Radiation Safety

Radiological Safety at TAMU

TAMU maintains strict requirements for working with sources of radiation. The radiation safety program at TAMU protects employees, students, and visitors as well as the public and the environment from the harmful effects of exposure to ionizing and nonionizing radiations. The Environmental Health & Safety Department (EHSD) governs the protocol and use of radioactive materials and radiation-producing devices on campus. Any faculty or staff member who desires to work with radioisotopes or radiation-producing devices must apply for and receive a permit from the EHSD. In addition, their employees and other employees who work with sources of radiation must receive formal training in equipment operation, safety guidelines, and emergency procedures.

The "Radiological Safety Program Procedure Manual" is available from the EHSD. It is divided into the following parts:

- Part One: Procedure Manual for the Use of Radioactive Materials
- Part Two: Procedure Manual for the Use of Radiation Producing Devices
- Part Three: Procedure Manual for the Use of General License Acknowledgment Sources
- Part Four: Procedure Manual for the Use of Lasers

Radioactive Materials

The purpose of the Procedure Manual for the Use of Radioactive Materials is to establish the policies of TAMU with regard to the use of licensed radioactive materials. These policies apply to sealed sources as well as to open isotopes regardless of physical or chemical form.

- Radioactive materials may only be possessed by or under the supervision of individuals who have been formally permitted by the EHSD.
- Permit Holders or their designees shall obtain approval from the EHSD before placing an order for radioactive materials. Approvals are also required before Permit Holders receive radioactive materials via transfer from another licensee, via donations, etc.

- All sources of radiation shall be secured from unauthorized access or removal.
- All radioactive wastes shall be disposed through the EHSD or via written procedures approved by the EHSD.
- All persons are responsible for safe working practices and for maintaining their own exposures to ionizing radiations As Low As Reasonably Achievable (ALARA).
- Each user is responsible for reporting unsafe practices and/or rules violations to the Permit Holder or, if responses are not satisfactory, to the EHSD or the Texas Bureau of Radiation Control.
- EHSD personnel are on duty 24-hours per day, 7 days per week. For incidents or emergencies which occur after normal business hours, contact the University Communications Center at 409/845-4311 or the University Police Dispatcher at 409/845-2345.
- Permit Holders and users of radioactive materials shall comply with all aspects of the "Radiological Safety Program Procedure Manual".

Lasers

The State of Texas regulates the use of lasers through the Bureau of Radiation Control (BRC), Texas Department of Health. The TAMU Environmental Health & Safety Department registers, and is responsible for, the safe use of all lasers on campus.

Lasers present many safety threats, but the most common threat is damage to the eyes. Other common laser concerns include skin damage, electrical hazards from high-energy power sources, chemical exposure, fire/explosion hazards, and exposure to cryogenic materials such as hydrogen and oxygen. Many lasers emit invisible ultraviolet or infrared radiation.

Lasers are classified into four basic categories as indicated below:

- **Class 1:**

  Lowest power lasers that do not emit hazardous levels

- **Class 2:**

  Low-power lasers that pose a hazard only if viewed directly for extended periods

- **Class 3:**

  Medium-power lasers that pose moderate risk and can cause injury

- **Class 4:**

  High-energy, high-risk lasers that can cause injury to the eyes and skin from direct or diffused reflection

  NOTE:
  If you work with a class 3 or 4 laser, you must obtain a Laser Permit from the Environmental Health & Safety Department.

Laser devices require engineering controls to ensure safety. All Class 3 and 4 lasers require a combination of protective housing, area warning signs or remote firing capabilities.

The following information is required for obtaining a laser permit:

- Classification of the laser device
- Wavelength of the laser output
- Power output
- Appropriate eyewear

Follow these guidelines when working with Class 3 and 4 lasers:

- Never aim a laser at a person.
- Be very careful when working with hand-held laser pointers.
- Do not allow children access to pointers.
- Wear protective clothing such as eyewear and skin protection as appropriate.
- Post warning signs at entrances where lasers are present.
- When working with power supplies, remove jewelry, stand on a dry surface, and work with only one hand at a time. Observe high voltage precautions (see Electrical Safety chapter).
- Control access to areas where lasers are used (i.e., no spectators).
- If possible, enclose the entire laser beam path on Class 4 lasers.

Magnets

The information in this section pertains only to large magnets at TAMU such as those used for magnetic resonance imaging.

Because the magnetic flux lines (or *pull*) from the main magnetic field can extend well beyond the actual magnet, the greatest hazard associated with large magnets is the *missile effect*. Ferromagnetic objects such as pens, scissors, screwdrivers, oxygen cylinders, and other metallic devices can be pulled into the magnet with enough force to cause a serious injury or accident. In addition, magnetic fields may also disrupt pacemakers or cause injury to individuals with surgically implanted metal pins or plates.

> ***IMPORTANT:***
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> *To protect bystanders and prevent the accidental introduction of ferromagnetic materials within the proximity of a magnet, establish a security zone around any large magnet.*

Microwaves

Microwaves are part of the electromagnetic spectrum; they range in frequency from 300 megahertz (MHz) to 300 gigahertz (GHz). Microwaves are used for communications, radar, intrusion alarms, door openers, and medical therapy, but they are most commonly used for cooking.

Metal reflects microwave radiation, but dry nonmetallic surfaces allow microwaves to pass through with little or no heating effect. Organic materials, however, are extremely heat conductive. Because microwaves can penetrate organic materials, including tissues, thermal burns and other effects may result from microwave exposure.

> ***NOTE:***
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> *Microwave ovens are very safe when kept in good working condition and used properly. They do not serve as a source of exposure to harmful microwaves.*

Even though microwave ovens are not a source of harmful radiation exposure, they should be properly

used and maintained.

- Do not put metal objects (including aluminum foil) into a microwave oven.
- Do not use a microwave oven if it is damaged.
- Ensure that the seal on a microwave oven is tight, intact, and in good condition (i.e., not charred or distorted).
- Ensure that microwave ovens are clearly labeled for laboratory use or food preparation only.
- Microwave ovens should only be repaired by trained personnel.

Radiation-Producing Devices

Radiation-producing devices such as X-ray machines, electron microscopes, and particle accelerators are regulated through the BRC, Texas Department of Health. All radiation-producing devices must be registered with the TAMU Environmental Health & Safety Department.

Radiation-producing devices (other than human and veterinary diagnostic devices) shall be interlocked to prevent access to the unshielded beam during normal or routine operations. Exceptions may be granted by the TAMU Radiological Safety Committee.

> ***IMPORTANT:***
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> *The door(s) to a room where a radiation-producing device is located should be posted with a radiation warning sign, unless the device is totally self-contained.*

Ultraviolet Lamps

Ultraviolet (UV) lamps are useful germicidal tools, but they also pose a potential health hazard. The following sections provide essential safety information for working with UV lamps and light.

Health Hazards

Exposure to UV radiation can cause extreme discomfort and serious injury. Therefore, you must protect your eyes and skin from direct and reflected UV light. Pay particular attention to laboratory surfaces, such as stainless steel, that can reflect UV light and increase your UV exposure.

The effect of UV radiation overexposure depends on UV dosage, wave length, portion of body exposed, and the sensitivity of the individual. Overexposure of the eyes may produce painful inflammation, a gritty sensation, and/or tears within three to twelve hours. Overexposure of the skin will produce reddening (i.e., *sunburn*) within one to eight hours. Certain medication can cause an individual to be more reactive to UV light.

Personal Protective Equipment

Adequate eye and skin protection are essential when working around UV radiation. Before entering a laboratory with ultraviolet installations, you must turn off the lights or wear protective equipment (e.g., goggles, cap, gown, and gloves).

> ***NOTE:***

Safety glasses with side shields or goggles with solid side pieces are the only equipment that provide adequate eye protection against direct and reflected UV light.

Germicidal Function

UV radiation is particularly useful in the laboratory when combined with other methods for decontamination and disinfection. UV radiation is used primarily to reduce the number of microorganisms in the air and on surfaces. It is most effective against vegetative bacteria.

UV rays can only kill organisms that are invisible to the naked eye. To be effective, UV rays must directly strike the microorganisms. If microorganisms are shielded by a coating of organic material (e.g., culture medium), the UV light will be ineffective.

Maintenance

Ultraviolet lamps lose germicidal effectiveness over time and may need to be replaced even though the lamp has not burned out. It may be necessary to replace the lamp according to the manufacturer's recommendations. There are two types of UV lamps – hot cathode and cold cathode. The hot cathode lamp has two pins at each end, and the cold cathode lamp has one pin at each end. Manufacturers recommend that hot cathode lamps be replaced every six months and that cold cathode lamps be replaced every 12 months.

In addition to replacing UV lamps as indicated above, follow these guidelines to maintain UV lamps:

- Regularly wipe cool, unlit UV lamp bulbs with a soft cloth moistened with alcohol. (Dust can decrease the effectiveness of a UV lamp.)
- Do not touch a UV bulb with your bare hands. The natural oils on your hand may leave a fingerprint and create *dead space* on the bulb's surface.
