LP-5

Procedure for Performing Routine Laboratory Monitoring

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Approved by: _____ Date: _____

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Surveys will consist of direct monitoring and wipes to test for removable activity. ***Wipe surveys (see III.C. below) are required to be performed and documented each week when radioisotopes are used***; when radioisotopes are stored but not used, quarterly wipe surveys of storage locations should be performed. Direct surveys are not required to be documented, and are not required for laboratories that use less than 10 microCuries or only tritium (^{3}H). Document your wipe surveys using one of the Laboratory Survey Records in Appendix A or a similar survey report.

I. EQUIPMENT AND SUPPLIES

A. Diagram of laboratory to be surveyed (e.g. Lab Survey Records)
B. Filter paper or other suitable wipe medium
C. Survey meter(s)
D. Protective gloves
E. Liquid Scintillation counter or gamma counter
F. "Caution Radioactive Material" tape

II. PRECAUTIONS

A. When using the survey instrument, care must be taken to avoid inadvertently contaminating the detector or puncturing the window of the probe.
B. Wear protective gloves while conducting the wipe survey.
C. Contamination survey must be performed by an authorized radioisotope user.

III. PROCEDURE

A. Preparation
    1. Using the Contamination Survey Log Sheet at the end of this procedure, or an RSO approved substitute, sketch a diagram of the laboratory showing the location of benches, hoods, desks, refrigerators, etc.
        a) Indicate all radioactive material use areas.
        b) Number the locations on the diagram that are to be wipe tested. Include radioactive material work areas and items likely to be contaminated, e.g. inside of centrifuges and refrigerators used for radioactive material; door and cabinet handles, etc.
    2. Select a portable survey instrument suitable for the nuclides involved:
        a) Geiger counter for 14C, 35S, 32P, 33P, 51Cr; scintillation probe for 125I. (3H can not be detected with a portable survey instrument).
        b) Perform a battery check on the instrument selected.
        c) Turn on the instrument and set it to its most sensitive (lowest) setting, away from any radioactive material, and record the background reading on the survey form.
        d) Using the instrument speaker can help determine when the meter is responding to contamination.

B. Direct Contamination (Meter) Survey
    1. Monitor for surface contamination by moving the detector at a speed that allows you to detect the nuclide(s) used in the laboratory.
    2. The survey meter should be held at a distance of 1/2 inch to 1 inch from the surface being monitored.
    3. Monitor desks, hoods, refrigerator handles, phones, laboratory equipment, under chairs and stools (where they may have been grasped to be moved), non-radioactive waste cans, etc.
    4. Areas showing greater than 3X the average background count rate are considered contaminated and should be decontaminated or labeled with "Caution Radioactive Material" tape, as appropriate.

C. Smear Survey (Wipe Test)
    1. Wipe the locations chosen on the laboratory diagram. Each wipe should cover approximately 100 cm2.
    2. Count the survey wipes with the appropriate instrument, i.e. Geiger counter, liquid scintillation counter (LSC) or a gamma counter.
        a) Geiger counters can be used to count wipes for beta emitters, but these surveys must also be counted once/month on an LSC. All surveys for 3H contamination must be counted on an LSC.
        b) Make sure to include a blank wipe for LSC and gamma counts.
    3. Wipes showing counts above the corresponding background +LLD (see Example Calculations) are considered contaminated.

D. Survey Results
    1. Contaminated areas must be recorded on the Laboratory Survey Record in disintegrations per minute (dpm).
    2. Accessible areas which show contamination must be cleaned, resurveyed and the results documented.
    3. Inaccessible areas which will not be decontaminated (inside centrifuges, remote handling tools, etc.) must be clearly labeled with "Caution Radioactive Material" tape.

E. Documentation
    1. The following items must be recorded as part of your wipe survey (direct surveys are not required to be documented):
        a) Make and model of the instrument(s) used in the survey.
        b) Background count rate of the instrument(s) used.
        c) Calibration date of the instrument(s) used.
        d) Name of person performing survey.
        e) Date of survey.
        f) Survey results, including contamination levels and follow up survey results.
    2. Non-use weeks when no contamination surveys are being performed should be clearly indicated in the log.
    3. Survey records should be kept in a log book in the laboratory. These records

are to be maintained by the lab until the radioactive material program is terminated, at which time the records are to be given to Radiation Safety and filed as part of the program's permanent documents.

