SECTION 33
RADIATION SAFETY

SECTION CONTENTS

I. Radiation Safety (p. 2)
   A. Radiation Safety Committee
   B. Compliance
   C. Compliance Requirements for Grant Proposal Certification

II. Ionizing Radiation (p. 3)
   A. Definition
   B. Usage of Dosimeters in Exposure Monitoring
   C. Purchase, Usage, Handling of Radioactive Materials
   D. Spills Involving Radioactive Materials
   E. Potential Hazards or Malfunctions of Radiation Producing Equipment

III. Non-Ionizing Radiation (p. 7)
   A. Definition
   B. High Frequency/Microwave Radiation
   C. Laser Generating Equipment
   D. Laser Control Area—Required for Work with Class 3 and 4 Lasers
   E. Protective Equipment—Required for Work with Class 3 and 4 Lasers
   F. Training—Required for Work with Class 3 and 4 Lasers

ADDITIONAL READING

Emergency Response Section 1
Environmental Health & Safety Section 2
Hazard Communication Section 12
Hazardous Materials Safety Section 29
Inspections and Compliance Section 13
Laboratory Safety Section 30
Personal Protective Equipment Section 14

CONTACTS

RADIATION SAFETY OFFICER
Mail: OEH S TW-16
Phone: (504) 988-2867
E-mail: creindl@tulane.edu

RADIATION DOSIMETER MONITOR
Mail: OEH S TW-16
Phone: (504) 988-2868
E-mail: ksimon@tulane.edu
I. RADIATION SAFETY

A. Radiation Safety Committee

Radiation safety is the joint responsibility of the Office of Environmental Health and Safety (OEHS) and the Radiation Safety Committee (RSC). The RSC was established to ensure that radioactive materials and radiation producing devices are handled in the safest possible manner. The RSC consists of appointed members of the University faculty actively engaged in teaching and research that involve use of radioactive materials and/or ionizing radiation producing devices.

Regulations, responsibilities, and procedures promulgated by the RSC are based on, among other sources, regulations, recommendations, and guidelines of the Occupational Health and Safety Administration (OSHA), the American Conference on Governmental Industrial Hygienists (ACGIH), the American National Standards Institute (ANSI), and the Bureau of Radiological Health (BRH) and are outlined in the University's Radiation Safety Manual which is reviewed and approved by state regulatory authorities.

The University’s administration has appointed OEHS, through its Radiation Safety Officer (RSO) who is a certified radiological physicists, to provide both administrative and technical services necessary to ensure compliance with provisions of the University’s radioisotope/radiation license as outlined in the Radiation Safety Manual.

B. Compliance

Departmental Safety Representatives (DSR) help to ensure that the units they represent that handle radioactive materials and/or radiation producing equipment are in compliance with the Radiation Safety Manual and policies and procedures outlined in this section. (A unit is a department, section, center, or program, or any number or configuration of these components.) DSRs also collect and submit to OEHS any required documentation such as inspection reports, training documentation, etc., prepared by unit supervisors/principal investigators.

DSRs help ensure that the necessary measures have been taken by supervisory and other unit personnel to correct problems discovered during unit inspections. If corrections are not made despite deadlines and warnings from the DSR, the DSR shall report the unit's non-compliance to the Unit Head.

If the problem remains unresolved, OEHS shall consult with the Unit Head, and, if necessary, take the issue of the non-compliant unit to the University's Environmental Health & Safety Operations Committee for resolution. See, Section 2, Environmental Health & Safety, of this manual for information on the University’s Compliance Management System.)
C. Compliance Requirements for Grant Proposal Certification

Grant proposals that require certification of compliance with environmental health and safety regulations must be sent to OEHS for verification before grants may be funded. The Director of OEHS shall *not* certify a grant if the applicant is not in compliance with policies related to any of the following topics: OSHA Hazard Communication, OSHA Laboratory Standard, Animal Handler Health Surveillance Program, Fire Safety, Radiation Safety, Hazardous Waste, and Biological Safety.

