

I. Licensing Authority of State of Alabama for Ionizing Radiation Users

The Atomic Energy Act of 1954 requires that all individuals engaged in the use of radioisotopes be duly authorized by license to procure radioisotopes in specified quantities, the only exception being certain license exempt quantities. ***These procedures require that every radioisotope that is received by UAH personnel for use at the university must be cleared through the Radiation Safety Officer or Radiation Control Technician.***

The Alabama State Board of Health is the regulatory agency responsible for licensing and the enforcement of radiation practices within the state. All UAH Radiation Safety Procedures are governed by the Rules of State Board of Health, Bureau of Environmental and Health Service Standards, Chapter 420-3-26, Radiation Control and specific conditions set forth in the University's Radioactive Material License. Copies of the State's Regulations and the UAH Radioactive Material License are maintained on file with the RSO and RCT. The referencing Rules chapter and section are given for selected section below.

II. UAH Radiation Safety Organization and Responsibilities

Since UAH is an independent campus in the University of Alabama System, it provides its own license and Radiation Safety Officer. This revision of the Radiation Safety Procedures recognizes the resultant changes in responsibility for radiation safety. The Radiation Committee of The University of Alabama in Huntsville (UAH) was formally established on March 6, 1968. It is the policy of the committee's officers and members to ensure that UAH complies with all state and federal regulations pertaining to the used of ionizing radiation sources. Some specific responsibilities of the committee are as follows (420-3-26-8):

- A. Be concerned with all forms of ionizing radiation, their sources, associated equipment, and instrumentation, utilized in UAH programs. Such radiation shall include x-rays, gamma rays, alpha and beta particles.
- B. Review the procurement, use, and disposal of all radioactive materials and radiation producing equipment.
- C. Provide guidance and assistance to the Radiation Safety Officer in the enforcement of radiation safety practices as required by the UAH Radiation Procedures and the State of Alabama Radiation Control Regulations.
- D. Be responsible for the evaluation and approval of all users of radioactive materials, radiation producing equipment and associated procedures.
- E. Assist the Radiation Safety Officer in representing The University of Alabama in matters of licensing and compliance with State regulations.

The Radiation Safety Committee will meet formally once a year to formulate policy, develop criteria for evaluation of users and to address current issues. The Radiation Safety Committee will be called into Special Sessions when:

- 1) There has been a report of radiation exposure above the quarterly or semiannual limits,
- 2) After investigation by the RSO and RCT there has been a nonauthorized use of radioactive material or radiation producing equipment,
- 3) There has been a request for a new Authorized User to be added to the UAH license,
- 4) There has been a request for additional radioactive materials to be used by a current authorized user.

The Radiation Safety Committee will be composed of the following individuals:

Radiation Safety Officer
Radiation Control Technician
Representative of the UAH Office or Environmental Safety
Representative(s) of UAH license Authorized Users.

Radiation Safety Committee Representation of UAH license Authorized Users will be one for each 5 (five) Authorized Users listed on the UAH license. For the purpose of the Authorized User status the Radiation Safety Officer and the Radiation Control Technician will not be included in the 5 (five). There will be at least one Authorized User Representative if there are more than 3 (three) Authorized Users* on the License. Authorized User's included in the UAH license as part of the agreement with NSSTC are not included in the Authorized User total.

A quorum for the committee will be when more than a simple majority (1/2) of the members are present. Voting for the committee will be by simple majority of the members present at the meeting. In special circumstances, a telephone conference may be employed.

UAH Authorized Users* may request a meeting of the Radiation Safety Committee to discuss radiation safety procedures and campus procedures relating to radiation safety

UAH Authorized Users* will be invited to the Radiation Safety Committee meeting except when policies or procedures involving that Authorized User to be discussed.

*In term of this policy "Authorized User –UAH Authorized User" refers to on-campus UAH Faculty and Research Staff and does not include NSSTC Staff who are included on both the UAH and Marshall Space Flight Center license due to their primary research being conducted at the NSSTC and are primarily using radioisotopes which are 1) inventoried by the MSFC Radiation Office and, 2) are to be returned to MSFC at the completion of the respective project.

The Radiation Safety Officer (RSO) is responsible through the Vice President for Research and Provost for implementing and supervising radiation safety practices within the UAH program. The RSO works in close association with the Vice President for Research and Provost and the Radiation Committee in assuring compliance with Radiation Safety Procedures. Some specific responsibilities of the RSO are as follows (420-3-26-8):

- A. Review and tentatively approve all applications for the use of radioactive materials and ionizing radiation producing equipment,
- B. Write, review and/or update the Radiation Safety Procedures as needed,
- C. Approve receipt and transfers of radioactive materials,
- D. Provide Radiation Safety training workshops for new users and periodic training sessions for all users,
- E. Respond to all radiological emergencies,
- F. Act as chairman of the Radiation Committee and university contact person for the State Agency and other organizations and
- G. Provide written or verbal notification and response to users, regarding radiation safety violations and abnormally high dosimetry reports.
- H. Approve Requisitions and/or Purchase Orders for Radioisotopes.

The Radiation Control Technician (RCT) works along with the RSO to implement the university's radiation safety procedures. Some specific responsibilities of the RCT are as follows:

- A. Under the authority of the RSO, approve requisitions and/or P.O.'s for radioisotopes,
- B. Write and/or update the Radiation Safety Procedures as needed,
- C. Perform sealed source leak-test,
- D. Perform laboratory contamination surveys as required by procedures,
- E. Maintain a quarterly radioactive material inventory,
- F. Perform radiation surveys of ionizing radiation producing equipment,
- G. Provide radiation monitoring equipment to users and maintain individual exposure records. Notify the RSO and user of an abnormally high film badge exposure report,
- H. Notify the RSO of any radiation safety procedural or policy violations,
- I. Provide timely on the scene response to radiological emergencies,
- J. Maintain survey instruments in current calibration,
- K. Supervise radioactive waste disposal and

- L. Write and present an overall Radiation Safety Status Report for the committee meetings.

III. *Radiation Safety Procedures*

This manual is to be used as a guide as to what procedures are to be followed. The User applicable specific procedures described in this section will be supplied to the approved Authorized Users as separate documents. A complete file of all Radiation Safety Procedures are maintained in the Radiation Safety Officers and Radiation Control Technician's Office.

The following radiation procedures will be practiced at UAH in an effort to control or minimize the radiation hazards associated with the use of ionizing radiation sources and to comply with state and federal regulation.

The maintenance of records of procurement, receipt, transfer, surveys, use and disposal of radioactive materials is essential in order to effectively implement a radiation safety program. *It is therefore, necessary that all individuals utilizing radioactive materials maintain these records.*

The establishment of “as low as reasonably achievable (ALARA)” practices is required in order to prevent exposure of individuals to hazardous quantities of ionizing radiation. If radiation safeguards are not followed an individual may receive an exposure either by external or internal radiation. Radiation which is external to the body can be readily monitored and evaluated. The exposure dose may be reduced to acceptable values by reducing the time of exposure, shielding, and/or increasing the distance from the source. One may also receive radiation either through ingestion, absorption or inhalation of radioactive materials. The internal radiation hazard is much-more subtle and probable in terms of general use of unsealed radioisotopes. The quantities of many radioisotopes representing a high degree of hazard are extremely small. Once radio-nuclides become fixed in the body they are difficult to measure and little can be done to improve the hazardous situation.

III.A Authorization to use Ionizing Radiation Sources and Procurement

1. *Applications*

All individuals who wish to use ionizing radiation sources at UAH must first complete and submit an application to the RSO. Form RSO-12A, “Application for Use of Radioactive Materials,” is to be used for radioisotope applicants and form RSO-12B, “Application for use of Analytical X-Ray Generator,” is to be used for x-ray applicants. These forms may be obtained from the RSO or RCT.

The RSO and the Radiation Committee will evaluate all applications and if approved issue a permit. The criteria used for the evaluation of radioisotope applicants is detailed in procedure RSO-12 (See Appendix B). Individuals who have been approved to use ionizing radiation sources are referred to as Authorized Users.

An Authorized User is primarily responsible for the safe use of all sources under their control and the implementation of all required radiation safety procedures applicable to their use.

Authorized users are required to submit a new application if a different procedure or use of ionizing radiation sources, other than what was specified in the original application will be employed.

2. Procurement

Radioisotopes may be ordered only on the unique subcode designations within the UAH electronic (on-line) purchasing system; currently the subcode for Radioactive Material is 7431 (although this may change in the future). The Authorized User is the responsible party to ensure the unique radioactive subcode is included in the requisition. Authorized Users are required to submit the completed Requisition to the RSO and/or RCT for approval. **The Authorized User should clearly indicate on the Requisition that Radioactive Materials are being purchased.** If approved the original will be sent to purchasing and a copy will be placed on file in the Radiation Safety Office. For further information on how to order radioisotopes review procedure RSO-14, "Radioactive Material Procurement." It is a violation of the UAH Radiation Safety Procedures and the Authorized User's authority to superseded the UAH on-line requisition system by using the incorrect subcode.

3. Receipt of Radioactive Materials (420-3-26-03-32)

The Radiation Safety Officer or the Radiation Control Technician will inform UAH Shipping and Receiving that Radioactive Materials have been ordered.

Receiving will call Radiation Control Technician or the Radiation Safety Officer. The RCT or RSO will inspect and survey the package per procedure RSO-2, "Receipt of Radioactive Material" and if acceptable, deliver the container to the Authorized User. Package acceptable contamination and radiation limits are ≤ 100 cpm alpha, beta, gamma and ≤ 200 mr/hr on contact or ≤ 10 mr/hr at three feet. The RCT will note the storage location and permanently label the source container with P.O. number, isotope, quantity and date to facilitate the next inventory. A sample "Receipt of Radioactive Materials" form is contained in Appendix G.

III.B Radioactive Material Inventory (420-3-26-03-25/26)

All users of radioactive materials are required to maintain up to date records of all source usage, disposal and transfer. It is required that all Authorized Users of unsealed radioisotopes maintain a logbook to record the data mentioned above. A sample of a logbook inventory sheet is contained in Appendix E.

The RCT (RSO), along with each Authorized User, will perform an unsealed source inventory for all such sources at the end of each school quarter. Authorized Users will complete an inventory annual report to the RSO of non-licensed exempt sealed sources in their possession; it is preferable that this report be submitted electronically to the RSO and the RCT.

Procedure RSO-13, "Radioactive Source Inventory," lists the steps and forms to be completed by the RCT and Authorized User, when performing an inventory.

III.C Transfer of Material

(420-3-26-03-21 through 24)

All transfers of radioactive materials must be approved by the RSO. Transfers are to be performed in accordance with procedure RSO-3, "Transfer of Radioactive Material." Authorized Users who are interested in transferring radioisotopes to an on or off campus facility must first complete form RSO-3 and submit it to the RSO. Transfers may be completed under the following condition:

1. On Campus Transfers
 - 1.1 The transferee must be duly authorized by the RSO or Radiation Committee to receive the type and quantity of radioactive materials being transferred.
 - 1.2 The transferee must have available facilities and equipment necessary to safely use and store the material.
2. Off Campus Transfers
 - 2.1 A copy of the receiving facility's Radioactive Material License or permit indicating the individual or facility is authorized to possess the type and quantity of material being transferred, must be on file in the Radiation Safety Office.

A sample "Transfer of Radioactive Materials" form is contained in Appendix G.

III.D Instrument Calibration

(420-3-26-03-17)

All portable radiation survey instruments will be calibrated by qualified Radiation Safety personnel on a routine yearly schedule. The method of calibration will be per RSO-4, "Survey Instrument Calibration Procedure," if the instruments are calibrated by the RCT. Survey instruments may also be calibrated off-campus by a licensed Health Physics Technician on contract to UAH. Records of calibration will be maintained on form RSO-4 by the RCT.

Procedure RSO-4 is contained in Appendix G.

III.E Leak Tests

(420-3-26-03-16)

Pursuant to Alabama Department of Public Health-Office of Radiation Control Regulation(s) 420-3-26-.03-16: each sealed non-exempt radioactive sources will be leak tested 1) prior to the source being put into use or 2) on a six-month frequency. Leak tests may be performed by licensed commercial company (typically the Original Equipment Manufacturer for alpha and beta sources) or by UAH Radiation Safety Personnel. In general if the test is performed by UAH Radiation Safety Personnel the technique employed in leak-testing will be to physically wipe the surface of the source with a two-inch filter disk. The filter paper will then be counted in a radiation gas-flow counter or liquid scintillation counter to determine whether or not leakage is present. If radioactive contamination is revealed above the acceptable limit of <0.005 microcuries, the source's Authorized User and the State Regulatory Authority will be advised within the regulation time limits and appropriate radiation safeguards will be employed by the RSO. Any leaky sealed source will be carefully sealed and tagged and (1) either returned to its vendor for repair or replacement or (2) shipped for burial by a contract radioactive waste

disposal company. Procedure RSO-5, "Leak Test" will be followed by the RCT when performing this surveillance procedure.

III.F Personnel Monitoring

(420-3-26-03-17)

1. External Monitoring

Film badges shall be worn by all individuals, including students entering a radiation area. Pocket ionization chambers in addition to the film badge may be required as a day-by-day check in certain higher radiation level areas. The "Instructions for the Proper Use of Film Badges (RSO-8x)," details the use and need for personnel dosimetry. Film badges and other dosimetry equipment may be obtained from the RCT or RSO. Exposure records will be maintained by the RCT for all individuals who are issued film badges. These records are available for personnel review.

Individuals will be notified by the RSO of any abnormally high dosimeter readings for them on the quarterly or semi-annual report and an investigation will be initiated to determine the cause.

All dosimetry devices issued to ionizing radiation source workers will to be returned to the RCT upon completion of assignment and/or termination. Film badges that will not be needed for a period of six months or more should also be returned to the RCT.

Procedure RSO-8x is contained in Appendix G.

