ELECTRICAL SAFETY AWARENESS TRAINING

- including Lock Out/Tag Out

Electrical Fires in the USA

- Daily, fires occur due to electrical problems: defective electrical device, circuit overloading, circuit overheating, explosions ignited by electrical spark, etc.
- Electricity is one of the most common causes of fire in the USA. In 2011, there were approximately:
  - **47,700 electrical fires reported,**
  - **causing 431 fire deaths,**
  - **1,813 fire related injuries,**
  - **$1.9 billion in property damage.**

Source: National Fire Protection Association, 2013

Electrical Injuries

There are four main types of electrical injuries:

- Electrocution
- Electrical Shock
- Electrical Burns
- Falls, other secondary injuries

Electrocutions

- **In 2013, there were 139 deaths from electrocution, comprising 3% of all workplace fatalities in the US.**
- **Victims who survive electrocutions have high probability of permanent nerve damage to limb or body.**
- **30,000 US workers suffer from electrical shock and/or burns annually.**

Source: Bureau of Labor Statistics, 2013

Electrical Shock

- Injuries vary depending on intensity and duration.
- Damages can stop the heart, lungs, brain and other organs.
- Always seek medical attention, as full impact of the electrical injury may not be immediately apparent.

Electrical Burns

- Most common shock-related, nonfatal injury.
- Often occurs on the hands.
- Ranges from partial to full thickness.
- Extremely painful.

Falls and Secondary Injuries

- Electric shock can cause secondary injuries. Falls are the most common.
- Workers in elevated locations who experience shock can fall, resulting in injury or death.

How Electricity Can Hurt You

- The effects vary and depend on:
- Voltage, amperage, and resistance
- How long the shock lasts
- Pathway of current through the body

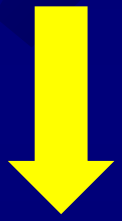
Effects of Electrical Current

Current	Effect
• 1 mA(milliampere) (one thousandth of a full ampere)	• Faint tingle
• 10-25 mA	• Painful shock, loss of muscle control
• 50-150 Ma	• Extreme pain, respiratory arrest, severe muscular contractions
• 1-4 amperes (A)	• Heart stops; death likely
• 5-12 A	• Current drawn by typical household appliances
• 10 A	• Cardiac arrest and severe burns; death probable
• 15 A (most standard household circuits)	• Lowest overcurrent at which a typical fuse or circuit breaker operates

Ohm's Law

This is not what hurts

This is!



$$\frac{\text{Voltage (volts, V)}}{\text{Resistance (ohms, }\Omega\text{)}} = \text{Current (amps, A)}$$

Electrical Safety Devices

- Insulation (barrier)
- GFCI
- Grounding
- Fuses and breakers

Ground Fault Circuit Interrupter (GFCI)

- Protects *people* from shock by detecting small current leaks, called a ground fault.
- When a GF is detected, GFCI shuts off electricity within 1/40thof a second.
- Use in wet and other high-risk areas.
- Test periodically - plug something in, push “test”; equipment should turn off. Reset.

Grounding

“Grounding” a tool or electrical system means intentionally creating a low-resistance path that connects to the earth. This prevents the buildup of voltages that could cause an electrical accident.

Grounding is normally a secondary protective measure to protect against electric shock. It will substantially reduce the risk of injury or death in case of shock, especially when used in combination with other electrical safety measures.

An equipment ground helps protect the equipment operator. It furnishes a second path for the current to pass through from the tool or machine to the ground. This additional ground safeguards the operator if a malfunction causes the tool’s metal frame to become energized. The resulting flow of current may activate the circuit protection devices.

All electrical equipment shall be grounded at this facility.

Shown in the picture is a ground wire.

Fuses and Circuit Breakers

Overcurrent devices for protection of equipment –not for protection of people.

When there is too much current:

- Fuses melt
- Circuit breakers trip

Circuit breaker panels need to be unobstructed and have at least 36 inches of clear space in front of panels.

VHSO Electrical Safety MCM XX-138-05

- Upon arrival, before delivery to the using service, biomedical, electrical and electronic equipment shall be inspected by Biomedical Engineering personnel. Equipment will be labeled with appropriate area restrictions before delivery to the user.
- Authorized using personnel shall inspect all pieces of equipment before each use for hazards, e.g., broken or damaged plugs, frayed line cords or abnormal operation, obvious chassis damage, overheating or tingling sensations. If a hazard is suspected, that piece of equipment shall not be used.
- The use of extension cords in patient care areas is prohibited.
- Personally owned (employee) line operated electrical devices are prohibited without written approval from the Medical Center Director. Approval will be requested using VA-form 90-2235 in accordance with MCM XX-00-28 (Personally Owned Property Program). Qualified Engineering personnel will inspect electrical equipment and written permission from the Chief, Engineering Service, must be obtained prior to use. Such equipment will not be used in patient care areas.

