

Laboratory Electrical Safety By Christopher G. Rock

All of Tufts University's laboratories have electrically powered equipment that is used routinely in day-to-day operations. Because of the frequent use, this equipment can pose a serious hazard if not properly maintained. In addition, uncontrolled electrical energy could cause burns and shocks, cause a laboratory fire and ruin electrical circuits in equipment.

Electrical shock and fires caused by sparks or arcs are major hazards associated with electricity in the laboratory.

Recently, a Cleveland State University scientist was conducting an experiment related to plant growth that required light for specific time-periods. He constructed a portable fluorescent lighting rack and obtained a household electric timer. However, since the timer only accepted a two prong plug, an adapter "cheater" was used to plug the three prong plug of the lighting rack into the two prong outlet on the timer. While the researcher was adjusting the timer, another researcher in the lab noticed him grasping the lighting rack and appearing rigid and pulled him away from the lighting rack. The researcher was transported to a hospital where he was later pronounced dead. The investigation revealed the following details:

- The light fixtures and the wall outlet were found to be wired correctly and without faults.
- A potential difference of 400 volts was measured between the metal fluorescent light fixture and the adjacent metal sink.
- The light fixture ballast transformer was found to have short circuited to the

metal light case but still allowed the lights to function properly.

- The lighting fixture was rated for 800 mA lamps, but the lamps installed were 1500 mA. It is believed that the use of 1500 mA bulbs drew more current causing the ballast to overheat and damage the insulation around the

transformer coil where it was then allowed to make contact and energize the surrounding metal lighting fixture. When the researcher grasped the fixture and part of his body touched the metal sink, this completed a

circuit to ground killing him.
NOTE: Even if a person touches the hot and neutral conductor at the same time - even if the circuit is GFCI-protected, electrocution can still occur. This is because the current transformer within the GFCI protection device does not sense an imbalance between the departing and returning current due to the missing ground on the timer.

Tufts University recommends all laboratory personnel inspect all electrical equipment in the laboratory and remind yourself where to find shutoff switches, circuits and emergency contact information. At your next lab meeting remind your laboratory workers to:

- Visually inspect wiring of equipment before each use. Look for cracks, wear marks, or damaged insulation on electrical cords. Cord attached to portable laboratory equipment that is frequently moved is prone to premature failure; examples include: vacuum pumps, electrophoresis devices, hot and stir plates, and bench top centrifuges.
- Electrical panels in front of the equipment must be at least

30-inches wide (or the width of the equipment).

A clearance of at least three feet is required. The workspace also must permit at least a 90-degree opening of all hinged panels and equipment

- doors. This space cannot be used for permanent fixtures or temporary storage.
- Multi-outlet power strips are approved for use, however, they must be UL 1449 rated (surge suppressed). It is recommended that only one power strip should be plugged into a duplex wall outlet to prevent overloading or nuisance tripping of the circuit breaker at the main electrical panel.
- Only equipment with three prongs (two plus ground) shall be used in the laboratory. No "cheaters" or "adaptors" (3 prong to 2 prong) are allowed. The grounding prong must not be cut off the plug to make it fit a 2 prong outlet!
- Extension cords are used for temporary operation only (90 days or less) while additional outlets and circuits are being installed.
- Unplug any electrical device before performing any maintenance or repairs. Only "qualified persons" at Tufts are allowed to replace electrical cords on electrical devices. Contact TEHS for qualifications.
- Capacitors store electricity and are typically located inside some laboratory equipment and can remain energized to produce harmful or lethal shocks long after it has been unplugged.
- Electrophoresis equipment uses high voltage. The wire leads insulation should be checked periodically for cracks, particular attention to the end connectors.
- Ensure that GFCI outlets are installed on any outlet within six feet of a sink or area where water is usually present. You should test frequently by using a dry hand press the "TEST" button to operate the GFCI, then press "Reset" to return to normal operation.
- In the event of an electrical fire and or electrical emergency, leave the area, call x6691 1, and pull the fire alarm. If only safe to approach, shut down the main power source.
- If a person receives an electrical shock, Call x6691 1. Do not touch a person being shocked until power is shut-off at the circuit breaker in the electrical panel. If only safe to approach, shut down the main power source.

