

## Radiation Safety Manual

### I. Scope

These regulations pertain to all artificially produced radioactive isotopes which must be licensed pursuant to the regulations in Title 10, Chapter 1, Parts 19, 20, 30 and 33 of the Federal Register and to any radiation-producing device or source which is capable of providing radiation in excess of the standards listed in Title 10, Chapter 1, Part 20 of the Federal Register.

### II. Material Receipt and Accountability

In general, possession or use of any radioisotope or radiation-emitting machine at any Montana Tech location must be in accordance with a written Radiation Use Authorization (RUA) issued by the Montana Tech Radiation Safety Committee (RSC). There are no exceptions for small quantity or low emission rate. However, there are exceptions for specific uses. These include:

1. Modest quantities of naturally-occurring radioactive materials in unprocessed form, i.e., ore samples, rock samples, etc.
2. Readily available commercial items containing small amounts of radioactive materials, i.e. gas lantern mantles, smoke detectors, small static elimination brushes for photo lab use, thoriated weld rod, exit signs and other commercial devices using radioisotopes for illumination, etc., so long as radioactive materials will not be separated or used for experimental purposes.
3. Optics having thorium in anti-reflection coatings.
4. Electron microscopes, electron beam welders, and other similar devices exempt from state registration.

Surveys will be made by the Radiation Safety Officer or a designated member of the Radiation Safety Committee of those laboratories and project areas using radiation sources. These surveys are to be made as often as safety dictates, but at least once per quarter. Permanent records of these surveys are kept by the RSO.

Radioactive materials must be controlled at all times. This means that they must be secured when not in use. When in use, radioactive materials must be under the direct supervision and control at all times of an individual who is an authorized user.

Physical inventories will be conducted at intervals not to exceed 6 months to account for all sealed sources and devices received and possessed under the license

### III. Procurement of Radioactive Materials

1. The applicant must submit a written request to the RSC via the Radiation Safety Officer (RSO). The request must provide sufficient detailed information to enable adequate safety analysis and prescription of adequate precautions. (See Appendix A for *Application for Authorization* and Appendix B for *Radioactive Materials Requisition Form*.)
2. The RSO will review the request, review the proposed facilities, obtain any additional information needed, and then prepare a safety review and a proposed Radiation Use Authorization (RUA) for submission to the RSC.
3. The RSC will review the request, the safety review authored by the RSO, and the proposed authorization. The RSC can then approve, disapprove or modify the proposed the authorization.
4. The authorization will specify every location, person, source of radiation, and activity authorized. It will list the expiration date and any special precautions required, and will include any additional information required by the committee.
5. When the RSC has approved the request, the applicant becomes an authorized user of radioactive materials at this institution. Purchase of materials may then be accomplished by obtaining clearance from the RSO or a designated member of the RSC who must countersign a purchase requisition for radioactive materials. (See Appendix B for *Radioactive Materials Requisition Form*.) The purchasing office personnel are aware of this arrangement.
6. At the time the purchase requisition is signed, the authorized user will be listed with the radioactive material specified. If for any reason the material is not received or the order is canceled before delivery, the purchaser must notify the RSO to correct the records. The RSO or a designated member of the RSC must make certain before countersigning any purchase requisition that the material being ordered will not cause the total campus inventory of that nuclide or material to exceed the possession limit stated in Montana Tech's NRC license.

### IV. Transfer of Licensed Materials

1. Occasionally, gifts of licensed materials are offered to the institution. All such gifts of radioactive materials must be transferred to the licensee and handled in accordance with NRC requirements and the conditions of the license. In any case, the RSO must approve the gift prior to the transfer.
2. Internal transfers from one department to another on campus must receive approval by the RSO to ensure that transfers are done in accordance with the conditions of the license. All transfers must be done in a way that minimizes the probability of spillage or breakage. Double containers should be used, including suitable shielding for such transfers.
3. External transfers to another institution or organization must have the approval of the RSO to ensure that transfers are done in accordance with the conditions of the license. Materials must be packaged and labeled in accordance with DOT, NRC, or U.S. Postal Service regulations, whichever is applicable

### V. Training for Individuals Working In or Frequenting Restricted Area

Training for individuals working in or frequenting restricted areas that contain radioactive materials will be commensurate with that person's duties and/or research activities related to the use of such materials. Training for handling of radioactive materials will be conducted by the Radiation Safety Officer who will decide on the degree of supervision required for each

trainee. The highest degree of authorization given to qualified experimenters will allow them to conduct experiments without direct supervision once they have achieved an appropriate level of proficiency.

