ESH408

BASIC ELECTRICAL SAFETY AWARENESS

Course Objectives

Welcome to the Basic Electrical Safety Awareness.

You are taking this course because by learning to spot and prevent electrical hazards, you will make your home and workplace safer.

In addition, at the end of the course, you will be able to do the following:

- Locate electrical safety resources
- Recall electrical safety principles
- Recognize shock and arc flash hazards
- Identify Nationally Recognized Testing Laboratory (NRTL) requirements
- Recall general electrical safety practices
- Recognize methods used to prevent unauthorized access to work areas
- Recognize electrical injuries and emergency response

What this course is NOT

It is important to know that this course ***NOT*** "Qualified Electrical Worker" training, and it will not teach you specific skills or safety techniques to qualify you as an electrical worker.

In addition, this class does not authorize work.

You will be required to attend additional classes if you are required to act as a standby person, perform electrical work or engage in Lockout/Tagout (LOTO)*.

You may also need additional training for switching or working with capacitors or batteries depending on the amperage or voltage of the equipment you will be working on.

* *Lockout/Tagout (LOTO) is a method of keeping equipment from being turned on, or otherwise releasing energy that could or would endanger workers working on or near the equipment.*

Did you know?

Annually, electrical hazards are listed as the cause of about 4,000 injuries.

The statistical information listed here provides some examples of incidents that often result in injuries, property damage, and even death.

- Electricity ranks sixth among all causes of occupational injury in the United States.
- On average, there are more than 400 electrocutions in the United States each year. Electrocutions from wiring hazards, including damaged or exposed wiring, totaled about 20%.

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Many **electrocutions (or electric shocks that results in death)** and home fires can be prevented by understanding basic electrical safety principles and adhering to safe practices.

By learning to spot and prevent electrical hazards, you will make your home and workplace safer.

- Every year, electrical incidents involve a large portion of non-electrical workers, with approximately one-half of incidents involving workers from outside electrical crafts.
- Electricity is the cause of more than 140,000 fires each year and $1.6 billion in property damage.
- Roughly 3,300 home fires originate from extension cords each year, killing 50 people and injuring 270 more.

Electrical Safety Resources

There are several electrical safety resources available to you. They are accessible through the **Electrical Safety website** on Inside Argonne.

The link to the website and all resources discussed are available on the last page of this document.

One of the most important and comprehensive sources of electrical safety information is **Argonne's Electrical Safety Manual**.
It is a practical how-to guide for recognizing electrical hazards, developing controls, and planning electrical work.

Throughout the course, you will notice the Electrical Safety Manual section references. If desired, you are welcome to visit the Manual sections for details.

In addition to the Electrical Safety Manual, the electrical safety website contains **key contact information, field guides, and other helpful references and resources**.

If you have any questions regarding electrical safety, please don't hesitate to **visit the website or contact** the:

- Electrical Safety Subject Matter Expert (SME)
- Electrical Safety Committee
- ESH Coordinator
- Qualified Electrical Worker
- Electrical Safety Group

You can also direct your questions to electricalsafety@anl.gov.

Principles of Electrical Safety

Electricity is one of the most commonly encountered hazards in any home or workplace.

Under normal conditions, safety features built into electrical equipment protect people from electrical shock injuries.

Electricity is particularly hazardous because it is common in our lives, undetectable by human senses and potentially fatal upon contact.

Since we use electricity every day and everywhere in our lives, the use of specialized equipment and safe work practices is important to prevent serious injuries or death.

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Shock and Arc Flash Thresholds

There are shock and arc flash threshold values that are established to prevent injury from electricity.

These thresholds are for Alternating Current (AC)* and Direct Current (DC)* sources.

We deal with Alternating Current when we plug in equipment to our wall outlets, and with Direct Current if we were to handle batteries.

Source	Includes	Thresholds
AC	50-60 Hertz (Hz) nominal	≥ 50 Volts (V)
DC	All	≥ 100 Volts (V)

See ESM Section 2.2 & 5.15

Values that are above the thresholds shown here would pose a potential for injury, and only a Qualified Electrical Worker (QEW) is allowed to perform electrical work on these systems.

Please note that standard outlets and power distribution are 120V, and are above the 50V threshold, so electrical work performed on these systems requires a QEW.

** Alternating Current (AC) - an electric current that reverses its direction many times a second at regular intervals, typically used in power supplies.*

** Direct Current (DC) - an electric current flowing in one direction only.*

** Volt (V) - one of the three basic units of electricity.*

** Hertz (Hz) - unit used for measuring of the frequency of oscillations (or regular movements). One hertz is simply one cycle per second.*

Qualified Electrical Worker

In order to perform electrical work, the individual needs to be:

- Knowledgeable
- Skilled
- Trained
- Authorized
- Approved

Qualified Electrical Workers at Argonne must meet all of the requirements that were just mentioned. They must complete all required training, they must be able to independently recognize the hazards, and they must have the skills and tools to protect against the hazards. They must also be authorized and approved for the work they perform.

Any modification, repair, build or assembly of electrical circuit parts or wiring, designed to operate above the shock thresholds, requires a Qualified Electrical Worker.

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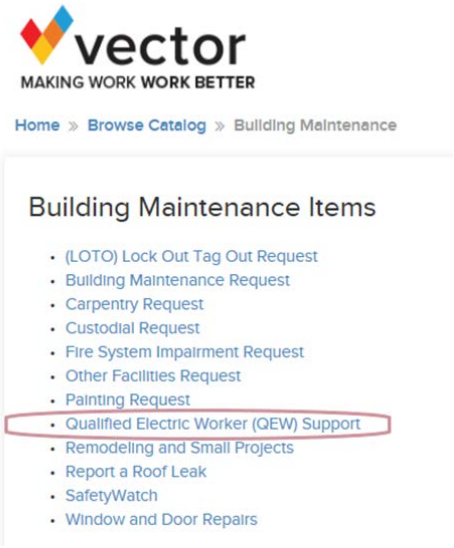
In order to request QEW's support, you should complete a **help ticket using the Vector system**.

If you are unsure if a task would be considered *electrical work*, ask a QEW or send your question to electricalsafety@anl.gov.

The list of all Argonne QEWs is available on the Electrical Safety website on Inside Argonne.



See ESM Section 6.4 & 6.12

What can non-Qualified Electrical Workers do?

Individuals who are not Qualified Electrical Workers are allowed to do a very limited list of electrical tasks.

These include:

- Plugging or unplugging equipment to and from standard receptacles
- Replacing batteries that are both
  - **less than 100 Volts*** and
  - **less than 1000 Watts*** in accordance with manufacturer's instructions
- Perform switching on panel boards, circuit breakers, or fused disconnects rated at less than **15 Amps*** (greater than 15 amps requires completion of additional training)

Non-Qualified Electrical Workers are NOT permitted to perform electrical work.

Field Guide 1 has additional information on what is considered electrical work as a reference.

** Volt (V) - one of the three basic units of electricity.*

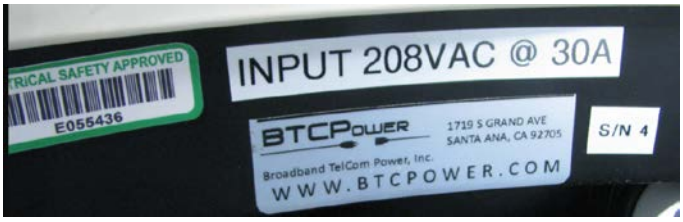
** Watt - measure of electrical power.*

** Amp - measure of electric current.*

Nationally Recognized Testing Laboratory (NRTL) Requirements

ALL electrical equipment used at Argonne, including appliances and research and development equipment, must be labeled or listed by a Nationally Recognized Testing Laboratory (NRTL). This information would normally be found on the back of the equipment.

Research and development equipment is sometimes not NRTL-listed because of its unique nature. If the equipment is not listed, it must be field-evaluated and approved by a Designated Electrical Equipment Inspector prior to use.



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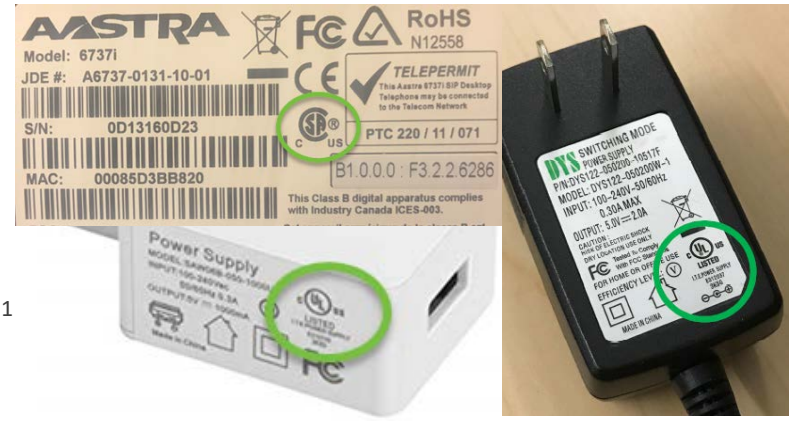
Some examples of approved markings are shown here. You can see the OSHA website to view other acceptable NRTL markings (link provided on the last page of the document).

The 3rd leading category of electrical fatalities involved workers coming into contact with electricity from machines, tools, appliances, or light fixtures.



General Electrical Safety Practices

Here are some general electrical safety practices, *do's and don'ts that* you should be aware of.

