



## **Electric and Natural Gas Safety and You Teacher's Guide**

### **Introduction**

This discussion guide contains background for teachers, followed by questions for each page in the booklet and suggested activities that can be done in class or as homework. Please refer to the last page for a glossary of terms used in this booklet.

### **Teacher Background: Electricity**

Most electricity used in the U.S. is produced at power plants, using a variety of energy sources, such as coal, oil, natural gas, nuclear or solar power, water, or wind.

High-voltage electricity leaves the power plant and travels long distances over transmission lines on tall towers. Electricity loses some of its strength as it travels, so it must be helped along by transformers that boost or “step up” its strength or voltage.

When electricity gets closer to where it will be used, its voltage must be decreased. Different kinds of transformers at utility substations do this job, “stepping down” electricity’s power. Electricity then travels on smaller overhead or underground distribution wires to neighborhoods. When the distribution wires reach a home or business, another transformer, usually on a power pole, reduces the electricity down to just the right voltage to be used in appliances, lights, and other things that run on electricity.

A power line called a service drop carries the electricity from the distribution wires to the house and connects to wires running through the walls to outlets and lights. Electricity is always waiting in the wires to be used. Electricity travels in a circuit. When you switch on an appliance, you complete the circuit. Electricity flows along power lines to the outlet, through the power cord into the appliance, then back through the cord to the outlet, and out to the power lines again.

By its nature, electricity seeks the easiest path to the ground. It will travel through any conductive material available. Human beings conduct electricity because we are 60-70 percent water, and water is a great conductor. If you get between electricity and the ground or something touching the ground, electricity will flow through you. A person standing on a tree or the floor is connected to the ground and can still be shocked.

Emphasize to students that an electrical shock can be quite serious. People who are shocked can be burned internally and externally. A shock hurts a lot. It can stop your heart and even kill you.

Most power lines are not insulated and are located underground or high overhead to prevent accidental contact. However, substations, pole-mounted transformers, and pad-mounted transformers may attract curious children. The danger of shock is high near any of this electrical equipment. Warn students that they should not climb substation fences or power poles or fly kites near power lines.

### **Teacher Background: Natural Gas**

Natural gas is a fossil fuel used for heating, cooking, and producing electricity. A colorless and odorless gas, it is lighter than air. Natural gas is primarily methane that is formed when organic material decomposes under pressure. Most of the natural gas we use today has been formed over millions of years as ancient plants and animals died and were buried under sand and mud in swamps, lakes, or oceans. As they decayed, the methane gas was trapped under layers of solid rock. Natural gas is found in the same underground areas where crude oil (petroleum) is found.

Geologists (scientists who study the earth) find natural gas by sending shock waves down through the earth. When a gas deposit is found, wells are drilled through the rock to bring the gas to the earth's surface. From the well, the gas is pumped to a processing plant where it is cleaned. Then compressors pump the gas through pipelines to towns. There are about one million miles of underground steel pipeline carrying natural gas throughout the U.S.

Regulator stations control how much gas is pumped into smaller pipes that lead to homes, businesses, and factories. A chemical called mercaptan is added to the natural gas to make it smell like rotten eggs.

We use natural gas by burning it in our furnaces and other appliances and in motor vehicles. To burn, natural gas must mix with the proper amount of oxygen and be ignited by a flame or spark. Burning natural gas without the proper amount of oxygen produces carbon monoxide, a deadly poison.

When people dig they must be careful not to damage natural gas pipelines. Students should remind adults who are planning a digging project to call 811 several days before digging to find out where gas pipes are located.

When natural gas leaks, there is a risk of fire and explosion. Gas pipeline leak warning signs include a smell of rotten eggs, a hissing or roaring sound, dirt spraying or blowing into the air, water that is bubbling, or grass or plants that are dead or dying for no apparent reason.

**Discuss with students: If you notice any signs of a gas leak, do not use a candle or anything electrical—not even a phone or flashlight.** Go far away from the area right away, and do NOT go back until safety officials say it is safe. Ask a trusted adult to report the leak by calling 911 and the local natural gas utility.

### **Cover**

Ask students these questions:

- Why must we do things safely? (So we don't get hurt.)
- Why should you be careful around electricity and natural gas? (You can get hurt if you use them incorrectly.)

