Eggsportation

Grades: 6
State Standards: Grade 6 Writing Strategies 1.0 Students write clear, coherent, and focused essays. The writing exhibits student awareness of the audience and purpose. Essays contain formal introductions, supporting evidence, and conclusions. Physical Science 3.0 Heat moves in a predictable flow from warmer objects to cooler objects until all the objects are at the same temperature. As a basis for understanding this concept: a. Students know energy can be carried from one place to another by heat flow or by waves, including water, light and sound waves, or by moving objects. b. Students know that when fuel is consumed, most of the energy released becomes heat energy.
Preparation Time: 20 minutes
Groups; of 2
Activity Time: 30-40 minutes
Key Words: hazmat facilities

OBJECTIVE

The students will design, construct, and test a toxic waste transportation vehicle. Students will understand there are appropriate methods of identifying potential hazards and communicating them to others, which include placarding for transported materials (DOT/DPS regulations) and material safety data sheets (MSDS) for chemical constituents (OSHA regulations).

MATERIALS

- raw egg for each team of students
- scissors
- tape
- staples meter stick
- balance/scale
- materials brought in by students (various)

BACKGROUND

Many times we think that only large companies produce hazardous or toxic wastes. Many common household products contain ingredients that are toxic which makes them hazardous when used and disposed of improperly. When disposed of improperly, household hazardous wastes can contaminate soil, air, and water.

In Austin Texas, January of 2003, a flash fire killed three and seriously burned four workers at a commercial oil and gas waste disposal facility. The U. S. Chemical Safety and Hazard Investigation Board (CSB) (website at www.chemsafety.gov) investigated the accident and concluded that neither the waste generator nor the waste hauler recognized the potential flammability hazard of oil and gas waste.

The accident involved two vehicles operated by employees of an authorized oil and gas waste hauler who were transporting basic sediment and water (BS&W) in 50-barrel vacuum trucks from gas leases to an authorized commercial disposal facility. Apparently

the BS&W contained a significant amount of gas well condensate. The drivers discharged wastes by opening the drain valves at the rear of the vacuum trucks allowing the BS&W to drain into a concrete pit. This method of drainage released sufficient hydrocarbon vapors to form a combustible mixture in air. The drivers left the engines of the vacuum trucks running and the CSB concluded that intake of flammable vapors caused the diesel engine to initially race and then backfire, igniting the vapor cloud to cause the flash fire.
http://www.rrc.state.tx.us/forms/publications/SurfaceWasteManagementManual/safety.pdf

Additional information regarding hazardous material transportation and communication may be found at the following sites:
http://www.fmcsa.dot.gov/safetyprogs/hm/complyhmregs.htm
"How to Comply with Federal Hazardous Materials Regulations," Federal Motor Carrier Safety Administration,
U.S. Department of Transportation
http://hazmat.dot.gov/
http://www.txdps.state.tx.us
http://www.txdps.state.tx.us/lw/Publications/hazmat.pdf
"Do you transport hazardous materials?" U.S. Department of Transportation
http://www.osha-slc.gov/SLTC/hazardcommunications/
"Safety and Health Topics: Hazard Communications," Occupational Safety and Health Administration, Department of Labor

PROCEDURE

Assign each student a partner. Tell students that they will be working together to design and test a vehicle that contains a raw egg (toxic waste).They will enclose the raw egg in a device/vehicle that will be dropped on concrete from the top of a second story staircase. You have just been hired as the Chief Hazardous Waste Disposal Engineers for the Environmental Goo and Gross Stuff Company, known as EGGS. EGGS (company) is faced with new government regulations for the transport of toxic wastes produced during the production of a new pesticide, yellow outdoor lice killer strips (yolks). As hazardous waste disposal engineers, your team is assigned to design, build, and test a model of a new hazardous waste transport vehicle. This vehicle will be used to transport YOLKS waste to a landfill, about 2,500 miles away from the factory. Your team must bring materials from home for the construction of your vehicle.

You will be given one class period to completely construct your vehicle. Your vehicle will be tested (dropped) the following class period. Sorry, no trial runs allowed!
Note: The size of your next raise (your grade) will be evaluated on the following criteria:

1. Egg does not crack or break–20 points
2. Egg breaks, but does not leak from container–20 points
3. Vehicle completed on time–20 points
4. A written description of materials used and directions for construction of vehicle to boss (teacher)–20 points
5. Vehicle must fit inside 40 cubic centimeter area–10 points
6. Empty vehicle must not weigh more than 500 grams–10 points

It is also very important for EGGS to maintain good public relations as an environmentally– conscious company. Your team may earn bonus points by demonstrating environmental concern with the following criteria:

1. Vehicle is made from recycled materials–two points
2. Vehicle is constructed from recyclable resources–two points
3. Vehicle's exterior is decorated to show that your are an environmentally concerned company and safety signs are clearly visible–two points

Ask students these questions and write them out in essay form: What are the goals of the project? How did you design the vehicle? How did your vehicle rate or perform? If the egg withstood the impact, describe what feature(s) of your model allowed this to happen. In your conclusion if the egg cracked or broke, what major problem did your vehicle have and how could you correct it.

Extension
Students should research how diesel, propane, or nitrogen are required to be transported. Then the students will ask themselves if these requirements are adequate.

ANALYSIS

Students recognize the importance of communicating information regarding hazardous material transportation, special handling requirements, and risks involved.