HHW and your Waste Stream!

Grades: 6
State Standards: Earth Science, 6.0 Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their information. As a basis for understanding this concept: c. students know the natural origin of the materials used to make common objects. Students can provide examples of the goods that are produced by natural systems that are used to make common household products.
Groups: 3-4 per group
Preparation Time: 25 minutes
Activity Time: 3-4 class periods
Key Words: household hazardous waste

Objectives

Household hazardous wastes must be placed somewhere that is safe for the environment. As a result of this activity students will:

- