

Activity 6

1 SESSION

Labeling Hazardous Materials

Activity Overview

Students are introduced to the United States Department of Transportation (DOT) system for labeling hazardous materials. The students decide which DOT placards to use to label the barrel containing the simulated hazardous waste. They extend the activity by collecting data on the transportation of hazardous materials through their community.

CONCEPTS, PROCESSES, AND ISSUES

(with NSE 5–8 Content Standards Correlation)

1. Hazardous materials are substances that pose a danger to the health and safety of living organisms. (*PhysSci: 1*)
2. Hazardous substances may be present as solids, liquids, or gases. (*PhysSci: 1*)
3. Hazardous materials must be identified and labeled before being treated, moved, or disposed of. (*Perspectives: 4*)
4. Substances can be hazardous because they are biohazards, corrosive, flammable, radioactive, reactive, or toxic. (*PhysSci: 1*)

TEACHING SUMMARY

Step 1.

Introduce the DOT system of labeling hazardous materials.

Step 2.

Decide which placard(s) to use to label the simulated hazardous waste.

Step 3.

Discuss student choices.

Step 4.

Collect data on hazardous materials transported through the local community.

MATERIALS

For each student

- Data from Investigation 4, “So Many Solids”
- Data from Investigation 5, “Looking at Liquids”
- 1 completed copy of Thinking More About Investigation 1, “What’s Hazardous at Home?” (optional)

Teaching Suggestions

GETTING STARTED

Step 1. Introduce the DOT system of labeling hazardous materials.

Remind students of the categories of hazardous substances first introduced in Investigation 2, “HAZMAT Training.” Explain to students that once the hazardous material has been categorized, the next step is to label the materials as clearly as possible for public safety. Ask, *Have you ever seen a truck or a building labeled with a diamond-shaped sign that provided some sort of warning about hazardous materials?* If students have seen such signs, have them describe the shape, color, and symbols they have seen.

Inform student that the U.S. Department of Transportation (DOT) oversees all federal transportation programs and prepares relevant legislation. The DOT is responsible for enforcing the Hazardous Materials Transportation Act passed by Congress in 1975. The goal of this act is “to improve the regulatory and enforcement authority of the Secretary of Transportation to protect the nation adequately against risks to life and property which are inherent in the transportation of hazardous materials in commerce.” It is this act that required labeling of all hazardous materials in transit. The DOT system of labeling hazardous materials is one of the outcomes of this act.

INVESTIGATING

Step 2. Decide which placard(s) to use to label the simulated hazardous waste.

Distribute Investigation 6, “DOT Placards,” and have students read the introduction. Use the table to discuss the DOT placarding system, which takes five of the six general categories presented in Investigation 2 and divides them into nine classes of hazardous materials. Discuss how the four hazard categories that students learned to recognize and test fit into the DOT categories. Flammability alone makes up the first four categories of the DOT placarding system (though nonflammable gases are also a part of the gases category). Oxidizers are a subset of reactive substances, and poisons are a type of toxic substance. Corrosive materials are in a category of their own, as are radioactive materials.

Have students take out their data tables from Investigation 4, “So Many Solids,” and Investigation 5, “Looking at Liquids,” to help them determine which placards they will use to label the barrel.

SYNTHESIZING

Step 3. Discuss student choices.

Have students share their choices for labeling the barrel. As a class, work to reach a consensus on what labels are the most appropriate. You may wish to have one or two students draw or cut out the symbols from an extra copy of Investigation 6, “DOT Placards,” and label the plastic barrel in the class.

You also may wish to have students take out Thinking More About Investigation 1, “What’s Hazardous at Home?” and have them determine which placards they would need if they were to transport a large amount (anything over 1,000 pounds is considered large by the DOT) of a household hazardous material.

QUESTION 1

Look at the symbols on the different placards. How do the symbols help explain the hazardous properties of these materials?

The explosives symbol shows an explosion. The placards for flammable materials have a symbol that shows a flame or fire. The oxidizer symbol shows an “o” going up in flames, indicating a substance that reacts with oxygen. Poisons are identified by a skull and crossbones, which symbolizes

death. The corrosive symbol shows a substance spilling and a hand, indicating danger to skin.

QUESTION 2

Do any of the hazardous materials in your home have placard symbols on them? Do you think that any of these materials ever required a placard, even if it does not have one now? Explain.

Most household hazardous materials do not have placard symbols on them. The DOT placards are required when large volumes of hazardous materials are being transported. Most containers of household hazardous materials are in volumes so small that they do not need to be placarded. However, trucks or containers that were used to ship large amounts of these materials to stores would have been placarded.

QUESTION 3

Explain why your group decided on the placard(s) you did. Describe the evidence you used in making your decisions.

Most groups will decide on multiple placards, such as flammable liquids, oxidizers, poisons, and corrosive. The mineral oil is flammable, so the flammable liquid placard addresses this hazard. The iron nitrate was corrosive, so the corrosive placard is needed. The iron nitrate was also reactive and toxic. The poisons placard could be used to indicate toxicity. Some students may suggest using the oxidizers placard to address the reactivity, while other students may suggest using another symbol or getting more information before possibly mislabeling the waste.

Step 4. Collect data on hazardous materials transported through the students' community.

Students can continue exploring hazardous materials in their community by recording the frequency of placards on trucks. Distribute Thinking More About Investigation 6, “Watching Trucks Go By,” and give students a period of time, such as a week, to collect data. Have them record the number of placards they see on trucks while traveling in a car or bus or stationed at some other safe observation point. Discuss the results, and if possible, obtain data from your local HAZMAT office or from the DOT website on the estimated number of hazardous materials shipments in your community.