Training will be provided before employees assume duties with, or in the vicinity of, radioactive materials, whenever there is a significant change in duties, regulations, or the terms of the license, and annually as a refresher.

***For use of soil moisture/density gauges:***

Before an individual is permitted to use a gauge, the individual must successfully complete a training course in its use. The individual must also receive training on the operating procedures, emergency procedures, basic radiation safety described below, and must receive authorized user status.

***For use of radioactive standards and any use of radioactive materials:***

Personnel who will be using radioactive standards for calibration of equipment or personnel involved in the use of any radioactive materials, including sealed sources, will receive the following basic radiation safety training. This training is delivered via an interactive training CD that each authorized user (AU) must complete and pass the exam at the end of the training. In addition, lecture/video training is provided with opportunity for questions.

- Initial orientation on basic radiation safety, including types of radiation, their interactions with natural substances and exposure to humans.
- ALARA concept, use of time, distance and shielding to minimize exposure.
- Material control and accountability, transfer and disposal of materials.
- Recordkeeping, surveys, postings.
- Labeling of containers.
- Handling and reporting of incidents or events.
- Licensing and inspection by NRC.
- Need for complete and accurate information.
- Employee protection, including TLD badging.

## **VI. Facilities and Equipment**

All of the radioactive sealed sources and instruments containing sealed sources, as well as any standards or other radioactive materials, must be kept in a secured storage area. This area must be posted appropriately.

The portable moisture/density gauges must be checked out through the RSO for use. The RSO will verify that the user has received the proper training before allowing use.

If the portable gauges are to be used and transported, they must be secured in transport with the method dependent on the type of vehicle. For example, gauges must be locked in the trunk of a car, hidden from view while in a locked van, secured by a lock and chain while in an open bed truck, or locked in the bed of a truck covered by a shell with a lockable door.

Gauges must be controlled by the constant surveillance of trained users at all times when not in storage. Gauges cannot be left unattended at a temporary jobsite.

## VII. Radiation Safety Program

### A. Radiation Monitoring Instruments

The following instruments are maintained in the Office of Environmental Health and Safety and are available for use:

1. One portable GM survey meter with a pancake detector for alpha, beta, and gamma detection.
2. Two portable ion chamber survey meters for beta, gamma and x-ray detection.

Calibration of survey instruments is done annually by a vendor.

### B. Precautions for Incoming Shipments of Radioactive Materials

Radioactive material shipments are delivered to the campus mailroom. The authorized user or the RSO should be notified immediately of the arrival, but not later than three hours after the package is received.

The authorized user or the RSO must ensure the shipment is in order by using the following procedures and completing the *Radioactive Shipment Receipt Survey form* (Appendix C):

1. Wear gloves to prevent hand contamination.
2. Visually inspect the package for any sign of damage (e.g. crushed, punctured). If damage is noted, stop and notify the RSO.
3. Check DOT White I, Yellow II, or Yellow III label or packing slip for activity of contents, to be certain shipment does not exceed license possession limits.
4. Use the appropriate radiation detection instrument(s) to confirm that the type and amount of radiation perceptible through the package is proper. Notify the RSO if this is not the case.
5. As each increment of packaging is opened and removed, check its surface for contamination, being aware that the supplier may have introduced contamination during packaging, or by non-obvious leakage during transit.
6. Survey the packing material and packages for contamination before discarding. If contamination is found, treat as radioactive waste. If no contamination is found, obliterate the radiation labels prior to discarding in the regular trash.
7. Record the results of this inspection in your permanent records.
8. Notify the final carrier, and by telephone, fax, telegram or mailgram, notify the Administrator of the appropriate NRC Regional Office listed in 10 CFR 20, Appendix D when removable radioactive surface contamination exceeds the limits of 10 CFR 71.87(l); or external radiation levels exceed the limits of 10 CFR 71.47.

### C. Occupational Dose

Montana Tech will monitor individuals in accordance with the criteria in the section entitled 'Radiation Safety Program –Occupational Dose' in NUREG 1556, Volume 7, 'Consolidated Guidance about Materials Licenses: Program-Specific Guidance about Academic, Research, and Development and Other Licenses of Limited Scope,' dated December 1999.

