SAFE SCI: Be Protected!
By Dr. Ken Roy
Director of Environmental Health & Safety
Glastonbury Public Schools
Glastonbury, CT, USA;
Chief Science Safety Compliance Adviser & NSTA
Safety Blogger
National Science Teaching Association (NSTA);
Safety Compliance Officer
National Science Education Leadership
Association (NSELA)
Email Address: safersci@gmail.com
For the Latest on K-12 Lab Safety Follow Ken Roy
on TWITTER @drroysafersci

Laboratory Electrical Safety

I. A Shocking Lab Activity?

What do science laboratory sink faucets, ripple
tanks, aquariums and other water sources have
in common? All have the risk of providing an
electrical shock or even worse —
 electrocution. This is
why all science labs
need to have every
electrical receptacle
protected with ground
fault circuit interrupters (GFCI or GFIs). In most
cases this is required by legal safety standards
and in all cases by better professional safety
practices.

II. “Grounding” is no fault?

Unfortunately, many school employees including
science teachers mistakenly believe the circuit
breakers in the electrical panels protect the
science lab and building from electrical harm.
In reality, they are
designed to prevent
electrical fires by
tripping if too much
electricity tries to
flow through the
circuit’s wires. Too much electricity means too
much resistance. Too much resistance means
too much heat. Too much heat means FIRE!

Although the human body is a poor conductor
directly, a wet surface and as little as 1/5-Amp
can cause serious injury in the right situation. The
job of protecting the body of the teacher or student
is that of a ground fault circuit interrupter (GFCI or
GFI), not the building circuit breakers. The GFCI
has the function of constantly comparing current
flowing from the “Hot” wire to “Neutral” wire. If
the GFCI senses an imbalance of approximately 5
milliAmps in the current flow, the switch is open
and the current stops flowing in about 1/40 of a
second.

Like all mechanical devices, preventative
maintenance is a must. GFCI electrical devices,
if not “exercised” on a scheduled basis, may
corrode and not “trip” if called on to do their
task over time. Preventative maintenance is
important in this situation. This can easily
be done by simply flipping the breaker several
times every month or two. Users of the circuit
should be advised, in case computers or other
technologies are being operated during the
exercising of the breaker.

III. Is Your Lab GFCI Protected?

Occupational Safety and Health Standards for
General Industry (OSHA) states the following in
29 CFR part 1910.303(b): “Electrical equipment
shall be free from recognized hazards that are
likely to cause death or serious physical harm to
employees.” (OSHA Electrical Standard - https://
www.osha.gov/pls/oshaweb/owadisp.show_
document?p_id=9880&p_table=STANDARDS)
Application of this electrical standard by OSHA
should be the basis of science labs in middle
and high schools requiring GFCI protection.

Teachers and supervisors involved with
renovations or new science laboratory facilities
need to ensure that such protection is provided.
Existing laboratory facilities should also have
such protection for teachers and students. Again,
remember this is not only legal safety standard
in most cases, but also better professional safety
practice.

There are three different locations where the
installation of GFCI protective devices can be
placed. A standard electrical receptacle can
be replaced with a GFCI receptacle. This is the
usual location in labs where GFCI receptacles
are installed. The second option is to install a
GFCI circuit breaker in the service panel. The
third option (though temporary) is a “portable”
GFCI device, which can be placed between the
wall receptacle and the electrical device. It plugs
into an existing three prong grounded outlet and
converts that receptacle to a ground fault protected
receptacle. Remember however that the GFCI will
only provide protection downstream from the GFCI
to the end of the circuit.

IV. One “Fault” With the Ground Fault
System!

This is a true story that happened years ago in
one of the author’s science labs. A student in a
biology lab plugged in a microscope lamp into
a GFCI protected receptacle. The student began
actively dancing around and was being shocked
according to the horrified science teacher. The
teacher was perplexed in that the GFCI had just
been tested and proved to be fully operational.
Yet, the student was not protected from being
shocked.

The flaw in a GFCI system is that it does not
protect the individuals from line-to-line contact
hazards. This is what happens when a person
holds two “hot” wires or a
“hot” and a “neutral” wire
at the same time. In the
case of the student, he was
not paying attention and had his fingers on the
metal prongs of the plug when pushing it into the
wall receptacle. This constituted a line-to-line
contact. Students and teachers need to be made
aware of this danger in safety training workshops.

V. GFCI Protection – A Requirement!

Is your science lab. GFCI (Ground Fault Circuit
Interrupter) protected? If unsure,
two things can be done. First, the
supervisor of facilities should be
contacted and asked to inspect the
lab for GFCI protection. Secondly,
hardware or electrical stores
usually carry GFCI test devices for
about $15.00. They are very simple to operate
and a whole lab can be tested within a few
minutes.

GFCI protection is the law and better professional
safety practice as noted previously. It needs to be
enforced for the protection of all lab occupants -
teachers and students - from being shocked or
electrocuted. Be an advocate and work with
administration to bring your lab into code compliance. It is highly recommended that either the teacher, administrator or facility director check with a licensed electrician or local building inspector for applications of the National Electrical Code and OSHA standards in your school facility.

VI. General Safety Guidelines!

The following list are several suggested safety guidelines when working with or near electrical sources:

- Always first inspect portable cord-and-plug connected equipment, extension cords, power bars, etc. for damage or wear before each use. Pull damaged equipment immediately out of service for repairs.

- In order to prevent trip/fall and electrical hazards, always tape extension cords to walls or floors when necessary. Do not use nails and staples because they can damage extension cords and cause fire and shocks. Disconnect live cords at the end of the school day. They can over heat and cause fire during the night!

- Only use extension cords or equipment that is rated for the level of amperage or wattage being used.

- Unusually warm or hot outlets or cords are a sign of potentially unsafe wiring conditions. Unplug any cords or extension cords from these outlets and do not use until a qualified electrician has checked the wiring.

- Use caution with halogen lights. Keep them away from combustible materials such as cloths or curtains. Halogen lamps can become very hot and may be a fire hazard.

- Risk of electric shock is greater in areas that are wet or damp. Install Ground Fault Circuit Interrupters (GFCIs) as they will interrupt the electrical circuit before a current sufficient to cause death or serious injury occurs.

- Use a portable in-line Ground Fault Circuit Interrupter (GFCI) if you are not certain that the receptacle you are plugging your extension cord into is GFCI protected.

- Know the location of the emergency electrical shut-off button, electrical panel and circuit in case of an emergency.

- Never use outlets or cords that have damaged/exposed wiring.

- Per the National Fire Protection Association—NFPA electrical standard, always have a minimum 6-foot clearance for access to panels and circuit breakers or fuse boxes.

- Do not touch a person or electrical apparatus in the event of an electrical incident. Always disconnect the power source first.

Resource:

*Electrical Safety in the Workplace* — OSHA Safety Manual -

*Electrical Safety* – Princeton University -

CSTA Newsletter January-February 2000, Page 4
WANTED: ELECTRICITY - GFCI ✖️✖️