



## **Natalie and Gus Explore the World of Natural Gas Video Teacher's Guide**

### **LESSON #1 WHAT IS NATURAL GAS AND HOW IS IT FORMED?**

#### **TEACHER BACKGROUND:**

Natural gas is a fossil fuel used for heating air and water, cooking, and producing electricity. It is a colorless, odorless gas that is lighter than air. Natural gas is composed mainly of methane (CH<sub>4</sub>). When ancient plants and animals were buried under swamps, lakes, or mud, they decayed, slowly forming methane gas. This gas became trapped under layers of solid rock. Natural gas is found underground in the same areas that contain crude oil (petroleum).

About 3,000 years ago people found burning springs of natural gas. Ancient people built temples around these “eternal flames.” It wasn’t until about 2,500 years ago that the Chinese realized these springs could be used. The Chinese used bamboo poles to pipe the natural gas. This natural gas was used to evaporate seawater, leaving behind valuable sea salt.

#### **MOTIVATION:**

Blow up a balloon. Ask students what is in the balloon. What other gases do you know about? What is gas? (Elicit: Gas is a form of matter that is not solid or liquid. Gas can move and does not have a definite shape).

#### **DISCUSSION QUESTIONS:**

1. What gas do we need to live? (Elicit: Air is a mixture of gases. Air consists of nitrogen, oxygen, argon, carbon dioxide, hydrogen and small quantities of neon, helium, and other inert gases.)
2. What is meant by the term “natural”? (Elicit: Found in nature and not made by people).
3. A few thousand years ago people discovered burning springs of natural gas. How do you think these springs were naturally ignited (lit)? (Elicit: Lightning)
4. Natural gas, like coal and oil, is a fossil fuel. Why is it called a “fossil fuel”? (Elicit: Formed from the remains of plants and animals).

#### **ACTIVITIES:**

- To understand how natural gas is found deep underground, have students make clay models of the rock layers in the earth. Rock layers can be different thicknesses and shapes. Use red clay for natural gas and green clay for oil. When finished, punch a hole down to the natural gas and oil layers. (Students may have to research the various layers found in the earth.)
- Research through a natural history museum, library, or local college what rock layers lie under your town, and then construct cross-sections out of clay.

### **LESSON #2 WHERE IS NATURAL GAS FOUND AND HOW IS IT DISTRIBUTED?**

#### **TEACHER BACKGROUND:**

Geologists (scientists who study the earth) send shock waves down from the surface in order to try to locate gas deposits. They measure how long it takes the waves to bounce back. A derrick is constructed to support the equipment needed for drilling and for hoisting and lowering pipe into the well. In some offshore locations, drilling platforms are used to obtain gas.

When gas is found it is pumped to a processing plant where other substances found with the gas are removed. After processing it goes through underground steel pipelines with the aid of compressors. Compressors are large pumps that push the gas through the pipelines at about 15 m.p.h.

Before reaching us the gas passes through a regulator station that controls the amount of gas pumped into the smaller pipes that lead to our homes, businesses, and factories. At this point a chemical (mercaptan) that can smell like rotten eggs is added to the gas so leaks can be detected.

Natural gas production involves very little disturbance of the surrounding area. When production is completed and the gas drilling equipment is removed, the land returns to its natural state.

#### **MOTIVATION:**

Fill an aquarium half full of water. Blow up a balloon and hold the opening closed as you submerge the balloon in water. Relate to natural gas trapped beneath impermeable rock (like clay). Discuss what would happen if you drilled a hole to where the natural gas was trapped. Let air out of balloon under water.

#### **DISCUSSION QUESTIONS:**

1. How do you think gas is obtained from below the surface of the earth? (Elicit: Wells)
2. How is gas sent from where it is found to homes, schools, and businesses? (Elicit: Through underground pipes)
3. What pipes or wires can be found underground? (Elicit: Water mains, electrical wires, natural gas pipelines, telephone lines, etc.)

#### **MATH PROBLEM:**

If you dug a 5,000-foot well and you had to spend \$100.00 per foot how much would it cost?

#### **ACTIVITY:**

Fill several small-necked glass jars (8 oz.) with a mixture of 1/4 cup of soil and 1/3 cup of vegetable scraps (carrot and cucumber peels) and grass clippings. Stretch a balloon over the opening of each jar and secure it well. With a magic marker mark the level of the mixture that you start with. Place the jars in different places (direct sunlight, artificial light, in a dark place, etc.). Observe the jars for a week. Chart the results, both the level of each mixture and what happens to each balloon. (Depending on the contents of the mixture and the amount of heat in each location, mixtures will decompose at different rates and produce different amounts of gas.)