### **Page 2**

Ask students these questions:

- Which item in the picture works on natural gas? (The barbecue.)
- Which item in the picture works on electricity? (The train.)
- What would your life be like without electricity and natural gas? (Answers will vary.)

### Activity

List on the chalkboard the things students have in their homes or in the school that use electricity and natural gas.

### Page 3

Ask students these questions, and then encourage them to follow the instructions to find the hidden message:

- What is the striped cat holding? (*A plug.*)
- Why is it important to put only plugs in outlets? (*You could get a shock if fingers or other objects get stuck in outlets.*)
- Do you use safety caps in outlets in your home? (*Answers will vary.*)

Activity answer: **Be Safe** Around Electricity & Natural Gas

### Page 4

Ask students these questions:

- Who is at the switch in the home? (*The cat.*)
- What travels through the wires? (*Electricity.*)
- Where does electric energy come from? (*Power lines.*)
- When do you use a switch in your home? (*To turn on a light.*)
- Why do we need electricity in our homes? (*It runs lights and appliances like TV, refrigerator, etc.*)

Encourage students to color this page and to color the electricity in the wires yellow. Explain that electricity travels in a continuous path called a circuit. Electricity in circuits requires a complete loop through which an electrical current can pass. Electricity in circuits can produce light, heat, and sound. Ask students for examples of heat, light, and sound from electricity. (*Heat comes from electric heaters and ovens; light comes from electric light bulbs; sound comes from electric doorbells.*)

### Page 5

Ask students these questions, and then encourage them to decode the message:

- Why should you stay away from substations and utility towers? (*They have electrical equipment that is dangerous to touch.*)
- Where have you ever seen a substation in your town or city? (*Answers will vary.*)

Activity answer: Danger High Voltage

### Page 6

Ask students these questions:

- Who do you think the striped cat is calling on the telephone? (*911 or an adult*)
- Who should you call if you see a fallen power line? (*911*)
- Why should you stay away from fallen power lines? (*They can hurt you.*)

### Activity

After coloring this page, have students act out a telephone call to the utility company reporting a downed power line.

### Page 7

Ask students these questions:

- Why is it dangerous to swim during a thunderstorm? (*Lightning could strike the water.*)
- Why is it dangerous to go near a substation? (*It contains electrical equipment that is dangerous to touch.*)
- Why is it dangerous to go near a fallen electrical wire? (*It can shock you.*)
- Why is it dangerous to fly kites near electric lines? (*If the kite goes into the lines you could get shocked.*)

Encourage students to match the sentences to the pictures. Tell the students that some things allow electricity to flow through them easily. Water and most metals are good conductors. Because your body is mostly water, you

are a great conductor, too! So if you touch an electric circuit and the ground at the same time, you will become electricity's easiest path. Electricity will flow through you, and you could be seriously hurt or killed.

### **Pages 8 & 9**

Ask students these questions:

- Describe what you see in each of the three pictures. (*A frayed cord, someone turning on a light while standing in a puddle of water, playing near natural gas appliances.*)
- What is the safe thing to do in each of the situations in the pictures? (*Don't use the dryer with the frayed cord, dry the puddle and your hands before turning on the light; play away from gas appliances.*)

### **Page 10**

Ask students these questions:

- What does the picture in the circle show? (*Someone turning on a light while standing in water.*)
- Why is this a dangerous situation? (*Water conducts electricity and the cat could get shocked.*)

Explain to students that water is an excellent conductor for electricity. You can become electricity's path to the ground if you are touching water that touches electricity. Electricity would travel through the water and through you to the ground and you could get seriously hurt or killed.

Activity answer: Water and Electricity Don't Mix!

### **Page 11**

Ask students these questions:

- What is an electrical fire? (*A fire that involves something electrical like appliances, wiring, or outlets.*)
- Why don't you pour water on an electrical fire? (*Water conducts electricity so it could make the fire worse or it could conduct the electricity to you!*)
- What should you use to put out an electrical fire? (*A special fire extinguisher made for electrical fires.*)
- What is the meaning of "Don't overload electrical outlets"? (*Don't plug in too many things.*)
- What can happen if an outlet is overloaded? (*An electrical fire can happen.*)

Explain to students that if they have an electrical fire in their home, they should get out of the house quickly and call for help. Explain that adults who put out electrical fires should use Class C fire extinguishers. Never use water to extinguish these fires, as the risk of electrical shock is far too great!

