MRB
Laboratory Procedure Manual
for
Radioactive Materials

TEXAS A&M UNIVERSITY SYSTEM
HEALTH SCIENCE CENTER
COLLEGE OF MEDICINE
MEDICAL RESEARCH BUILDING
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GENERAL LABORATORY SAFETY RULES

Each Permittee possesses a copy of this "Procedure Manual for the Use of Radioactive Materials". Please refer to this manual or contact the ORLC for additional information on any topic covered in this section.

1. Appropriate laboratory coats and eye protection are required when working with any unsealed radioactive materials.

2. Gloves shall be worn when working with unsealed radioactive materials.

3. Closed-toe shoes shall be worn when working in a radioactive material laboratory.

4. Monitor hands and clothing for contamination after each procedure or before leaving an area.

5. Monitor area where unsealed radioactive materials are used after each procedure and document the results. Decontaminate if necessary.

6. Remote handling tools and shielded containers should be used whenever possible to minimize doses.

7. Do not eat, drink, smoke, use tobacco products or apply cosmetics in any area where radioactive materials are used or stored. Do not store food, drinks, eating utensils, or cups and other food and drink containers in laboratories or refrigerators where radioactive material use or storage is authorized. Do not use ice from a laboratory ice machine for personal use. Do not use a laboratory microwave oven to heat food.

8. Dispose of radioactive materials only in conspicuously labeled, ORLC approved containers. Segregate wastes by nuclide, half-life, and physical characteristics per instructions provided by the ORLC.

9. Use absorbent paper and spill trays to confine radioactive liquids that may spill.

10. Store radioactive materials in shielded containers or storage areas to minimize dose rates.

11. Use volatile liquids, especially tritiated water or unbound I-125, in a fume hood.

12. Survey meters must be calibrated and fume hoods must be inspected annually by the ORLC or other organizations approved to perform these evaluations.

13. Do not dispose of empty shipping boxes or return Styrofoam inserts to the vendor without first surveying them to ensure that they are not contaminated. Remove or obliterate all radioactive signs and symbols before discarding a shipping box.

14. If one or more radiation dosimeters have been issued to you, wear it (them) whenever working with or near radioactive material. Wear the dosimeter(s) according to instructions provided by the ORLC.

15. Keep any radioactive materials secure from unauthorized access or removal.

ORDERING RADIOACTIVE MATERIALS

All radioactive materials to be purchased (or otherwise obtained) must be approved by the ORLC **before** the order is placed.

1. Prior to ordering or receiving radioactive materials, Permittees or designees shall obtain approval from the ORLC by one of the following means:

    a. submit the purchase requisition for approval, or
    b. telephone (724-7774) to receive verbal approval, or
    c. fax (742-7181) to request approval.

2. The ORLC will require the following information:

    a. Permittee name and Permit number,
    b. caller name and phone number,
    c. radionuclide, compound, and activity (quantity in microcuries, millicuries, or curies),
    d. vendor, and
    e. any special delivery requests.

3. If either the radionuclide or the activity to be ordered cannot be accommodated under the Permittee's existing authorizations, approval for the order shall be denied. The Permittee may not place the order.

4. Standing orders can be authorized for large users where identical orders are placed regularly. A single approval by the ORLC is acceptable for standing orders. Call for more information.

5. When placing the order, specify your address as the "Bill to" address and give the following "Ship to" address:

    Office of Research Laboratory Compliance
    College of Medicine
    Texas A&M University System Health Science Center
    Attn: *(enter Permittee's name)*
    702 Southwest H.K. Dodgen Loop
    Temple, TX, 76504

6. Contact the ORLC if an order is changed or canceled after receiving approval from the ORLC.

7. Questions and special requests may be referred to the ORLC at 724-7774.

RADIOACTIVE MATERIAL PACKAGE CHECK-IN

This procedure is designed to assist the RSO or ORLC designated personnel performing check-in of shipments of radioactive material. This check-in process ensures that the integrity of the package has been maintained during transport, that the material received is the material ordered, and that the material is properly entered into the permittee's radioactive material inventory.

Cautions

1. As with all exposure to radiation and radioactive material, it is important to keep your exposure as low as reasonably achievable (ALARA).

2. Gloves should be worn at all times while checking in radioactive material shipments.

3. A leaking or contaminated primary vial may result in personnel and surface contamination. If a shipping container appears damaged or wet, survey the package for contamination immediately and take extra care to prevent contamination from spreading. If a leaking package is identified, notify the ORLC immediately and survey for secondary contamination in the package check-in area.