DOT Placards

••••► CHALLENGE

What warning signs should be posted on the simulated hazardous waste mixture?

Now that your HAZMAT team has tested and identified the hazardous materials in the barrel, you need to label the barrel for public safety and for eventual transportation. The U.S. Department of Transportation (DOT) uses a system of special signs, known as placards, to identify different types of hazards. These placards are used to label trucks, trains, and ships carrying hazardous materials.

MATERIALS

For each student

Data from Investigation 4, “So Many Solids”

Data from Investigation 5, “Looking at Liquids”

••••► PROCEDURE

1. Look at the table on the next page, which shows some of the different placards used by the DOT to identify hazardous materials.
2. Use your data from Investigation 4, “So Many Solids,” and Investigation 5, “Looking at Liquids,” to make a list of all of the placard categories that could be used to describe the simulated hazardous waste.
3. Work with your group to decide which placard(s) should be posted on the barrel containing the simulated hazardous waste.

••••► ANALYSIS









Group

1. Look at the symbols on the different placards. How do the symbols help explain the hazardous properties of these materials?
2. Do any of the hazardous materials in your home have placard symbols on them? Do you think that any of these materials ever required a placard, even if it does not have one now? Explain.

Individual

3. Explain why your group decided on the placard(s) you did. Describe the evidence you used in making your decisions.

DOT Hazardous Material Placards

Category	Symbol	Description of Class
Explosives		Explosive materials.
Gases		Compressed gases. Because compressed gases have different chemical properties, this class can be subdivided into flammable, nonflammable, and poisonous gases.
Flammable Liquids		Flammable liquids. Certain common flammable liquids have their own placards, where the name of the material (such as gasoline and fuel oil) replaces the word "flammable."
Flammable Solids		Flammable solids, which are materials that ignite in the presence of oxygen or react when exposed to water or humidity.
Oxidizers		Oxidizing materials, which are those that react in the presence of oxygen.
Poisons		Liquids that are toxic or are dangerous if inhaled. These materials may not be transported with food, feed, intended for humans or animals.
Radioactive Materials		Radioactive materials and equipment.
Corrosive		Corrosive liquids.

Thinking More About Investigation 6

Watching the Trucks Go By

What hazardous materials are transported through my community?

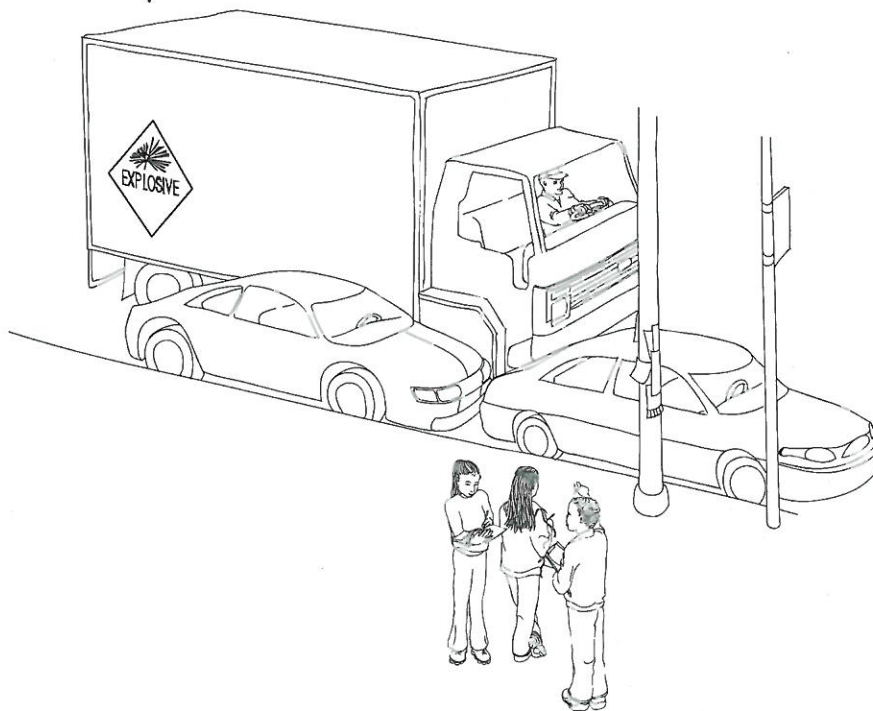
Hazardous materials are transported daily throughout the United States. As you have learned, whenever hazardous materials are shipped, they must be properly packaged and labeled according to the U.S. Department of Transportation regulations. Now that you can recognize hazardous materials placards, observe truck traffic in your community. Observe when, where, and how frequently hazardous materials are transported on roads near you.



Observe from a location that is safe. Be sure an adult is aware of your location. Observe traffic through your community during daylight hours.

••••► PROCEDURE









1. Observe from one location or make observations while you are traveling in a car or bus to and from school.
2. Record your results in the table on the next page.
3. Add another column to the table if you observe on more than one day.



Date: _____

Length of time observing: _____

Your location or route: _____

DOT Placard	Number of Placards Observed
 Explosives	
 Gases	
 Flammable liquids	
 Flammable solids	
 Oxidizers	
 Poisons	
 Radioactive materials	
 Corrosive	
Other	
Total Number of Placards	