



Worker Beware[®]

Electric and Natural Gas Safety Trainer's Guide

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Introduction

The *Worker Beware* training program from Pacific Gas and Electric Company (PG&E) is designed to provide contractors and agricultural workers with the information they need to work safely around overhead and underground power lines and near natural gas pipelines.

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 learning preferences.
- **Utility 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 for Survival.** Step-by-step training guidance.
- **Before and After Quiz.** Reproducible utility safety quiz to help trainers and participants evaluate the program's impact.

Section One: Know Your Audience

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

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

Section Two: Utility 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**.
- The force propelling the flow of electrons is measured in **voltage**, or volts for short.
- The rate at which electricity moves is called **amperes**, or **amps** 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 plastics, rubber 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

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 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 on poles or on the ground, where the voltage is reduced again to a level that is safe for typical use. From transformers, electricity travels into buildings through service drop wires. These connect to the meter and to all the wires that run inside walls to 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 and agricultural workers should understand that even with training, their understanding of electricity is basic.

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 ignites at about the temperature at which a cigarette burns.
- Natural gas burns within a specific concentration range: between approximately 5% and 15% gas to air. At the ideal 10% concentration, natural gas burns cleanly.
- 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. PG&E adds a distinctive, sulfur-like odor to natural gas within all its pipelines so you can detect even small amounts of escaping gas. Gas that has been treated with these chemicals is **odorized**; however, certain weather conditions can strip the odorant from the natural gas.
- Many natural gas transmission companies do not odorize natural gas transmission lines.
- Natural gas is nontoxic.

The Natural Gas Transmission and Distribution System

To harness and transmit natural gas, we use thousands of miles of pipes. There are three types of pipes used in the system: transmission pipelines, distribution lines and service lines.

Transmission pipelines move natural gas from refining plants across long distances. Always be aware of pipeline markers that indicate the need for extra care around a high-volume transmission line. These markers specify the line's approximate location, but not all pipelines follow a straight path between markers.

From transmission pipelines, distribution lines bring natural gas into residential and commercial areas where it will be used. Service lines bring natural gas from distribution 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 from 1 inch to 4 feet in diameter; the pressure can vary from 1/4

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 utility 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 participants 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 activities** might bring them close to underground power lines and/or natural gas lines?
- **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 and agricultural workers 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 these participants.

Section Four: Your Five-Step Training for Survival

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—that it can help protect participants, their coworkers 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 electric and natural gas emergencies 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 a discussion:

- **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 importance of participants keeping themselves, their tools, their equipment and their vehicles the required distances away from overhead power lines.**
 - **When cranes or derricks are used in construction: Keep the crane boom and load at least 20 feet away** from lines up to and including 350 kV, and 50 feet away from lines greater than 350 kV but at or less than 1,000 kV until the operator has taken specific safety measures. Consult Cal/OSHA for all requirements.
 - **For tools and equipment other than cranes and derricks used in construction:** OSHA requires *at least* 10 feet of clearance from power lines carrying 50 kV or less.
 - **Higher voltages require a larger safety zone.** If you have questions about power line voltages, contact PG&E at 1-800-743-5000.
- **Review the proper 811 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 they learned** from the materials or discussion that will help them be safer in the future.

Remember that discussions are 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: Utility 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 photocopying.

***Worker Beware* Utility Safety Quiz Answers:**

1. C
2. D
3. B
4. D
5. D
6. A
7. B
8. D
9. D
10. A

Name: _____

Date: _____

Worker Beware Utility Safety Quiz

Before

Questions

After

1. **What is the current minimum safe clearance from overhead power lines carrying 50 kV or less?**

- A. 6 inches
- B. 100 feet
- C. 10 feet
- D. 5 feet

2. **If you suspect a natural gas leak, you should:**

- A. Bury your excavation
- B. Use your phone or radio
- C. Attempt to shut off the gas supply
- 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 PG&E 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 utility lines before digging on a job site?**

- A. Look for right-of-way markers
- B. Check your maps
- C. Call the local utility
- D. Call 811

5. **How should you assist a coworker who contacts a power line while operating heavy equipment?**

- A. Notify 911 and PG&E
- B. Encourage them to stay on the equipment until PG&E personnel say it is safe to get off
- C. If there is danger from fire or another hazard, tell them to jump clear of the equipment, keep both feet together, and land without touching the ground and equipment at the same time
- D. All of the above

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- _____ **6. True or false? Before digging, you should ask the property owner about any private underground lines that may not be marked by the locator.** _____
- A. True
B. False
- _____ **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. Which of the following is a warning sign of a natural gas leak?** _____
- A. A distinctive, sulfur-like odor
B. Bubbling in a pond or creek
C. A hissing sound
D. All of the above
- _____ **9. If your heavy equipment contacts a power line and you are not in imminent danger, you should:** _____
- A. Stay on the equipment
B. Warn others to keep away
C. Have someone call 911 and PG&E
D. All of the above
- _____ **10. True or false? You cannot be shocked by a service drop wire.** _____
- A. False
B. True