

# RADIATION SAFETY MANUAL



October 6, 2015

## FOREWORD

The Louisiana State University Health Sciences Center New Orleans (LSUHSC) Radiation Safety Manual presents the recommendations and requirements governing use of radiation sources. LSUHSC faculty may use radionuclides in research under specific permits as participants in the broad form license issued to the LSU System Office by the Louisiana Department of Environmental Quality. Possession of this license carries strict responsibilities governing use and disposal.

Recommendations in the manual are derived from principles of radiation safety provided by the Nuclear Regulatory Commission, the National Council on Radiation Protection and Measurements, the National Institutes of Health, the Louisiana Department of Environmental Quality, and the LSU System Radiation Safety Committee.

The procedures and policies outlined in this manual are designed to permit maximum beneficial use of radiation sources with minimum exposure to faculty, staff, students, and the public.

All personnel using radiation sources shall be familiar with the LSUHSC radiation safety regulations and will conduct experiments in accordance with them.

Web links referenced in this manual may be found at the LSUHSC [Radiation Safety Homepage](#) as well as the [Radiation Safety Training lesson plan](#).

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## 1. INTRODUCTION

Ionizing radiation is one of the most versatile and useful tools of modern medicine and biomedical research. Like many other items used in medicine and research, ionizing radiation is potentially hazardous unless used in strict adherence to safety rules, procedures and policies.

Unlike most other such hazards, the risk of unguarded exposure to ionizing radiation includes the possibility of damage to future generations. Thus, the safety rules, which govern all uses of ionizing radiation are as concerned with preventing genetic damage as with protecting the health of the exposed individual. The rules, procedures and policies set forth in this manual have one single straightforward purpose; to protect researchers and visitors to LSUHSC against unnecessary and potentially harmful radiation exposure.

## 2. RADIATION EMERGENCY NOTIFICATION LIST

*(CALL IN ORDER UNTIL FIRST PERSON IS REACHED)*

1. Radiation Safety Officer	Office: 504-568-4952 Cell: 504-314-5989
2. Executive Director, Environmental Health and Safety	Cell: 504-905-6316
3. University Police	Office: 504-568-8999
4. L. Max Scott, PhD LSU System Radiation Safety Officer	Office: 225-578-4557 Cell: 225-241-4979
5. Louisiana Department of Environmental Quality	Office: 225-219-5337

### 3. Radiation Protection Program

#### A. Radiation safety program scope

The LSUHSC radiation safety program includes surveillance of:

- All radioactive materials, including natural and synthetic radionuclides in any chemical or physical form.
- All radioactive materials, including natural and synthetic radionuclides, in the form of sealed sources unless specifically exempted by the Louisiana Radiation Regulations.

**Surveillance includes** all aspects of the control of radiation hazards to assure the wellbeing of University personnel, integrity of University properties, and compliance with all applicable state and federal regulations, in keeping with standards of good practice.

#### B. General objectives of the program

The general objectives of the radiation safety program are:

- Compliance with all applicable state and federal regulations.
- Compliance with all state and local codes and ordinances.
- Ensure the integrity and usefulness of University facilities and properties are not compromised.
- Do not subject University personnel, students, visitors or the general public to undue radiation exposure from radioactive materials or radiation sources.
- Minimize the risk of release of radioactive materials to the environment.
- Maintain the standards of good practice and safe handling of radiation materials and radiation sources throughout the University System.

C. Program restrictions

LSU System Office broad scope license specifically prohibits:

- The use of radioactive materials in any chemical or physical form, whether sealed or unsealed, for the intentional exposure of patients for the purpose of medical diagnosis or medical therapy of human beings;
- The possession of sufficient amounts of fissile (i.e., Special Nuclear Materials) substances to achieve a critical mass in any geometry, regardless of the geographical separation of individual small amounts of fissile materials
- The combination of fissile substances with neutron energy moderating substances in any amount of geometry capable of yielding a self-sustaining nuclear fission chain reaction
- The release of radioactive material into the environment without prior approval from the Louisiana Department of Environmental Quality

D. Specific objectives of the program are:

- To prevent, to the extent practicable, the occurrence of severe radiation-induced nonstochastic diseases by adhering to dose equivalent limits that are below the apparent practical threshold dose equivalent levels.
- To limit risk of the stochastic effects, fatal cancer and genetic effects, to a reasonable level in comparison with non-radiation risks and in relation to societal needs, benefits gained and economic factors.

These objectives are achieved by applying individual dose equivalent limits for occupational and non-occupational (general public) exposures.

For the purposes of radiation protection, a cautious assumption is made, the reliability of which has not been established. This is the assumption that the dose-risk relationship is strictly proportional (linear) without threshold throughout the range of dose equivalent and dose equivalent rates of importance in routine radiation protection. Furthermore, doses and the probability of response (risk) are assumed to accumulate linearly. At higher doses, received acutely, such as in accidents, more complex (non-linear) dose- risk relationships may apply.

Under these assumptions, any selected dose equivalent limit will have an associated level of risk. LSUHSC endorses the following:

- The need to justify any activity, involving radiation exposure on the basis that the expected benefits exceed the predicted results.
- The need to reduce the total radiation detriment from such justifiable activities or practices to as low a level as is reasonably achievable (ALARA), economic and social factors are taken into account.
- The need to apply individual effective dose equivalent limits to ensure that the procedure for justification and ALARA don't result in individuals or groups exceeding levels of acceptable risk.

The LSU System Radiation Safety Officer will perform an annual review of the radiation safety program. This shall include review of the summaries of the types and amounts of radioactive material used, occupational dose reports, and continuing education and training for all personnel who work with or in the vicinity of radiochemicals.

The purpose of the review is to ensure that individuals make every reasonable effort to maintain occupational doses, doses to the general public, and release of radioactive material as low as reasonable achievable, taking into account the state of technology and the cost of improvements in relation to benefits. Modification to operating procedures or to equipment and facilities will be made where they will reduce exposures unless the cost is considered unjustified. In addition to maintaining doses to individuals as far below the limits as is reasonably achievable, the sum of the doses received by all exposed individuals will also be maintained at the lowest practicable level.

Table 1: Occupational Dose Limits for Adults

Description	Dose Limit
Whole Body	5,000 mrem/yr (50 mSv/yr)
Skin	50,000 mrem/yr (500 mSv/yr)
Extremity	50,000 mrem/yr (500 mSv/yr)
Any organ other than the lens of the eye	50,000 mrem/yr (500 mSv/yr)
Lens of the eye	15,000 mrem/yr (150 mSv/yr)

The following actions will be taken if exposure limits are exceeded.

- The Radiation Safety Officer (RSO) will review the exposure of each individual. If he/she exceeds the stated limit per Table 1 above, the RSO will report the results of the review at the first Radiation Safety Committee meeting following when the exposure was recorded.
- The RSO will also review techniques/procedures and make recommendations for reducing exposure. The committee will review the recommendations and indicate appropriate follow-up. A written notification of the exposure will be forward to the individual.

## 4. Radiation Safety Committee

The LSUHSC Radiation Safety Committee will:

- Control use of radiochemicals, radiation producing machines, sources, and nuclear safety.
- Evaluate the qualification of applicants for the use of radiochemicals and other ionizing radiation producing units.
- Review and grant approval, or disapproval, for the use of radiochemicals for routine or non-routine uses within the institution from the standpoint of radiation safety and the safety of Health Sciences Center personnel, patients, and visitors.
- Prescribe special conditions that will be required during a proposed use of byproduct materials and cyclotron produced products, such as requirements for bioassays, physical examination of users, minimum level of training and experience of users.
- Receive and review records and reports from the LSUHSC Radiation Safety Officer.
- Recommend remedial action to correct safety infractions.
- Maintain written records of actions taken by the Committee.
- Meet a minimum of four times a year, and report annually to the LSU System Radiation Safety Committee.

The LSUHSC Radiation Safety Committee will be appointed annually by the Vice Chancellor of Academic Affairs (VCAA) and shall be composed of at least three members, to include:

- Permitted Users
- Radiation Safety Officer
- Management representative (non-authorized user)
- Other members may be included as the license deems appropriate

The members of this committee must have demonstrated by either special training or extensive experience a competence in the field of radionuclide/radiation technique, including decontamination procedures, shielding requirements, radiation risks, etc. Based on a majority vote of its membership, the committee is empowered to approve or deny applications for individual permits, and to warn or suspend temporarily or permanently, permits of individuals found to be in violation of its rules.

When possible, each campus location where radiochemicals are in use should be represented. The normal initial term of appointment shall be for three years. Reappointment thereafter shall be made annually by the VCAA.

The Committee will nominate to the VCAA one member to serve as Chair. Upon appointment by the Vice Chancellor, the Chair will conduct the routine business of the Committee and serve as liaison with the Office of Environmental Health and Safety and other administrative entities. The Chair will call and arrange Committee meetings, distribute properly completed applications for radiochemical usage to the Committee, set agenda, and record minutes. The Chair will have discretionary authority to temporarily and provisionally:

- Grant approvals for applications to use radioisotopes
- Approve increases in limits of, or amendments to, user permits
- Suspend such approvals in concert with the deadlines should conditions warrant, all subject to Committee approval at the next meeting of the Radiation Safety Committee

The Chair will normally, upon appointment by the VCAA, serve as the representative from the Health Sciences Center to the LSU System Radiation Safety Committee, or equivalent entity that holds the broad scope license under which this Campus operates.

The Committee will normally meet at least four times a year, near the beginning of each calendar quarter, but may meet either more or less frequently depending the business coming to its attention. An emergency meeting will be called in case of a serious accident or violation, concerning a suspension or other modification of the user's permit.

A quorum of three members will be required to grant approvals or to affect disciplinary measures, but proxy votes may be registered with the Chair when a member has had an opportunity to study documentation but is unable to attend a meeting.

## 5. Radiation Safety Officer (RSO)

The **LSUHSC RSO** will:

- Be responsible for the execution of the established policies of radiation protection and safety established by the LSU System broad scope license to LSU and the Radiation Safety Committee, and for insuring compliance with Federal and State regulations.
- Recommend procedures for the construction of working areas, for the protection of individuals, facilities, procurement, safe handling, monitoring, use, and disposal of all radioactive sources.
- Be responsible for periodic radiation survey of all laboratory areas employing a radioactive source at **three** month (quarterly) intervals.
- Be responsible for maintaining records of the survey, as well as personnel exposure records, records of receipt, use, transfers, disposal of all radionuclides, and registration of radiation-producing sources.
- Be notified in case of accidents and will be responsible for the prevention of spread of contamination. Has the authority to temporarily seal off any contaminated work area and suspend experimental work therein.
- Be responsible for the initial response to any accident or violation of regulations regarding the use of radiation sources. All such cases will be referred to the **LSUHSC** Radiation Safety Committee for action.
- Review applications by investigators for the use of radiochemicals in research.
- Review and submit to the **LSUHSC** Radiation Safety Committee grant proposals that involve the non-routine use of radiochemicals and/or radiation-producing apparatus and determine the necessary safety requirements set by the limitations inherent in the facilities.
- Conduct general surveillance of all health-physics activities, including both personnel and environmental monitoring.
- Furnish consulting services to personnel at all levels of responsibility on all aspects of radiation protection.
- Receive, survey, and inventory all radioactive materials coming to or leaving **LSUHSC**.
- Monitor all machines capable of producing penetrating radiation.
- Distribute and process personnel monitoring equipment, including keeping the records of internal and external personnel exposure, and notifying the individuals and their supervisors of exposure, and recommending appropriate remedial action.
- Instruct personnel in proper procedure for the use of radiochemicals.

- Supervise and coordinate the waste disposal program, including the keeping of waste storage and disposal records.
- Perform leak tests on all sealed sources at **six** month intervals or as specified.
- Maintain an inventory of all radiochemicals of **LSUHSC**.
- Supervise the decontamination in cases of contaminating accidents.
- Maintain a continuous program of environmental radiation hazard evaluation and hazard elimination.
- Calibrate all radiation survey instruments at least yearly.

