Identifier: CAES-065
Effective Date: April 22, 2011
Revision ID: R1
Revision Date: September 26, 2011

Radiological Primer and Lab Orientation

Center for Advanced Energy Studies

Radiological Primer and Lab Orientation

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CONTENTS

TABLES

1. PURPOSE

This document describes some of the key elements of how to perform work safely in CAES radiological laboratories with compliant implementation of the ISU radiological program. Each radiation user is responsible for understanding and performing work in accordance with these requirements. This document describes and implements some key elements of the IDAHO STATE UNIVERSITY RADIATION SAFETY POLICY MANUAL, Revision 8: 17 August, 2009, (AKA ISU Manual) available online at http://www.physics.isu.edu/health-physics/tso/rad.html. The ISU Manual conveys the official policies of Idaho State University (ISU) for the control of all sources of, and exposures to, ionizing radiation that are within the jurisdiction of the University; defines responsibilities of individuals and organizations for radiation control; specifies the policies that guide specific decisions on radiation control matters; describes the regulatory framework imposed on licensees. Elements of the ISU Manual are implemented by a set of ISU Radiation Procedures also available online at the above address.

NOTE: *The CAES Safety Officer is the resident member of the ISU Technical Safety Office (TSO). Therefore, when the TSO is cited below it includes the CSO as the primary point of contact and representative at CAES.*

Using this document and a radiation safety protocol (RSP), the CAES Safety Officer and cognizant Laboratory Lead will conduct a face-to-face lab orientation for each radiological project. A checklist is provided in Appendix A that may be used as a job aid in performing lab orientation. Each project participant is required to participate in the orientation before they perform rad work in CAES. The orientation includes a walk thru that demonstrates how to perform some tasks, laboratory radiologically controlled areas, radiological waste disposal containers, signage, etc.

2. RADIATION SAFETY PROTOCOL (RSP)

Each CAES project that uses radiological materials and sources, unless exempted by the CSO, requires a RSP that defines the operating parameters and controls for the specific work scope. The radiation safety protocol is written either project-specific or for a piece of equipment or process that is repetitively used by multiple users. Each person working on a project is required to read the radiation safety protocol before the face-to-face lab orientation is conducted, understand it, and perform work within its specified parameters.

3. NOTIFICATIONS AND PREPARATION FOR INITIATING RAD WORK

Prior to commencing rad work, the lab lead and CSO must be notified.

A project brief is required at the initiation of a new project. Ongoing briefings are either specified in a project plan or recommended at the discretion of the principal investigator. For all briefings the following questions, as a minimum, are answered to address the context of the activity hazards and associated mitigations:

- Has the activity been previously performed?

- What are the critical steps or phases of this activity?
- How can we make a mistake at a critical step?
- What could go wrong with the facility, the environment, the equipment or personnel?
- What barriers or defenses are needed or are in place?
- Have we adequately considered and mitigated hazards to non-project personnel?
- If contamination or a spill occurs, how will you combat the spill, make notification, minimize the spread of contamination and decontaminate the area?

4. LABORATORY DESIGNATION

Each radiological laboratory is classified as a restricted area. A restricted area means access is controlled and only allowed for approved personnel.

NOTE: *A glossary of radiation control terms is provided as Appendix B.*

Administrative and engineered controls are used to control access to radiological laboratories. The labs or designated areas within them are further classified as radiologically controlled areas (see glossary) using appropriate signage, tape, barriers, etc. People who routinely work in a radiologically controlled area require training and a dosimeter. Visitors to radiologically controlled areas do not require training, but an escort and dosimeter are required. It is the responsibility of each person, based on their research and access needs, to understand and complete the required training and escort requirements.

5. LABORATORY NORMAL WORK HOURS

Normal work hours for CAES Laboratories are 8 am to 4:30 pm Monday through Friday. Even during normal working hours, on a project-specific basis, special radiological controls (e.g., CAES presence of TSO staff) may be prescribed for specific tasks. If applicable, such requirements are defined during the project planning process.

Off hour work may be accommodated with prior approval from the Laboratory Lead. For example, Focused Ion Beam (FIB) analysis in the Microscopy and Characterization Suite (MaCS) often includes overnight unattended sample processing.

6. MATERIAL RECEIPT, REMOVAL, AND ACCOUNTABILITY

Any and all acquisitions of radioactive materials including those materials that originate from CAES partners - Idaho National Laboratory, Boise State University, and University of Idaho must be transferred to ISU and placed under their NRC license for radiological materials. The transfer of materials is accomplished through use of Form RPR-13F, "Radioactive Material Purchase Authorization" and submitted to the CSO. This form is provided in the Appendix and is available on-line at http://www.physics.isu.edu/health-physics/tso/rad.html.

6.1 Material Receipt

The ISU Radiation Safety Officer (RSO) approves all acquisitions of radioactive materials and where, how, and who delivers them to CAES. Receipt of radioactive materials by CAES is only by the TSO or designees. The main issue of concern with receipt of radioactive material is to make certain that a regulatory required radiation and radioactive contamination surveys are completed within three hours of the receipt of any radioactive package. If you are asked to take receipt of radioactive materials at CAES through any other process, you should decline and immediately notify the TSO.

6.2 Material Removal

Customers should plan to have their radiological materials removed from CAES as soon as their use is completed. This is necessary to gain maximum benefit from the rad inventory allocated to CAES, prevent CAES from becoming a repository for radiological materials, and support ALARA goals.

Only the TSO or individuals approved by the RSO are allowed to remove radioactive materials from CAES. The process is initiated by the requestor by completion and submittal to the TSO of form RPR 14 ISU-1, REQUEST FOR SHIPMENT OF RADIOACTIVE MATERIAL. The form is provided in the appendices of this document and on the CAES Portal at http://www.physics.isu.edu/health-physics/tso/rad.html. If you are asked to remove radioactive materials from CAES by someone other than the TSO, you should decline and notify the TSO. RPR 14 provides all necessary information for completing Department of Transportation (DOT) shipping paperwork. Only individuals who have the regulatory required and current DOT training on shipping radioactive material are allowed to ship radioactive materials. It is not uncommon for DOT to levy large civil penalties (fines) for those individuals and institutions who fail to comply with shipping regulations.

6.3 Material Accountability

CAES radiological inventories are maintained by each responsible user with a comprehensive inventory. The CSO oversees the CAES facility inventory of radioactive materials.

Radiological materials may only be stored in preapproved locations. All other short term or temporary storage or unattended use of radiological samples and materials must be preapproved by the cognizant Laboratory lead or TSO. Examples of short term storage or use of radiological samples and materials include:

- Samples being placed in a designated cabinet as they are being prepared for analysis.
- Samples left in an instrument overnight for analysis.

In all instances, when samples are stored in a temporary location, the location must have proper signage and secured behind a locked door or as appropriate the sample must be behind two locked doors.

The signage should include:

- Information about why the source is being left in a particular location. (e.g. Radiological Samples are being analyzed or Radiological Samples are being stored.)
- Name
- Contact Number.

All movement of radiological samples/materials outside of radiologically controlled areas must be performed by personnel designated by the TSO and with prior approval of the cognizant Laboratory Leads. This specifically applies to movement of radiological materials between two rad labs that are physically separated such as the Radiochemistry and MaCS laboratories. This is necessary to ensure the proper controls are in place based on the dose rates of the samples/materials being moved, to minimize personnel exposure, and to minimize the risk of accidentally contaminating public areas within the CAES facility.

The cognizant person is required to make an entry in the *source tracking log-book* section of the CAES Radiological Inventory database for all movement of radioactive material. The inventory must also be updated for movement of materials between labs.

NOTE: *Because a significant portion of the Advanced Materials and MaCS radiological work involves the same materials that are processed in different stages of a single process, one inventory is maintained for these two labs. Therefore, movement of materials between the two labs using the inner door between these two labs requires a note in the source tracking log-book and not a change in lab inventory.*

7. TRAINING AND PERSONAL PROTECTION

Each individual working with or in the presence of radioactive materials or other radiation sources is required to receive training in the applicable provisions of regulations and license conditions, in the potential health problems associated with exposure to radiation, in the precautions and procedures required for safe use of radiation, and in the proper use of protective and measurement devices (10 CFR 19.12).

The extent of the training is commensurate with the potential risk of radiation exposure to the individual. The training required for three researcher categories – radiation, non-radiation, and casual, are defined in Table 1.

Casual Users are people who only require short term access to CAES radiological labs. Their training is assigned based on the hazards involved in their work, the duration of their assignment, and if they require unescorted access.

The project planning process may identify project-specific radiation safety training requirements that compliment ISU Radiation User training. Development, completion, and documentation of project-specific training are the responsibilities of the Principal Investigator, Lab Lead, and CSO. Records for completion of project specific radiation safety training shall be maintained in the Laboratory Manual and electronically on the CAES Portal.

Table 1. CAES radiation safety training.

Audience	Training Module(s)	
Radiation Users	Initial	• ISU Radiation Safety Policy Manual (reference document not a required read) • Radiological Lab Primer and Orientation (read and face-to-face meeting with Lab Lead) • Online: ISU Radiation Introduction Training • Project-specific Training: As required per project plan
	Refresher	• Required Read: CAES Lessons Learned available on the CAES Training and Access Management System (TAMS) • Online: ISU Annual Refresher Training
Non-radiation worker	Initial	• Required Video: ISU Radiation Awareness accessible through TAMS and ISU TSO Home Page • Laboratory Orientation
	Refresher	• Required Read: CAES Lessons Learned available on the CAES Training and Access Management System (TAMS).
Casual Users	Initial	• Assigned on a case-by-case basis

7.1 Dosimeter Use and Storage

External exposures are monitored by using individual monitoring devices (dosimeters). These devices are required to be used if the worker is likely to receive an external exposure that will exceed 10 percent of the allowed annual dose or enter radiation areas. The most commonly used monitoring devices include:

- Thermo-luminescent Dosimeter (TLD)-(modern technology often uses Optically Stimulated Luminescence (OSL) Dosimeters). ISU dosimeters are currently OSL dosimeters.
- Finger ring is required when one is likely to receive an extremity exposure to the hand which is in excess of 10 times that anticipated to be received by the whole body.
- Direct Reading Dosimeter (DRD).

The Whole body dosimeter is worn to measure the exposure to the whole body (i.e., between the neck and the waist), finger rings are worn on the work hand and underneath a glove so as not to contaminate the ring, DRDs are worn adjacent to the Whole body dosimeter.

All dosimeters are issued by the CSO. Documents will be provided upon request.

CAES dosimetry practices are governed by and performed in accordance with ISU TSO-08-02-REV 2: Dosimetry. Whole body dosimeters are required for all personnel who perform work in

radiological controlled areas (see definition in glossary). On an individual project and activity basis, decisions are made by the CSO regarding the need for extremity dosimeters (finger or ring badges).

All dosimeters are to be kept on location at CAES. Dosimeters should not be removed from CAES to ensure (1) their availability when needed and (2) that dose received elsewhere is not captured by the dosimeter. When not in use dosimeters are kept in the dosimeter storage racks.

7.2 Personal Protective Equipment (PPE) Requirements

When working with radiological materials required PPE includes gloves, a lab coat, and safety glasses. Additional PPE may be required on a project/task-specific basis. When performing radiological work NEVER touch walls, door handles, people (including yourself), or any surface unnecessarily. Always remove and properly dispose of gloves in a designated radiological waste container before leaving a room.

All gloves worn when handling radiological materials are disposed of in designated radiological waste containers. Lab coats are not disposed of and are periodically frisked by the laboratory lead and TSO.

8. SURVEY AND DECONTAMINATION REQUIREMENTS

At the completion of work activities that involve radiological samples/materials, project personnel are responsible for surveying all work areas, instruments, tools, and equipment used in the task. Until they are formally approved by the TSO to independently perform these functions, contamination surveys must be performed by project personnel under the direct supervision of TSO personnel or designee (e.g., lab lead or a responsible user) approved by the TSO.

It is important to note that although project personnel's direct work in the labs does not involve the use of radiological samples/materials, they may be working a radiological laboratory and must follow all radiological controls that are in place. For example, upon exiting radiological laboratories, each individual must perform contamination surveys on their hands, feet and any personnel items brought into the laboratory. Until they are formally approved by the TSO to independently perform these functions, contamination surveys must be performed by project personnel under the direct supervision of TSO personnel or designee (e.g., lab lead or a responsible user) approved by the TSO.

Specifically when and where surveys needs to be performed for a specific project /task shall be established on a project basis during the project planning process.

The completion of each project involving unsealed radiological material requires a radiological release survey.

A description of the procedure and release limits for the radiological release of equipment or materials is outlined in section 11 of the ISU Radiation Safety Manual, specifically pages 34-36 (Idaho State University Radiation Safety Policy Manual). The laboratory removable contamination survey procedure is listed at the ISU Technical Safety Office (TSO) website (Procedure #: TSO-08-07-REV 1). (ISU > technical safety office > radiation safety > TSO RPR procedures > Radionuclide laboratory procedures). The required lab removable contamination survey maps are also provided. The CAES RSP-006 Area and Contamination Survey, covers CAES specific protocol.

9. RADIOACTIVE WASTE MANAGEMENT

All materials (gloves, rags, etc.) used when handling radiological material must be disposed of in radioactive waste containers. Radioactive waste disposal is ultimately performed by the TSO. The TSO will, upon being notified by the CSO or their designee, remove waste to an accumulation area from which it is ultimately disposed of at a low-level radioactive waste facility. Project personnel should never dispose of radioactive waste except to place it into a designated radioactive waste container. To avoid generation of airborne radioactive materials, the contents of radioactive waste containers should never be manually compressed.

When responsible users have no further use for radioactive materials, they should contact the CSO and arrange for a waste pick-up. (Waste pick-up is arranged with the TSO by completing a waste pick up form found at http://www.physics.isu.edu/health-physics/tso/ohome1.html). A radwaste tag must be filled out by the responsible user indicating the radionuclide, activity and volume or weight, if appropriate. The CSO will verify that the waste is safely contained and the radwaste form is properly completed before accepting custody of the waste. Radwaste tags can be obtained from the CSO upon request and constitute a record of radwaste inventory for the University.

NOTE: *Radioactive materials shall not be mixed with hazardous materials as this creates "mixed waste." Any process that has the potential to generate mixed waste should be discussed with the RSO in the project planning process.*

10. EGRESS REQUIREMENTS

Egress from radiologically controlled areas requires frisking. The specific type of frisking required is a function of the type of work and therefore varies from lab to lab. Frisking requirements for each laboratory are communicated during the lab orientation and prejob brief. **Note:** *A daily source check is performed on each frisker to ensure proper operation.*

If contamination is discovered during frisking the following actions are required by the person who made the discovery:

- Control access and egress from the room. Do not move from the area, notify others in the area of the contamination, have others outside the contaminated area notify the CSO, TSO or Lab lead if possible. Until the contamination issue is resolved, no personnel are allowed to enter or leave the room without TSO, CSO, or Lab Lead approval.
- Immediately notify the lab lead and TSO using the phone in the room and posted contact numbers.

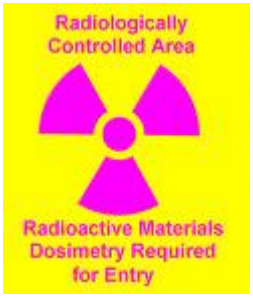
Decontamination will be performed under the direction of the TSO or CSO.

11. SIGNAGE

Each person performing work with radioactive materials or radiation producing machines shall confirm the areas in which they plan to perform work are marked with the proper signage before they commence work. Area classifications are posted as shown below.

CLASSIFICATION OF AREAS

Controlled Area: Any area, to which access is limited for any reason. X-ray rooms and accelerator rooms are controlled administratively by the personnel who operate the equipment. Laboratories using radioactive materials are controlled by posting and locking for the purpose of preventing unauthorized removal of these materials. Exposure to radioactive materials is prevented by controlling the materials, and by limiting normal access to the laboratory when it is open and attended.



Restricted Area: An area, to which access is limited for the purposes of protecting individuals against undue risks from exposure to radiation and radioactive materials. It is an area that is defined by a responsible user to the purposes of working with radioactive materials. An area must be posted as a Restricted Area if the dose rate is ***>2 mrem/hr*** or it contains ***> 0.02 ALI*** of dispersible radioactive material. A Restricted Area will have some type of marked or physical boundary so that untrained personnel will be prevented from accessing the area.

Radiation Area: Any accessible area in which an individual could receive a dose equivalent **exceeding *5 mrem in 1 hour at 30 cm*** (1 ft) from the source or from any surface the radiation penetrates.

12. STOP WORK POLICY

Any person should initiate a stop work whenever conditions that are potentially unsafe or adverse to quality are identified. They should determine if the condition is readily fixable and within their work scope and authorization to correct. If it is not readily fixable or they are not authorized to remedy the situation, then they should declare a stop work and notify the Laboratory Lead, CAES Safety Officer, and/or their project's Principal Investigator.

Stop Work is an action that keeps us safe and reflects a good questioning attitude.

13. RECORDS

Records are an important component of ISU's radiation safety program. A subset of the records specified in the ISU Manual are maintained at CAES for the convenience of researchers; to allow immediate access to staff upon request; to serve as the basis for confirmation of qualifications to perform radiological research; and to provide evidence of compliance with the requirements of the ISU Manual and NRC license.

The radiation safety records maintained by CAES are:

1. A list of responsible users approved to use the CAES facility accompanied by the RSO approval letter for each (available on CAES Portal)
2. Current inventory of all sources and materials at CAES (available on CAES Portal)
3. Copies of all transfers of material to and from CAES on the associated shipping records (hard copy)
4. Copies of training completion records (available on CAES Portal; project-specific also available in Laboratory Manual)
5. Results of contamination and exposure surveys (available in Laboratory)
6. Archive of lab radiation log books.

Each user of radioactive materials (RAM) shall maintain a complete record of all acquisitions, uses, transfers and disposals of such materials and provide this data to the TSO in a timely manner upon request.

Appendix A

CAES Laboratory Orientation Checklist

This checklist is a job aid for conducting lab orientation. The checklist is administered by the CAES Safety Officer or the cognizant Laboratory Lead, face-to-face, for each project participant before they perform work in CAES. The orientation includes a walk thru that demonstrates how to perform some tasks.

☐ **Key Personnel and Notifications:** Lab Lead, CAES Safety Officer, Technical Safety Office and where contact information is posted

☐ **Laboratory Normal Hours and Need to Work Off-Hours:**
- ☐ Laboratory working hours for mentoring work (example: using instruments) 8 am – 4:30 pm
- ☐ Radiological samples movement must be before 3:00 pm
- ☐ Laboratory normal working hours 6:00 am – 6:00 pm (does not require mentoring)
- ☐ Working off-hours **must be** approved by the Lab Lead, designated alterative, or CSO

☐ **Emergencies**:
- ☐ Location of Fire Alarms
- ☐ Location of Fire Extinguishers
- ☐ Location of First Aid Kit
- ☐ Location of Shower and Eye Wash
- ☐ CAES Physical Address (postings)
- ☐ Evacuation Plan
  - Exits and meeting area
- ☐ Lockdown Plan