II. IONIZING RADIATION

A. Definition

Ionizing radiation is any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, by interaction with matter. Ionizing radiation produces short-wavelength, highly energetic, penetrating rays (gamma rays, x-rays, subatomic charged particles) that can be extremely dangerous and even lethal if exposure is extended over a period of time.

B. Usage of Dosimeters in Exposure Monitoring

For employees who work in areas where there is danger of exposure to ionizing radiation (e.g., areas using x-ray equipment, radioisotopes, etc.), OEHS provides a campus-wide monitoring program to ensure that these employees are not being exposed to radiation levels that exceed safety standards. Monitoring is accomplished through the use of “dosimetric devices” (*aka* dosimeters or film badges) that are issued to at-risk employees, routinely collected, and sent to an independent lab for analysis.

Dosimeters measure radiation through a thin layer of “sensitive material” that changes its structure when exposed to radiation. Heat stimulates the sensitive material causing it to become luminescent in proportion to the amount of radiation exposure.

The University contracts a dosimetry processing service (DPS) for processing its dosimeters. Processing results are compiled into a report by the DPS and forwarded to the RSO for analysis.
The RSO uses this analysis to determine whether employees are being exposed to unsafe levels of radiation, and if so, the RSO can authorize moving the employees out of harms way until the problem is investigated and corrected. Any questions as to whether a dosimeter is required or any question about exposure history, may be directed to the RSO. Details concerning the dosimetry program may be found in the Radiation Safety Manual.

1. Types of Dosimeters/Who Must Wear Them

**Whole body** dosimeters affixed to a lab jacket must be worn by employees working in areas where radioactive materials are present at certain levels. **Ring and whole body** dosimeters are to be worn by employees handling millicurie amounts of radioisotopes. **Baby dosimeters** worn at belt level are to be worn by pregnant women in addition to the whole body dosimeters they themselves wear. Dosimeters are optional for users of weak beta emitters such as H-3, C-14, P-33 and S-35.

2. Returning Dosimeters to OEHS

For effective monitoring, dosimeters shall be exchanged monthly (new dosimeters are issued monthly by the RSO). Within two days of being issued new dosimeters, employees must return their used dosimeters to the employee designated (by the supervisor) to collect them. The designated person shall then forward the used dosimeters to OEHS’s Radiation Dosimeter Monitor.

C. Purchase, Usage, Handling of Radioactive Materials

Units needing to purchase radioactive materials must obtain a license to do so from the Radiation Safety Committee. Obtaining a license requires that an application be submitted to the RSO; the RSO shall submit the application to the Committee. Once the license is obtained, the RSO must nevertheless approve all purchases of radioactive materials and radiation producing equipment. Purchasing must verify that the unit ordering radioactive materials has a) a license to do so, and b) approval from the RSO.

1. In order to avoid undue exposure to ionizing radiation, unauthorized employees must not enter a laboratory where radioactive materials are being used except when accompanied by an authorized person.

2. Only persons specifically authorized shall prepare and/or administer tracer and/or therapeutic doses of any radioactive material.

3. There must be no eating, drinking or smoking in the isotope storage, preparation or usage areas.

4. There must be no storing of food and/or drink in refrigerators located in isotope storage and preparation areas.

5. All radioactive materials must be stored, handled, and administered in designated areas approved by the RSO.

6. Employees authorized to handle, or assist in the handling of radioactive materials shall wear radiation dosimeters when indicated by the RSO.

7. All employees must wear laboratory coats while handling or administering radioactive materials.
8. All employees must wear rubber gloves while handling liquid radioactive material and disposing of decayed radioactive materials.

9. Mouth pipetting of radioactive materials under any circumstances is prohibited.

10. Areas where radioactive materials are used or stored must be identified by the appropriate signage.

D. Spills Involving Radioactive Materials

1. Minor Radiation Spill

A minor radiation spill is one that laboratory staff is capable of handling safely without the assistance of safety and emergency personnel. All other spills are considered major.

- Alert people in the immediate area of the spill.

