



Worker Beware[®]

Electrical and Natural Gas Safety Training Facilitation Guide

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Introduction

The *Worker Beware*® training program from Consumers Energy is designed to provide contractors with information that will assist them in working safely around overhead and underground power lines and near natural gas pipelines.

For specific safety and training requirements, consult the Michigan Occupational Safety and Health Administration (MIOSHA).

This trainer's guide will help you make the most of the *Worker Beware* program. It contains five sections:

- **Know Your Audience.** An overview of contractors' learning preferences.
- **Electricity and Natural Gas Basics.** Information on how electricity and natural gas work and some terms to know.
- **Plan Your Session.** Tips for preparing an effective training session.
- **Your Five-Step Training Facilitation Guide.** Step-by-step training guidance.
- **Before and After Quiz.** Reproducible electrical safety quiz to help trainers and participants evaluate the program's impact.

Section One: Know Your Audience

Understanding how contractors learn best will help you tailor your training session to this unique audience. Take into consideration the following:

- **Contractors are very focused on working efficiently.** Contractors may face pressure to cut corners where safety is concerned in the interest of saving time and money. Acknowledging this from the start—and cautioning against it—will put you all on the same page.
- **Contractors tend to be action-oriented learners** who do best when given an opportunity to practice and repeat recommended behaviors.
- **Contractors prefer practical (rather than theoretical) information.** Keep the focus on real-life situations.

Section Two: Electricity and Natural Gas Basics

This section will help you answer questions about electricity and natural gas from session participants.

What Is Electricity?

Electricity results from the flow of electrons between atoms that occurs when atoms carry different charges. Electrons are negatively charged and flow to positively charged atoms until the charge is level or neutral.

- The flow of electrons is called **current**.
- Current is measured in **amperes**, or **amps** for short.
- The force propelling the flow of electrons is measured in **voltage**, or **volts** for short.

- When an object or substance limits the flow of current, this property is called **resistance**. Resistance is measured in **ohms**.
- Materials with a high level of resistance are called **insulators**. Common insulators include porcelain, plastics and air. These materials do not allow electricity to pass through them easily; however, even insulators can conduct electricity under certain conditions.
- Materials with a low level of resistance are called **conductors**. Common conductors include water, most metals and the human body. Electricity can pass easily through these materials under almost all conditions.

The Electricity Distribution System

Most of the nation’s electricity is generated at power plants. A thick coil of wire spins inside giant magnets at the plant, moving the electrons in the wire and making electricity flow.

Wires on tall transmission towers carry high-voltage electricity from power plants to substations, where the voltage is typically reduced. From substations, electricity travels on smaller wires that branch out down streets, either overhead or underground.

Overhead and underground power lines carry electricity to transformers, which can be found on poles, on the ground in metal structures or underground in vaults. These transformers are where the voltage is reduced again to a level that is practical for typical use. From transformers, electricity travels into buildings through service wires. These wires connect to the meter panel, which is connected to all the wires that energize wall outlets and switches.

Note that electric-line workers receive extensive training and are experts in handling power lines. They also have special equipment for handling electric infrastructure. Contractors should understand that even with training, their understanding of electricity is basic and their personal protective equipment is not designed for electrical work.

What Is Natural Gas?

Natural gas, like petroleum, is a fossil fuel. It is found in pockets deep underground and is harvested by drilling. Here are some basic properties of natural gas:

- Natural gas is nontoxic.
- Natural gas ignites at about the temperature at which a cigarette burns.
- Natural gas burns within a specific concentration range: between approximately 4% and 15% gas to air.
- Natural gas is lighter than air. Whenever possible, it will rise. If contained, it will move laterally or **migrate**, seeking an upward path, and it will follow the path of least resistance.
- Natural gas is odorless. Consumers Energy adds a distinctive, sulfur-like or “rotten egg” odor to natural gas to assist in the detection of leaks. However, in certain conditions you may not be able to smell this odorant. Additionally, natural gas in major transmission lines usually does not have odorant added. So do not rely on your nose alone to detect a gas leak. Use your senses of sight and hearing as well, and be alert for the following:
 - “Rotten egg” smell from distribution lines
 - Blowing or hissing sound
 - Dead or discolored vegetation in an otherwise green area
 - Dirt or dust blowing from a hole in the ground
 - Bubbling in wet or flooded areas
 - Flames, if a leak has ignited

The Natural Gas Distribution System

Thousands of miles of underground pipes are used to harness and transmit natural gas. These include transmission pipelines, main lines and service lines.