Use of Flexible Cords

More vulnerable than fixed wiring, flexible cords can be damaged by:

- Aging
- Edges of other items, such as windows and doors
- Staples or fastenings
- People in the area

Improper use of flexible cords can cause shocks, burns, fire, and can be a trip hazard.

Use of Extension Cords and Power Strips

Extension Cords are for TEMPORARY USE only!

Power Strips

(Transient Voltage Surge Suppressors)

- For electronics only (computers)
- Not for appliances (Refrigerator, Microwave, Coffee Pot)
- Do not overload

  The number of outlets on the power strip DOES NOT indicate how many devices can be connected!
- Extension cords should never be attached to power strips

Clues That Electrical Hazards Exist

- Repeated tripped circuit breakers or blown fuses.
- GFCI trips unexpectedly.
- Overheated tools, wires, cords, connections, or junction boxes.
- Warm outlets or switches
- Worn or frayed insulation around wire or connection.

What Should I Look For?

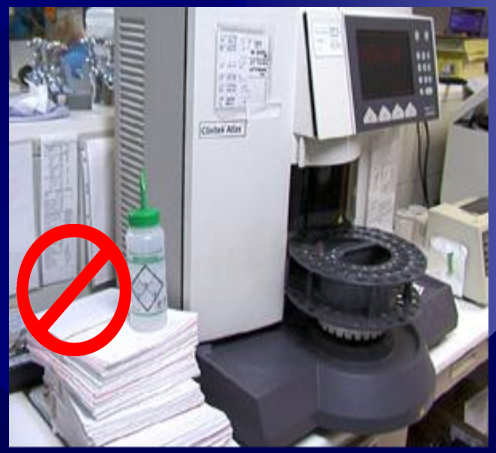
- Damaged electrical equipment–including extension cords and power strips.
- Improperly grounded or insulated power tools and equipment.
- Overloaded circuits and inadequate wiring
- Ground Fault Circuit Interrupters (GFCI) in wet areas.

What to Do?

- Inspect cords and equipment before use.
- Properly use plugs.
- Use 3-prong grounded extension cords.
- Protect cords and equipment.

What Not to Do?

- Don’t fasten cords using nails, staples, etc.
- Don’t strain cords
- Don’t use power taps
- Don’t use “cheater” plug or pull out the 3rd prong
- Don’t handle, plug or unplug electrical equipment with wet hands, and avoid turning on an electrical switch while standing on a wet surface
- Keep flammables and combustibles separate from electrical equipment
- Always remove the power to equipment before servicing



What Else to Do?

- Label electrical hazards.
- Use barriers and guards appropriately.
- No jewelry or metal objects around electricity.
- Use GFCI in wet areas.
- Repair and maintain equipment.
- Be aware of Lock Out / Tag Out situations.

Lock Out – Tag Out

This is a method of keeping equipment from being set in motion (turned on) and preventing injury or death when work is performed on electrical or other energized power sources. A written warning (tag out) is attached to the energy-isolating device, which has been placed in a safe position. Locking devices (lock out) which physically hold the switch, handle or other means of activation in the “off” position can also be used.

The tag will have the name of the person attaching it, the date and time affixed. The item shall only be reconnected to the power source by the person attaching it or supervisory Engineering personnel.

What If an Injury Happens?

Never touch a victim in contact with electricity before disconnecting the power – the electricity can go through you too!

Shut down power at remote controls or breaker.

Use a non-conductive item (e.g. wooden broom handle) to pry him away from the contact.

Seek immediate medical help for all electrical injuries.

Provide first aid and CPR (if trained) until help arrives.

Notify a supervisor and complete an Employee Injury Report (CA-1).

Electrical Work

- All building electrical repairs, splices, and wiring shall be performed by Engineering Service, ext. 65466
- Reporting of equipment failures will be by submission of electronic work orders.
  - Do not attempt to fix on your own
  - Attempting to repair equipment yourself may create a hazard

Conclusion

- Know and follow safe work practices and procedures, and if you are unsure….ASK!!
- Report all unsafe conditions to lab safety committee or VHSO Safety, ext. 65416