2. Internal Monitoring

This procedure is primarily intended to be performed by individuals who work with millicurie levels of tritium, sulfur-35, carbon-14 and iodine-125. The normal method of determining an individual's internal exposure to gamma or weak beta emitters shall be through the measurements of biological samples from the exposed individual. Such samples (urine) shall be submitted per procedure RSO-8, "Internal Monitoring," to the radiation safety office for analysis. Accidental ingestion of radioactive materials may also result in the need for bioassay samples.

Procedure RSO-8, "Internal Monitoring" is contained in Appendix G.

III.G Waste Disposal

(420-3-26-03-33 through 39)

Special waste receptacles are provided by the Radiation Safety Officer for the collection of contaminated dry solids, aqueous solutions, solvents and liquid scintillation vials, to laboratories that produce radioactive waste. These containers are clearly labeled indicating the form of waste to be disposed of in each. All containers have a disposal record either attached or nearby that must be filled out whenever waste is added to its contents. When disposing of contaminated or potentially contaminated waste, the following rules are to be observed;

1. Contaminated Liquids

- a. Segregate aqueous liquids, organic solvents and liquid waste which contain isotopes with half lives of 60 days or less, by disposing of each in the appropriately labeled laboratory container.

- b. Residual contamination after the rinsing of glassware, is to be poured down the sink along with a copious water flush.
2. Liquid Scintillation Vials
 - a. Whole vials containing the cocktail solution are to be dropped into the designated long-term storage container labeled “Liquid Scintillation Vial Only.”
3. Dry solid waste
 - a. Potentially contaminated absorbent paper, pipets, gloves, glassware, plastic containers, etc. are to be disposed of in the “Dry Solids Only” labeled laboratory container.

The RCT will routinely monitor the levels of waste in the lab receptacles and empty or replace the containers as needed. It is very important that all Authorized and Secondary Users follow procedure RSO-15, “Radioactive Waste Disposal,” when disposing of radioactive contaminated materials. Sample RSO-15, “Radioactive Waste Disposal Record” forms are contained in Appendix G.

III.H Training Requirements

(420-3-26-03-07-(10 through 12))

1. Authorized Users:

All newly approved Authorized Users will be provided training on the UAH Radiation Procedures that are applicable to his or her work. This training will be conducted and documented by the RSO. Authorized Users may also be required to attend the “Ionizing Radiation Fundamentals” training course offered by the University’s Radiation Safety Program. The RSO may require an Authorized User to attend an off-site professional academy Radiation Safety Course. An Authorized User is required to notify the RSO of all Secondary Users who will be working under his or her supervision and provide informal training to those individuals per RSO-12, Form A or B.

2. Secondary Users:

Secondary or laboratory assistants are individuals who work under the direction and supervision of an Authorized User. Individuals who will be working with ionizing radiation sources for a period of six months or more are required to attend the “Ionizing Radiation Fundamental” training course. Procedure RSO-12, Form A or B is required to be completed by the Secondary User within six months after starting to work with sources. These forms are used to document radiation safety training given to the Secondary User by the Authorized User. Additional Radiation Safety workshops will be conducted by the RSO to update users on new procedures and requirements. Sample RSO-12 “Form A and Form B” are contained in Appendix G.

III.I Posting and Warning Labels

(420-3-26-03-(28))

1. Sealed and Unsealed Radioisotope Facilities

a. **Caution-Radioactive materials are used and stored must have this standard radiation caution sign posted on the entrance door and storage locations.**

b. Caution-Radiation Area

This standard warning sign is to be posted in areas in which there exists radiation at levels in which an individual could receive an exposure of 5 mr or more in one hour measured at a distance of 6 inches from the source.

c. Caution-High Radiation Area

This warning sign is to be posted at the entrance to areas in which there exists radiation at levels in which an individual could receive an exposure of 100 mr or more in one hour measured at a distance of 6 inches from the source. High radiation areas are to be locked except during periods when access to the area is required. Access to high radiation areas should be strictly controlled.

d. Caution-Contaminated Area

This sign is to be posted while the decontamination procedures are in progress, and in areas where unsealed radioisotopes are being used. Once the area's contamination level is determined to be within acceptable limits (<100 cpm gamma/beta or > 10 cpm alpha), the sign is to be removed.

e. Caution-Radioactive Material (label)

All containers of radioactive materials (beakers, source containers, flask, etc...) must contain this label along with the isotope, amount and date. Prior to release or disposal of an empty uncontaminated container to an unrestricted area, remove or deface the radioactive material label.

f. "Film-Radiation Badge Required"

This sign is to be posted at the entrance to all radiation areas.

g. Instructions to Personnel

Each radioisotope laboratory must post copies of the following documents:

1. Radioisotope Safety Rules and Procedure list
2. Emergency Procedures
3. Any notice of violation involving radioactive materials
4. Agency form X, "Notice to Employees" (In restricted areas only)

2. Analytical X-Ray Facilities

a. **Caution X-Rays, This equipment produces x-rays when energized**

This warning sign is to be located on the x-ray unit's cabinet or in clear view of the x-ray equipment.

b. X-Rays Produced When Light is On

This caution sign is to be located adjacent to the red warning light at the entrance to an x-ray facility or on the instrument's control panel.

c. Instructions to Personnel

Copies of the following documents are to be posted in an x-ray facility:

1. Emergency Procedures
2. Any notice of violation involving x-ray equipment
3. Results of the latest radiation survey
4. Standard Operation Procedures
5. "Film Badge Required" (As determined by the RSO)

All signs, labels, notices and procedures can be obtained from the Radiation Safety Office. Routine inspections will be performed by Radiation Safety personnel to ensure all facilities are in compliance with posting requirements. The Radiation Safety Officer will assist new Authorized Users in the initial setup and posting of his or her facility.

J. Analytical X-Ray Equipment

Faculty and staff members who wish to use an analytical x-ray device at UAH must first submit an application (Form RSO-12B) for permission to operate the instrument to the RSO. The criteria used by the RSO and Radiation Committee when evaluating the application is found in rule 420-3-26.11(6) (a) of the Alabama Radiation Control Regulations. Any x-ray producing device capable of producing x-ray of less than 0.9 MeV must be registered with the State Agency prior to acquiring the machine for use at UAH. The RSO will submit the necessary forms for such registration after evaluation and approval of the applicant. Operating Analytical x-ray machines will be surveyed once per quarter by the RCT. The procedure use for this survey is RSO-9X, "Analytical X-Ray Radiation Survey" procedure.

IV. Contamination Control Procedures

A. Clean Areas

Care must be exercised to prevent the spread of radioactive contamination, should it exist, from laboratories employing radioactive materials to the other areas designated as clean areas about the campus. Good housekeeping practices such as maintaining an orderly and properly posted work area, along with frequent contamination surveying on the part of laboratory personnel, should aid in the prevention of extensive contamination in clean areas. As an extra measure of protection, all equipment must be monitored and decontaminated if needed, before being transferred from a laboratory employing

radioactive materials to a clean area. The transfer limit is <100 cpm above background. Refer to the “Radioactive Contamination Survey Procedure” (RSO-9).

