RADIATION REVIEW

UW - Madison Safety Department | Radiation Safety Program
103 N. Lake St. 262-8769 May 1994

Training

Radiation Worker Training is conducted weekly at the dates and times indicated below. The class is 4 hours long with a comprehensive, open-book exam being given during the last hour. All training is conducted in Biochemistry Rm. 1B.

Date	Day	Begin
18 May	Wed	8:00 AM
25 May	Wed	12:30
2 June	Thur	12:30
8 June	Wed	12:30
14 June	Tue	12:30
20 June	Mon	12:30
30 June	Thur	12:30
8 July	Fri	12:30
13 July	Wed	12:30
19 July	Tue	12:30
25 July	Mon	12:30

Please call Radiat ion Safety at 2-8769 or Radiation Safety Annex at 5- 5241 if you have any questions.

NRC Inspection

The Nuclear Regulatory Commission has promised to visit us for an inspection this spring, probably sometime in June. As part of the inspection, inspectors will probably visit laboratories on campus, and talk to workers about radiation surveys, survey instruments, radiation safety, etc. If the inspectors visit you, give them your full cooperation.

Surveys

Surveys are a deliberate effort to locate, identify, and quantify residual radiation and radioactive contamination. Two types of surveys are mandated by the Nuclear Regulatory Commission (NRC) research license: portable (GM/LEG) meter surveys and wipe (removable contamination) surveys.

To simplify recordkeeping by users, the University Radiation Safety Regulations require (Table 1) both types of surveys be done monthly in all approved areas if a user has on hand in one month 200 microCuries (:Ci) or more of radioactive material. Most users [exceptions include use only of ^{3}H, sealed sources (e.g., ^{63}Ni), kits (an HP will determine total quantities which will require monthly surveys), storage rooms, etc.] will need to perform and post monthly radiation surveys (Table 2).

Additionally, meter surveys for residual contamination should be performed after each use of unsealed radioactive material and, for their own protection, workers should check their hands and feet before leaving the laboratory. Neglect of this latter safeguard has led to significant accidents at the University of Michigan ($3700 fine, $30,000

Table 1. Survey Frequency

Frequency	On-Hand Activity
Monthly (30 day intervals)	$\geq$ 200 :Ci in any one month
Semi-annually (6 month intervals)	< 200 :Ci **or** radioactive material in storage or counting room only (packaged radioactive waste, stock vials)
Immediately after use	$\geq$ 5 mCi of radioiodine

Table 2. Survey Requirements for Beta (β) Emitters

Energy (keV)	On-Hand Activity	Type Survey
< 100	see Table 3	wet wipe tests
100 - 200	< 200 :Ci in 1 month	wet wipe tests
> 100	> 200 :Ci in 1 month	meter <u>and</u> wet wipe tests

damages), Mayo Clinic ($6000 fine), Harvard Medical School, and Los Alamos, to name a few. All of these incidents involved the use of ^{32}P and could have been prevented had the worker performed a simple meter survey after conducting the experiment and before going home.

The Safety Department experienced a similar accident in one of our waste storage facilities. Approximately 1 - 2 mCi of ^{32}P dripped from a container of liquid waste and was tracked over our loading dock and facility entryway before being discovered. A survey of the packages revealed the problem before people left the facility. Even so, the total area contaminated was approximately 300 sq ft and, even though the facility was operational throughout the clean-up, about 200 man-hours was expended on decontaminating the area. That incident precipitated some changes in our liquid waste handling procedures which, if in use previously, would have saved us considerable anxiety and effort.

In order to obtain viable results when using a portable survey meter, the meter must be sensitive to and calibrated for the type of radiation (β vs γ) being emitted.

Sensitivity

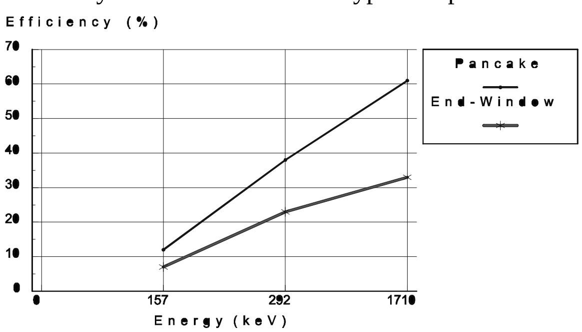
Sensitivity is the ability of a measurement sys- tem to quantify the effect being considered. The human ear is a relatively sensitive instrument, however, it can not hear sounds above about 20,000 Hz. A dog can often hear sounds to a- bout 30,000 Hz. Thus, a dog is more sensitive to high pitched sounds than is a human.

Radioisotopes used in research may emit β , γ, or β /γ radiations. Researchers are required to monitor 8- emitters with a thin-window GM (Geiger) counter, but if they use low energy Ξ–/γ emitters (^{125}I), they must use a scintillation detector (e.g., LEG) to survey for contamination. The reason is that the GM counter's detector is not sensitive to small amounts of X-/γ activity and will not produce counts. A scintillation detector is denser and consequently is sensitive to x-rays. LEG detectors are also capable of detecting higher energy (> 200 keV) β particles.

