Radiation Safety Office
East Fraternity Circle

LOUISIANA STATE UNIVERSITY AND AGRICULTURAL AND MECHANICAL COLLEGE
BATON ROUGE · LOUISIANA · 70803-0301
(504) 388-4400

July 27, 1987

Mr. Jack Whitten
Region IV
Nuclear Regulatory Commission
611 Ryan Plaza Drive, Suite 1000
Arlington, Texas 76011

Dear Mr. Whitten:

Enclosed are the current procedures for the Louisiana State University Radiation Safety Program. Activities licensed under and required by SNM-1966 are conducted in accordance with these procedures except that leak testing of the plutonium-beryllium sources are in accordance with license condition 12.

As far as the procedures are concerned with plutonium-beryllium sources there are only changes (from the original application submission) in two items:

1. Personnel Monitoring:
   a. Frequency may vary from monthly to quarterly
   b. Prior radiation histories are not obtained unless the person of concern has indicated a past exposure in excess of the appropriate limit.
   c. Students in Nuclear Science courses may or may not be monitored depending on the judgment of the Radiation Safety Officer and the instructor.
   d. Records are maintained on a computer file containing the information included on DRC-4 and DRC-5.
   e. Monitoring is not specified to be by film badges.

2. Instrument Calibration
   a. Listing of instruments is by typical type.
   b. Neutron calibration is by a plutonium-beryllium source.

Sincerely,

L. Max Scott

L. Max Scott
Radiation Safety Officer

Enclosure

8/6/87
Aug-1-IE
8/6/87

FEE EXEMPT
170.11(a)(4) Mats

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RADIATION EMERGENCY CHECKLIST

Radiation Safety Manual

CLEAR AREA.....

go to the closest safe place
get everyone out
carefully help anyone who is injured

SEAL OFF AREA.....

post guards to keep people away
turn hoods and water off before leaving
close doors behind you

CALL FOR HELP.....

Radiation Safety Office	388-2163 or 388-4400
University Police	388-3231
University Emergency NO.	388-HELP (4357)

TELL WHAT HAPPENED.....

Major spill
Exposed source
Air-borne contamination
Fire or explosion
Badly contaminated major injury

TELL WHERE.....

TELL WHO.....

WAIT CLOSE BY.....

Tie a hankerchief around your arm for quick identification

4616601

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ORGANIZATION

The authorization, structure, personnel, and responsibilities of individuals for the radiation safety program for Louisiana State University and Agricultural and Mechanical College at Baton Rouge are described in this section. The names and telephone numbers of individuals currently involved in the program are listed at the front of this manual.

Authorization

Authorization for Louisiana State University to possess, store, and use radioactive materials is stipulated in a broad-scope radioactive materials license issued by the Louisiana Nuclear Energy Division of the Department of Environmental Quality, which has vested responsibility from the United States Nuclear Regulatory Commission within the State of Louisiana or a special nuclear material license issued by the United States Nuclear Regulatory Commission. The broad-scope license allows the University maximum flexibility in the use of radioactive materials for teaching and research through the operation of an internal radiation safety and control program. Copies of these licenses are available for inspection in the Radiation Safety Office.

Administrative authorization from the University is contained in Pm-30, issued from the Office of the President. Included in this document are the responsibilities and authorities of the individuals and committees required by the University's broad-scope license, and the names of the individuals and committee members. A copy of the most recent revision of PM-30 is included in this manual as Appendix 1.

Authorizations for individual campus activities are contained in minutes of the LSU System Radiation Safety Committee, in campus policy statements, and in approved individual campus radiation safety manuals. Special authorization for unusual circumstances may be required, and will supersede the contents of this manual.

Program Structure

The Chairman of the System Radiation Safety Committee is administratively responsible for the radiation safety programs within the University, and reports directly to the University President. Direct responsibility for implementation of the radiation safety policies and directives established by the System Radiation Safety Committee is assigned to the LSU System Radiation Safety Officer.

Appointment of individual Campus Radiation Safety Officers is authorized in PM-30, and appointment of individual Campus Radiation Safety Committees has been approved by the System Radiation Protection Committee. The Campus Radiation Safety Committee has the responsibilities for local supervision and control of radiation hazards and will direct the activities of the Campus Radiation Safety Officer.

The Chairman of the Campus Committee will appoint a temporary Campus Radiation Safety Officer when the permanent Campus Radiation Safety Officer is unavailable for periods exceeding one work-day. It is incumbent on the permanent Campus Radiation Safety Officer to inform the Committee Chairman when he will be unavailable for periods exceeding one day.

The LSU and A & M College Radiation Safety Committee is composed of representatives from the College of Agriculture, the College of Basic

Sciences, the College of Engineering, the Nuclear Science Center, the School of Veterinary Medicine, the Agricultural Center and other persons having knowledge in the use of radiation and radioactive materials. Non-voting members shall include the Director of the Nuclear Science Center, Campus Safety Officer and Campus Radiation Safety Officer. Administratively, the Campus Radiation Safety Committee reports to the Vice-Chancellor for Research.

Responsibilities and Authority

All persons involved with the handling, use, and storage of radioactive materials and radiation sources have the general responsibilities to:

1. Assure that University personnel, students, and visitors are not subject to undue radiation exposure;
2. Assure that all federal and state regulations have full compliance;
3. Assure that all University regulations and policies pertaining to radiation safety have full compliance;
4. Assure that special project restrictions have full compliance;
5. Assure that University insurance restrictions are met;
6. Assure that local and state codes and ordinances have full compliance;
7. Assure that the integrity and usefulness of University facilities are not compromised;
8. Assure that maximum standards of good practice and safe handling are maintained.

These general responsibilities apply to all individual users, technicians, students, and operating personnel.

Each person who handles radioactive materials or radiation sources must realize that the ultimate success of a radiation safety program lies in responsible actions by individuals in their daily work.

The Campus Radiation Safety Committee is charged with the responsibility and authority to control the use of radioactive materials and radiation sources on a local basis. The Campus Radiation Safety Committee can expedite action on radiation safety matters because of its intimate knowledge of local situations, and because of the ability to convene quickly. An executive committee, consisting of the Radiation Safety Committee Chairman, the Campus Radiation Safety Officer, and one other member chosen by the Committee, is empowered by the full Committee to act in emergency situations. The Campus Radiation Safety Committee has advisory responsibilities for:

1. Assuring that user projects comply with license restrictions, University policies and regulations, and standards of good practice;
2. Assuring that proposals for grants and contracts do not impose unacceptable radiological risks to individuals;
3. Assuring that new construction and renovation of existing buildings meet standards of good practice for using or storing radioactive materials or radiation sources;
4. Assuring that University personnel involved in the control of radiation hazards, including users and their assistants, have appropriate training and experience; and
5. Reviewing the actions of the Campus Radiation Safety Officer.

The Campus Radiation Safety Officer is appointed by the Chancellor to supervise the radiation safety program in all aspects, with the responsibility for proper control of radiation-related projects on the campus and at any other site under campus supervision or control. As

specified in PM-30, approval of the Campus Radiation Safety Officer is required for:

1. All matters pertaining to the LSU System radioactive-material license and radiation-source registration;

2. All requisitions for purchase of radioactive materials and radiation-producing equipment;

3. All user projects, including laboratory and teaching uses, research and development projects, and other activities with potential radiological hazards;

4. All contract and grant proposals involving radioactive materials or radiation sources;

5. All personnel who will directly use radioactive materials or radiation sources to assure that they are properly trained; and

6. All facilities, construction, outfitting, and renovation, including review and approval of construction plans, drawings and specifications involving radioactive material and radiation sources.

The Campus Radiation Safety Officer has the vested authority to act immediately in all matters pertaining to radiation safety for the purpose of assuring individual well-being and the integrity of University property. The Campus Radiation Safety Officer may appeal directly to the Chancellor for support in these actions, which are then subject to review by the Campus Radiation Safety Committee and by the LSU System Radiation Safety Commit .

PROCEDURES

Specific procedures required for the proper control of radioactive materials and radiation sources at LSU and A & M College are described in this section. Questions concerning these procedures should be directed to the Campus Radiation Safety Officer.

Grant and Contract Proposals

All proposals to outside agencies must be routed through the Campus Radiation Safety Officer if they involve the use of radioactive materials or radiation sources. The Campus Radiation Safety Officer may approve such applications. At times when the Campus Radiation Safety Officer is off campus, the Chairman of the Committee will be the approving authority. If the Chairman is also unavailable, members of the Committee at their discretion may approve. When approval is by other than the Campus Radiation Safety Officer, the originator of the proposal shall forward a copy of the proposal and approval form to the Campus Radiation Safety Officer. 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 University President can be obtained. All approvals will be reviewed at the next scheduled Committee meeting.

User-Project Applications

Individuals who wish to use radiation sources or radioactive materials in research, development, teaching, or demonstration projects must obtain prior approval of the Campus Radiation Safety Officer.

A User-Project Application Form (NS1009R) is shown on the following page, and are available from the Radiation Safety Office. The date submitted, project title, user's department, and college are to be filled in on the appropriate lines. In the following space, and on additional sheets if necessary, the user must supply information relative to training and work experience in the handling of radiation sources and radioactive materials. User qualifications must be commensurate with the planned use. If the application is from a user who has received approval previously on another project, the phrase "Qualifications on file in the Radiation Safety Office" may be inserted for convenience.

User-Project approvals are issued only to principal investigators and group leaders. It is their responsibility to provide proof to the Campus Radiation Safety Officer of radiation safety training for all persons involved with radiation related activities under their control. Acceptable training includes Nuclear Science course work, preferably including laboratory and radiation safety short courses offered by the Radiation Safety Office.

The radionuclides or radiation sources required for the project must be specified in sufficient detail for radiological safety review. This listing includes radiation-producing equipment which requires registration by the Nuclear Energy Division. For radionuclides, the total activity that the user expects to have on hand at any one time must be indicated.

Specific information must be supplied on all locations where radioactive materials or radiation sources are to be employed during the course of the project. This information is required so that the Campus

BATON ROUGE NUCLEAR SAFETY COMMITTEE
Louisiana State University

USER-PROJECT APPLICATION

Project title: _____

_____

_____

College: _____

Department: _____

Project director: _____

Training and experience in the handling of radioactive materials and sources: _____

_____

_____

_____

_____

_____

(Supply the names and qualifications of other project personnel on a separate page attached to this application.)

Radionuclides (identify nuclides, chemical/physical form, total activity): _____

_____

_____

Location (identify building and room number, or otherwise identify place of use): _____

_____

_____

Schedule (identify expected approximate beginning and ending dates):

_____

_____

Attach a project outline in sufficient detail to permit evaluation of potential radiation hazards, including procedures assuring radiation control, waste-handling procedures, etc.

Radiation Safety Officer can establish that the sites are under the coverage of 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 is consistent with license restrictions, federal and state regulations, and University rules and policies.

Expected approximate beginning and ending dates, if applicable for the project, should be indicated in the space provided. Unless a shorter period is specified, all approvals will expire 3 years from date of issue.

The user is to attach to the application form a project outline in which the specific details of the planned use are described in sufficient clarify to permit review by the Campus Radiation Safety Officer and Campus Radiation Safety Committee. In general, this will involve operational details for radiological safety rather than details of experimental planning. Standard laboratory practice for handling radioactive materials can be assumed, but deviations from standard practice must be described. Waste-handling plans must similarly be described in detail.

When the User-Project Application 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-Project Applications by the Campus Radiation Safety Officer is restricted to matters of radiological safety only.

Radionuclide Orders

Radionuclides can be ordered only by approved users for a project that has been assigned a serial number. Orders for radioactive materials are placed just as any other materials or supplies are ordered, with the single exception that the approval of the Campus Radiation Safety Officer is required on the purchase requisition. Without such approval, the requisition will not be processed by the Purchasing Department to an off-campus vendor. The purchase requisition including the name of the approved user is transmitted to the Radiation Safety Office. The Campus Radiation Safety Officer will review the requisition to assure that the purchase will not exceed the license-limits and that the radionuclides are authorized for that particular project. The purchase requisition will be stamped and signed by the Campus Radiation Safety Officer, and the requisition will be forwarded to the Purchasing Department for processing.

If the radioactive material is to be purchased by either a blanket purchase order or a standing purchase order, approval may be obtained to cover the order for the period up to the end of the fiscal year in which the order was originally initiated. Prior approval will be granted for blanket orders of radioactive materials if requested by letter to the Radiation Safety Office. Standing order will be approved in the same manner as any purchase order. When radioactive material is ordered by either method, the individual ordering must provide written notice to the Radiation Safety Office as to what, and how much is being ordered and the name of the vendor. The purpose of this notification is to ensure that the shipments are properly handled and available to the user in a timely fashion.

Purchase requisition approval is also required for any equipment containing radioactive sources, such as gas chromatographs equipped with electron-capture detectors.

Delivery of Radioactive Materials

All radioactive materials arriving on the campus are to be delivered to the Radiation Safety Office. There are only two allowed exceptions to this requirement:

1. 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; and

2. 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.

In both instances, the Campus Radiation Safety Officer must be notified promptly upon arrival of the radioactive material so that proper inventory and receipt procedures can be completed.

Delivery of all other radioactive materials to the Radiation Safety Office is required to insure adequate inventory control, and to allow proper initial radiation monitoring of packages. Federal and state regulations require that the University be able to verify at any time the total quantities of radioactive materials on hand, and to be able to show an inspector the physical location of each individual shipment or prove that it has been properly removed or shipped for disposal. Monitoring of packages before distributing them to individual users is required to prevent release of material from broken or otherwise contaminated containers, and to allow notification of excessive working radiation levels when the packages are handled.

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

The inventory record to be completed by the Radiation Safety Office is form NS-1020/1021, which consists of a cover sheet to be distributed to the user at the time of disbursal, and a second page that provides internal records for the Radiation Safety Office. The second page, 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 throughout its stay on the campus.

Radionuclide Disbursement

Upon notification 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 designated alternate. At the time of transfer, the individual who receives the material must sign for receipt of the material.

When the radioactive material is transferred to the user, the cover sheet of the inventory form (NS-1020R) will accompany the material. The user is required to keep on this sheet cummulative records of withdrawals and ultimate disposition of the material. When the material has been completely used and/or disposed of, the sheet shall be returned to the Radiation Safety Office. This procedure will produce an estimate needed for management of the radioisotope inventory.

Waste-Handling Procedures

State and federal regulations, and the University's radioactive materials license impose severe restrictions on waste-disposal methods.

Radionuclide _____ Total Activity _____ Serial No. _____

Department Ordering _____ Individual _____ Purchase Order _____

Supplier _____ Catalog No. _____ Date Rec'd _____

Specific Activity _____ Date Assayed _____ Total vol. (wt.) _____

Form _____

_____

Inspected by _____ Radiation Level _____ Smear Test _____

Notice to User: Record all withdrawals from this stock in the space below.
Record waste-disposal action on back of this sheet.
Return this sheet to Radiation Safety Officer when you are finished with this material.

Date	Log No	Dispensed To	Use	Amt. Dispensed		Balance	
				Activity	Vol. (wt)	Activity	Vol. (wt)

Radionuclide _____ Activity _____ Form _____ Serial No. _____

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

Waste materials can be generally classified as:

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

2. Major aqueous-solution waste (reaction solutions, primary dilutions of stock solutions, residual stock solutions, etc.);

3. Minor aqueous waste solutions (third rinses from glassware, radioactively decayed solutions containing less than microcurie amounts of activity, etc.);

4. Major organic-waste solutions (see 2, above);

5. Minor organic-waste solutions (see 3, above, and liquid scintillation counting solutions);

6. Animal carcasses;

7. Animal excreta, botanical wastes; bedding and

8. Permanently contaminated equipment.

The only uncontrolled waste materials are minor aqueous waste solutions (item 3. above), which may be disposed of directly to the sanitary sewer system via laboratory sinks (disposal through toilets and washroom basins is not permitted).

Wastes in user laboratories shall be stored only in approved and appropriately labeled containers. Waste shall be segregated by solid, aqueous liquid, organic liquid and animal carcasses, excreta and bedding. Radioisotopes with half-lives greater than 150 days may be combined provided no chemical hazard is created. Radioisotopes with shorter half-lives should be stored separately. Each container of waste shall have a label to indicate the isotope(s) total content in millicurie and for short lived material the date the material was placed in the container should be included.

The Radiation Safety Office on a routine basis will schedule radioactive waste pickups at the generating laboratories. By prior arrangement waste may be brought to the Radiation Safety Office. Waste will be disposed of in one of the following manners.

1. Shipment to a radioactive waste burial site: Solid and organic radioactive waste with half-lives greater than 100 days will be disposed of in this manner. Cost of disposal will be borne by the generator.

2. Held for decay: Solid, organic liquid, aqueous liquid radioactive waste and radioactive animal carcasses with half-lives of less than 100 days will generally be disposed in this manner. After holding for 10 half-lives, the material can be disposed of as ordinary waste. Note radiation labels shall be removed before placing this type waste into a radioactive waste container.

3. Dumped to the sanitary sewer: Water soluable radioactive waste, i.e., aqueous liquids can be disposed of in the sanitary sewer. The concentration of the radioactive waste and total millicurie quantity 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 are not being exceeded.

4. Designated as Hazardous Non-radioactive Waste: Organic scintillation medium containing 0.05 microcuries of ^{3}H, ^{14}C or ^{125}I or less per gram of material may be disposed of as hazardous waste without regard for the radioisotope content. Note this is limited to the three radioisotopes listed above.

5. Incineration: Disposal by incineration will be the favored 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.

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

Transfer and Shipment of Radioactive Materials

Federal and state regulations restrict the transfer of radioactive materials, except in certain carefully specified situations, to persons holding valid radioactive materials licenses. A copy of the receiver's

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 advice on acceptable shipment methods and applicable regulations and restrictions. The department from which the shipment originates is expected to pay the cost of the transfer. 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.

Storage of Radioactive Materials

Individual users are expected to keep on hand in their laboratories only those radioactive materials which they are actively using, or those which they feel must receive personal attention. The intent of this policy is to reduce as far as possible the number of places on the campus where the security of radiological materials might be jeopardized in emergencies such as fires or explosions. Space is available through the Radiation Safety Office for storage of radioactive materials which users wish to keep but are not actively using, or wish to submit to the general University inventory stock.

All storage locations must be posted with approved radiation warning signs, which are available from the Radiation Safety Office. No storage of radioactive materials in locations where food or beverages are also stored is permissible.

Room 52 in the basement of the Nuclear Science Center is employed 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 room is under the direct supervision of the Radiation Safety Office, from which permission must be obtained to remove radioactive materials and radiation sources.

Radioactive Materials Accountability

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

Individual users are expected to keep internal records of the radioactive materials they receive from the Radiation Safety Office, how they are used, what the current content 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 information when it is requested by the Radiation Safety Office. The Radiation Safety Office performs a physical inventory each six months to verify records.

The Radiation Safety Office must be notified of exchanges of radioactive materials among users, which requires approval of the Campus Radiation Safety Officer, and when radioactive materials are moved to a location other than shown on the disbursal record.

Certain specified materials on loan from the federal government require additional accountability procedures, which are the responsibility of the Radiation Safety Office.

Registration of Machines Producing Ionizing Radiation

Regulations of the Nuclear Energy Division require that all equipment that produces ionizing radiation must be registered with the Division, 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 are diagnostic X-ray machines of all classes (e.g., field-portable, fluoroscopic, special-procedures, panoramic-dental, cystological, 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.), imaging instruments (e.g., scanning electron microscopes, etc.), and accelerators (e.g., Cockcroft-Walton, 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 the Campus Radiation Safety Officer and the Campus Radiation Safety Committee through a User-Project Application.

When an instrument 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, which will be granted only after preliminary safety and shielding analyses have been completed.

New Facilities Approval

New buildings or renovated areas in old buildings in which radioactive materials or radiation sources are to be used must be approved by the Campus Radiation Safety Officer, the Campus Radiation Safety Committee. Additional review by the LSU System Radiation Safety Committee may also be required in certain instances.

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.

Personnel Monitoring

Every employee of the University 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 10% of the applicable radiation dose standard specified by the state of Louisiana shall be included in the radiation monitoring program. Long-term visitors, post-doctoral fellows and other such persons working with radiation as described above shall also be covered by the program.

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 a decision cannot be reached, 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 that they had received an over exposure 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 and A & M College of greater than 25% of the applicable radiation dose standard.

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

Good practice dictates, and state and federal laws require, that the University provide information to users that their radiation doses are within regulatory limits, and also that individuals be notified if their radiation doses exceed radiation protection guidelines.

The monitoring program includes, where applicable, personal body dosimeters, personal direct-reading pocket dosimeters, personal extremity dosimeters, rate-sensitive area monitors, portable survey instruments, portable and fixed air-sampling instruments, surface smears, and bioassay procedures. Personal dosimetry devices are available for detection of beta, X and gamma, and neutron radiations; supporting techniques allow assessment of alpha inhalation hazards. At the time of approval, the Campus Radiation Safety Officer will determine what monitoring techniques are to be used for a project.

Excessive exposure detected on a personal dosimeter requires immediate notification of the wearer, initiation of any appropriate medical assistance, and a determination of the cause of the exposure. When necessary, Nuclear Energy Division and United States Nuclear Regulatory Commission offices will be notified of the incident. These agencies can be of assistance in assuring the best available medical care, and also in procuring support personnel for facilities recovery. Anyone who suspects an over-exposure should report this immediately to the Campus Radiation Safety Officer, who can be reached at the telephone numbers listed at the front of this manual.

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

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 normally are made at approximately three-month intervals; no 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 the previous check is detected. Users may request special checks on a one-time basis, or may request more frequent routine checks.

Site-monitoring checks include smears to establish removable contamination levels and where applicable portable-survey-meter

measurements of radiation levels and surface contamination levels. Checks also include visual inspection of working conditions, observations of operating techniques, storage of waste, labeling of containers, posting of warning signs, radioisotope disbursement records, instrument calibration 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 special needs. Records of laboratory monitoring by users must be maintained in the laboratories; these will be reviewed periodically by the Campus Radiation Safety Officer.

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

Special Services

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

PRACTICE

Guidelines, policies, and rules for the practice of radiation safety on the LSU and A & M College are presented in the following sections of this chapter.

General Rules for Radioactive Materials

1. Eating, drinking, smoking, or the application of cosmetics are not permitted in areas where radioactive materials are used or stored.

2. Personnel monitoring devices (TLD badge, pocket dosimeter, finger badge, wrist badge) prescribed for the area must be worn.

3. Protective clothing (gloves, laboratory smock, coveralls, respirator, shoe covers, etc.) prescribed for the area must be worn.

4. Proper containment (absorbent paper, trays, secondary liquid containers) required for the operations must be in place.

5. Fume hoods are to be used for all operations that potentially involve release of air-borne materials, including gases, volatile compounds, and dusts and aerosols (minimum air flow shall be 85 fpm).

6. Prescribed radiation detection equipment and calibrated survey instruments must be available and known to be working.

7. Work areas should be monitored when an operation is completed, or at the end of the work period.

8. Radioactive materials must be stored and shielded in the manner prescribed for the area, and secured to restrict unauthorized persons from using or removing the material.

9. All bottles, jars, boxes, and cabinets containing radioactive materials must be clearly labeled as to the radionuclide, quantity, and date, and initialed by the responsible person.

10. All entrances must be properly labeled with signs appropriate to the hazard, and posted with the names and telephone numbers of individuals to be contacted in emergencies.

11. Initial runs on new procedures should be made with non-radioactive materials or less than 10 microcurie amounts of radioisotopes.

12. Procedures should be designed to reduce to a minimum transfers from container to container, bench to bench, and room to room as a means of reducing spills.

13. Radiation levels in work areas should be determined before an operation is begun so that proper shielding and remote-handling equipment can be employed to reduce individual exposures.

14. Individuals unfamiliar with radiation hazards and emergency procedures must not be permitted to work with radioactive materials.

15. Pipetting by mouth in areas where radiation materials are being used is forbidden.

16. All equipment, glassware, and other contents of an area in which radioactive materials are being used, or have been used, should be considered as contaminated until properly monitored.

17. Any injury, no matter how slight, involving radioactive materials must be monitored to determine if the wound is contaminated.

General Rules for Radiation-Producing Machines

Electron microscopes, microprobes, and other instruments in which electrons are accelerated to energies in excess of 10 KeV require registration by the State of Louisiana. Many such instruments pose minimal radiation safety hazards. Instruments in this class must be monitored annually and after maintenance which involves the radiation producing chamber. Operators should, however, be thoroughly familiar with potential problems, and should request assistance if they believe that a problem has develcped.

The following rules apply to machines which yield intentionally externalized beams of ionizing radiation:

1. All operating personnel must be intimately familiar with the principles of operation, principles of radiation safety, and potential general and specific hazards of their particular machine.

2. Radiation surveys must be made annually, whenever beam-target -specimen-detector geometry is changed, or whenever shielding arrangements are altered and after maintenance work.

3. System interlocks must be installed to assure that the equipment cannot be operated in an unsafe manner or when personnel are in exposure areas.

4. For irradiation vaults, target rooms, and X-ray therapy and diagnostic rooms, both voice and visual communication are desirable.

5. Master-switch keys and secondary keys should be in the possession of the first person entering an exposure room, and that person should be the last to leave the room.

6. Situations which require interlocks to be temporarily disabled requires prior approval of the Campus Radiation Safety Officer.

7. For multiple-beam-port instruments, beam-port shields should be brightly colored to allow quick visual checks that they are properly positioned.

8. All radiation-producing equipment must have clearly visible warning lights to indicate when the equipment is generating radiation. Additional caution lights are recommended as a redundant system for showing the machine status. Warning-light systems should be wired to indicate when a light is not operational.

9. Permanently installed radiation monitors and portable survey instruments prescribed for the installation should be available and known to be calibrated and functioning when the equipment is going to be activated.

10. A log of operations, in which both routine procedures and unusual situations are recorded, should be kept.

11. All operating personnel must be properly badged with individually assigned integrating dosimeter devices.

12. A written and oral practical examination, with results kept on file for new operating personnel is desirable before a new operator is allowed to work without supervision.

13. Operators should check radiation levels with portable survey instruments before entering an irradiation room.

14. Emergency notification procedures must be posted, and emergency response procedures should be reviewed with all personnel periodically.

15. Approved warning signs indicating the nature of the hazards must be posted at entrances to hazard areas, and the instrument console must be posted with a plaque indicating the nature and quality of the radiation produced.

16. Unusual operations or unexpected machine behavior must be reported to the Campus Radiation Safety Office immediately.

Signs, Notices and Labels

Regulations of the Nuclear Energy Division require that signs be posted to inform the public of the existence of a hazard in areas where radioactive materials and radiation sources are used and stored. Posted signs must comply with federal regulations, which are in agreement with international symbols for recognition of hazards. These signs are printed with magenta ink on a yellow background, and bear the work "caution" at the top, the standardized three-bladed "propellor" symbol for radiation in the center, and a descriptive prescribed phrases denoting the magnitude of the hazard at the bottom. The prescribed phrases are "RADIOACTIVE MATERIALS" for areas in which an individual is unlikely to receive a radiation dose in excess of 5 millirems in an hour, "RADIATION AREA" for situations in which dose rates are between 5 and 100 millirems per hour, and "HIGH RADIATION AREA" where dose rates are possible in excess of 100 millirems per hour.

Radiation Safety Office personnel will determine which regulation signs are appropriate for a location, and will supply the signs to the users. Users are required to notify the Radiation Safety Office promptly if a sign is removed or defaced so that it can be replaced.

Two modifications of the legal signs are permitted under the radiation safety program. These include the addition of the phrase "X RADIATION" across the bottom blade of the propellor symbol on a radiation-area sign to be posted where X rays are present in an external beam, and the phrase "CONTAMINATION ZONE" across the bottom of the symbol on a radiation-area or high-radiation-area sign to be posted

where uncontained radioactive material exists in a hazardous condition. Hand-lettered signs bearing other phrases are not acceptable substitutes.

In addition to signs indicating the presence of a radiation hazard, each area must be marked with a notice identifying individuals to be called in an emergency, and their current telephone numbers at the University and at home. Individuals to be listed on the notice include:

1. Principal user
2. Alternate person knowledgeable of the specific area (if possible)
3. Campus Radiation Safety Officer

Emergency notices will be supplied by the Radiation Safety Office, which should be informed promptly of any changes.

General Rules for Animal Handling Involving Radioactive Materials

Because of the variety of experimental animals and locations where they are employed for radioactive studies, only guidelines for handling such animals can be covered in this manual. It is the responsibility of each user to supply detailed procedures with the User-Project Application.

General rules for the use of radioactive materials in experimental animals are:

1. All project personnel, including animal handlers, farm workers, students, and technical personnel, must be fully in form the hazards posed by the project specifically, and radioactive materials generally; emergency procedures; and restrictions on areas, waste handling, carcass disposal, and procedures for cleaning facilities when the experiment is terminated.

2. All areas where experimental animals are housed, including holding pens, must be clearly posted with proper signs commensurate with potential hazards.

3. No animal is to be kept, even temporarily, in an area not previously designated and posted for radioactive-materials use.

4. Each cage, pen, or stall in which an animal dosed with radioactive materials is held must be clearly marked as to the nature, quantity, and date of administration of the material.

5. Cages, pens, and stalls must be designed to facilitate thorough collection of excreta to reduce contamination levels. Additional measures may be required for control of special hazards, such as feather dust from poultry or saliva from cattle.

6. Dirt-floored holding areas are not acceptable for animals dosed with radioactive materials.

7. Unless specifically authorized for a project, animals dosed with radioactive materials may not be pastured. Similarly, small animals may not be returned to stock colonies.

8. Animal sacrifice is permitted only in an area previously designated for this purpose and properly outfitted with necessary decontamination gear and waste-handling facilities. Unless specifically exempted, blood cannot be drained to the sanitary sewer for disposal.

9. All personnel must wear approved work clothes and protective equipment when handling radioactive animals and excreta, or working in the area where dosed animals are being held.

10. Portable survey meters sensitive to the emitted radiation from the radioactive materials must be available, calibrated and known to be in working order, and all personnel must be capable of using and interpreting the readings from these instruments.

11. All wounds on animals incurred in posted areas must be monitored for radioactive contamination, and reported immediately to the Campus Radiation Safety Office if contamination is detected.

12. Specific instructions for the collection, storing and disposal of excreta and carcasses must be approved for each user project.

13. Animals dosed with radioactive materials may not be sold, nor may they be used for human food.

14. Milk from lactating animals must be treated as excreta, and may not be sold or consumed.

15. Areas where animals are dosed with radioactive materials must be checked frequently for contamination by instrument surveys and wipe tests according to approved procedures.

General Rules for Field Use of Sealed Radiation Sources

Sealed sources constitute a class of radioactive materials in which the radionuclides are compacted as high-integrity solids, and then encapsulated into two successive and independently sealed capsules to prevent the escape of the central radiation source. These capsules are designed to allow useful radiation to penetrate the walls, while containing the radioactive material. Both gamma-emitting and neutron-emitting sources are in the possession of the University, and are available for both laboratory and field experimental uses.

Gamma sources, and neutron sources to a lesser extent, designed for field use offer intense radiation fields, and therefore require special precautions, particularly when exposed in open areas such as rice ponds and forest plots. Field uses include radiographic insoections of the interior of test specimens, determination of soil density, and the estimation of soil moisture content.

Although gamma-emitting (cobalt-60, cesium-137, iridium-192, and radium-226) sources and neutron-emitting (polonium-beryllium, radium-beryllium, plutonium-beryllium, americium-beryllium, and californium-252) sources are designed and utilized for a wide variety of procedures, similarities in field use exist. The following general rules are applicable, subject to specific stipulations by the Campus Radiation Safety Officer and Campus Radiation Safety Committee after review of a user's application form:

1. Two individuals (e.g., a principal user and a helper) must be present whenever a sealed source is being used in normally uncontrolled areas.

2. All personnel who may be involved as principal users and helpers must be trained in the operation of the exposure device, and in the specific hazards relating to the device.

3. Appropriate survey instruments, known to be calibrated and operational must be in the possession of the source users in the field. Users must be capable of operating and interpreting the readings of the instruments.

4. The principal user must be capable of predicting and determining the extent of radiological exclusion areas for the specific source in use.

5. Signs reading "CAUTION, RADIATION AREA" must be posted at distances from the exposed source where readings indicate a dose-equivalent rate of 5 millirems per hour. A physical barrier (e.g., high-visibility rope) must be placed to enclose the area in which the dose-equivalent rate may exceed 100 millirems per hour, and signs reading, "CAUTION, HIGH RADIATION AREA" must be posted at this perimeter.

6. Either the principal user, the helper, or a knowledgeable alternate must be within controlling distance when the source is in their possession in the field, and must have visual supervision of the source when it is exposed.

7. A source must be logged out of and back into a storage area by the principal user.

8. Sources must be locked and the keys to source locks must be in the possession of either the user or helper whenever a source is not under visual supervision.

9. The user and helper, and any other alternates, must be provided with badges (film or TLD) and/or pocket dosimeters appropriate for the radiation emitted by the source.

10. Vehicles may require warning signs and contain shipping documents when sources are moved between the storage location and the use site. This will be determined at the time the user-project application is approved.

11. Users, helpers, and alternates must be knowledgeable of proper emergency procedures for the source in their possession.

12. Personnel in the Radiation Safety Office are available for discussion of special hazards, rules, regulations, and standards of good practice for field use of sealed radiation sources.

13. Field use of unsealed sources cannot be undertaken without specific approval of the Campus Radiation Safety Officer and Campus Radiation Safety committee following review of environmental impacts for the use.

General Rules for Decontamination

Although Radiation Safety Office personnel are available to assist in decontamination operations, it is standard policy of the nuclear industry that the person who is responsible for contamination has the obligation to assume primary responsibility for decontamination. Immediate reaction to a contamination situation frequently can prevent serious side-spread problems. The order of priorities is:

1. Well-being of involved individuals
2. Prevent spread of contamination
3. Decontamination of individuals
4. Decontamination of facilities and equipment.

THE LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE SYSTEM
99 UNIVERSITY LAKESHORE DRIVE
BATON ROUGE · LOUISIANA · 70803-0101

OFFICE OF THE PRESIDENT (504) 388-2111

October 17, 1986

Mr. William Spell
Box 14690
Nuclear Energy Division
Baton Rouge, LA 70898

Dear Mr. Spell:

Enclosed is the application for renewal of the broad scope by-product material license LA-0001-L01 issued to Louisiana State University. It was our attempt to make this a complete application and the renewal should be based on this submission and any future submission required for clarification or to accommodate program changes. It is our desire not to be bound by any submission prior to this date.

In our application, LSU is requesting the authority to incinerate radioactive waste at the Dental School at New Orleans (currently approved), the Medical School at Shreveport (the incinerator approved under the current license is no longer in operation), and at LSU and A&M College at Baton Rouge. A timely review and approval of that portion of the application pertaining to incineration of radioactive waste at Shreveport and Baton Rouge will result this fiscal year in a saving of $10,000 - $30,000, depending on when approval is received. I leave it to your judgement as to whether this approval should be issued as an amendment to the current license or by some other administrative procedure.

The previous license permitted extensive laboratory teaching utilizing radiography sources and the operation of a Cockcroft-Walton neutron generator using ^{3}H targets. These activities are no longer conducted, nor are there any plans for such activities. If plans change, a license amendment application will be submitted.

This application was compiled by Dr. L. Max Scott, System Radiation Safety Officer, and was approved by the System Radiation Safety Committee. If additional information is needed, please contact Dr. Scott directly; he will prepare the response and direct it through the System Radiation Safety Committee to this office for formal submission to you.

