**RADIATION SAFETY MANUAL**

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 **SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY**

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**ADMINISTRATIVE FUNCTIONS AND RESPONSIBILITIES**

1. **The Radiation Safety Officer.**

The Radiation Safety Officer (RSO) must ensure that established policies are followed by all individuals whose work involves the use of radioactive materials and/or ionizing or non-ionizing radiation. The RSO will communicate with the Environmental Health Safety and Risk Committee (EHS&R) regarding program implementation and compliance status. The RSO is the Chair of the EHS&R Committee and will serve as a liaison between the University or federal regulatory agencies. The RSO reports directly to senior management and has the authority to immediately terminate any activities that are found to be a threat to public health, safety or property. Specific duties of the Radiation Safety Officer include and are not limited to:

1. Ensuring that all aspects of the radiation safety program are in compliance with federal regulations or other recognized standards;
2. Reviewing all applications for the use of radioactive materials or equipment capable of producing ionizing or non-ionizing radiation;
3. Providing consultation concerning radiological safety procedures to all potential users of radioactive materials and/or ionizing or non-ionizing radiation;
4. Supervising radiation measurement and protection activities including monitoring for radiation exposure, survey methods, waste disposal and radiological safety practices;
5. Supervising the maintenance of the following records:
6. Personnel Dosimeter Records
7. Quarterly Inventories
8. Waste Disposals
9. Orders for All Radioactive Materials
10. Wipe Tests of All Incoming Packages Containing Radioactive Materials
11. Registration of All X-Ray Producing Devices
12. Leak Tests of Sealed Radioactive Sources
13. Bioassay Results
14. Incident Report
15. Files on Each User of Radioactive Materials Including His/Her Authorization Request and Other Supporting Documents
16. Laboratory Inspection Reports
17. Records on Electronic Products Emitting Radiation
18. Inventory of Sealed Sources
19. Establishing and conducting training courses for radioactive material users and users of equipment producing ionizing or non-ionizing radiation;
20. Supervising and coordinating the disposal of radioactive waste;
21. Providing direction in cases of accidents, decontamination, or emergencies related to radiation matters;
22. Coordinating the posting and restricting of radiation areas, and storage and safeguarding of radioactive materials.

1. **The Principal Investigator.**

In addition to the requirements stated in each policy, the principal investigator must assume responsibility for the following matters:

1. Supervising and instructing each individual user in the safe use of radioactive materials or radiation producing equipment; ensuring attendance at required radiation safety courses; and instructing the individual user in the course of action in the event of an emergency;
2. Careful planning of each experimental procedure; the amount and types of radiation or radioactive material must be determined for the experiment and the appropriate safety precautions must be outlined;
3. Complying with all applicable federal regulations or other recognized standards;
4. Informing the Radiation Safety Office of major changes in techniques, equipment modifications, operating procedures, or lab setups that may lead to increased personnel exposure or contamination levels in the laboratory prior to execution;
5. Ensuring personnel are properly monitored by requesting dosimeters as applicable;
6. Furnishing the Radiation Safety Officer with personnel changes or sabbatical leaves; if the principal investigator terminates employment with the University, all radioactive materials shall be properly disposed and a final survey of the laboratory shall be performed;
7. Assisting with any decontamination or emergency response activities that may be required in the principal investigator's authorized areas;
8. Providing immediate notification to the Radiation Safety Officer when there is an over-exposure to radiation indicated, gross contamination in a laboratory, lost or stolen radioactive material, or any other situation which may result in a hazard to persons in the area.

1. **Individual User**

In addition to the requirements stated in each policy, the individual user has the following responsibilities:

1. Performing all work with radiation in a manner that will keep exposures as low as reasonably achievable (ALARA);
2. Complying with all requested items dictated by the authorized user, radiation safety officer and/or any other ranking official;
3. Complying with applicable federal regulations or other recognized standards;
4. Attending formal safety courses offered by the Radiation Safety Officer and on-line course on the basics of radiation safety;
5. Utilizing appropriate personal protective equipment and monitoring devices;
6. Informing the authorized user and the Radiation Safety Office of any known hazardous conditions, or of an apparent overexposure.
7. **Environmental Health Safety and Risk Office**

In addition to the requirements stated in each policy, the Environmental Health Safety and Risk Office must assume responsibility for the following matters:

1. Personnel monitoring service including badge exchanges, preparing reports required by regulations, maintaining records of all exposure data, investigating overexposures and notifying regulatory agencies of overexposures;
2. Evaluation of internal exposures to personnel including the collection and analysis of air samples, bioassay samples (or in vivo counting), or thyroid monitoring;
3. Removal of radioactive waste from the laboratories and processing the waste;
4. Direction of decontamination efforts;
5. Control of the ordering, receipt and distribution of all radioactive materials;
6. Maintenance of survey equipment including calibration and operational checks;
7. Leak testing of all sealed sources.

**ALARA PROGRAM**

South Dakota School of Mines and Technology is committed to maintaining radiation exposures to employees, students and visitors As Low As is Reasonably Achievable (ALARA, please see 10 CFR Part 20 for more information). The following program has been developed in support of the ALARA program:

1. The Radiation Safety Officer has developed specific policies related to the safe acquisition, use and disposal of materials or devices capable of producing ionizing or non-ionizing radiation. All individuals working with radiation must abide by the provisions of the policies.
2. The Radiation Safety Officer or designee will conduct semi-annual inspections of all laboratories using radioactive materials. The inspections will include a contamination survey and wipe test of laboratory work areas and an audit of the records. Users classified as “Inactive” will be inspected annually. In addition, a yearly check of air flow in ventilation hoods that may be used for volatile radioactivity will be performed to ensure adequate capture velocity. Inspections of radiation producing equipment will be performed at periodic intervals to ensure that they are functioning in a safe and proper manner.
3. Radiation safety training programs have been established for University personnel. All individuals working with radioactive materials are required to have training in radiation safety and are required to participate in the University's training program if they have no prior experience. New radioactive material users can begin work with isotopes and/or receive a personnel dosimeter while waiting to attend a training class but they must be under the direct supervision and in the physical presence of a trained laboratory employee. This training requirement must be satisfied within one year or the individual’s personnel dosimeter and permission to use radioactive materials will be revoked. Individuals with prior training will be required to provide proof of training such as a certificate or a letter from the RSO at another institution. In addition, the principal investigator shall provide instruction and on-the-job training to employees concerning specific procedures employed in the laboratory. It cannot be assumed that this type of instruction has been adequately provided by prior occupational training.

**RADIATION SAFETY POLICIES AND PROCEDURES**

1. **Radioactive Materials Authorization Request Format**

1. Policy and Procedure

This policy is designed to aid a principal investigator in obtaining authorization to use radioactive materials under the University's Specific License.

1. Responsibilities
2. The principal investigator has the responsibility for understanding and complying with all the provisions of the specific academic license and the Radiation Safety Manual.
3. The radiation safety officer will review authorization requests and work with requester to amend specific license to allow work.
4. Procedures
5. Any requests for an authorization to use radioactive materials must be prepared on the form found in the Appendix of this manual or online at: http://business.sdsmt.edu/ehs/
6. The following information must be contained in the application:
7. Name, title, department, laboratory address, phone numbers, and e-mail address of individual who will be responsible for the use of radioactive materials (hereafter called the authorized user);
8. Provide authorized user’s training and experience with radiation, including any type of instruction in radiation safety, prior licenses or authorizations, and information regarding the isotopes, maximum activity levels used at a time, institution, and length of time work was performed;
9. Applicant must provide a description of the general scope of the research to be conducted and a brief protocol for each isotope being requested. For sealed sources, the manufacturer’s name, model, and serial number must be listed;
10. Using the chart that is provided on page two of the application, list the specific techniques that will be used for each isotope. The activity required for each experiment and the expected frequency must be completed to properly assess possession limits. All limits are subject to change at the discretion of the radiation safety office or radiation safety committee;
11. The investigator must also provide information on the types of waste generated from the research. (refer to Preparation & Disposal of Radioactive Waste) Please note the restrictions to the waste since it is difficult to dispose of certain types of waste;
12. A laboratory sketch (need not be to scale) detailing radioactive material work areas, storage areas, waste storage areas, hoods, hot sinks and shielding;
13. A brief description of the appropriate contamination controls which will be utilized (ex. wipe tests, GM surveys and personnel monitoring) as well as the types of shielding;
14. List the radiation instruments to be utilized, including manufacturer, model and serial number of each instrument. Provide a room number where the instrument is located;
15. Provide two references, including phone numbers and e-mails, of individuals who can attest to the principal investigator's experience with radioactive materials;
16. After reading the University's Radiation Safety Manual, sign the application.

1. The completed forms must be returned to the Radiation Safety Officer for review. The principal investigator will be notified of any discrepancies or clarifications needed.
2. The Radiation Safety Officer will forward the completed authorization request form to the Environmental Health Safety and Risk Committee for their review.
3. After approval, the Radiation Safety Officer will grant an authorization to the principal investigator. The Radiation Safety Officer or designee will then assist the principal investigator with posting and record keeping requirements.
4. All requests for changes in the principal investigator's authorization agreement (i.e. changes in possession limits, adding or deleting isotopes, new protocols etc.) must be made directly to the Radiation Safety Officer.
5. **Radiation Safety Training**
6. Policy and Purpose

This policy is designed to ensure that all employees working with or near radioactive materials or radiation emitting devices receive proper training. Radiation safety training consists of three parts: (1).formal training classes offered by the Radiation Safety Office, (2). training on specific techniques, protocols and/or equipment operation offered by the principal investigator or his/her designate and (3). annual refresher training offered by the principal investigator or his/her designate.

1. Responsibilities
   1. The principal investigator is responsible for ensuring that all laboratory employees working with radioactive materials attend the formal training classes offered by the Radiation Safety Officer or designee and for the training of each employee in specific safety measures associated with each research protocol and/or the operation of each radiation emitting device. Training conducted by the principal investigator or his/her designee must be documented in writing.
   2. The individual user (employee) must attend formal training classes offered by the Radiation Safety Officer or designee and must participate in all specific training sessions provided by the principal investigator or his/her designee.
   3. The radiation safety officer or designee must provide formal classes and/or computer based self-paced classes to all employees in need of training in radiation safety. In addition, the radiation safety officer must ensure that principal investigators offer specific training and yearly refresher training to laboratory employees and ensure that this training is documented.
2. Procedures and Practices
   1. The Radiation Safety Officer will provide training programs for users of radioactive materials on an “as needed” basis. Student achievement will be assessed by having each participant take an examination and answering at least 80% of the questions correctly. A certificate of achievement will be mailed to each successful participant.
   2. A radiation safety training lesson has been developed on SDSM&T’s Radiation Safety Website for employees or students who will be working with radiation but have not yet had the opportunity to take one of the formal courses. This lesson will give the user some insight into matters related to radiation safety until one of the required formal courses can be taken. This lesson is also designed for SDSM&T employees, students and/or visitors who are not actually working with radiation but have a need to visit research laboratories or medical offices where radioactive materials or radiation emitting devices may be present. This 20 minute lesson will familiarize the participant with these radiation sources and help to avoid unnecessary exposure. The address for the website is: http://business.sdsmt.edu/ehr/training/
   3. Before an employee begins work with radioactive materials, the principal investigator must ensure that the employee has received specific instruction on techniques and protocols related to the laboratory work that they will be required to perform. The training must include:

* Handling of Radioactive Materials
* Waste Disposal Procedures
* Storage of Radioactive Materials
* Emergency Procedures
* Other Matters the Principal Investigator Deems Appropriate

1. **Ordering, Receipt and Transfer of Radioactive Materials**
   1. Policy and Purpose

This policy is designed to ensure that radioactive materials are ordered, received and/or transferred in a safe manner and that all activities are in compliance with federal regulations governing the possession, use, and transport of radioactive materials.

* 1. Responsibilities

1. The principal investigator is responsible for ensuring that he/she is authorized to receive any radioactive material ordered from a vendor or received from another investigator. The amount of radioactive material received plus the amount already in possession must not exceed the authorized limits. The principal investigator is also responsible for assuring that orders from his/her lab are properly placed.
2. The radiation safety officer is responsible for receiving orders for radioactive materials from the principal investigator or his designate. The RSO or designee will check to ensure that the principal investigator is authorized to receive the isotope and authorized for the amount ordered. The order will be processed as outlined below. The RSO or designee will handle any problems that occur with a shipment and will ensure that all shipments are handled in a safe manner after receipt by the University. The radiation safety officer will also oversee the transfer of radioactive materials to investigators at other institutions.

* 1. Procedures

1. Ordering
2. Purchase requisitions for radioactive materials will be written by the principal investigator and marked "Radioactive Material Order". Purchase requisitions will be sent to the University Chemical Storeroom to be processed by the Radiation Safety Officer or designee. The RSO or designee will check the requisition against the authorization of the individual placing the order. If approved, the order will be assigned a radiation safety inventory number, signed, and ordered.
3. Any order that does not meet the approval of the Radiation Safety Officer or designee (i.e. individual not authorized for isotope ordered, order exceeds authorized limits for certain isotope or the blanket P.O. has expired) will be immediately referred back to the individual placing the order.

1. Receipt
2. All packages containing radioactive materials will be picked up at the mailroom by the RSO or designee.
3. Packages that are damaged or appear to be leaking will be handled by the RSO or designee and appropriate actions will be taken.
4. The transport index on each package will be checked and recorded by the radiation safety officer or designee using a portable GM survey instrument.
5. The packing slip attached to the package will be examined and checked against ordering information. The contents of the package will also be checked against the packing slip once the package has been opened.
6. Wipe tests will be performed by Radiation Safety Officer or designee on each incoming package. The outside of the box and each successive layer of packaging will be tested. Wipe tests will be analyzed with alpha/beta counter. Wipe test results will be recorded at the top of Radioactive Material Worksheet (SDSMT-RAD-10 or SDSMT-RAD-05) and delivered to the laboratory with the radioactive package.
7. If contamination is detected on any of the packing material, the packing material will be disposed of as radioactive waste.
8. If contamination (measured DPM's greater than 3 times background on the alpha/beta counter) is detected on the vial and found to be less than 1,000 DPM alpha or 20,000 DPM beta or gamma, an attempt will be made to decontaminate the vial through washing. If contamination exceeds levels listed above, or if a contaminated vial cannot be decontaminated, the vendor will be notified to send a replacement shipment. The contaminated package will be disposed of by Radiation Safety Officer.
9. If no contamination is found or if decontamination is successful, the package will be delivered to the principal investigator along with a record of GM survey and wipe test results. The Radiation Safety Officer or designee will also keep a copy of all survey and wipe test results.
10. Transfers
11. If radioactive material is received from another investigator at the University, this receipt must be recorded on standard transfer form SDSMT-RAD-05 found in the radioisotope logbook.
12. If radioactive material is transferred to an investigator at another University, the transfer must be recorded on a transfer form SDSMT-RAD-05 that is obtained from the Radiation Safety Officer. The Radiation Safety Officer will provide the necessary instructions for proper packaging. **Extreme caution must be used in transferring radioactive material.** The material must be packaged in a manner that would reduce the spread of contamination in the event of an accident (i.e. use of absorbent material, unbreakable container, etc.). Shipments of radioactive material must be made in compliance with U.S. Department of Transportation (DOT) Regulations. If such shipments are necessary, contact the RSO for assistance.
13. If radioactive material is being received from another institution, it is the responsibility of the laboratory to inform the Radiation Safety Officer of its expected arrival day. The material must be picked up in the mailroom by the RSO so that the necessary surveys can be conducted.

1. **External Exposure Monitoring**

1. Policy and Purpose

Personnel dosimeters provide a record of individually accumulated radiation doses. This policy provides the necessary control for monitoring personnel and maintaining exposures below prescribed limits.

1. Responsibilities
2. The principal investigator must request badge service from the RSO for all personnel working in an area where radioactive material or radiation producing equipment is used. A request for dosimeters must be made using the form supplied by the radiation safety office (Form SDSMT-RAD-01). Any changes in personnel or badges that are lost or damaged must be reported immediately. Personnel who work only with pure alpha emitters or pure beta emitters having a maximum energy of less than 0.2 MeV will not be required to wear personnel dosimeters.
3. The individual user must follow all of the guidelines of this procedure.
4. The RSO will coordinate the exchange of badges on the designated exchange schedule. The badges will be forwarded to the commercial dosimeter processing service. Records of exposure will be maintained for each occupationally exposed worker. Exposure histories will be requested from previous employers and copies of current exposure records will be forwarded to future employers, upon request.
5. The RSO will review all requests for film badge service and will issue dosimeters at his discretion. All results will be reviewed and any abnormal readings will be investigated. The radiation safety officer will take any immediate action concerning overexposures that is deemed necessary and will make a full report to the EHS&R Committee and the NRC.

1. Procedures and Safety Practices
2. Always wear a dosimeter when working in restricted areas.
3. Whole body badges must be worn on the trunk of the body nearest to the source of radiation (collar, belt, pocket, etc.)
4. A ring badge must be worn on a finger that would be nearest to the radiation source. Rubber gloves must be worn over the badge to prevent contamination of the badge.
5. Do not take the badge home. Leave it at the workplace in a safe area away from radiation sources.
6. Never intentionally expose a badge to ionizing radiation.
7. Do not wear the badge while being exposed to medical x-rays or fluoroscopes. The badge is only for monitoring occupational exposure, not medical exposure.
8. Do not tamper with the badge or open the packet that contains the dosimeter device (except during periodic changes). Erroneous readings could result.
9. Protect the badge from moisture (i.e., rain, washing machines, etc.) and excessive heat (i.e. dryer, car, etc.).
10. Notify the RSO of any change in status: termination of employment, leave of absence, maternity leave, name change etc.
11. Keep all exposure records indefinitely.
12. The badge is assigned to one person and must not be worn by another individual for any reason.
13. **General Laboratory Safety Procedures**
14. Policy and Purpose

This policy provides general guidelines for the safe handling of radioactive materials in the laboratory. The safety procedures contained in this policy apply to all laboratories and must be used in conjunction with other safety procedures that are pertinent to each specific laboratory.

1. Responsibilities
2. The principal investigator must ensure that the general safety procedures are observed by all individuals working in the laboratory and must establish additional safety practices, when applicable, to assure the safe utilization of radioactive materials.
3. The individual user must exercise extreme caution when working with radioactive materials and must observe all provisions of this procedure.
4. The radiation safety officer will assess the level of compliance of the general safety procedures contained in this procedure.
5. Procedures and Safety Practices

The following items are general radiation safety procedures that must be followed by each laboratory using radioactive materials.

1. Appropriate personal protective equipment or apparel must be utilized by persons working with radioactive materials, e.g., disposable gloves, lab coats, lab aprons, goggles, etc.
2. Radioactive materials must be stored under lock and key or the door to the laboratory must be locked when unattended, to prevent exposure to unauthorized persons and/or loss or theft of the materials. All radioactive materials will be stored such that the exposure rate at the surface of the storage area is less than 2.0 mR/hr.
3. Work with radioactive materials must be performed in ventilated fume hoods if the manipulation of such materials involves any possibility of airborne contamination.
4. Pipetting of radioactive solutions by mouth is strictly prohibited.
5. Smoking, drinking, eating, and applying of cosmetics is prohibited in areas where radioactive materials are used or stored.
6. Food and drink must not be kept in refrigerators used to store radioactive materials.
7. Contaminated glassware and other utensils must be kept separate from other laboratory glassware or utensils and must be labeled "radioactive".
8. Personnel monitoring badges, when required in a laboratory, must be kept in an area free of radioactivity when not in use. Do not take the badges home!
9. Remote handling equipment (long-handled tongs, remote pipettes, etc.) will be routinely used in handling high levels of radioactive materials.
10. If a personnel monitoring device has been assigned, it must be worn at all times while in areas where radioactive materials are being used.
11. Lead and/or Plexiglas shields must be used for sources having high radiation intensity. Contact the RSO for information concerning the type and amount of shielding that would be required for your laboratory set-up.
12. Hands, shoes and clothing must be frequently monitored.
13. Liquid and solid radioactive waste must be placed in approved containers. Liquid waste containers are provided by the RSO.
14. When working with a new procedure in which radioactive materials are to be used, a dry run (without the isotope) should be considered to isolate any problem areas.
15. In the case of a spill or breakage, the area (table top, floor, etc.) must be decontaminated until all loose activity is removed. Fixed contamination must be reduced to the practical minimum. DECONTAMINATION IS TO BE PERFORMED BY LABORATORY PERSONNEL, NOT BY HOUSEKEEPING PERSONNEL. The spill should be reported to the RSO and an incident report completed.
16. All persons involved in a spill and decontamination activities must be checked immediately after the spill and after decontamination is finished. A Geiger-Mueller survey meter is to be used as required. After such an accident, the general area especially floors, doors, handles, stair railings, etc. must be surveyed.
17. Label all work areas where radioactive materials are used with "radioactive" tape.
18. All areas in which radioactive material is used or stored must be in compliance with Occupational Safety and Health Act, 1970 (OSHA) and United States Nuclear Regulatory Commission (NRC).
19. Entrance doors to rooms and laboratories in which radioactive materials are stored or used will be posted with a conventional sign bearing the words "CAUTION - RADIOACTIVE MATERIALS". In addition to the foregoing requirement, some areas may be required to post a sign bearing the words "CAUTION - HIGH RADIATION AREA" or "RADIATION AREA"; these areas will be designated by the RSO, in compliance with federal regulations.
20. **General Emergency Procedures**
21. Policy and Purpose

This policy provides general guidelines for handling emergency incidents involving radioactive materials in the laboratory. The safety procedures contained in this policy apply to all laboratories and must be used in conjunction with other safety procedures that are pertinent to each specific laboratory.

1. Responsibilities
2. The principal investigator must ensure that the emergency procedures are observed by all individuals working in the laboratory and must establish additional lab specific emergency procedures, when applicable, to assure the safe utilization of radioactive materials.
3. The individual user must exercise extreme caution when working with radioactive materials and must observe all provisions of this procedure.
4. The radiation safety officer will assess the level of compliance of the general safety procedures contained in this procedure.
5. Emergency Procedures (NUREG - 1556, Vol. 7 P-4 used as basis)

Copies of emergency procedures should be provided to all users. Post a current copy in each laboratory or other area where radioactive material is used.

**General Safety Procedures to Handle Spills**

Name and telephone number of RSO or an alternate person(s) should be posted conspicuously in areas of use, so that it is readily available to workers in case of emergencies. Licensee should have emergency equipment readily available for handling spills. Spill kits shouldinclude the following:

* Disposable gloves
* Housekeeping gloves
* Disposable lab coats
* Disposable head coverings
* Disposable shoe covers
* Roll of absorbent paper with plastic backing
* Masking tape
* Plastic trash bags with twist ties
* “Radioactive Material” labeling tape
* Marking pen
* Pre-strung “Radioactive Material” labeling tags
* Box of Wipes
* Instructions for “Emergency Procedures”
* Clipboard with a copy of the Radioactive Spill Report Form for the facility
* Pencil
* Appropriate survey instruments including batteries (for survey meters).

**Minor Spills of Liquids and Solids**

Instructions to Workers

1. Notify persons in the area that a spill has occurred.
2. Prevent the spread of contamination by covering the spill with absorbent paper. (Papershould be dampened if solids are spilled).
3. Clean up the spill, wearing disposable gloves and using absorbent paper.
4. Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
5. Survey the area with an appropriate low-range radiation detector survey meter or other appropriate technique. Check the area around the spill for contamination. Also check hands, clothing, and shoes for contamination.
6. Report the incident to the Radiation Safety Officer (RSO) promptly.
7. Allow no one to return to work in the area unless approved by the RSO.
8. Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
9. Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
10. RSO will complete incident report and will report to NRC, if appropriate.

**Major Spills of Liquids and Solids**

Instructions to Workers

1. Clear the area. If appropriate, survey all persons not involved in the spill and vacate the room.
2. Prevent the spread of contamination by covering the spill with absorbent paper (paper should be dampened if solids are spilled), but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all personnel who may be contaminated.
3. Shield the source only if it can be done without further contamination or significant increase in radiation exposure.
4. Close the room and lock or otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to enter that a spill of radioactive material has occurred.
5. Notify the RSO immediately.
6. Survey all personnel who could possibly have been contaminated. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with a mild soap.
7. Allow no one to return to work in the area unless approved by the RSO.
8. Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
9. Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
10. RSO will complete incident report and will report to NRC, if appropriate.

**Incidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases**

Instructions to Workers

1. Notify all personnel to vacate the room immediately.
2. Shut down ventilation system, if appropriate, to prevent the spread of contamination throughout system and other parts of facility.
3. Vacate the room. Seal the area, if possible.
4. Notify the RSO immediately.
5. Ensure that all access doors to the area are closed and posted with radiation warning signs, or post guards (trained) at all access doors to prevent accidental opening of the doors or entry to the area.
6. Survey all persons who could have possibly been contaminated. Decontaminate as directed by the RSO.
7. Promptly report suspected inhalations and ingestions of licensed material to the RSO.
8. Decontaminate the area only when advised and/or supervised by the RSO.
9. Allow no one to return to work in the area unless approved by the RSO.
10. Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
11. Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision and collection of bioassay samples, requested documentation).
12. RSO will complete incident report and will report to NRC, if appropriate.

**Minor Fires**

Instructions to Workers

1. Immediately attempt to put out the fire by approved methods (i.e., fire extinguisher) if other fire hazards or radiation hazards are not present.
2. Notify all persons present to vacate the area and have one individual immediately call the RSO and fire department (as instructed by RSO).
3. Once the fire is out, isolate the area to prevent the spread of possible contamination.
4. Survey all persons involved in combating the fire for possible contamination.
5. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water, then washing with a mild soap.
6. In consultation with the RSO, determine a plan of decontamination and the types of protective devices and survey equipment that will be necessary to decontaminate the area.
7. Allow no one to return to work in the area unless approved by the RSO.
8. Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
9. Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
10. RSO will complete incident report and will report to NRC, if appropriate.

**Fires, Explosions, or Major Emergencies**

Instructions to Workers

1. Notify all persons in the area to leave immediately.
2. Call 911.
3. Notify the RSO and Campus Safety.
4. Upon arrival of Rapid City Fire Department (RCFD), inform them where radioactive materials are stored or where radioisotopes were being used; inform them of the present location of the licensed material and the best possible entrance route to the radiation area, as well as any precautions to avoid exposure or risk of creating radioactive contamination by use of high pressure water, etc.
5. Cooperate with RSO/RSO staff (e.g., investigation of root cause, provision of requested bioassay samples).
6. Allow no one to return to work in the area unless approved by the RSO.
7. Follow the instructions of the RSO/RSO staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
8. RSO will complete incident report and will report to NRC, if appropriate.
9. **Preparation and Disposal of Radioactive Waste**

1. Policy and Purpose

This policy is designed to ensure that all radioactive waste is handled safely and is sorted for ease of disposal. Implementation of this policy will ensure compliance with State Regulation RHA 3.55, concerning the general requirements for waste disposal.

1. Responsibilities
2. The principal investigator is responsible for preparing all waste material for transport from the laboratory. The material must be sorted and labeled as outlined in this policy.
3. The individual user must dispose of radioactive waste in a safe manner and must follow the provisions outlined in this policy.
4. The RSO is responsible for ensuring that all radioactive trash is properly sorted, labeled and tagged. The RSO has the authority to reject or return any waste that has not been properly handled by the principal investigator. The RSO will oversee the packaging, transport and disposal of all radioactive waste generated by the University.

1. Procedures and Practices
2. The RSO must be notified by e-mail at Jerilyn.Roberts@sdsmt.edu

when a radioactive waste pick-up is needed. All waste will be picked up based on scheduled appointment.

1. In the event of inclement weather, holidays, etc., the schedule will be changed to the next available day.
2. RSO will **REJECT** any material that is not properly packaged, labeled or tagged.
3. The activity (mCi or uCi) for each type of waste must be recorded on form SDSMT-RAD-06 and the disposal of radioactive waste shall be handled as follows:
4. Solid Waste
5. Solid waste must be placed in covered, trash containers that are lined with plastic bags. The containers must be labeled with "radioactive" tape or radiation warning signs.
6. No liquid whatsoever shall be put into the solid waste. If any liquid is found in the collected solid waste, the waste will be returned to the principal investigator's laboratory to be separated.
7. Pasteur pipettes, needles, razors and other sharp objects must be packaged in a cardboard box.

1. Liquid Waste
2. Two and one half gallon plastic carboys are provided, on request, from the Radiation Safety Office or designee for collection of bulk liquids.
3. Bulk liquids must be separated as follows:
4. Aqueous liquids
5. C-14 and H-3 (tritium) can be combined;
6. It is preferred that all other isotopes be separated for ease of analyzing.
7. Mixed liquids

The generation of mixed liquids (radioactive and hazardous) must be avoided due to severe disposal restrictions. If the generation of this type waste is unavoidable, the RSO must be contacted prior to its generation to ensure a disposal option is available. Bulk scintillation media with C-14 and/or H-3 may be classified as “Hazardous Only” providing a radioactive limit is not exceeded.

1. All liquid waste must be readily soluble with no trace of mold, bacteria, tissues, or other materials that would prohibit pouring.
2. Liquids can only be accepted with a pH range of 6 to 9.
3. Scintillation Vials
4. **Only vials containing non-hazardous scintillation fluid will be accepted for disposal.**
5. Vials will be picked up with the scintillation fluids in them if they are packed in scintillation vial trays and separated as follows:
6. C-14 and H-3 can be combined;
7. All other isotopes must be separated; for example P-32 vials and S-35 vials go into different waste drums, so they must be placed in separate trays.

1. No liquid radioactive waste shall be disposed of in the sanitary sewer system. When cleaning contaminated glassware, the first two rinses must be poured into a plastic carboy and treated as liquid waste. Any remaining residue in the glassware can be washed down the sink drain.
2. **Laboratory Surveys and Contamination Control**
3. Policy and Purpose

This policy is designed to provide appropriate controls over radioactive contamination of personnel, equipment and work areas and to satisfy the requirements of United States Nuclear Regulatory Committee concerning tests and surveys.

1. Responsibilities
2. The principal investigator has the responsibility of ensuring that all surveys and wipe tests are performed in accordance with the provisions of this policy.
3. The individual user must survey his/her hands, clothing, shoes/footwear and work area at the completion of each experiment. In addition, occasional surveys must be performed while the experiment is in progress.
4. The RSO shall ensure that all survey instruments are calibrated at the appropriate intervals. In addition, the radiation safety officer or his designate will periodically assess the contamination control program for each laboratory and will respond to emergencies.

1. Procedures and Safety Practices
2. Each laboratory must have adequate instrumentation for detecting and counting contamination. A Geiger-Mueller (GM) survey instrument is essential for detecting contaminated areas (excluding H-3) in the laboratory. More sophisticated instrumentation, such as a liquid scintillation counter (or gamma scintillation counter), is necessary for accurately counting radioactive emissions from wipe samples.
3. Survey instruments will be calibrated at intervals not to exceed one (1) year. The Radiation Safety Office will make the appropriate arrangements for instrument calibration.
4. The GM survey instrument must be used to monitor the work area during and after completion of each experiment. The individual user must also monitor his/her hands, shoes/footwear and clothing for contamination.
5. Wipe tests using absorbent filter paper must be performed in the laboratory work area on a weekly basis. If radioactive materials are not used during a particular week, then it is not necessary to smear test the work area. A notation stating that isotopes were not used is to be included in the logs. Approximately 100 cm2 of area must be wiped with each filter disc.
6. The survey meter must be used in those areas inaccessible to a wipe, for example, cracks in benches, grills in hoods, areas around radioactive waste containers.
7. Before removing any piece of equipment from a restricted or radioactive area, a wipe test must be performed on the equipment to ensure that no loose contamination is present. Large appliances (refrigerators) or sink drains must be free of contamination prior to any work by maintenance personnel.
8. If a laboratory or facility designated as a restricted or radioactive area is being changed to an unrestricted use, a copy of the exit survey and wipe test results must be forwarded to the Radiation Safety Officer.
9. Weekly wipe test results must be recorded in the principal investigator's log book using form SDSMT-RAD-10.
10. If contamination is found to exceed three times the background level in the laboratory, then decontamination procedures must be instituted and must continue until further wipe tests indicate that the area has been decontaminated.
11. If contamination is found to exceed 20,000 dpm beta/gamma or 1,000 dpm alpha, then Laboratory Surveys and Contamination Control Section must be instituted. The principal investigator must halt all traffic into and out of the area to minimize the spread of contamination to adjacent laboratories and offices. The Radiation Safety Officer must be immediately notified and all personnel in the contaminated area must remain there until the Radiation Safety Officer or his designated representative has arrived.
12. The clean-up of a contaminated area will be performed by the principal investigator and laboratory personnel under the supervision of the Radiation Safety Officer. **At no time are University custodial personnel to be involved in the decontamination process.**
13. Laboratories using sealed sources in gas chromatographs must ensure that all sources are secured against loss or theft. Wipe tests of the sealed sources will be performed by Radiation Safety Officer or designee at appropriate intervals. The sealed source may be removed from the gas chromatograph, the actual source housing must never be disassembled by laboratory staff. Copies of the wipe test results will be maintained by the Radiation Safety Office.
14. **Decontamination of Laboratories and Personnel**

1. Policy and Purpose

This policy is designed to provide safe and effective methods for the decontamination of laboratory work areas, equipment and personnel in order to minimize personnel radiation exposure and prevent the spread of contamination.

1. Responsibilities
2. The principal investigator shall ensure that laboratory contamination is adequately contained and proper decontamination procedures are utilized.
3. The individual user is responsible for informing the principal investigator of **ANY** contamination found in the laboratory and will work with the principal investigator in decontaminating the laboratory and/or personnel, if necessary.
4. The radiation safety officer will oversee decontamination efforts when a significant portion of the laboratory is contaminated and will ensure that laboratory and personnel are safely and properly decontaminated.

1. Procedures and Safety Practices
2. Laboratory Decontamination:
3. If laboratory contamination is localized (e.g., a small portion of a workbench or floor) and is found to be more than three times the normal background levels for the laboratory (determined by GM survey or smear results), then decontamination procedures must be instituted by laboratory personnel.
4. If laboratory contamination is widespread (e.g., on workbench, chairs, floor, refrigerator, etc.) or if removable contamination in any area exceeds 1,000 dpm alpha or 20,000 dpm beta/gamma, then decontamination procedures must be supervised by the Radiation Safety Officer or his designate.
5. Attempts should be made to keep contamination localized. Use dry paper towels to absorb liquid or cover a dry spill with a damp cloth. Be sure to wear gloves!
6. To reduce the further spread of contamination, eliminate all traffic in the area. If floor contamination is extensive, rope off the area and lock all doors leading to the area. A step-off area must be established at the contamination boundary and shoes, lab coats, gloves, etc. must be removed in the step-off area to avoid spreading contamination. All personnel leaving a contaminated area must have their hands, shoes and clothing surveyed.
7. Radcon or cleaners containing alcohol are usually most effective in removing loose contamination from hard surfaces. Gloves and protective clothing must be worn when decontaminating an area. Generally, glassware and counter tops can be decontaminated by repeated washings.
8. Survey the area repeatedly with a GM counter or by taking wipe samples. Continue to clean the area until contamination is removed. If contamination cannot be removed, contact the RSO for further instruction.

1. Personnel Decontamination
2. External contamination (including small amounts) resulting in local skin exposure must be treated seriously. Radioactive materials can penetrate intact skin, especially when organic solvents are present. Contamination may also be ingested or inhaled and may be spread to other areas or personnel. Therefore, it is most critical to remove loose contamination as quickly and safely as possible.

Decontamination Procedures Are as Follows:

1. **Skin:**
2. Wet contaminated area and apply mild soap; use luke-warm water-NOT hot water;
3. Work up a good lather and use a soft bristled brush;
4. Repeat at least 3-4 times; monitor between washes;
5. If necessary, use a mild abrasive such as lava soap or a paste of cornmeal and Tide, 50/50, wash and dry the skin and monitor.
6. **Hair:**
7. Shampoo hair with head deflected backwards; wear gloves!
8. Rinse with 3% citric acid; wash again and rinse;
9. Dry hair with dryer and monitor.
10. **Eyes:**
11. Spread eyelids;
12. Rinse thoroughly with water in a direction from the nose to the lateral angle of the eye.
13. **Whole Body:**
14. Remove all clothing;
15. Shower immediately with water; brush with mild soap;
16. Repeat at least 4 or 5 times;
17. Towel dry and monitor;
18. If unsuccessful, await for physician's orders.
19. **Wound(s):** (In the presence of radionuclides must be considered contaminated until proven otherwise)
20. Rinse wound under running water;
21. Delimit contaminated area with waterproof material;
22. Decontaminate skin around the wound;
23. Remove wound cover and apply a sterile dressing;
24. If highly radiotoxic substances are involved, apply venous tourniquet close to the wound;
25. Notify the Radiation Safety Officer immediately.

1. Internal Contamination, if internal contamination is suspected, determine the time of accident, the type of uptake (ingestion, inhalation, absorption), the isotope involved, and the chemical nature and level of activity of the contaminant. Notify the Radiation Safety Officer immediately!
2. Decommissioning of a laboratory

When a principal investigator is vacating a laboratory, all equipment must be decontaminated, all radioactive materials and chemicals must be disposed in a proper manner and all work surfaces and storage locations must be free of any contaminants (both radioactive and non-radioactive). The University has developed a laboratory decommissioning policy that must be followed under these circumstances. Please read the laboratory decommissioning policy section.

1. **LABORATORY DECOMMISSIONING POLICY**
2. Policy and Purpose

This policy is applicable to all laboratories and auxiliary spaces serving as laboratories. It provides measures for the removal of hazards from laboratory spaces when the principal investigator is leaving the University, moving to another building on campus, or relocating to another laboratory within the same building. When laboratories are vacated, all chemical, radioactive and biological materials, sharps and other wastes must be disposed in a proper manner. All laboratory equipment must be decontaminated before it is placed back into service, stored in another location, or disposed in a proper manner. Working surfaces and storage locations must also be properly decontaminated.

1. Responsibilities
2. Principal Investigator
3. Provide EH&S with sufficient notice before leaving the university or relocating;
4. Make arrangements before leaving for the transfer or disposal of chemicals, radioactive materials and biological materials;
5. Ensure that all labs, storage areas, equipment and work surfaces within these spaces are thoroughly cleaned before vacating the space(s);
6. Correct all non-conformances that remain after a decommissioning inspection by EH&S.
7. Environmental Health & Safety Office
8. Be responsible for all costs associated with decommissioning if this policy is not followed;
9. Verify that the following activities have occurred:
10. All chemicals, radioactive materials, biological materials, and sharps (i.e. razor blades, broken glass and needles) have been properly removed, disposed and/or stored;
11. All non-fixed equipment has been removed; drawers and cabinets emptied, and fume hoods cleaned;
12. All work surfaces have been properly cleaned and decontaminated.
13. Notify the Principal Investigator and appropriate administrative unit of the survey results;
14. Evaluate and approve the relocation to a new laboratory within the University system;
15. Conduct a final radiological survey of the facility with notification to the Principal Investigator and appropriate administrative unit of the survey results;
16. Schedule the removal of hazardous waste materials;
17. Supply waste tags and additional information regarding disposal of chemicals;
18. Coordinate chemical recycling efforts.
19. Procedures
20. The Principal Investigator must contact EH&S when a decision is made to decommission a laboratory;
21. Laboratory personnel must make arrangements for the removal of all chemicals, biological agents and radioactive materials from the laboratory. All equipment must be decontaminated and tagged;
22. If radioactive materials were used in the laboratory, the following action must be completed by laboratory personnel:
23. Survey and decontaminate all areas where radioactive materials were used or stored. Equipment in which radioactive materials were used or stored shall also be surveyed and decontaminated, as necessary. The surveys shall be documented in the laboratory logbook;
24. Contact Radiation Safety to transfer the remaining radioactive materials to another permit holder or to Radiation Safety for disposal. Arrangements can be made through Radiation Safety to ship radioactive materials;
25. Remove and destroy all labels indicating the presence of radioactivity;
26. Reconcile the radioactive materials inventory;
27. Terminate or transfer the dosimeter badges, if appropriate.
28. EH&S personnel will conduct a final survey of the decommissioned laboratory and certify, in writing, when no non-conformances are present. If any non-conformances are found, they must be addressed by the principal investigator and a new survey scheduled.
29. **Record-Keeping**
30. Policy and Purpose

This policy specifies the various records that must be maintained by each authorized user to be in compliance with Nuclear Regulatory Commission.

1. Responsibilities
2. The principal investigator must assure that all records required by the radiation safety office are properly maintained.
3. The individual user must be knowledgeable of all records pertinent to the radioactive materials authorization and must assist the principal investigator in properly maintaining the records.
4. The radiation safety officer must supervise the maintenance of records for all radioactive material use at the University.
5. Procedures
6. The following records must be maintained by each laboratory and must be available for inspection at any time by representatives of the Nuclear Regulatory Commission or the Radiation Safety Office:
7. Radioactive Material Authorization - this lists the isotopes and possession limits, and the conditions under which these materials may be used;
8. A copy of the SDSM&T Radiation Safety Manual;
9. A worksheet for each radioactive material shipment received by the laboratory will serve as a receipt, utilization and disposal record for that particular shipment. If more than one isotope or more than one form of isotope is received in any shipment, a separate worksheet must be used for each isotope. The top portion of the worksheet will be completed by the Radiation Safety Office when the initial wipe tests on the package are performed. Each use of a portion of the shipment must be recorded on the worksheet along with the date used and a brief description of the procedure performed. Whenever a portion of the shipment is discarded as solid or liquid waste, the disposal portion of the worksheet is to be completed including the type (solid, liquid, scintillation vials), amounts and dates of disposal;
10. A separate log for all radioactive waste picked up by the radiation safety personnel (SDSMT-RAD-06);
11. Copies of all wipe tests must be recorded on the radiation control logs. If radioactive material is used intermittently, records must indicate the dates of discontinuance and resumption of use and that no wipe tests were performed during that period. Background measurements must be indicated for each survey and wipe test performed;
12. Copies of transfer forms for radioactive materials transferred either to or from the principal investigator (SDSMT-RAD-05);
13. Copies of quarterly inventories of all radioactive materials in the possession of the principal investigator (SDSMT-RAD-04);
14. Copies of decontamination reports, if needed;
15. Copies of yearly survey instrument calibration records;
16. Copies of thyroid monitoring or bioassay results.
17. Emergency contact numbers and Notice to Employees (NRC Form 3; http://www.nrc.gov/reading-rm/doc-collections/forms/form3\_us.pdf) should be posted near a laboratory telephone.
18. **Decontamination of University Buildings due to the release of Radioactive Materials from a Generally Licensed Device**
19. Policy and Purpose

This policy is designed to provide effective methods for assessing the levels of radioactive contamination in University buildings and to the occupants as a result of damage to devices possessed by the University under a general license. The methods are designed to minimize radiation exposure to the general public and prevent the spread of contamination.

1. Responsibilities
2. The maintenance employees have the responsibility of immediately reporting any damaged devices containing radioactive materials to the Radiation Safety Officer.
3. The radiation safety officer has the authority to close any building or portions of buildings that are potentially contaminated with radioactive materials and to confiscate any contaminated items. He/She also has the authority to quarantine and monitor any individuals potentially contaminated with radioactive materials to assess potential health risks to the individuals.
4. The building managers/personnel must support the Radiation Safety Officer in his/her efforts to assess the extent of radioactive contamination and return the building to a level that is safe for the occupants.

1. Procedures and Safety Practices
2. When a device containing radioactive material is damaged, the Radiation Safety Officer must be immediately contacted for determining if contamination is present and assess the extent of the contamination. The Radiation Safety Officer must report the incident to the Nuclear Regulatory Committee and request assistance, if necessary.
3. If contamination is minimal, then the affected area must be sealed off to prevent the further spread of radioactivity. Decontamination efforts must be directed by the Radiation Safety Officer and must begin as soon as possible. Potentially contaminated individuals must be monitored and decontaminated, if necessary.
4. If contamination is localized and can be removed by radiation safety personnel, the following personal protection items must be used:
5. Protective Clothing
6. Shoe Covers
7. Rubber Gloves

Any personal protective item that becomes contaminated must be placed in a plastic bag

and disposed of as radioactive trash. When decontamination is complete, all personnel involved in the clean-up must submit urine samples to the Radiation Safety Officer for analysis of possible internal contamination when applicable.

1. If contamination is widespread throughout a building, then all occupants are to be monitored and decontaminated, if necessary. Clothing and personal items will be confiscated if found to be contaminated. If internal contamination of an individual is suspected, then bioassay samples must be submitted by the individual to the Radiation Safety Officer for analysis. A determination of the proper procedures for decontaminating the building must be made after all persons have been monitored and treated.
2. The building may not be occupied until acceptable radiation levels result.
3. Attempts must be made to decontaminate equipment, clothing or personal items only after treating contaminated persons. If such items can not be adequately cleaned, then they must be sent to a low-level radioactive waste disposal facility for burial.
4. **Radiation Dose to the Embryo/Fetus**
5. Policy and Purpose

This policy is designed to inform University employees of the potential health risks to the embryo/fetus from exposure to ionizing radiation and to satisfy the requirements of 10 CFR Part 20.1208.

1. Responsibilities
2. The principal investigator will take precautions to ensure that the declared pregnant employee/student does not exceed a dose to the embryo/fetus in excess of the limits established by Nuclear Regulatory Committee and will ensure that substantial variations above a uniform monthly exposure rate are avoided. In addition, the principal investigator will work with the Radiation Safety Officer to determine if additional precautions or engineering controls are necessary to reduce potential radiation exposure.
3. The individual user has the responsibility of deciding when or whether to formally declare her pregnancy to the Radiation Safety Office. She must take all precautions to keep her exposure and the exposure to the embryo/fetus as low as reasonably achievable.
4. The radiation safety officer will ensure that a declared pregnant employee/student is fully aware of the potential risks to the embryo/fetus and will ensure that radiation dose to the embryo/fetus is below the limits established by Nuclear Regulatory Committee.

1. Procedures
2. Since the developing embryo/fetus is considered relatively radiosensitive, all employees/students who have the potential of becoming pregnant must be informed of the potential risks associated occupational exposure of the embryo/fetus to ionizing radiation. In addition, they must also be informed of the proper controls to be employed to limit the risk. Detailed information related to this matter can be found in the NRC Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure".
3. In order to properly monitor the external and internal dose to the employee/student and the embryo/fetus, it is strongly suggested that the pregnant worker declare her condition to the radiation safety officer as soon as possible using form SDSMT-RAD-02. It is the responsibility of the pregnant worker to decide when or whether she wishes to formally declare her condition. If a University employee/student wishes to declare her pregnancy, she must do so by completing the form and returning it to the Radiation Safety Office.
4. The dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant employee/student, must not exceed 0.5 rem. The dose to the embryo/fetus is determined by the sum of the deep dose equivalent (external dose) to the declared pregnant employee/student and the committed dose equivalent (internal dose) from radionuclides in the embryo/fetus and the declared pregnant worker.
5. External dose to the embryo/fetus will be monitored with a whole body dosimeter, (if appropriate) that will be placed in the abdominal region.
6. Air samples of the work area or bioassay (urine samples) from the declared pregnant employee/student may be necessary to properly assess internal doses from radiation exposure. The Radiation Safety Officer will advise the employee about whether either of these steps are necessary for her particular use of radiation.
7. Any employee/student may alter work routines to further reduce radiation exposure if the proposed alterations are approved by the principal investigator.
8. Accidental exposures to a declared employee/student that are deemed to be potentially significant by the employee and/or supervisor, will be immediately evaluated by the Radiation Safety Officer.

**DEFINITIONS**

Airborne Contamination - any radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors or gases;

Aqueous Liquid - liquid radioactive waste which has no constituents defined as hazardous by 40 CFR, Part 261. (ex. buffer solutions, nutrient media, lysed cells);

Bioassay - determination of the kind, quality or concentration, and location of radioactive material in the human body by direct (in vivo) measurement or by analysis of materials excreted or removed from the body (in vitro);

Contamination - radioactive material that has left the confines of the device in which it was held;

Committed Effective Dose Equivalent (CEDE) – projected dose to the body from radiation sources, through inhalation, ingestion or absorption measured by whole body counts or bioassays;

Counts per Minute (cpm) - the number of radioactive transformations that are actually detected by an instrument; dpm = cpm/instrument efficiency;

Declared Pregnancy - when a University employee officially declares, in writing, her condition to the Radiation Safety Officer; the "Declaration of Pregnancy" form should be utilized;

Decommissioning - the process of decontaminating existing laboratory space and equipment prior to vacating the location;

Deep Dose Equivalent (DDE) - dose to the body at a depth of one centimeter measured by a personnel dosimeter;

Disintegrations per Minute (dpm) - the number of radioactive transformations that would be expected to occur in a material in a period of a minute;

Embryo/Fetus - official term used in the regulations which refers to the developing human organism from conception until the time of birth;

External Contamination - contamination found on the skin or hair;

Fixed Contamination - radioactive material that cannot be removed from a surface by normal wiping action;

Formal Training Classes – classes offered by the Radiation Safety Officer. These classes must be taken by individual users of radioactive materials or radiation emitting devices;

Geiger-Mueller (GM) Survey Meter - an instrument for detecting radiation; it consists of a counting instrument and a gas-filled GM tube that responds to ionizing radiation;

High Radiation Area - any area accessible to individuals in which there exists radiation at such levels that the whole body could receive in any one hour, a dose in excess of 100 millirem;

Internal Contamination - contamination of the blood and organs by inhalation, ingestion, or absorption of radioactive materials;

Laboratory - a space where research or teaching is conducted and where relatively small quantities of hazardous chemicals, biological materials, and/or radiological agents are used;

Licenses - Before an individual or institution can possess radioactive materials in the United States, a license must be obtained which specifies the conditions under which the radioactive material can be possessed and used. Licenses for radioactive materials are of two types:

1. Specific License - a license issued by the US Nuclear Regulatory Commission (NRC) or an Agreement State to an individual or institution that requires the filing of a formal application. The license specifies the amount and type of radioactive material that may be possessed and lists the conditions under which the materials may be possessed and utilized by the licensee.
2. General License - a license that becomes effective without the filing of applications with the NRC or an Agreement State or the issuance of licensing documents to particular persons or institutions. For example, individuals possessing smoke detectors or tritium exit signs automatically have a general license to possess these materials upon the purchase of the devices. It is the responsibility of the vendor to register the devices for the purchaser with the appropriate regulatory agency.

Liquid Scintillation Counter (LSC) - an instrument used to measure the activity of radioactive substances; it consists of a phosphor or scintillation cocktail, a photomultiplier tube and electronic circuits that count signals in an appropriate fashion; liquid scintillation counters are extremely efficient for counting beta radiation but much less efficient for counting alpha or gamma radiation;

Loose Contamination - radioactive material that can be removed from a surface by normal wiping action;

Mixed Waste - waste which meets both the NRC's definition of radioactive waste in 10 CFR Part 61.55 and the EPA's definition of hazardous waste in 40 CFR Part 261;

Non-Hazardous Scintillation Fluids - scintillation fluids that have no constituents defined as hazardous by 40 CFR, Part 261, and are labeled as biodegradable or environmentally safe. (will not contain toluene, xylene, or have a flash point <140o F);

Occupationally Exposed - exposure of a person who normally works with radiation as a part of the job, as opposed to exposure received from a medical exposure;

Personnel Dosimeter - a packet consisting of either film, thermoluminescent (TLD)crystals or optically stimulated luminescence (OSL) compounds that can measure the amount of ionizing radiation present over a certain period of time;

Radiation Area - any area in which ionizing radiation exists at such levels that the whole body could receive in any one hour, a dose in excess of 5 millirem or in any 5 consecutive days, a dose of 100 millirem;

Radioactive Waste - any material that contains:

1. Radioactive contaminated general laboratory trash such as glass, paper, lab clothing, gloves, culture dishes, syringes, etc.;
2. Sealed radioactive sources used for instrument response checks or research;
3. Aqueous solutions containing radioactive contaminants;
4. Vials containing scintillation fluids and radioactivity;
5. Outdated or empty stock vials.

Radioisotope Log Book - log containing all the records necessary to be in compliance with Nuclear Regulatory Commission (NRC); when a principal investigator obtains authorization to use radioactive materials, the Radiation Safety Office will issue a standard log book to the investigator which contains all of the forms necessary for proper record-keeping;

Refresher Training – training offered by the principal investigator or his/her designate on an annual basis which is designed to remind all employees of the importance of working safely with radiation;

Regulatory Limits - the following regulatory limits have been established Nuclear Regulatory Commission (NRC) found in 10 CFR 20.1201:

An annual limit, which is the more limiting of:

1. The total effective dose equivalent being equal to 5 rem;
2. The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rem;

The annual limits to the lens of the eye, to the skin and to the extremities, which are:

1. An eye dose equivalent of 15 rem;
2. A shallow dose equivalent of 50 rem to the skin or to each of the extremities.

Restricted Area -area in which access is controlled by the authorized user for purposes of protection of personnel from exposure to radiation and radioactive materials;

Specific Academic License - a license which grants authorized users authority to the University concerning the acquisition, receipt, ownership, possession, use and transfer of chemical or physical form of radioactive material for only the authorized purposes listed on the license; authorized users are those listed on the site license; principal investigators are authorized users of sealed sources only;

Specific Laboratory Training – training offered by the principal investigator or his/her designate to complete the initial phase of an employee’s training;

Survey - the process of examining an area for radioactive contamination through the use of an appropriate survey instrument;

Total Effective Dose Equivalent (TEDE) - the sum of the DDE and CEDE;

Transport Index (TI) - a number placed on a package of "Yellow Label" radioactive materials by the shipper to denote the degree of control to be exercised by the carrier. The transport index is the highest measured dose rate at one meter from the surface of the package;

Wipe Test - a test for finding loose contamination by wiping a surface (100 cm2) with a filter disc; the disc is then counted in a radiation measuring instrument;

**REFERENCES**

**Radioactive Materials Authorization Request Format**

-"A Guide for Preparation of Applications for Laboratory Use of Radioactive Materials." SC Bureau of Radiological Health Licensing Guide, April 1994.

**Radiation Safety Training**

-Ordering, Receipt, and Transfer of Radioactive Materials 49 CFR, Parts 100-177, Requirements for Transportation of Radioactive Materials.

**External Exposure Monitoring**

-10 CFR 20.1201, Occupational Dose Limits for Adults.

-Cember, Herman Introduction to Health Physics 2nd ed., Pergamon Press, Volume 105, New York, 1987, pp. 257-261.

-Knoll, G.F., Radiation Detection and Measurement 2nd ed., J. Wiley and Sons, New York, 1989, pp. 693-695.

-Shleien, Bernard , Radiation Safety Manual for Users of Radioisotopes in Research and Academic Institutions Nucleon Lectern Associates, 1987.

**Radioiodine Bioassays**

**General Laboratory Safety Procedures**

-U.S. Department of Health, Education and Welfare Publication No. (NIH)79-18, The National Institutes of Health Radiation Safety Guide, 1979 Edition.

**Preparation and Disposal of Radioactive Waste**

-40 CFR, Part 261, Hazardous Waste Identification.

-10 CFR, Part 61, Licensing Requirements for Land Disposal of Radioactive Waste.

**Laboratory Surveys and Contamination Control**

-NCRP Report No. 57, "Instrumentation and Monitoring Methods for Radiation Protection, National Council on Radiation Protection and Measurements", Washington, D.C. May, 1978.

-Penn, A.C., "A Guide to the Safe Use of Radioactive Material" Job Safety and Health Vol.5, No. 6, June, 1977, pp. 11.

**Decontamination of Laboratories and Personnel**

-International Atomic Energy Agency (IAEA), Technical Reports Series NO. 152, Evaluation of Radiation Emergencies and Accidents, Vienna, 1974, 136 pages.

-NCRP Reports N. 65, Management of Persons Accidentally Contaminated with Radionuclides, Washington, DC, April 1980, 205 pages.

**Record Keeping**

-10 CFR Part 20 Subpart L-Records.

**Decontamination of University Buildings due to the Release of Radioactive Materials from a Generally Licensed Device**

**Radiation Dose to the Embryo/Fetus**

-Nuclear Regulatory Guide 8.13, "Instructions Concerning Prenatal Radiation Exposure".

-10 CFR Part 20.1208, Dose Equivalent to an Embryo/Fetus.

**APPENDIX - STANDARD RADIATION SAFETY FORMS**

RADIATION SAFETY OFFICE USE ONLY:   
ACCOUNT NO:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ TEMPORARY BADGE TYPE:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NUMBER:\_\_\_\_\_\_\_\_\_\_\_\_\_\_  
  
DATE OF SERVICE:\_\_\_\_\_\_\_\_\_\_\_\_\_ PERMANENT BADGE TYPE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NUMBER:\_\_\_\_\_\_\_\_\_\_\_\_

**SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY**

**FILM BADGE SERVICE REQUEST**

PLEASE PRINT

I. NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ SEX: MALE FEMALE

*LAST FIRST MIDDLE/MAIDEN*

SOCIAL SECURITY NUMBER: \_\_\_\_\_-\_\_\_\_\_-\_\_\_\_\_\_ DATE OF BIRTH: \_\_\_\_\_/\_\_\_\_\_\_\_/\_\_\_\_\_

*MM DD YY*

DEPARTMENT: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_POSITION/TITLE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

PRINCIPAL INVESTIGATOR: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_BLDG.: \_\_\_\_ RM#: \_\_\_\_\_\_ PHONE: \_\_\_\_\_\_\_\_\_

DATE BADGE SERVICE NEEDED: \_\_\_\_\_\_/\_\_\_\_\_\_\_/\_\_\_\_\_\_\_

………………………………………………………………………………………………………

II.PLEASE CHECK **ALL** RADIOISOTOPES AND ANY X-RAY EQUIPMENT YOU WILL BE USING:

H‑3, C‑14, S‑35 ‑ I-125 P‑32 Other: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

X‑Ray - Type of equipment Using: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

………………………………………………………………………………………………………

III. TRAINING AND EXPERIENCE:

1. Have you ever received training in radiation safety? NO YES

*If YES, please provide a copy of your training certificate.*

1. Have you had prior experience working with radioactive materials or x-ray equipment? NO YES

*If YES, describe* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Have you read and understood the *SDSMT RADIATION SAFETY MANUAL*? NO YES

………………………………………………………………………………………

IV. PREVIOUS EMPLOYMENT INVOLVING RADIATION EXPOSURE: (Use back of sheet if more than one.)

1. EMPLOYER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Street/P.O. Box: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ City: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_State: \_\_\_\_\_\_\_\_\_\_\_Zip:\_\_\_\_\_\_\_\_\_\_\_\_

Department: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date ‑ From: \_\_\_\_\_\_\_\_\_\_\_\_\_\_To: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Have you ever been assigned a badge at the SDSM&T: NO YES

\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_

*I hereby authorize the release of my occupational exposure records to the*

*South Dakota School of Mines and Technology.*

*Signed:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *Date*: \_\_\_\_/\_\_\_\_/\_\_\_

**SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY**

**RADIATION SAFETY OFFICE**

**DECLARATION OF PREGNANCY**

This form complies with the requirements of 10 CFR Part 20.1208, Dose Equivalent to an Embryo/Fetus, for declaration of a pregnancy and for limiting dose to the embryo/fetus. The dose to an embryo/fetus during the entire term of pregnancy, due to occupation exposure of a declared pregnant employee must not exceed 0.5 rem.

Name (PRINT)\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SSN#\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Principal Investigator\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

List the isotopes or type of x‑ray equipment that has or will be used during the term of the pregnancy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Estimated date of conception\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR)

Estimated due date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR)

Please inform the radiation safety office when/if your condition changes, ie. birth, termination or loss of pregnancy.

**All records will be kept confidential.**

I am voluntarily informing the South Dakota School of Mines and Technology of my pregnancy for the purpose of monitoring dose to the embryo/fetus.

Signature\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR)

OFFICE USE:

ACCOUNT:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

BADGE#(S):\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

BEGIN MONTH/YR:\_\_\_\_\_\_\_\_\_\_\_\_

END MONTH/YR:\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**SOUTH DAKOTA SCHOOL OF MINES AND TECHNOLOGY**

**APPLICATION FOR THE USE OF RADIOACTIVE MATERIALS**

1. Principal Investigator: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Faculty Title: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Department: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Office Phone: \_\_\_\_\_\_\_\_\_\_\_

Laboratory Address: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Phone: \_\_\_\_\_\_\_\_\_\_\_\_

E-mail Address:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Training for the Principal Investigator: List Location(s) and circle appropriate response.

|  |  |  |  |
| --- | --- | --- | --- |
| **Type of Training** | **Location** | **On the Job** | **Formal Course** |
| 1.Principles & Practices of Radiation Protection. |  | Y N | Y N |
| 2.Radioactivity measurements, monitoring techniques and instrumentation |  | Y N | Y N |
| 3.Math and calculations basic to use and measurement of radioactivity. |  | Y N | Y N |
| 4.Biological effects. |  | Y N | Y N |

1. Experience:

Isotope Maximum Activity Institution Duration \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Protocols: On a separate sheet of paper, explain the general scope of your research. In addition, provide a brief protocol for each isotope you are requesting to use.
2. Specific Techniques: Please list the specific techniques involving radioactivity in your research, ie. PCR, tissue culture, labeling, RIA kits, iodination. Using the following chart, list each technique with the isotope, chemical form, the amount (uCi/mCi) that will be used for the experiment, the frequency of each experiment and the usual amount that will be ordered each time.