- Assemble all potentially contaminated persons and monitor them before allowing them to leave the area. Shoes should be included in the monitoring of clothing.

- If employees are found to be contaminated, instruct them to remove contaminated clothing, rinse exposed body areas and then wash these same areas with soap and water, monitoring the contaminated areas after each washing. Safety showers should be used if available.

- Wear protective equipment including safety goggles, disposable gloves, shoe covers, and lab coat before any cleanup activity.

- Place absorbent paper towels over liquid spills. Place towels dampened with water over spills of solid materials.

- Collect paper towels in a plastic bag using forceps.

- Dispose of materials in containers labeled “radioactive waste.”

- Contaminated clothing must be collected in the same manner (with forceps), bagged, and labeled with appropriate warning before being forwarded to the laundry.

- Use an appropriate survey meter or method when monitoring for contamination.

- Repeat cleanup until contamination is no longer detected.

- Rinse, then wash hands with soap and water upon completion of cleanup.

- Notify the supervisor/principal investigator, OEHS (Radiation Safety Officer) and Security.

2. Major Radiation Spill

- Immediately notify the supervisor/principal investigator, OEHS (Radiation Safety Officer), and Security. Alert employees in the area of the spill.
Assemble all potentially contaminated persons and monitor them before allowing them to leave the area. Make certain that shoes are monitored along with other clothing.

If attending others who are injured and unable to help themselves, make certain that you are wearing the appropriate personal protective equipment.

Instruct contaminated persons to remove contaminated clothing and wash exposed body areas with water first (using a safety shower if available), and then with soap and water, monitoring the contaminated areas after each washing.

Wait for response from OEHS (Radiation Safety Officer). Employees from the laboratory shall be required to provide support to OEHS employees in the “uncontaminated” area.

E. Potential Hazards or Malfunctions of Radiation Producing Equipment

1. Electrical Hazard or Malfunction

If any piece of radiation producing equipment presents a possible electrical hazard or malfunctions, the following procedures must be adhered to: a) all equipment in affected area must be shut down immediately; b) main "on-off" switch (or button) turned to "off"; c) all circuit breaking switches turned to "off"; d) evacuate employees from area; e) notify supervisor or principal investigator immediately.

2. Mechanical Hazard or Malfunction

If any unsafe or potentially unsafe condition is noticed with respect to radiation producing equipment, it must be reported immediately to the supervisor/principal investigator. If the well-being of any employees, students, or visitors may be jeopardized, evacuate the area immediately, then report the unsafe condition.

3. If an evacuation of personnel is required because of electrical or mechanical hazard or malfunction, employees should be evacuated to a designated area and monitored for radiation exposure before being released.

See, Section 24, Facilities Services, VIII, Equipment Lockout/Tagout, of this manual for information on reaching zero mechanical state and tagging machinery that requires maintenance or repair work.
### III. Non-Ionizing Radiation

A. Definition

Non-ionizing radiation is any electromagnetic radiation that does not cause ionization in biological systems and that has photon energies less than 10-12eV. Non-ionizing radiation can cause dissipation of energy in the form of fluorescence or heat. Sources of non-ionizing radiation, including lasers and radio frequency/microwave sealers, heaters and transmitters shall be used in accordance with “Standards for the Construction Industry” (OSHA 29 CFR 1926.54), “Standards for General Industry” (OSHA 29CFR 1910.97), Bureau of Radiological Health regulations, and recommendations of the American Conference of Governmental Industrial Hygienists.

B. High Frequency/Microwave Radiation

1. Exposure to radiation in the frequency range from 0.01MHz to 300 GHz shall not exceed the Threshold Limit Values (TLVs) established by the ACGIH.
2. OSHA covers frequency ranges from 10MHz to 100GHz with a limit of 10mW/cm² as averaged over any one-tenth hour (OSHA Regulations, 29CFR Nonionizing Radiation 1910.97, Radiation Protection Guide (a)(2)(i)).