Individual monitoring devices for external dose will be used for:

- Adults who are likely to receive an annual dose in excess of the following (each evaluated separately)
  - 5 mSv (.05 rem) deep-dose equivalent

- 15 mSv (1.5 rems) eye dose equivalent
- 50 mSv (5 rems) shallow-dose equivalent
- 50 mSv (5 rem) shallow-dose equivalent to any extremity
- Declared pregnant women who are likely to receive an annual dose from occupational exposures in excess of 0.5 mSv (0.05 rem) deep-dose equivalent, although the dose limit applies to the entire gestational period.
- Individuals entering a high or very high radiation area.

Internal exposure monitoring (not necessarily individual monitoring devices) is required for:

- Adults likely to receive in one year an intake in excess of 10% of the applicable ALLs for ingestion and inhalation.
- Declared pregnant women likely to receive in one year a committed effective dose equivalent in excess of 0.5 mSv (0.05 rem).

## **D. Safe Use of Radionuclides and Emergency Procedures**

Procedures for safe use, including security of materials and emergencies, include the following. (See Appendix D for *Emergency Procedures to Post in Laboratories.*)

### **Emergency response**

1. If spill or contamination involves injury, administer first aid.
2. If spill is on the skin, flush thoroughly; if spill is on clothing, discard.
3. Take whatever steps to contain the contamination that can be taken safely and immediately.
4. If accident involves gases, notify persons to vacate area; shut off hoods and fans if possible, seal areas, and post warning.
5. Take immediate steps to decontaminate personnel involved.
6. Monitor all persons involved in the spill and clean-up.
7. Contact the Radiation Safety Officer (RSO).
8. Permit no person to resume work in the area until a survey has been made and approval of the RSO is secured.

### **General laboratory rules for the use of radioactive materials**

1. The NRC requires that all radioactive materials be in secure (locked) storage or under the direct and constant supervision of the user. Each authorized user is responsible for ensuring this occurs.
2. Rehearse operations without radioactive material to ensure that the procedure and methods will be reasonably free of incidents. Develop procedures in advance for each lab where radioactive materials are used that will contain methods to safely clean up any spilled material. The size, identity, and physical state of the samples in use should be taken into consideration.
3. Inform others in the area that you will be using radioactive materials.
4. Minimize the time spent near radioactive material.
5. Increase the distance between the material and the body. Use remote handling tools like tweezers or forceps to handle stock vials. Do not handle the vial with your hands for an extended period of time.
6. Provide appropriate shielding materials and/or devices when indicated by the nuclides being used (beta, gamma). Use shielding between the source and your body. Use ½" plastic for high energy beta emitters like P-32, lead foil for low energy gamma emitters like I-125, lead bricks for higher energy emitters such as Na-22, Sc-46, Fe-59. Use of such shielding material can significantly reduce the radiation dose to finger tips and hands.

7. Make sure the material is properly contained. Use drip trays lined with absorbent material in case of spills; stabilize glassware to prevent it from tipping. For dry powdered material, use a glove bag or box.
8. Transport items in shielded containers and/or use equipment and techniques for the transportation of samples from one work area to another that will minimize the possibility of contamination whether by spill, dusting, or any other means.
9. Use extreme care in handling items such as pens, pencils, notebooks, door knobs, telephones, etc. to prevent contamination during work with radioactive materials.
10. Wear a laboratory coat or other protective clothing at all times in areas where licensed materials are used. The authorized user must establish rules in each lab where radioactive materials are used that govern the use of protective clothing and equipment such as coveralls, lab coats, rubber gloves, etc., specifying when and where they must be used and how they should be stored when not in use.
11. Wear disposable gloves at all times when handling licensed materials.
12. Do not eat, drink, smoke or apply cosmetics in areas where radioactive materials are used or stored, nor store food, drink or personal effects in those areas.
13. Make an adequate survey of hands, shoes, hair, and clothing before removing protective clothing and before leaving the radioactivity control area (laboratory). If any activity is found, it must be reported to the person in charge of the laboratory and decontamination accomplished before leaving the area.
14. Wear personnel monitoring devices, if required, at all times while in areas where licensed materials are used or stored.
15. Never pipette by mouth. Use a syringe or other type pipette control.
16. Do not discharge radioactive materials in any sink or by usual waste disposal services. All ordinary wastes generated in a controlled laboratory that might conceivably be contaminated must be surveyed with an appropriate survey instrument before being deposited in non-controlled wastebaskets.
17. Report immediately to the RSO any spills of a quantity greater than that indicated in Appendix C of Title 10, Chapter 1, part 20, Code of Federal Regulations (quantities requiring labeling), or one where contamination cannot be completely removed. See Appendix D for *Spill Cleanup Guidelines*.
18. Report to the RSO within 24 hours any incident (fire, explosion, spill, etc.) which involves radioactive material and which results in contamination of work areas outside of such control areas as hoods, shielded storage, etc.
19. Observe proper and careful housekeeping practices. To this end, proper equipment should be provided (raised edged trays, waterproof backed absorbent paper to cover work areas, dry waste containers, jars for liquid waste, etc.
20. Outline clear procedures for handling and marking glassware and other containers, and for washing and/or decontaminating them. Label all containers of radioactive materials "CAUTION: RADIOACTIVE MATERIALS," and include the radioisotopes, activity, and initial date (or must be kept in a container which is so labeled).
21. All items used for radioactive materials work in the labs such as test tubes, glassware, refrigerators, bench tops, water baths, fume hoods, etc., are also required to be labeled with "CAUTION: RADIOACTIVE MATERIALS."
22. Laboratories authorized for radioactive material use must be posted with "CAUTION: RADIOACTIVE MATERIALS."
23. When the nature and quantities of the radionuclides in use are very limited, such as H<sup>3</sup> and C-14 in tracer quantities, dosimetry badges are not required. For nuclides such as P-32, Cr-51 and I-125 (or others of similar penetrating power), the use of dosimetry badges is required. Permanent records must be kept and made available to

employees. The RSO maintains the records and notifies the authorized users in writing of their dose.

24. Records of the radioactive material inventory, survey results, a copy of this manual, and a copy of the Radioactive Materials Authorization must be kept in the laboratory.

### **Exposure guidelines**

The maximum exposure of an individual to radiation must not exceed the limits indicated in paragraph 20.1201, Title 10, Chapter 1, Part 20, Code of Federal Regulations. These include an annual limit of:

- The total effective dose equivalent equal 5 rems (0.5 mSv) or
- The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue or the lens of the eye equal to 50 rems (5 mSv).
  - The annual limits to the lens of the eye, to the skin, and to the extremities are: a lens dose equivalent of 15 rems (1.5 mSv) and a shallow-dose equivalent of 50 rems (5 mSv) to the skin or to any extremity.

The licensee is responsible for conducting operations so that the effective dose to members of the public does not exceed the limits indicated in paragraph 20.1301, Title 10, Chapter 1, Part 20, Code of Federal Regulations. The total effective dose cannot exceed 10 rem (1 mSv) in a year.

The maximum exposure of a declared pregnant woman, as defined in paragraph 20.1003, Title 10, Section 1, Part 20, CFR, (a woman who has voluntarily informed her employer, in writing, of her pregnancy and estimated date of conception) must not exceed the limits indicated in paragraph 20.1208, Title 10, Chapter 1, Part 20, CFR. This limit is 0.5 rem (5 mSv).

## **E. Surveys**

Surveys will be made by the RSO or a designated member of the RSC of those laboratories and project areas using radiation sources. Surveys of sealed sources are completed every six months using kits supplied by an approved organization, and the samples are sent back to the facility for evaluation. Records are maintained in the RSO's office.

Surveys of laboratories using radionuclides are performed monthly by the authorized users, evaluating contamination that could be present on surfaces of floors, walls, laboratory furniture, and equipment. They are also conducted after any spill or contamination event. The RSO conducts surveys of these laboratories at least every six months. The authorized user is requested to submit a record of their monthly surveys to the RSO.

## **VIII. Waste Management**

The following procedures are published in Appendix T to NUREG –1556, Volume 7, ' Program-Specific Guidance About Academic, Research and Development, and other Licenses of Limited Scope,' dated December 1999.

### **General guidelines:**

1. All radioactivity labels must be defaced or removed from containers and packages prior to disposal in ordinary (non-radioactive) waste. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.
2. Do not mix any non-radioactive waste such as leftover reagents, boxes and packaging material with radioactive waste.

3. Custodians will be provided with adequate training to avoid the possibility of unauthorized disposal or exposure to radioactive materials

### ***Decay in Storage (DIS)***

1. Only short-lived waste (physical half-life of less than or equal to 120 days) may be disposed of by decay-in-storage.
2. Short-lived waste should be segregated from long-lived waste (half-life greater than 120 days) at the source.
3. Waste should be stored in suitable well-marked containers, and the containers should provide adequate shielding.
4. Liquid and solid wastes must be stored separately.
5. When the container is full, it should be sealed. The sealed container should be identified with a label attached to it.
6. The identification label should include the date when the containers was sealed, the longest-lived radioisotope in the container, date when ten half-lives of the longest-lived radioisotope will have transpired, and the initials of the individual who sealed the container.
7. The contents should be allowed to decay until radiation exposure rates are indistinguishable from background exposure rates.
8. Prior to disposal as ordinary trash, each container should be monitored as follows:
  - a. Check the radiation detection survey meter for proper operation.
  - b. Survey the contents of each container in a low background area.
  - c. Remove any shielding from around the container.
  - d. Monitor all surfaces of the container.
  - e. Discard the contents as ordinary trash only if the surveys of the contents indicate no residual radioactivity, i.e., surface readings are indistinguishable from background.
  - f. If the surveys indicate residual radioactivity, return the container to DIS area and contact the RSO for further instructions.
9. If the survey indicated no residual radioactivity, record the date when the container was sealed, the disposal date, type of waste (used or unused material, gloves, etc.) survey instrument used, and the initials of the individual performing surveys and disposing of waste.

### ***Disposal of liquids into sanitary sewerage***

1. Confirm that the liquid waste being discharged is soluble or biological material that is readily dispersible in water.
2. Calculate the amount of each radioisotope that can be discharged by using the information from prior, similar discharges and the information in 10 CFR 20, Appendix B.
3. Make sure that the amount of each radio isotope does not exceed the monthly and annual discharge limits specified in 10 CFR 20.2003(a)(4) and 10 CFR 20, Appendix B.
4. Record the date, radioisotope(s), estimated activity of each radioisotope, location where the material is discharged, and the initials of the person discharging the waste.
5. Liquid waste should be discharged only via designated sinks, toilets, or release points.
6. Discharge liquid waste slowly with water running from the faucet to dilute it.
7. Survey the sink and surrounding work surfaces to confirm that no residual material or contamination remained in the sink or on work surfaces.
8. Prior to leaving the area, decontaminate all areas or surfaces, if found to be contaminated.
9. Maintain records of each radioisotope and its quantity and concentration that is released into the sanitary sewer system.



## Appendix A: Application for Authorization to Use Radioactive Materials

<b>Purpose of this application:</b>	
New or renew application	Amend existing application

<b>Individual responsible for all use of radioactive material under this authorization (the authorized user)</b>	
Name:	Department:
Phone number:	Job title:

Note: Normally only members of the academic or research faculties will be approved as authorized users of radioactive material. This includes individuals holding job titles of professor, associate professor, assistant professor, instructor, research scientist, associate research scientist, assistant research scientist, and research professor. Requests for exception to this policy must be fully justified in writing and will be considered on a case by case basis.

<b>Individual responsible for ensuring radiation safety in the absence of the authorized user</b>	
Name:	Phone number:

<b>Individual(s), other than authorized user, who may submit requests to purchase radioactive materials on behalf of authorized user</b>	
Name 1:	Phone number:
Name 2:	Phone number:
Name 3:	Phone number:

Note: Keeping this list to a minimum helps eliminate duplicate orders.

<b>Approval is requested for the following radioactive material:</b>					
Radionuclide	Chemical and/or physical form	Order/transfer limit (mCi)	Possession limit (mCi)	Max. amount per experiment (mCi)	Max. amount per year (mCi)

<b>Provide information for each individual who will be working with radioactive material</b>				
A complete statement of training must be attached for each individual				
Complete name	Employee/student ID number	Date of birth	Job title	Date completed orientation

Note: Every individual working with radioactive material, including authorized users, must attend the Radiation Safety Orientation Course within three months after starting work and at least once every two years thereafter. New applications will not be approved until this requirement is met.

<b>List each physical place where radioactive material will be used or stored under this authorization.</b>		
<i>Building name</i>	<i>Room number</i>	<i>Room use (i.e. lab, storage only, etc.)</i>

**Describe your proposed use of radioactive materials. Be as detailed as possible. Include a description of any special procedures that you and your staff will follow to ensure the safe use of radioactive material under this authorization.**

Note: you will be asked to detail your general radiation safety program in section 15 of this application. If you prefer, you may combine the two sections as an overall Standard Operating Procedures section since you will need an SOP on file for your new hires to review prior to the first use of radioisotopes.

<b>Do you intend to transfer radioactive material procured under this authorization to other authorized users within Montana Tech or to individuals outside Montana Tech?</b>		
Yes	No	If Yes, provide information on the anticipated recipient.