An example is provided.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Technique** | **Isotope** | **Chemical Form** | **Amt. Per experiment** | **Frequency of experiment** | **Amt. to Order** |
| *EXAMPLE:*  *Southern Blots* | *P-32* | *DCTP* | *50 uCi* | *Weekly* | *250 uCi* |
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1. Waste Generation:

Mark each type of radioactive waste that will be generated by your research.

**√ Type of Waste\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

\_\_\_\_\_ Solid Waste (paper, glassware, lab trash)

\_\_\_\_\_ Scintillation Waste:

List Brand & Type of Scintillation fluid to be used: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(**NOTE:** **Only non-hazardous/biodegradable types may be used**.)

\_\_\_\_\_ Biological Waste (animals, tissues, bedding)

\_\_\_\_\_ Liquid Waste:

Include all major constituents, i.e. Chemicals, that will be added to the liquid and approximate percentages:

Constituents other than radioisotope:

(Buffers, TCA, solvents, other chemicals) Percentage:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_%

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_%

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_%

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_%

**\*\*\*Please Note: The generation of mixed waste (waste containing both radioactive material and EPA listed or characteristic hazardous waste) is to be avoided.**

**\*\*\*pH of liquids must be between 6-9 before Radiation Safety can pick up for disposal.**

1. Please submit a sketch of each room in which radioactive materials will be used or stored, detailing radioactive work areas, storage areas, waste storage, hot sinks, ventilation hoods, and shielding. Also indicate locations of student or technician desks.
2. Briefly describe the contamination controls you will be following (i.e. weekly wipes, GM surveys, personnel monitoring), shielding needs, and other precautions which will be considered:

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1. List all radiation detection or measurement instruments that you will use. Include the model number and the location of the unit.  **(PLEASE NOTE: Each laboratory shall be equipped with a portable monitoring device to be used for personnel and area monitoring, except if H-3 is used solely.)**

Type Model No. Location of Unit

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Please list two references of individuals who could attest to the Principal Investigator’s experience with radioactive materials.

Name Institution Phone No.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Radiation Protection Program:

*I certify that I have read and fully understand the University’s Radiation Safety Manual and I will abide by all of its provisions.*

*Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_*(MM/DD/YEAR)

**South Dakota School of Mines and Technology**

**Radioactive Material**

**QUARTERLY INVENTORY WORKSHEET**

PRINCIPAL INVESTIGATOR: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ NAME OF PERSON COMPLETING FORM:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

QUARTER/YEAR: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR)

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| Authorized  Isotopes | Material that has **PHYSICALLY** BEEN REMOVED  Limits Last Inv. + Total + Transfer - Transfer ‑ Solid ‑ Liquid ‑ Scint . ‑ Carcass = Actual Amt.  (mCi) Amt. Ordered IN OUT Waste Waste Waste Waste On Hand  (mCi) (mCi) (mCi) (mCi) (mCi) (mCi) (mCi) (mCi) (mCi)\* | | | | | | | | | |
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*QUARTER TOTALS SHOULD INCLUDE ONLY ACTIVITY INCLUSIVE FOR THAT QUARTER PERIOD*

*\*Actual amount on hand INCLUDES WASTE IN LAB*

**FIRST QUARTER**: JANUARY 1 ‑ MARCH 31

**SECOND QUARTER**: APRIL 1 ‑ JUNE 30

**THIRD QUARTER**: JULY 1 ‑ SEPTEMBER 30

**FOURTH QUARTER**: OCTOBER 1 ‑ DECEMBER 31

**South Dakota School of Mines and Technology**

**RADIOACTIVE MATERIALS TRANSFER FORM**

TRANSFERRED FROM: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

TRANSFERRED TO: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ISOTOPE:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ CHEMICAL FORM:\_\_\_\_\_\_\_\_\_\_\_ AMOUNT:\_\_\_\_\_\_\_\_\_\_\_\_\_

REASON FOR TRANSFER:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature of Originator Signature of Receiver

─────────────────── ───────────────────

Date\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR) Date\_\_\_\_\_\_\_\_\_\_\_\_\_(MM/DD/YEAR)

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**FOR RECEIVER USE ONLY:** WASTE DISPOSAL

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DATE OF USE AMOUNT SOLID LIQUID VIALS CARCASSES DATE INITIALS

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**\*\*\*PLEASE NOTE:**

* BOTH THE TRANSFEROR AND THE RECEIVER MUST KEEP ONE COPY OF THIS FORM
* THE RECEIVER MUST COMPLETE THE USE LOG INFORMATION AND FILE WITH OTHER RADIOISOTOPE USE LOG RECORDS
* ONE COPY MUST BE SENT TO THE RADIATION SAFETY OFFICE

**South Dakota School of Mines and Technology**

**Radiation Safety**

**WASTE DISPOSAL WORKSHEET**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Pick Up Date | Isotopes | FORM AND AMOUNT (mCi/uCi)  Solid | Liquid | Vials | Carcasses | Comments |
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**Date RS# Investigator Isotope Amount TI Surface 1M Alpha/Beta LSC Box Area DPM Area DPM Area DPM Area DPM Comments**

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**South Dakota School of Mines and Technology**

Check one:

\_\_\_\_\_ Initial

\_\_\_\_\_ Refresher

**ANALYTICAL X-RAY MACHINE TRAINING**

The principal investigator will be responsible for the initial and refresher training. This training should include a review of: operating, alignment and emergency procedures, the function of all safety devices, use of personal protective equipment, if required, and any other hazards associated with the equipment. The initial training also requires that each person working in the laboratory read the “Radiation Safety Manual”

All employees must receive **initial** in-laboratory training before the using any x-ray equipment.

**Refresher** training must be completed by January 31st of each year.

(This training record must be maintained in the laboratory log book for review by the Radiation Safety Office).

|  |  |  |  |
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| **PI:** | | **DEPARTMENT:** | |
| **BUILDING :** | | **LABORATORY ROOM NUMBER(S):** | |
| **#** | **NAME** | | **DATE** |
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Check one:

\_\_\_\_\_ Initial

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**South Dakota School of Mines and Technology**

**RADITATION SAFETY TRAINING**

The principal investigator will be responsible for the initial and refresher training. This training should include a review of: proper handling of isotopes in the laboratory including, ordering, storage, waste procedures, wipes tests, GM surveys and emergency response. The initial training also requires that each person working in the laboratory read the “Radiation Safety Manual”.

All employees must receive **initial** in-laboratory training before the use of any radioactive materials.

**Refresher** training must be completed by January 31st of each year.

(This training record must be maintained in the laboratory log book for review by the Radiation Safety Office).

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| **PI:** | | **DEPARTMENT:** | |
| **BUILDING :** | | **LABORATORY ROOM NUMBER(S):** | |
| **#** | **NAME** | | **DATE** |
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| **South Dakota School of Mines and Technology** WIPE TEST AND INVENTORY LOG FOR SEALED SOURCES | | | | | | | |  | | |  | | |  | |
|  |  | | |  | | |  | | |  | | |  | |
| Radioisotope | | Mfg/model No. | Sealed Source Serial Number | | Maximum Activity | Wipe Test (Initial and Date) | | | Inventory and Labels and Signs Checked (Initial and Date) | | |
| Nickel-63 | | Merck / NER-004 | Ni014 | | 20 mCi |  | | |  | | |
| Nickel-63 | | Agilent/G2397-655505 | U8361 | | 15 mCi |  | | |  | | |
| Nickel-63 | | SRI/Valco 140BN Electron Capture Detector/N-1001 | E0239 | | 5 mCi |  | | |  | | |
| Nickel-63 | | HP5890 – Hewlett Packard Electron Capture Detector | K3483 | | 15 mCi |  | | |  | | |
|  | |  |  | |  |  | | |  | | |
| Radioisotope | | Mfg/model No. | Sealed Source Serial Number | | Maximum Activity | Wipe Test (Initial and Date) | | | Inventory and Labels and Signs Checked (Initial and Date) | | |
| Nickel-63 | | Merck / NER-004 | Ni014 | | 20 mCi |  | | |  | | |
| Nickel-63 | | Agilent/G2397-655505 | U8361 | | 15 mCi |  | | |  | | |
| Nickel-63 | | SRI/Valco 140BN Electron Capture Detector/N-1001 | E0239 | | 5 mCi |  | | |  | | |
| Nickel-63 | | HP5890 – Hewlett Packard Electron Capture Detector | K3483 | | 15 mCi |  | | |  | | |
|  | |  |  | |  |  | | |  | | |
| Radioisotope | | Mfg/model No. | Sealed Source Serial Number | | Maximum Activity | Wipe Test (Initial and Date) | | | Inventory and Labels and Signs Checked (Initial and Date) | | |
| Nickel-63 | | Merck / NER-004 | Ni014 | | 20 mCi |  | | |  | | |
| Nickel-63 | | Agilent/G2397-655505 | U8361 | | 15 mCi |  | | |  | | |
| Nickel-63 | | SRI/Valco 140BN Electron Capture Detector/N-1001 | E0239 | | 5 mCi |  | | |  | | |
| Nickel-63 | | HP5890 – Hewlett Packard Electron Capture Detector | K3483 | | 15 mCi |  | | |  | | |