C. Laser Generating Equipment

1. Policy

The University shall make certain that all laser generating equipment is controlled and operated in such a manner that employees are not overexposed to non-ionizing radiation. Laser safety guidelines are established as recommended by the American National Standards Institute and the American Conference of Governmental Industrial Hygienists. The University’s laser safety program is under the direction of OEHS.

2. Responsibility

The responsibility for properly maintaining and operating laser generating equipment in a safe manner must rest with trained and qualified employees. For this reason, the Department of Biomedical Engineering at TUHSC and trained service employees at other campus locations are charged with servicing laser equipment, while OEHS is responsible for environmental conditions, operating techniques, and protective equipment.

3. Pre-Installation Procedures

OEHS shall 1) perform a pre-purchase evaluation of all electronic equipment; 2) receive notification of any plans to install lasers; and 3) conduct an environmental survey of the area intended for laser use, review the classification of the laser intended for the area, and provide details of any specific changes required.

4. General Controls

a. Each laser shall be operated under the direct supervision of an individual knowledgeable in its use and in applicable safety procedures.

b. Each laser shall be operated, maintained, and serviced only by qualified persons trained in the hazards of lasers and the control of such hazards. Outside service technicians shall abide by all University internal procedures when servicing lasers.

c. All controls, labels, settings, etc., shall be maintained in accordance with the manufacturer's instructions.

d. Laser equipment must bear a label indicating maximum output. Areas in which lasers are used shall be posted with standard laser warning placards.

e. A laser beam must never be directed at any person.

f. Lasers shall be turned off when laser transmission is not required.

g. Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the laser.
h. Due to the hazard of uncontrollable scattered rays, the outdoor operation of laser systems shall be prohibited where practicable when it is raining or snowing or when dust or fog is in the air.

i. Anti-laser eye protection shall be provided in areas where the potential exposure to direct or reflected laser light may be greater than 5 milliwatts. Laser equipment shall bear a label indicating maximum output. **No one shall be exposed to light intensities above the following levels:** Direct Staring = 1 microwatt/cm²; Incidental Observing = 1 mw/cm²; Diffused Reflected Light = 2.5 watts/cm².

j. Following maintenance, service, or modifications that could increase or decrease the hazardous nature of the laser, the LSO shall determine if changes in safety equipment or procedures are warranted.

D. **Laser Control Area - Required for Work with Class 3 and 4 Lasers**

1. Admittance to the area shall be controlled so that unauthorized or unexpected entry is not possible while the laser is in operation. Provisions such as a panic button to deactivate the laser for emergency entry and exit shall be maintained. Authorized persons may enter if there is no optical hazard at the point of entry and protective eyewear is worn.

2. Where feasible, only diffusely reflective material shall be used in or near the beam path.

3. Any windows shall be covered or restricted to prevent the beam or any reflection from exiting the controlled area.

4. A sign approved by OEHS shall be posted at the entrance to the area with a warning light to indicate when the laser is on.

5. Room and/or instrument lighting shall be adjusted as required to account for the use of protective eyewear.

6. Where recommended by the LSO, an audible alarm and/or light (visible through protective eye wear) shall be installed in the room to alert all parties that the laser is in operation.

7. Spectators shall be allowed into the area only when 1) proper supervisory approval has been granted, 2) the laser hazards and avoidance procedures have been explained, and 3) protective measures (such as eye protection) have been taken.

E. **Protective Equipment - Required for Work with Class 3 and 4 Lasers**

1. Protective goggles shall be properly selected, approved by OEHS, and worn by all present in the area while the laser is in operation.

2. The goggles shall be properly maintained, stored, and periodically inspected to verify the integrity of the lens.

3. Long sleeved clothing shall be worn to protect against excessive skin exposure.
F. **Training - Required for Work with Class 3 and 4 Lasers**

1. All users of lasers shall be properly trained in the hazards and the control measures for the lasers they use. Users shall include those utilizing the laser for medical or experimental procedures, technicians present during use, and service employees.

2. Training shall be conducted prior to assignment of laser use.

3. Training for all employees must be approved by the LSO.

● *End of Text – Return to Section 33, Page 1 Outline*