Sincerely,

Allen A. Copping
President

Enclosure

4161601

DEPARTMENT OF ENVIRONMENTAL QUALITY

LOUISIANA NUCLEAR ENERGY DIVISION

P.O. BOX 14690
BATON ROUGE, LOUISIANA 70898-4690

APPLICATION FOR RADIOACTIVE MATERIAL LICENSE

DHC 11 (Rev. 8/79)

OFFICE USE ONLY
License No.
Amendment No.
Expiration Date
Date Issued
Date Received

SM

1. NAME OF APPLICANT
Louisiana State University

MAILING ADDRESS
Center for Energy Studies
Baton Rouge
Louisiana | Zip Code 70803

AREA CODE | TELEPHONE NO.
504 | 388-4400 (Suppl. 1)

2. ☐ New License Application
LOUISIANA LICENSE NO. LA-0001-LA01
☒ Renewal ☐ Amendment
NRC License No. SNM 1966

AGREEMENT STATES	LICENSE NO.

3. DEPARTMENT, LOCATION OR ADDRESSES AT WHICH USED AND OR STORED
☐ Check if same as Item 1 only
See Supplements, Item 3

☐ Temporary Job Sites in La ☐ Offshore
☐ Out of State (List States)

4. RADIATION PROGRAM PERSONNEL	TITLE OR FUNCTION	RESUME PREV. SUBM. (DATE)	RESUME ATTACHMENT	RESUME PAGE, ITEM
PERSON RESPONSIBLE FOR RADIATION PROTECTION: L. Max Scott, Ph.D. C.H.P.	LSU System Radiation Safety Officer	See supplements		
INDIVIDUALS OR COMMITTEE RESPONSIBLE FOR USE: Paul W. Hyde, Ph.D.	☒ Committee Chairman	Item 4		
See supplements, Item 4				

COMMITTEE TITLE: LSU System Radiation Safety Committee

NO. OF ADDITIONAL COMMITTEE MEMBERS OR INDIVIDUALS:

5. PERSONNEL MONITORING			NOT APP.	PREV. SUBM. (DATE)	ATTACHMENT	PAGE, ITEM
a. Film Badge	Name of Supplier: R. S. Landauer, Jr.	RADIATION DETECTED: ☐ Alpha ☒ Beta ☒ Gamma ☒ Neutron ☒ X-Ray ☐ Radon				
	Exchange Period: See Supplements, Item 5					
	Where Worn:					
b. Pocket Chamber or Dosimeter	Manufacturer: NA	RADIATION DETECTED: ☐ Alpha ☐ Beta ☐ Gamma ☐ Neutron ☐ X-Ray ☐ Radon				
	Model: Max. Range:					
	☐ Direct Reading					
c. Bio Assay	Laboratory: See Supplements, Item 5					
	Type of Sample: Frequency of Samples:					
	Radiation or Radioactive Material Assayed:					
d. Other	DESCRIBE:					

6. AREA MONITORING					
a. Contamination Surveys: Routine Frequency: See Supplements, Item 6					
b. Radiation Area Surveys: Routine Frequency: See Supplements, Item 6					
c. Environmental Surveys: ☐ Air ☐ Water Where: Freq.					

7. LEAK TESTS					
Company: See Supplements, Item 7 ☐ Evaluated by Applicant (Attach Procedure)					
Kit Model No. Frequency					

8. WASTE DISPOSAL					
Company: See Supplements, Item 8					
Maximum Total Activity: Maximum Storage Period:					
☐ Incineration ☒ Storage ☐ Burial ☒ Sewer System ☒ Ship to Licensed Recipient					

9. ATTACHMENTS					
a. Health Physics Program: See Supplements, Item 9					
Supplements, Item 9					

10. HEALTH PHYSICS INSTRUMENTATION

MANUFACTURER	MODEL	QUAN TITY	RADIATION DETECTED	DOSE OR COUNT RANGE	ENERGY RANGE	TYPE USE OR PURPOSE	CALIBRATION COMPANY OR PROCEDURE	FREQUENCY
Supplements, Item 10								

11. GENERAL INSTRUMENTATION

NOT APPLICABLE	PREVIOUSLY SUBMITTED (DATE)	ATTACHMENT	PAGE OR ITEM

MANUFACTURER	MODEL	QUAN TITY	RADIATION DETECTED	TYPE USE OR PURPOSE
See Supplements, Item 11				

12. MEDICAL SUPPLEMENTS	NOT APP	PREV. SUBM. (DATE)	ATTACH. MENT	PAGE OF ITEM
a. ructions for Care of Patients Containing Radioactive Materials				
b. HOSPITALS WHERE RADIOACTIVE MATERIALS ARE USED (INDIVIDUALS ATTACH APPROVAL)				
c. HOSPITALS WHICH ADMIT MY PATIENTS CONTAINING RADIOACTIVE MATERIALS (ATTACH APPROVAL)				
d. PRECEPTOR STATEMENTS				

13. INDUSTRIAL RADIOGRAPHY SUPPLEMENTS				
a. Training Program for Industrial Radiography Personnel; Periodic Retraining				
b. Internal Management Review Procedures and Controls				
c. Organizational Structure				
d. Applicant is: Individual ☐ Partnership ☐ Corporation ☐ Other ☐				
e. APPLICANT IS CONTROLLED DIRECTLY OR INDIRECTLY BY THE FOLLOWING CORPORATION OR LEGAL ENTITY (NAME & ADDRESS)				
f. Applicant is Incorporated Under the Laws of				

g. OFFICERS PARTNERS OR STOCKHOLDERS	ADDRESS	NUMBER OF SHARES OR PERCENTAGE IF OVER 10%

14. R NAME & COMPANY AFFILIATION OF ANYONE OTHER THAN AN EMPLOYEE OF THE LICANT GIVEN IN ITEM 1 WHO ASSISTED IN THE PREPARATION OF THE APPLICATION

Name

Company

I, the applicant and any official executing this certificate on behalf of the applicant named in Item 1 certify that this application is prepared in accordance with the Louisiana Radiation Regulations and that all information contained herein, including any supplements attached thereto, is true and correct to the best of our knowledge and belief.

10/27/86 | Louisiana State Univ. | J. M. Scott | Radiation Safety Officer

SCHEDULE OF RADIOACTIVE MATERIALS

RADIOISOTOPE Element	Mass No.	Maximum Possession Activity	CHEMICAL FORM	PHYSICAL STATE	USE	IF APPLICABLE: Attach. No.	IF APPLICABLE: Date Prev. Subm.
Any radionuclide, A=3 to 226 inclusive, except as specified below:		3000 mCi	Any	Any	General laboratory use for instruction and research exclusive of human use (and including also sealed Mossbauer and low-intensity gauging sources). See Supplements, for DRC-13, for details		
Hydrogen-3		25 Ci	"	"	As above (and including gas-chromatograph detectors).		
Cobalt-60		5 Ci	"	"	As above (and including sealed sources).		
Iodine-125		1.5 Ci	"	"	As above.		
Iodine-131		1.5 Ci	"	"	As above.		
Cesium-137		15 Ci	"	"	As above (and including sealed sources)		
Iridium-192		1 Ci	"	"	As above.		
Radium-226		50 mCi	"	"	As above.		
Americium-241		50 mCi	"	"	As above.		

SEALED SOURCES

RADIOISOTOPE Element	Mass No.	Number of Sources	Max. Activity per Source	SOURCE: Manufacturer	SOURCE: Model	DEVICE OR STORAGE CONTAINER: Manufacturer	DEVICE OR STORAGE CONTAINER: Model	USE	IF APPLICABLE: Attach. No.	IF APPLICABLE: Date Prev. Subm.
Americium-241		Any	See Supplements DRC-13					Depth-Moisture Gauge for field and forestry research.		
Cobalt-60		30,000	Ci for pool irradiator; see Supplements,					DRC-13, for details		
Cesium-137		1,000	Ci for pool irradiator; see Supplements,					DRC-13, for details		
Cesium-137		1,000	Ci irradiator AECL Cammacell 1000 Model A							
Californium-252		230 μg (.13 Ci) for general research; see Supplements, DRC-13), for details.								

URANIUM—THORIUM—PLUTONIUM

ELEMENT		MAXIMUM POSS.: Grams	MAXIMUM POSS.: Pounds	ISOTOPIC ABUND.: Isotope	ISOTOPIC ABUND.: Percent	CHEMICAL FORM	PHYSICAL STATE		USE OR PROCESS	IF APPLICABLE: Attach. No.	IF APPLICABLE: Date Prev. Subm.
Uranium	X		5,056			Metal	Solid	X	For subcritical assemblies; see Supplements, DRC-13.		
Thorium	X		200			Any	Any		General laboratory use.		
Uranium	X		200			"	"		General laboratory use.		

RADIOLOGICAL QUALIFICATIONS AND TRAINING

INDIVIDUAL RESPONSIBLE FOR RADIATION PROTECTION, INDIVIDUALS OR COMMITTEE MEMBER RESPONSIBLE	FORMAL RADIATION TRAINING		RADIOISOTOPE EXPERIENCE
	TITLE OR DESCRIPTION & LOCATION	DATES	
Name ☐ Previously Submitted Date Attachment Page or Item School, College or University / Degree/Year			
Name ☐ Previously Submitted Date Attachment Page or Item School, College or University / Degree/Year			
Name ☐ Previously Submitted Date Attachment Page or Item School, College or University / Degree/Year			
Name ☐ Previously Submitted Date Attachment Page or Item School, College or University / Degree/Year			

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Item 1.

The listed telephone number is for the Louisiana State University System Radiation Safety Officer, Center for Energy Studies, Baton Rouge, Louisiana, who has liaison responsibility with state and federal agencies on matters pertaining to radiological protection.

The Chairman of the Louisiana State University System Radiation Safety Committee may be reached at:

Louisiana State University
LSU Medical Center
Department of Biochemistry
1901 Perdido Street
New Orleans, LA 70112

Area Code: 504 Telephone Number: 568-6585

Item 3.

Radioactive materials will be used and stored at locations within the legal properties, auxiliary facilities, and rental properties of Louisiana State University, and at additional sites as listed below:

Louisiana State University and A & M College
Baton Rouge, Louisiana 70803

including: Ben Hur Plantation
Perkins Road Farm (Agronomy)
Perkins Road Farm (Poultry)
Pennington Biomedical Research Laboratory

Louisiana State University at Eunice
Eunice, Louisiana 70535

Louisiana State University at Alexandria
Alexandria, Louisiana 71303

Louisiana State University at Shreveport
8515 Youree Drive
Shreveport, Louisiana 71105

University of New Orleans
Lake Front
New Orleans, Louisiana 70148

including: Main campus
East campus

Louisiana State University Medical Center

School of Medicine (New Orleans)
1901 Perdido Street
New Orleans, Louisiana 70112

School of Dentistry
1100 Florida Avenue
New Orleans, Louisiana 70119

Florida Avenue Research Campus
1100 Florida Avenue
New Orleans, Louisiana 70119

Item 3. (continued)

School of Medicine (Shreveport)
1501 Kings Highway
Shreveport, Louisiana 71130

Agricultural Center
Baton Rouge, Louisiana 70803

including: Burden Research Plantation
Baton Rouge, Louisiana 70809

Dean Lee Research Station
Alexandria, Louisiana 71302

Hammond Research Station
Hammond, Louisiana 70401

Iberia Research Station
Jeanerette, Louisiana 70544

Idlewild Research Station
Clinton, Louisiana 70722

Calhoun Research Station
Calhoun, Louisiana 71225

Northeast Research Station
St. Joseph, Louisiana 71366

Hill Farm Research Station
Homer, Louisiana 71040

Macon Ridge Location, Northeast Research Station
Winnsboro, Louisiana 71295

Pecan Research - Extension Station
Shreveport, Louisiana 71135

Citrus Research Station
Port Sulphur, Louisiana 70083

Item 3. (continued)

Red River Research Station
Bossier City, Louisiana 71113

Rice Research Station
Crowley, Louisiana 70527

St. Gabriel Research Station
St. Gabriel, Louisiana 70776

Southeast Research Station
Franklinton, Louisiana 70438

Sweet Potato Research Station
Chase, Louisiana 71324

Rosepine Research Station
Rosepine, Louisiana 70659

Louisiana State University Memorial Forest
Sheridan, Louisiana 70427

Louisiana Universities Marine Consortium
Marine Research and Education Center
Star Route Box 541
Chauvin, LA 70344

Item 4.

Members of the Louisiana State University System Radiation Safety Committee, in addition to Paul M. Hyde, Chairman, are:

University of New Orleans, 1 member:
Gary C. Allen (Vice-Chairman)

Director of the Nuclear Science Center, Baton Rouge:
Edward N. Lambremont (Secretary)

LSU System Radiation Protection Officer:
L. Max Scott

Louisiana State University at Alexandria, 1 member:
James Marler

Louisiana State University and A & M College (Baton Rouge), 1 member:
Donald L. Thompson

Louisiana State University Agricultural Center, 1 member:
Jerry B. Graves

Louisiana State University at Eunice, 1 member:
Bayani I. Ramirez

Louisiana State University Medical Centers, 2 members:
William R. Gallaher (New Orleans)
Mary J. Wood (Shreveport)

Louisiana State University at Shreveport, 1 member:
Joseph W. Goerner

Appointment of the members is accomplished through Memorandum from the President, PM-30. A copy of this Memorandum is attached as Exhibit 1 of Item 4.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. Paul M. Hyde

POSITION: Chairman, LSU System Radiation Safety Committee

GENERAL EDUCATION:

School, College, or University	Degree	Year
University of San Francisco	BS	1947
University of California (Berkeley)	MS	1950
St. Louis University	Ph.D.	1953

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates

(See attached sheet)

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description

RADIOLOGICAL SAFETY EXPERIENCE:

(See attached sheet)

Item 4. (continued)

RADIOISOTOPE EXPERIENCE: Dr. Paul M. Hyde, Chairman, LSU System Radiation Safety Committee

Experience

Isotope	Max. Amount	Where experience was Gained	Duration of Experience	Type of Use
^{14}C, ^{3}H	mCi	St. Louis University University of Washington LSUMC	3 years 4 years 29 years	tracer synthesis tracer research tracer synthesis and research
^{32}P	mCi	LSUMC	15 years	student radiochemistry laboratory
^{35}S	mCi	LSUMC	15 years	student radiochemistry laboratory
^{131}I, ^{125}I	mCi	LSUMC	20 years	student radiochemistry laboratory
^{137}CS	mCi	LSUMC	20 years	student radiochemistry laboratory

Item 4. (continued)

FORMAL RADIATION TRAINING: Dr. Paul M. Hyde, Chairman, LSU System Radiation Safety Committee

Training

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
a. Principles and practice of radiochemistry and radiation control	St. Louis University	3 years	Yes	No
	University of Washington	4 years	Yes	
	Louisiana State University Medical Center	29 years	Yes	
b. Radioactivity measurement and monitoring techniques and instruments	St. Louis University	1 Year	Yes	Yes
	University of Washington	4 years	Yes	
	LSUMC	29 years	Yes	
c. Mathematics and calculations basic to the use and measurement of radioactivity	St. Louis University	1 Year	Yes	Yes
	University of Washington	2 Years	Yes	
	LSUMC	29 Years	Yes	
d. Biological effects of radiation	St. Louis University	1 Year	Yes	Yes
	University of Washington	4 Years	Yes	
	LSUMC	29 Years	Yes	

Item 4. (continued)

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Paul M. Hyde

Dr. Hyde received his Ph.D. from St. Louis University in 1953 in Biochemistry. During his tenure as a graduate student, he worked as an AEC research assistant utilizing radioisotopes in the synthesis of ^{14}C labeled steroids.

Dr. Hyde joined the faculty of the University of Washington Medical School in Seattle as an Instructor in the Department of Medicine responsible for radiochemistry studies in animals. He was the radiation safety instructor for the department faculty there for 4 years.

Dr. Hyde moved to Louisiana State University School of Medicine in 1957 and was chairman of the Isotope Committee locally and a member of the LSU System Nuclear Safety Committee for 1958 to 1965. He started teaching Radioisotopes in Biological Research (including laboratory) to graduate students in 1963 and has taught it 22 semesters since then. He was made chairman of the LSUMC Radiation Protection Committee in 1977 and Radiopharmacologist at Charity Hospital in New Orleans. In 1983, he was appointed Chairman of the LSU System Radiation Protection Committee.

University of New Orleans

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. Gary C. Allen

POSITION: Vice-Chairman, LSU System Radiation Safety Committee

GENERAL EDUCATION:

School, College, or University	Degree	Year
Stanford University	BS	1961
Rice University	MA	1963
University of North Carolina	Ph.D.	1968

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Allen is a geochemist-petrologist who has over 24 years of experience in x-ray diffraction and spectrography. He is also conducting research in laser applications to mineral studies. Additionally he served 4 years as the Radiation Safety Officer for the University of New Orleans.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. Edward N. Lambremont

POSITION: Committee Member, Secretary, LSU System, Radiation Safety Committee
Director, Nuclear Science Center, LSU and A & M College

GENERAL EDUCATION:

School, College, or University	Degree	Year
Tulane University	BS	1949
Tulane University	MS	1951
Ohio State University	Ph.D.	1958

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates
Radiotracer Techniques, LSU	4 mo.	1962
U.S. Dept. of Agric. Research training and experience	4 yr.	1962-66
Nuclear Science Center, Professor of Nuclear Science	20 yr.	1966-present
Oak Ridge Assoc. Univ., Visiting Scientist	20 mo.	1967-present
Sabbatical leave, ½ year,		1977
ORAU - Nuclear Power Training Course	1 wk.	1975

Isotope	Max Activity	Description
^{3}H	10 mCi	Tracer applications and research in the life sciences, physiological and biochemical processes
^{14}C	10 mCi	
^{32}P	20 mCi	
^{35}S	1 mCi	
^{51}Cr	10 mCi	
^{65}Zn	20 mCi	
^{86}Rb	10 mCi	
^{131}I	20 mCi	
^{60}Co	kilocurie	Radiation biology of insects
Neutron Sources (HPRR)		Radiation effects on insects

Item 4. (continued)

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Edward N. Lambremont

Dr. Lambremont has worked for 25 years with millicurie amounts of ^{3}H, ^{14}C, ^{32}P, ^{65}Zn and other nuclides in physiological and biochemical research, and has advised and consulted with students and other scientists and practicing physicians during this period in isotope applications in the biomedical sciences. He has taught basic and advanced Nuclear Science courses at Louisiana State University since 1967. In addition to the above radioisotopes he has had experience in research and teaching using ^{22}Na, ^{35}S, ^{36}Cl, ^{42}K, ^{56}Mn, ^{59}Fe, ^{60}Co, ^{65}Ni, ^{90}Sr, ^{99}MTC, ^{125}I, $^{137}mB2$, ^{137}Cs, ^{140}La, ^{204}Tl, ^{210}Pb, ^{226}Ra, Radium daughter ^{252}Cf and numerous other nuclides and radiation sources including X-ray machines and kilocurie cobalt-60 irradiators.

He has variously held positions at the Nuclear Science Center of associate professor and professor of nuclear science, and presently is serving as the Director of the Nuclear Science Center, a position held since 1974. He serves as a radiation consultant to several corporations and agencies in the private sector including the River Bend Nuclear Station of Gulf States Utilities, Inc. Flav-o-Rich Foods, Standard Brands Foods, the Ethyl Corporation, Dow Chemical Corp. and the U.S. Committee for Energy Awareness. He holds the permanent position of visiting scientist with the Medical and Health Sciences Division of Oak Ridge Associated Universities, Biological Chemistry Laboratory and has represented ORAU by eight years of service as the LSU councilor and six years on the board of directors. He also is a member of the medical staff of Mary Bird Perkins Cancer Center (a radiotherapy center) in Baton Rouge, La.

Item 7. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. Louie Max Scott

POSITION: LSU System Radiation Safety Officer

GENERAL EDUCATION:

School, College or University	Degree	Year
Texas A & M College	B.S.	1955
Purdue University	M.S.	1959
Purdue University.	Ph.D.	1961

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates

(see attached sheet)

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description

(see attached sheet)

RADIOLOGICAL SAFETY EXPERIENCE:

(see attached sheet)

Item 4. (continued)

RADIATION SAFETY EXPERIENCE WITH FOLLOWING RADIOISOTOPES: Dr. L. Max Scott

Radioisotope	Max. Amount	Where Exp. Was Gained	Duration of Experience	Type of Use
^{3}H	100 mCi	LSU, Gulf	9 years	tracers
	50 Ci	Gulf	8 years	generator targets
	10's Ci	Union Carbide	16 years	weapon related
^{14}C	10 mCi	LSU, Gulf	9 years	tracers
^{22}Na	1 mCi	LSU	1 year	tracers
^{32}P	10 mCi	LSU	1 year	tracers
^{35}S	5 mCi	LSU	1 year	tracers
^{45}Ca	1 mCi	LSU	1 year	tracers
^{51}Cr	1 mCi	LSU	1 year	tracers
^{54}Mn	1 mCi	LSU	1 year	tracers
^{55}Fe	1 mCi	LSU	1 year	tracers
^{59}Fe	1 mCi	LSU	1 year	tracers
^{57}Co	40 mCi	LSU	1 year	Mossbauer effects
^{60}Co	4000 Ci	LSU	1 year	irradiator
	100 Ci	Union Carbide	16 years	radiography
	100 Ci	Gulf	8 years	static electricity eliminator
^{63}Ni	30 mCi	LSU, Gulf, Union Carbide	25 years	electron capture detectors
^{65}Zn	1 mCi	LSU, Gulf	9 years	tracers
^{86}Rb	5 mCi	LSU	1 year	tracers

Item 4. (continued)

RADIATION SAFETY EXPERIENCE WITH FOLLOWING RADIOISOTOPES: Dr. L. Max Scott

(continued)

^{90}Sr	2 Ci	Gulf	8 years	petroleum research
	50 mCi	LSU	1 year	irradiator
^{125}I	125 mCi	LSU	1 year	tracers
^{134}Cs	25 Ci	Gulf	8 years	irradiator
^{137}Cs	1000 Ci	Gulf	8 years	irradiator
	600 Ci	LSU	1 year	irradiator
^{192}Ir	100 Ci	Union Carbide	16 years	radiography
^{226}Ra	20 mCi	LSU, Gulf	9 years	neutron sources
^{232}Th	10's Ci	Union Carbide	16 years	weapon related
^{233}U	10's Ci	Union Carbide	16 years	weapon related
^{234}U	10's Ci	Union Carbide	16 years	weapon related
^{235}U	10's Ci	Union Carbide	16 years	weapon related
^{238}U	10's Ci	Union Carbide	10 years	weapon related
^{238}Pu	10's Ci	Union Carbide	16 years	weapon related
^{239}Pu	10's Ci	Union Carbide	16 years	weapon related
	10 Ci	LSU, Gulf	9 years	neutron sources
^{241}Am	1 Ci	Gulf	8 years	analytical instruments neutron sources
	100 mCi	LSU	1 year	neutron sources
	10's Ci	Union Carbide	16 years	weapon related
^{252}Cf	200 mCi	Union Carbide, LSU, Gulf	25 years	neutron sources

Item 4. (continued)

RADIATION SAFETY EXPERIENCE: Dr. L. Max Scott
(continued)

Equipment				
Medical X-Ray	NA	Union Carbide LSU, Gulf	25 years	health services
Analytical X-Ray	NA	Union Carbide, LSU, Gulf	25 years	analytical chemistry
Industrial X-Ray	NA	Union Carbide, LSU, Gulf	25 years	radiography
Linear Accelerators neutron	NA	Union Carbide LSU, Gulf	25 years	radiography, generators

Item 4. (continued)

RADIATION SAFETY TRAINING: Dr. L. Max Scott

Type of Training	Where Trained	Duration of Training	On the Job	Formal Course
a. Principles and practices	Union Carbide	16 years	yes	
	East Tennessee Chapter-Health Physics Society	2 weeks		yes
	Western Penn. Chapter-Health Physics Society	2 days		yes
				yes
b. Radioactivity Measurement,	Health Physics Society	2 weeks		yes
Monitoring tech. and instruments	Union Carbide Y-12 Plant	16 years	yes	
	Oak Ridge Assoc. University	1 day		yes
c. Mathematics & calculations basic to the use and measurement of radioactivity	Purdue Univer.	4 semesters		yes
d. Biological Effects of Radiation	Batelle Northwest Lab.	4 days		yes
e. Packing and Transportation of Radioactive materials	Nuclear Energy Waste Consultants	3 days		yes
f. General Topics	Health Physics Professional Enrichment and Continuing Education	Approx. 20-30 different sessions ranging from 1 to 4 hours		yes

Item 4. (continued)

RADIOLOGICAL EXPERIENCE: Dr. L. Max Scott

Dr. Scott worked as a health physicist for Union Carbide for sixteen years. During portions of this time, he was administratively and technically responsible for internal and external radiation dosimetry and X-ray and radiography safety. From 1977 to 1985, he was corporate director of radiation health physics for Gulf Oil Corporation. In this position, he had audit and technical responsibility for some 30 state and federal licenses in Canada and the USA, and he was the Radiation Safety Officer for a large research center and a uranium mining and milling complex. Since 1985, he has served as Radiation Safety Officer for LSU and A & M College at Baton Rouge and as Radiation Safety Officer for the statewide LSU system.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. William Richard Gallaher

POSITION: Committee Member

GENERAL EDUCATION:

School, College, or University	Degree	Year
Saint Peter's College	BS	1966
Harvard University	Ph.D.	1972

FORMAL RADIATION TRAINING:

Radioisotopes in Research, Harvard University 3 mos., 1967

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description
^{3}H	10 mCi	Tracer in Cell Culture Biochemistry
^{14}C	5 mCi	"
^{35}S	1 mCi	"
^{32}P	5 mCi	Labeling of Cell Culture and Animal lipids with Inorganic Phosphate
^{51}Cr	1 mCi	Irracellular Labeling and Metauoproteins
^{125}I	1 mCi	Labeling of Proteins in vitro.

RADIOLOGICAL SAFETY EXPERIENCE:

Dr. Gallaher has worked with radioisotopes in cellular biochemistry continuously since 1967. Since 1973 he has been independently approved for radioisotope usage at LSU Medical Center, where he is currently Associate Professor of Microbiology, Immunology and Parasitology. He has been a member of the Campus Radiation Safety Committee for the Medical Center since 1980, has served temporarily as acting RSO on an ad hoc basis at the request of the RSO, and has repersented the Campus Committee on the LSU System Committee since 1983.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Joseph W. Goerner

POSITION: Committee member

GENERAL EDUCATION:

School, College, or University	Degree	Year
Rice University	BA	1957
Louisiana State University	Ph.D.	1966

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Goerner has been Chairman of the Chemistry Department at Louisiana State University in Shreveport since 1968. Prior to that time he taught at the school of the Ozarks in Missouri, and served as the National Science Foundation Coordinator for summer teaching programs at LSU in Baton Rouge, which required frequent direct association with the Nuclear Science Center there. He has had industrial experience with Dow Chemical Company and Shell Development Company.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Jerry B. Graves

POSITION: Committee Member

GENERAL EDUCATION:

School, College, or University	Degree	Year
Mississippi State University	BS	1955
Mississippi State University	MS	1958
Louisiana State University	Ph.D.	1962

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates
Radioisotope Methodology	1 sem.	1962

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description
14-C	10 mCi	Biological tracer, 1 year

RADIOLOGICAL SAFETY EXPERIENCE: Five publications on effects of gamma radiation and incorporation of radioisotopically labeled substrates in insects.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: James E. Marler

POSITION: Committee Member

GENERAL EDUCATION:

School, College, or University	Degree	Year
University of Miami (Florida)	BS	1962
University of Texas	MS	1965
LSU	Ph.D.	1969

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates
Nuc Sci 4101 (LSU)	1 sem.	1968
Research Prob. Course (UT)	2 yrs.	1963/4
NSF Summer Fellowship	3 mo.	1970

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity *	Description
C-14		Research Projects
P-32		
Tc-99		
Co-60		

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Marler, as a microbiologist, has worked with the above isotopes in conjunction with various research projects. Currently there are no isotope users at LSUA with the exception of sealed sources for Physics Lab calibration of intruments.

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Dr. Donald Lynford Thompson, Jr.

POSITION: Committee Member

GENERAL EDUCATION:

School, College, or University	Degree	Year
Rutgers University	BS	1973
Colorado State University	MS	1976
Colorado State University	Ph.D.	1979

FORMAL RADIATION TRAINING:

1. Formal coursework taken at Colorado State University, required for work with radioisotopes:

   1977 R 400A Radiation Physics 1.0 cr.
   R 400B Radiochem. Tech. 1.0 cr.
   R 400C Radiotracer Tech. 1.0 cr.

2. Previous experience with radioisotopes:

   Trained as graduate student in the use of ^{125}I-labeled and ^{3}H labeled compounds for radioimmunoassay at Colorado State University

   Have performed radioiodinations and have used radioimmunoassay techniques in research for the past 9 years at Colorado State University, Johns Hopkins University and Louisiana State University

   Have served on LSU and A & M College Campus Radiation Safety Committee since October 1985 and currently Chairman of this committee

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Bayani I. Ramirez

POSITION: Committee Member

GENERAL EDUCATION:

School	Degree	Year
Ateneo de Manila University	BS	1969
University of Houston	Ph.D.	1976

FORMAL RADIATION TRAINING

RADIOISOTOPE EXPERIENCE

Americium-241	Graduate work (Compton Scattering)

RADIOLOGICAL SAFETY EXPERIENCE

Item 4. (continued)

RADIOLOGICAL QUALIFICATIONS AND TRAINING

NAME: Mary J. Wood

POSITION: Committee Member

GENERAL EDUCATION:

School, College, or University	Degree	Year
University of Kentucky	BS	1948
University of Arkansas Medical School	MD	1966

FORMAL RADIATION TRAINING:

Title or Description	Duration	Dates
Radiology Resident		1968-71
Diagnostic	2 yr.	
Therapeutic	9 mo.	
Nuclear Medicine	3 mo.	
(Formal Teaching Courses)		
Physics of Radiology	1 yr.	
Radiation Biology	3 mo.	
Nuclear Medicine	1 yr.	

RADIOISOTOPE EXPERIENCE:

Isotope	Max. Activity	Description
I-131		Medical Diagnostic Amounts
I-123		
Tc-99m		
Se-75		
Ga-67		
In-111		
Tl-201		
Xe-133		
Yb-169		
Cr-51		
I-125		

RADIOLOGICAL SAFETY EXPERIENCE: Dr. Wood has worked with medical diagnostic quantities of isotopes since 1971 at the Confederate Memorial Hospital, which later became the LSU Medical Center Hospital in Shreveport. Dr. Wood is currently Chief of the Division of Nuclear Medicine and is responsible for the safety, supervision of isotope laboratory and technologists as well as interpretation of scans and in vitro tests. She has her boards in American Board of Radiology and in the American Board of Nuclear Medicine.

Item 5(a)

Radiation monitoring for LSU faculty, staff and students is conducted at LSU and A & M College, LSU Medical School (New Orleans, Shreveport) and the University of New Orleans. Specific details are included in the radiation safety manual for each location (Appendix).

Item 5(c)

The quantities of radionuclides handled are such that there is no need for routine bioassay. If as the result of an accident, bioassay is needed, services will be obtained from a commercial vendor. The Nuclear Energy Division will be advised as to the vendor when bioassay is conducted.

Item 6(a)

Both direct probe measurements and smears for removable contamination are employed for contamination surveys. Routine probe measurements for radionuclides which emit beta radiation with a maximum energy greater than 0.2 MeV and gamma emitters are made with a Geiger-Muller detector equipped with a 1.4-mg/cm^2 window. Smears are routinely taken with a polystyrene-foam pad or absorbent paper.

Smears for beta emitters are measured by liquid-scintillation counting with the instrument set for ^3H, ^{14}C and high energy beta discrimination. Smears for gamma emitters are measured by gamma counting with settings dictated by the suspected contaminant (usually ^{125}I).

The person with primary responsibility for a given area will be notified promptly of contamination levels exceeding 100 pCi/100 cm^2 (beta) or 25 pCi/100 cm^2 (alpha). Similar notifications will be made if direct measurement results exceed 50% of applicable allowable reading for the area based on the posted radiation warning signs.

Twenty-four hour notification to the Nuclear Energy Division will be given for incidents in which removable levels or survey readings are in excess of 100 times the internal notification levels, and immediate notification will be given to the Division for levels in excess of 1000 times internal notification levels.

Item 6(a). (continued)

University personnel are expected to request smear tests on all equipment transferred from areas where unsealed sources of radioactivity are handled.

Records of smear and survey results are maintained by the Campus Radiation Safety Officer on forms appropriate to each respective campus.

Permanently installed area monitors are considered essential for particularly hazardous locations where significant radiation levels could develop from loss of shielding or source rupture. Area monitors are currently installed above the ^{60}Co irradiator pool at the LSU and A & M College Nuclear Science Center at Baton Rouge.

Item 7.

Sealed beta sources larger than 100 µCi which are not stored under the direct control of the Campus Radiation Safety Officer are leak tested at six-month intervals. At the time sources are removed from storage, they are leak tested. Sealed alpha sources larger than 10 µCi are leak tested at three-month intervals. Certain sources will be leak tested either more or less frequently at the stipulation of the Nuclear Energy Division. Records of sealed-source leak tests are maintained by the individual Campus Radiation Safety Officers.

Analysis of leak test will be by procedures and instrumentation documented to have a limit of detection of less than 0.005 µCi.

Item 3.

Waste-disposal techniques employed by Louisiana State University include transfer to a commercial burial site, decay in storage, incineration, as hazardous waste, and dilution to the sanitary sewer system.

Classification of Radioactive Waste. For the purposes of discussion in the license-renewal application, the following classification of waste containing radioactive materials will be employed:

I. Waste containing short-lived radionuclides.

II. Very low-specific-activity waste materials consisting of aqueous and water-miscible organic solutions.

III. Intermediate- and low-specific activity wastes consisting of aqueous solutions and liquid organic materials.

IV. Intermediate- and low-specific-activity waste consisting of miscellaneous solid refuse.

V. Intermediate- and low-specific-activity wastes consisting of general biological materials, including botanical materials, animal bedding and animal excreta.

VI. Animal carcasses.

VII. Waste materials requiring special handling, including those presenting unusual radiation hazards, explosive and combustible materials, toxic and pathogenic materials, contaminated large or heavy equipment, and large quantities of mildly-contaminated wastes.

Item 8. (continued)

Disposal by Storage and Decay. Category I waste materials may be stored under suitable conditions for a time sufficient to allow radioactive decay of the included materials to reduce the specific activity to exempt concentration, as defined in Louisiana Radiation Regulations Part C, Section C.4, paragraph (b), and tabulated in Schedule B of Part C. For this purpose, the specific activity is calculated by the radioactive decay equations, and is based upon the average for all contents of a single container. For mixed radionuclides in a single container, the decay calculation will be for the longest-lived substance, or the limit of disposability will be established for the most hazardous substance.

When the contents of a container meet the exempt-concentration criteria stipulated above, the container is checked with a survey meter to assure acceptable radiation levels, as predicted by calculation, and then is treated as non-radioactive waste for permanent disposal.

In general, radionuclides with half-lives shorter than 100 days are candidates for decay disposal, with storage times being on the order of ten half-lives. Suitable conditions for storage include refrigeration or freezing for wastes subject to putrefaction, prevention of volatilization of low-boiling-point organic liquids, and similar precautions to assure that inadvertent release of material prior to acceptable radioactive decay does not occur.

Dilution to the Sanitary-Sewer System. All Category II and aqueous category III waste materials are generally disposed of by dilution to the sanitary-sewer system. Prior to disposal, the Campus Radiation Safety Officer verifies that the radionuclide when diluted does not

Item 8. (continued)

exceed either the concentrations tabulated in Louisiana Radiation Regulations Part D, Appendix A, Table I, Column 2 or 10 times the tabulated amount in Louisiana Radiation Regulations, Part D, Appendix B, and that such disposal will not result in the total discharged for the year exceeding 1 curie (1 Ci). In the dilution calculation it is assumed that 75% of the average daily water consumption is discharged to the sanitary-sewer system.

Methods of discharge whether via laboratory sink or central discharge varies among the campuses. Records of discharge are to be maintained by each Campus Radiation Safety Officer.

Because of the geographical separation of each of the major units of the University, and the improbability of compounded hazard to the general public by multiple discharges from each of the campuses, the restriction of Part D., Section D.303, paragraph (&.4), Louisiana Radiation Regulations, to one curie per year is interpreted to apply independently to each of the following operational units of the University:

Medical and Dental Schools at New Orleans and University of New Orleans.

LSU and A & M College and Pennington Biomedical Research Laboratory at Baton Rouge.

Medical School at Shreveport.

The following units of the University are each restricted to sanitary sewer disposals of one-tenth (0.1) curie cumulative per year:

LSU at Alexandria;

LSU at Eunice; and

LSU at Shreveport.

Item 8. (continued)

The total permissible discharge of radioactive materials to the sanitary-sewer system for Louisiana State University is therefore limited to 3.3 curies per year, with all other restrictions of the Louisiana Radiation Regulations fully applied to such discharges.

Disposal as Hazardous Non-radioactive Waste. Organic solvents in Category III which contain ^{3}H, ^{14}C and ^{125}I in concentrations of not more than 0.05 microcuries per gram of medium may be disposed as hazardous waste without regard to its radioactivity in accordance with Louisiana Radiation Regulations Part D, Section D.306. The respective Campus Radiation Safety Officer maintains records of quantities of material disposed by this method.

Commercial Disposal Service. Radioactive waste generated by the University which cannot be disposed of by other means is disposed by transfer to a licensed commercial burial agent. Currently, the service is provided by ADCO Services, Inc., Tinley Park, Illinois 60477. Competitive-bid regulations for the University make the stipulation of a single company impossible. It is anticipated that competitive bids for an annual contract will be sought; in such case, the Division of Radiation Control will be notified when the vendor changes.

Disposal by Incineration. Combustible waste of any category is generally disposed of by incineration. Incineration takes place at the LSU Dental School - New Orleans, LSU Medical School - Shreveport and LSU

Item 8. (continued)

and A&M College - Baton Rouge. Charging of the incinerator is controlled such that no more than 50% of the allowable air concentration for any given radioisotope as specified by Louisiana Radiation Regulation Part D Appendix A Table II will be released and that the mixture of radioisotopes will not exceed the results of the formula specified by Louisiana Radiation Regulations Part D Appendix A page 39-D. To be conservative, when determining the allowable charge concentration it is assumed that only 50% of the rated stack flow is actually occurring.

Pertinent information for the incinerators are as follows:

LSU and A&M College:

Location: North of the Veterinary Medicine School
Intersection of River Road and South Stadium Drive

Model: Consumat 550-P Waste Combustion Corporation
Richmond, Virginia

Capacity: 1080 pounds of Type IV waste

Operating Temperature: 1400^{o}F

Stack Flow Rate: 1105 cfm

Stack Height: 22 feet above burner level

Meteorological Data: Prevailing wind from south and southeast at approximately 3 miles per hour.

Operational Constraints: Radioactive waste incineration is limited to nights and weekend.

Item 8. (continued)

Medical School-Shreveport:

Location: Corner of Kings Highway and Linwood Avenue

Model: Consumat 225-P Waste Combustion Corporation, Richmond Virginia

Capacity: 588 pound of Type IV waste

Operating Temperature: 1400°F

Stack Flow Rate: 1000 cfm

Stack Height: 36 feet above ground

Meteorological Data: Prevailing wind from south at approximately 9.5 miles per hour

Operational Constraints: None

Dental School - New Orleans

Location: Roof of Dental School Building

Model: P-150 LA Inferno Associates New Orleans, Louisiana

Capacity: 150 pounds of Type IV waste

Operating Temperature: 1400°F

Stack Flow Rate: 1860 cfm

Stack Height: 7 feet above roof (167 feet above ground)

Meterorological Data: Wind from the south at approximately 5 miles per hour

Operational Constraints: None

Disposal of radioactive waste by incineration is under the supervision of the Campus Radiation Safety Officer who is responsible for control of types and quantities of radioactive waste treated, for assuring that regulatory restrictions are met and for maintaining all records pertaining to disposal by incineration. Daily operations are accomplished by persons specifically trained for this purpose, and authorized by the Radiation Safety Officer.

In addition to basic radiation safety training, the operation of the incinerator will be trained in the use of radiation survey meter, safe handling of radioactive waste and constraints of incinerator charging.

Incinerators are cleaned before and after each use for radioactive waste materials with the ash from such burns being stored in clearly and properly marked cans. Grab samples are taken and assayed for radioactive content so that the ash may be properly disposed.

Item 9(a).

The radiation safety program for Louisiana State University is designed to meet the needs of a broad-scope radioactive materials license which encompasses the entire University System. The concept is that of maintaining careful control of all sources of ionizing radiation, while simultaneously providing maximum flexibility for the use of such sources in research and teaching activities.

Administrative Structure. Ultimate responsibility for radiation safety under the broad-scope license concept resides in the Office of the President of the University. The President has by official memorandum (see Item 4, Exhibit 1, Memorandum from the President, PM-30) designated the Chairman of the Louisiana State University System Radiation Safety Committee as his authorized representative, and has made the Chairman administratively responsible for the radiation safety programs of the University.

This memorandum also has established the Louisiana State University System Radiation Safety Committee to advise the Chairman of the Committee in his administration of the radiation safety program. The Committee is composed of representatives of the individual campuses of the University System, who are selected from the major disciplines in which radioactive materials and radiation sources are most likely to be used. The System Radiation Safety Committee advises in the establishment of policies, rules, and guidelines for maintaining an effective radiation control program which is consistent throughout the University, and

Item 9(a). (continued)

reviews and advises on activities of the Louisiana State University System Radiation Safety Officer. The Committee normally meets once during the fall semester, once during the spring semester of each academic-calendar year and once during the summer, with additional meetings scheduled as required to discharge its responsibilities. Emergency matters, and trivial business may be handled on an interim basis by an Executive Committee, consisting of the Chairman, Vice Chairman or Secretary, and the System Radiation Safety Officer, with all actions of the Executive Committee subject to review by the System Radiation Safety Committee in full at its next official meeting. Meeting minutes are taken at each meeting and are maintained as permanent records.

Each campus on which there is a major use of radioactive materials and radiation sources is authorized by PM-30 to establish a Campus Radiation Safety Committee to expedite action on matters pertaining to radiation safety on that campus. The responsibilities of a Campus Radiation Safety Committee include approval (concerning radiation safety only) of grant and contract proposals to agencies outside the University, approval of user projects, approval of new construction and renovations, and review of the actions of the Campus Radiation Safety Officer. The Campus Radiation Safety Committee may also establish special policies, rules, and guidelines for activities under its particular jurisdiction. All actions of the Campus Radiation Safety Committees are subject to review by the System Radiation Safety Committee and by the System Radiation Safety Officer.

Item 9(a). (continued)

The following campuses have established Radiation Safety Committees:

School of Medicine at New Orleans, jointly with the School of Dentistry

School of Medicine at Shreveport

University of New Orleans

Louisiana State University and A & M College

Louisiana State University at Shreveport

Each Campus Radiation Safety Committee must have a minimum of three members, but may have more members if the activities of the campus so warrant. Changes in the membership of a Campus Radiation Safety Committee may be authorized by the System Radiation Safety Committee without notification of the Louisiana Nuclear Energy Division, and without requiring license amendment.

Each Campus Radiation Safety Committee meets as required to accomplish its responsibilities, but not less than once in the fall semester and once in the spring semester of each academic-calendar year. Meeting minutes are taken at each meeting and are maintained as permanent records. A Campus Radiation Safety Committee may establish subcommittees composed of no less than three persons to provide efficient review services, with the actions of all subcommittees subject to review by the Radiation Safety Committee, and all subcommittee actions being a part of the official Committee business.

Implementation and review for compliance with policies, rules, and guidelines established by the System Radiation Safety Committee has been

Item 9(a). (continued)

specifically assigned by the President of the University to the System Radiation Safety Officer. The System Radiation Safety Officer is vested with authority to act immediately in all matters adversely pertaining to radiation safety involving University personnel engaged in University-sponsored activities, or any other individuals on University property. His review and approval are required on matters which may alter established practices and procedures for control of radiation hazards within the University, including Campus Radiation Safety Committee policies, rules, or guidelines that may conflict with those established by the System Radiation Safety Committee. The System Radiation Safety Officer is responsible for coordination of activities of Campus Radiation Safety Officers to assure uniform implementation of University-wide standards for radiation control.

Specific duties of the System Radiation Safety Officer include:

1. Coordinating all licensing actions throughout the University system, including the preparation of amendment applications and maintaining current valid licenses; providing liaison between regulatory agencies and campus committees, and personnel concerned with radiation safety; and assuring that regulatory compliance is consistent and complete throughout the University system.
2. Two site visits per year to each campus where a radiation safety committee has been established. During these visits, a complete radiation safety program audit is conducted to ensure that license conditions, System Radiation Safety Committee policies and procedures and Campus Radiation Safety Committee policies and

Item 9(a). (continued)

procedures are being complied with and/or followed. Results of the audits with any recommendation are conveyed in writing to the Chairman of the Campus Radiation Safety Committee and to the Chairman of the System Radiation Safety Committee.

3. Provide technical assistance and advice to the System and Campus Radiation Safety Committees and Campus Radiation Safety Officers.

The actions of the System Radiation Safety Officer are subject to review by the System Radiation Safety Committee. He is a permanent member of that Committee.

The System Radiation Safety Committee may authorize the appointment of one or more Alternate System Radiation Safety Officers to assure continuity in the radiation safety program when the System Radiation Safety Officer is temporarily away from the University.

With the approval of the System Radiation Safety Committee, a Campus Radiation Safety Officer may be appointed for each campus where radioactive materials or radiation sources are in use, or where the use is reasonably anticipated. Each Campus Radiation Safety Officer is vested with the authority to act immediately to assure the well-being of individuals and the integrity of facilities within the jurisdiction of the campus. The Campus Radiation Safety Officer has responsibility for proper control and supervision of radiation sources and radioactive materials within the campus jurisdiction, and for approval of matters pertaining to licensing, users and assistants, proposals for grants and contracts, user projects, procurement, and facilities. Actions of a

Campus Radiation Safety Officer are subject to review by the Campus Radiation Safety Committee, the System Radiation Safety Committee, and System Radiation Safety Officer.

A summary chart of Committee and Radiation Safety Officer organization and inter-relationships is presented in Exhibit 1 of Item 9(a). All Committees which have been authorized are shown.

Radiation Safety Program Scope. The Louisiana State University radiation safety program includes surveillance of:

1. All radioactive materials, including natural and synthetic radionuclides in any chemical or physical form, except those specifically exempted in Part B, Sections B.4, B.5, and B.7, and certain Generally Licensed Devices listed in Schedule A of Part B of the Louisiana Radiation Regulations:
2. All radioactive materials, including natural and synthetic radionuclides, in the form of sealed sources unless specifically exempted by the Louisiana Radiation Regulations; and
3. All radiation-producing instruments and devices which yield ionizing radiation, including X-ray diffraction and fluorescence instruments, electron microscopes, electron microprobes, and other electronic instrumentation which may potentially emit X-radiation incidental to its operation.

Generally Licensed Materials, according to System Radiation Safety Committee desires, are considered as being included in the scope of

surveillance of the radiation safety program where there is a possibility that uncontrolled use would lead to possession exceeding applicable limits. Exempt devices may also be included in the scope of surveillance if they are deemed to offer potential hazards for use within the University environment.

Surveillance is construed to be inclusive of all aspects of the control of radiation hazards to assure the well-being of University personnel and the integrity of University properties, and compliance with all applicable state and federal regulations, in keeping with standards of good practice.

General Objectives. The general objectives of the radiation safety program are:

1. Assurance that all applicable state and federal regulations have full compliance;
2. Assurance that University insurance restrictions are met;
3. Assurance that state and local codes and ordinances have full compliance;
4. Assurance that the integrity and usefulness of University facilities and properties are not compromised;
5. Assurance that University personnel, students, and visitors are not subject to undue radiation exposure from radioactive materials or radiation sources;
6. Assurance that the general public will not be subject to undue radiation exposure from activities on the University properties;

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7. Assurance that releases of radioactive materials to the environment are minimized, in keeping with "as-low-as-reasonably achievable" concepts of radiation control; and
8. Assurance that maximum standards of good practice and safe handling of radioactive materials and radiation sources are maintained throughout the University System.

Members of all University System radiation safety committees, the System Radiation Safety Officer, individual Campus Radiation Safety Officers, and individual users are expected to maintain awareness of the general objectives. Users who fail to support the program objectives will not be permitted continued access to radioactive materials or sources.

Restrictions. The broad scope by-product license radiation safety program at Louisiana State University specifically prohibits:

1. 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;
2. The possession of sufficient amounts of fissile (i.e., Special Nuclear Material) substances to achieve a critical mass in any geometry, regardless of the geographical separation of individual small amounts of fissile materials;

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3. The combination of fissile substances with neutron-energy-moderating substances in any amount or geometry capable of yielding a self-sustaining nuclear-fission chain reaction; and

4. The use of students or University employees for the purpose of practice patients in the training of individuals in diagnostic X-ray techniques, unless there is legitimate need as determined by an attending physician or dentist.

The Louisiana State University System Radiation Safety Committee or a Campus Radiation Safety Committee may authorize, after appropriate study, additional general or local restrictions.

Procedures for Control of Radioactive Materials. Control of radioactive materials within the Louisiana State University System is maintained through review of grant and contract proposals, user projects, ordering, receipt and distribution, individual use, storage, and waste disposal. Details of the procedures for such controls vary from campus to campus because of local needs, including forms, reviews, supervision, and inspection. Individual campus Radiation Safety Manuals appended to this amendment application contain descriptions of local practices. (See Appendix)

It is a uniform policy of the University that individuals who anticipate the use of radioactive materials or radiation sources in the course of research or teaching activities, and seek funds from outside agencies to support such uses, must submit copies of the proposals to the Campus Radiation Safety Officer and to the Campus Radiation Safety

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Committee for their reviews. Reviews are specifically limited to matters dealing with radiation safety.

When an individual is awarded a grant or contract involving the use of radioactive materials or radiation sources, or when an individual wishes to initiate a research or teaching project supported by University funds, the individual is required to submit a user-project application to the Campus Radiation Safety Officer and/or to the Campus Radiation Safety Committee for their reviews. Reviews are for matters of radiation safety only. An individual user will be notified promptly of the decisions of the Radiation Safety Officer and the Committee, with suggestions for revision if the review decisions are unfavorable.

An individual must receive approval for a user project before an order for radioactive materials can be placed, or before a radiation producing machine may be ordered. Requisitions are transmitted through regular campus channels, with the exception that the routing for radioactive materials orders must include the Campus Radiation Safety Officer for his review and signature. The review includes determing that the originator has been approved for use, that the use is consistent with the anticipated procedures described in the user-project application, and that the purchase will not lead to violation of license restrictions. Purchasing agents and their administrative personnel have been alerted to question orders clearly stipulating radioactive materials, and orders which are suspected to include radioactive materials, and to refuse to accept a purchase requisition unless it has been reviewed and signed as authorized material by the Campus Radiation

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Safety Officer. It is general practice to initiate radiation-control record forms at this time to assure that license limits for possession will not be exceeded inadvertently by purchase of other radioactive material through a subsequent order. Requisitions for radiation-producing equipment, or instruments containing licensable radioactive materials are expected to follow an identical routing to those for radioactive materials, and to require approval of the Campus Radiation Safety Officer prior to issuance of the purchase order. In compliance with law, the System Radiation Safety Officer must either provide for the vendor a copy of the University's radioactive materials license, or determine that a copy has already been transmitted to the vendor. Emergency telephone orders must have prior oral authorization, verified later by signature on the purchase requisition.

Radioactive materials are expected to be delivered directly to the Campus Radiation Safety Officer, and purchase orders are to be so marked. Exceptions are allowed to this general practice when a very short-lived radionuclide is involved, when the radioactive material is subject to rapid deterioration unless properly stored, or in situations when an experimental project may fail without immediate application of the radioactive material. For such cases the Campus Radiation Safety Officer may authorize direct delivery to a user. Those shipments which require package examinations in accordance with Louisiana Radiation Regulations Part D, Section D.205 will be performed by the Campus Radiation Safety Officer or a designated alternate. These examinations include radiation measurement of the exterior of the package to

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determine the surface exposure rate for verification of the shipper's label, wipe testing the exterior of the package to ascertain whether removable contamination is present, wipe tests of the interior of the package to check for removable contamination, examination of the contents to establish that the innermost container is intact, and determing the unshielded exposure rate for the innermost package to establish suggested handling precautions for the user. The Campus Radiation Safety Officer is not responsible, however, for establishing either authenticity of the packaged material or radiochemical purity except for checking container labelling against the purchase information. External contamination or unexpected exposure rate at the surface of the package, removable contamination, or obvious damage to the primary container are considered sufficient reasons to stop transfer of the material to the user, with prompt notification of both the user and the vendor of the unusual observations. Lack of agreement between the purchase information and container label requires prompt notification of the user, who is then expected to reconcile the difference and to recommend an action.

If the radioactive material is deemed acceptable, the Campus Radiation Safety Officer records the shipment on appropriate Campus forms, and assigns an identification number to the containers in the shipment. The records include sufficient information to establish radiological hazards for the material, the name of the user and the location at which it will be used, and the date of receipt. This record is retained in the files of the Campus Radiation Safety officer until

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the material has been fully used and disposed of, or has decayed to negligible activity, at which time the record is transferred to an inactive file with a notation of disposal action and date. The purpose of this record is to provide the Campus Radiation Safety Officer with ready information on the nature, amount, and locations of all radioactive materials actively in use on the campus, or stored for potential use. This record also provides information for preparation of inventory lists. Annually, a physical inventory is conducted by either the Campus Radiation Safety Officer or each user to assure that all radioactive material is accounted for. Physical inventories may be performed at other times, either totally or partly, to verify on-hand materials.

After inventory records have been completed, a shipment of radioactive material is transferred to the user, with written acknowledgement of the transfer and the date of the transfer being retained by the Campus Radiation Safety Officer. The user is informed by the Campus Radiation Safety Officer of any special precautions required for handling the material, or any unusual hazards that may be involved in the planned use of the material.

Direct control of the radioactive material becomes the user's responsibility with transfer of the material into his possession. The user is expected to maintain records of withdrawals from stock, application to experimental animals or other use, and disposal. Although exact material balance is not expected in these records, they must be sufficiently complete to permit estimation of the quantity of material in a particular shipment still in possession of the user at any time. Users'

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records are subject to inspection by the Campus Radiation Safety Officer or the System Radiation Safety Officer without prior notification.

Waste materials or other materials no longer wanted by a user are returned to the Campus Radiation Safety Officer for disposal. Full details of waste handling are presented in Item 8 of this license renewal application.

Approval of Users. Individuals who wish to employ radioactive materials and radiation sources on the properties of the University, or to use these materials and sources for official University projects at sites not under the control of the University, must receive approval from a Campus Radiation Safety Committee before the work is undertaken. If the project involves unusual practices, or initiates a class of uses never attempted previously, the Radiation Safety Committee may forward the request to the System Radiation Safety Committee for determination of University-wide policies, rules, or guidelines to be applied to the project or use.

The review process is initiated with applications for contracts or grants to agencies outside the University. Proposals for such grants and contracts must be provided to the Campus Radiation Safety Officer or the Campus Radiation Safety Committee prior to the time they are submitted for official signature and transmitted to the outside agencies. Approval is required before the proposal may be signed. Details of the routing and review process for each campus are contained in the radiation safety manuals appended to this renewal application (See Appendix). In general, review includes:

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1. Determination that the individual submitting the proposal has sufficient experience with radioactive materials or sources required for the work to be able to perform the work safely (or that the individual will receive the proper training and experience before initiating the work);
2. Determination that appropriate facilities are available to permit the proposed work to be accomplished according to the standards of practice for radiation safety set by the System Radiation Safety Committee and the Campus Radiation Safety Committee, or that the necessary facilities will be operational before the work is initiated, including written commitments from the University that renovations, new construction, or special equipment will be provided;
3. Determination that the proposed work is not in violation of license restrictions or state or federal laws (and, in some instances, local ordinances and codes), or that amendment of the license to permit the work is possible;
4. Determination that procedures are in keeping with all policies, rules, and guidelines; and
5. Determination that personnel, other than the originator, who are properly trained in safe-handling practice for the radioactive materials or sources will be available if they are required.

This review is strictly from the view-point of radiation safety, and does not involve review of the scientific merit, quality of the

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investigation or use proposed. If the proposal is found deficient as submitted, revisions and corrections may be suggested, and the proposal may be resubmitted for review after it has been amended. Written notice of the approval or rejection (with reasons) is provided to the originator, and indication of approval must be transmitted with the proposal to the University administrative offices.

Approval of a proposal to an outside agency is not an authorization for an individual to use radioactive materials or radiation sources. In order to obtain authorization to actually employ radioactive materials of radiation sources, an individual must obtain approval for a user-project. The information required includes identification of the originator, including departmental and other identification, a descriptive title for the project, and the following reviewed information:

1. Training and experience of the originator and all other individuals who will be handling radioactive materials or radiation sources under the project director (originator), in sufficient detail to establish if the individuals involved are competent to accomplish the proposed work safely;
2. The quantity and form of all radioactive materials expected to be on hand at any one time in the life-time of the project, with complete identification of the radionuclides present, or identification of the radiation source required for the work;
3. The location at which the radioactive materials or radiation source will be used, and any auxiliary locations where supporting work may be performed;

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4. Details of the procedures to be employed, facilities necessary for accomplishing the work, radiation safety equipment required, storage locations and security measures to be followed, and waste handling techniques, in sufficient detail to establish that policies, rules, and guidelines, and standards of good practice for radiation safety will be followed; and
5. Approximate schedules for beginning and ending the program.

The user-project application form containing this information is submitted to the Campus Radiation Safety Officer or to the Campus Radiation Safety Committee for review sufficiently early that questions can be resolved satisfactorily before work involving radiation hazards is undertaken. Review includes determinations similar to those for contract and grant proposals, with particular attention directed toward procedures, special-handling techniques, and facilities to be used. If the project requires amendment of the University's radioactive-materials license, the amendment must be secured prior to completion of the review. Review of a user-project application is for matters of radiation safety only, with comment on the quality of the project being reserved for other channels.

The user-project must be approved before work may be undertaken. The results of the review are transmitted in writing to the applicant, with reasons for rejection being provided, or special restrictions being

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clearly stipulated. In the event of a rejection, the project director may resubmit the application after it has been revised, or may appeal to the System Radiation System Committee for evaluation of the Campus decision.

Records of all approved user-projects are maintained by the Campus Radiation Safety Officer. Users are expected to notify the Campus Radiation Safety Officer of terminated projects; records of terminated project are transferred to inactive files for permanent storage.

User-projects may be amended in minor details by letter to the Campus Radiation Safety Officer, and his written concurrence.

Training required for users to qualify to employ radioactive materials and radiation sources in teaching and research projects varies with the nature of the hazards involved. Inexperienced users normally are permitted to work only with "general-license" quantities under the direction of trained and experienced users; when the necessary expertise has been acquired, the users will be permitted to increase the quantities and hazard levels. Inexperienced users, whether faculty, students, or technicians, may be required to take formal courses in tracer methodology and radiation safety before undertaking work with radioactive materials and radiation sources. Occasional short courses may be offered by senior users or Campus Radiation Safety Officers to afford workers access to formal training. In some instances, because of the nature of a project, formal training and extensive experience may be stipulated as a specific requirement for all project personnel. The level of training and experience required for a project is judged during the review process. Areas of training shall include.

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1. Principles and practices of radiation safety;
2. Radioactivity measurements, standardization, and monitoring techniques, and instrumentation;
3. Mathematics and calculations basic to the measurement of radioactivity;
4. Biological effects of radiation;
5. Handling and use of radioactive material;
6. Radiation Limits;
7. Applicable sections of the Louisiana Radiation Regulations; and
8. Local campus procedures for management of radioactive materials.

Exemptions from one or more of these training areas may be granted when warranted, or when the user agrees to coöperative direction by a senior user.

Control of Radiation Exposure. Louisiana State University recognizes that the use of radioactive materials and radiation sources is an essential part of the teaching and research programs conducted by faculty and students. The University simultaneously recognized its obligation to restrict exposure of personnel, students, visitors, and the general public. In responding to this obligation, the University has adopted the philosophy of maintaining "as low as reasonably achievable" limits (the ALARA concept) on the exposure of individuals to ionizing radiation and on the release of radioactive materials to the environment.

Control of radiation exposure is accomplished by imposing an extensive radiation monitoring program on the radioactive-materials

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control program. The latter restricts the uses of radioactive materials and radiation sources to individuals who have been through a comprehensive review process prior to authorization for use. This administrative process is supplemented by personnel dosimetry, contamination surveys, and radiation-area surveys during the time that the sources and radioactive materials are actually in use. Details of the procedures for these three surveillance techniques are presented in Items 5 (including Supplements to 5(a) and 5(c)), 6 (including Supplements to 6(a)), and 7 (including Supplement 7) of this license renewal application. Specific campus procedures are included in the Appendix.

Radiation Protection Standards adopted by the University take cognizance of Louisiana Radiation Regulations (Part D, Standards for Protection Against Radiation). Operations officially performed under the authorization of the University must be conducted in such a way that it would be unlikely that an individual would assimilate within a critical organ (by inhalation, ingestion, or absorption) a quantity of radionuclide (or nuclides) that would commit the individual to an organ dose exceeding a specified standard. The Radiation Protection Standards employed by the University are tabulated on the following page for both personnel included under the "controlled" category working in restricted areas, and for the general public in unrestricted areas. For this purpose, controlled personnel are those individuals whose radiation exposure is monitored, and restricted areas are those where control and surveillance of radioactive materials and sources is established; the general public is not monitored, and unrestricted area are those in which there is no control of radiation sources or radioactive materials

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(surveillance may, however, be maintained in unrestricted areas). In each column of the table the values given are regulatory maxima, while those enclosed in parentheses are target values which are generally considered practicable with careful attention to standards of good practice.

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RADIATION PROTECTION STANDARDS

Controlled Personnel in Restricted Areas

Type of Exposure	Expos. Per.:	Dose Commitment, rem[a] Year	Quarter	Emergency[b]
Whole body; head, trunk, gonads, lens of the eye, red bone marrow, active blood-forming organs		5 (0.5)	1.25 (0.125)	100 (12)
Unlimited areas of the skin (hands & forearms excluded); other organs, tissues and organ systems (bone excluded)		15 (1.5)	7.5 (0.5)	-
Bone		30 (1.5)	10 (0.5)	-
Forearms		30 (1.5)	10 (0.5)	200 (50)
Hands & feet		75 (1.5)	18.75 (0.5)	200 (50)

a. Values in parentheses represent "as-low-as reasonably achievable" target commitments.
b. Values for emergency-dose commitments are one-time-only life-saving dose commitments; values in parentheses are target commitments for timed entries.

General Public in Unrestricted Areas

Type of Exposure	Annual Dose Commitments, rem Individual	Population Avg.
Whole body, gonadal tissue, bone marrow, lens of the eye	0.5 (0.1)[a]	0.17 (0.1)a
All other organs	1.5 (0.2)[a]	0.5 (0.1)[a]

a. Average annual gonadal background dose-equivalent rate for Louisiana.

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To work toward the "as-low-as-reasonably achievable" values tabulated, radiation safety personnel and individual users survey working areas by instrumental monitoring (both portable and fixed) and smear tests. Specific action values may vary between campuses due to differing problems and protection philosophy. See campus Radiation Safety Manuals (Appendix) for specifics.

Electronic devises that produce ionizing radiation, such as particle accelerators, X-ray machines, electron microscopes, fluoroscope and similar instruments, are included in the radiation control program. This equipment is thoroughly inspected for leakage radiation and general operational radiation levels when it is installed and annually thereafter. Checks subsequently are performed after maintenance or repair work, to assure that operating personnel are not exposed to hazardous radiation levels. Interlocks and other safety devices are inspected on an annual basis.

Diagnostic X-ray machines used in University infirmaries, athletic departments and teaching where human subjects are exposed, are inspected annually to assure that proper collimation and filtration are employed, and that Part F (Use of X-rays in the Healing Arts) of the Louisiana Radiation Regulations has full compliance.

All beginning students and University personnel subject to working with and around electronic devices that produce ionizing radiation are provided with general rules for working with radioactive materials. A typical set of rules is included as Exhibit 2 of Item 9(a) of this

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renewal application. Because of the variety of X-ray-producing equipment used at the University, no general set of rules for such equipment has been devised; however, it is a standard part of operating procedures for each individual with senior responsibility for a particular piece of equipment to instruct new workers in safety matters as well as operations.

The Louisiana Division of Radiation Control Form DRC 3, "Notice to Employees", is posted where radioactive materials and radiation sources are used.

Each Campus Radiation Safety Officer has the responsibility of maintaining proper caution signs where radioactive materials and radiation sources are used or stored. Individual users are expected to notify the Radiation Safety Officer promptly if a sign is removed, damaged, or becomes unreadable. All caution signs and posting rules comply with Part D, Section D.203 of the Louisiana Radiation Regulations. Additional special signs may be authorized by the System Radiation Safety Committee. All areas, rooms, storage cabinets, refrigerators, and storage shields are posted. In addition, users are expected to label all containers of radioactive materials with labels, tags, or tape approved by the Campus Radiation Safety Officer. Each device containing a radiation source, and each radiation-producing instrument which requires registration with the Louisiana Nuclear Energy Division

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is labeled with a radiation-warning plaque indicating the nature of the hazard.

Access to areas where radiation exposures might occur is controlled by limiting authorization of individuals; limiting door keys; maintaining radioactive materials in locked storage areas, cabinets, and containers when necessary; requiring redundant safety switches and interlocks on radiation-producing equipment, and by installing physical barriers when applicable. Additional source-security measures may be required in special situations, including direct observation by posted guards, to assure that unauthorized entry into a hazardous area does not occur.

Personnel dosimetry devices are provided to all persons who may be subjected to radiation exposure of a magnitude such that 10% of the applicable limit might be exceeded. Records are maintained on all monitored personnel. Cumulative radiation exposures are derived from radiation badges.

The Louisiana State University System Radiation Safety Committee, the System Radiation Safety Officer, Campus Radiation Safety Committees, or Campus Radiation Safety Officers may impose additional or alternate methods or radiation-exposure control to assure minimal individual exposures in unusual situations without notification of the Louisiana Nuclear Energy Division prior to the change. This provision is required to permit prompt action in emergency situations, and is not intended to obviate notification of permanent policy changes.

Emergency Procedures. It is the responsibility of each Campus Radiation Safety Officer to establish detailed emergency plans and procedures for installations in which there is a potential for release of significant quantities of radioactive materials or the possibility for significant uncontrolled radiation exposure.

Although general procedures for emergency situations are published in each Campus Radiation Safety Manual (See Appendix), detailed plans and procedures which are not of general interest are maintained by the Campus Radiation Safety Officer and by the individual with primary responsibility for a particular installation. These procedures are available for inspection, and are provided to all persons working in such an installation.

Each Campus Radiation Safety Officer is required to provide all persons working in restricted areas with general emergency-procedure information. A typical quick-reference checklist is included in this amendment application as Exhibit 3 of Item 9(a).

Emergency procedures developed for each campus must provide information for:

1. Notification of the Campus Radiation Safety Officer or alternate individuals knowledgeable of emergency practice in general and of specific local procedures;
2. Notification of campus security personnel of the occurrence of an emergency involving radiation or

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radioactive materials, and proper instructions on supporting actions for such emergencies;

3. Alerting fire-fighting personnel of the existence of a radiation hazard or potential hazard, with instructions on precautionary methods to avoid exaggeration of emergency and to minimize their own individual exposures; and
4. Obtaining medical assistance for exposed or contaminated persons who have been injured, including the names of knowledgeable medical doctors, and precautionary instructions to hospitals where it may be necessary to transfer injured persons.

The Campus Radiation Safety Officer or alternate must be aware of the reporting requirements of the Louisiana Radiation Regulations, Part D, Sections D.402 D.403 and D.404, and is required to comply fully with the stipulations of these sections. Assistance from the Louisiana Nuclear Energy Division may be requested if an emergency situation warrants, or if no University personnel knowledgeable of radiation-emergency handling is available.

Approval of New Facilities and Renovations. All new facilities to be constructed by the University, and all renovations of existing facilities in which the use of radioactive materials and radiation sources is planned or anticipated must be reviewed by the Campus Radiation Safety Committee, the Campus Radiation Safety Officer, and the

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System Radiation Safety Officer. If policy questions are raised by the renovation or new construction, review by the System Radiation Safety Committee may also be required.

The review will consider arrangements of working areas, relationships between restricted and unrestricted areas, shielding of rooms where significant radiation hazards may be expected, problems related to security of radioactive materials, control of accidental releases of radioactive materials within the facility or building, and the consequences of releases of radioactive materials to the environment.

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Through its radiation safety program, Louisiana State University has established procedures to assure that radioactive materials and radiation sources are used and stored in facilities which meet standards of good practice for the particular radiation hazards involved. These provide for:

1. Consultation with Campus Radiation Safety Officers and the System Radiation Safety Officer during initial planning of a new building or renovation, with input to the selection of fume-hood design, laboratory arrangements, shielding, surface materials, and similar matters;

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2. Critical examination of architectural drawings and specifications by Campus Radiation Safety Committees and Campus Radiation Safety Officers, the System Radiation Safety Officer, and for matters of general policy and unusual projects, the System Radiation Safety Committee;
3. Inspection of completed facilities by the Campus Radiation Safety Officers and the System Radiation Safety Officer, with recommendations for corrective actions required before use of radioactive materials or radiation sources will be permitted;
4. Personal examination by Campus Radiation Safety Officers of facilities in use to assure that they are being properly maintained, and that unauthorized changes have not been made;
5. Establishment of working-level restrictions by Campus Radiation Safety Committees and Campus Radiation Safety Officers for specific facilities, with particular attention to laboratories or other facilities not originally intended for radionuclide or radiation projects; and
6. Surveillance of facilities by Campus Radiation Safety Officers to assure that administrative restrictions stipulated for each location have full compliance.

Radiotracer apolications which involve especially hazardous nuclides or large quantities of minimal-hazard materials are restricted

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to laboratories or other facilities specifically designed and constructed for such work. Facilities in which X-ray machine are to be employed are designed according to standards set forth by the National Council on Radiation Protection and Measurements. Conservative work-load, use, and occupancy factors are routinely employed for primary and secondary barrier calculations. Shielding calculations for gamma emitting sources are based on National Bureau of Standards Handbooks. For general neutron-shielding calculations, data and procedures from National Bureau of Standards Handbooks are utilized. Conservative assumptions, as for X-ray, are made for gamma-radiation and neutron-radiation shielding calculations. All shielding calculations are verified by direct physical measurements after a facility has been completed. Whenever possible, facilities are inspected while under construction to assure that all shielding specifications are being met, and that shielding is properly installed.

The literature cited in the preceding paragraph, and the general philosophy of laboratory design and shielding calculations are included in this license renewal application in lieu of detailed description of the general facilities of the University in which conventional procedures and carefully controlled quantities of radioactive materials are utilized, or in which conventional X-ray equipment is installed. The Louisiana Nuclear Energy Division is routinely provided with detailed architectural drawings of all major construction in which the presence of potential radiation hazards is planned, with additional required information being supplied by the appropriate Campus Radiation Safety Officer or the System Radiation Safety Officer.

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In addition to the general facilities, Louisiana State University has established certain special facilities, which are described in the following sections of this Item.

High Intensity Gamma Irradiation Facility. This facility is located in the basement of the Nuclear Science Center LSU and A & M College campus. The facility consists of a well in the basement floor 15.5 feet deep by 6 feet in diameter, made of Gunite lined with stainless steel. The pool can be filled to a depth of 15 feet with demineralized water, which is circulated through a mixed-bed ion-exchange/filter column, with make-up water added to maintain constant level. The pool is covered with an aluminum walk-on grating, with a single hatch in the center to provide access to the pool during routine use. The grate may be removed for cleaning or sources handling, but only after unlocking padlocks which prevent retaining nuts from being removed from studs set into the curb around the top of the pool. The pool hatch also is padlocked in place when it is not in use.

The pool is designed so that a 100,000-curie point source of cobalt-60 placed at a depth of 14 feet will yield a dose rate of less than 2 millirems per hour at critical-organ distance above the grate. The present inventory (as of April 1, 1986) of the two annular source arrays, one being 460Ci of ^{60}Co and the second being 3070 Ci of ^{60}Co.

Currently there are two formal source configurations located at the bottom of the pool, one in the center and one near the west wall.

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Each of these configurations is bolted to the bottom of the pool by means of studs fixed to a large source-positioning plate.

Each of these irradiation assemblies is used by lowing the irradiation canister through the water into the center of the annulus, and retrieving the canister after a pre-calculated exposure time. Both an electric hoist and manual handling are employed for lowering and raising the irradiation canisters.

An I-beam supported by A-frame members at the ends is positioned over the pool for source-loading and unloading operations. For introducing sources into the facility, the shipping cask containing the sources is lowered into the stairwell at the entrance door, and then moved on rollers into the pool room up to the curb and adjacent to one of the A-frame supports. Chains are attached to lifting eyes on the cask and to a hook on a chain hoist supported on the horizontal I beam; a second chain is attached to the lifting eyes on the cask cover and to a second hoist on the I beam. Bolts holding the cask cover are loosened at this time, but not removed. With the pool grating removed and the water level in the pool lowered to accept the displacement of the cask, the cask is lifted and positioned over the center of the pool, and then is lowered until it is submerged several feet under the surface of the water. The cover retaining bolts are removed with remote tools, and the cask is lowered to the bottom of the pool. With the second hoist, the cask cover is removed to expose the sources, which are then lifted individual by remote tools out of the cask and placed at the side of the pool. When all sources have been removed from the cask, it is lifted

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out of the pool, after careful verification that it is empty and uncontaminated, it is re-assembled, and returned to the supplier. The sources left in the pool are then arranged into the desired configuration, and the grating is replaced and locked into position. Frequent water samples are taken from the pool after new sources have been introduced for gamma-count checks against leaking or contaminated sources.

Removing sources from the pool for shipment to another location is accomplished by the reverse of the pool loading procedure.

While there is little likelihood that the pool will leak, loss of shielding water is considered as a major accident mode. As a precaution, a fixed monitor, which will sound a high-audibility horn, is located above the pool to detect loss of shielding and warn personnel. Whenever the horn sounds, entering personnel check radiation levels at both the emergency escape hatch in the ceiling of the pool room, and at the main basement entrance door, and enter the pool room cautiously while continuously checking radiation levels. If a high radiation level were found, the condition of the pool could be checked safely through the escape hatch, and water could be added with hoses brought in through the basement entrance should it be needed. A fire hydrant is immediately available for introducing large volumes of water if a severe leak were to develop. Lead casks are kept on hand for temporary storage of sources were to become necessary to remove them to repair the pool. If it were judged that the pool could not be repaired, and the leak was so severe that no shielding water could be contained, the sources could

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simply be covered by concrete by their existing locations by remote procedure, or the pool could be filled remotely with sand which could be removed subsequently when a source-recovery procedure was developed.

A second maximum-conceivable accident would be the rupture of one or more sources, and dissolution by corrosion of the radioactive metal, followed by collection of the cobalt on the resin in the ion-exchange bed so that an intense unshielded gamma source would exist in the pool room at floor level. For the current pool inventory, simultaneous rupture and complete dissolution of two of the most intense sources would lead to approximately 500 curies of cobalt-60 trapped in the unshielded resin-bed vessel, resulting in an exposure rate of approximately 400 mR/hr through the ceiling to the floor of the offices immediately above, and approximately 41 Ṙ/hr at both the escape-hatch cover and at the entrance to the pool room. Several options are available for recovery from this situation, including competitive desorption of the cobalt from the resin and returning it to the pool, from which it could be recovered in controlled quantities; remotely cutting the plastic piping loose from the resin-bed vessel and dumping it into the pool, where it could be dismantled remotely and the resin loaded into burial containers in small quantities; or the vessel could be cut loose, removed from the basement intact and placed into a large shipping vault constructed on a flat-bed truck, and transported under escort to a hot cell for dismantling and removal of the contaminated resin in small batches for subsequent disposal. The likelihood of this maximum incident is remote to the extent of being nearly impossible

Item 9(b). (continued)

because of the improbability of flash-dissolving cobalt metal in distilled water.

The maximum probable incident for this facility is the corrosion penetration of a weld to allow leakage of the cobalt into the circulating pool water, which would be detected before external radiation levels became serious. The difficulty here is how to determine which source is leaking so that it could be removed from the pool, and then decontaminating the pool water or otherwise disposing of it. Each individual source holder would be checked by placing it into a submerged isolation chamber, removing the water, and then pressurizing with pure helium to a pressure of 100 PSIG for 30 minutes. Then the helium would be removed by a nitrogen purge and a vacuum pulled to approximately 50 microns of mercury absolute pressure. At this time the gas removed from the isolation chamber would be routed to Helium Mass Spectrometer Leak Dectector for analysis. The integrity of the source holder would be determined by comparison of the helium concentration vs. time plot with results from a similarly tested stainless steel bar. This process would be repeated until the leaking source was located. The source would then be transferred remotely into an uncontaminated isolation container and then into a cask for shipment to a processor for disposal. Once the leaking source had been removed from the pool, the pool-water decontamination process could be undertaken. Circulating the water through small disposable cation-exchange columns would be the most attractive option, with each column being carefully monitored to determine when a prescribed external radiation level had been reached. The column would then be replaced with a fresh one, and the radioactive

column would be placed into a shielded container for shipping to a disposal site. This process would be repeated until the remaining pool water was essentially free of cobalt.

The pool may be also used for storage of both cobalt-60 and cesium-137 sources not arranged into specific configuration. Such sources would be available individually or collectively to experimenters for special irradiations. Only authorized personnel would be permitted to move these sources, using 20-foot-long handling tools. Because the ceiling of the pool room is only 10 feet high, handling tools would be manipulated into a vertical position up through the escape hatch before being introduced into the pool through the grating hatch. Once the tools were introduced into the pool, the escape hatch in the ceiling would be closed and sealed, thereby preventing the tools from being removed from the pool. Under these conditions, a source could not be brought closer than 10 feet below the surface of the pool, and accidental exposure of handling personnel thus avoided.

Under special conditions, experimenters are permitted to modify the top of an irradiation canister to provide gas flow or coolant flow into the canister when it is in the irradiation position. This will introduce channels which penetrate the shielding water, creating potential radiation-streaming conditions. To avoid this problem, experimenters would be required to flex supply and exhaust lines into S curves or wide arcs to assure tortuous streaming paths.

Item 9(b). (continued)

User-projects which employ the pool irradiator must be approved by the Campus Radiation Safety Officer. The Campus Radiation Safety Officer maintains a file of individuals who have been trained and authorized to use the facility without direct supervision; all other users are required to work under the supervision of a staff member of the Nuclear Science Center or an authorized user.

Subcritical Assembly. A subcritical assembly has been established in the Nuclear Science Center LSU and A & M College. It is fueled with aluminum-clad natural-uranium slugs (Savannah River Model MK VIIa) with hollow centers for threading onto support members, and are moderated with light water; conventionally, they are driven by isotopic sources (either plutonium/beryllium or californium-252) with neutron yields on the order of 10^6 to 10^8 neutrons /second, and are operated at ambient temperature. The device is not capable of sustaining a critical state. The effective multiplication factor is approximately 0.88.

The location of the assembly is as shown in Exhibit 1 of Item 9(b). This assembly consists of a 1,100-gallon aluminum tank, coated on the inside with heavy epoxy-resin paint, into which individual rods containing five fuel slugs each are hand loaded. Geometrical positioning of the fuel rods is accomplished by a grid plate located in the bottom of the tank, with holes to receive the ends of the rods drilled in a hexagonal array. When fully fueled, the subcritical

Item 9(b). (continued)

assembly contains 225 fuel rods representing a total mass of 2,500 kilograms of uranium. When not in use, the rods are locked in a cabinet. The maximum background dose rate from the uranium is approximately 5 mrem/hr at one foot from the cabinets.

To reduce potential radiation problems, the water introduced into the tank is carefully de-ionized by circulated through a mixed-bed ion-exchange resin/filter unit. This system is designed so that the tank cannot be drained accidentally.

With the subcritical assembly fully fueled and moderated, and containing a driver source emitting approximately 10^7 neutrons/second, the dose-equivalent rate at the surface of the tank in the working area will not exceed 13 millirems/hour. This value is based upon interpretation of neutron and gamma survey-meter readings, and calculations of prompt-gamma, fast-neutron, and capture-radiation dose rates. Because student class-room exercises with this subcritical assembly are limited to six consecutive hours, and the assembly is utilized for only part of planned laboratory activities, total semester exposure for a single student is not expected to be greater than 125 millirems.

The subcritical assembly does not present any severe radiation problem. The most extreme hazard is due to the driver source; these are, however, low-intensity sources for general use, and therefore can be handled safely by even inexperienced persons. Loading and unloading the uranium slugs could lead to hand doses (i.e., to the skin on the

Item 9(b). (continued)

palm of the hand) of up to 300 millirems for an individual; therefore, it is standard practice for working personnel to share handling, particularly for the large assembly where doses are likely to be the greatest, and thereby reduce individual doses. However, an experience faculty or staff member is always present during the source transfer to and from the assembly.

Item 10.

General Health Physics Instrumentation: The instrument inventory at Louisiana State University is quite large and due to the dynamics of research programs is continually changing. Rather than provide a detailed listing of instruments, a general description of type of instruments is more appropriate as follows:

Instrument Type	Minimum Number	Dose Rate Range Covered by Combination of Instruments
Geiger Muller	25	0.1 mR/hr to 1.0 R/hr
Ion Chambers	5	0.1 mR/hr to 25.0 R/hr
Bonner Ball (Neutron)	2	0.1 mR/hr to 10 R/hr
Micro R Meter	1	0.01 mR/hr to 3 mR/hr
Air Proportional (alpha)	1	NA
Gas Proportional (alpha)	1	NA

Instrument Calibration. Portable survey meters employed for radiation-field measurements where whole-body or partial-body personnel exposure may occur from either gamma-emitting or neutron-emitting sources are calibrated at approximately six (6) month intervals. It is standard practice to calibrate a survey instrument whenever it is repaired. Records of survey meter calibration are maintained by each Campus Radiation Safety Officer for the instruments on the campus. These records, and the instruments themselves, are subject to inspection by the System Radiation Safety Officer.

Item 10. (continued)

Three calibration sites have been established for the University, located at the Medical Center at New Orleans (providing service for the School of Medicine, the School of Dentistry, and the University of New Orleans), the Nuclear Science Center at the LSU and A & M College (providing service for all of the Baton Rouge complex, and for Louisiana State University at Eunice, Louisiana State University at Alexandria), and Pennington Biomedical Research Laboratories and the School of Medicine at Shreveport (providing service to the Medical School complex, and to Louisiana State University at Shreveport).

Survey-meter calibration is performed with either cobalt-60 or cesium-137 sources at Baton Rouge, with cesium-137 at Shreveport, and with radium-226 at New Orleans. Source intensities are known to within ±10%, based upon published specific-gamma-ray constants (Radiological Health Handbook, Revised Edition, 1970; p. 131). For calibration, an instrument (or its radiation-sensitive element) is placed at a calculated distance from the source such that the meter reading should be approximately two-thirds of full scale, the source is exposed, and the actual reading is noted. If the observed reading deviates by more than 15% of full-scale reading, the calibration potentiometers in the instrument will be adjusted until an acceptable meter reading is obtained. In many instances the calibration potentiometers are adjusted to obtain the proper reading even though the 15% criterion is not exceeded.

For routine survey instrument calibration, the procedure is used to check a single point on the highest-range scale. An optional procedure

Item 10. (continued)

is often followed, however; this includes two-point calibration on each scale, and a complete linearity determination for the scale which includes 5 milliRoetgens per hour.

Neutron-sensitive portable survey instruments are calibrated with a plutonium/beryllium neutron source. The procedure for neutron survey-meter calibration is essentially the same as that for gamma-sensitive instruments.

Item 11.

All general instrumentation at Louisiana State University is available to the radiation safety program on a priority basis. Current general-purpose nuclear instrumentation is extensive, including liquid-scintillation spectrometers; single-channel analyzer systems; multichannel analyzer systems coupled to NaI(Tl or GeLi) detectors; automatic gamma-counting systems; and a variety of proportional counting systems (both thin-window and windowless), end-window Geiger-Muller counting systems, fillable ionization chambers for direct gas counting, high-geometry detectors, and supporting electronic equipment and general laboratory preparative equipment.

Specific general-purpose equipment used frequently in the radiation safety program include liquid-scintillation counter for smear counting for hydrogen-3, carbon-14 and high energy beta emitters.

To assist in analyzing and identifying gamma-emitting radionuclides found on surface and sealed-source smears, the LSU and A & M College Campus Radiation Safety Office has available automatic gamma counters and multichannel analyzers coupled to either sodium iodine or germanium detectors.

Supplement DRC 13.

Louisiana State University is requesting by this license renewal application an increase in the possession limits for general radionuclides with atomic weight from 3 through 226, inclusive, from 600 millicuries to 3000 millicuries of each, except as specified in the first section of Form DRC 13.

This possession limit is for the University in its entirety, and will be subdivided by the System Radiation Safety Committee into possession limits for the individual campuses. The current allocations for general radionuclide possession made by the Committee are:

LSU and A & M College, Pennington Biomedical Research Laboratories and LSU at Alexandria and Eunice	925 millicuries of each radionuclide
Medical Center:	
School of Medicine at New Orleans, including the School of Dentistry	925 millicuries of each radionuclide
School of Medicine at Shreveport	925 millicuries of each radionuclide
LSU at Shreveport	25 millicuries of each radionuclide
University of New Orleans	100 millicuries of each
Uncommitted reserve	100 millicuries of each radionuclide

It is the responsibility of each Campus Radiation Safety Officer to maintain records and to exercise controls to assure that the allocated possession limit for the campus is not exceeded. If the use of radioactive materials on a campus increases to a point that the general radionuclide allocation is restrictive, the Campus Radiation Safety Committee may petition the System Radiation Safety Committee for

Supplement DRC 13. (continued)

an additional allocation. Normally, the increased allocation will be made from the uncommitted reserve, but it may also be withdrawn from another campus allocation if the use-level of radionuclides there is less than anticipated.

In addition to the increased general radionuclide possession limits, the University is requesting by this renewal application larger quantities of certain radionuclides in the general-radionuclide category, and additional radionuclides with atomic numbers greater than 83. These additional quantities and additional radionuclides are specified in the first section of Form DRC 13. The possession limits for cobalt-60 and for cesium-137 of, respectively, 5 and 15 curies, in any form are requested to permit flexibility in the acquisition, use, and disposal of small sealed sources of these radionuclides and also to permit preparation of special-geometry sources for research purposes within the properties of the University. Included in these uses are special dosimetry calibration sources from commercial vendors.

The request for hydrogen-3 is reduced from previous possession limits. This quantity is adequate to cover tritium-labeled compounds for general research purposes and gas-chromatographic detectors.

By this renewal application Louisiana State University is requesting revision of previous seal-source possession limits as follows:

1. Radioactive material contained in soil and surface moisture/density gauges manufactured and distributed by Troxler Electronic Laboratories, Inc. or Campbell Pacific Nuclear Corporation. The maximum activities and sealed source

identifications shall be limited to those specifically authorized for the device by the manufacturer's distribution license.

2. Increase from 15,000 curies of cobalt-60 to 30,000 curies. The current inventory consists of approximately 460 curies in the form of AECL Type A-CP-17-C encapsulated sources secondarily encapsulated by Budd Corp. according to LSU Drawing 108, 2120 curies in the form of Brookhaven National Laboratory Strip Source configuration, encapsulated by Lockheed Georgia Corp. according to LGNL Procedure Co-60-1; and 950 curies in the form of AECL Model C158 encapsulated sources. This material is housed in the water-shielded gamma-irradiation facility described in detail in Item 9(b) of this amendment application. The University anticipates later acquisition of cobalt-60 to increase the inventory to approximately 30,000 curies, but the quantity, supplier, and encapsulation details are not currently available.
3. Cesium-137 sources in the form of cesium chloride encapsulated in annular right cylinder according to Oak Ridge National Laboratory Drawing B-RD-1430, to a total of 580 curies.
4. A possession limit of 230 micrograms (approximately 0.13 curies) of californium-252 in the form of doubly encapsulated sources by Mound Laboratory.

Supplement DRC 13. (continued)

Louisiana State University also requests continuation of its possession limit of 5,056 pounds of natural uranium in the form of hollow metal slugs clad with aluminum. These slugs are for use in subcritical light-water moderated assemblies, and for other neutron-multiplication or shielding experiments reviewed and approved by the Campus Radiation Safety Officer and Campus Radiation Safety Committee. At the present time the use of these aluminum-clad uranium slugs is restricted to the LSU and A & M College campus, specifically in the Nuclear Science Center. Physical inventories (by count) are made each six months, and records of the inventories are maintained by the campus Radiation Safety Officer. No utilization records are routinely maintained, but unusual observations or occurrences are noted in full and filed by memoranda with the campus Radiation Safety Officer. Details of the subcritical assemblies employed for laboratory demonstrations of nuclear-reactor properties are provided in Supplements, Item 9(b), of this amendment application.

Exhibit 1, Item 4

THE LOUISIANA STATE UNIVERSITY
AND AGRICULTURAL AND MECHANICAL COLLEGE SYSTEM

99 UNIVERSITY LAKESHORE DRIVE

BATON ROUGE • LOUISIANA • 70803-0101

OFFICE OF THE PRESIDENT

504/ 388-2111

PM-30

October 1, 1986

MEMORANDUM TO: Chancellors Bogue, Caffey, Firnberg, Hawkland, Mackin, Mumphrey, Rigby and Wharton

SUBJECT: LSU System Radiation Protection Program

This memorandum supersedes PM-30 dated August 16, 1983.

1. An LSU System Radiation Safety Committee is established to develop and implement a program to assure the proper and safe usage of radioisotopes, and other sources of ionizing and non-ionizing radiation within the LSU System. The position of Coordinator is created to control and coordinate the University System's radiation safety program.

2. Membership on the LSU System Radiation Safety Committee shall be as follows:

A. the Coordinator of the LSU System Radiation Safety Program,

B. the Chairperson from each of the campus radiation safety committees, or the equivalent,

C. the Director of the Nuclear Science Center located on the Baton Rouge campus, and

D. the System Radiation Safety Officer.

3. The Coordinator shall serve as Chairman of the Committee. A Vice Chairman shall be elected from those members of the Committee representing another campus of the University System. The Director of the Nuclear Science Center shall serve as the Secretary. The Coordinator, Vice Chairman, Secretary and System Radiation Safety Officer shall serve as an Executive Committee with authority to conduct official business after polling the other committee members by telephone or mail.

4. The President shall designate as Coordinator any member of the University System Faculty who is knowledgeable in the use of radiation and radioactive materials. The Coordinator shall be administratively responsible for the radiation safety necessary in the use of radiation and radioactive materials required in the University System research, instructional, and service programs. This requires surveillance of all properties owned or controlled by the University System and all personnel on or about these properties where the possibility of occupational exposure to radiation or radioactive materials exists.

When medical exposure to patients occurs in University-owned facilities for the purpose of diagnosis and/or therapy, the amount of exposure to the patient is the responsibility of the administering physician. The overall radiation safety program for all other personnel, including the attending physician(s), is vested in the Campus Radiation Safety Officer of that campus.

The individual Chancellors, with the approval of the Coordinator of the System radiation safety program, shall appoint a Campus Radiation Safety Officer and a Campus Radiation Safety Committee if nuclear materials or other sources of ionizing or non-ionizing radiation are in use on the campus. These individuals shall be selected from those faculty and staff members having knowledge and work experience in the areas of radiation and radioactive materials. The Campus Radiation Safety Officers and Campus Committees will be responsible to the System Coordinator for the proper control and supervision of projects utilizing radiation and/or radioactive materials on his/her campus. On campuses where the only sources of radiation and radioactive materials consist of small teaching sources or those in analytical instruments, the Chancellor is only required to appoint a person responsible for radiation on campus.

LSU System Radiation Safety Committee shall have direct responsibility for (a) Licensing - all matters requiring and/or affecting the campus use of the University System's license or registration, and (b) Supervision - of the activities of each of the Campus Radiation Safety Committees and of the Radiation Safety Officer on those campuses without a Committee.

Approval of the Campus Radiation Safety Officer and the Campus Radiation Safety Committee are required in:

a. Personnel - all responsible persons desiring to use radioactive materials and radiation shall have acceptable training or experience.

b. Procurement - all requisitions for radioactive materials and radiation sources.

c. Projects - all academic programs, research and development projects and other University activities involving radiation and radioactive materials.

d. Contracts and Grants - all contracts and grants requiring use of radiation or radioactive materials.

e. Facilities and Radiation Monitoring Equipment - all University activities requiring radiation or radioactive materials shall have suitable facilities and radiation monitoring equipment to provide acceptable radiation safety.

f. OSHA Regulations Pertaining to Ionizing Radiation - all University activities falling within the purview of the Occupational Safety and Health Act, Section 1910.96, entitled "Ionizing Radiation" are the responsibility of the campus Radiation Safety Officer.

g. OSHA Regulations Pertaining to Non-ionizing Radiation - all University activities falling within the purview of the Occupational Safety and Health Act, Section 1910.97 entitled "Non-Ionizing Radiation" are the responsibility of the Campus Radiation Safety Officer.

h. Implementation of Portions of the Electromagnetic Radiation Act (1968) - all University activities utilizing equipment which potentially generates ionizing radiation incidental to its main purpose, such as microwave devices, video display terminals and television monitors, are the responsibility of the Campus Radiation Safety Officer with regards to occupational radiation safety.

5. The LSU System Radiation Safety Officer is directly responsible for implementation and review of compliance with the regulations and policies established by the System Coordinator and the System Radiation Safety Committee. The System Radiation Safety Officer is vested with the authority to act immediately in all matters pertaining to radiation safety involving LSU System personnel engaged in University sponsored activities or any other personnel on University property. His/Her authority and actions, as defined in this memorandum, are subject to review by the System Radiation Safety Committee. This assigned authority shall not relieve the individual from the normal review and authority of his/her departmental administration.

6. An annual operating budget shall be prepared by the Executive Committee and submitted to the Office of the President no later than April 30 for the upcoming fiscal year. This budget shall reflect all anticipated legitimate expenses related to regular meetings of the Committee as-a-whole, meetings of the Executive Committee, and duties of the System Radiation Safety Officer, as well as such emergency funds as may be required during the course of the fiscal year (estimated to be 10% or less of the total of the other expenses). Said budget shall reflect reasonably equitable travel requirements of Committee members for the purpose of attending scheduled meetings, necessitating selection of meeting sites well in advance of each fiscal year. Control of the budget shall remain within the Office of Vice President for Academic Affairs.

7. Periodic revisions of PM-30, when necessary, shall be accomplished after consultation with the LSU System Radiation Safety Committee, since the membership of that Committee is comprised of persons with experience, training, responsibility and authority necessary to implement the University System's radiation safety program.

8. A current list of the individual members of the LSU System Radiation Safety Committee and their telephone numbers is attached to this memorandum as an "ADDENDUM".

Allen A. Copping
President

cc: System Offices

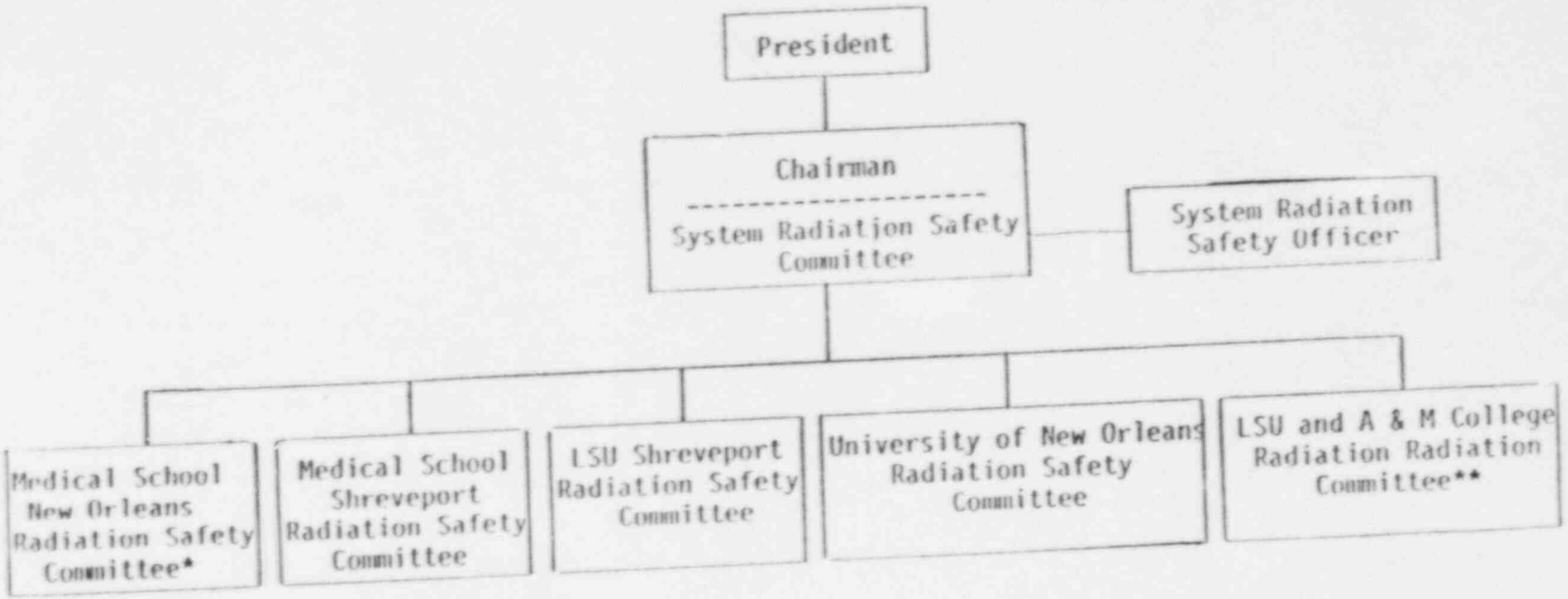
ADDENDUM TO PM-30

The following appointments are made to the LSU Radiation Safety Committee for terms ending on September 30, 1988. Previous addenda are hereby superseded.

	Campus	Office Telephone No.	Home Telephone No.
Coordinator and Chairman Paul M. Hyde	MED CTR - NO	(504) 568-6585	(504) 888-8321
Vice Chairman Gary C. Allen	UNO	(504) 286-6798	(504) 242-5026
Secretary Edward N. Lambremont	LSU-BR	(504) 388-2163	(504) 766-4192
System Radiation Safety Officer Max Scott	LSU-BR	(504) 388-2163	(504) 767-5519
Campus Radiation Safety Committee Chairpersons			
Gary C. Allen	UNO	(504) 286-6798	(504) 242-5026
William R. Gallaher	MED CTR-NO	(504) 568-4076	(504) 242-2047
Joe Goerner	LSU-S	(318) 797-5087	(318) 868-9825
Jerry B. Graves	AG CTR	(504) 388-1832	(504) 766-1632
James Marler	LSU-A	(318) 473-6431	(318) 443-5184
Bayani L. Ramirez	LSU-E	(318) 457-7311	(318) 457-1258
Donald M. Thompson	LSU-BR	(504) 388-4011	(504) 769-2830
Mary J. Wood	MED CTR-SHREV	(318) 674-6216	(318) 938-7516

APPROVED: Allen A. Copping, President

October 1, 1986
Date



*Joint with the School of Dentistry and Pennington Biomedical Re. rch Laboratory

**Joint with the Agricultural Center

Nuclear Science Center Laboratory Rules

1. Radiation-exposure-history forms are to be completed or already on file before permission to work in the Laboratory can be granted. (Persons under 18 years old, or persons with known excessive exposures must notify the instructor immediately.)

2. Film badges must be worn in the laboratory.

3. Appropriate protective clothing must be worn when loose radioactive materials are being handled.

4. Protective clothing is to be left in the laboratory. Do not wear potentially contaminated gloves, lab coats, etc., in the counting room.

5. Working surfaces and protective clothing are to be surveyed for contamination at the end of each work period, or at any time you suspect a spill. Report contamination immediately.

6. It is mandatory that hands, shoe soles, and street garments be checked for contamination before you leave the laboratory. If contamination is detected, report it immediately to the instructor <u>while you are still in the laboratory</u>.

7. Operations while working in the laboratory:

   a. There will be no eating, drinking, use of cosmetics, or cooking in the laboratory.

   b. Assume that everything in the laboratory is potentially contaminated. Monitor it.

   c. Do not assume that the radiation level is safe. Check it yourself.

   d. Never pipette by mouth. Use the various suction devices provided.

   e. All potentially contaminated items, (glues, beakers, etc.) are to be disposed of into the "Hot Waste" can.

   f. Radioactive solutions are to be disposed of only in the "Hot Waste" bottle.

   g. Consult the instructor for procedure before you clean any contaminated equipment.

   h. All radioactive preparations must be identified. Each bottle, flask, beaker, sealed counting source, etc., you prepare must bear the following information:

      Radionuclide
      Amount
      Date prepared
      Your name.

i. Never work in the laboratory alone.

j. Do not operate equipment with which you are not familiar unless an instructor is present.

k. Report all personal injuries and emergencies to the instructor immediately.

l. Respect your co-workers, and keep good housekeeping in mind at all times.

RADIATION EMERGENCY CHECKLIST

* CLEAR AREA.....

go to the closest safe place

get everyone out

carefully help anyone who is injured

*SEAL OFF AREA.....

post guards to keep people away

turn hoods and water off before leaving

close doors behind you

*CALL FOR HELP.....

Nuclear Safety Office	388-2163, 388-5040
University Police	388-3231
University Emergency No.	380-HELP (4357)

*TELL WHAT HAPPENED.....

Major spill

Exposed source

Air-borne contamination

Fire or explosion

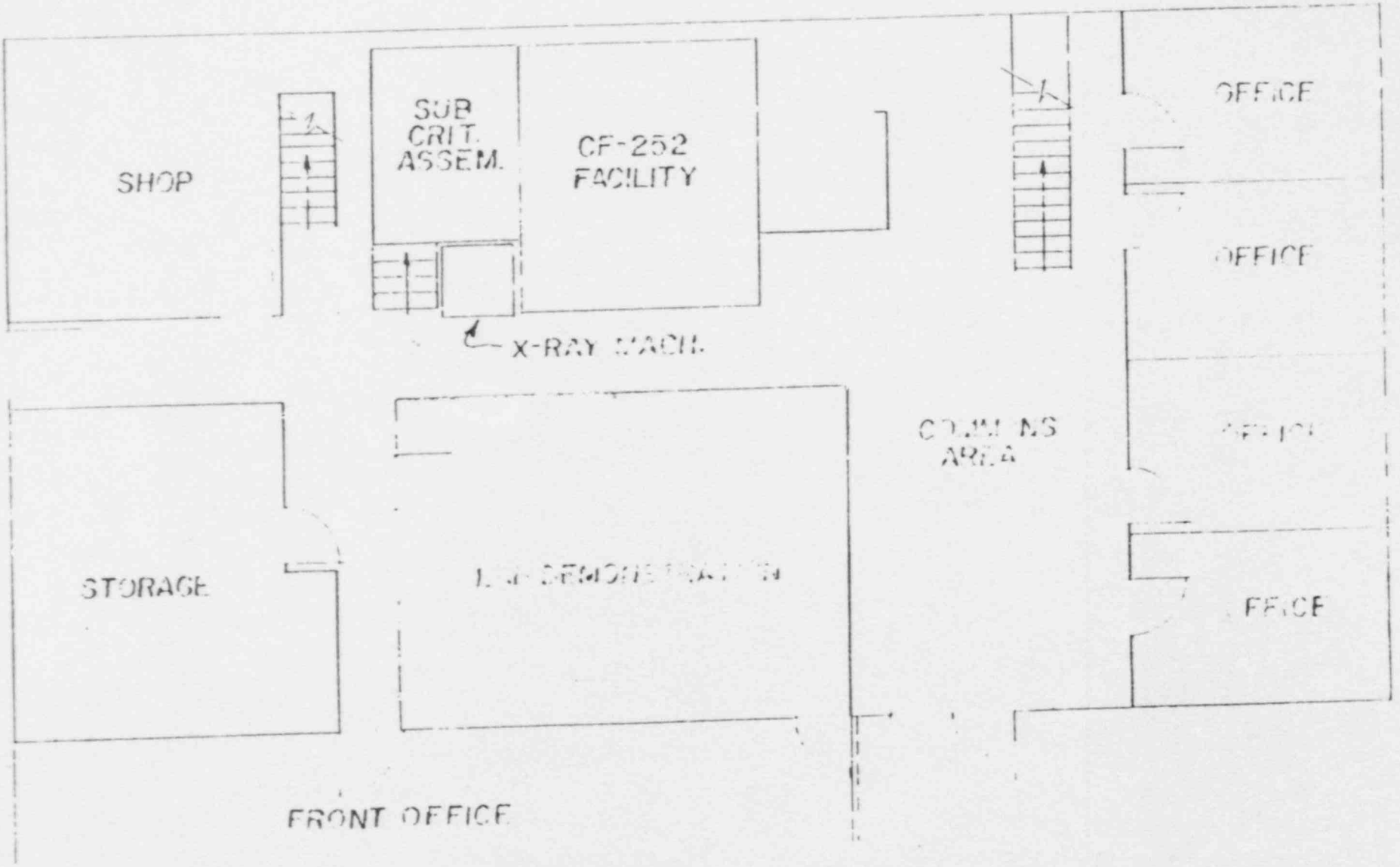
Badly contaminated major injury

*TELL WHERE.....

*TELL WHO.....

*WAIT CLOSE BY.....

Tie a handkerchief around your arm for quick identification


SHOP
SUB CRIT. ASSEM.
CF-252 FACILITY
OFFICE
OFFICE
X-RAY MACH.
STORAGE
FRONT OFFICE