

Radiation Safety Regulations

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RADIATION SAFETY REGULATIONS for LOUISIANA TECH UNIVERSITY

1. INTRODUCTION

The general purpose of these regulations is to establish standards and procedures to minimize exposure of the facility, staff, and students of Louisiana Tech University to ionizing radiation. We follow the ALARA program in accordance with LAC 33:XV.406. All data submitted to the Louisiana Department of Environmental Quality will be accredited by the Louisiana Environmental Laboratory Accreditation Program in accordance with LAC 33:I.4501A.

- a. Scope of Regulations. The regulations in this brochure apply to all people who in any way are associated with radioactive material or instruments that produce ionizing radiation within areas under the jurisdiction and control of Louisiana Tech University.
- b. Administration of the Regulations. The administration of these regulations will be vested in the Biosafety and Radionuclide Institutional Review Committee appointed and empowered by the University President.
- c. Sources of Detailed Information. All persons concerned with radiation must have a thorough acquaintance with the Louisiana *Environmental Regulatory Code, Part XV. Radiation Protection*. Copies of this material are available in the office of the Louisiana Tech Radiation Safety Officer. This material is also available at: www.deq.state.la/us/planning/regs/title33/index.htm . In addition to this, particular attention is also called to the National Institute of Science and Technology Handbooks Nos. 48, 49, 51, 53, 62, 65, 76, and 92. The Code of Federal Regulations, CFR, Part 10, Section 0 through the End. The National Academy of Science, NAS, and Publications: BEIR IV and V are also available. In addition computer software from the EPA and a library of Health Physics and radiation protection publications is maintained.
- d. Definitions. The following definitions will apply to the present brochure:
 - (1) *Airborne radioactive material* means any radioactive material dispersed in the air in any form.
 - (2) *Individual or person* means any human being.
 - (3) *Radiation* means any or all of alpha particles, beta particles, gamma rays, x-rays, neutrons, protons, and other atomic particles, but not sound, radio, visible, infrared, or ultraviolet radiation.
 - (4) *Radioactive material* means any material that produces ionizing radiation.
 - (5) *Restricted area* means any area into which access is controlled for purposes of protection of individuals from exposure to ionizing radiation and radioactive materials.

- (6) *Source material* means any material except special nuclear material that contains 0.05% or more of uranium, thorium, or a combination thereof.
 - (7) *Special nuclear material* means plutonium, uranium-233, uranium-235, enriched uranium, or any other materials so designated by the Atomic Energy Commission, except source material.
 - (8) *Unrestricted area* means any area into which access is not controlled.
 - (9) *Airborne radioactivity area* means any area in which airborne radioactivity may exist in concentrations in excess of the amounts specified in Appendix A, Table 1 of Chapter 4 of the Environmental Regulatory Code.
 - (10) *ALARA* means to make every reasonable effort to maintain exposures to ionizing radiation as far below the dose limits as practical.
 - (11) *Radiation area* means any area accessible to individuals, in which there exists radiation at such a level that a major portion of the body could receive in one hour a dose in excess of .05 mSv (5 mR) or in any 5 consecutive days in excess of 1 mSv (100 mR).
 - (12) *High radiation area* means any area in which there may exist radiation such that any portion of the body may receive radiation at a minimum rate of 1 mSv (100 mR) in any 1 hour period.
- e. Units of Radioactivity. The following units of radioactivity and of radiation dose will be used in the present brochure:
- (1) *Curie* means that amount of radioactive material undergoing 3.7×10^{10} disintegrations per second.
 - (2) *millicurie*, mCi, means 10^{-3} Curie.
 - (3) *microcurie*, μ Ci, means 10^{-6} Curie.
 - (4) *Dose* refers to absorbed dose or dose equivalent as appropriate.
 - (5) *Gray*, Gy, is the SI unit of absorbed dose. It is 1 Joule per kilogram. One rad. Is 0.01 Gy.
 - (6) *Sievert*, Sv, is the unit of dose equivalence. It is 1 Joule per kg.
 - (7) *Rem* is a measure of the dose received by body tissue in terms of its relative biological effect relative to 1 R of X-rays.
 - (8) *Millirem*, mR, is 0.001 Rem.

2. PERMISSIBLE DOSES, LEVELS, AND CONCENTRATIONS

- a. Hazards. The known hazards of radiation may be classified roughly as follows:
- (1) Deposition of radioactive materials in the body.
 - (2) Exposure of the body or its parts to gamma rays and/or x-rays.
 - (3) Exposure of the body or its parts to beta particles.

- (4) Exposure of the body or its parts to alpha particles.
- (5) Exposure of the body or its parts to neutrons. Deposition may result from ingestion, inhalation, and/or absorption through the intact or injured body surfaces.

b. Principles of Radiation Protection. The fundamental purposes of these protective measures are:

- (1) To prevent entry of radioactive materials into the body.
- (2) To prevent external radiation from exceeding certain permissible levels. These requirements can be fulfilled by proper housekeeping, work habits, laboratory facilities, manipulative devices, ventilation, waste disposal techniques and shielding, working times and distances.
- (3) To observe the ALARA principle.

c. Exposure Limits for individuals. The following are the dose limits:

- (1) an annual limit, which is the more limiting of:
 - a. the total effective dose equivalent of 0.05 Sv (5 Rem)
 - b. the sum of the deep dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye of 0.5 Sv (50 Rem); and
- (2) the annual limit to the lens of the eye, to the skin and to the extremities which are:
 - a. an eye dose equivalent of 0.15 Sv (15 Rem); and
 - b. a shallow dose equivalent of 0.5 Sv (50 Rem) to the skin or any extremity.

d. Permissible Levels of Unrestricted Areas. No levels shall be allowed to exist in unrestricted areas such that a person would receive at any time a dose rate in excess of 0.02 mSv (0.002 Rem) in any one hour.

e. Concentration in Released Effluents. No release of radioactive material shall be carried out so that there is liberated into the air or water of any unrestricted area any concentration of radioactive material in excess of the limits specified in LAC 33:XV.421. Discharge into sanitary sewers must comply with LAC 33:XV.462.

3. PRECAUTIONARY PROCEDURES

- a. Surveys. A survey of all areas using radioactive solutions shall be made at the end of each day by the instructor in charge or his representative. This survey will include measurements of radiation levels of all work surfaces, hoods, sinks, cabinets, floors, materials, equipment, and radiation sources. All laboratories and facilities where radiation sources are used or stored shall be surveyed periodically by the Radiation Safety Officer or his representative.

- (1) All machines producing ionizing radiation shall be surveyed and/or calibrated so as to insure that the requirements for use of such machines are fulfilled as specified in ERC chapters 5, 6, and 8.
 - (2) Survey instruments shall be calibrated at intervals not to exceed twelve months. Records shall be maintained of the latest date of calibration. Instruments used in performing surveys shall have a range such that one microRem per hour through one Roentgen per hour can be measured.
- b. Leak Tests. Appropriate leak tests shall be conducted on all sealed sources as described in LAC 33:XV.426.
- c. Personnel Monitoring.
- (1) A film badge shall be issued to any adult that is likely to receive in one year from sources external to the body a dose in excess of 10 percent of the limits in LAC 33:XV.410.A.
 - (2) The Radiation Safety Officer shall supervise the obtaining, distribution, and collection of film badges.
 - (3) Routine film badge processing shall be carried out in the Nuclear Center using NIST traceable standards for dose measurement.
 - (4) It is the responsibility of the instructor in charge of class or research to notify the Radiation Safety Officer whenever an individual will require personnel monitoring and whenever the need for personnel monitoring is terminated.
 - (5) The Radiation Safety Officer shall maintain all personnel monitoring records.
- d. Signs, Labels, Signals. Signs and labels in the colors, wording, and shapes prescribed by the LAC 33:XV.450 shall be posted at all radiation areas, high radiation areas, airborne radioactivity areas, storage areas, laboratory areas, instruments producing ionizing radiation, and on containers of radioactive material.
- e. Instruction of Personnel. All individuals working with radiation sources shall have had adequate instruction in radiation safety procedures and shall have been informed as to the various radiation levels in working areas.
- f. Quality Control. All data submitted by the Louisiana Tech Nuclear Center will be accredited as specified in LAC 33:I.4501.A. All guidelines stipulated by the Louisiana Accreditation Program, (LELAP) will be observed as required.

4. WASTE DISPOSAL

- a. General Requirements. No disposals of radioactive waste may be made except by specific approval of the Biosafety and Radionuclide

Institutional Review Committee unless by means as specified in 33:XV.462.

- b. Disposal into Sewers. No disposal of radioactive material into sewers shall be made unless by the following accepted means:
- (1) The material is readily soluble or readily dispersible biological material in water.
 - (2) The activity released in one month of diluted by the monthly quantity of released water will not exceed the limits in Table III of Appendix B of the ERC. The gross activity of radioactive material does not exceed one Curie per year.
 - (3) Organic Solvents for liquid scintillation counting shall not be placed in the sanitary sewage system.

5. RECORDS AND REPORTS

- a. Surveys, Monitoring, Disposal, and Receipt. A record shall be maintained of all surveys performed by the Radiation Safety Officer or his representative as specified in 33:XV.471. At the end of each day's laboratory work or at other intervals as specified by the Biosafety and Radionuclide Institutional Review Committee, each instructor shall record a Health Physics Report recording survey data, personal monitoring data including film badge and ionization chamber data when applicable, disposal data, and receipt data. These reports shall be dated and signed by the individual making the report. Report forms are available from the Radiation Safety Officer. All over exposures and over tolerance levels are to be reported immediately to the Radiation Safety Officer. All notification procedures as specified in LAC 33:XV.487 will be followed. Personnel monitoring records shall be maintained by the Radiation Safety Officer showing the radiation exposures of all individuals for whom personnel monitoring is required. These records shall contain all the information required on Form DRC-5; quarterly summations of exposure shall be made on each individual for which monitoring is required. The individual's record of accumulated dose to the whole body will be maintained and shall contain the information required on Form DRC-4.
- b. Theft and Loss. All suspected thefts and losses of radioactive materials are to be reported immediately to the Radiation Safety Officer.
- c. Incidents. All over-tolerance exposures, release of materials, and other dangerous or potentially dangerous situations are to be reported immediately to the Radiation Safety Officer. Any exposures or excessive levels will be reported as specified in LAC 33:XV.487.

6. STORAGE AREAS

- a. Location. The only general storage area on the Louisiana Tech campus for the placement of stock radioactive materials will be the Nuclear Center. This facility will be provided with the adequate containers, shielding, and facilities

for dispensing. The Radiation Safety Officer will be in charge of the storage area.

- b. Dispensing. The supplies of radioactive materials will be dispensed to the various individual professors for their particular research and teaching programs. These dispensations will take place under the supervision of the Radiation Safety Officer.
- c. Records. Adequate records are to be kept by the Radiation Safety Officer of all receipts, dispensations, and disposals of radioactive materials from the storage area.
- d. Signs. All appropriate signs and labels are to be displayed in and around storage areas. No unlabeled materials or containers are to be permitted in the area.
- e. Monitoring. A continual monitoring of the storage area is to be carried out with a continuous monitoring instrument at all times when the area is in use. Records of this monitoring are to be kept by the Louisiana Tech Radiation Safety Officer.
- f. Security. Maximum security precautions are to be taken to prevent unauthorized personnel from entering.

7. WORKING AREAS:

- a. Laboratory Design. All laboratories for the use of radioactive materials are to be adequately equipped for the purpose intended. Smooth, non-absorbent, easily decontaminated surfaces are preferred throughout.
- b. Surveys, Monitoring, and Records. At the end of each day's work or appropriate period, each individual shall record a Health Physics report concerning a radiation survey of all work surfaces, hoods, sinks, addition, he will survey his clothes, shoes, and hands. The report shall also include information on film badge or pocket ionization chamber data that may become available, plus records of disposals and receipts of all radioactive materials. Blanks for these reports are available from the Radiation Safety Officer. The Health Physics Report is to be filed in the office of the Radiation Safety Officer. All overexposures and over-tolerance levels are to be reported immediately to the Radiation Safety Officer.
- c. Signs. All appropriate signs and labels are to be displayed in the laboratory. No unlabeled radioactive materials or radiation sources are to be permitted.
- d. Security. Maximum-security precautions must be taken to prevent tampering and entry by unauthorized personnel.

- e. Equipment. All equipment used in the laboratory should remain in the laboratory and should not be used for other types of work.
- f. Waste Containers. Each laboratory shall have at least one container for solid radioactive waste and one for liquid radioactive waste. The Radiation Safety Officer will make arrangements for periodic disposal.
- g. Contamination. Any detectable contamination (twice background) should be reported to the immediate project supervisor and then, if he feels it warranted, to the Radiation Safety Officer.
- h. Approvals. All new radioactive material laboratories must be inspected and approved by the Biosafety and Radionuclide Institutional Review Committee before they are eligible to use radioactive materials. Likewise, all personnel are subject to such approval.
- i. Animals. Animals containing radioactive materials are to be segregated by maintaining them in properly labeled separate cages. These cages are to be especially designed for use with radioactive materials. All excrement or other potentially contaminated material must be collected and isolated from the trash.
- j. Laboratory Rules. In every radioactive material working area the following rules shall be posted:
 - (1) General rules:
 - (a) Wear a lab coat or apron, rubber gloves and eye protection.
 - (b) Do not smoke, eat, or drink in laboratory.
 - (c) Do not put mouth in contact with any apparatus.
 - (d) Wash hands thoroughly before leaving the laboratory.
 - (e) Use hood if there is a possibility of spraying or volatilization of a radioactive solution.
 - (f). Keep laboratory clean and orderly.
 - (g) Carry only the minimum possible radioactive materials into counting rooms.
 - (2) Survey and Monitoring:
 - (a) At end of each day's work, survey all work surfaces, hoods, sinks, cabinets, floors, counting room used by you, also scan your hands, clothing, and shoes before leaving the area.
 - (b) At end of each day's work fill out a Health Physics Report giving the results of your survey, dosimeter data available, disposals, and receipts of radioactive materials.
 - (c) Report all levels twice background and greater to your supervisor.
 - (d) Wear film badge at all times and pocket ionization chamber when instructed to do so.
 - (3) Waste Disposal:
 - (a) All radioactive waste will be presented to the Radiation Safety Officer for proper disposal.

8. EMERGENCIES

- a. Definition. An “emergency” is here defined as any situation in which there is produced or is being produced conditions which might produce an overexposure or an over dosage to an individual or which might produce contamination of personnel, property, or areas.
- b. Area Contamination Accidents. The following steps are to be taken:
 - (1) Immediately remove all personnel in danger of overexposure, making sure contaminated clothing is left behind.
 - (2) Without endangering personnel, attempt to limit or arrest the spread of contamination.
 - (3) At the earliest possible moment notify the Radiation Safety Officer.
 - (4) Proceed to decontaminate the area under direct or indirect supervision of the Radiation Safety Officer.
- c. Personnel Contamination Accidents. The following steps are to be taken:
 - (1) Immediately remove contaminated clothing, flush contaminated wounds with water, and/or induce vomiting as required.
 - (2) At the earliest possible moment notify the Radiation Safety Officer and Northern Louisiana Medical Center
 - (3) Transport the person to the hospital and insure that the Radiation Safety Officer is notified.
- d. External Over-Exposure. The following steps are to be taken if a suspicion of exposure to more than 1 Sv (100 Rem) is held:
 - (1) At the earliest possible moment notify the Radiation Safety Officer.
 - (2) Follow his and Northern Louisiana Medical Center's recommendations.

9. PROCUREMENT

- a. Procedure. Each applicant for radioactive material shall complete the form *Application for Permission to Obtain and Use Radioactive Isotopes*. Assistance in filling out this form may be obtained from the Radiation Safety Officer. One copy is then submitted to the Biosafety and Radionuclide Institutional Review Committee for approval or rejection.
- b. Availability. If the application is approved, the Biosafety and Radionuclide Institutional Review Committee will submit the order to the purchasing department. They will order the radioactive materials requested. All such material is received at the Tech Shipping and Receiving Dock at 1250 Hull Street, Ruston, Louisiana. The shipping department delivers radioactive material ONLY to the Tech Nuclear Center. Upon arrival, these materials will be stored in the Nuclear Center. The requesting party will then be notified and the material dispensed as approved. No after hours delivery of radioactive material is allowed.

- c. Accounting. Each user of radioactive materials is required to keep the records of receipt, uses, and disposals. *The Isotope Issue Slip* will be completed by the RSO. The *Isotope Utilization Slip* will be completed by the requesting party. The RSO will also complete the *Radioactive Material Record* for each isotope issued.
- d. Transfer. No transfer of radioactive materials from one site to another shall be except by explicit arrangements with Radiation Safety Officer.

10. THE BIOSAFETY AND RADIONUCLIDE INSTITUTIONAL REVIEW COMMITTEE

- a. Personnel. The Biosafety and Radionuclide Institutional Review Committee shall be made up of at least one person from each of the following:
 - (1) College of Engineering and Science
 - (2) College of Applied and Natural Science
 - (3) Director of the Nuclear CenterAll members will be appointed by the President of Louisiana Tech University. The President will designate a Chairman to coordinate the functions of the Committee.
- b. Responsibilities. The Biosafety and Radionuclide Institutional Review Committee will supervise the use of all radiation sources on Louisiana Tech University property. The ALARA principle will be continually observed.
- c. The Radiation Safety Officer, RSO. The executive office of the Biosafety and Radionuclide Institutional Review Committee will be the Louisiana Tech Radiation Safety Officer. He will see to the enforcement of all regulations set forth in this brochure and set by the Biosafety and Radionuclide Institutional Review Committee. Further, he will be available to assist all users of radioactive materials with their specific problems in health physics. In routine matters, appeals from decisions of the RSO may be made to the Biosafety and Radionuclide Institutional Review Committee. In emergency matters, there is no appeal.