Instrumentation

To accurately measure radioactive contamination and radiation levels, you must use appropriate calibrated instruments. Contact the ORLC for information regarding annual calibration of these instruments.

Ordering/Receiving Radioactive Material

1. Before you order radioactive material, you must receive permission from the ORLC to place the order. Please refer to "Ordering Radioactive Material" for instructions.

2. If the order is approved, the order shall be assigned an RSO Number, or Ship Code. If the order is denied, you will receive instructions regarding reducing your present inventory or amending your Permit to allow possession of a greater activity of the nuclide you are ordering.

3. The Texas Department of State Health Services (DSHS) requires that the shipment of radioactive material be processed as soon as is practicable, but **not later than three hours after receipt** of the package at the Permittee's facility if it is received during working hours. If the order is received after normal working hours (or during holidays), the shipment must be checked in no later than 3 hours after the beginning of the next regular business day. Crushed, wet, or damaged packages must be inspected immediately.

Check-in Documentation

Document the package check-in on the attached ORLC form, "MRB Radioactive Material Package Check-in Form". Note: **All blanks on the form must be filled in.**

1. Enter the RSO Number on the check-in form.

2. Enter the Permittee's name, Permit number, and department. Enter the date the material is being checked in.

3. Enter the building and room number(s) in which the material is to be used or stored.

4. Enter the radionuclide and form. Typically, the compound (Bovine Growth Hormone, dATP, thymidine, etc.) should be entered here. If the material is a sealed source, that should be noted.

5. Enter the activity received and indicate units--millicuries (mCi) or microcuries (μCi).

6. Enter detector type and manufacturer/model/serial number of equipment used for all measurements.

7. Perform a radiation survey for external radiation exposure at the surface of the package and at a distance of one meter. If the exposure rates at the surface of the package and at a distance of 1 meter from the package are less than 0.5 mR/hr and 0.1 mR/hr, respectively, these values can be recorded as simply <0.5 mR/hr and <0.1 mR/hr. If the radiation levels are above those values, the actual readings need to be recorded. **If the exposure rate exceeds 10 mR/hr at one meter from the package or 200 mR/hr at the surface of the package, contact the ORLC immediately**.

   This survey must be performed using a meter calibrated in mR/hr.

8. Survey the exterior of the package for removable contamination. This will be the first indication that the primary container is leaking. This measurement can be accomplished using a piece of tissue or filter paper and a liquid scintillation counter (LSC).

The liquid scintillation counter is the preferred method of counting wipes for removable contamination. A GM survey meter will not detect ^{3}H and the detection efficiency of the LSC for all nuclides typically found in the laboratory is higher than that of the GM survey meter. The GM should be used only if a liquid scintillation counter is not available.

Wipe the exterior of the package with a filter paper or a piece of tissue, wiping an area of at least 300 cm^2. This wipe must be counted on the appropriate, calibrated counting instrument:

End Window GM Survey Meter - Alphas, High Energy Betas (^{32}P), Beta/Gamma
Liquid Scintillation Counter - Low Energy (^{3}H, ^{14}C, ^{35}S, ^{33}P), High Energy Betas, Low Energy Photons (^{125}I), and Alphas
Thin Window Scint. Probe - High Energy Betas (^{32}P), Low Energy Photons (^{125}I)
Gamma Counter - Low Energy, High Energy Photons

The Minimum Detectable Activity (MDA) is an indication of the minimum level of contamination that a counting system can practically measure above background. A "blank" is counted to determine the background count rate. The MDA must be calculated and entered on the receipt form. The package is then surveyed, with the results entered on the receipt form.

***For a system that integrates counts over a preset time, such as an LSC, gamma counter or any counting system with a scaler (assuming that background and wipe count times are equal), the MDA for removable surface activity can be approximated by:

$$\text{MDA (dpm)} = \frac{3 + 4.65\sqrt{(B_R)(t)}}{(t)(E)}$$

where:

MDA = activity level in disintegrations/minute
B_R = background rate in counts/minute
t = counting time in minutes for sample and background counts
E = detector efficiency in counts/disintegration

Note: If the instrument used to count the wipe displays a total number of counts, the value indicated for the background count can be substituted for the value $(B_R)(t)$.

Compare the wipe activity with the MDA. If the net wipe activity (dpm):

$$\text{Net Wipe Activity (dpm)} = \frac{\text{Wipe Count Rate (cpm) - Background Count Rate (cpm)}}{\text{Detector Efficiency (counts / disintegration)}}$$

is less than the calculated MDA for that system, indicate as such by entering "< MDA" in the blank provided for the contamination level on the surface of the package. If the sample activity is greater than the MDA, indicate the calculated wipe activity.

