

YOUNGSTOWN STATE UNIVERSITY

RADIATION SAFETY PROGRAM

Design and Purpose of the Radiation Safety Program

Purpose of the Radiation Safety Manual

This manual is designed to provide information to personnel and the general public regarding the structure of Youngstown State University's (YSU) Radiation Safety Program. It is designed to conform closely to applicable Ohio Administrative Code chapters on radiation protection. Copies of these regulations are on file in the Radiation Safety Office located in the Department of Environmental and Occupational Health and Safety, Room 2046, Cushwa Hall. They can also be found on the Ohio Department of Health website.

The YSU Radiation Protection Program Goal

The chief goal of the YSU Radiation Safety Program is to minimize the exposure to radioactive materials and their radiation to a level as low as reasonable achievable. The main objectives are as follows.

- a. To reduce occupational radiation exposure to levels reasonably achievable by means of good radiation protection planning and practice.
- b. To reduce radiation exposures to the general public to levels as low as is reasonably achievable.
- c. Commitment of management to encourage good radiation safety planning to establish and enforce radiation safety practice and to remain vigilant to the goal of improving the radiation safety program.

Administrative Line of Authority

Radiation Safety Office (RSO)

The Radiation Safety Officer is responsible for ensuring the University remains in compliance with regulations specified by the Ohio Department of Health. The RSO has the authority to halt any activity judged to be a threat to health, safety, the environment or is a violation of the Ohio Department of Health regulations or the conditions of the license. The RSO reports to the Vice President for Finance and Administration and performs the following duties.

- a. General surveillance of all health physics activities including both personal and environmental monitoring.
- b. Furnish consulting services to personnel at all levels of responsibility on any aspects of radiation protection necessary.

- c. Receive, deliver and ship all radioactive materials coming to or leaving the YSU campus.
- d. Monitor all materials, devices or equipment capable of producing ionizing radiations.
- e. Receive, review and approve all applications for the use of radiation sources to determine if the proposed work can be safely accomplished within the existing licensed procedures and isotope possession limits.
- f. Instruct personnel in proper procedures for the use of radioactive materials.
- g. Approve all purchase requisitions for radioactive materials assuring receipt of the ordered material will not exceed the license possession limits.
- h. Administer the waste disposal program. Obtain and keep all Federal, State and Local waste disposal records and permits.
- i. Perform leak tests on all sealed sources at minimum 6 month intervals.
- j. Maintain an inventory of radioactive materials on campus to ensure licensed limits are not exceeded.
- k. Store radioactive materials not in current use.
- l. Maintain permanent records of all radiation activities.
- m. Maintain central storage and waste facilities.
- n. Perform air quality and ventilation surveys of radioisotope areas as needed.
- o. Perform periodic audits of laboratory inventories and monitoring records.
- p. Maintain an inventory of calibrated survey instruments to be distributed to investigators as needed.
- q. Schedule monthly meetings with the Vice President for Finance and Administration.

The Radiation Safety Committee

The Radiation Safety Committee performs the following functions.

- a. Provide advice to the RSO on policies and technical matters regarding radiation safety.
- b. Receive and review reports from the RSO as needed regarding monitoring, contamination and personnel exposure.
- c. Conducts annual audits of the Radiation Safety Program to determine that all necessary functions are being performed at their required intervals and all required records are intact. Reports of all audits will become part of the radiation file.

YSU Policy Governing Violations of ODH Regulations

The RSO will determine the severity of the violation and the appropriate prompt action. The RSO has the right to immediately terminate any activity found to be a threat to health or property. Those individuals committing serious violations or frequently violating safety standards will have their privilege to use radioactive materials revoked.

If necessary, individuals may appeal a decision to the Radiation Safety Committee. In the event of a disagreement between the RSO and the Radiation Safety Committee, representatives of the ODH will be contacted to review the situation.

Personnel Involved in the Use of Radioactive Material

This section discusses the requirements for participation in the Radiation Safety Program and outlines the training and responsibilities of each person in the program.