☐ **Stop Work Policy:** Who has the authority and its importance

☐ **Training Completion**: Responsibility of PI to verify completion of CAES and project-specific

☐ **General Lab Rules**:
- ☐ No eating, drinking, gum, mints, chap stick, etc.
- ☐ No food or drink to be stored in the lab refrigerators
- ☐ Dress Code for CAES Labs:
  - Researchers must wear:
    - Shoes covering their entire foot
      - No sandals, open toe shoes, or slipper type shoes

- Long pants or long skirts (Length: to your ankle)
  - No shorts, capris, or skirts

□ General Lab Supplies provided by CAES are **NOT** to be removed from the labs
- General Lab supplies are to be stored in general lab drawers or cabinets and not in personnel drawers
- Researcher's can label a drawer or cabinets in labs for their supplies
- Researcher's can only borrow items from other Researcher's if they have prior authorization from the Researcher who owns the item. **Do not** remove items from others drawers or cabinets without prior approval.

☐ **Personal Protective Equipment:** General required PPE and project-specific; best practices such as not touching things, changing gloves, etc.

☐ **Instrument Log and Usage Log Book**

☐ **Sample Log book**:
- □ Include date, sample owners name, sample name, and description of sample
- □ Write CAES ID number on sample container

☐ **Labeling Samples**:
- □ All containers containing solid/ liquid/gas chemicals this includes water must be **labeled with your name, date, chemical name/or sample name, and concentration/or contents**.

☐ **Ordering Chemicals**:
- □ Quick Guide to CAES Chemical Requisitions

Radiological Labs

☐ **Material Receipt, Removal, and Accountability**: Who can receive and remove; inventory and chain-of-custody

☐ **Dosimeter Use and Storage**: When and location to attach on-person; where they are stored

☐ **Rad Surveys and Decontamination**: Who can perform, how to perform, and how to document

☐ **Waste Management**: What is rad waste; rad waste containers; who can remove waste

☐ **Egress**: Where to egress; when and how to frisk

☐ **Signage**: Discuss what each sign means and what actions to take

☐ **Records**: Required records

☐ **Applicable Radiation Safety Protocols**: Discuss each applicable protocol and confirm researchers understand them. Emphasize both normal and what to do if off-normal conditions occur.

☐ **Using Surveying Equipment**

☐ **Checking Survey Equipment**

Name (print and sign): _____ Date: _____

_____

Advisor's Name (print and sign): _____ Date: _____

_____

Lab Lead's Name (print and sign): _____ Date: _____

_____

Appendix B

Glossary

Absorbed Dose. The mean energy per unit mass imparted to any matter by any type of ionizing radiation. The units of absorbed dose are **rad** or **gray (Gy).**

Activity. A quantity of a radionuclide specified by the mean rate of spontaneous nuclear transformations which it undergoes. The common unit of activity is the **Curie** (Ci) or the quantity of radioactivity which decays at the rate of 3.7×10^{10} disintegrations per second.

Quantities of radioactivity of biological or environmental interest are commonly expressed in submultiples of the curie:

1 millicurie (mCi) = 3.7×10^{7} s^{-1} 1 microcurie (μCi) = 3.7×10^{4} s^{-1} = 2.2×10^{6} min^{-1} (dpm)

1 nanocurie (nCi) = 37 s^{-1} = 2,220 dpm

1 picocurie (pCi) = 0.037 s^{-1} = 2.22 dpm

The international standard unit for activity is the **Becquerel (Bq)**. One Bq equals one transformation per second (or one disintegration per second).

Annual Limit on Intake (ALI). The quantity of a radionuclide which, if taken into the body, produces a committed effective dose equivalent of 5 rem. Because of differences in physiological transport mechanisms, the ALIs vary depending on the route of intake. For purposes of contamination control and bioassay procedures, the most conservative ALI, either for ingestion or inhalation, is used.