Example:

A package of ^{3}H has been received. The LSC efficiency for ^{3}H is 33%. The

background count rate for the blank is 20 cpm. The wipe count rate is 40 cpm. The counting time for both is one minute. The MDA for this system is:

$$\text{MDA (dpm)} = \frac{3 + 4.65\sqrt{(20\text{ cpm})(1\text{ min.})}}{(1\text{ min.})(0.33)} = 72\text{ dpm}$$

The net wipe activity is:

$$\text{Net Wipe Activity (dpm)} = \frac{40\text{ cpm - }20\text{ cpm}}{0.33} = 61\text{ dpm} < 72\text{dpm}$$

The contamination level for the external surface of the package can then be entered as "<MDA". If the net wipe activity was greater than 72 dpm, the actual net wipe activity would have been entered on the form.

The permittee is responsible for establishing an efficiency for the LSC and the nuclide in question. Contact the ORLC for assistance, if necessary.

***If a ratemeter instrument (such as a GM survey meter) is used to measure the removable contamination, the MDA can be estimated by taking twice the time constant (which may be referred to as the response time in the meter instruction manual) of the meter as the counting time and using the relationship:

$$\text{MDA (dpm)} = \frac{4.65\sqrt{B_R/2t_c}}{(E)}$$

where:

MDA = activity level in disintegrations/minute/cm^2
B_R = background rate in counts/minute
t_c = meter time constant in minutes (Refer to Table 1)
E = detector efficiency in counts per disintegration

Note: For meters that display the count rate in counts per second, the time constant must be in units of seconds. For meters that display the count rate in counts per minute, the response time must be in units of minutes.

Example:

A Ludlum Model 3 meter is used to count a smear from a package receipt survey on a package containing Sulfur-35. The background rate of the meter is 40 counts per minute. The efficiency of the survey meter for ^{35}S is 5%. With the response switch in the fast position, the time constant of the meter is 4 seconds. The minimum detectable activity for that meter is:

$$\text{MDA (dpm)} = \frac{4.65\sqrt{(40\text{cpm})/2(0.0667\text{ min})}}{(0.05)} = 1610\text{ dpm}$$

The meter reads 60 cpm when the wipe from the external surface of the package is counted. The net wipe activity is

$$\text{Net Wipe Activity (dpm)} = \frac{60\text{ cpm} - 40\text{ cpm}}{0.05} = 400\text{ dpm} < 1610\text{ dpm}$$

The contamination level for the external surface of the package can then be entered as "<MDA". If the net wipe activity was greater than 1610 dpm, the actual net wipe activity would have been entered on the form.

The efficiency of the survey meter for the nuclide in question can be found on the calibration sticker affixed to the survey instrument. If this is not indicated, contact the ORLC regarding instrument calibration.

The meter time constant, also referred to in operator's manuals as the response time, is most often defined as the time required for the meter to read 90% of full scale. A list of meter time constants is attached. If the time constant for your meter is not on this list, consult the operator's manual, contact the manufacturer's technical support department, or contact the ORLC.

If the calculated MDA for the counting system is greater than 3300 dpm for beta-gamma counting systems or 330 dpm for alpha counting systems, contact the ORLC for instructions. The detector may be malfunctioning or contaminated, causing a high background count rate, or a more efficient detector may be required.

If there is evidence that the vial is leaking (i.e., an elevated contamination level is found on the exterior of the package) take precautions to limit the spread of the contamination and notify the ORLC immediately.

9. Open the package and visually verify that the interior packaging is intact. If the interior packaging is damaged, the vial may be damaged and leaking. Take extra care to prevent surface and personnel contamination when handling the primary vial.

10. Survey the primary vial for removable contamination (using the appropriate counting instrument) and compare the reading to the MDA. If the surface of the primary vial is contaminated, other personnel who may use that radioactive material need to be made aware of the condition of the vial. If the level of removable contamination is such that you suspect that the vial is cracked or broken, contact the ORLC immediately.

11. Check the primary vial label to ensure that it matches the entry on the shipping invoice. If the wrong material was shipped, you must inform the ORLC if a replacement shipment will be sent.

12. Transcribe the RSO Number to the primary and secondary containers. This allows the shipment to be identified for radioisotope inventory verification and helps ensure proper completion of waste disposal forms.

13. The person who checked in the package must sign the form as Surveyor to indicate that the shipment was received and checked in.