<b>Complete this section if iodinations will be performed under this authorization or if any container of a radioiodinated compound possessed under this authorization will contain five millicuries or greater of the isotope.</b>	
Radionuclide(s) involved:	Chemical form:
Max. activity present in any container:	
Location (building and room number) of fume hood where iodinations will be performed or where any container holding five millicuries or more of any radioiodinated substance will be used or stored.	
If you will perform iodinations, provide a brief description of the procedure that you will follow including an estimate of the tagging efficiency you expect to achieve:	
List every individual who will be performing iodinations under this authorization or who will be handling any container with five or more millicuries of any radioactive substance.	

**Complete this section if you will work with either 100 millicuries or more of tritium as tritiated water and/or sodium borohydride OR 25 millicuries or more of organically bound tritium.**

Chemical form:	Max. activity present in any container:
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Location of fume hood where work involving tritium above the specified levels will be performed.

Describe the procedures you will follow to ensure that any spill of radioactive material is promptly detected and that appropriate steps are taken to prevent the spread of contamination:

List each individual who will be handling any container with tritium at or above the levels listed above.

**Complete this section if work will be done under this authorization involving P-32**

Max activity present in stock solution:	Max. activity present in container other than stock solution:
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Provide a description of the procedure you will follow for manipulating P-32 so as to minimize exposures from P-32 to the eyes and whole body of any individual:

Provide a description of any shielding that will be provided to minimize exposures from P-32 while in storage, while in use, and as waste material awaiting disposal:

List each individual who will be handling 0.1 millicurie of P-32 at any one time.

**If sealed or plated sources will be fabricated under this authorization, describe the procedure you will use and what leak test method you will employ to ensure source integrity.**

**If you will use commercially available sealed sources, list each source including manufacturer, model number, isotope, activity, calibration date and location of the sealed source.**

Note: if the required information is not available at the time of application, provide a general description that can be followed by the specifics as soon as you know them.

**If you will use a gas chromatograph containing radioactive material, list each source including manufacturer, model number, isotope, activity, calibration date and location of the sealed source.**

Note: if the required information is not available at the time of application, provide a general description that can be followed by the specifics as soon as you know them.

**Outline the survey program you and your staff will follow on a day to day basis to ensure that any spill involving radioactive material is promptly identified, that contamination is not spread beyond the immediate area of the spill and that clean-up of the spill is successfully accomplished. Also, outline precautions you and your staff will follow to ensure that external radiation exposures are maintained as low as reasonably achievable. List survey instruments you will use to ensure that the program is successfully implemented including type of instrument, manufacturer, model number, and sensitivity of each instrument used for surveying or monitoring:**

List any biohazards involved in the use of radioactive materials and describe the special precautions that will be taken to avoid exposure of persons to these hazards. Describe what, if any, special handling is required for waste generated.

List all toxic chemicals involved in the use of radioactive materials involved in the use of radioactive materials and describe the special precautions that will be taken to avoid exposure of persons to these hazards. Describe what, if any, special handling is required for waste generated.

Signature of applicant \_\_\_\_\_ Date \_\_\_\_\_

RSO approval \_\_\_\_\_ Date \_\_\_\_\_

This form must be printed after completion, signed, and emailed to [mcameron@mttech.edu](mailto:mcameron@mttech.edu) or brought to EH&S office, CBB 003.

## Appendix B: Radioactive Materials Requisition Form

Please provide all requested information, including the banner account number to which the materials will be charged.

Authorized user:	Telephone:
Date of request:	Date materials required:
Vendor name:	Vendor telephone:
Building and room materials will be used in:	

Banner index #:	Purchase order #:
Item description:	
Quantity (specify micro or millicuries)	
Catalog #:	Price:

