

Idaho State University
Radiation Safety Training
REFRESHER TRAINING STUDY GUIDE

Prepared by the ISU Technical Safety Office
Rev. 08/07

*****Instructions for use:**

1. Read the following information.
2. Take the Refresher Training Test (separate document).
3. Mail the test to: Radiation Safety, Campus Box 8106, or bring it to the Technical Safety Office in the Physical Science building room 101.

*If you have **questions** at **ANY TIME**, contact the
ISU Technical Safety Office at **282-2310/2311**.*

ISU's Organizational Entities

***Key Words:** Provost and Vice President for Academic Affairs, Radiation Safety Committee, Radiation Safety Officer, Technical Safety Office, Responsible User, badged personnel, potentially exposed personnel.*

Provost and Vice President for Academic Affairs (P-VPAA)

The Provost and Vice President for Academic Affairs is the official spokesperson for the University on matters pertaining to radiation protection. The P-VPAA appoints Radiation Safety Committee members.

Radiation Safety Committee (RSC)

The RSC is the governing body for all aspects of radiation protection within the University, including affiliated research, clinical, instructional and service units using radiation sources in facilities owned or controlled by the University. The RSC will ensure that all possession, use and disposition of radiation sources by University personnel complies with pertinent federal and state regulations and with the specific conditions of licenses issued to the University, and that all concomitant radiation exposures are maintained as low as reasonably achievable (ALARA). The RSC is empowered and directed to promulgate policies, rules and procedures for the safe use of ionizing radiation. The RSC reports to the P-VPAA. The RSC has many faculty with expertise in radiation protection.

Radiation Safety Officer (RSO)

The RSO is the individual appointed by the P-VPAA 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.

Technical Safety Office (TSO)

The TSO is the organizational entity that provides administrative and technical services in support of the radiation protection program. The Director of the Technical Safety Office, who is normally the RSO, reports to the P-VPAA.

Responsible User

A "responsible user" is an individual authorized by the Radiation Safety Committee to acquire (via the TSO) and use specific radiation sources and to supervise such use by others. Responsible users are typically the faculty in charge of the research project.

Radiation Users

A "radiation user" is 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.

"Badged personnel" are individuals who may receive more than one tenth (10%) of the occupational radiation dose limit in any calendar quarter. This category includes those personnel who rarely receive more than 100 mrem in any calendar quarter, but who work with radiation sources that could produce such a dose under certain conditions. The radiation exposures received by these individuals are individually monitored.

"Potentially exposed" personnel are individuals who have a need to enter Restricted Areas as part of their job description or have a potential of exposure to a radiation source but do not normally work in the presence of a radiation field. This category includes custodial, receiving, and security personnel.

Individual Dose Limits

Key Words: *NRC occupational annual limits, Idaho quarterly occupational dose limits, general public dose limits; fetal dose limits, Idaho quarterly occupational dose limits, dose limits for minors.*

Federal and State Authorities establish legal dose limits that an employee should not exceed in a calendar year. Administratively, ISU establishes more conservative values than allowed by Federal and State authorities and the

ALARA goals (explained in the next section) are set and self imposed by the ISU Radiation Safety Committee in order to minimize personnel exposure.

The Idaho State University's Administrative Occupational Dose Limits (legal limits set by ISU) are as follows:

The annual adult occupational dose limit is the more limited of:

- The total effective dose equivalent being equal to 2,000 mrem (2 rem); or
- The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue, being equal to 10,000 mrem (10 rem).

ISU's administrative occupational dose limits are far less than the occupational dose limits set by the NRC or the State of Idaho.

Idaho State University's ALARA Goals

The ALARA goals are included here as a comparison to the legal limits. The ALARA concept is explained in the next section.

Radiation Technology Program:

- 600 mrem/calendar year (total)
- 150 mrem/calendar quarter

All Other Radiation Safety Programs:

- 100 mrem/calendar year
- 25 mrem/calendar quarter (notification level)

NRC Occupational Annual Dose Limits (applies to radioactive materials users)
The annual adult (persons 18 years of age or older) occupational dose limit established by the United States Nuclear Regulatory Commission is the more limiting of:

- The total effective dose equivalent being equal to 5,000 mrem (5 rem); or
- 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 50,000 mrem (50 rem).
- An eye dose equivalent of 15,000 mrem (15 rem), and
- A shallow dose equivalent of 50,000 mrem (50 rem) to the skin or to each of the extremities.

Idaho Quarterly Occupational Dose Limits (applies to X-ray and accelerator users only)

- Whole body; head and trunk; active blood-forming organs; lens of eye or gonads 1,250 mrem/cal qtr.

- Hands and forearms; feet and ankles 18,750 mrem/cal qtr.
- Skin of whole body 7,500 mrem/cal qtr.

General Public Dose Limits

The dose limit for members of the general public, including all persons who are not classified as radiation users, is a total effective dose equivalent not to exceed 100 mrem per year. In addition, the dose in any unrestricted area from external sources cannot exceed 2 mrem in any one hour.

Fetal Dose

The embryo-fetus may be more susceptible to radiation effects than an adult and is, therefore, subject to a lower dose limit. The dose limit for the embryo-fetus is 500 mrem (5 mSv) during the entire gestation period. As a further precaution, this limit should not be experienced in an acute fashion, but rather distributed relatively uniformly during the gestation period if it is to be experienced (Regulatory Guide 8.13). This degree of protection for the embryo-fetus can only be achieved with the cooperation of the employee. It is recommended that she notifies her supervisor or the RSO as soon as the pregnancy is known. **In order for a pregnant worker to take advantage of the lower exposure limit and dose monitoring provisions, the woman may declare her pregnancy in writing to the TSO.** This notification is optional, and at the discretion of the employee the TSO encourages the act of notification, when appropriate. Unless a woman declares her pregnancy, ISU can not set special dose equivalent limits for her.

Dose Limits for Minors

The dose limits for minors (persons under 18 years of age) are 10% of the adult occupational dose limits.

ALARA Policy

Key words: As Low As Reasonably Achievable (ALARA), ALARA goals

Policy

Idaho State University is committed to an effective radiation protection program to *eliminate unnecessary exposures* to radiation and to *reduce all exposures* to levels that are **As Low As Reasonably Achievable (ALARA)**, taking into account social and economic considerations. The ALARA principle is a formal requirement of the U.S. Nuclear Regulatory Commission and the Idaho Department of Health and Welfare.

The ALARA principle is implemented by a comprehensive radiation protection program that includes specific requirements and procedures for:

- training of all radiation users,
- safety evaluations of proposed facilities or projects utilizing radiation in any way,
- regular surveys of work areas for contamination and exposure rates,
- monitoring of radiation exposures to groups and individuals,
- investigations of all exposures that exceed predetermined levels, and
- reviews of the program by the Radiation Safety Committee.

Idaho State University's ALARA Goals

The ALARA goals for Idaho State University are set by the Radiation Safety Committee (RSC). The RSC reviews the University's goal at least annually to verify all exposures at ISU are consistent with the ALARA policy of the NRC.

ALARA Goals for the Radiation Technology Program:

- Total effective dose equivalent being equal to **600 mrem/year** (**150 mrem/calender** quarter).

ALARA Goals for All Other Radiation Safety Programs:

- The total effective dose equivalent being equal to **100 mrem/year** (**25 mrem/** quarter - notification level).

If an ALARA goal is exceeded, the TSO will perform an investigation. The TSO's investigation is intended to determine if the personnel are following good radiation protection practices and if the ALARA goals are appropriate for the particular activity. Appropriate action will be taken based upon the results of the TSO's investigation.

Training

Key Words: RSO training program, student, lab. Supervisor, radiation user, responsible user

Each individual working with or in the presence of radioactive materials or other radiation sources is required to receive training or provide documentation showing they have received 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 (10CFR 19.12). The extent of the training is to be commensurate with the potential risk of radiation exposure to the individual.

Students who use small, non-dispersible radiation sources shall receive appropriate training by the laboratory instructor provided:

- The use of the source is a part of a scheduled laboratory course under the supervision of an instructor who is either a qualified "Responsible User" or designated by the Responsible User for use of the source, AND;
- The estimated individual effective dose equivalent is less than 10% of the public dose limit of 100 mrem/year.

The **primary responsibility** for providing adequate training for radiation users **rests with their responsible users or supervisors**. Except for students in regularly scheduled laboratory courses discussed above, the responsible user or supervisor will generally fulfill this responsibility by assuring that each person participates in the appropriate training program offered by the RSO.

Classification of Areas

Key words: controlled area, radiation area, high radiation area, restricted area

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.

Very High Radiation Area: Any accessible area, in which radiation absorbed dose exceeds 500 rad in 1 hour at 1 meter (3.28 ft) from the source or from any surface the radiation penetrates.

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.

Restricted Area: an area, access to which 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** (Annual Limit on Intake, as defined below) 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.

Radionuclide Data

Key Words: "radioiodines", gases, RQ, ALI, RCL.

Definitions:

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.

Reference Quantity (RQ) - A quantity of a radionuclide (expressed in microcuries) related to its relative hazard potential and used to prescribe requirements for handling, monitoring, labeling and disposal. Reference quantities are obtained from 10CFR20, Appendix C.

Removable Contamination Limits (RCL) - A basic limit for removable surface contamination, specified in "Contamination Limits and Action Levels" (RPR 10B*, based on NRC Reg. Guide 8.23).

Dose Equivalent Rates (mrem/hour) as given:

Penetrating - the dose rate from photons at 1 meter from a point source of 1 millicurie, assumed to be proportional to the inverse of the square of the distance between the point source and the receptor.

Skin dose - dose rate to the basal epidermal cells from contamination on the skin, expressed in microcuries per unit area of skin ($\mu\text{Ci}/\text{cm}^2$) over an area of at least 1 cm^2 .

Low-energy beta or electron emitters with negligible external exposure potential.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
H-3	12 years	1,000	80
C-14	5,730 years	100	2
S-35	87 days	100	6
Cl-36	3×10^5 years	10	2

High-energy beta emitters with negligible gamma emission but capable of significant bremsstrahlung[†] production if not properly shielded. Emphasis is on control of doses to extremities and prevention of intake.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
P-32	14.3 days	10	0.6
Sr-Y-90	29.12 years	0.1	0.03

* Please see Appendix A.

† Bremsstrahlung radiation is electromagnetic radiation emitted by swiftly moving charged particles as they de-accelerate.

Radioiodines are treated as a separate category for exposure evaluation. Emphasis is on prevention of intake by ingestion or inhalation.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
I-125	60 days	1	0.04
I-129	1.57×10^7 years	1	0.005
I-131	8 days	1	0.03

Noble gases present minimal exposure potential or waste disposal problems.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
Kr-85	10.7 years	1,000	N/A
Xe-133	5.2 days	1,000	N/A

Naturally occurring radionuclides are primarily alpha emitters. Emphasis is on prevention of intake by ingestion or inhalation.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
Th-232	1.4×10^{10} years	100	0.0007
U-238	4.5×10^9 years	100	0.02

Radionuclides which emit gamma rays of substantial energy and with ALI greater than or equal to 1 millicurie; emphasis is on external exposure control and monitoring.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
Na-24	15 hours	100	4
Mn-54	312 days	100	2
Mo-99	2.8 days	100	1
Tc-99m	6 hours	1,000	80
Au-198	2.7 days	100	1

ALL OTHER RADIONUCLIDES not included in one of the above groups are assumed to have potentials for both external and internal exposures and must be evaluated individually.

Nuclide	Half Life	Reference Quantity (μCi)	Ingestion ALI (mCi)
Na-22	2.6 years	10	0.4
Co-60	5.27 years	1	0.2
Zn-65	244 days	10	0.4
Ir-192	74 days	1	0.9
Hg-203	47 days	100	0.5

Laboratory Safety Procedures

Key Words: *responsibilities, posting, survey instruments, minimize the external exposure, prevention of intake.*

Responsibilities

Each person who works with unsealed or dispersible radioactive materials is responsible for:

- knowing the basic properties of the radioactive materials to be used, e.g. the half-life of the nuclide(s), the type(s) of radiation emitted, the annual limit on intake (ALI) and the type and quantity of the appropriate regional shielding.
- following the instructions or procedures provided by the responsible user and the RSO, or provided in the Radiation Safety Policy Manual.
- surveying of gloves, clothing, equipment and work area frequently during procedures in which more than 1 ALI is manipulated, and surveying of hands and personal clothing before leaving the laboratory.
- providing a urine sample, obtaining a thyroid count or other bioassay measurements, at intervals specified by the RSO.
- recording the results of all radiation surveys and screening bioassays promptly, completely and accurately.

Postings

Each room containing more than 10 times the Reference Quantity values given in 10CFR20, Appendix C and RPR10* must be labeled with a "CAUTION RADIOACTIVE MATERIALS" label. For rooms containing X-ray machines "CAUTION X-RAY EQUIPMENT" label should be used.

If any dose rate exceeds 2 mrem in any one hour at 30 cm (1ft.) from an accessible source or surface, the room shall be posted as a "RESTRICTED AREA" to prevent entry of unauthorized individuals. If any dose rate exceeds 5 mrem in any one hour at 30 cm (1ft.) from an accessible source or a surface, the room must be labeled with a "CAUTION RADIATION AREA" sign.

A "NOTICE TO EMPLOYEES", available from the RSO, must be posted in a location clearly visible to anyone entering the laboratory.

All containers of radioactive materials should be labeled with the "CAUTION, RADIOACTIVE MATERIAL" or "DANGER, RADIOACTIVE MATERIAL" sign.

* Please see Appendix A.

Survey Instruments

The responsible user shall ensure that instruments used for determining exposure rates or for direct detection of contamination are calibrated biannually and capable of responding appropriately to the types of radiation anticipated. The user must know the detection efficiency (e.g. % efficiency for the radionuclides being used in the laboratory, cpm/dpm) for each contamination survey instrument and record it with all survey results.

Lantern Mantle Check Sources

We have recently provided laminated lantern mantle check sources to verify that your survey instrument is in proper working order. Contact TSO if you do not know how to use these.

Minimize the external exposure

Careful planning of work, good handling techniques and thorough monitoring are all necessary to minimize exposure. Adequate time, distance, and shielding (the ALARA concept) from sources are also important factors in reducing exposure.

Prevention of intake of radioactive material

Ingestion of radioactivity must be prevented by avoiding mouth contact with any items handled in a radioactive material laboratory (pipettes, pencils, etc.), by prohibiting eating, drinking and smoking in radionuclide handling areas and by careful attention to personal hygiene.

Conditions for Bioassay

Key Words: ALI, minimally exposed, potentially internal exposed

A bioassay involves directly measuring the radioactive material that may be present in an individual's body. In some instance, bioassays mean the radioactive materials excreted from the body to infer what is present within human tissue. A bioassay is required whenever personal contamination or injury caused by a contaminated object occurs, or if airborne radioactivity may have been inhaled. Routine bioassays, at intervals determined by the radionuclides used, are required from each user who handles more than certain threshold quantities of dispersible radioactive materials. A routine bioassay may be waived when appropriate surveys for contamination, conducted during and after each use of radioactive material according to recommended procedures, demonstrate that there was essentially no exposure from unconfined, dispersible radioactive material and as authorized by the RSO.

Definitions

Bioassay interval - The bioassay interval is the maximum time that may elapse between bioassays that will assure detection of the verification level for a given nuclide and assay method. The bioassay interval for a particular radionuclide is

determined by its physical and metabolic characteristics, and by the instrumentation used for the measurement. For most commonly used radionuclides and typical analytical systems, the bioassay interval is 13 weeks (one calendar quarter); for P-32, and a few other very short-lived radionuclides, however, the bioassay interval is only one month.

Minimally exposed: A radiation user who handles a cumulative quantity of radioactive materials in dispersible form of less than 1 ALI per month, averaged over the bioassay interval, is unlikely to experience an annual intake of 0.1 ALI and does not require routine bioassays. If a worker is exposed to contamination exceeding the levels specified under "Conditions Requiring Bioassays", however, a non-routine bioassay will be required.

Potentially exposed: A radiation user who handles a cumulative quantity of radioactive materials in dispersible form of more than 1 ALI per month, averaged over the bioassay interval, is considered to be potentially exposed to an annual intake of more than 0.1 ALI. Such an individual must perform or obtain bioassays routinely unless the records of contamination surveys of both the user and the RSO verify that there was no exposure to unconfined radioactive materials exceeding the levels specified.

Conditions requiring bioassays:

The optimum time for performing a bioassay is within a few days after a potential exposure, and **therefore each user will** perform a screening assay within a few days after handling any unusually large quantities, or after performing any procedure involving a greater than usual opportunity for exposure. Subsequent routine bioassays would not be required again until the end of another full bioassay interval unless another unusual exposure situation occurred. The Technical Safety Office will notify users when a bioassay is due (upon delivery of the radioactive material), i.e. the expiration of the bioassay interval, but it is the responsibility of the user to complete the bioassay promptly.

- A bioassay is required within 5 days for each individual having contamination of the skin or hair exceeding 10 RCL.
- A bioassay is required within the normal bioassay interval for any individual having skin or hair contamination exceeding 1 RCL.
- A bioassay is required within 5 days for each individual involved in a spill, or other uncontrolled release, of >0.5 ALI of radioactive material outside of a properly functioning fume hood or >5 ALI inside a hood.
- A bioassay is required within 5 days for each individual who was present in an area during a time when removable contamination exceeding 100 RCL was present on any readily accessible surface.
- A bioassay is required within the normal bioassay interval for each individual who was present in an area during a time when removable

contamination exceeding 10 RCL was present on any readily accessible surface.

- A bioassay is required within the normal bioassay interval for personnel who work in laboratories that have >1 ALI of cumulative quantity handled, averaged over the bioassay intervals. The determination of the cumulative quantity handled will be based primarily on records of receipts and disposals of radioactive materials, with adjustments for individual work assignments as defined by the responsible user. Routine bioassays may be waived at the discretion of the RSO if the records of contamination surveys of both the user and the RSO verify that there was no exposure to unconfined radioactive materials exceeding the levels specified above and no incidents of personal contamination since the last bioassay. When mixtures of radionuclides are present in the laboratory, the necessity of a bioassay will be based upon a sum of the fractions evaluation.

Physical Security of Radioactive Materials

Key words: security, radioactive materials

Policy

According to the provisions of 10CFR20 the licensee shall: (i) secure from unauthorized removal or access licensed materials that are stored in controlled or unrestricted areas (10CFR20.1801) AND (ii) control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage (10CFR20.1802). These security requirements apply to radionuclides in any form, sealed or non-sealed, and to radionuclides in original containers, anywhere in the experimental process, and in waste containers. Only those persons who are qualified to work with radioactive materials have access to those materials. Administration at Idaho State University is extremely sensitive regarding this policy and strongly encourages its employees to strictly adhere to the policy because of problems discovered during recent NRC inspections.

ISU Security Requirements

All Responsible Users at Idaho State University are required to maintain security of the licensed radioactive material in their possession. This includes but is not limited to: radionuclides in original containers, reagents and test materials, and waste in waste containers.

1. The presence of authorized personnel in the laboratory will be sufficient to meet the NRC security requirement (at least one authorized individual must continuously be present in the laboratory when radioactive materials are not secured).

2. When there are no authorized personnel in the laboratory, the following conditions apply:

- a) One or more physical barriers will be maintained for licensed material above the exemption level of Schedule B of 10 CFR 20.
- b) Two or more barriers will be maintained for all radioactive material in excess of 100 times the levels of Appendix C of 10 CFR 20.
- c) No exceptions to the two barrier rule for material in excess of 1000 times the levels of Appendix C of 10 CFR 20 will be granted by the Radiation Safety Officer or the Radiation Safety Committee. Responsible users who desire an exception to this policy may appeal to the P-VPAA.

Common safe storage measures are recommended for all radioactive material below the levels specified above. A physical barrier is defined as some form of fixed locked storage. The door to the laboratory is considered to be one barrier if it is maintained in a locked condition when the lab is unoccupied. Other barriers may be: a fixed locked cabinet, locked refrigerator, locked fume hood sash or similar fixed locked storage.