14. Immediately send or fax (742-7181) a copy of the completed form to the ORLC.

15. The box that the material was shipped in may be discarded as non-radioactive waste as long as the permittee ensures that the box is not contaminated (by performing and documenting a contamination survey) and obliterates any radioactive signs or symbols. The signs and symbols can be obliterated by covering them with duct tape or marking them out with a black marker. The container may then be discarded as normal solid waste. All material used during the package check-in procedure (gloves, wipes, etc.) should be considered contaminated and discarded in a radioactive waste container.

16. Some vendors participate in a Styrofoam container recycling program. It is a requirement of the vendor as well as the ORLC that a survey of the container for removable contamination be performed and documented before the Styrofoam package is sent back to the vendor.

17. Any questions regarding this procedure may be directed to the ORLC at 724-7774.

Table 1 - Time constants for common survey meters

1. Ludlum Models 2 and 3

Fast Response: t_c = 4 sec. = 0.0667 min.
Slow Response: t_c = 22 sec. = 0.3667 min.

2. Ludlum 2200

Fast Response: t_c = 4 sec = 0.0667 min.
Slow Response: t_c = 22 sec = 0.3667 min.

3. Rad Monitor 9000 GM-1 and GM-2

t_c = 4 sec

4. Eberline E-120

Fastest Response (response knob to clockwise limit): t_c = 2 sec. = 0.0333 min.
Slowest Response (response knob to counterclockwise limit): t_c = 10 sec. = 0.1667 min.

MRB RADIOACTIVE MATERIAL CHECK-IN FORM

CURRENT VERSION

TRANSFER OF RADIOACTIVE MATERIALS

This procedure describes the requirements for the transfer of radioactive material between TAMUS ORLC Permittees and the transfer of material to or from non-TAMUS ORLC Permittees. This procedure does not apply to the disposal/transfer of radioactive waste to the ORLC.

If the transfer of radioactive material involves transporting material on public roadways (including campus streets), the material must be packaged and transported in accordance with state and federal regulations. Except for those instances where the packaging, labeling, documentation and transport are performed in accordance with a specific procedure written or approved by the TAMUS ORLC (such as transport of waste), the Permittee shall contact the ORLC prior to transportation of radioactive material. Radioactive material which is hand carried or transferred on a moveable cart between laboratories or buildings does not require special packaging other than that used to ensure that the material is packaged in such a way to prevent spillage or the spread of contamination.

Transfers Between TAMUS Permittees

The Permittee who transfers licensed material from his or her Permit to another shall contact the ORLC for approval prior to releasing the material, and complete and sign the appropriate section of the "MRB Radioactive Material Transfer Form". The receiving Permittee shall then complete and sign the appropriate section of the form. The form shall then be forwarded to the ORLC.

If the entire inventory item is transferred, the RSO Number will remain the same. If only part of the inventory item is transferred, a new RSO Number will be assigned to the transferred portion.

Transfers Involving Non-TAMUS Permittees

Transfers involving non-TAMUS licensees (as receiver or transferor) shall also require advance approval from the ORLC. Transfer documentation shall be prepared by the TAMUS Permittee as described previously. For transfers from TAMUS to a non-TAMUS license, a copy of the receiver's license must be obtained and provided to the ORLC prior to the transfer.

MRB RADIOACTIVE MATERIAL TRANSFER FORM

CURRENT VERSION

WASTE SEGREGATION AND DISPOSAL

Laboratory personnel are required to segregate (or separate) radioactive material for proper disposal. Segregation of waste at its origin allows for the most economical disposal of the final waste product. Radioactive waste is categorized by its form (solid, liquid, etc.), nuclide content, activity, and the presence of chemical or biological hazard.

A "MRB Radioactive Waste Form" must be completed for each RSO Number prior to requesting a waste collection by the ORLC. This procedure includes instructions for filling out the waste form.

Solid Waste

Solid waste is generally classified into two categories: waste containing radionuclides with a short half-life (almost any nuclide with a half-life of less than 300 days) and waste containing radionuclides with a long half-life (nuclides with a half-life greater than 300 days). Nuclides with a short half-life include P-32, P-33, S-35, Ca-45, I-125, and I-131. Radionuclides with a long half-life include H-3, C-14, Mn-54.

1. All solid waste containers must have a lid. The lid should only be removed when adding waste to the container.

2. Short half-life solid waste may be mixed in a single solid waste container.

3. H-3 and C-14 solid waste may be mixed in a single solid waste container. Other long half-life nuclides should be collected in a separate waste container.

4. Remove or deface all radioactive material tags and markings (stickers, tape, etc.) before placing material in the solid waste container. (Masking or duct tape may be used to cover markings).

5. No liquids should be placed in solid waste. Exception: primary containers or empty vials containing microliter volumes of liquid.