Byproduct Material. (10CFR20 definition)

(1) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material;

(2) The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition;

(3) (i) Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or

(ii) Any material that—

(A) Has been made radioactive by use of a particle accelerator; and

(B) Is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; and

(4) Any discrete source of naturally occurring radioactive material, other than source material, that—

(i) The Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other

appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and

(ii) Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

Contamination Survey. A systematic investigation to determine the presence, or to verify the absence, of radioactive materials in unwanted locations, e.g., on the body or personal clothing, on surfaces of objects that may be touched or handled, on equipment or materials to be removed from a restricted area, etc.

Controlled Area. Any area outside of the restricted area but inside the site boundary, access to which can be limited by the licensee for any reason. Radioactive material laboratories are controlled by posting and locking for the purpose of preventing unauthorized removal of radioactive materials. Exposure to radioactive materials is prevented by controlling the materials, not by limiting normal access to the laboratory when it is open and attended.

Dose. Refers either to absorbed dose or to dose equivalent, depending upon the context and the units used.

Dose equivalent. (H_T)**:** means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the **rem** and **Sievert (Sv).**

Dispersible Radioactive Material. Radioactive material in a form that has the potential to become loose and can easily be spread, such as liquid, powder or gas.

Exposure Survey. A systematic investigation to determine external radiation exposure rates at specific locations where individuals may be present and potentially exposed

High Radiation Area. Any accessible area in which an individual could receive a dose equivalent *exceeding* ***100 mrem*** *in 1 hour at 30 cm* (1 ft) from the source or from any surface the radiation penetrates.

Radiation Area. Any accessible area in which an individual could receive a dose equivalent *exceeding* ***5 mrem*** *in 1 hour at 30 cm* (1 ft) from the source or from any surface the radiation penetrates.

Radiation Safety Officer (RSO). The Radiation Safety Officer is the individual appointed and approved by the Nuclear Regulatory Commission (NRC) to administer the radiation protection program and to provide technical guidance to the RSC and to radiation users. The RSO is authorized and directed to promulgate and enforce such procedures as are necessary to assure compliance with applicable federal and state regulations and to ensure the accurate interpretation and effective implementation of the policies and rules established by the RSC. The RSO is responsible for receipts, uses, transfers and disposal of radioactive materials. Additionally, the RSO is responsible for investigating deviations from approved radiation safety policy such as spills, losses, thefts, variations from approved radiation safety practice, and implementing corrective actions as necessary. The RSO receives direction from the RSC with regard to policy. The RSO provides technical advice to the RSC, radiation users and the administration.

Radioactive Contamination. Unwanted presence of radioactive substances on surfaces, air or inside the human body.

Radioactive Half-life. The amount of time that it takes for a radioactive isotope to be reduced by one half of its value through the process of radioactive decay.

Radioactive Material. Any material having a specific activity greater than 70 Bq/g (0.002 mCi/g), in accordance with 49 CFR 173.403. Also, any nonradioactive material (activity less than 70 Bq/g) with surface contamination (both fixed and non-fixed/removable) that, when averaged over each 300 cm^2 (46.5 in^2) of all surfaces, is equal to or greater than 0.4 Bq/cm2 (10^{-5} mCi/cm2) for beta and gamma emitters and low-toxicity alpha emitters; and equal to or greater than 0.04 Bq/cm2 (10^{-6} mCi/cm2) for all other alpha emitters.

Radiation User. Any individual whose official duties or authorized activities include handling, operating, or working in the presence of any type of radiation source, whether or not such use is confined to a restricted area. Radiation user includes all the badged personnel as well as the minimally exposed personnel.

Responsible User. An individual authorized by the Radiation Safety Committee to acquire and use specific radiation sources and to supervise their use by others, in compliance with pertinent regulations and under conditions approved by the Committee. Responsible users must demonstrate, to the satisfaction of the Committee, competence in the safe use of radiation sources by virtue of appropriate training and experience. Responsible users must assume full responsibility for all radiation sources under their control.