IV. EXAMPLE CALCULATION

A contamination survey is performed for ^{35}S. This example calculation will determine the lowest level of detection (LLD) for ^{35}S contamination for a LSC.

"**Contamination**" is defined as:

LSC wipe showing counts greater than LLD + background count rate,

Background count rate is determined by counting a blank LSC vial (clean vial with clean LSC cocktail).

Example

A background count for 5 minutes in the ^{14}C window yields a total of 108 counts (^{14}C has the same beta decay energy as ^{35}S, so the LSC efficiency will be the same for these two isotopes).

Count the ^{14}C counting standard that came with the LSC in the ^{14}C window (the ^{14}C window for an LSC is usually predefined from the factory). In this example, this yields

16,650 counts/minute (cpm) in the ^{14}C window.

The label on the ^{14}C standard shows that it contains .01 µCi of ^{14}C.

$$convert\ source\ \mu Ci\ to\ disintegrations/minute\ (dpm) = 0.01\mu Ci(\frac{2.22x10^6\ dpm}{\mu Ci}) = 22{,}200\ dpm$$

$$Efficiency = \frac{source\ cpm}{source\ dpm} = \frac{16{,}650\ CPM}{22{,}200\ DPM} = 75\%$$

Determine Lower Limit of Detection (LLD at 95% confidence level) for LSC:

$$LLD(95\%)_{cpm} = \frac{3 + \left(4.65x\sqrt{background\ counts}\right)}{counting\ time} = \frac{3 + \left(4.65\sqrt{108\ counts}\right)}{5\ minutes} = 10\ cpm$$

$$Background = \frac{108\ counts}{5\ \text{minutes}} = 22\ cpm$$

Lowest detectable contamination $= Background + LLD = 10\ cpm + 22\ cpm =$ ***32 cpm***

In this example, wipes showing counts above 32 cpm (background + LLD) should be considered contaminated and recorded on the survey form.

To record contaminated wipes, subtract the background count rate and log the results in disintegrations/minute (dpm). For example, for a wipe that shows 520 cpm, the removable contamination recorded on the survey form would be:

(520cpm - 22cpm)/ .75 = 664 dpm

Notes on LSC Efficiency

For ^{32}P counting on an LSC, assume a 100% counting efficiency.

Note: for very old ^{3}H LSC standards, you may have to correct for radioactive decay:

*current activity = original activity * exp (-0.693*time/12.6)*

where time is in years (the half life for ^{3}H is 12.6 years)

Efficiencies for portable survey instruments, such as a Geiger counter, are listed on a label which is affixed to the side of the instrument case when it is calibrated by the OSU Radiation Center. Use the ^{14}C efficiency for ^{14}C and ^{35}S. Use the ^{210}Bi efficiency for ^{32}P. For scintillation probes, the ^{125}I efficiency may be listed on this label, or on the side of the scintillation probe.

Contamination Survey Log Sheet

Location (bldg/room)

Signature/Date:		Signature/Date:		Signature/Date:		Signature/Date:		Signature/Date:	
Wipe #	Results[1]	Wipe #	Results[1]	Wipe #	Results[1]	Wipe #	Results[1]	Wipe #	Results[1]

LSC or Gamma Counter : Make & Model:_____ Background:_____ cpm

Serial # or location:_____ Efficiency:_____ Calibration Date:

Survey Meter: Make & Model:_____ Background:_____cpm

Serial #:_____ Efficiency/Isotope:_____ Calibration Date:

(1) Results (see Example Calculations in "Procedure for Performing Routine Laboratory Monitoring")
In the Results column, record "Net DPM" for contaminated wipes. Record "0 net" or "ok" for wipe locations that were not contaminated. The wipe is considered contaminated when the net cpm is greater than (LLD_{cpm}+ Background)

$LLD_{cpm} = \frac{3+(4.65 \times \sqrt{\text{Total Background Counts}})}{\text{Counting Time}} = \frac{3+(4.65 \times \sqrt{\quad\quad})}{\text{minutes}} =$ _____ cpm

Net dpm = $\frac{(\text{Counts per Minute} - \text{Background})}{\text{Counter Efficiency}}$

CONTAMINATION SURVEY MAP

Location (building and room #s)
Diagram of Facility. Indicate all radioactive material work, waste and storage areas
Isotopes used: ☐^{3}H; ☐^{14}C; ☐^{32}P; ☐^{33}P ☐^{35}S; ☐^{125}I; ☐Other: