

SECTION 3

PROCEDURES

3.1 INTRODUCTION

The specific procedures required for the proper control of radioactive materials and radiation sources at Louisiana State University and Agricultural & Mechanical College (LSU) are described in this section. Questions concerning these procedures should be directed to the Radiation Safety Office.

3.2 GRANT AND CONTRACT PROPOSALS

All proposals involving the use of radioactive materials or radiation sources must be routed through the Radiation Safety Office prior to submission to the Office of Sponsored Program. Only the Campus Radiation Safety Officer or the Assistant Radiation Safety Officer are routinely authorized to approve such applications. At times when both the Campus Radiation Safety Officer and the Assistant Radiation Safety Officer are off-campus, the Chairperson of the Campus Radiation Safety Committee shall act as the approving authority. If the Radiation Safety Committee Chairperson is also unavailable, individual committee members may elect to approve a proposal at their discretion. This should ordinarily be done only during an "urgent" grant proposal to meet the submission deadline. When approval is by other than the Campus Radiation Safety Officer, the originator of the proposal shall forward a copy of the approval form and proposal abstract to the Radiation Safety Office.

The Campus Radiation Safety Officer conducts reviews of proposals for their radiological safety content only. This review must be completed before the signature of the Committing Authority can be obtained. The Campus Radiation Safety Committee may ask to review any proposal or be asked to review proposals by the Campus Radiation Safety Officer.

3.3 USER APPLICATIONS

Individuals who wish to use radiation sources or radioactive materials in research, development, teaching, or demonstration projects must obtain prior approval from the Campus Radiation Safety Committee. The Committee has delegated this authority to the Campus Radiation Safety Officer. For unusual or new projects the Campus Radiation Safety Officer may request review and approval by the Campus Radiation Safety Committee. Request shall be by completion and submission of a User Application to the Radiation Safety Office. Users shall be notified of project approval, in writing, from either the Campus Radiation Safety Officer or the Chairperson of the Campus Radiation Safety Committee. Approval will be granted for a three-year period supposing no change has been made from the original application, after which a renewal approval becomes necessary.

User Application Forms (see Exhibit 3-1) may be downloaded from the Radiation Safety Office home page (see www.radsafety.lsu.edu). The Application Form requires the date submitted, descriptive title, user's name, department, college, user's social security number, e-mail address, and a general description of the procedures involving the use of sources of radiation. **NOTE:** This description should be general enough to cover most anticipated uses. The applicant must also supply information about his/her training and work experience in handling radiation sources and radioactive materials. The applicant's qualifications must be commensurate with the planned use of sources of radiation.

SECTION 3

PROCEDURES

User approvals are only issued to principal investigators (faculty, or persons deemed qualified by the Radiation Safety Office). It is the principal investigator's responsibility to provide proof to the Campus Radiation Safety Officer of radiation safety training for all persons involved with radiation related activities under his/her control (see Section 3.4: Training).

Radionuclides or radiation sources and their proposed uses required for the project must be sufficiently described to permit an adequate radiological safety assessment. The use of radiation producing equipment requires separate registration by the Louisiana Department of Environmental Quality. List the total activity of each radionuclide that the user anticipates ordering at any one time and the total activity of each radionuclide that the user expects to possess on hand at any one time on the User Application Form.

Each location where radioactive materials or radiation sources are to be employed and/or stored during the course of the project must be specified. This information is required in order that the Campus Radiation Safety Officer can ensure that the sites conform to the University's radioactive materials license. The Campus Radiation Safety Officer is also required to inspect the specified locations to ascertain that the proposed use of sources of radiation is consistent with all applicable license specifications, state and federal regulations, and University rules and policies.

Indicate the proposed start and end dates for the project in the space provided. All approvals shall expire three years from the approval date, unless the user has indicated an earlier closing date for the project.

Attach a project outline with the User Application Form detailing operational parameters of importance to radiological safety assessment. Standard laboratory practice for handling radioactive materials can be assumed, but deviations from standard practice must be described. Waste handling plans must also be described in detail.

Once the application package is completed, it is to be transmitted to the Radiation Safety Office for review. This review may include discussions with the applicant and site visits, with specific suggestions for revision of the application. It is the Campus Radiation Safety Officer's responsibility to assure that the application meets all regulatory standards. Review of User Applications by the Campus Radiation Safety Officer is limited only to matters of radiological safety.

3.4 TRAINING

The Campus Radiation Safety Officer shall maintain a list of all persons who have been certified and trained in radiation safety commensurate with their radiation exposure potential. Certification of training shall be one of the following:

- a. Faculty by credentials submitted with the User Application;

SECTION 3

PROCEDURES

- b. Certification submitted, in writing, from the principal investigator that the person is trained in radiation safety and that he/she has read and understand his/her responsibilities as defined in the Campus Radiation Safety Manual; or
- c. By completing the online course offered by the Radiation Safety Office (see www.radsafety.lsu.edu) and passing a subsequent examination.

The Campus Radiation Safety Officer may require the person involved in radiation activities to take the online course offered by the Radiation Safety Office as it is deemed necessary.

In addition to the standard radiation safety training each approved user is required to provide annual in-laboratory training to all persons assigned to or who frequent their laboratories. The following topics shall be covered, but not limited to.

- No eating and drinking (section 5.2)
- Security of radioactive materials (section 3.11 and 3.12)
- Proper waste disposal (section 3.9)
- Laboratory emergencies involving radioactive materials (section 6)

Such training shall be documented in a timely manner and filed in the laboratory for future inspections.

3.5 RADIONUCLIDE ORDERS

Only principal investigators may authorize to order radionuclides. Radioactive materials are ordered just as any other materials or supplies with the proviso that the shipment is to be made to the physical address of the Radiation Safety Office. When radioactive materials are ordered, the individual ordering should notify the Radiation Safety Office as to what and how much is being ordered along with the name of the vendor. The purpose of this notification is to ensure that the shipments are properly processed and available to the user in a timely fashion. When ordering radioactive materials the following information shall be provided to the vendor:

Ship to: Radiation Safety Office
112 Nuclear Science Building
South Campus Drive
Louisiana State University
Baton Rouge, LA 70803-5820

Billing address and name of the principal investigator ordering must appear on the mailing/packaging slip.