## 6. Requirements for Authorized Use of Radiochemicals

### A. Procedures for obtaining permits

To become an approved user **under** the broad scope license, a completed copy of the [Radiochemical Use Permit Application \(Appendix A\)](#) must be submitted to the Chair of the LSUHSC Radiation Safety Committee for review by the Committee. The headings are guidelines only; therefore, the use of additional sheets is advised if needed.

The applicant must demonstrate by either specific training or extensive experience a competence in the field of radioisotope/radiation techniques, including decontamination procedures, shielding requirements, radiation risks, etc. In addition, the Radiation Safety Committee will also be concerned with the adequacy of the radiation safety procedures for the protection of the University and personnel, and may request an interview. The applicant will be notified in writing by the Radiation Safety Committee when the proposal is approved.

### B. Temporary approval to use isotopes

Upon consultation with the Chair of the Radiation Safety Committee and the Radiation Safety Officer, newly arrived faculty members and/or new faculty users may be given temporary approval to use radioisotopes. The temporary approval will be valid until the Radiation Safety Committee meets to review the applicant's proposal. Each applicant must complete a properly formatted application for radiochemical use for review by the Radiation Safety Committee scheduled meeting. The applicant will be notified in writing by the Radiation Safety Committee when the proposal has been approved.

### C. Appeal process

Persons refused approval have the right to appeal to the Committee or to apply for the use of radioactive material under the supervision of an approved user designated by the Radiation Safety Committee.

### D. Amending permits

Approved users may apply to amend their permit at any time. They may request to add new radiochemical species or increase their approved limits. Amendments should be requested by a memo addressed to the Radiation Safety Committee Chairman, who may temporarily grant approval pending the next committee meeting.

## E. Cancellation of a Radioactive Materials Permit

The Radiation Safety Officer (RSO) must be informed of any intention to terminate a radioactive materials permit if:

- The Principal Investigator (PI) is leaving the University;
- The PI is relocating to an off campus location;
- The PI will no longer use radioactive materials

Contact the RSO 30 days prior to schedule a time for the RSO to perform a laboratory clearance survey. Prior to the clearance survey, the PI will:

- Return all remaining radioactive isotopes and waste to the RSO for disposal;
- Ensure that all personnel have returned their dosimetry badge to RSO;
- Perform a final radiation survey of all laboratory areas, equipment and furniture to ensure that no contamination is present. Report these findings to the RSO in writing

When the RSO completes the laboratory clearance survey, he will provide the PI with written clearance. (See Radiation Material Laboratory Survey Clearance Form, Appendix B)

## 7. Responsibilities of Approved Users

Approved users are responsible for the following:

- A. Observing the rules and recommendations of the Radiation Safety Committee, the Radiation Safety Officer and the requirements of the [Radiation Safety Manual](#) and [LSU](#) Radioactive Material [State](#) License.
- B. Adequate planning: Before an experiment is performed, the approved user should determine the types and amount of radiation or radioactive materials to be used. This will generally give a good indication of the protection required. The procedure must be well outlined. In many cases, before the procedure is actually performed using radiation, it should be rehearsed so as to preclude [mishaps](#) or unexpected circumstances. In any situation where there is appreciable radiation hazard, the Radiation Safety Officer must be consulted before proceeding.
- C. [All users of radiochemicals and employees working in areas containing radiochemicals must participate in the training course offered by the RSO. Furthermore, supervisors will provide additional training to users specific to their operations involving radioisotopes.](#)
- D. Directing, instructing, and observing isotope handling by technical personnel.
- E. Contacting the RSO whenever major changes in operational procedures, new techniques, or alterations in the physical laboratory layout might lead to personnel exposure.
- F. Complying with the regulations governing the use of radiochemicals as established by the LSUHSC Radiation Safety Committee for:
  - Correct procedure for the procurement of radiochemicals by purchase or transfer. ([See Radioactive Material Order Form, Appendix C](#))
  - Posting areas where radiochemicals are kept or used, or where radiation fields may exist.
  - Seeing that each sign carries the name of the personnel currently responsible for the associated area.
  - Recording the receipt, transfer, and disposal of radiochemicals in the area. This includes sealed sources as ion sources in gas chromatographs and internal sources in liquid scintillation counters.
  - Properly packaging, labeling, storing and identifying wastes and assuring that all radiochemical waste materials are consigned to the Radiation Safety Officer for disposal.

- Taking steps to prevent the transfer of radioactive materials to unauthorized individuals. This includes the proper disposition of radiochemicals possessed by personnel who are leaving the University.
  - Updating inventory control sheets on all isotope use for the RSO to review during lab inspections. (See LSUHSC Radionuclide Inventory Form, Appendix D)
  - Providing adequate shielding for all radioactive materials including waste.
- G. Keeping stocks of stored radiochemicals to a minimum within laboratory areas.
- H. Follow the proper termination procedure of the use of a radioisotope lab:
- Complete Radiation Material Laboratory Survey Clearance Form, Appendix B.
  - Forward form to RSO.
  - RSO will then verify all requirements and declassify lab for radioisotope use.
- I. Contacting RSO to insure that a proposed radiochemical use facility meets the proper requirements
- J. New approved users will be on probation for six (6) months. If an infraction of radiation safety is found, the probation period will be extended. If a second such infraction is found, the Committee may consider withdrawal of the permit from the user. If a third infraction is found, it will usually be recommended that the person be removed from the license participation list (i.e. no more radioisotopes can be ordered). Each decision is to be made by the Radiation Safety Committee based on the severity of the infraction. If in the opinion of the Committee any single infraction is severe enough, any such infraction or violation may be sufficient cause for revoking a user's permit.
- K. Investigators may be put on probation for one year if one of the following violations is noted
- Eating/drinking or having eating utensils in a lab designated as a radioactive lab.
  - Not performing or recording wipe tests (during the each isotope use).
- L. It will be necessary for the applicant to participate in formal training or have had five years or more of on the job training to be qualified when applying for an isotope approval.
- M. Users are approved for three year periods. Prior to the end of the third year, the user must submit a request to continue radioisotope use including amendments or changes to the Radiation Safety Committee for approval.