Transmission pipelines move natural gas from refining plants across long distances. Pipeline markers indicate the need for extra care around Consumers Energy high-pressure natural gas transmission pipelines. These markers indicate a pipeline's general location only. Never use them as a substitute for calling 811.

From transmission pipelines, distribution lines bring natural gas into residential and commercial areas where it will be used. Service lines bring natural gas from main lines to individual structures.

Pressure, created at various points along the lines, moves the gas through the pipes. The size of natural gas lines varies greatly, and the pressure can vary as well: from ¼ pound per square inch to 1,000 pounds per square inch. The size of a gas line is NOT a reliable indicator of the internal pressure.

Section Three: Plan Your Session

A well-organized, informed instructor will gain participants' respect and be far more effective. Below are some recommendations to help you prepare for the electrical safety training session with confidence.

Know Your Material

Always preview the materials before showing them to session participants. Gathering information in advance can be useful and make the training materials more relevant. Review all the materials and rehearse your presentation well before the session.

Make the Material Relevant

Identify the key situations that contractors in your training session may encounter, and focus the group's attention on these topics during training:

- **What job site situations** bring them close to overhead power lines?
- **What type of long or tall equipment do they use** that might come into contact with overhead power lines?
- **What type of digging or earth-moving activities** might bring them close to underground power lines and/or natural gas pipelines?
- **What utility hazards** have participants encountered in the past? Recently?

Tailor the Session to the Training Space, Audience Size and Allotted Time

Remember that contractors are hands-on, action-oriented learners. The session will need to include opportunities to simulate recommended practices and to discuss potential applications of the material. Room size and arrangement can have a measurable impact on the participation level.

Consider:

- **Will all materials be visible** to all participants, or do you need additional space or equipment?
- **Are the seats arranged in a way** that will foster discussion?

- **Is there adequate space** for participants to conduct simulations?
- **Is there adequate lighting** for all participants to see the instructor and materials and to take notes if necessary?
- **Will everyone be able to hear?**

Just as room and audience size can impact the effectiveness of training, so can session time. No one learns well sitting for long periods. On the other hand, cramming too much information into a short session can reduce retention. Plan your session to allow time for discussions and simulations. If there is not time for all the materials, consider which ones will be most effective for participants.

Section Four: Your Five-Step Training Facilitation Guide

Follow these steps for a high-impact meeting that will keep participants involved and reinforce essential safety information:

1. Advertise the meeting.

Post a notice well in advance of the meeting in a highly visible location.

2. Pass a sign-in sheet.

Keep attendance records of all safety meetings. Someday you may have to show who attended the meeting, what the session covered and when it was held.

3. Offer an overview.

Tell participants what you will cover in the meeting and what you hope they will learn. This is a good time to convey the importance of this information, and that it can help protect contractors, their co-workers and the public from utility-related injury or death.

4. Present the Worker Beware[®] materials.

Discuss the utility safety information in these materials and the electrical and natural gas emergencies that participants might encounter. Review these vital safety tips with participants periodically to refresh their memories.

5. Conduct a discussion.

Participants will retain more information if they get involved in discussion. Here are some ideas:

- **Remind participants of the circumstances of any recent power line or natural gas line contacts** in your region. Discuss how information in the materials is relevant to those incidents.
- **Stress the necessity of maintaining the required safety clearances from overhead power lines:**
 - Remind participants that MIOSHA safety standards require that anyone working near power lines stay at least 10 feet away, plus the length of any tools or equipment they are using. Emphasize that the safest practice is always to stay as far away as possible from power lines.