6. "Sharps" (syringes, Pasteur pipettes, broken glass, and razor and scalpel blades) must be placed in sturdy boxes or plastic containers and identified as radioactive sharps. Even a capped syringe must be placed in the "sharps" container.

7. Biohazardous and pathological waste requires special handling. This waste must be treated to remove the biohazard before it can be placed in the radioactive waste container. Notify the ORLC before disposing of this material. Possible treatment options may include autoclaving, bleaching, or other chemical neutralization.

8. Empty biohazard bags contaminated with radioactive material may be disposed of in the radioactive waste container provided they have an additional label that indicates that there is no biohazard.

9. Uncontaminated lead shields or lead lined containers (pigs) should be separated from other waste. Remove or cover radiation signs or symbols.

10. Limit weight of container to 50 pounds.

11. Chemical constituents must be delineated on the form. See the following "Waste Pick-up" section for additional information.

Vials

Vials are defined as glass or plastic containers used for liquid scintillation counting that contain radioactive materials in liquid form. The procedures for handling vial waste will depend on the vial size and chemical characteristics of the liquid. Use a biodegradable liquid scintillation cocktail, if possible. Permittees disposing of vials containing hazardous/non-biodegradable cocktail may be assessed significant disposal fees. Ensure that no other materials (gloves, paper towels, or other solids) are placed in the vial waste containers.

1. 20 ml. or greater – These vials must be emptied before disposal. The liquid contents must be poured into a carboy designated for the appropriate nuclide and waste type (non-toxic/biodegradable or hazardous/non-biodegradable) as defined by the previously stated rules for liquid disposal. If the empty vials once contained hazardous liquid, the empty vials must be tightly capped and placed in a separate waste container for disposal. If the vials once contained non-hazardous liquid, they must be capped and can be discarded in a separate waste container or may be added to the solid waste can designated for that nuclide.

2. Less than 20 ml. – These vials are not required to be emptied. After separating non-toxic/biodegradable vs. hazardous/non-biodegradable, place these vials, tightly capped, in a plastic-bag and place the bag inside designated waste container.

Liquid Waste

Liquid wastes are collected in approved containers provided by the ORLC. If high activity waste is generated (greater than 5 mCi in a single container), or materials are used that could not be safely stored in a plastic container, please contact the ORLC for special instructions.

1. Liquid waste containers must be capped at all times, except when the container is being filled or emptied.

2. Liquid waste must be segregated by nuclide. If mixing nuclides is required by protocol, contact the ORLC prior to mixing.

3. Liquid waste is classified by hazard (non-hazardous vs. hazardous). Waste classified as non-toxic/biodegradable should not contain hazardous chemicals (toluene, chloroform, benzene, etc.). To minimize the production of mixed waste, use a biodegradable liquid scintillation cocktail, if possible. Permittees disposing of mixed waste may be assessed significant disposal fees.

4. Chemical constituents **MUST** be delineated on the “MRB Radioactive Waste Form”

5. Biohazardous liquid waste must be treated to remove the biohazard before it can be collected by the ORLC. Treatment options include bleaching or other chemical neutralization. Contact the ORLC with questions regarding the removal of biohazards from liquid waste.

6. No solids shall be placed in the liquid waste containers (for example caps, pipettes, vials, and test tubes).

Carcasses

Carcasses are defined as animals, animal tissue, or blood products that contain radioactive material. Only RAM trained users working under the supervision of the permittee will handle the animals in the MRB and contaminated animals are never returned to the animal facility. All the procedures are terminal and the carcasses will be handled per the manual and disposed of as radioactive material. The ORLC will discuss with the PI whether or not bodily fluids from the animals will contain radioactive materials. If yes, then the bodily fluids must be collected and treated as radioactive waste. In addition, proper contamination control techniques must be implemented. A high level of security and control must be maintained over the animals before they are euthanized in order to ensure they don't escape and mix with the normal indigenous fauna. If gamma-emitting radioisotopes are used, radiation surveys must be performed. No animal or animal product will be used as food for humans or other animals. Animal usage in the MRB is strictly governed and supervised by the Institution Animal Care and Usage Committee (IACUC) and proper precautions are taken to ensure staff who handle animals are not injured or wounded through animal bites.

1. Carcasses that are frozen will be accepted, provided all labeling and other requirements are met.

2. Tissue that is not frozen must be sterilized (rendered a non-biohazard) prior to collection by the ORLC. Contact the ORLC regarding treatment options. Examples of tissue that must be treated include:
   - small amounts of tissue on slides or products of other analyses
   - tissue in alcohol or formaldehyde
   - paper or labware contaminated with blood

3. Contact the ORLC before beginning a new series of experiments that will produce carcass waste. There may be options available that reduce both waste volume and disposal cost.