SECTION 3

PROCEDURES

3.6 DELIVERY OF RADIOACTIVE MATERIALS

All radioactive materials destined for LSU AND Pennington Biomedical Research Center shall be delivered directly to the Radiation Safety Office. There are only four allowed exceptions to this requirement:

- a. By prior approval of the Campus Radiation Safety Officer, a user may be permitted to retrieve a very-short-lived (less than 24-hour half-life) radionuclide shipment directly from the carrier;
- b. By prior approval of the Campus Radiation Safety Officer, large pieces of equipment containing radioactive materials may be delivered directly to the building where they are to be installed;
- c. By prior approval of the Campus Radiation Safety Officer, no more than 10 μCi of ^3H , ^{125}I , or ^{131}I in RIA kits may be delivered directly to the user. A log of receipt and use of kits shall be maintained and submitted to the Radiation Safety Office periodically; and
- d. Liquid scintillation standard of ^3H or ^{14}C and sealed check source whose activity is less than 10 μCi .

With the exception of RIA kits, the Radiation Safety Office must be notified promptly upon arrival of the radioactive materials so that proper inventory and receiving procedures can be completed.

All other radioactive materials are delivered to the Radiation Safety Office to ensure adequate inventory control through the completion of the Disbursement and Inventory Log Form (see Exhibit 3-2) and to ensure proper initial radiation monitoring of packages. State regulations require that the University be able to verify at any time the total quantities of radioactive materials on hand and to show an inspector the physical location of each shipment or prove that it has been properly removed or shipped for disposal. Monitoring packages before distributing them to individual users is required to prevent release of material from broken or otherwise contaminated containers and to permit notifying end-user of excessive radiation levels in order to ensure extra care when the packages are handled.

After the inventory form and package monitoring have been completed, the principal investigator who ordered the radioactive materials will be notified by telephone that the material is available for disbursement.

The inventory form to be issued by the Radiation Safety Office consists of a cover sheet given to the user at the time of disbursement and a duplicate inventory card for internal records that is maintained by the Radiation Safety Office. The duplicate inventory card, which provides space for detailed inventory information is filed according to a serially assigned number when the shipment is received. This serial number identifies the radioactive material during its usage and storage on the campus.

SECTION 3

PROCEDURES

3.7 RECEIVING AND MONITORING OF SHIPMENTS

For the purpose of receiving and monitoring isotope shipments, a "qualified" staff member shall be any person employed by the Radiation Safety Office who is authorized by the Campus Radiation Safety Officer to inspect and log-in radioactive packages. A "senior" health physics staff member shall be someone employed by the Radiation Safety Office who is recognized by the Campus Radiation Safety Officer as competent in the field of health physics.

A qualified staff member shall wear latex or vinyl gloves, laboratory coat, and safety glasses at all times during the inspection and opening of any package known or suspected to contain radioactive materials.

All radioactive isotope packages are required to be received and inspected at the Radiation Safety Office, by a qualified staff member, before release to the approved users. Exceptions to this procedure require prior approval by the Campus Radiation Safety Officer. All shipments received by the Radiation Safety Office will be inspected for leakage, breakage, or defective packaging within three hours of receipt.

If the package is affixed with a WHITE I, YELLOW II, OR YELLOW III label, the staff member inspecting the package will measure the external dosage rate at the surface of the package before opening the packaging using a meter suitable for quantitative measurement of beta and gamma radiation levels. If the penetrating exposure rate is greater than 10 mR/hr at the surface of the package, the staff member will alert a senior health physics staff member before opening the package. Such a package will be opened and inspected only by or directly under the supervision of a senior health physics staff member as stipulated above. Such packages will be opened and inspected only in an approved fume hood and/or area with appropriate shielding intervening between the source and personnel. The outside of **All** packages affixed with a WHITE I, YELLOW II, OR YELLOW III label will be tested for external contamination by means of a smear test. The smear will be measured with the appropriate instrument in order to determine surface contamination levels. The package will not be released from the Radiation Safety Office if contamination levels greater than 2,200 dpm of beta and gamma total or 220 dpm of alpha per 100 cm² are detected. In addition, if these limits are found to have been exceeded, the Radiation Safety Office must notify the final delivery carrier and the Louisiana Department of Environmental Quality by telephone or facsimile.

If the radioactive material is in a special form (sealed source), a contamination smear will be taken from the outer surface of the encapsulation and measured with an appropriate instrument in order to determine surface contamination levels. The package will not be released from the Radiation Safety Office if contamination levels are greater than 185 Bq (0.005 μ Ci) of removable contamination. If this limit is found to have been exceeded, the Radiation Safety Office must notify the final delivery carrier and the Louisiana Department of Environmental Quality by telephone or facsimile.

Once it is determined that an isotope package is suitable for release, it will be logged in. The log-in procedure checks whether or not the user is approved for the specific isotope and activity as well as assigns a unique serial number to the isotope shipment for tracking purposes. If the potential end user is not approved for a particular shipment for any reason, the shipment will be held at the Radiation Safety Office until proper approval is obtained from the Campus Radiation Safety Officer. If the isotope

SECTION 3

PROCEDURES

shipment meets all of the requirements for release discussed in this section, the assigned serial number will be inscribed with indelible ink on the innermost container, which actually contains the radioactive material. In the case of a sealed source, a preprinted tag bearing the assigned serial number will be attached to the outer casing or housing of the sealed source. The shipment will be recorded on the master log and the approved user will be notified that it is ready for pickup.

Additional information kept on record concerning each isotope includes the purchase order number, date of receipt, reference date, physical and chemical form of the isotope, activity, volume or weight, specific concentration, manufacturer, and the name of the person who inspected the package.

3.8 RADIONUCLIDE DISBURSEMENT

Upon being notified of the arrival of radioactive material, the user who originated the order may pick it up from the Radiation Safety Office or may send a trained member of his/her staff. At the time of transfer, the individual who receives the radionuclide must sign for receipt of the material. **NOTE:** Radioactive materials which must be transported on a public thoroughfare must comply with Department of Transportation regulations. This is accomplished by completing a shipping form. At this time (2005) this includes disbursements to the School of Veterinary Medicine, the Pennington Biomedical Research Center, and the Louisiana Universities Marine Consortium.

When the radioactive material is transferred to the user, the cover sheet of the inventory form shall accompany the material. The user is required to maintain on this sheet a cumulative up-to-date record of withdrawals from and ultimate disposition of the material. When the material has been completely used and disposed of, the disposition of the source shall be noted and the completed cover sheet shall be returned to the Radiation Safety Office. Only the principal investigator shall sign "Disposition Certified by" as in Exhibit 3-5.

3.9 WASTE HANDLING PROCEDURES

State regulations as well as the University's radioactive materials license impose severe restrictions on waste disposal methods. **NOTE:** Waste that is classified as biohazardous must be certified bionutralized before packaging as radioactive waste.

For this reason, waste disposal is centralized through the Radiation Safety Office. Exceptions to this policy are specifically and individually considered.

3.9.1 Classification of Waste Materials

Waste materials can be generally classified as:

- a. Miscellaneous solid waste (glassware, paper towels, dissecting instruments, gloves, etc.);

SECTION 3

PROCEDURES

- b. Major aqueous waste solutions (reaction solutions, primary dilutions of stock solutions, residual stock solutions, etc.);
- c. Minor aqueous waste solutions (third rinses from glassware, radioactively decayed solutions containing less than microcurie amounts of activity, etc.);
- d. Major organic waste solutions (see b. above);
- e. Minor organic waste solutions (see c. above and liquid scintillation counting solutions);
- f. Animal carcasses;
- g. Animal excreta, botanical wastes, bedding; and
- h. Permanently contaminated equipment.

3.9.2 Disposal of Potentially Contaminated Items

It is incumbent on the person working with radioactive materials to assure that all waste is discarded properly. This means that unless it is known otherwise, all items in a radiation laboratory are to be considered contaminated. Such items shall be surveyed prior to disposal as uncontrolled released.

3.9.3 Storage and Labeling

Wastes in radiation laboratories shall be stored only in approved and appropriately labeled containers. **NOTE:** Any container which could be mistaken for a container for ordinary trash will not be approved. Waste shall be segregated by solid, aqueous liquid, organic liquid, and animal carcasses, excreta and bedding. Radioisotopes with half-lives greater than 100 days may be combined provided no chemical hazard is created. Radioisotopes with shorter half-lives shall be stored separately. Radioisotope waste with half-lives of no more than 36 days may be held in the laboratory for decay. Each container of waste shall have a label to indicate the isotope(s), total quantity in millicuries, and the date the material was placed in the container.

3.9.4 Waste Packaging

To ensure that radioactive waste can be handled in a safe and efficient manner the following is required of the generator:

- a. Do not mix solid and liquid waste. If it is determined that waste has been mixed it will be returned to the generator for separation.
- b. Remove all radioactive labels from short half-life waste that is to be held for decay.

SECTION 3

PROCEDURES

- c. Store bulk liquid waste in containers provided by or approved by the Radiation Safety Office. Waste in unapproved containers will not be picked up. **NEVER USE BREAKABLE GLASS CONTAINERS.** The generator will be required to transfer the waste to an approved container.
- d. Affix a completed radioactive waste tag to each box, bag, or container of the radioactive waste (see Exhibits 3-3 and 3-4).
- e. For certification of final disposition complete the lower portion of the Disbursement and Inventory Log Form (Exhibit 3-5) and return the form to the Radiation Safety Office. This form must be signed by the principal investigator.

3.9.5 Waste Pick-Up

The Radiation Safety Office will schedule radioactive waste pickups from the generating laboratories on a routine basis. By prior arrangement, waste may be brought to the Radiation Safety Office.

3.9.6 Disposal

Waste will be disposed of in one of the following manners:

- a. **INCINERATED:** Disposal by incineration is the preferred method of disposal when incinerator facilities are available. **NOTE:** Sealed sources and large pieces of glass and metal shall be segregated from other dry waste.
- b. **SHIPPED TO A RADIOACTIVE WASTE DISPOSAL SITE:** Solid and organic liquid radioactive wastes with half-lives greater than 100 days will be disposed of in this manner. Cost of disposal will be borne by the generator.
- c. **HELD FOR DECAY:** Radioactive wastes (solid and organic liquid) and radioactive animal carcasses with half-lives of less than 100 days will generally be disposed in this manner. After being held for 10 half-lives, the material may be disposed of as ordinary waste. **NOTE:** Prior to disposal as ordinary waste all containers shall be surveyed to confirm that the radioactive material has decayed. **EXCEPTION:** Animal carcasses and tissues must be disposed of in accordance with any additional regulations pertaining to such materials. **NOTE:** Radiation labels shall be removed before placing this type of waste into a radioactive waste container. **NOTE:** One of the conditions of the broad-scope license is that radioactive waste with a half-life of greater than 36 days must be held for decay exclusively by the Radiation Safety Office.
- d. **DUMPED TO THE SANITARY SEWER:** Water soluble radioactive waste which does not contain hazardous chemicals and metals, i.e., aqueous liquids can be disposed of in the sanitary sewer. The concentration of the radioactive waste and total millicurie quantity

SECTION 3

PROCEDURES

disposed per year is governed by state regulations. **NOTE:** Prior to disposing of radioactive waste in this manner the generator shall inform the Radiation Safety Office to assure that the concentration and annual quantity released to sanitary sewer are not being exceeded.

- e. DESIGNATED AS HAZARDOUS NON-RADIOACTIVE WASTE: Organic scintillation medium or animal tissue containing 0.05 μCi of ^3H , ^{14}C , or ^{125}I or less per mL or gram of material may be disposed of as hazardous waste provided the applicable regulations for the chemicals are followed.

Disposal of radioisotopes by any of these methods requires that permanent auditable records of the amount of disposed material be kept in the generator's office or laboratory. It is the user's responsibility to keep a record of the source serial number from which the waste was generated and the amount generated.

3.9.7 Disposal Fees

All costs of the disposal of radioactive waste shall be the responsibility of the generator (approved user).

3.10 TRANSFER AND SHIPMENT OF RADIOACTIVE MATERIALS

Federal and state regulations restrict the transfer of radioactive materials to persons and institutions holding valid radioactive materials licenses. A copy of the receiver's radioactive materials license must be provided to the Campus Radiation Safety Officer before the shipment or transfer can be authorized.

The Radiation Safety Office will assist in the transfer, including providing specific information on packaging and labeling packages for shipment and giving advice on acceptable shipment methods, applicable regulations, and restrictions. The department from which the shipment originates shall incur the cost of the transfer. Permanent records of transfers are maintained in the Radiation Safety Office. When particularly hazardous shipments are received or sent, records of personnel exposures, shipping-cask smears, and other pertinent information are maintained in the Radiation Safety Office.

3.11 STORAGE OF RADIOACTIVE MATERIALS

Individual users are expected to keep on hand in their laboratories only those radioactive materials that are actively in use or those that they feel must remain in their possession. The intent of this policy is to reduce as far as possible the number of places on campus where the security of radiological materials might be jeopardized in emergencies such as fires or explosions. Space is available at the Radiation Safety Office for storage of radioactive materials that users wish to keep but are not actively using.

All storage locations must be posted with approved radiation warning signs, which are available from the Radiation Safety Office. Quantities of radioactive material above those limits listed in Table 1 shall be

SECTION 3

PROCEDURES

secured to prevent removal or unauthorized use. Security may be accomplished in the following manners:

- a person assigned to the laboratory being physically present in the laboratory
- the laboratory locked
- all radioactive materials locked in a cabinet, refrigerator, or freezer
- all radioactive material locked in a properly labeled box of minimum dimensions of 4×6×6 inches
- any radiation producing equipment with an on/off key shall have the key removed and be properly safe-guarded
- sealed sources in portable instruments such as moisture gauges shall be secured by locking or surveillance
- sealed sources in instruments such as ⁶³Ni electron capture detectors will be considered secure as long as the instrument is not portable

Other methods of security may be approved by the Campus Radiation Safety Committee on request from an authorized user.

TABLE 1
TOTAL LABORATORY QUANTITIES REQUIRING SECURITY

ISOTOPE*	MICROCURIES
³ H	1000
¹⁴ C	100
³² P	10
³⁵ S	100
⁴⁵ Ca	10
⁵¹ Cr	1000
¹²⁵ I	1

(*) for isotopes other than those listed above, contact the Radiation Safety Office.

Storage or the consumption of food, beverages, tobacco products, or storage of eating utensils in areas approved for the use or storage of radioactive materials is prohibited. On request by an approved user to the Campus Radiation Safety Officer, exceptions may be made in situations where radiation safety is not compromised. In these cases the area shall be posted as a non-radiation area. Routine house-hold items used in the research laboratory (e.g. casserole dishes, can openers, spatulas spoons) must be labeled not for human consumption of food. Normal food stuffs (e.g. sugar, cornmeal, molasses, powdered milk, etc) used for laboratory rearing of laboratory animals (e.g. fruit flies, etc) must be marked "Not for human consumption."

SECTION 3

PROCEDURES

Part of the Nuclear Science Building is used for long-term storage of small quantities of radionuclides and for storage of all intense radiation sources that are not permanently installed in separate locations. The storage facility is under direct supervision of the Campus Radiation Safety Office, from which permission must be obtained to access or remove radioactive materials and radiation sources.

3.12 RADIOACTIVE MATERIALS ACCOUNTABILITY

The University is required by the terms of its radioactive materials license and by state regulations to be able to account for all radioactive materials under its control. Records of receipt, disbursement, transfer, and ultimate disposal of radioactive materials are maintained in the Radiation Safety Office, as described in preceding sections of this manual. Records in the Radiation Safety Office must reflect known locations and known users.

Individual users must keep current up-to-date internal records of the radioactive materials they received from the Radiation Safety Office, how the radioactive materials are used, what the current activity of each individual bottle or vial is, and what material has been returned to the Radiation Safety Office. These records need not be highly formal nor extremely detailed, but they must provide the necessary up-to-date information when requested by the Radiation Safety Office. Periodically, the Radiation Safety Office will ask each user to conduct physical inventories of their radioactive materials and to certify that the records are in agreement with those of the Radiation Safety Office.

Transfer of radioactive material between approved users requires prior approval of the Radiation Safety Office. Radioactive material may be used and stored only in rooms previously approved by the Radiation Safety Office. Certain specified radioactive materials on loan from the federal government require additional accountability procedures, which are the responsibility of the Radiation Safety Office.

3.13 REGISTRATION OF MACHINES PRODUCING IONIZING RADIATION

Regulations of the Louisiana Department of Environmental Quality require that all equipment that produces ionizing radiation (unless specifically exempted by the regulations) must be registered with that department, which then issues a certificate of registration to the owner of the equipment. The certificate must be posted on or near the machine. The Radiation Safety Office has the responsibility for submitting registration applications.

Machine sources included under the registration requirement include diagnostic x-ray machines of all classes (e.g. field-portable, fluoroscopic, special-procedures, panoramic-dental, crystological, etc.), therapeutic x-ray machines of all classes (e.g. deep-therapy, superficial-therapy, supervoltage, etc.), industrial x-ray units, analytical instruments (e.g. diffraction, fluorescence, etc.), and accelerators (e.g. synchrotron, cyclotron, electron-therapy systems, etc.).

Although the Radiation Safety Office has the responsibility of completing registration forms, it is incumbent upon individuals initiating purchase of radiation producing equipment to notify the Radiation Safety Office of the arrival of such equipment. Such purchases must have been approved previously by

SECTION 3

PROCEDURES

the Campus Radiation Safety Officer or the Campus Radiation Safety Committee via a User Application. When a radiation producing machine is moved to a new location or is transferred from the campus, the Radiation Safety Office must be notified to assure that records are current. Physical inventories of radiation-producing equipment will be made on an annual basis. Movement of a radiation-producing machine from one location to another requires prior authorization from the Campus Radiation Safety Officer that will be granted only after preliminary safety and shielding analyses have been completed.

3.14 NEW FACILITIES APPROVAL

New buildings or renovation of areas in old buildings in which radioactive materials or radiation sources are to be used must be approved by the Campus Radiation Safety Officer and/or the Campus Radiation Safety Committee. Additional review by the Louisiana State University System Radiation Safety Committee may also be required.

Radiation safety personnel should be involved as early as possible in the planning of new facilities. Proper design considerations can result in significant savings to the University by reducing initial costs and avoiding expensive corrective alterations later.

3.15 PERSONNEL MONITORING

All employees of LSU and its consultants handling radioactive materials or using radiation sources of types and quantity such that it is possible to receive an exposure equal to or greater than ten percent of the applicable radiation dose limit specified by the State of Louisiana and persons operating potentially open beam analytical x-ray equipment shall be included in the radiation monitoring program. Long-term visiting researchers, post-doctoral fellows, and other such persons working with radiation as described above shall also be covered by the program. Other persons may be assigned to the personnel monitoring program at the discretion of the principal investigator and/or the Campus Radiation Safety Officer. Records for persons who are monitored but who do not meet regulatory monitoring requirements will not necessarily be kept.

Students who are enrolled in courses involving the handling of radioactive material or use of radiation sources may be assigned to the radiation monitoring program. The decision to assign or not to assign will be a joint decision between the instructor and the Campus Radiation Safety Officer. If they cannot reach a decision, the Campus Radiation Safety Committee will make the determination. When persons are assigned to the monitoring program they will be asked if they know or have been told whether they have ever received an overexposure of radiation. If the answer is affirmative, the person will not be allowed to work with radiation until the past radiation exposure records have been obtained and evaluated. For other persons, prior exposure histories will not be obtained unless they receive an exposure at LSU of greater than twenty-five percent of the applicable radiation dose limit.

Personnel dosimeters will be exchanged on a frequency from monthly to annually depending on the exposure potential and type radiation being monitored.

SECTION 3

PROCEDURES

Good practice dictates, and state laws require, that the University provides individual radiation exposure information on an annual basis upon request to the Radiation Safety Office. Further, individuals must be notified if their radiation doses exceed radiation protection guidelines.

The monitoring program includes, where applicable, personnel body dosimeters, personnel extremity dosimeters, rate sensitive area monitors, portable survey instruments, portable and fixed air sampling instruments, surface smears, and bioassay procedures. Personnel dosimetry devices are available for detection of beta, x- and gamma-ray, and neutron radiations. Supporting techniques allow assessment of alpha inhalation hazards. At the time of project approval, the Campus Radiation Safety Officer will determine the type of monitoring techniques required for that project.

Exposure in excess of administrative limits detected on a personal dosimeter requires immediate notification of the wearer, initiation of any appropriate medical assistance, and investigation as to the cause of the exposure. When necessary, the Louisiana Department of Environmental Quality shall be notified of the incident. Anyone who suspects an overexposure should report this immediately to the Campus Radiation Safety Officer, who can be reached at the telephone number listed at the front of the campus telephone book.

Records of individual radiation dose histories are maintained in the Radiation Safety Office. Individuals may check their individual records. The Radiation Safety Office will respond to requests for radiation exposure histories from employers after an individual leaves the campus.

3.16 PROCEDURE FOR BADGING AND FOR INVESTIGATING ELEVATED RESULTS

Anyone requiring a radiation dosimeter must complete and sign a radiation worker application (see Exhibit 3-6) in order to be enrolled in the radiation monitoring program. If a person has been exposed to radiation over the regulatory allowable limit prior to coming to LSU, then contact will be made with the previous employer to obtain a copy of that person's cumulative exposure history. This will be used to closely monitor that person's cumulative exposure while working at LSU.

Dosimeters are issued either on a temporary basis (good for one calendar quarter only) or on a permanent basis. Most new participants are issued a dosimeter for the first quarter of their enrollment in the program within five working days of receipt of the completed dosimeter application. Any participant continuing to work with radioactive materials for longer than one quarter will be placed on the permanent program to receive dosimeter(s) routinely on a quarterly or monthly basis, depending on the exposure potential and type of radiation being monitored.

Prior to the beginning of each wear period, the dosimeters will be mailed to each principal investigator for his/her staff. Participants must return their used dosimeter(s) within the specified number of days following their wear period so that accurate readings can be made. Any participant failing to meet the deadline for returning his/her dosimeter(s) may be penalized with a late fee of \$10.00 for each dosimeter returned after the due date. **Note:** Students working on semester class projects, with permission, are allowed to retain their dosimeters until the end of their class semester.

SECTION 3

PROCEDURES

After the wear period, dosimeters are packaged and sent to an NVLAP-approved processor for reading. The Radiation Safety Office examines the recorded results upon receipt in order to determine whether or not administrative limits have been exceeded. If a whole body dose equivalent is found to be greater than or equal to 100 mrem, or if a ring dosimeter dose equivalent level is found to be greater than or equal to 1,000 mrem within the time of one wear period depending on the monitoring sites, then the matter will be investigated. The results of the investigation along with any corrective actions will be documented. Individuals will be notified if their radiation doses exceed radiation protection guidelines.

Any participant seeking to be dropped from the dosimeter program must notify the Radiation Safety Office in writing. All letters requesting removal from the dosimeter program are maintained in the Radiation Safety Office.

3.17 SITE MONITORING

The Radiation Safety Office has the responsibility for monitoring all locations where radioactive materials and radiation sources are used or stored. Site monitoring checks are normally made at approximately three-month intervals; no prior notification for such a check is given. More frequent site-monitoring checks will be made if unusual hazards exist or if a significant change from previous monitoring is detected. Users may request special monitoring on a one-time basis or may request more frequent routine monitoring.

Site-monitoring checks includes smears to establish removable contamination levels and, where applicable, portable-survey-meter measurements of radiation levels and surface contamination levels. Monitoring also includes visual inspection of working conditions, observations of operating techniques, storage of waste, labeling of waste containers, posting of warning signs, radioisotope disbursement records, instrument calibration (calibrated annually), records of in-laboratory training, and discussions with site personnel to suggest improvements in radiation safety practices.

Because Radiation Safety Office personnel cannot be present for frequent monitoring in every laboratory, users are encouraged to monitor their own facilities on schedules tailored to their specific needs. **NOTE:** The principal investigator must conduct or ensure that contamination surveys are conducted by his/her staff at the end of each day when "handling" of more than 0.5 mCi of a radionuclide has occurred (see section 3.18.6). The term "handling" entails any activity involving the use of radioactive material. In other words, if a person picks up a vial containing more than 0.5 mCi of radioactive material, then a laboratory survey is required. Records of laboratory monitoring by users shall be maintained in written form within each laboratory for two years (see 3.18.6). These records will be reviewed periodically by the Radiation Safety Office.

Corrective recommendations in writing will be sent to the principal investigator. However, memoranda to the Campus Radiation Safety Committee may become necessary in the event of persistent problems.

SECTION 3

PROCEDURES

3.18 PROCEDURE FOR LABORATORY SURVEY INCLUDING ANALYSIS BY RADIATION SAFETY OFFICE

3.18.1 Laboratory Surveys

The goal of the laboratory survey program is to maximize the ability to detect contamination, excessive exposure levels, and/or procedural problems in all laboratories handling radioactive materials on campus. The survey program is designed to make the most effective possible use of personnel and Radiation Safety Office resources for timely detection and remediation of potential problems in laboratories using radioactive materials.

Each laboratory that handles or stores unencapsulated radioactive materials regardless of isotope or activity shall be surveyed at approximately three-month intervals based on the calendar quarter beginning in the month of January each year.

Personnel who conduct laboratory contamination surveys will be persons employed by the Radiation Safety Office. Personnel conducting surveys will be those recognized by the Campus Radiation Safety Officer as competent to safely and effectively carry out laboratory contamination surveys.

The person(s) conducting a survey shall wear a laboratory coat and vinyl or latex gloves at all times during a contamination survey. Gloves will be properly disposed of as radioactive waste after surveys for a given work period are completed.

3.18.2 Opening Laboratory Surveys

If a laboratory has never been surveyed before or is an inactive laboratory where isotopes were used at some point in the past, an opening survey will be performed before isotopes are used or stored in the laboratory. The principal investigator shall provide a diagram of the basic layout of the laboratory including exits and entrances, benches, desks, sinks, refrigerators, fume hoods, incubators, centrifuges, and waste container(s) as well as indicate on the diagram where the majority of isotope work will be performed (usually on a laboratory bench) as a "work area". This diagram will be used to make up the computer-generated, permanent laboratory diagram to be kept on file at the Radiation Safety Office and submitted with each contamination survey report.

The person conducting the survey will ascertain where the work areas will be. Areas in the laboratory which will actually be tested for surface contamination will be chosen, with top priority given to those areas where the isotope(s) will be handled most frequently (work area) and where the probability of detection of contamination is greatest (floor at exits and entrances, door handles, sinks, fume hoods, refrigerators). Any given laboratory shall have no fewer than six sample areas with samples at exit(s) and entrance(s), floor in front of work area(s), and work area surface(s) always included. These sample areas shall be listed and correspondingly numbered on the laboratory diagram. All appropriate emergency notification, caution, and "Notice To

SECTION 3

PROCEDURES

Employees" signs will be posted during the opening survey by the person conducting it. The person conducting the survey will then proceed with the Laboratory Survey Procedure as specified in the next section.

3.18.3 Laboratory Survey Procedure

Once the sample areas have been established, the person conducting the survey will measure background levels of ionizing radiation in the laboratory using a currently calibrated survey meter connected to a pancake probe (Ludlum Model 44-9 probe or equivalent) where applicable. The surveys will be concentrated in the numbered sample areas. If any given sample location reads greater than or equal to 0.1 mR/hr in the case of gamma or greater than twice background cpm in the case of alpha or beta emitting sources, the measurement will be recorded on the laboratory diagram at the point corresponding to the location in the laboratory where the measurement was taken. **Any reading exceeding these limits will be verbally reported to the Campus Radiation Safety Officer or the Assistant Radiation Safety Officer immediately after the survey is completed.** The Officer alerted will take whatever action deemed appropriate and commensurate with the potential seriousness of the situation.

Samples for removable contamination will be taken with dry polyfoam smears at each of the sample locations. Each smear will be taken so as to cover an area of approximately 100 cm² of the numbered sample location. Once taken, the smear will be placed in a correspondingly numbered coin envelope and retained for appropriate analysis.

The person conducting the survey will also check for violations of proper laboratory procedures such as evidence of eating, drinking, or smoking in the laboratory. Any violations noted will be recorded on the laboratory diagram under the section "Comments". The person conducting the survey will verbally report any observed violations to the Campus Radiation Safety Officer or the Assistant Radiation Safety Officer immediately. The Campus Radiation Safety Officer or the Assistant Radiation Safety Officer will confirm the violation and make recommendations to the Campus Radiation Safety Committee as appropriate. Additionally, the isotopes listed on the Radiation Notification Sign will be checked against those listed on the laboratory diagram. If there is a discrepancy, this will also be noted on the laboratory diagram under "Comments".

3.18.4 Close-Out Surveys

In order for a close-out survey to be conducted, the principal investigator must notify the Radiation Safety Office at least two weeks in advance that he or she intends to close the laboratory and remove all radioactive materials. Before the close-out survey can be conducted, the principal investigator must demonstrate to the Radiation Safety Office that all isotope sources have been accounted for and that all laboratory equipment and supplies used in connection with radioactive materials have either been properly decontaminated or properly disposed of. Additionally, all radioactive wastes must be accounted for and properly disposed of. Failure to comply could result in civil or criminal penalties against the responsible individual and/or the University. If a principal investigator has left the University without prior notification to the

SECTION 3

PROCEDURES

Radiation Safety Office, the requirements listed in this section become the responsibility of the head of the department where the principal investigator carried out his or her research activities.

When the requirements set out in this section have been satisfied, a qualified staff member of the Radiation Safety Office will conduct a routine laboratory survey including contamination smears and survey meter measurements where applicable. If all samples and measurements are below the action limits, a senior health physics staff member will enter the laboratory and conduct a visual inspection for any remaining radioactive materials or equipment. If the laboratory appears to be in good order and there is no evidence of remaining radioactive materials or equipment, all signs and notifications related to radioactive materials usage will be removed from the laboratory. The laboratory will then be removed from the survey list and placed in the inactive laboratories file.

3.18.5 Laboratory Contamination Smears Analysis

After laboratory contamination smears have been taken from a laboratory, the samples will be analyzed for radioactive contamination. If the laboratory uses gamma emitting isotopes, the contamination smears will be counted first using a solid scintillation detector calibrated for the detection of gamma and x-rays. A ^{137}Cs standard and blank control will be run along with each group of samples counted with the solid scintillation detector. If the particular laboratory being sampled does not use gamma emitting isotopes, the smears will only be run in a liquid scintillation counter.

All smears will be subsequently counted in a liquid scintillation counter calibrated for the detection of beta emitting isotopes. ^{14}C and ^3H standard vials and blank control will be run along with each group of samples counted with the liquid scintillation detector.

3.18.6 Laboratory Surveys by Approved Users

A laboratory survey shall be conducted by the approved user on any day that more than 0.5 millicuries of radioactive material has been used or handled. **NOTE:** Handling is defined as the touching or picking up a vial or container containing radioactive material. Laboratory surveys may be conducted by swiping surfaces with styrofoam tabs and subsequent counting in the appropriate counting equipment, or in the case of energetic beta emitters and gamma emitters, by survey with the appropriate radiation survey instrument. Typical survey instruments will not detect the presence of ^3H or ^{14}C . All survey results shall be documented in writing and retained in the laboratory for a period of two years.

3.19 LEAK TESTING OF SEALED SOURCES

Procedures for leak testing of sealed sources are as follows:

- a. All sealed sources greater than 100 μCi and all sealed alpha sources greater than 10 μCi shall be leak tested upon arrival at the Radiation Safety Office.

SECTION 3

PROCEDURES

- b. Sealed sources that are greater than 100 μCi , designed not to emit alpha particles, and not stored under the direct control of the Campus Radiation Safety Officer, shall be leak tested at six-month intervals.
- c. Sealed sources that greater than 10 μCi , designed to emit alpha particles, and not stored under the direct control of the Campus Radiation Safety Officer, shall be leak tested at three-month intervals.
- d. At the time any sealed source is removed from storage, leak testing shall be conducted before it is released or transferred for use.
- e. Occasionally, certain sources shall be leak tested either more or less frequently at the stipulation of the Louisiana Department of Environmental Quality.
- f. Leak tests for sealed source special form isotopes alpha and beta contamination are measured on an ultra-low background Tennelec Alpha/Beta Counting System, Model TB 5100 or equivalent, which utilizes a gas-flow proportional ion chamber or equivalent. The 3-sigma MDA for alpha contamination using a one-minute count for this unit is $3 \times 10^{-6} \mu\text{Ci}$ per 100 cm^2 , assuming that contamination is 100 percent removable from the tested surface. The 3-sigma MDA for beta contamination using a one-minute count for this unit is $5 \times 10^{-6} \mu\text{Ci}$ per 100 cm^2 assuming that contamination is 100 percent removable from the tested surface. Leak tests are generally obtained by using a dry cotton swab (Q-Tip) to wipe the outside surface of the container.
- g. Records of sealed-source leak tests shall be maintained by the Radiation Safety Office.

3.20 FEES

All users are assessed an annual user fee to cover a portion of the budget of the Radiation Safety Office. The current fee (2005) schedule is as follows:

■ Approved to use radiotracers and received less than 10 shipments in the prior fiscal year	\$250
■ Approved to use radiotracers and received 10 or more shipments in the prior fiscal year	\$500
■ Approved to used sealed sources or irradiators	\$125
■ Approved to use radiation producing equipment	\$125

Fees are subject to change by actions of the Campus Radiation Safety Committee.

SECTION 3

PROCEDURES

3.21 DECLARED PREGNANT WOMEN

Once a woman has declared, in writing, that she is pregnant, the allowable dose equivalent to the embryo/fetus during the entire pregnancy, due to occupational exposure, is not to exceed 0.5 rem. The regulatory definition of a declared pregnant woman is:

"A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception."

3.22 SPECIAL SERVICES

Personnel in the Radiation Safety Office are available for confidential consultation on all problems related to radiation hazards and their control.

SECTION 3

PROCEDURES

EXHIBIT 3-1

RADIATION SAFETY OFFICE

Telephone: 578-2008 ♦ Fax: 578-2094 ♦ Internet: www.radsafety.lsu.edu

APPLICATION TO USE RADIATION SOURCES AND/OR RADIOACTIVE MATERIALS

Applicant _____ Social Security # _____
College _____ Department _____ Office _____
Phone (office) _____ Phone (home) _____ E-mail _____
Assistant _____ Laboratory Phone _____
Phone (office) _____ Phone (home) _____ E-mail _____
User Fee Account # _____ Waste Disposal Charges Account # _____

Attach an outline of the proposed use of radiation sources and/or radioactive material to be considered for approval. Provide sufficient detail to permit evaluation of potential radiation hazards, including procedures assuring radiation control, waste handling, etc.

List your training and experience in the handling of radioactive material and radiation sources

List radionuclides to be used and possessed

Radionuclide _____ : Possession Limit _____ mCi; Shipment Limit _____ mCi

Radionuclide _____ : Possession Limit _____ mCi; Shipment Limit _____ mCi

List location(s) where radiation sources and/or radioactive materials will be used or stored. Please provide a diagram of the basic layout of the laboratory including exits and entrances, benches, desks, sinks, refrigerators, fume hoods, incubators, centrifuges, and waste container(s) as well as indicate on the diagram where the majority of isotope work will be performed as a "work area".

Building _____ Room(s) _____

Survey Meter Manufacturer _____ Model _____ Serial # _____ Calibration Date _____

Applicant Signature _____ Date _____

I acknowledge that the department is responsible to see that the above named person closes out all issues related to radioactive material prior to that person leaving the University. The department will bear the cost of resolving all unresolved issues.

I acknowledge that the above named emeritus professor has permission to use laboratory space. Additionally, I acknowledge that the department will be responsible for all expenses related to that person's possession and use of radioactive materials.

Department Chair _____ Date _____

SECTION 3

PROCEDURES

EXHIBIT 3-2

RADIATION SAFETY OFFICE

Telephone: 578-2008 ♦ Fax: 578-2094 ♦ Internet: www.radsafety.lsu.edu

DISBURSEMENT AND INVENTORY LOG

Radionuclide _____ Total Activity^(*) _____ Serial # _____
 Dept. Ordering _____ Individual _____ Purchase Order _____
 Supplier _____ Catalog # _____ Date Received _____
 Specific Activity _____ Date Assayed _____ Total Vol.(wt) _____
 Form

Inspected _____ Radiation Level _____ Smear Test _____

(*) Total below must equal "Total Activity" above when the final disposition of the source is tallied

Date	Log No.	Dispensed to	Use	Amount Dispensed		Balance	
				Activity	Vol.(wt)	Activity	Vol.(wt)

NOTICE TO USER: Use this form to maintain inventory and to record final disposition of this source

DISPOSITION: Decayed _____ mCi
 Dry Radioactive Waste _____
 Sanitary Sewer _____
 Scintillation Fluid as Waste _____
 Other as _____

DISPOSITION
 CERTIFIED BY: _____ Total^(*)

SECTION 3

PROCEDURES

EXHIBIT 3-3

RADIATION SAFETY OFFICE

Telephone: 578-2008 ♦ Fax: 578-2094 ♦ Internet: www.radsafety.lsu.edu

RADIOACTIVE WASTE TAG

Principal Investigator: _____

Location: _____

Date Radwaste Received: ____ / ____ / ____

Check category of package and describe below	H-3 and/or C-14	Half-life less than 100 days	Heavy elements mass>209	Any other nuclides
1. Dry solid				
2. Aqueous waste				
3. Organic waste			XXX NOT ALLOWED XXX	
4. Vials				
5. Other liquids				
6. Other materials				
7. Animal or other biological				

Description of Material

Description of Material	Amount
_____	_____ mCi
_____	_____ mCi
_____	_____ mCi

Solid Containers: _____ ft³
 Liquid Containers: _____ gal.
 Vials (total): _____ vials

For Radiation Safety Office Use Only:

Total Volume: _____ % of barrel

SECTION 3

PROCEDURES

EXHIBIT 3-4

RADIATION SAFETY OFFICE

Telephone: 578-2008 ♦ Fax: 578-2094 ♦ Internet: www.radsafety.lsu.edu

SAMPLE OF COMPLETED RADIOACTIVE WASTE TAG

Principal Investigator: H.J. Muller

Location: Life Sciences 1234

Date Radwaste Received: 01/02/2003

Check category of package and describe below	H-3 and/or C-14	Half-life less than 100 days	Heavy elements mass>209	Any other nuclides
1. Dry solid	√			Sr-90
2. Aqueous waste				
3. Organic waste			XXX NOT ALLOWED XXX	
4. Vials				
5. Other liquids				
6. Other materials				
7. Animal or other biological				

Description of Material

Isotope	Amount	
<u>H-3</u>	<u>2.5</u>	mCi
<u>C-14</u>	<u>1.2</u>	mCi
<u>Sr-90</u>	<u>0.6</u>	mCi

Solid Containers: 10 ft³
Liquid Containers: _____ gal.
Vials (total): _____ vials

For Radiation Safety Office Use Only:

Total Volume: _____ % of barrel

SECTION 3

PROCEDURES

EXHIBIT 3-6

RADIATION SAFETY OFFICE

Telephone: 578-2008 ♦ Fax: 578-2094 ♦ Internet: www.radsafety.lsu.edu

SAMPLE OF RADIATION WORKER APPLICATION

LSU RADIATION SAFETY OFFICE
Radiation Worker Application

FIRST NAME: _____ LAST NAME: _____
DEPARTMENT: _____ DEGREE: _____
ADDRESS: _____ E-MAIL: _____
OFFICE PHONE: _____ LABORATORY PHONE: _____
BIRTH DATE: _____ SOCIAL SECURITY #: _____
SEX: _____ EMPLOYMENT TYPE: _____
P.I.: _____ STARTING DATE: _____

TRAINING DATE INFORMATION

____ / ____ / ____ certified by P.I.

____ / ____ / ____ online course offered by the Radiation Safety Office

DOSIMETRY INFORMATION

RING BADGE

WHOLE BODY

PARTICIPANT# _____ ISSUED:

TEMPORARY BADGE# _____

Have you ever been told that you have been exposed to radiation over the allowable limit?

Yes _____ No _____

Signature _____ Date _____

ADDITIONAL NOTES:
