

Policy 2002

Electrical Safety and Procedures

Purpose

The object of this Safety Policy is to ensure the physical safety of all faculty, staff, students, and visitors. The Safety Policy is determined and monitored by the Department Safety Committee. The University's Comprehensive Safety Plan will amplify and amend this policy. The Departmental Chemical Hygiene Plan detailing procedures for safe handling of chemicals in laboratories is identical to that of the JMU Chemistry Department. Each laboratory has a copy as well.

Guide to the department safety policies and procedures:

Safety Committee:

The Physics Department Safety Committee Members meet as needed to discuss safety issues. The Safety Committee is appointed by the Department Head. The members of the safety committee include three or more Department members as necessary.

Safety/Emergency Notices:

There are three types of notices to be found in the department.

Emergency Escape Procedure:

Emergency escapes routes are posted throughout the department, near the exit areas.

Safety Information:

Safety information posters are yellow, located on the outside of laboratory doors. Contains information pertaining to hazardous materials and whom to contact in case of an emergency.

Applicability

The policies and procedures described here apply to all department personnel, faculty, staff and students.

Policy

Hazards related to lasers, microwaves, cryogenics, compressed gases, ionizing radiation etc. will be covered by the special rules for laboratories that contain such hazards. However, since the danger of electrical shock is present in almost all laboratories, we include the following guidelines.

Safe current is about 10 mA at 60 Hz. Currents larger than this lead to muscle spasms which in turn can cause physical injury. Currents of more than about 100 mA can cause fibrillation or loss of coherence of heart muscle contractions leading to death. Body contact resistance varies from several kilohms (dry) to less than one kilohm (wet);

internal body resistance is about 500 ohms from hand-to-foot, and about 100 ohms ear-to-ear. Since current equals voltage divided by resistance, it can be seen that sweaty hands in contact with a source as low as 100 volts can produce a body current of at least 100 milliamperes; enough to kill you if it passes through your body.

Procedures

1. *Never ever work alone on electrical equipment.* Always have a partner or another person in the lab to call emergency services if necessary. Familiarize yourself with the location of the nearest Automatic External Defibrillator before beginning work.
2. Ground electrical equipment and cover high voltage conductors with physical barriers. Whenever possible work only with one hand when you must work on energized circuits.
3. Where larger currents are not needed, large series resistors can permit the use of high voltages without the dangerous high currents.
4. Skin resistance is what saves you. In one case, a man was killed by a twelve volt car battery, because he touched the terminals while his hands were wet with ocean water. You should instinctively remove rings and wristwatches whenever you work around electricity since the sweaty skin covered with metal provides a low resistance contact.
5. Develop a healthy respect for certain common pieces of equipment.
 - a. Capacitors - Any large high-voltage capacitor whose terminals are not shorted may be dangerous. A piece of bare wire or solder should be wrapped around its terminals when it is not in use. If a capacitor is momentarily discharged, relaxation of stress in the dielectric can recharge it to a dangerous voltage in a few seconds. If the capacitor is charged to more than 200V, and its stored energy is between 0.25J and 50J, it can cause considerable pain and loss of muscle control. If the energy exceeds 80J it may cause lethal fibrillation of the heart.
 - b. Batteries and DC power supplies. Any source of DC voltage exceeding about 150V is dangerous.
 - c. Large Magnets - It is exceedingly dangerous to try to switch off the current to a large magnet. The self-inductance can produce essentially infinite voltage arcs. Magnet currents must be first turned down. Switches should be bypassed with a resistor.
 - d. Hi-voltage Power Supplies - Remember that the breakdown voltage of dry air is 30 kV/cm, less for humid air. Design the laboratory to keep hands and bodies away from high voltages.

Injuries:

All injuries serious enough to require treatment by a doctor should be reported to the department chairman. In the event of a serious accident, some member of the faculty should be immediately notified. For accidents involving radioactive or carcinogenic materials, also call the general emergency number, **8-6-9-1-1**.

Training:

Physics majors will be introduced to the safety manual during their freshman year in **either 105 or the majors lab**. Students who are working with a professor should have review

instruction on safety at the beginning of their work, upon the introduction of new risks into the laboratory and at least yearly thereafter.

Responsibilities

All personnel are responsible for alerting others to potential hazards in their presence. It is everyone's responsibility to correct (if possible) and report an unsafe conditions to the faculty in charge of the lab. If unsafe conditions persist, notify the laboratory manager or the department head. **All accidents must be reported to the department within 24 hours.**

Sanctions

Students violating these rules or promoting an unsafe working environment will have their access privileges suspended or revoked at the discretion of the department head.

Exclusions

There are no exclusions to the this policy. There may, however, be additional restrictions or procedures imposed in specific laboratories. This is true in particular for the machine shop.

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