- Metal ladders, cranes and some other specialized equipment require 20 feet of clearance. Higher voltages also may require greater distances and encroachment prevention precautions; contact MIOSHA for specific requirements. (A MIOSHA Fact Sheet on Electric Safety Power Line Clearances can be downloaded from ConsumersEnergy.com/worksafe.) Contact Consumers Energy to verify voltages and request overhead assistance.
 - Discuss how these rules apply to workers and the situations they may encounter.
- **Review the proper “Call 811 Before You Dig” procedures and the utility color code.** Discuss why following the law and allowing extra time for a utility locate can save time and money in the long run. Discuss additional safety measures, such as asking the property owner about underground lines.
 - **Invite participants to ask questions** about the materials and the safety procedures they outline. If they have questions you can’t answer, research the answers yourself, and provide that information as soon as possible.
 - **Ask participants to brainstorm a list of key safety issues** identified in the materials. Review these key issues and discuss incidents that resulted when related safety precautions were ignored. What were the consequences?
 - **Ask each participant to name one thing he or she learned** from the materials or discussion that will help him or her be safer in the future.

Remember that discussion is intended to reinforce proper behavior—NOT to call out or embarrass participants. Maintain a cooperative, supportive atmosphere at all times, and encourage participants to ask questions and provide feedback.

Section Five: Electrical and Natural Gas Safety Quiz

The quiz on the next page is intended to help instructors and participants assess the program’s effectiveness. Administer it before beginning the training, and ask participants to record their answers in the “Before” column. Then administer it again at the end of the session, and ask participants to list answers in the “After” column. The quiz is designed for two-sided copying.

***Worker Beware*[®] Utility Safety Quiz Answers:**

- | | |
|------|-------|
| 1. C | 7. B |
| 2. B | 8. D |
| 3. B | 9. D |
| 4. D | 10. B |
| 5. D | 11. C |
| 6. D | 12. A |

Name: _____

Date: _____

Worker Beware® Electrical and Natural Gas Safety Quiz

Before

Questions

After

- _____
- 1. What is the *minimum* safe clearance you must maintain between a metal ladder and overhead power lines?**

 - A. 6 inches
 - B. 100 feet
 - C. 20 feet
 - D. 5 feet
- _____
- 2. What is the color of the locator marks for underground electric power lines?**

 - A. Yellow
 - B. Red
 - C. Orange
 - D. None of the above
- _____
- 3. If you must work closer than the safe clearance distance from overhead power lines, which of the following should you do?**

 - A. Attempt to disconnect electrical service
 - B. Call Consumers Energy in advance to make arrangements
 - C. Evacuate nearby homes
 - D. Both A and C
- _____
- 4. What does the law require that you do to determine the location of underground electric and gas lines before digging on a job site?**

 - A. Look for right-of-way markers
 - B. Check your maps
 - C. Call the local utility company
 - D. Notify 811
- _____
- 5. How should you assist a co-worker who contacts a power line while operating heavy equipment?**

 - A. Call 911 and Consumers Energy
 - B. Encourage him/her to stay on the equipment until Consumers Energy personnel arrive
 - C. If forced off by fire or another hazard, tell him/her to jump clear of the equipment, land with feet together and shuffle away, keeping feet close together and on the ground
 - D. All of the above

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Before

After

- _____
- 6. Which of the following is a warning sign of a natural gas leak?**
- A. Dirt or dust blowing from a hole in the ground
 - B. Bubbling in wet or flooded areas
 - C. Blowing or hissing sound
 - D. All of the above
- _____
- 7. What is the job of a spotter?**
- A. To stabilize a load
 - B. To prevent equipment from contacting power lines
 - C. Both A and B
 - D. None of the above
- _____
- 8. If you make contact with a natural gas pipeline and suspect that gas is leaking, which of the following should you do?**
- A. Bury the damaged area
 - B. Attempt to stop the flow of gas
 - C. Use a flashlight to find the leak
 - D. Leave the excavation open
- _____
- 9. If your equipment contacts a power line and you are not in imminent danger, you should:**
- A. Stay put and tell others to stay far away from the equipment
 - B. Have someone immediately call 911 and Consumers Energy
 - C. Move the equipment away from the line if you can do so safely
 - D. All of the above
- _____
- 10. True or false? You cannot be shocked by a service wire.**
- A. True
 - B. False
- _____
- 11. How can you confirm all buried facilities have been marked before you dig?**
- A. Call each utility operator individually
 - B. Ask the property owner to count the locator marks
 - C. Using the MISS DIG ticket number, go to response.missdig811.org or call back into 811
 - D. All of the above
- _____
- 12. True or false? Prior to using power digging equipment within 48 inches of a marked underground utility line, the law requires you to use hand tools or vacuum technology to verify the exact location of the marked facility.**
- A. True
 - B. False