4. Because freezer space may be at a premium, individual laboratories may be required to store carcasses for extended periods of time before collection by the ORLC.

5. Double bag and label carcass waste, indicating that the bag contains carcasses.
   - Indicate nuclide and total activity, or weight and specific activity.
   - Remove excess air from bag.

Waste Pick-up

A completed "MRB Radioactive Waste Form" must accompany all radioactive waste collected by the ORLC. Please make certain that the form is properly completed **before** you call for a waste pick-up. The ORLC will not to pick up waste unless a properly completed form is available when they arrive to collect the waste. If the waste or the form is not ready when the technician arrives he will leave a discrepancy notice indicating the nature of the problem. The technician will not wait for the form to be completed. The waste pick-up will need to be rescheduled.

1. Information on the form must include:
   - The nuclide, the name of the permittee, the permit number, and the RSO number for the waste.
   - The starting amount of the nuclide - This may be the original activity when the nuclide is first received or the balance of the activity after disposal of part of the material.

2. All units of activities must be indicated--millicuries (mCi) or microcuries(µCi).

3. Each entry should be dated and you must indicate how much activity in that disposal is in each form (solid, liquid, vials, carcass). Do not use percent or volumes.

4. Total the amount disposed and calculate the remaining activity. You do not need to decay correct this number.

5. You must also indicate the chemical constituents of the bulked liquid and vials. This may include the type or brand of liquid scintillation cocktail and anything you added in the course of the research

6. Sign the document, print your name, and date it on the day you call the ORLC for pick up.

7. An MRB Radioactive Waste Form is included with this procedure and may also be found on the ORLC web site.

8. When waste is ready to be picked up, call the ORLC at 724-7774.

MRB RADIOACTIVE WASTE FORM

CURRENT VERSION

EMERGENCY PROCEDURES

The ORLC office is on call 24-hours per day, seven days per week to respond to emergencies involving radioactive materials. In the event of any spill or accident, the ORLC should be notified immediately. Remember, personnel safety comes first.

Emergency Fire & Medical	9-911
Office of Research Laboratory Compliance	724-7774 (MRB, Room 106) 718-0265 (Rad Safety 24-hr cell) 979-845-7551 (RSO, office) 979-450-2586 (RSO cell, after hours)

Accident/Spill Response

If an accident or spill involves personnel injury:
1. Provide first aid immediately for serious injuries
2. Call 9-911
3. Notify the ORLC or RSO as per the numbers listed above.
4. As possible, without doing harm to the victim, monitor the injured individual and remove contaminated clothing and gross personal contamination

Decontamination shall be the responsibility of the group that caused the spill. For large spills (i.e., greater than 10 microcuries) or spills that are difficult to clean up, the work would be carried out under the supervision of the ORLC. Appropriate protective clothing shall be worn during decontamination activities.

1. Stop the source and confine the spill
2. Immediately notify the ORLC for assistance
3. Warn others and isolate the area
4. Soak up any free-standing liquid
5. Wash area with soap and water or commercial decontamination solution
6. Survey area (portable instrument and/or smear survey), documenting all surveys
7. Repeat wash and survey, if necessary
8. Identify and decontaminate any secondary contamination locations
9. Monitor personnel for contamination during and after cleanup
10. Remove and bag any contaminated clothing
11. Discard all refuse as radioactive waste
12. Write an account of the incident and forward a copy to the ORLC

*** If the spill involves millicurie quantities of iodine or any other radionuclide where there may be question of any person approaching applicable limits, exit and seal off room, notify the ORLC, and isolate personnel involved in spill for cleanup and bioassay.

Decontamination of Personnel

1. Remove and bag all contaminated clothing
2. Use mild soap or commercial decontamination solution and tepid water (note: some solution must be highly diluted before use on skin; read directions carefully)
3. If contamination is in a wound (e.g., a cut from contaminated glassware), wash with copious amounts of water
4. Survey affected area and repeat cleaning and survey as necessary
5. If skin becomes irritated, discontinue decontamination and notify the ORLC
6. Identify and decontaminate secondary contamination locations (floor, shoes, doorknobs, telephones), etc.), documenting all surveys
7. Notify ORLC (even if the decontamination was successful)
8. Write an account of the incident, signed by the author and the Permittee, and forward a copy to the ORLC

RADIATION SURVEYS

Radiation surveys are performed to measure external exposure or dose rates from sources of radiation that are in storage, in waste, or in use. Radiation survey results may be used to evaluate exposure controls, indicate posting and access control requirements, and verify compliance with regulatory limits for radiation exposure to personnel and the public.