Authorized Users

All users who desire to use radioisotopes or other forms of ionizing radiation must provide a summary of their past training and experience in handling radioactive materials. This summary must be submitted to the ODH in order to authorize new investigators. The RSO will prepare the necessary license amendment for submission to the ODH.

Authorized users are responsible for the health and safety of all personnel in their laboratory. They must ensure procedures used to accomplish the intended research goals are as safe as possible. The following duties are performed.

- a. Determine if all individuals working in their laboratory have completed the required training programs before beginning to handle radioactive materials.
- b. Assure all personnel working in their laboratory are included in the personnel monitoring program if necessary.
- c. Monitor their laboratory's ambience conditions as often as necessary to determine exposure to radiation is minimized.
- d. Label all areas and materials with the proper warning signs and assuring the information is kept current and accurate.
- e. Properly dispose of radioactive wastes and prevent the accumulation of excessive quantities of waste material in the laboratory.
- f. Notify the RSO of any changes in personnel, techniques or physical facilities from those outlined in their original approved procedures.

Authorized Assistants

All individuals who desire to use radioisotopes or other forms of ionizing radiation under the supervision of an authorized user must provide a summary of their past training and experience in handling radioactive materials to the RSO. The RSO will review the credentials to determine whether they are sufficient or if the individual would be required to pass a written examination.

Authorized assistants must work under the supervision of an authorized user. Authorized assistants will be responsible for setting up and completing their experiments in as safe a manner as possible. They shall report all unsafe conditions to the authorized investigator responsible for that area or to the RSO.

Students

All students will work under the direct supervision of an authorized user.

Before students are allowed to handle radioactive materials, the following procedures shall be completed.

- a. The specific procedures to be conducted by the students must be submitted to the RSO for review and approval.
- b. The Radiation Safety Rules and General Safety Rules for Laboratories must be distributed and reviewed.
- c. The specific techniques to be performed must be demonstrated.
- d. The techniques for monitoring facilities and personnel must be demonstrated.
- e. The procedures for the proper disposal of all generated wastes must be reviewed.
- f. The procedures for handling spills or other emergency events must be reviewed.

Ancillary Personnel

All ancillary personnel (security, custodial, maintenance, etc.) who enter laboratories containing radioactive materials will be trained on current policies and procedures at the beginning of their employment and updated annually thereafter. Topics to be covered include:

- a. Types and locations of all radioactive materials on campus.
- b. Specific radiation signs and labels used on campus.
- c. Routine safety procedures to follow in the event of an emergency involving radioactive materials.
- d. Reporting suspicious or unusual behavior of coworkers and others in the vicinity of radioactive materials.

In addition, Chemical Management personnel will receive similar instructions including:

- a. How to recognize packages containing radioactive materials.
- b. General procedures to follow for receiving packages and notifying the radiation safety office.
- c. Specific procedures to follow in emergencies involving damaged packages.

Policies and Procedures

Authorization of Radioactive Materials Locations

All rooms in which radioactive materials or radiation producing equipment is used or stored must be specifically approved for that purpose by the RSO.

Approval will consider the isotope to be used, the maximum activity expected, the volatility and dispersibility of the radioactive materials and the specific procedures to be carried out in the area. Other factors which may influence a decision are the amount of bench space, fume hoods, bio-hoods, shielding, storage space and waste handling facilities.

All rooms approved for use of radioactive materials must also be under the direct control and supervision of an investigator authorized for radioisotope usage. The investigator must accept full responsibility for continual safe conditions in the laboratory.

Before attempting any new procedures with radioactive materials a “dry run” must be carried out to help anticipate possible hazards during the experiment. An aid in detecting potential flaws is to perform the experiment with a fluorescent material or dye. Ultraviolet light will be used to survey the area following an experiment to help indicate where materials may have contaminated the area.

Purchasing and Receiving Radioactive Materials

All orders for radioactive materials must be approved by the RSO.

Receipt During Normal Working Hours

All packages containing radioisotopes will be delivered to the Chemical Management Center (CMC). Central Receiving will not accept packages containing radioisotopes but will refer the transit company to the CMC for delivery.