## 8. Laboratory Rules for Use of Radiochemicals

- A. Wear laboratory coats or other protective clothing at all times in areas where radioactive materials are used.
- B. Wear impermeable disposable gloves at all times while handling radiochemicals. It is recommended that users wear double gloves while working with 32P and 125I.
- C. Monitor hands and clothing for contamination after each procedure or before leaving the area.
- D. Do not eat, drink, smoke, or apply cosmetics in any area where radiochemicals are being stored or used.
- E. Do not pipette by mouth.
- F. Personnel monitoring devices (such as Optically Stimulated Luminescence (OSL) badges must be worn, when working with or where, radiochemicals (excluding H<sub>3</sub> or C<sub>14</sub>) are being used. When not being worn to monitor occupational exposures, personnel monitoring devices should be stored in the work place in a designated low-background area.
- G. Do not dispose of radioactive waste with other waste, such as chemicals. Place in separated rad waste containers.
- H. Use plastic backed absorbent paper to cover the work area to absorb radiochemicals in the event of a spill.
- I. Confine radioactive solutions in shielded containers that are clearly labeled. The LSUHSC Radionuclide Inventory Form (Appendix D) provided with each source vial should be properly filled out as to how much activity is left in the vial and what fraction went to liquid or solid waste. This form should be completely filled out and returned when the source vial leaves the approved user's laboratory.
- J. Always transport radioactive material in shielded containers
- K. Always work in a fume hood when working with volatile isotopes (S35 & I125 and I133)
- L. Perform required Radioactive Laboratory Survey and Wipe Test Form (See Appendix E). Wipe tests must be recorded after each isotope use in the lab.
- M. Good Housekeeping Habits:

To reduce the probability of the spread of radioisotope contamination, follow these good housekeeping procedures

  - Keep the laboratory neat and clean.
  - Keep the work area free of equipment and material not required for the immediate procedure.
  - Wash hands and arms thoroughly before handling any object that may contact the mouth, nose, or eyes.

- Monitor the hands whenever contamination is suspected and decontaminate immediately.
  - Keep fingernails short and clean.
  - Do not work with radiochemicals if there is a break in the skin below the wrist unless the wound is so protected that radiochemicals cannot gain access to the body. Cover the break with tape (plastic or adhesive) and wear rubber gloves.
  - Food containers are not permitted in the laboratory. Refrigerators shall not be used jointly for food and radiochemicals.
- N. Radioactive **animal carcass** specimens should be bagged, labeled with the radionuclide, activity in microcuries, date and type of animal and weight. The carcass should be held in a **radiation** labeled freezer until it can be removed by the **RSO**.

## 9. Responsibilities of the Radiation Worker

Each individual at LSUHSC who has any contact with radiochemicals is responsible for:

- A. Keeping their exposure to radiation as low as possible.
- B. Wearing the prescribed monitoring equipment such as OSL badges, ring badges, and dosimeters in radiation areas. Personnel who work only with pure beta emitters having a maximum energy of less than 0.16 MeV will not be required to wear OSL badges.
- C. Wearing assigned OSL badge only at LSUHSC facilities. The OSL badge is not to be worn at other research facilities, clinics, or institutions.
- D. If you are issued a dosimeter badge due to potential exposure at a non-LSUHSC facility (e.g., University Medical Center, Touro, Ochsner) notify the LSUHSC RSO. The LSUHSC RSO will contact the RSO at the non-LSUHSC facility. The RSO at the non-LSUHSC facility will then notify the LSUHSC RSO if the LSUHSC employee exceeds 20% of the applicable regulatory exposure limit.
- E. Surveying in an appropriate manner, hands, shoes, and body for radioactivity, and removing all contamination before leaving the laboratory. Contact the RSO if all of the contamination is not removed.
- F. Never leave a radioactive package unattended.
- G. Never dispose of a box with a radioactive label on it. Boxes must be defaced of all radioactive markings before disposing in the regular waste.
- H. Using all appropriate protective measures such as:
  - Wearing protective clothing whenever contamination is possible and not wearing such clothing outside the laboratory.
  - Wearing gloves and respiratory protection whenever necessary, and discarding them before leaving the work area
  - Using protective barriers and other shields whenever possible (e.g., one cm thick Lucite for protection when using 32p)
  - Using mechanical devices whenever their aid will assist in reducing exposure
  - Performing radioactive work within the confines of an approved area such as a hood or glove box unless it is known that it is safe to work in the open
- I. Recognizing that smoking and eating are prohibited. Wearing protective clothing such as a laboratory coat which was used in an experiment in which radioisotopes were handled to the cafeteria is prohibited. Cooking, eating or drinking utensils (e.g., coffee pots, cups, spoons) are not allowed in labs marked for radiochemicals use or storage.

- J. Maintaining good personal hygiene.
- K. Checking the immediate areas, (e.g., hoods, benches) in which radiochemicals are being used, immediately following each usage, by use of survey meter and/or wipe tests as indicated for the radiochemical in question.
- L. Keeping the laboratory neat and clean. The work area should be free from equipment and materials not required for the immediate procedure. Keep or transport materials in such a manner as to prevent breakage or spillage (double-walled container), and to insure adequate shielding. Whenever practical, keep work surfaces covered with absorbent material, preferably in a stainless steel tray or pan, so as to limit spread and permit the worker to collect spillage in case of accident.
- M. Labeling and isolating radioactive waste and equipment, such as glassware, used in laboratories for radiochemicals. Once used for radioactive substances, equipment should not be used for other work, and shall not be sent from the area to central cleaning facilities, repair shops, or to surplus, until demonstrated to be free of radioactive contamination.
- N. Requesting Radiation Safety supervision of any emergency repair of contaminated equipment in the laboratory by Facility Services personnel or by commercial service contractors. Servicing personnel shall not be permitted to work on equipment in radiation areas without the presence of a member of the laboratory staff to provide specific information.
- O. Reporting accidental inhalation, ingestion, or injury involving radiochemicals to the approved user and the RSO, and carrying out the required corrective measures. The individual will cooperate in any and all attempts to evaluate his/her exposure.
- P. Carrying out decontamination procedures when necessary, and taking the necessary steps to prevent the spread of contamination to other areas.
- Q. Keeping inventory of all isotopes and proper paperwork associated with isotopes delivered to the laboratory. The inventory forms must be maintained and returned to the RSO when the radiochemical leaves the laboratory.

## 10. Personnel Monitoring

### A. Requirement for Monitoring Individuals

Personnel Monitoring is recommended for individuals for whom there is a reasonable probability of exceeding 10% of the occupational dose equivalent limit of 50 mSv/yr (5 rems/yr) in the course of their work. Personnel who work with radiation sources and may exceed 10% of the occupational dose equivalent limit must wear a **OSL personnel-monitoring device** to assess actual exposure during work or as a check against unplanned exposures.

### B. Declared Pregnant Women

**Pregnant females may obtain an additional fetal badge if she notifies the RSO in writing using the Declaration of Pregnancy form, Appendix F. This second personnel-monitoring device will be issued and should be worn at the waist under any protective apron in order to monitor the embryo/fetal radiation dose. Fetal dosimeters will be changed monthly.**

### C. Ring Badges

Any individual eluting a generator, preparing kits, injecting doses of radioisotopes in the millicurie or larger amounts or individuals performing invasive radiological procedures in which the hands of the individual could inadvertently become exposed to direct radiation will be issued a ring badge for extremity (hand) monitoring.

### D. Exchange

Personnel monitoring devices and ring badges will be exchanged at quarterly intervals. All monitoring devices must be returned no later than two weeks after issue of new monitoring devices. New monitoring devices must be worn within two days of issue date.

### E. Issue of Personnel Monitoring Devices and Maintenance of Records

The RSO will issue all personnel monitoring devices and maintain results of quarterly and annual dose summaries for all monitored individuals.

### F. Thyroid Monitoring

Individuals involved in vented operations which use, at any one time, more than 1 millicurie of 125I and/or 131I or laboratory operations involving 0.1 mCi of 125I and/or 131I in an aqueous form should have a thyroid scan performed within 72 hours following a single operation and every **two** weeks if use of these amounts continue.

## 11. Limits for Exposure to Ionizing Radiation

- A. Occupational exposures (annual)
- Effective dose limit.....5,000 mR
  - Dose equivalent limits for issue and organs
    - Lens of eye .....15,000 mR
    - All other (red bone marrow, breast, lung, liver, skin and extremities ..... 50,000 mR
- B. Declared Pregnant Females
- Total dose equivalent limit .....500 mR
  - Dose equivalent limit per month.....50 mR

Exposure limit in labs should not be more than 0.1 mR/m when working with/or around **radiochemicals**. Anything above this reading should be shielded appropriately, decontaminated, or decreased working time should be considered.

## 12. Area Surveys

Wipe test of each laboratory using isotopes shall be performed and recorded after each isotope use. Wipe areas where isotope was used and include such areas where contamination is possible (e.g., floor, refrigerator handles, door handles, etc.). A diagram of each lab should be drawn and labeled according to each area wiped. A copy of the diagram and wipe test results shall be retained by the approved user and made available for review by the RSO. A wipe test or area survey (See Radioactive Material Laboratory Survey and Wipe Test Form, Appendix E) shall be performed at the end of each isotope use.

## 13. Decontamination Procedures

### A. General Considerations

- **Prevent spread of contamination:** The RSO should be called for assistance as soon as possible whenever a spill occurs **exceeding 100uci**. Important factors to consider include spread of radioactive material by personnel (on clothing, shoes, etc.) by air currents (hoods, fans, etc.), and by mopping and other physical activity. To confine a spill, decontaminate the spill from outside toward center.
- **Make a plan:** Successful decontamination calls for planned action. Spur of the moment action or a poorly planned attempt at decontamination can cause more harm than good. The best thing to do after a spill is make a thorough plan of the steps to be taken in the decontamination procedure.
- **Monitoring:** Make full use of instruments and available assistance. Each step of the decontamination should be monitored. When monitoring instruments become contaminated, decontamination of an area is impossible to monitor. Protective clothing, footwear, gloves, and masks should be used as needed.
- **Records:** Complete records should be made of each action. Copies should be sent to the RSO. In spills **exceeding 100 uCi** the RSO will be involved, so a joint report can be filed.
- **Waste disposal:** Provisions must be made for disposal of cleaning solutions and contaminated articles. In some instances, it may be better to dispose of a contaminated article rather than to attempt to decontaminate.

### B. Specific Procedures

- Skin and hands as contaminated areas:
  - Decontaminating agent - mild soap and water or detergent and water. If necessary, follow by soft brush, heavy lather, and tepid water.
  - Remarks - Wash **two or three** minutes and monitor. Do not wash over **three or four** times. Use light pressure with heavy lather. Wash for **two** minutes, three times. Rinse and monitor. Use care not to scratch or erode skin.
  - Maximum permissible levels of contamination
    - Beta-Gamma - Average less than 0.3 mR/hr for each hand surface of 100 cm<sup>2</sup> of skin surface, using survey meter.

- Wounds (cuts and breaks in skin):
  - Decontaminating agent - running tap water. Report to Physician and RSO
  - Remarks - wash wound with large volumes of water. Spread wound to permit flushing action by water
  - Maximum permissible levels of contamination - keep wound contamination as low as possible
- Ingestion by swallowing:
  - Decontaminating agent -immediately induce vomiting. Drink large quantities of liquids to dilute activity.
  - Remarks - urine and fecal analyses will be necessary to determine amount of radionuclides in body.
  - Contact the RSO

## 14. Storage of Radionuclides

All areas where liquid and solid radiochemicals are used and stored shall be locked when not occupied by authorized personnel.

- The storage areas shall be well marked with a "Caution Radioactive Materials" sign, and, if necessary, entrance requirements posted.
- It is important that all stored radioactive samples be clearly labeled at all times with pertinent and accurate information about the contents, including the name of the isotope, its chemical form, quantity and the name of the responsible person.
- Storage sites for large amounts of radiochemical should be as remote from occupied areas as is practical.
- The background radiation in unrestricted areas should be such that individuals continuously present in the area will not receive a dose in excess of two millirems in one hour or will not receive a dose in excess of 100 millirems in seven consecutive days. The whole body exposure in unrestricted areas should be such that any individual will not receive a dose in excess of 0.5 rem in of one calendar year.
- The storage place should be chosen so as to minimize risk from fire.

## 15. Radioactive Waste

- A. Liquid radioactive waste shall not be poured down the drain in the laboratory.
- B. Solid dry radioactive waste shall never be disposed of in standard waste containers to be collected by housekeeping personnel.
- C. All radioactive waste must be placed in appropriate waste containers and held for pick-up and disposal by the RSO.
- D. Waste Containers

To insure that solid and liquid wastes are kept separate, each laboratory generating radiochemical waste must be equipped with containers for solid dry waste and for liquid waste. Request waste containers needed for this purpose and labeled as to the isotopes being used.

- Solid dry waste containers, cardboard boxes with waterproof polyethylene liners shall be obtained from the RSO.
- Plastic carboys or plastic bottles are suitable for storage of liquid wastes and shall be obtained from the RSO. No glass containers are accepted for pick-up. Liquid containers must have securely fitting covers and must be kept closed. In addition, they must be conspicuously marked with the appropriate radiation signs and labeled. Aqueous and organic liquids waste must be kept in separate containers. Individual isotopes shall also be kept in separate containers.
- Small radioactive animals should be placed in the standard polyethylene bags. Larger animals (dogs, etc.) should be placed in double-thickness, large polyethylene bags. If pickup cannot be made within 24 hours of sacrifice of animals, such animal carcasses must be refrigerated or preferably frozen. Some animals may require infusion with formalin depending on the isotopic label. It is the researcher's responsibility to store the animals in a Radiation Safety labeled freezer until pick-up by the RSO.

## E. Waste Pickup

Request for removal of liquid and dry radioactive waste should be made using the [On-Line service request work order system](#). At time of pickup, the investigator must identify the radiochemical, activity of the radionuclide being discarded, and the contents of the dry and liquid waste using the [radiation waste pick-up form](#), (See [Radiation Material Waste Record, Appendix G](#)).

Each container of waste must be labeled with the following information:

- Approved user's name
- Isotope and activity
- Content (i.e.: solid waste, liquid waste, liquid scintillation vials, chemical nature of fluid such as organic or aqueous, etc.)
- Building and room number
- Date
- Radioactivity symbol or tape.

Mixed radiochemical waste presents a hazardous waste disposal challenge problem in that it requires Environmental Health and Safety to address. Contact the RSO for guidance on the disposal of mixed radiochemical waste.

## 16. Radiation Producing Equipment and Areas

Operator's Responsibility. The operator of any radiation producing equipment is responsible for:

- A. Notifying the RSO when new radiation equipment is purchased and installed, or there is any change in the operation or location of a piece of equipment.
- B. Requesting and wearing appropriate monitoring devices. Always wear the assigned monitoring device (e.g., OSL badge) when working with the unit. Whenever protective lead aprons are worn, the body monitor should be worn on the outside of the apron at the neckline. In addition, wrist monitors are to be worn if the unprotected hands and forearms must come in close proximity to a radiation beam.
- C. Keeping exposure as low as possible. The operator must never expose him/herself to the direct radiation beam, and must not stand within six feet of the tube or irradiated target while the unit is in operation unless adequately shielded. Make full use of protective barriers, lead aprons, gloves, and goggles. Contact the RSO prior to deviation from the rules.
- D. Clearing the area of all nonessential personnel. All nonessential personnel must leave the exposure area before the unit is operated. All essential personnel be adequately shielded.
- E. Observing any restrictions on the use of the unit recommended by the RSO.
- F. Adequate dark adaptation. The eyes of the fluoroscopist should be well dark-adapted before use of fluoroscope without image intensifying equipment. Do not increase the output of the unit to compensate for poor dark adaptation.
- G. Using minimum exposure factors. Fluoroscopic work must be performed in the minimum time possible using the lowest dose rate and smallest aperture consistent with clinical requirements.
- H. Visually monitoring tube current and potential of fluoroscopic equipment with image intensifiers at frequent intervals, because under automatic brightness control this variable can rise to high values.
- I. Notifying the approved user and the RSO immediately of any accidental exposures to radiation.
- J. Keeping the unit disconnected or locked when not in use.
- K. Areas in which radiation producing machines are located or are being used shall be posted with the characteristic "CAUTION RADIATION - This equipment produces radiation when energized."
- L. The structural shielding requirements of any new installation or an existing one in which changes are contemplated, shall be reviewed and approved by the RSO.

- M. An annual, scheduled survey of all radiation producing equipment used on patients, except dental machines (every three years), shall be made by the RSO. In addition, radiation surveys will be made of all new installations and all existing installations after every change that might increase the radiation hazard (e.g., replacement of x-ray tube, changes in filtration of a beam).
- N. In the operation of dental units, the operator shall stand not less than twelve feet from the X-ray tube, or step behind an adequate shield.
- O. The hand of the fluoroscopist must never be placed in the useful beam unless the beam is attenuated by the patient and a protective glove of at least 0.25 mm lead equivalent is worn.
- P. Shutter mechanisms and interlocking devices should not be tampered with and should be inspected at frequent intervals to insure proper operation.
- Q. All protective devices that may have become worn due to use or abuse, such as protective lead aprons or gloves, should be inspected annually, or whenever the integrity of the equipment is suspect.
- R. Personnel specifically responsible for such equipment must insure that all workers in the area are monitored in accordance with the requirements for the specific unit.
- S. All interlocks, visual and audible warning devices, and monitoring equipment must be inspected periodically for proper operation by the RSO.

## 17. Appendices

- A. Radiochemical Use Permit Application
- B. Radiation Material Laboratory Survey Clearance Form
- C. Radioactive Material Order Form
- D. LSUHSC Radionuclide Inventory Form
- E. Radioactive Material Laboratory Survey and Wipe Test Form
- F. Declaration Of Pregnancy
- G. Radioactive Material Waste Record

## RADIOCHEMICAL USE PERMIT APPLICATION

**INSTRUCTIONS:** You can fill in this ADOBE Form by tabbing to the various sections. If you do not use Adobe to fill in the form, it must be typed. Return the completed form to Radiation Safety Committee Chairman, Dr. Dennis Paul, Department of Pharmacology, Campus Mail Box # P7-1, Medical Education Building, LSUHSC. Any section that is not applicable to your project should be marked "*Not applicable.*" Do not leave any section blank. If you need assistance in completing this form, call 568-6585 and ask to speak to the Radiation Safety Officer.

<b>Applicant's Name:</b>	
<b>Department:</b>	<b>Building:</b>
<b>TelephoneNumber(s):</b>	<b>E-mail:</b>

**1. List all radiochemicals to be used, the chemical form (e.g. <sup>3</sup>H-thymidine, etc) of each, and the maximum amount (in microCuries [ $\mu$ Ci] or milliCuries [mCi]) which you will have in your laboratory at any one time. Also, estimate the total amount of each isotope to be ordered during your three-year license approval.**

Radiochemical(s)/chemical form (e.g., <sup>3</sup> H-thymidine, etc.)	Maximum amount to be on hand at any one time	Estimated amount to be ordered for 3 years

**2. List the applicant's qualifications for radiochemical use. (Specify experience [dates] and formal training of the applicant in radiochemical use.)**

**3. Describe how radiochemicals will be used in experiments with emphasis on waste disposal. Limit to 300 words or less. (Example: After oligonucleotide labeling with  $^{32}\text{P}$ , the unincorporated radiochemical will be collected in a liquid waste vessel for disposal. Solids such as towels, pipettor tips, syringes, needles, plastic bags, etc. which come in contact with  $^{32}\text{P}$  will be bagged, labeled, and disposed of in the appropriate solid waste container for pickup by the Radiation Safety Officer.)**

**4. List all other individuals under your supervision who will handle radiochemicals.**

Name	Title

**5. Location of Radiochemical Storage (Building & Room #):**

**6. Method of Chemical Storage:**

**7. Location of Radiochemicals Use if Different from Storage Room:**

**8. Safety procedures for individuals working with radiochemicals and safety equipment that will be used (e.g., hood, shield, gloves):**

**9. Method of monitoring work areas for contamination, (wipe tests, Geiger counter) for each radiochemical:**

**If Radiochemicals Will Be Used in Animals in This Project Complete A, B & C.**

- A. Has the appropriate institutional review form been filed with the Institutional Animal Care and Use Committee (IACUC)?**
- B. List species (e.g., mouse, rat, etc.) of animal and the approximate number that will be disposed of weekly/monthly.**
- C. List the approximate amount of radiochemical per animal and where animals will be housed during the experiments.**

**CERTIFICATE**

The applicant certifies that he/she and appropriately trained co-investigators, fellows, students, and technicians, etc. will comply with the UNIVERSITY BROAD SCOPE RADIOACTIVE MATERIAL LICENSE requirements and regulations published in the LSUHSC-NO Radiation Safety Manual and that the project will be conducted as described herein and that there will be no use of radioisotopes in humans. Approvals are granted for 3 years.

<b>Name of Applicant:</b>	<b>Signature:</b>	<b>Date:</b>
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**DEPARTMENTAL AUTHORIZATION**

**I acknowledge that the department will be responsible for notifying the Radiation Safety Officer regarding disposal of radiochemicals remaining after departure of the above-named faculty member.**

<b>Signature of Department Chairman:</b>	<b>Date:</b>
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**FOR RADIATION SAFETY OFFICE USE ONLY**

<b>APPROVED:</b> <input type="checkbox"/> YES <input type="checkbox"/> NO	<b>APPROVAL NUMBER:</b>
<b>SIGNATURE:</b>	<b>DATE:</b>

**Radiation Material Laboratory Survey Clearance Form**

PI \_\_\_\_\_ Bld/Lab # \_\_\_\_\_ Date \_\_\_\_\_

Yes   No

- All Radiation materials and waste have been picked up.
- All Radiation Labels have been removed from equipment and lab doors.
- Survey/Wipe test have been performed and results (attached) indicate no radiation contamination exists. (2x background and/or 1000 DPM)
- All radiation dosimetry badges have been returned to RSO.

Equipment used for survey/wipe test results:

Handheld Survey Meter: \_\_\_\_\_

Last Cal date: \_\_\_\_\_

Scintillation Machine: \_\_\_\_\_

Last Cal date: \_\_\_\_\_

I have inspected/verified and release this lab room and equipment for non-radiation use.

Radiation Safety Officer \_\_\_\_\_

Date: \_\_\_\_\_

## Radioactive Material Order Form

### Auxiliary Enterprises



### Medical Center Stores

#### Radioactive Material Order Form

Date: \_\_\_\_\_

Company: \_\_\_\_\_

Catalog: \_\_\_\_\_

Isotope: \_\_\_\_\_

Amount: \_\_\_\_\_ Cost: \_\_\_\_\_

Do you need a special lot# or specific activity? \_\_\_\_\_

Permit holder: \_\_\_\_\_

Ordered by: \_\_\_\_\_

Phone: \_\_\_\_\_

Acct. Name: \_\_\_\_\_

Acct. #: \_\_\_\_\_

Dept: \_\_\_\_\_ Bldg: \_\_\_\_\_

Day/Date Needed: \_\_\_\_\_ Date Ordered: \_\_\_\_\_ Arrival Date: \_\_\_\_\_

RSO Approval \_\_\_\_\_

All Information Must be filled in at the time the order is taken

Medical Stores phone: 504-568-8334



## **LSUHSC Radionuclide Inventory Form Instructions**

**1. Vial No.**

Each source vial is assigned a number by the Radiation Safety Officer upon arrival at LSUHSC. This assigned number will be the tracking number during use, storage and disposal from your lab.

**2. Date Received**

The date the source vial or radioactive material was received by the Radiation Safety Office.

**3. Storage Location**

The laboratory/room number and building name.

**4. Radionuclide**

The symbol of the isotope; (P32, S35, I125, H3, ex...) chemical name; (Methionine, ATP, DCTP, etc.) and Amount activity; (*u* Ci or *m*Ci).

**5. Permit Holder**

The name of the licensed permit holder under whose authority this radioactive material was ordered.

**6. Department of permit holder**

7. **Reference Date** is the ASSAY DATE of the isotope

**8. Vial Container - CPM**

Survey the colored plastic outer Vial with a wipe test and write down CPM

**Isotope Vial - CPM**

Survey the inner isotope vial with a wipe test and write down CPM

**9. Background Survey - CPM**

Perform a background survey outside of the lab in a non radioactive area. Take a wipe test and compare the results in CPM to the Vial Container and Isotope Vial CPM, if contamination of either is 3 times greater than background notify Radiation Safety Officer at 568-6585.

**10. Amount Used - (*u*Ci or ml)**

Amount of radioactivity or volume remaining in source vial at each entry. The user should consider the decay factor of the specific nuclide when completing this column for radioactivity. (Example: If you have a 250 *u*Ci of P-32 isotope with an assay date of 1/1/2004 and you used half of that total volume on that date you would have 125 *u*Ci Left. Or if you had 10ml volume you would have 5 ml volume that day left. Remember if you are using activity values you need to figure out decay factors.)

**11. Balance**

The total amount of radioactivity or volume remaining in the source vial. The user should consider the decay factor when listing the entry in this column.

**12. Date used**

The date any quantity is removed from source vial.

**13. User's name**

The name of each person removing radioactivity from the source vial.

**14. Amount Disposed**

Radioactive waste discarded and stored within the lab, which was generated from the amount listed in the "Amount Used (*u*Ci or ml)" column.

**15. Disposal Form: L/D/V/C**

List from the following options; L = liquid; D = dry solids; V = scintillation vial cocktails and other liquids; C = animal carcasses (LIST KIND AND QUANTITY)

## Radioactive Material Laboratory Survey and Wipe Test Form

PI: \_\_\_\_\_ Department: \_\_\_\_\_ Building & Lab #: \_\_\_\_\_

Gamma Counter - Manufacturer/Model/Serial #: \_\_\_\_\_

LSC - Manufacturer/Model/Serial #: \_\_\_\_\_

Note: LSC must be used to protect H<sub>2</sub> & C<sub>14</sub>.

Survey Meter - Manufacturer/Model/Serial # \_\_\_\_\_

Background: \_\_\_\_\_ mR/Hr or cpm Battery Check: \_\_\_\_\_ Calibration Date: \_\_\_\_\_

Counter Information Type (Check one)  gamma counter or  LSC:

Isotopes used in Lab: (Check all that apply)

C-14  Ch-51  H-3  P-32  I-125  S-35  \_\_\_\_\_

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

Rewipe of # \_\_\_\_\_ Rewipe of # \_\_\_\_\_

**(\* Results should read less than twice background in cpm.)**

Inform the Radiation Safety Officer if it exceeds this amount.

(Contaminated areas must be decontaminated immediately and documented)

Performed By: \_\_\_\_\_

Date: \_\_\_\_\_



**DECLARATION OF PREGNANCY**

In accordance with Title 10 of the Code of Federal Regulations, Part 20, I hereby declare my pregnancy to the LSUHSC-NO Radiation Safety Officer (RSO). This declaration authorizes RSO to evaluate the dose received by the embryo/fetus from my occupational exposure to ionizing radiation and to assist me in limiting that dose to 0.5 rem (500 mrem). I understand that this limit is intended to provide an extra measure of protection for the embryo/fetus since it may be more sensitive to ionizing radiation than an adult. The 0.5 rem limit will be applied from the estimated date of conception, \_\_\_\_\_, until the end of the pregnancy. I will comply with any restrictions imposed on my use of ionizing radiation by the RSO in order to meet this limit. If I am not contacted within five work days of when this form should have been received by the RSO, I will notify Environmental Health and Safety by calling (504) 568-6585.

**(NOTE: this form should be completed, printed and signed)**

\_\_\_\_\_  
Name (printed) Phone Number

\_\_\_\_\_  
Social Security Number Date of Birth

\_\_\_\_\_  
Work Location Mailing Address

\_\_\_\_\_  
Signature Date

Send in envelope marked "Confidential" to:  
LSUHSC-NO Radiation Safety Officer  
Stanislaus Hall, Room 216

Privacy Act Statement: The information requested on this form is essential for maintenance of records for individuals potentially exposed to ionizing radiation, as required by the Code of Federal Regulations, Title 10, Part 20. Certain information is protected by the Privacy Act of 1974. The primary users of this information are the Radiation Safety Officer, LSUHSC-NO. "Routine Uses" may also include disclosure of some information provided on this form to the U.S. Nuclear Regulatory Commission or if necessary to defend the Government or an employee of LSUHSC-NO in a lawsuit.

# RADIOACTIVE MATERIAL WASTE RECORD

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\_\_\_\_\_  
Permit Holder

\_\_\_\_\_  
Room No. /Bldg. /Tel.No.

\_\_\_\_\_  
Radionuclide /Activity /Date

Waste Type: (Circle One)

DRY SOLIDS

LSC in VIALS

\_\_\_\_\_  
Name of Cocktail

BULK LIQUID

ANIMAL CARCASSES

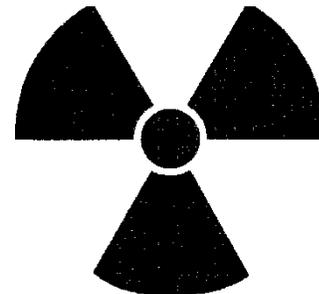
If Bulk Liquid: Aqueous or Organic?

(circle one)

If Organic, list contents:

\_\_\_\_\_  
\_\_\_\_\_

**CAUTION**



**RADIOACTIVE  
MATERIAL**

EH&S DEPT USE ONLY:

\_\_\_\_\_  
Date removed from LAB

\_\_\_\_\_  
Date removed form LSUHSC

\_\_\_\_\_  
Method of removal