Authorized user signature \_\_\_\_\_ Date \_\_\_\_\_

Approved by RSO \_\_\_\_\_ Date \_\_\_\_\_

## Appendix C: Radioactive Shipment Receipt Survey

Survey Date/time: _____		Location: _____		Survey #:	
Shipped from: _____		Receipt date/time: _____			
Shipping method: _____		Contents: _____			
<b>Package condition:</b> OK      Punctured      Wet      Crushed      Other _____					
<b>DOT radiation label affixed and transport index indicated:</b> None (limited quantity)      WI      YII      YIII      TI					
<b>Maximum measured direct radiation levels:</b> Survey instrument used: _____ Serial #: _____ Background reading: _____ mR/hr Max at package surface _____ Max at 1 meter from package surface: _____					
<b>Maximum wipe results:</b> Survey instrument used: _____ Serial #: _____ Background count rate: _____ cpm=- _____ dpm Maximum package outer surface: _____ net cpm/100cm <sup>2</sup> = - _____ dmp/100cm <sup>2</sup> Maximum final container: _____ net cpm/100cm <sup>2</sup> = - _____ dmp/100cm <sup>2</sup> <b>All    Some</b> smears of the container surface <b>did    didn't</b> show removable radioactivity above background. Exceptions: _____					
<b>Did shipping papers and radioactive contents agree?</b> Radionuclide(s):    Yes    No    Amount (uCi, ect.):    Yes    No    Phys/chem form:    Yes    No List any differences: _____					
<b>Packing materials:</b> Survey of packing material and cartons: _____ net cpm = net dpm _____ Survey of instruments used: _____ Serial number: _____ Disposition of packing materials and cartons: Radioactive waste      Conventional waste (labels destroyed)      Stored for reuse					
Regulatory agency & carrier notification required?    Yes    No (If yes, fill in below)					
Agency: _____	Date: _____	Time: _____	Individual notified: _____	Remarks: _____	
Shipment was received in order. There was no indication of leakage or significant contamination, and no unexpected or abnormal radiation levels.      Yes      No Remarks: _____ Signature of Surveyor: _____					
<b>Disposition of radioactive materials after inspection survey:</b> Material released to: _____ Location: _____ Date and time: _____					
I certify that I am authorized to receive the above listed radioactive material in accordance with the Montana Tech NRC license # _____ Date/time: _____					
Reviewed by Radiation Safety Officer: _____				Date: _____	

# Appendix D

## Emergency Procedures for Radioactive Spill or Emergency

Major spills, contaminations, or injuries with radioactive materials must be reported. Contact:

Marilyn Cameron, Radiation Safety Officer  
Phone: 4463  
Office: CBB 13 (basement)  
Home phone: 494-8080  
Cell phone: 490-8893

Julie Hart, Radiation Safety Committee  
Phone: 4792  
Office: S&E 327  
Cell phone: 490-3799

Montana Tech Security: 4357 (HELP)

### **Emergency Procedures:**

1. If spill or contamination involves injury, administer first aid.
2. If spill is on the skin, flush thoroughly; if spill is on clothing, discard.
3. Take whatever steps to contain the contamination that can be taken safely and immediately.
  - If liquid, apply absorbent material
  - If gas or airborne powder, stop the release and
    - Evacuate the area
    - Seal and post the location
    - Shut down the ventilation in that area if possible
4. Take immediate steps to decontaminate personnel involved.
5. Do not leave scene until instructed to do so.
6. Monitor all persons involved in the spill and clean-up.
7. Contact the Radiation Safety Officer (RSO).
8. Permit no person to resume work in the area until a survey has been made and approval of the RSO is secured.



# Decontamination Procedures

## **Intact skin:**

- Avoid spread of contamination
- Remove clothing from contaminated person
- Decontaminate affected area of skin:

**Procedure:** scrub with mild soap, water and soft brush for 2-3 minutes. Repeat at least 3-4 times. Monitor in between washes. If necessary, use mild abrasive (paste of cornmeal and tide, 50/50, in water) repeating 3-4 times. Dry skin and monitor again.

## **Contaminated hair:**

Shampoo hair with head deflected backwards. Wear gloves! Rinse with 3% citric acid, wash again, rinse, and dry with hair dryer. Monitor.

## **Contaminated eyes:**

Spread eyelids, rinse with water from nose to lateral angle of eye.

## **Whole body contamination:**

Remove all clothing, shower immediately with water, brush with mild soap; repeat at least 3-4 times, towel dry, and then monitor. Use mild abrasive paste if necessary. If unsuccessful, await physician's orders. Following decontamination, use lotion on skin.

## **Contaminated wounds:** (Any wound acquired while using radionuclides)

Rinse wound under running water. Delimit contaminated area with waterproof material.

Decontaminate skin around the wound. Remove tape, apply sterile dressing.

In case of contamination with highly radiotoxic substances, apply venous tourniquet close to the wound. Notify physician immediately. If wounds are contaminated with short-lived radioisotopes of less toxicity, rinsing the wound with sodium chloride or 3% hydrogen peroxide should be done. Monitor, apply sterile dressing and obtain tetanus shot if needed.

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## **Uptake of Radioactive materials:**

Uptake may occur through ingestion (smoking, eating, drinking, pipetting); inhalation (gaseous substances, aerosols, gases); or penetration of skin (gaseous substances, acne, wounds).

Counter measures: Determine time of accident, type of uptake, kind of radionuclide, chemical nature and level of activity of contaminant. Contact physician immediately.