When a package of radioactive material arrives on campus, the CMC personnel will inspect the package for signs of damage (crushed box or wet areas due to leaks) before accepting it from the carrier. If the package appears damaged, the CMC personnel must contact the RSO immediately. The RSO will monitor the package, receiving area, the carrier’s vehicle and all personnel who handled the package to determine the extent of possible contamination.

If the package is received in good condition, CMC personnel will sign for its receipt, secure the package and immediately notify the Radiation Safety Office of its arrival. As soon as possible, Radiation Safety personnel will pick up the package at the CMC and complete a "Receipt of Radioactive Materials Form". The receipt form and packing slip will be retained for inspection by the ODH.

Monitoring shall consist of surveys and wipe tests using approved instruments and techniques. Wipe tests shall be performed by wiping a 300 cm² area of the exterior package with filter paper disks moistened in 50%-70% ethanol. Surveys shall be performed with calibrated instruments and recorded in mR/hr. If removable contamination in excess of 10⁻⁵ uCi/cm² (22 dpm/cm² or 6,600 dpm for 300 cm²); or radiation dose levels in excess of 200 mRem/hr at the surface of 10 mRem/hr at 1 meter are detected, the RSO will immediately notify the final carrier and the ODH.

All radioactive packages must be inspected and wipe tested as soon as possible but no later than 3 hours from the time of arrival on campus.

Receipt After Working Hours

The Chemical Management Center (CMC) is staffed between 7:30 a.m. and 4:30 p.m. weekdays. No shipments are received by the University before or after these hours. Delivery personnel must arrive during working hours or return the next day.

Storage

All radioactive materials must be stored in an area of controlled access to prevent unauthorized removal. The area must be locked when personnel authorized to handle the material are not present. Only approved laboratory areas will be used for storage.

The authorized investigator is responsible for assuring all items containing radioactive material are marked with an approved label bearing the isotope symbol and the words "Caution Radioactive Material".

Use

All radioactive materials must be handled in approved areas. Radioactive materials should be treated as hazardous substances and handled with all cautionary procedures normally accorded such substances. Normal precautions should include the following safety measures.

- a. All orders for radioactive materials must be approved by the RSO.
- b. All use of radioactive material must be supervised by an authorized user.
- c. All radioactive waste must be placed in appropriate containers in accordance with ODH licensing requirements.
- d. Eating, drinking, smoking, application of cosmetics or any other procedure that could lead to inadvertent ingestion of radioactive materials is prohibited.

- e. Dosimetry badges must be worn when using gamma ray, x-ray or high energy beta producing isotopes or equipment.
- f. Clothing should be disposable in the event of a major spill. Lab coat and disposable gloves should be worn when handling radioactive materials. Care must be taken not to contaminate other surfaces when working with gloves. Traces of radioactive material are often inadvertently transferred to refrigerator handles, telephones, sink faucets, instrument dials and centrifuge doors and rotors when handling them with a "hot" glove. Be sure to monitor such surfaces following use to assure no contamination has taken place. Potentially contaminated clothing is not to be worn out of the laboratory area.
- g. Glassware, tongs, pipettors and other similar materials used for radioisotope work should be suitably marked and must be decontaminated before being used in a non-radioactive area. "Hot" glassware should be disposed of or decontaminated promptly.
- h. Work should be confined to as small an area as possible. This simplifies the problem of confinement and shielding and aids in limiting the affected area in case of an accidental contamination.
- i. All work involving the likelihood of aerosols, dusts or gaseous products must be done in hoods, glove boxes or similar protective devices. All releases from these systems shall be ALARA, and may never exceed the maximum permissible concentration in the air.
- j. Work surfaces should be covered with an absorbent paper with waterproof backing. Procedures involving high activity liquids should be confined to an impervious tray. Change paper and wash trays frequently to prevent the spread of radioactive contamination.
- k. Pipetting radioactive materials by mouth is prohibited.
- l. Food or drink, even in sealed containers, must not be stored in the same refrigerator or freezer where radioactive materials are stored.
- m. Each laboratory or area utilizing high energy beta, gamma or x-radiation shall be equipped with a portable survey meter available from the Radiation Safety Office. Work and storage areas should be monitored before, during and after an experiment to detect contamination and to maintain exposure levels within the allowable limits.
- n. Minimize the exposure to high activities of gamma, x-ray and high energy beta emitting radioisotopes. Confine such isotopes to a suitable shielded storage box in a remote spot of the laboratory (back corner of a hood, refrigerator, etc.). Use long handled forceps or tongs when possible to reduce hand exposures.