Radiation surveys are required in laboratories using millicurie quantities of photon or neutron emitting radionuclides or radioactive sources. These surveys are required when

1. New and significantly higher activity sources are received,
2. Radioactive material storage areas are relocated,
3. Radioactive waste containers are relocated, or
4. Activity levels of radioactive material are changed significantly.

Permittees are not required to maintain survey instruments for performing radiation surveys. The ORLC will perform a radiation survey at the request of the permittee.

Radiation surveys that measure an exposure rate due to photons must be performed with a survey instrument that is calibrated in milliroentgens per hour (mR/hr) or millirem per hour (mrem/hr). Neutron surveys must be performed using a meter calibrated specifically for neutron dose measurements.

The selection of a proper survey instrument is critical to ensure that a radiation survey is performed correctly. If you are unsure if your survey meter is appropriate for the radiation to be measured, contact the ORLC.

Radiation survey instruments are calibrated to ensure that the radiation level registered by the instrument is an accurate indication of the actual radiation field being measured when the instrument is used properly. If your survey instrument is not calibrated to read out in mR/hr or mrem/hr, contact the ORLC for information regarding instrument calibration. Meters calibrated to read out in cpm are inappropriate for radiation surveys.

Performing a Radiation Survey

Before performing a radiation survey, the following steps should be performed to ensure that the survey instrument is operating properly:

1. Perform a physical inspection of the instrument, checking for obvious physical damage.
2. Verify that the instrument has been calibrated in the last twelve months.
3. Perform a battery check to verify that the condition of the batteries is within acceptable limits.
4. Perform a response check if a check source is available.
5. Ensure that the audio is working if the meter has audio capability.

If the instrument does not satisfactorily complete the pre-operational inspection, contact the ORLC for repair/calibration information.

Documenting a Survey

The following information should be recorded on the area radiation survey record:

1. Date performed
2. Survey location
3. Survey instrument information (make, model, and serial number)
4. Name of person performing survey
5. Description of conditions under which the survey is performed which may affect the radiation level being measured.

Radiation levels are normally taken at a height of one meter and at varying distances from the source. Radiation fields through a surface (e.g. beyond a wall or a shield) are taken at a distance of one foot beyond that surface. Readings should be taken at locations representing potential locations for personnel exposure in and around the facility

Forward a copy of all radiation surveys to the ORLC for evaluation. Excessive radiation levels may require additional shielding or a relocation of the sources.

CONTAMINATION SURVEYS

Introduction

Permittees are required, as a condition of their permit, to perform contamination surveys. Contamination surveys are used to identify and quantify radioactive contamination on surfaces or personnel. Laboratory contamination surveys consist of routine laboratory-wide contamination surveys and post-operational personnel and working area surveys. This guide is provided to assist you in performing contamination surveys and documenting routine contamination surveys.

Surveys are required to be performed by the permittee in all labs under a permit that allows use of unencapsulated radioactive material (liquids, powders, etc.).

ORLC will generally perform contamination surveys of common areas (where several labs are using radioactive material) on a routine basis.

Types of Contamination

There are two categories of contamination that may be present in a lab: removable and fixed. Fixed contamination does not present a significant hazard unless the material should come loose or there is such a high level of contamination that it presents an external hazard. Removable contamination presents external personnel contamination hazard and also an internal hazard due to ingestion. Contaminated areas generally have removable contamination, but may have a combination of the two types.

Types of Surveys

There are two types of surveys that can be performed by laboratory personnel, surveys using survey meters and surveys using “wipes” counted on a liquid scintillation counter (LSC) or a gamma counter. Survey meter surveys can identify gross contamination (removable plus fixed) while wipe tests identify only removable contamination.

Survey Instrumentation

One key to an effective contamination survey program is the selection of the proper instrument. The two most common survey meters found at the MRB are Geiger Mueller (GM) survey meters and thin window NaI(Tl) scintillation survey meters.

The GM meter is best used for ^{32}P, a high-energy beta emitter, but can also identify areas heavily contaminated with lower energy betas, such as ^{35}S or ^{14}C, for which the GM has a relatively low efficiency. Thin window NaI(Tl) scintillation survey meters are used to identify ^{125}I contamination. GM survey meters are poor detectors of ^{125}I, having a very low efficiency. Note that no common survey meter can detect ^{3}H.

Wipe tests must be used to survey an area for ^{3}H contamination. Due to their high efficiency, wipe test counters, such as LSC’s and gamma counters are very effective

tools for identifying removable contamination. Gamma counters are limited to counting wipe tests for photon emitters, such as ^{125}I or ^{51}Cr. The most versatile instrument is the LSC. Its efficiency is high for a wide range of nuclides. It is the best choice for removable contamination surveys in radioactive material laboratories.