### **LESSON #3 HOW IS NATURAL GAS USED?**

#### **TEACHER BACKGROUND:**

Natural gas is used in homes, schools, businesses, and factories. A compressed form of natural gas can be used in specially adapted cars, buses, and trucks known as natural gas vehicles (NGVs). Natural gas provides heating and cooling for stores and offices and is used for cooking in restaurants. Natural gas is also used to make electricity. Industry uses natural gas as a fuel, and transforms it chemically into plastics, fabrics, and durable goods.

Most of the natural gas we use comes from within the United States. This helps improve our energy self-sufficiency and eliminates concerns about overseas transportation. Because natural gas is abundant and easy to process, it costs less than many other fuels. Using natural gas in motor vehicles can improve air quality because it is a clean-burning fuel. Natural gas pollutes less than other fuels.

#### **MOTIVATION:**

Have you ever suffered because of “dirty” or polluted air? How did it affect you? Why is it important to keep the air clean? (Elicit: It is not healthy for us to breathe polluted air. Many respiratory disorders are aggravated by air pollutants. Plants and animals that we depend on also suffer from polluted air).

**DISCUSSION QUESTIONS:**

1. Which fossil fuel is the cleanest? (Elicit: Natural gas emits fewer harmful by-products than other fossil fuels do.)
2. What equipment in a restaurant would use natural gas? (Elicit: Water heater, fryers, range/oven, and grill.)
3. How would natural gas be used in offices and stores? (Elicit: Heating air and water.)

**ACTIVITIES:**

- Survey your home to determine which appliances run on natural gas and which appliances could run on natural gas. (Elicit: Natural gas furnace, barbecue, range, water heater, dryer, fireplace, swimming pool heater, and outdoor lighting.)
- With the help of an adult, locate where gas lines lead to and from appliances such as water heater, furnace, and stove. Notice how the vents are connected.

**LESSON #4 HOW CAN YOU BE SAFE AROUND NATURAL GAS?****TEACHER BACKGROUND:**

Natural gas is a safe fuel when used properly. To burn, gas must mix with the proper amount of air and be ignited by a flame or spark. Ranges and other appliances are carefully adjusted to provide the correct air-gas mixture. Burning natural gas without enough air produces carbon monoxide, a deadly poison. Your household should have your gas-burning equipment, home insulation, and ventilation checked to make sure your home is safe and fuel-efficient. All gas appliances must be correctly installed, maintained, and vented to the outside. Regular inspections of furnaces and chimneys (to make sure the furnace flue is vented properly) should be made by qualified service people.

Stress with your students that homes should not be heated with gas ovens. Tell them that there is a risk of fire and explosion from gas leaks. That is why when you smell gas you should leave the house. Do not turn on or off a light, unplug an appliance, or use a flashlight, match or even a phone, because a spark from these could cause an explosion. Make sure children know that they should call for help from a safe location. (It should be a neighbor that they know.) Keep the area around furnaces and water heaters clean and free from litter.

**MOTIVATION:**

Do a natural gas leak drill in the classroom. When you return, or while outside, discuss why you have these drills.

**DISCUSSION QUESTIONS:**

1. What senses do you have?
2. Which of your senses can you use to detect natural gas? (Elicit: Natural gas has a chemical called “mercaptan” added to it, which can smell like sulfur or rotten eggs. Note: A slight odor of natural gas may mean that a pilot light has gone out. A strong odor means you should leave the home immediately. In some cases you may not be able to smell natural gas, so you must rely on all your senses to detect a natural gas leak. Listen for a hissing or roaring sound, and look for continual bubbling in water; dirt spraying or blowing into the air; or grass/plants dead or dying for no apparent reason. All of these could be signs of a gas leak nearby.)
3. Why is it dangerous to hang from gas pipes? (Elicit: Pipes could break and gas would leak.)

**ACTIVITY:**

- As a class, create mini safety charts to list natural gas safety rules.
- At home, practice a safety drill for getting your family out of the house safely. (Stress not to turn on lights, and not to use flashlights, matches, phones, or anything electrical, as even a tiny spark could ignite the gas.)