Restricted Area. An area to which access is limited for the purposes of protecting individuals against undue risks from exposure to radiation and radioactive materials. It is an area that is defined by a responsible user to the purposes of working with radioactive materials. An area must be posted as a Restricted Area if the dose rate is ***>2 mrem/hr*** or it contains ***> 0.02 ALI*** of dispersible radioactive material. A Restricted Area will have some type of marked or physical boundary so that untrained personnel will be prevented from accessing the area.

Sealed Source. Radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release and dispersal of the radioactive material under the most severe conditions which are likely to be encountered in normal use and handling.

Source Material. (10CFR20 definition) **(1)** *Uranium* or *thorium* or any combination of uranium and thorium in any physical or chemical form; or

(2) Ores that contain, by weight, one-twentieth of 1 percent (0.05 percent), or more, of uranium, thorium, or any combination of uranium and thorium. Source material does not include special nuclear material.

Special Nuclear Material. (10CFR20 definition) **(1)** *Plutonium*, *uranium-233*, *uranium enriched* in the isotope *233* or in the isotope *235*, and any other material that the Commission, pursuant to the provisions of section 51 of the Act, determines to be special nuclear material, but does not include source material; or

(2) Any material artificially enriched by any of the foregoing but does not include source material.

Swipe Test. The detection and evaluation of removable contamination by measurement of radioactive material wiped from the surface onto an absorbent material such as a filter paper.

Unsealed Source. Radioactive material that is loose or dispersible such as liquid, powder or gas and *non-contained* solid materials.

Appendix C

RPR 13F. Radioactive Material Purchase Authorization

1. All Radioactive Materials purchases requests **must** be cleared by the Technical Safety Office.
2. Radioactive material purchases must be submitted at least three working days in advance.
3. All Radioactive Material Purchase Orders are to be addressed as follows:

Responsible User's Name
c/o Technical Safety Office
Idaho State University
Shipping & Receiving Dept.
638 E. Dunn St.
Pocatello, ID. 83209

4. Forward the purchase request and this form to:

Technical Safety Office
Box 8106

The attached requisition specifies the purchase of radioactive material under Idaho State University's radioactive material license.

Responsible User: _____ Program #: _____

Dept.: _____ Supplier: _____

Authorized Isotope	Chemical/Physical Form	Isotope Possession Limit	Isotope Amount Requested

I certify I am allowed to posses this material and that this purchase will not exceed my radioactive material possession limit.

_____ _____

Responsible User Signature Date

To be completed by TSO staff - This purchase request has been reviewed and verified by the TSO

Users Limit: _____ Users Current Inventory: _____

ISU Limit: _____ ISU Current Inventory: _____

Lab Ali's: _____ Bioassay Frequency: _____

Lab Survey Frequency: _____ Verified by: _____

TSO Staff

I approve/disapprove this radioactive material purchase:

Radiation Safety Officer	Date

Appendix D

RPR 14 ISU-1 Request for Shipment of Radioactive Material

This form is to be completed for **transportation of any quantities of radioactive materials.** The individual desiring transportation of the material shall complete the form and submit it to the TSO for approval **before the material is transported.** For repetitive intramural transfers of the same material, a generic form may be used repetitively. **THIS REQUEST IS VALID ONLY FOR MATERIALS POSSESSED BY IDAHO STATE UNIVERSITY** [References are to Department of Transportation regulations, Title 49, Code of Federal Regulations.]

For Transportation Between (Consignor/Consignee):

Name (RU): _____ Name (RU): _____

Address: _____ Address _____

_____ _____

_____ _____

Phone: _____ Phone _____

Package Contents and Hazardous Material Classification:

Description of Material (Solid/Liquid, Serial Number, Type of Packaging, etc.):

_____

_____

Nuclide	Item Activity (Bq/Ci)	Package Activity (Bq/Ci)

Type of Request:

_____ One Time, One Way

_____ One Time, Round Trip (Same Day)

_____ Routine Shipment from _____ (date) to _____

_____ _____

Signature Date