

## Meter Survey

The meter survey offers a direct measurement of external radiation dose rates enabling assessments for shielding needs and effectiveness. It is also the quickest and easiest (though not the most sensitive) method to assess surface contamination on objects such as lab coats, hands, floors, benches, etc. Compared to a wipe survey, a meter survey provides increased assurance that contamination "hot spots" will be detected and, unlike a wipe survey, it can detect fixed contamination. A meter survey alone will not determine if contamination is removable.

### Performing the meter survey

1. Check the meter for proper operation
  - a. Check the batteries using the self-check function of the meter.
  - b. Determine that the background count rate is normal (20-50 cpm for GM and 250-350 cpm for LEG). Zero background indicates that the meter is nonfunctional. A high background indicates contamination of the probe or a meter malfunction.
  - c. Check detector response by exposing the probe to a radiation source. An intermittent response indicates a damaged probe cable. If no response is observed, the meter is nonfunctional.

*If found to be nonfunctional, immediately label with an "Out of Service" label and contact University Radiation Program Coordinator (348-2622) or phone Environmental Health & Safety (3480-2621) for further instruction.*

2. Survey all authorized areas as per floor plan. For maximum sensitivity, hold the probe no more than 1 centimeter from the surface, move the probe slowly, and check for increased count rates.
3. Background count rates will vary by perhaps a factor of 2. Consider a reading to exceed background when the count rate exceeds twice the background count rate.
4. Mark areas of suspected contamination (use a grease pencil, a non-permanent marker, tape, etc.). Include the marked areas when performing the wipe survey.

### Tips:

- $^3\text{H}$  is the exception for which no ordinary survey meter probe will respond; reliance is placed on thorough wipe surveys and liquid scintillation counting.

- Choose the appropriate probe:
  - For beta emitting radionuclides, except  $^3\text{H}$ , use a thin window GM probe. The lower detection limit is about 1000 dpm for  $^{14}\text{C}$  and  $^{35}\text{S}$  and about 200 dpm for  $^{32}\text{P}$ .
  - For low energy gamma (10 - 100 keV) emitters, use a thin crystal NaI (LEG) probe. The lower detection limit is about 200 dpm for  $^{125}\text{I}$ . GM probes are inadequate, as the lower detection limit is about 100,000 dpm.
  - For high-energy gamma (>100 keV) emitters, accompanied by beta radiation, use a thin window GM probe.
  - For high-energy gamma (>100 keV) emitters without beta radiation, use a thick NaI probe.
- Meters must be calibrated for each authorized radioisotope.
- Be sure not to move the probe too quickly over surfaces. This will obstruct finding contamination.

# Wipe Survey

The wipe survey is the most sensitive method for determining the amount of removable contamination. It is the only method for determining whether contamination is removable or fixed. To perform the wipe survey, follow instructions below.

## 1. Collect wipe samples

- a. Use a 2.5 cm paper filter disk. It may be moistened with distilled water, ethanol or "decontamination" solution. A dry filter is acceptable, but less sensitive.
- b. Wipe areas designated by lab's survey system and any area marked during the meter survey.
- c. Wipe some additional non-use areas, including areas of frequent contact, such as door knobs, sink handles, light switches, telephones, etc.
- d. Wipe an area of approximately 100 cm<sup>2</sup>.
- e. Specify in the record any area(s) wiped which is not indicated on the floor plan.

## 2. Prepare samples

### a. Beta emitters

1. Using tweezers, place filter disk wiped-side up on the bottom of a 20 ml counting vial.
2. Add 0.5 ml of distilled water.
3. Add five (5) ml of liquid scintillation counter (LSC) cocktail.
4. Mark cap with wipe identification.
5. Repeat steps (1) - (4) for each sample taken.
6. Prepare a control sample using a clean filter and following steps (1) - (4). The control provides the background count rate.

### b. Gamma emitters

1. Using tweezers, place filter disk into a gamma counting vial.
2. Mark vial with wipe identification.
3. Repeat steps (1) - (2) for each sample taken.
4. Prepare a control sample using a clean filter and following steps (1) - (2). The control provides the background count rate.

## 3. Count samples

Wipes for monthly surveys shall be counted with the most sensitive instrument available. This is usually a liquid scintillation counter (LSC) for beta radiation emitters and a gamma counter (GC) for gamma radiation emitters (with no associated betas).

When the survey is for both beta and gamma, count the filter first in the gamma counter and second in the LSC.

a. Liquid Scintillation Counter

All beta emitters

1. Count the samples, a control and a standard(s) for at least two (2) minutes each.
2. Results of less than two (2) times background are considered negative. Counts which are greater than or equal to two (2) times background are considered positive.
3. Recount the sample(s) with positive results for verification. Some positive results could be the result of extraneous luminescence.

**Tips:**

- Factors, such as chemiluminescence and static, can cause false positive results.
- A moist filter improves the survey sensitivity enabling more activity to be transferred. If a decontamination solution is used, allow any chemiluminescence to dissipate by storing samples in the dark for at least 2 hours before counting.
- Using a larger filter or a mini vial causes the filter to either fold in on itself or attach itself to the side of the vial. This reduces the counting efficiency, especially for the lower energy beta emitters.
- Dissolvable filters are acceptable.
- LSC counting efficiency may be determined by counting filters spotted with a known activity of a radioisotope in use.
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