B. Work Surfaces

Work areas (bench tops, hoods floors, etc.) as well as radioisotope storage areas should be covered with plastic-backed absorbent paper. This paper should be changed frequently while working with radioisotopes to prevent further surface and personnel contamination. The potentially contaminated absorbent paper is to be disposed of as dry solid radioactive waste in the “Dry Solids Only” labeled container located in the laboratory area.

C. Personnel

All persons while working with the radioactive materials where hand and shoe contamination is possible are to:

1. Wash hands thoroughly before eating, drinking, smoking or leaving work.
2. Wash rubber (not disposable latex or plastic) gloves before removing from hands.
3. Utilize an available radiation survey instrument after using high energy beta or gamma emitters, to assure that contamination is not present on clothing and body.

No work with long-lived alpha and beta-gamma emitters, in any chemical or physical form is to be performed by a person having a break in the skin below the wrist unless gloves known to be clean on the inside are worn. See RSO-7 (Appendix A), for other safety rules.

D. Emergency Procedures

Radiological Emergencies can present a safety hazard to individuals involved in the accident and non-involved personnel. Anticipated emergencies can be caused by a major spill (≥ 1 mci), minor spill, loss of radioactive source, personnel contamination involving injury and accidental x-ray exposure. All users of ionizing radiation sources should review the “UAH Radiological Emergency Procedures” (Appendix C), for actions to take and who to contact in case of an accident.

V. Exposure Limits

It is the purpose of the UAH Radiation Safety policies and procedures to maintain or minimize personnel exposures in such a manner that the total individual dose does not exceed the State’s maximum permissible exposure limits. Section 420-3-26.03 of the Rules of State Board of Health sets forth the maximum permissible level of ionizing radiation exposure that an individual may receive per calendar quarter.

The personnel exposure limits are as follows:

	<u>Rems per Calendar Quarter</u>
A. Whole body; head and trunk active	
Blood forming organs; lens of Eyes; or gonads	1 ¼
Hands and forearms; feet and ankles	18 ¾
Skin of whole body	7 ½
B. During the entire gestation period, the maximum permissible dose equivalent to the fetus from occupation exposure of the expectant mother should not exceed 0.5 rems. The expectant mother should notify the Authorized user of her condition.	
C. Internal exposure can occur from accidental ingestion, inhalation or absorption of radioactive materials. Internally deposited radioisotopes tend to concentrate in specific organs of the body. The internal exposure limits are the same as those listed above, but it should be noted that each radioisotope has a maximum permissible body burden (see RSO-8).	

VI. Radiation and Radioactive Contamination Survey Procedures

A. Sealed and Unsealed Source Facilities

The Radiation Control Technician will be responsible to survey all areas within the University in which radioactive materials are used and stored. The frequency of these surveys will range from 1 year to one-month dependent on the amount of use, radiation levels, and previous laboratory monitoring results. The RCT, may however, survey any room or laboratory where radioactive materials are used or stored at any time deemed necessary in the interest of radiation safety.

Radiation surveys will be conducted under the following frequency schedule depending on the activity and, of half-life of the radioisotope used.

Radiation surveys for P32, P33, and S35 are covered by a separate set of procedures for these isotopes.

These surveys are to be augmented by surveys performed by the UAH Authorized User immediately before and immediately after performing procedures utilizing radioisotopes; for both sealed and unsealed sources.

- a) Once a month: A current activity greater than 100 times the exempt quantity, or the exempt concentration, and a half-life greater than 30 days.
- b) Once a quarter: A current activity greater than 50 times the exempt quantity, or the exempt concentration, and a half-life greater than 30 days,
- c) Once every six months: A current activity greater than 10 times the exempt quantity, or exempt concentration, and a half-life greater than 30 days.
- d) Once a year: All other sources.

Once a source life has exceeded 10 half-lives the work area will no longer require radiation surveys.

Areas covered under the agreement with NSSTC will be governed by the Radioactive Contamination Survey rules of MSFC.

The procedure and form to be used by the RCT and Authorized Users when performing a survey is provided by RSO-9, "Radioactive Contamination Survey Procedure".

An area is considered contaminated if a count rate of 2 times background for an instrument count rate or 2 times background for a swipe sample for beta-gamma and/or 2 times above background is obtained for alpha, using appropriate survey method and detection device.

Areas in which sealed sources are stored will surveyed during the annual inventory.

A.1 Radiation Survey Procedures for P32, P33, S35

These Radiation Survey Procedures are for the short half-life, beta only emitters P32, P33, and S35. These procedures cover the use of P32, P33, S35 when the experimental testing or study using these isotopes is conducted inside a laboratory hood, or conducted in a containment-tray that can be readily placed inside a laboratory hood. These procedures are for biological type research, studies, where the solutions are contained in vessels or vials that themselves act as the primary radiation shielding. (As a note, even in the case of working in a laboratory hood, a containment tray should be used.)

- 1) At the ***end of each day of use***, the general area of the laboratory (vent or fume) hood or the containment tray will be surveyed.
 - a. In the case of the containment tray this will include the outside edge of the tray and the areas immediately around the tray.
 - b. In the case of work conducted in a laboratory hood this will include the outer surfaces of the hood including any valves and handles.
 - c. The actual experimental vials or vessels themselves do not need to be surveyed.
- 2) Survey levels greater than 2X (two times) the background level indicate radioactive material contamination out of the intended area of use. The Authorized User will decontaminate the area using appropriate procedures. This may include decontamination sprays and wipes that are then properly disposed of. If the area cannot be decontaminated, the Authorized User will
 - a. Shield the contaminated area with appropriate barriers,

- b. Contact the RSO, and
 - c. Cease work in the area until a mitigation plan is formulated.
- 3) At the ***end of the study***, the Authorized User will perform a radiation survey that ***will include a wipe test of the area***. Following the same procedures as in 1) above, the survey and wipe test will include:
 - a. In the case of the containment tray this will include the outside edge of the tray and the areas immediately around the tray.
 - b. In the case of work conducted in a laboratory hood this will include the outer surfaces of the hood including any valves and handles.
 - c. The actual experimental vials or vessels themselves do not need to be surveyed, until they are prepared for disposal; at 10 half-lives, or until the calculated activity level is below the exempt limit.
- 4) Survey levels of great than 2X (two times) the background level, will indicate radioactive contamination. The Authorized User will decontaminate the area using appropriate procedures. This may include decontamination sprays and wipes that are then properly disposed of. If the area cannot be decontaminated, the Authorized User will
 - a. Shield the contaminated area with appropriate barriers,
 - b. Contact the RSO, and
 - c. Cease work in the area until a mitigation plan is formulated. The mitigation plan may include restricting access to the hood or work area for several half-lives.
- 5) For radiation meter survey levels and wipe test survey levels of less than 2X background, no further radiation surveys for that particular experimental test or study are required.

A. Analytical X-Ray Surveys

All analytical x-ray producing devices will be surveyed for x-ray leakage on a once per quarter schedule. Non-routine surveys are required after modifications to an x-ray device have been made and/or any other condition as listed in procedure RSO-9X, "Analytical X-Ray Radiation Survey Procedure," have occurred. These surveys will be performed and documented by the RCT. The RSO-9X survey requirement table is contained in Appendix G.

VII. Vacating a Radioisotope Laboratory and Terminating Use

When an Authorized User is planning on terminating the use of radioactive materials, the following guidelines are to be followed:

1. Notify the RSO at least one week in advance of planned termination of radioisotope use of vacating facility.
2. Prepare an up to date inventory of all radioactive materials under his or her control.

3. Remove all absorbent paper from radioisotope work areas and either survey or have the RCT perform one. Perform decontamination procedures if required.
4. Return all dosimetry assigned to personnel to the RCT.
5. After a review of the inventory and survey forms, the RSO will meet with the Authorized User to determine whether the remaining sources will be disposed of, transferred to another user, or transferred to the RSO.
6. After the removal of all remaining sources including waste, remove all posting and warning signs.

VIII. Violation and Noncompliance

The UAH Radiation Safety procedures and policies have been established by the Radiation Committee to ensure that ionizing radiation sources are used in a safe manner and its overall use complies with all State Radiation Control regulations. All users of such radiation must be familiar with the contents of this guide and strictly observe all of the required procedures. Failure to do so will jeopardize the authorization of the University to use ionizing radiation sources. In addition, Authorized Users should be aware that accidental or willful violation of state and federal regulations may also subject an individual to civil or criminal prosecution by government agencies.

It is the policy of the UAH Radiation Committee to suspend or terminate an individual's authorization to use ionizing radiation for repeated violations of established radiation safety procedures and policies.

Appendix A

Radioisotope Laboratory Safety Rules For Users of Unsealed Sources

Introduction: One cannot give working rules to apply in all situations. The activity level and hazard class of the isotope being used determine the degree of precaution required. The following rules are intended to minimize internal and external hazards, to prevent contamination of the laboratory and personnel.

- 1) Eating, drinking, storing or preparing food, smoking, or applying cosmetics is forbidden in any area where radioactive materials are stored or used.
- 2) Direct contact with radioactive materials must be avoided by using protective laboratory coats, wearing rubber or disposable plastic gloves, and employing safety pipettes.
- 3) All spills of radioactive materials must be reported to the RSO and/or RCT. See the UAH Radiological Emergency Procedures for actions to take.
- 4) Complete records of receipts, usage and disposal of radioactive materials must be kept per RSO-13, "Radioactive Source Inventory" procedure.
- 5) A film badge must be worn whenever working with gamma emitters and high energy (>0.200 MeV) beta emitters.
- 6) Work should be carried out under a hood in all cases where radioactive materials may be lost by volatilization, dispersion of dust, or by spraying or splattering.
- 7) All radioactive samples should be properly labeled with the isotope and activity indicated, and covered. Liquid scintillation vials need only be labeled to identify the isotope contained.
- 8) Liquid waste should not be poured into the drain. Follow steps outlined in RSO-15, "Radioactive Waste Disposal," procedure for proper disposal practices.
- 9) The disposal of solid wastes and contaminated articles should be into designated containers and, under no considerations, into ordinary trash receptacles. Follow steps as outlined in RSO-15, "Radioactive Waste Disposal," procedure for proper disposal practices.
- 10) The storage of all radioactive material must be in properly designated locations. A Radioactive Material label should be located on the outside of the storage cabinet, refrigerator, safe, etc. Store radioisotopes in such a manner as to prevent unauthorized use or removal.
- 11) Absorbent paper with waterproof backing shall be used to cover the working surface of tables and hoods used for radioactive materials.

- 12) At the close of a radioisotope working period, the laboratory work surfaces should be carefully monitored per RSO-9, "Radioactive Contamination Survey Procedure".
- 13) Before leaving the laboratory after working with isotopes, each person should wash their hands thoroughly and check those with a monitoring instrument (if isotopes used were gamma or high energy beta emitters). Monitoring of clothing and particularly shoes should always be carried out before leaving the Laboratory area.
- 14) Routine urine analysis should be carried out by means of liquid scintillation counting whenever millicurie levels of C-14, S-35 and H-3 handled. See the "Personnel Monitoring Procedure," RSO-8 for other bioassay requirements. Thyroid monitoring is to be performed whenever mill curie levels of I-125 are used. See RSO-8 for procedure.

Criteria for Approval of Radioisotope Application and Level of Use

Individuals who desire to work with radioisotopes must complete and submit form RSO-12 to the Radiation Safety Officer. Copies of this form can be obtained from the Radiation Safety Office. The application will be evaluated to determine if the applicant has appropriate training and/or experience in the handling of the radioactive material which they intend to use.

Listed below are the minimum training and/or experience requirements that will be utilized in evaluating the qualifications of all person applying for radioactive material licenses.

Threshold quantities (mica) for User Class

Hazard Group	Class A	Class B	Class C	Class D
(I) Extremely Hazardous	1	0.1	0.01	0.001
(II) High Hazard	10	1.0	.10	.010
(III) Hazardous	100	10.0	1.00	0.100
(IV) Low Hazard	1000	100.0	10.00	1.000

(Note: Sealed Source User Quantities are 10x greater.)

Class a Users

Licensee

Satisfactory completion of a formal radioisotope handling course, one year experience and a formal radiation safety course.

Supervised Users

Competence and instruction in radioisotope handling techniques and a formal radiation safety course. (Radioisotopes handling techniques documented by licensee).

Class B Users

Licensee

Satisfactory completion of a formal radioisotope handling course or two years experience and formal radiation safety course.

Supervised User

Satisfactory completion of a formal radiation safety course. Instruction in radioisotope handling techniques by licensee.

Class C Users

Licensee

Satisfactory completion of a formal radiation safety course and one year experience.

Supervised User

Satisfactory completion of a radiation safety course.

Class D Users

Licensee

Satisfactory completion of a formal radiation course.

Supervised User

Radiation safety instruction by licensee.

For all new personnel who will be working with ionizing radiation under the supervision of the Licensee, Form A must be completed and submitted to the Radiation Safety Office.

In some cases the length of experience may be substituted for the formal radiation safety course. This determination will be made by the Radiation Safety Officer. Radiation safety courses taken at other institution are acceptable. Documentation of any instructions to personnel by a licensee to meet the minimum requirements must be submitted to the Radiation Safety Office within six months after employment.

The minimum radiation safety training requirement can be met by the applicant attending the “Ionizing Radiation Fundamentals” short course offered by the University’s Radiation Safety Program.

After the application has been evaluated, and if approved, a user authorization permit will be issued to the Principal Investigator indicating the isotopes and maximum quantities that he or she is authorized to possess at any given time.

A listing of radioisotope hazard groups are contained in Supplement A.

Supplement A

Safety Hazard Grouping for Radioisotopes
According to Radiotoxicity

Group I Extremely Hazardous	Group II High Hazard	Group III Hazardous	Group IV Low Hazard
Sr-90	Ca-45	Na-22*Ga-72*1-132*	H-3
Y-90	Fe-59	Na-24*As-74*CS-137*	Be-7*
Pb-210*	Sr-89	P-32 As-76*Ba-137	C-14
Bi-201	Y-91	S-35 Br-82* La-140*	F-18
Ra D&E	Ru-106	Cl-36 Rb-86*	Pr-143 Cr-51*
At-211	Rh-106*	K-42* Zr-95* Pm-147	Ge-71
Ra-226	1-125*	Sc-46* Nb-95*	Ho-166 TI-201*
U-233*	1-131*	Sc-47 Mo-99 Lu-177	
Pu-239	Ba-140*	Sc-48 Tc-98 Ta-182*	
Am-241*	La-140	V-48* Rh-105*	W-181
Cm-242	Ce-144	Mn-52*	Pd-103 Re-183*
Cf-252	Pr-144	M-54* Rh-103	Ir-190*
	Sm-151	Mn-56*	Ag-105*Ir-192*
	Eu-154	Fe-55 Ag-111	Pt-191
	Tm-170*	Co-60*	Cd-109 Pt-193*
	Th-234*	Ni-59 Ag-109*	Au-196*
	Pa-234*	Ni-63 Sn-113*	Au-198*
	Natural-U	Cu-64*	Te-127*Au-199*
		Zn-65*Te-129*	TI-200
			TI-202
			TI-204
			Pb-203*

*Gamma-emitters

Appendix C

UAH Radiological Emergency Procedures

A radiation emergency can occur where radioactive materials are used, stored or transported. An emergency can be defined as any incident pursuant to the use of radionuclides which produces contamination of personnel, areas and/or atmosphere. An incident in which an individual is exposed to a primary x-ray beam, is also considered a radiation emergency.

Classification of types of radiation emergency:

- A) Major Spill
- B) Minor Spill
- C) Loss of Radioactive Source
- D) Personnel Contamination Involving Injury
- E) Accidents involving Analytical X-ray Equipment

Procedures

- A) Major Spill, Involving Radiation Hazards to Personnel:
 1. Notify all persons not involved in the spills to vacate the room at once. Limit the movement of displaced persons to confine the spread of contamination.
 2. If the spill is liquid and the hand protected, right the container; otherwise use a stick or lever.
 3. If the spill is on skin, flush thoroughly.
 4. If the spill is on clothing, discard outer or protective clothing at once.
 5. Switch off all fume hoods and ventilation fans.
 6. Vacate the room.
 7. Notify the Radiation Safety Office, as soon as possible. Phone numbers are listed in Appendix D. If unable to contact the Radiation Control Technician or Officer, notify the Authorized User for the laboratory.
 8. Remain outside the room door and be prepared to describe the major details of the incident when the RSO or RCT arrives. Prevent anyone from entering the room.
 9. Permit no person to resume work in the area without the approval of the RSO or RCT.
 10. A complete history of the accident and subsequent activities must be submitted to the RSO.

B) Minor Spills, Involving No Radiation Hazard to Personnel

1. Notify all persons in the area in which the spill occurred.
2. Confine the spill immediately.
 - 2.1 Liquid Spills
Don protective gloves
Drop absorbent paper on spill
 - 2.2 Dry Powder or Solid Spills
Don protective gloves
Dampen thoroughly the spill area, taking care not to spread the contamination.
Drop absorbent paper on the spill.
3. Place all absorbent paper, plastic gloves etc. used in the cleanup into a plastic bag, then place the bag in the “radwaste” container located in the lab area.
4. Contact the Radiation Control Technician for a survey of the spill area. The Authorized User or other lab personnel who are competent in performing contamination surveys can direct cleanup activities. Use the survey techniques as outlined in the Radiation Survey Procedures.
5. A complete written report of the accident and subsequent cleanup must be submitted to the RSO.

C) Loss of Radioactive Source

1. When it becomes apparent that a radiation source is missing from its normal storage area, notify the Authorized User at once. An attempt to locate the source should be made.
2. If the source cannot be found, notify the RCT or the RSO at the phone number listed in Appendix D.
3. A report may be filed with the Campus Police if theft is suspected.

D) Personnel Contamination Involving Injury

1. Wash minor wounds immediately under running water, spreading the edges of the gash.

2. Report all radiation accidents (involving wounds, overexposure, ingestion, and inhalation) to the Radiation Safety Office as soon as possible.
3. Fill out an accident report and file a copy with the Campus Safety Office.

The most important directive for personnel attempting to cope with a radiation accident is to “Think before you act.”

E) Emergency Action for X-ray Accidents

1. Shut off power to the unit.
2. Notify the Radiation Safety Officer.
3. Obtain and record all details of the incident.
4. Have exposed individual examined by a physician.
5. Except for obvious first aid, do not treat the patient until the dose received has been determined.

Appendix E

Sample Radioisotope Logbook Inventory Page

Receipt

(page 1)

Entry#	P.O.#	Date rec'd	Amt. UCi	Isotope	Vendor	Vial I.D.#	Chemical Form

Use Waste

(page 2)

Date Used	Amt Used (uCi)	Remaining in vial uCi	Date vial emptied	Date uCi	Drum #	Date last contents disposed	Date last of vial contents leave UAH

Appendix F

Required Records and Reports

Description of Record Or Report	Frequency	Responsibility	Reference
1. Purchase Requisition sent Thru RCT	occurrence	Authorized User	RSO-14
2. University Radioactive Material Inventory	quarterly	Authorized User RCT	RSO-13
3. User Radioisotope Unsealed source inventory Maintain up-to-date logbook	occurrence	Authorized User	RSO-13
4. Sealed Source Leak-Test	biannually	RCT	RSO-5
5. Swipe survey Of lab work areas	after using radioisotope	Authorized User	RSO-9
6. General lab area Contamination swipe surveys	monthly to biannually	RCT	RSO-9
7. Analytical X-ray Survey	quarterly	RCT	RSO-9X
8. Dosimetry Reports	monthly	RCT	RSO-8X
9. Lab Radioactive Disposal Records	occurrence	RSO	RSO-15
10. Waste Shipment	occurrence	RSO	RSO-15
11. Renewal of South Carolina Waste Transport Permit	on occurrence	RSO	Application sent by SC
12. Registration and Training for new personnel	on assignment	Authorized User	RSO-12
13. Radiation Safety Status Report	annually or on occurrence	RCT, RSO	Committee meetings
14. Request for Bioassay	occurrence	Authorized User	RSO-8
15. Receipt of Radioactive Materials	occurrence	Authorized User	RSO-2
16. Calibration of survey instruments	annually	RCT	RSO-4

Appendix G

RSO Forms and Procedures

Form RS)-2	Receipt of Radioactive Materials
Form RSO-3	Transfer of Radioactive Materials
Procedure RSO-4	Survey Instrument Calibration
Procedure RSO-8	Internal Monitoring
Procedure RSO-8x Of Film Badges	Instructions for the Proper Use
Procedure RSO-9 Survey	Radioactive Contamination
Procedure RSO-9X (table only)	Analytical X-Ray Survey
Form RSO-12A	Registration and Training Record for New Personnel Working with Radioisotopes
Form RSO-12B	Registration and Training Record for new Personnel Working with Analytical X-Ray Equipment
Form RSO-14	Requisition for Radioisotopes
Form RSO-15 Disposal Record	Radioactive Liquid Waste
Form RSO-15 Disposal Record	Radioactive Solid Waste

RSO-2

Record of Receipt of Radioactive Material

Date Rec'd:		Isotope:		Activity:	
Chemical Form:		Vendor			
Catalog Number:		Sealed?	Unsealed?		
University Purchase Order:					
Authorized User:			Department:		
Laboratory Location:			Storage Area:		
Container Inspection Report:					
Radiation Survey Results:		mr/hr (container contact reading)			
Instrument:		Background Reading:		mr/hr	
Net Results:		mr/hr			
Source Container Swipe Sample:			Net cpm (outer surface)		Net cpm (inner surface)
Package Accepted:			RCT:		
Transferred to:			Date:		
Radiation Safety Officer			Date		

RSO-3

Record of Transfer of Radioactive Materials

Date of Transfer: _____ Present Storage Location: _____
Kind of Transfer: () to a UAH Facility, () to an off campus facility

Radioactive Materials to be transferred

Isotope	Quantity (mCi)	Chemical Form
1)		
2)		
3)		
4)		
5)		
6)		
7)		
8)		
9)		
10)		

Attached an additional sheet or inventory if needed.

Bldg: _____ Rm#: _____

Transferred From: _____ UAH Authorized User: _____

Transferred To: _____

If the transfer is to an off campus facility provide the transferee's Radioactive
Materials permit #: _____ State: _____ No. _____

If transferring this material to an on campus facility in which radioisotopes were not previously used,
attach a lab diagram. Indicate on the diagram the planned radioisotope storage and usage areas.

Comments: _____

Transfer Approved () Yes, () No

Radiation Safety Officer

Date

Survey Instrument Calibration Procedure

All portable radiation survey instruments will be calibrated by qualified Radiation Safety personnel on a once per six month schedule. The calibration source used for this procedure is a 100 mci CS-137 source located in RI-17. All radiation safety practices must be employed while performing this procedure.

Procedure

Note: Ensure entrance to calibration area is secured and posted as a radiation area.

- (1) Determine the current activity for the calibration source by using the data from the vendor's calibration sheet and the standard decay equation.
- (2) Calculate source mr/hr at the indicated distances (see form RSO-4) from the source point using this formula:

$$\text{mr/hr} = \frac{1000yA}{d^2}$$

Where: y= gamma dose rate for CS-137 (see vendor's calibration sheet)

A= Activity of source (mci)

d= distance in cm

Log all data on form RSO-4.

- (3) Measure the distances from the point source and place the survey instruments probe in the calculated radiation fields, starting at one yard and progressing to 10 yards. Allow enough time at each distance for the instrument reading to stabilize. The instrument should read 20 +/- percent of calculated values. Refer to the instruments operational manual if adjustments are required to obtain an acceptable value.
- (4) Attached a gummed label to each instrument after calibration to denote the calibration date and due date along with the check source reading.
- (5) Instruments found to be defective may be repaired by the University employed instrument technician or off campus vendor.

Internal Monitoring

Introduction: When radioactive materials enter the body, they are absorbed, metabolized and distributed to the tissues according to the chemical properties of the elements and compounds in which they are contained.

1. Scope

1.1 Bioassay

For the purpose of this procedure, bioassay is the determination of kind, quantity, location, and/or retention of radionuclides in the body by in vitro analysis of material excreted or removed from the body.

Laboratory personnel working with millicurie levels of unsealed radioisotopes (H-3, C-14, S-35) will be required to perform this procedure whenever a threshold use level is exceeded. The threshold use levels and required bioassay sample times are listed in Table 1, of this procedure. Authorized users should notify the Radiation Safety Office whenever their level of unsealed tritium, sulfur-25, or carbon-14 use will exceed the listed threshold values.

1.2 Thyroid Scans

Individuals who use millicurie levels of I-125 are required to undergo thyroid scans after performing an iodination at the times listed in Table 1. The authorized user should notify the Radiation Safety Officer of impending iodination at least a week in advance, so that the required instrumentation checks and calibration can be performed.

(Note: Thyroid scans may also be performed by Huntsville Hospital's Radiation Medicine Department technicians when requested by the RSO and with at least one day prior notification.)

Procedure

A. Bioassay Sample Preparation

1. In accordance to the sample times listed in Table 1, use a urine collection bottle (provided by the Radiation Safety
2. Use an Eppendorf pipetter and a 1 ml. Liquid scintillation counting vial. Add a sufficient amount (app. 15 ml.) of cocktail solution and cap. Use a black marker to write your initials on the cap.
3. Complete the RSO-8, "Bioassay Data Form" and submit it along with the prepared sample to the Radiation Safety Office for radioactivity counting.
4. After counting and dose determination (if required)
Bioassay Sample Report will be returned to the Authorized User.

Note: Radiation dose will be determined for each sample by using the counting instrument's calibration data and International Commission on Radiological Protection reports.

B. Thyroid Monitoring

1. A sodium iodide crystal with photomultiplier tube shall be hooked to single channel analyzer and positioned on a stand for reading activity in the subjects thyroid. The results will be corrected using calibration data to determine the actual activity of I-125 in the thyroid.
2. Any person showing activity in excess of 23% of the maximum permissible body burden will be monitored at the discretion of the Radiation Safety Officer.

Internal Monitoring
Table I

Note: A bioassay will be performed at any time an accidental ingestion of any radioisotope is suspected or at the request of an authorized user.

A. Urine Sampling
Isotope
Level

Threshold Use
Interval

Monitoring
Collection

Sample

Isotope Level	Threshold Use Interval	Monitoring Collection	Sample
Carbon-14	Greater than 1 mci.	Semiannually	Once per six Months for Continuing Operation.
Hydrogen-3	Greater than 1 mci.	Monthly	Within one week following a single operation, then monthly for continuing Operation.
Sulfur-35	Greater than 1 mci.	Quarterly	Within one week of last quarterly Exposure.

B. Thyroid Monitoring

Individuals utilizing quantities of I-125 in excess of 1 mci. In a single operation shall have an initial thyroid scan performed within 72 hours of operation. Frequency and scheduling of additional examinations shall be determined by the Radiation Safety Officer.

Radioactive Contamination Survey Procedure

The definition of Radioactive Contamination is the undesired presence of radioactive substances in or on any material. Contamination may be loose (removable), or fixed (can not be removed from the surface of an object). Routine surveys will be performed by the Environmental Health and Safety Officer and laboratory personnel to ensure clean areas remain free of Radioactive Contamination. All survey results will be recorded on RSO-9. Surveys performed by the Authorized User are too maintained in the laboratory and a copy will be collected and reviewed by the Environmental Health and Safety Officer monthly. Routinely scheduled surveys are to be performed as follows:

Area	Frequency	Responsibility
Labs That Use	Once Per Quarter	Environmental
Unsealed Sources		Health and Safety Officer
Immediate	At the Completion	Authorized User
Unsealed Source	Of Radioisotope	
	Usage For Each	
	Procedure*	
Labs That Contain	Sealed Source	Environmental
Only Sealed	Leak Test Performed	Health and Safety
Sources	Once Per 6 Months	Officer
	No General Area	
	Surveys Required	

*Survey required after the use of one mill curie or more of an unsealed radioisotope.

Procedure

A) Labs that Use (H3, C-14, S-35, P-32)

Note: Always wear disposable gloves while performing surveys.

1. Use a Whatman No. 2 filter paper disk to survey or swipe about 100 sq. cm. of lab area. Take enough swipe samples to cover all areas of the lab where radioisotopes are used and stored.
2. Indicate areas surveyed by way of diagram or map on form RSO-9.
3. Place each filter disk in a liquid scintillation counting vial and add cocktail solution. Be sure to place the number of the sample on the cap of the vial.
4. Shake the vial for a few seconds to disperse any radioactive particles on the filter paper throughout the cocktail solution.
5. Prepare a blank by placing a clean filter disk in a liquid scintillation vial and adding cocktail solution.
6. Use a glass stirring rod or similar instrument to position the filter disk on the bottom of the counting vial.
7. Follow the LS-5801 operation procedure for counting samples.
8. Record results in net count per minute on RSO-9. An area is considered contaminated if a count rate of 100 cpm above background is obtained and should be cleaned up as soon as possible. If on any sample, a count rate of 1000 cpm or greater is obtained, tape off the area using the yellow and magenta contaminated area tape and notify the RCT and/or RSO immediately. Follow the decontamination guidelines as listed in part C of this procedure.

B) Labs that use (I-125, P-32, and other gamma, beta or alpha sources).

1. Use a portable GM tube survey instrument. Ensure the instrument is in current calibration.
2. Perform a battery and source check of the instrument. Source checks should be within 10% of the value obtained during calibration. If the instrument fails either of the operational checks, return it to the Environmental Health and Safety Officer for a replacement.
3. Always use the detector probe in the open window position.
4. Obtain a general lab area background reading.
5. Take readings in counts per minute at a distance of about one inch above the surface of laboratory benches, sinks, counter tops, etc.
6. Indicate areas surveyed and the net count rates on RSO-9.
7. An area is considered contaminated if a count rate of two times the background is obtained.
8. If a count rate of two times the background is obtained using a survey instrument, take a swipe sample and count rate of ≥ 100 cpm above background is obtained on any swipe.

C) Decontamination Guidelines

Note: It is the responsibility of the lab personnel and Authorized User to clean up radioactive contamination.

1. Use decontamination spray and towelettes clean the area. These items can be obtained from the Environmental Health and Safety Officer.

2. Re-survey the area and log all results on RSO-9.
3. Repeat steps 1 and 2 until a swipe sample of the area shows a count rate of less than 100 cpm above background.
4. Be sure to discard all items used during the decontamination process into a radwaste container.

Analytical X-Ray Radiation Survey

“Analytical x-ray equipment” means any device which utilizes x-rays for the purpose of examining the microstructure of materials. This includes all types of x-ray diffraction, fluorescence, and spectrographic analysis equipment.

A routine radiation leakage survey will be performed by radiation safety personnel on a once per quarter schedule. At the time of the quarterly survey, an inspection of the equipment will be conducted to ascertain its compliance with State Regulations. Results of the survey and inspection will be posted on the door of the x-ray room.

Additional non-routine surveys will be performed as follows:

1. Upon installation of equipment;
2. Following any change in initial equipment arrangement;
3. Following any maintenance requiring the disassembly or removal of a local component in the system;
4. During the performance of maintenance and alignment procedures requiring the presence of a primary x-ray beam when any local component in the system is disassembled or removed;
5. Any time a visual inspection of the equipment reveals an abnormal condition; and
6. Whenever personnel monitoring devices show a significant (50 millirem) increase over the previous monitoring period.

Authorized users of the x-ray equipment are required to inform the Radiation Safety Office whenever conditions one through five have occurred or will occur.

Registration and Training Record for New Personnel Working with Ionizing Radiation

A) Authorized User

B) Name of New Worker

C) Training Conducted	Initials	Date
1. Reading of Radiation Safety Procedure completed.	_____	_____
2. Use of required protective Equipment/clothing and Monitoring equipment has been demonstrated.	_____	_____
3. General rules of radiation safety have been discussed.	_____	_____
4. Disposal of contaminated waste equipment has been reviewed.	_____	_____
5. Directions for maintaining source inventory have been given.	_____	_____
6. Directions for actions to take and who to contact in case of a Radiological emergency. (UAH Radiation Emergency Procedures reviewed)	_____	_____

Signature of Authorized User Date

D) Equipment/Isotopes likely used by this worker:

E) This individual is required to attend the ‘Ionizing Radiation Fundamental’ course the next time that is offered.

Yes No

Date attended:

Received:

Radiological Safety Officer

Date:

Registration and Training Record for New Personnel Working With Analytical X-Ray Equipment

A) Authorized User

B) Name of New Worker

C) Training Conducted	Initials	Date
1. Identification of radiation hazard associated with the use of the equipment (Have been discussed)	_____	_____
2. Significance of the various radiation warnings and safety devices incorporated into the equipment, or the reason they have not been installed on certain pieces of equipment and the extra precautions required in such cases (Has been outlined)	_____	_____
3. Proper operating procedures for The equipment (Reviewed with Authorized user)		
4. Biological effects of radiation, including symptoms of an acute localized exposure (Handout material received)	_____	_____
5. .Proper procedures for reporting An actual or suspected exposure (UAH Radiation Safety Procedures reviewed)	_____	_____

Equipment to be operated by new Worker:

Signature of Authorized User & Date: _____

Personnel monitoring required& Received: _____

Radiation Safety Officer & Date: _____

Radioactive Liquid Disposal Record

Note: Do not mix liquid scintillation fluid and aqueous waste.

Container No	Location	Waste Type: Check only one box.
		Aqueous () Organic Solvents()
		Other ()

Date	Isotope	Chem Form	Activity	Approx-	Description	Int (uCi,mCi)	Volume
------	---------	-----------	----------	---------	-------------	---------------	--------

Disposal Data

If the liquid is organic solvent, contact the RSO when the container is full

Date Full	Total Activity	mCi, Total Volume
Date Emptied:	To radwaste drum()No	Sewer() Activity

Performed by:

Radioactive Solid Waste Disposal Record

Container No	Location	Waste Classification	

Date	Item No		Isotope	Chem. Form	Microcuries	Waste Description	Int
------	---------	--	---------	------------	-------------	-------------------	-----

Page Activity Totals in Millicuries

H3 C-14 P-32 I-125 S-35 Other

Date lab container emptied: To Drum No.

Performed by:

Authorized User