See ESM Section 20.1

PLUGGING IN EQUIPMENT

DO	DO NOT
• Remove a plug from the receptacle by the base of the plug • Only use NRTL-listed or DEEI-approved equipment • Have proper strain relief for wires • Use "CE" and European NRTL adaptors **only if** inspected by DEEIs • Contact a QEW if you damaged or deranged electrical equipment	• Remove ground from plug • Use damaged or deranged cables, cords, plugs, receptacles or connectors • Use a wet plug or wet hands to plug in equipment • Contact the plug blades while removing from the receptacle • Reset a tripped breaker

See ESM Section 5.9

EXTENSION CORDS

MUST BE	MUST NOT BE
• NRTL-listed (UL, CSA, etc.) • Used temporarily • Rated to carry the current (amperage) of the load • Used for the intended environment (outdoors, wet locations, etc.)	• Permanently installed or attached to building surfaces • Plugged into a relocatable power tap (power strip) • Run thru holes in walls, ceilings or floors • Concealed behind walls, ceilings or floors • Posing a trip hazard

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RELOCATABLE POWER TAPS (RPTS) OR POWER STRIPS

MUST BE	MUST NOT BE
• NRTL-listed (UL, CSA, etc.) • Incorporating a circuit breaker or fuse • Used for only light (low current) loads, such as computers and peripherals, calculators, desk lamps, etc.	• Permanently attached to surfaces (requiring tools for removal) • Plugged into another RPT or an extension cord (daisy-chained) • Used for heavy, high current loads, such as microwave ovens, refrigerators, heat guns, space heaters, etc.

See ESM Section 5.5 & 5.6

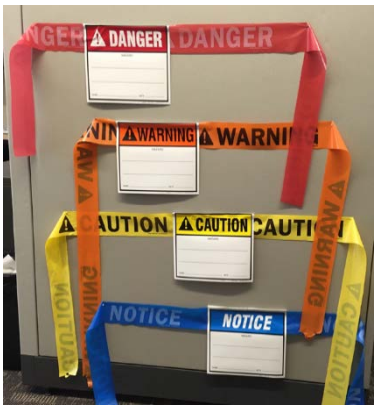
Barricades and Signage

Barricades, along with barricade tape and signs, are used to prevent or limit unauthorized employee access to work areas.

Do NOT enter electrical work barricades unless you are authorized to do so.

And remember to NEVER remove or manipulate a Locked Out or Tagged Out (LOTO)* equipment or breaker.

* *Lockout/Tagout (LOTO) is a method of keeping equipment from being turned on, or otherwise releasing energy that could or would endanger workers working on or near the equipment.*



Emergency Response

In any emergency event, dial **911** from a landline or **630-252-1911** from your cell phone.

See ESM Section 10.3

SHOCK INJURY

- If a person is being shocked, if possible, turn off the source of electricity.
- Next, immediately dial **911** from a landline or **630-252-1911** from your cell phone.

Remember – DO NOT TOUCH the person being shocked.

Also remember that any perceivable shock must be reported!

The effects of a shock may be delayed and take days to onset, and they may include the following:

- Cardiac arrest
- Involuntary muscle contraction
- Organ damage
- Internal hemorrhaging
- Destruction of tissues

See ESM Section 10.5

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ELECTRICAL FIRE

In the event of an electrical fire, activate the fire alarm, dial **911** from a landline or **630-252-1911** from your cell phone.

Alert everyone in the immediate area to evacuate.

Remember to never use water on an electrical fire!

DOWN OVERHEAD LINES

In the event of down overhead lines, dial **911** from a landline or **630-252-1911** from your cell phone.

If you are involved in a vehicle accident that brings a power line down on your vehicle, remain in the vehicle until emergency responders tell you it is safe to exit.

Remain 10 feet away from the overhead lines, including while carrying equipment such as poles or ladders.

See ESM Section 10.5 & 11.3

Some habits we are trying to develop at Argonne

Argonne has made great strides in the electrical safety program. Some habits applicable to non-Qualified Electrical Workers are still in need of further improvement.

As a non-QEW:

- Do not perform electrical work
- Report unsafe equipment

We are counting on you to help us in the progress and continuous improvement of our practices and programs.

We thank you for your input and support!

Conclusion

This concludes the Basic Electrical Safety Awareness training.

Keep in mind that Argonne has trained staff available to help you when identifying hazards, assessing risks and applying control measures.

You can discuss your safety concerns with the individuals listed here.

You can find all of the contacts mentioned here on the Electrical Safety website linked on the last page of this document.

Discuss safety concerns or questions with:

- Electrical Safety Subject Matter Expert (SME)
- Electrical Safety Committee
- ESH Coordinator
- Qualified Electrical Worker
- Electrical Safety Group
- electricalsafety@anl.gov

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Remember that completing this course DOES NOT make you a Qualified Electrical Worker (QEW).

In order to become a QEW, you must complete additional training, and you must be qualified and authorized for the job.

Resources:

- Electrical Safety Website
- Electrical Safety Manual
- Electrical Safety Subject Matter Expert (SME)
- Electrical Safety Committee
- OSHA NRTL List
- Field Guide 1: What is Electrical Work?

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