### **Page 12**

Ask students these questions:

- What is the orange cat doing? (*Trying to get something out of the toaster.*)
- Why must you unplug appliances before you work on them? (*To prevent an electric shock.*)
- What could happen if you put a fork in the toaster when it is plugged in? (*You could be shocked and seriously injured, even if the toaster isn't on.*)

Encourage students to find the missing word on the page ("unplug"). Emphasize that only qualified adults should fix appliances.

### **Page 13**

Ask students these questions:

- What is the blue cat doing? (*Putting clothes into a dryer.*)
- What form of energy is the dryer using? (*Natural gas.*)

Activity answer: Play Safely

## Page 14

Ask students these questions:

- Why should adults call a special service (now accessible by dialing 811) before starting a digging project? *(To find out where underground utilities are located so as not to contact them.)*
- How can each of the dangerous scenes be made safe? *(Play somewhere else, clean up all the papers near the natural gas appliances.)*

## Page 15

Review with students the correct procedure for what to do if they smell gas in their home. *(Tell an adult. If no adult is home, get everyone out of the house. Do not use a light switch, candle, flashlight, TV, radio, garage door opener, or even a phone—a spark could ignite the gas. Go to a safe location and ask an adult to call 911 and your utility for help.)*

Explain that natural gas can also leak out of underground pipelines outdoors, and that it can be recognized by a smell of rotten eggs, a hissing or roaring sound, dirt spraying or blowing into the air, water that is bubbling, or grass or plants that are dead or dying for no apparent reason. Tell students that if they notice any of these, they **should not use a candle or anything electrical—not even a phone or flashlight**. They should go far away from the area right away, and should NOT go back until safety officials say it is safe. They should ask a trusted adult to report the leak by calling 911 and the local natural gas utility.

Here is the correct sequence and explanation for the four pictures:

1. The cats smell a natural gas leak.
2. They leave the house.
3. They tell a trusted adult.
4. They wait at the adult's house while the gas company comes to fix the leak.

## Page 16

The pictures can be found on these pages:

- Flying a kite near power lines, page 7
- Leaving the house due to a gas leak, page 15
- Turning off the light while standing in water, pages 8, 10
- Playing near gas appliances, pages 9, 13
- Overloaded outlet, page 11

## Glossary

|                   |  |
|-------------------|--|
| APPLIANCE         | A household machine powered by electric current or natural gas. A refrigerator is a household <i>appliance</i> .   |
| DANGER            | Something that might hurt you. Stay away from things with signs that say <i>danger</i> .   |
| ELECTRICITY       | One of the basic forms of energy. It can also give light and heat. <i>Electricity</i> makes televisions and toasters work.   |
| ENERGY            | The ability to do work. <i>Energy</i> makes machines run.  |
| FIRE EXTINGUISHER | Container filled with chemicals that, when sprayed upon fire, put it out. Your school has a <i>fire extinguisher</i> in the hall.  |
| FRAYED            | When the insulation on a wire is worn off or broken. <i>Frayed</i> wires can cause fires.  |
| GAS PIPES         | Underground tubes that carry natural gas to homes, schools, and businesses.  |
| OUTLET            | A place to plug in appliances. Never put anything but a plug into an <i>outlet</i> .   |
| OVERLOAD          | To give something too big a load. It is dangerous to <i>overload</i> an outlet with too many appliances.   |
| POWER LINE        | Wires used to send out electric energy for public use. Never fly a kite near <i>power lines</i> .  |
| POWER PLANT       | A place where electricity is generated. The <i>power plant</i> sends power to the substations.   |
| SUBSTATION        | A smaller plant that receives energy from the power plant and then sends it to our homes. We were told not to play near the <i>substation</i> because it could be dangerous. |
| SWITCH            | A device for making or breaking an electric circuit. When you are not using a light in a room, turn the <i>switch</i> off.   |
| UTILITY POLE      | A pole used to hold up power lines and other wires. Don't ever climb a <i>utility pole</i> .   |