University of Alabama in Huntsville Radiation Safety Procedures
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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. Represent the University of Alabama in Huntsville in matters of licensing and compliance with State regulations.
Formal committee meetings will normally be held at least once a year to formulate policy, develop criteria for evaluation of users, and to address current issues. The committee meetings will be called by the RSO. The RCT, or supervisory campus official can call a meeting if an emergency occurs in the RSO’s absence.

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.
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. Approve all requisitions 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 quarterly 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 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 (ALRA)” 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 more 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 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 special red and yellow “Requisition of Radioisotopes” form (RSO-14) available from the RSO and departmental office and Appendix G. All requisitions must be signed by the Authorized User and submitted to the RCT or RSO for approval. If approved the original will be sent to purchasing, a copy will be returned to the Authorized User 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.” The use of the “Requisition of Radioisotopes” is not superseded by the UAH on-line requisition system; users must still submit this form to either the RCT or RSO.

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

Purchasing must stamp all Radioisotope P.O.’s in red 1 inch high letters, “Radioactive Materials” so as to alert receiving, who on the arrival of the shipping container, will mark it Radioactive” if it is not so marked.

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 \( \leq 100 \text{ cpm} \) alpha, beta, gamma and \( \leq 200 \text{ mr/hr} \) on contact or \( \leq 10 \text{ mr/hr} \) 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, along with each Authorized User, will perform an unsealed source inventory for all such sources at the end of each school quarter. A non-licensed exempt sealed source inventory will be completed biannually at the time of the required leak test. Procedure RSO-13, “Radioactive Source Inventory,” list the steps and forms to be completed by the RCT and Authorized User, when performing an inventory.
III.C Transfer of Material

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 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

All portable radiation survey instruments will be calibrated by qualified Radiation Safety personnel on a routine six months 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

All sealed non-licensed exempt radioactive sources will be leak tested on a six months frequency. 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 immediately 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 monthly 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

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. This procedure is primarily intended to be performed by individuals who work with millicurie levels of tritium, sulfur-35, carbon-14 and iodine-125. 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 30 or 55 gallon long-term storage container labeled “Liquid Scintillation Vial Only.” Presently this drum is located in Science Building, room 251.

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. 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.
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 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 a 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.

A. 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 420-3-26.1(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.

I. 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.

II. 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:
### Rems per Calendar Quarter

<table>
<thead>
<tr>
<th>Area</th>
<th>Rems per Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole body; head and trunk active</td>
<td>1 ¼</td>
</tr>
<tr>
<td>Blood forming organs; lens of Eyes; or gonads</td>
<td></td>
</tr>
<tr>
<td>Hands and forearms; feet and ankles</td>
<td>18 ¾</td>
</tr>
<tr>
<td>Skin of whole body</td>
<td>7 ½</td>
</tr>
</tbody>
</table>

### 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).

### III. Radiation and Radioactive Contamination Survey Procedures

#### A. Sealed and Unsealed Source Facilities

The Radiation Control Technician will routinely survey all areas within the University in which radioactive materials are used and stored. The frequency of these surveys will range from six months to one-month dependent upon the amount of use, radiation levels, and previous laboratory monitoring results. The RCT may however, survey and room or laboratory where radioactive materials are used or stored at any time deemed necessary in the interest of radiation safety. Authorized users should also survey their immediate work area after using an unsealed source. The procedure and forms to be used by the RCT and Authorized Users when performing a survey is provided by RSO-9, “Radioactive Contamination Survey Procedure” (contained in Appendix G).

An area is considered contaminated if a swipe sample or instrument count rate of \( \geq 100 \text{ cpm} \) beta-gamma and/or \( \geq 10 \text{ cpm} \) alpha above background is obtained, using the appropriate survey method and detection device.

Areas in which sealed sources are used and stored will not be routinely surveyed for contamination unless a source is found to be leaking.

Areas found to be contaminated are to be cleaned or decontaminated in accordance with the decontamination guidelines found in procedure RSO-9.

#### B. 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.

IV. 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.

V. 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 pipetters.

3) All spills of radioactive materials must be reported to the 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.


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 of 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 them 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 millicurie levels of 1-125 are used. See RSO-8 for procedure.
Appendix B

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, Science Building, Room 317. 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 licences.

<table>
<thead>
<tr>
<th>Threshold quantities (mCi) for User Class</th>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I) Extremely Hazardous</td>
<td>1</td>
<td>0.1</td>
<td>0.01</td>
</tr>
<tr>
<td>(II) High Hazard</td>
<td>10</td>
<td>1.0</td>
<td>0.10</td>
</tr>
<tr>
<td>(III) Hazardous</td>
<td>100</td>
<td>10.0</td>
<td>1.00</td>
</tr>
<tr>
<td>(IV) Low Hazard</td>
<td>1000</td>
<td>100.0</td>
<td>10.00</td>
</tr>
</tbody>
</table>

(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
Appendix B (cont.)
RSO-12
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

<table>
<thead>
<tr>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
<th>Group IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely Hazardous</td>
<td>High</td>
<td>Hazardous</td>
<td>Low</td>
</tr>
<tr>
<td>Hazardous</td>
<td>Hazard</td>
<td></td>
<td>Hazard</td>
</tr>
</tbody>
</table>

- Sr-90
- Y-90
- Pb-210*
- Bi-201
- Ra D&E
- At-211
- Ra-226
- U-233*
- Pu-239
- Am-241*
- Cm-242
- Cf-252
- Sm-151
- Eu-154
- Tm-170*
- Th-234*
- Pa-234*
- Natural-U
- Zn-65*Te-129*

*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, 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 D

Radiological Emergency Notification

<table>
<thead>
<tr>
<th>Organization or Individual</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Campus Safety Office (for accident report)</td>
<td>824-6594</td>
</tr>
<tr>
<td>2) Campus Police</td>
<td>824-6596</td>
</tr>
<tr>
<td>3) Radiation Safety Officer (RSO)</td>
<td>824-6969</td>
</tr>
<tr>
<td>Dr. Michael Banish</td>
<td>VBRH D-11</td>
</tr>
<tr>
<td>4) Radiation Control Technician (RCT)</td>
<td>824-2171</td>
</tr>
<tr>
<td>Ms. Marica Green</td>
<td>Johnson</td>
</tr>
<tr>
<td>Home:</td>
<td>430-3403</td>
</tr>
<tr>
<td>5) Health Physics Consultant</td>
<td>1-956-6751</td>
</tr>
<tr>
<td>Mr. Don Hammer</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Authorized Users</th>
<th>Campus Address</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office</td>
<td>Lab</td>
<td></td>
</tr>
<tr>
<td>1) Dr. Ronald Young</td>
<td>SB 258</td>
<td>SB 251</td>
</tr>
<tr>
<td>2) Dr. John Gregory</td>
<td>MSB 111</td>
<td>MSB 112</td>
</tr>
<tr>
<td>3) Dr. Sam Campbell</td>
<td>SB 328</td>
<td>SB 332</td>
</tr>
<tr>
<td>4) Dr. Milton Harris</td>
<td>MSB 315</td>
<td>MSB 300</td>
</tr>
<tr>
<td>5) Dr. Debra Moriarity</td>
<td>SB 240</td>
<td>SB 241</td>
</tr>
<tr>
<td>6) Dr. George Dimopollos</td>
<td>SB 254</td>
<td>SB 243</td>
</tr>
<tr>
<td>7) Dr. Marian Lewis</td>
<td>SB 360</td>
<td>SB 351</td>
</tr>
<tr>
<td>9) Dr. Arthur Smith</td>
<td>JRC 165-B</td>
<td>same</td>
</tr>
<tr>
<td>10) Yoshiyuki Takahashi</td>
<td>OB 212</td>
<td>OB 259</td>
</tr>
<tr>
<td>11) Dr. Adriel Johnson</td>
<td>SB 218D</td>
<td>SB 218</td>
</tr>
</tbody>
</table>

This page will be up-dated annually.
## Appendix E

### Sample Radioisotope Logbook Inventory Page

**Receipt**

<table>
<thead>
<tr>
<th>Entry#</th>
<th>P.O.#</th>
<th>Date rec’d</th>
<th>Amt. UCi</th>
<th>Isotope</th>
<th>Vendor</th>
<th>Vial I.D.#</th>
<th>Chemical Form</th>
</tr>
</thead>
</table>

### Use

<table>
<thead>
<tr>
<th>Date Used</th>
<th>Amt. Used</th>
<th>Remaining</th>
<th>Date vial</th>
<th>Date</th>
<th>uCi Solid</th>
<th>Drum#</th>
<th>Date last</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>UCi</th>
<th>in vial</th>
<th>uCi emptied</th>
<th>contents of vial</th>
</tr>
</thead>
<tbody>
<tr>
<td>leave UAH</td>
<td>contents</td>
<td>disposed</td>
<td>contents leave UAH</td>
</tr>
</tbody>
</table>

**Waste**
## Appendix F

**Required Records and Reports**

<table>
<thead>
<tr>
<th>Description of Record or Report</th>
<th>Frequency</th>
<th>Responsibility</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Purchase Requisition sent</td>
<td>occurrence</td>
<td>Authorized User</td>
<td>RSO-14</td>
</tr>
<tr>
<td>thru RCT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. University Radioactive</td>
<td>quarterly</td>
<td>Authorized User</td>
<td>RSO-13</td>
</tr>
<tr>
<td>Material Inventory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. User Radioisotope unsealed</td>
<td>occurrence</td>
<td>Authorized User</td>
<td>RSO-13</td>
</tr>
<tr>
<td>source inventory maintain up-to-date logbook</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Sealed Source Leak-Test</td>
<td>biannually</td>
<td>RCT</td>
<td>RSO-5</td>
</tr>
<tr>
<td>5. Swipe survey after using</td>
<td></td>
<td>Authorized User</td>
<td>RSO-9</td>
</tr>
<tr>
<td>radioisotope of lab work areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. General lab area contamination swipe surveys biannually</td>
<td></td>
<td></td>
<td>RSO-9</td>
</tr>
<tr>
<td>7. Analytical X-ray survey</td>
<td>quarterly</td>
<td>RCT</td>
<td>RSO-9X</td>
</tr>
<tr>
<td>8. Dosemetry Reports</td>
<td>monthly</td>
<td>RCT</td>
<td>RSO-8X</td>
</tr>
<tr>
<td>9. Lab Radioactive Disposal Records</td>
<td>occurrence</td>
<td>RSO</td>
<td>RSO-15</td>
</tr>
<tr>
<td>10. Waste Shipment</td>
<td>occurrence</td>
<td>RSO</td>
<td>RSO-15</td>
</tr>
<tr>
<td>11. Renewal of South Carolina Application Waste Transport Permit annually RSO sent by SC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Registration and Training on assignment Authorized User</td>
<td></td>
<td></td>
<td>RSO-12</td>
</tr>
</tbody>
</table>
for new personnel

13. Radiation Safety Status quarterly report
     RCT, RSO
     Committee meetings

14. Request for Bioassay occurrence
     Authorized User
     RSO-8

15. Receipt of Radioactive occurrence
     Authorized User
     RSO-2

16. Calibration of survey instruments
     biannually
     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  Instructions for the Proper Use Of Film Badges
Procedure RSO-9  Radioactive Contamination Survey
Procedure RSO-9X  Analytical X-Ray Survey (table only)
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  Radioactive Liquid Waste Disposal Record
Form RSO-15  Radioactive Solid Waste Disposal Record
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  (outer surface) net cpm
  (inner surface) net cpm
Package Accepted:  RCT:
Transferred to:  Date:

Radiation Safety Officer  Date
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

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Quantity (mCi)</th>
<th>Chemical Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10)</td>
<td>Attached an additional sheet or inventory if needed.</td>
<td></td>
</tr>
<tr>
<td>Bldg</td>
<td>Rm#</td>
<td></td>
</tr>
</tbody>
</table>

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:
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:

\[
\text{mr/hr} = \frac{1000yA}{2d}
\]

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 (9H-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 Office).
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 From” 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

<table>
<thead>
<tr>
<th>Isoptope</th>
<th>Threshold Use Level</th>
<th>Monitoring Interval</th>
<th>Sample Collection Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon-14</td>
<td>Greater than 1 mci.</td>
<td>Semiannually</td>
<td>Once per six Months for Continuing Operation.</td>
</tr>
<tr>
<td>Hydrogen-3</td>
<td>Greater than 1 mci.</td>
<td>Monthly</td>
<td>Within one week following a single operation, then monthly for continuing operation.</td>
</tr>
<tr>
<td>Sulfur-35</td>
<td>Greater than 1 mci.</td>
<td>Quarterly</td>
<td>Within one week of last quarterly exposure.</td>
</tr>
</tbody>
</table>

B. Thyroid Monitoring

Individuals utilizing quantities of 1-125 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 to 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:

<table>
<thead>
<tr>
<th>Area</th>
<th>Frequency</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labs That Use Unsealed Sources</td>
<td>Once Per Month</td>
<td>Environmental Health and Safety Officer</td>
</tr>
<tr>
<td>Immediate Unsealed Source</td>
<td>At the Completion Of Radioisotope Usage For Each Procedure*</td>
<td>Authorized User</td>
</tr>
<tr>
<td>Labs That Contain Only Sealed Sources</td>
<td>Sealed Source Leak Test Performed Once Per 4 Months No General Area Surveys Required</td>
<td>Environmental Health and Safety Officer</td>
</tr>
</tbody>
</table>

*Survey required after the use of one millicurie 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 (1-125, 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.
   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 spectographic 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

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Reading of Radiation Safety Procedure completed.</td>
</tr>
<tr>
<td>2.</td>
<td>Use of required protective Equipment/clothing and Monitoring equipment has been demonstrated.</td>
</tr>
<tr>
<td>3.</td>
<td>General rules of radiation safety have been discussed.</td>
</tr>
<tr>
<td>4.</td>
<td>Disposal of contaminated waste equipment has been reviewed.</td>
</tr>
<tr>
<td>5.</td>
<td>Directions for maintaining source inventory have been given.</td>
</tr>
<tr>
<td>6.</td>
<td>Directions for actions to take and who to contact in case of a Radiological emergency. (UAH Radiation Emergency Procedures reviewed)</td>
</tr>
</tbody>
</table>

_____________________________________
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.

<table>
<thead>
<tr>
<th>Response</th>
<th>Date attended:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Initials</th>
<th>Date</th>
</tr>
</thead>
</table>

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 Emptyed: To radwaste drum( ) No Sewer( ) Activity
Performed by
Radioactive Solid Waste Disposal Record

<table>
<thead>
<tr>
<th>Container No</th>
<th>Location</th>
<th>Waste Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Item No</td>
<td>Isotope</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page Activity Totals in Millicuries

<table>
<thead>
<tr>
<th>H3</th>
<th>C-14</th>
<th>P-32</th>
<th>1-125</th>
<th>S-35</th>
<th>Other</th>
</tr>
</thead>
</table>

Date lab container emptied: To Drum No.

Performed by: Authorized User