{(Efficiency)}$$

23 / 0.80 (efficiency for ^{14}C) = 29 dpm

The relationship is: MDA = 43 cpm = 29 dpm

If a sample is greater than twice the MDA in cpm (>86 cpm), you must clean, reswipe, recount and document.

To convert cpm to dpm:

$$\frac{Sample\ (cpm) - Background\ (cpm)}{(Efficiency)}$$

$$Example: \frac{129\ cpm - 20\ cpm}{0.80} = 136\ dpm$$

This example is for ^{14}C only. Cpm and dpm values will be different for other radionuclides.

You must calculate results for each channel used. For example, if you are counting ^{3}H, ^{35}S, and ^{32}P, you must have three efficiencies and six MDAs.

NOTES: Efficiencies vary for different counting equipment. Consult your user manufacturer or your service technician.

LABORATORY RADIATION/CONTAMINATION SURVEY FORM

Date: _____ Licensee: _____

Radionuclides: _____ Location: _____

Smear locations are circled

MDAcpm = 2.71 + (4.65 (/Bkgd)+ Bkgd

MDAdpm = (2.71 + 4.65 (/Bkgd)) / Efficiency

Smear Survey:

Instrument Used: LSC / GAMMA COUNTER
(Circle one)

Meter Survey:

Count Rate Meter Used: _____

Serial #: _____

Cal. Date: _____

Background: _____cpm

	Efficiency	MDA_{cpm}	MDA_{dpm}	2 X MDA_{cpm}
^{3}H				
$^{14}C/^{35}S$				
^{32}P				
^{125}I				

(ATTACH LSC DATA)

Reason For Survey: _____ ☐ No Contamination Found ☐ Contamination Found

Performed by: _____ Remarks: _____