Frequency

The frequency of routine contamination surveys is based on the amount of radioactive material used in the lab. The minimum frequencies for radioactive material user are:

Monthly: Labs where *in vitro* tests are performed, samples (<100 µCi) are analyzed, etc.

Weekly Labs where millicurie amounts of radioactive material are used

Daily Labs where > 100 millicuries of radioactive material is used per week

The RSO/ORLC may institute alternate survey requirements as it deems necessary based on nuclide, amount and form of activity being used, type of procedures, and other risk factors.

If your laboratory uses radioactive material infrequently, you may suspend routine contamination surveys and, instead, perform and document a contamination survey after each use of radioactive material.

If radioactive material use is suspended, a notation must be made in the survey log stating “No radioactive material has been used in the last 30 days”.

Documentation

Permittees are required to document post-operational contamination surveys as well as routine surveys. An ORLC form for documenting contamination surveys is attached. The following information must be included on every contamination survey report:

1. Permittee name and permit number
2. Date of survey
3. Building and room number
4. Radionuclides in use
5. Make, model, and serial number of survey/counting instrument
6. Name of person performing survey
7. Map of survey area with locations marked
8. Background reading of instrument
9. Survey results (including identification of contaminated areas, subsequent action, and results of re-survey)

Survey Locations

Survey locations should be chosen to reflect both areas where there is a likelihood of detecting contamination and also where contamination might be spread were an individual to become contaminated without knowing it.

1. Countertops, including the edges
2. Fume hoods (aprons, sashes, sash handles)
3. Beta shields
4. Refrigerator and freezer door handles
5. Sinks designated for radioactive material
6. Floor, around:
    a. working areas
    b. lab entrances
    c. waste containers
    d. fume hoods
7. Designated “clean” areas:
    a. Offices
    b. desks
    c. food areas
    d. doorknobs
    e. telephones
8. Equipment used with radioactive material, especially common equipment

Survey Instructions:

<u>Contamination survey using a survey meter:</u>

1. Perform meter examination
    a. Check physical condition of instrument
    b. Check ORLC instrument calibration/source check (contact ORLC for calibration arrangement if calibration is greater than one year old)
    c. Check batteries
    d. Perform source check, if available - Expose meter to known radioactive material to verify that the instrument is operating
    e. Determine and record background reading by holding the meter over an area that is not contaminated
    f. Turn on the audio, if available
2. Record the date of the survey and indicate the instrument used for the survey (Choose from instruments listed in the “Survey Instrument Response” section)
3. If performing a laboratory-wide routine contamination survey, obtain a map of the laboratory to indicate areas surveyed
4. If performing a post-operation survey, indicate that you are surveying a work area
5. Slowly move the probe over designated areas in a zigzag pattern, listening for an increase in the audible pulse rate survey instrument as an indication of increased activity
6. If an area with a count rate more than two times background is identified, record the location, determine the extent of the contaminated area and decontaminate
7. After decontaminating any area, resurvey to verify that the area is clean

Wipe tests counted on a LSC or a gamma counter

1. Wear gloves
2. Obtain map of laboratory
3. Using numbered filter papers or pieces of laboratory tissue paper, wipe areas in the laboratory and note location on map
4. Count the wipes on an appropriate counter, including one or two backgrounds (include a piece of clean wipe material) for comparison
5. If an area of removable contamination is identified (counts greater than twice background), clean and re-survey the area
6. Repeat the decontamination and re-survey until the area has removable contamination less than two times background
7. Record counting results, identified contamination, subsequent actions and resurvey results

Personnel Contamination Survey

Use a portable survey meter to survey personnel for contaminated skin or clothing. Documentation of negative results is recommended, but not required. Documentation of the detection of personnel contamination during a personnel contamination survey is required. See “Emergency Procedures”.

Action Level

Any location in which the count rate is more than twice the background should be considered contaminated. Clean the area with soap and water, a commercial cleaning solution (such as 409 or Dow bathroom cleaner) or a commercial decontamination solution specifically designed for radioactive contamination. Resurvey the area to verify that the contamination has been removed. If high level contamination is discovered and assistance in decontaminating the area is required, contact the ORLC immediately. If contaminated skin or clothing still reads more than twice background after repeated attempts to decontaminate, notify the ORLC. See “Emergency Procedures” for additional information regarding spill response and surface and personnel decontamination.

MRB RADIOACTIVE CONTAMINATION SURVEY RECORD

CURRENT VERSION