Decision to treat with chelating agents should be made by experts. Chelation should be started within less than one hour in order to be effective.

# Spill Cleanup Procedures

Major incidents such as contamination of the body or clothing, ingestion of radioactive material, contamination that cannot be cleaned up readily, etc., must be reported to the Radiation Safety Officer immediately.

Minor incidents such as a spill involving contaminants less than 1000 dpm per 100 square centimeters may be decontaminated by laboratory personnel under the supervision of the authorized user.

All spills of radioactive material must be cleaned promptly. The responsibility for cleaning up the spill rests on the individuals working in the area involved and responsible for the spill. Under no circumstances should an untrained person attempt to examine or clean up a spill of radioactive material. If assistance is needed, contact the Environmental Health and Safety (EH&S) Office at 4463.

The following general procedures should be followed when dealing with spills of radioactive materials:

## 1. Inform others of the spill

Adjust your response to the seriousness of the spill. Instruct those personnel present in the room at the time of the spill to remain in an evacuation area to prevent contamination spread. Have someone notify EH&S of the incident. If it occurs after normal working hours, report the incident to Security (4357) and have them contact the Radiation Safety Officer. Affected persons should limit their movement to confine the spread of contamination. Evacuated personnel should not eat, drink or smoke until they are monitored and found free of contamination.

## 2. Contain the spill

If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure. If the material is a liquid, place an absorbent material such as paper towels, tissues, cloth, etc., over the spill to prevent its spread. If the material spilled is a powdered solid, attempt to contain its spread by covering the area with a protective barrier such as a drip tray, empty beaker, section of craft paper, etc. If appropriate, close doors and windows and shut off ventilating equipment that may transport contaminated air or particles from the spill area to other parts of the building. Post or cordon off the contaminated area.

## 3. Assemble in a nearby safe or clear area

Begin monitoring and decontamination of affected persons. Remove contaminated clothing at once and flush contaminated skin areas thoroughly. DO NOT LEAVE THE AREA unless adequately decontaminated or with the permission of the radiation safety officer.

## 4. Decontaminate the area

Provide adequate protection and supplies for personnel involved in the cleanup. Begin at the periphery and work toward the center of the contamination. Cover cleaned areas with plastic or paper to prevent its recontamination. Place all contaminated items in the proper waste containers.

## 5. Monitor the progress of the decontamination

Using appropriate survey techniques (wipe samples, scan the area with a Geiger counter, etc.) verify all personnel and materials are properly decontaminated before releasing them to clean areas.

## **Appendix D: Guide for Custodians or Maintenance Personnel Working in Areas Where Radioactive Materials are Used**

Under normal conditions, entry into a radioactive materials laboratory for housekeeping duties does not present a hazard. Such employees do not require film badges since their duties do not involve working directly with radioactive material. The following set of rules should be observed at all times:

1. Obey all cautionary signs. They mean what they say.
2. Report any unusual event, such as spilled material from a container labeled with a radioactive material sticker, a radioactive materials storage freezer with power is defrosting, etc. These situations, if left unchecked, could develop into a more serious problem.
3. Report the incident to your supervisor and the lab director and then to the Radiation Safety Officer, Marilyn Cameron at 4463. After hours, call 494-8080 or 490-8893.
4. Before working on items suspected of being contaminated with radioactive material, make sure Radiation Safety has surveyed and approved the area. Examples are changing the light bulbs in the fume hood, working on the plumbing in a lab sink, fixing a refrigerator, water bath, etc., which are used for radioactive materials.
5. Do not handle items that are labeled with a Radioactive Caution sign. These items may be contaminated with radioactive material.
6. Do not handle or empty radioactive waste containers. They must be disposed of properly and cannot be released to normal trash.
7. Do not dust or clean radioactive material workstations. Unless specifically requested to do, no housekeeping activities should be performed in radioactive work areas; doing so may cause spread of radioactive contamination.
8. DO NOT attempt to clean up a radioactive spill. Only trained individuals with the proper protective clothing should attempt to clean a radioactive spill. If not monitored with special equipment, contamination could spread to other areas.
9. If you accidentally become contaminated with radioactive materials, stay calm. Wash off with soap and water. Remove any contaminated clothing. Minimize movement to prevent further spread of the material. Stay near the area, do not walk around. Have someone else call for help. Do not eat, drink, or smoke. Avoid contacting your eyes, nose, mouth, or any open wounds. DO NOT leave the area until cleared by Radiation Safety.

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