- o. Any equipment used with radioactive materials (refrigerators, ovens, centrifuges, lyophilizers, vacuum pumps, etc.) shall not be removed from its authorized area until demonstrated to be free of contamination. No potentially contaminated equipment shall be repaired by maintenance or other personnel without first being demonstrated to be free of contamination prior to servicing. These regulations also apply to any equipment being returned to the manufacturer for servicing.

Inventory

The RSO is responsible for maintaining inventory records of all radioactive materials on campus and ensuring the possession limits for each specific isotope are not exceeded. Prior to approval of an order, the RSO will check previous records of shipments and calculate decay if necessary.

Transportation of Radioactive Materials Off Campus

Limited quantities of radioactive materials may be transported off campus to another facility licensed by the NRC or an agreement state to receive the radioactive materials (to one of the consortium universities or hospitals). Due to the numerous NRC, ODH and DOT regulations governing transportation of these materials on public highways, all shipments must be made through the radiation safety office. Transfers must be arranged from the Radiation Safety Office of the YSU campus to the Radiation Safety Office of the other institution. All transfers must comply with applicable regulations found in the Ohio Administrative Code.

Safety Monitoring Program

The goals of the monitoring program are to assure the safe working conditions for all personnel in restricted and unrestricted areas. Frequent monitoring of laboratories and personnel helps to assure individuals will not exceed their maximum permissible exposure limits and that radiation levels remain as low as reasonably achievable.

The RSO will maintain all required records of personnel occupational exposure histories and laboratory working conditions.

Personnel Film Badge Dosimetry Program

YSU contracts with an accredited firm for the radiation film badge program. The standard badge given to personnel is a “whole body” badge. Special ring or wrist badges are available for situations in which hand exposures may be excessively high compared to whole body exposures. They are specifically required when handling > 1 mCi of strong beta or gamma emitters. Doses are reported to the Radiation Safety Office. Any individual receiving a dose above background levels (10 mR/month) will be notified immediately.

Who Should Wear a Dosimeter?

All individuals handling x-ray, gamma-ray or high energy beta emitting isotopes (I-125, Co-60, P-32) or x-ray producing equipment must wear a dosimetry badge. Individuals working exclusively with low energy beta emitters (H-3, C-14) need not. Finger extremity monitoring badges must be worn when working with P-32 having an activity of 1.0 millicurie or more.

The Radiation Safety Office also has a limited number of spare badges which may be issued in emergency situations when individuals not normally issued a badge, such as maintenance personnel, must enter radiation areas to perform maintenance work. Individuals issued spare badges will become part of the following month's dosimetry report. Badges can usually be obtained in 48 hours if a special need arises.

All exposures above minimal (less than 10 millirem) will be reported to the individual as soon as they are detected. The RSO will attempt to determine the cause of the exposure and try to eliminate it. In the event of whole body exposure greater than 200 millirem/month, the RSO will notify the individual, the authorized investigator responsible for the individual, and the chair of the Radiation Safety Committee. If deemed necessary, a meeting with the Radiation Safety committee will be scheduled. All concerned will attempt to determine the cause of the exposure and take corrective measures. Corrective measures may include revision of laboratory procedures, construction of additional shields and/or suspension of the use of radioisotopes by the individual for the appropriate time period.

All individuals have the right to examine their exposure reports at any reasonable time in the safety office. Future employers of the individual have the right to obtain a copy of their exposure history.

Any pregnant worker or student is encouraged to declare pregnancy in order to receive a monthly fetal badge. All females in the dosimetry program are provided with Regulatory Guide 8.13.

Laboratory Monitoring Program

All laboratories in which transferable radioisotopes are being used must be surveyed for removable contamination. Monthly surveys will be performed by the RSO.

The following table will be used to determine survey frequency.

	< 0.1 ALI	≥ 0.1 ALI < 1.0	≥ 1.0 ALI
In Use	Monthly	Weekly	Daily
Not in Use	Every 6 Months		
From NRC Nureg 1556 Volume 7, Guidance for Academic and Research Licenses			

The Annual Limits on Intake (ALI) for specific isotopes can be found in the Ohio Administrative Code. For example, 60 microcuries of P-32 (one tenth of the ALI of 600) would require weekly surveys.

Wipe tests are performed to detect removable surface contamination. Areas of approximately 100 cm² are wiped with filter paper disks and counted by liquid scintillation. Samples should be counted on a multichannel program to determine the quantity and type of radioisotopes present.

All contamination in excess of 200 dpm/100 cm² must be promptly removed. For contamination in excess of 2000 dpm, a contamination zone shall be established around the area until the contamination is removed. Contamination in excess of 20,000 dpm will initiate immediate termination of all activities in the contaminated area. The area will be immediately decontaminated by laboratory personnel under the supervision of the RSO.

All contaminated areas shall be promptly decontaminated with appropriate cleaning agents such as soap and water or a detergent made for radioactive substances. All contaminated materials will be processed through the corresponding routine waste streams. The contaminated area will be re-monitored by survey and/or wipe tests as appropriate to verify decontamination.

All routine or special monitoring records shall be retained in a designated monitoring notebook. Notebooks must be kept in a visible location in the laboratory for inspection by the RSO or the ODH.

Radioactive Waste Disposal

The term radioactive waste includes all wastes that contain or are contaminated with any radioactive material. This includes liquids, solids, animal carcasses, infectious materials, excreta, used scintillation counting liquids, etc. Waste that is not radioactive should never be thrown in with radioactive waste as the cost to YSU for disposing of radioactive waste is very high. All wastes must be classified and disposed of according to the following categories.

Liquids

Organic based must be collected in polypropylene or high-density polyethylene bottles which bear a Caution Radioactive Material label. These bottles will be supplied by the Radiation Safety Office. Liquid wastes are not to be stored in any other containers unless specifically approved by the RSO.

Certain amounts of radioactive materials may be released into the sanitary sewer systems if the activities present are below the regulatory limits and the chemical and physical form are shown to be readily soluble and dispersible. Because these amounts are based on the total volume of effluent released by the institution and monthly and annual limits, all releases must be approved by the Radiation Safety Office and recorded. Liquid waste not released by sanitary sewer is to be collected and disposed of in the same manner as organic based liquid waste.

Dry Solids

Dry solid wastes must be free of all residual liquids. Solid wastes must be collected in the special waste containers supplied by the Radiation Safety Office. Needles, scalpels and any other sharp objects must first be placed in puncture resistant sharps containers to prevent injury to personnel handling bags of solid waste. All radioactive waste containers must be specifically designed for storage of radioactive waste and will bear Caution Radioactive Materials labels.

Liquid Scintillation Vials

Currently, either plastic or glass vials can be accepted for disposal. Vials must have a capacity of 20 ml or less and may contain only the following radioisotopes in activities < .05 uCi/ml: H-3, C-14, Na-24, P-32, S-35, Ca-45, Cr-51, I-125. There are no restrictions on the type of scintillation fluid used at this time although biodegradable fluid is recommended.

Short Half Life

Short half life isotopes (those with a half life of less than approximately 70 days) are to be separated from long half life isotopes for each category listed above. Long half life wastes are shipped for disposal whereas short half life wastes are decayed on site.

Emergency Procedures

Low Level Spill

A low level spill is one that is confined to a limited area and does not increase the radiation levels in the area beyond 2 mR/hr. It must conform to both of the following criteria.

- a. The spill did not contact any part of a person's body.
- b. Radiation levels 1 meter from the center of the spill do not exceed 2 mR/hr.

The authorized investigator supervising the activities in the laboratory where the spill occurred must be notified immediately. The investigator is responsible for assuring the spilled material is collected and disposed of properly. Decontamination procedures should include the following steps.

Minor Spills of Liquids and Solids

NOTIFY: Immediately notify all other persons in the area that a spill has occurred

PREVENT THE SPREAD

- a. Liquids: Cover the spill with absorbent paper
- b. Dry Material: Dampen thoroughly taking care not to spread the contamination. Water should be used unless a chemical reactions would generate an air contaminant; oil should then be used instead of water.

DECONTAMINATE: Use disposable gloves. Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Also put contaminated gloves and any other contaminated disposable material in the bag.

SURVEY: Use an appropriate low range radiation detector survey meter. Check the area around the spill, your hands, shoes and clothing for contamination. Wipes should be taken for weak beta contaminants.

REPORT: Report the incident to the Radiation Safety Officer and include survey results in the monitoring notebook. The RSO will follow up on the cleanup and will complete a Radioactive Spill Report and a Radioactive Spill Contamination Survey.

Major Spills of Liquids and Solids

A major hazardous spill is any spill that is not a low level spill and does not involve contact with any part of a person's body. Procedures for major hazardous spills are as follows.

NOTIFY: Immediately notify all persons to vacate the room.

PREVENT THE SPREAD

- a. Confine the movement of all personnel to prevent the spread of contaminants
- b. Cover the spill with absorbent paper. Do not attempt to clean it up.

SHIELD: Shield the source if possible. This should be done only if it can be done without further contamination or a significant increase in radiation exposure.

CLOSE THE ROOM: Switch off all fans and hoods. Leave the room and lock the door(s) to prevent entry.

NOTIFY: Notify the Radiation Safety Office.

The RSO will assist in the decontamination of personnel.

The RSO is responsible for directing the decontamination and assuring the area is as free of contamination as reasonably achievable when decontamination procedures are completed. The authorized investigator is responsible for promptly executing all decontamination procedures deemed necessary by the RSO.

The RSO will determine the extent of the spill by monitoring the surrounding area. The contaminated area will be labeled and cordoned off to prevent inadvertent entry into the area. Only authorized personnel may enter the area until the decontamination procedures are completed.

The user must complete a Radioactive Spill Report and Radioactive Contamination Report form. A meeting of the Radiation Safety Committee may be convened to determine corrective measures to assure similar hazardous spills do not occur.

If conditions warrant, the RSO will report the incident to the Ohio Department of Health.

Bodily Contamination (External Only)

Radioactive materials in contact with body surfaces should be removed promptly using approved decontamination products such as D-Con, Radiac Wash or I-Bind. The area should be scrubbed gently and rinsed with lukewarm water.

Do not use harsh or caustic soaps.

Do not scrub with an abrasive tool (scrub brush).

The RSO must be notified of all accidents involving bodily contamination.

The RSO will determine whether decontamination can proceed on site or whether the individual should be transferred as a patient to the Nuclear Medicine section of Saint Elizabeth Hospital Youngstown, Ohio.

If decontamination is carried out on site, the RSO will perform bioassays to determine when the individual is considered decontaminated. The authorized investigator will complete the Radioactive Contamination Report and submit it to the RSO.

Bodily Contamination (Internal)

Ingestion or injection of radioactive materials must be reported to the RSO immediately. The individual will be transferred as a patient to the Nuclear Medicine section of Saint Elizabeth Hospital Youngstown, Ohio.

Radiation Emergency Information

Radiation Safety Office: Extension 3700
After working hours call 911

Saint Elizabeth Hospital: (330) 746-7211

The emergency room at Saint Elizabeth Hospital is an appropriate treatment center for cases of radiation ingestion or injury.