Meter Calibration

Besides being sensitive, a meter must also be calibrated for the type of radiation it is being used to measure. Consider a straight edge. If you want to measure something with it, the straight edge must be maked off in consistent intervals (e.g., inches, cm, etc.). So it is with survey meters.

The response from a survey meter when exposed to radiation must be made meaningful. A reading of 200 cpm does not tell the user much about the relative hazard of the radiation because the efficiency of a Geiger counter is proportional to energy; the higher the β energy, the higher the efficiency. Additionally, because of their construction, a pancake type GM probe has a higher efficiency than an end window type GM probe.



At Safety we calibrate each thin window probe against 3 different 8 energies (^{14}C, 157 keV; ^{99}Tc, 292 keV; and ^{90}Sr-^{90}Y, 1700 keV_{eff}) and provide an indication of the efficiency of that system for each of the radiations (see above). The user of a GM must be aware of the isotope being detected (e.g., in a lab where ^{32}P and ^{35}S or ^{33}P are used, use a credit card to discriminate low energy (^{35}S/^{33}P) β emitters from high energy (^{32}P) 8 emitters; the credit card will stop all low energy beta particles) to determine how much radioactive contamination is actually being measured.

LEG probes are calibrated using an ^{241}Am source which emits low energy x-rays. The calibration sticker then indicates the system's efficiency for ^{125}I.

Meter Survey Procedures

Draw a map of the lab and identify the areas where radioactive material is used and/or stored. Identify these locations on the floor diagram using numbers (e.g., 1, 2, etc.) or letters (e.g., a, b, etc.). Put the survey meter into operation by:

✔ Turn the speaker on and switch the meter to the **Battery** position; check for "Batt OK" response.

✔ Turn to the appropriate scale and check the functioning of the detector (i.e., place the detector window over the check source affixed to the meter and compare the result to that indicated on the calibration certificate)

✔ Move to a radiation free area (e.g., hallway) to determine (and record) the background count rate (for a thin-window detector it should be about 20 - 30 cpm, for LEG probes it should be about 200 cpm).

Perform the survey by slowly moving the detector over the numbered/lettered areas. Hold the probe as close as possible, but without touching, the area or equipment you wish to survey (e.g., approximately 1 cm). Pay special attention to door knobs, telephones, log books, instrument handle(s) and keys (i.e., things workers may have touched) as well as areas where radioactive materials were used. Survey all pieces of equipment for which the lab has a contamination exception to insure you are within the exception limits. The most efficient way to survey is with the speaker on. Because the speaker responds more rapidly to radioactivity than the meter's dial movement, the surveyor can be alerted to "hot" spots.

Record all readings on the survey form to include: date survey performed; background count rate; initials of the person doing the survey; meter used (type, serial number, and date calibrated) and room number. Be careful when moving the probe because you may generate electrical noise in the cable which can register as radiation or counts. Also, make sure you do not contaminate the probe. When you are finished, turn the meter and speaker off.

Wipe Test Procedures

Using the survey sheet, perform a wipe survey of the same areas you checked with the meter. Now you are interested in removable contamination.

Moisten pieces of filter paper, cloth smears, or cotton-tipped swabs and wipe each of the identified locations on the lab's diagram (e.g., swabs can be keyed by labeling the vial into which they will be placed). Wipe an area of at least 100 cm^2 (4" x 4") at each identified location or piece of equipment, using only one wipe per area.

Decontamination Procedures

Areas with removable contamination in excess of the levels in Table 3 must be cleaned (decontaminated) immediately, resurveyed to verify successful decontamination, and the results documented on the survey form.

Table 3. Action Levels for Removable Surface Contamination

Contamination Units	Type of radioactive Emitter		
	Alpha (α)	β [1], γ, x	Low Risk β [2]
net dpm/100 cm^2	66	660	2200
net cpm/100 cm^2	23	230	770

[1]β emitter values are applicable for all β except Low risk β

[2]Low risk includes β energies less than 200 keV max, i.e ^{3}H, ^{14}C, ^{35}S

To decontaminate, inform others in the lab of the contamination, secure area and mark and/or define contaminated area with tape. Clean the contaminated area using absorbent paper and Count-off (or other soap). Be careful not to let the soap drip onto clean surfaces. Start cleaning at the outside edge of the contamination and work inward. Dispose of the absorbent paper into a plastic bag after each wipe. Mark the plastic bag as "Radioactive Waste". Change your gloves frequently. Re-monitor the contaminated area to verify successful decontamination, document new results on the survey form. Take off your gloves and wash your hands using mild soap. When finished, recheck the area and monitor personnel who were involved in the decontamination procedures.

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