Responsible Users

The responsible user must ensure that:

- the licensed radioactive materials that are stored in controlled or unrestricted areas are secured from unauthorized removal or access.
- the licensed radioactive material that is stored in a controlled or unrestricted area and that is not in storage is constantly controlled and surveyed.
- all radiation users have received the required radiation safety and security instruction.
- radioactive materials are secured against theft, misuse and access by unauthorized personnel.
- all radioactive materials will be logged in and out.
- radioactive wastes are segregated properly and placed in appropriate containers (DO NOT generate mixed hazardous waste). The containers are to be provided by the user; labels and clear plastic bags are available from the TSO. The TSO is contacted for the disposal of radioactive wastes.
- accurate records of acquisitions and dispositions of radioactive materials are maintained.
- the RSO is notified promptly of any accident or abnormal incident involving radioactive materials.

- prior to any extended absence of the responsible user, another individual is authorized by the Radiation Safety Committee (or temporarily authorized by the Radiation Safety Officer) to assume the preceding responsibilities, or the use of radioactive materials is suspended or terminated.

To order and receive radioactive materials from stores, the laboratory supervisor should fill a purchase order which must be signed by the RSO.

Radioactive materials may be shipped from the University to another organization or individual **ONLY** after verification by the RSO that all transfer, packaging, labeling and transportation requirements have been met.

All transportation of radioactive materials ON campus must be conducted by the TSO.

Radiation Emergency

Key Words: protect people, get help, contain the hazard, follow-up action

Any accident, injury or loss of control of a radiation source or radiation producing device that could cause an excessive or uncontrolled radiation exposure to any individual is referred to as a radiation emergency. Each user of radiation sources should be familiar with the basic emergency responses listed below and methods for applying them in his or her own work area.

In case of a spill of radioactive material, you must respond in a timely manner to minimize your exposure and take appropriate actions. Employees are expected to clean up, survey and document their own spills **if** it is in their capability. The TSO offers assistance in spill clean-up if so requested. If you enter a lab with a spill and do not know what the material is or feel uncomfortable with decontamination procedures, you should contact the TSO for assistance.

There are no radioactive sources at the University that produce radiation exposure risks large enough to prevent giving first aid!

1. Protect People

1. Assist injured people and prevent any further injury. If you are qualified to render first aid, do so without regard to the presence of radioactivity.
2. If the situation involves a radiation-producing machine, turn off the machine (if it is in your capability).
3. Except for the usual precautions for moving an injured person, individuals should immediately leave the room or area until the extent of the

radiological hazard has been evaluated. However, all individuals should remain available in the vicinity until they are checked for contamination and their exposure has been assessed.

2. Get Help

Each individual using radiation sources should know **in advance** who to call in case of a radiation emergency. If fire injury or other emergency conditions are involved, first call the appropriate numbers listed on the 1st page of the Campus Directory.

1. Dial 911 immediately for medical assistance and report the nature of the illness or injury. Inform the 911 dispatcher that the injured individual may be contaminated with radioactive material.
2. Notify the Technical Safety Office at extensions 2310 or 2311 during normal working hours OR notify Public Safety, at 282-2515 during off duty hours. Public Safety will notify the TSO. **When reporting any emergency**, be sure to state the exact nature of the emergency; then give your name and the phone number from which you are calling, the exact location of the emergency (building, room, nearest entrance, etc.) and the name of the Responsible User, if known. Do not hang up! Let the dispatcher end the conversation after all pertinent information is clearly understood.

3. Contain the Hazard

Any of the following actions appropriate to the situation should be performed **provided** they can be carried out safely:

1. Turn off radiation producing machines.
2. Cover containers of radioactive materials.
3. Place absorbent material on spilled liquids.
4. Close the sash on fume hoods, but do not turn off hood exhaust fans.
5. Close doors to the area and post signs or guards to prevent unauthorized entry.
6. Allow no one to leave the area without being checked for contamination.

4. Follow-up Action

Any necessary decontamination of the facility or equipment after a radiation emergency shall be performed only under the direction of the Radiation Safety Officer (RSO) or his designee. Re-entry or re-occupancy must be authorized by the RSO. The RSO shall evaluate, record and report, as necessary, any radiation exposures to personnel, loss of radioactive material, or damage to radiation facilities resulting from the emergency. If required by the RSO, individuals involved in a radiation emergency shall submit specimens for bioassay, surrender personal clothing or other articles for decontamination or assay, and provide pertinent information.

APPENDIX- A

Under Revision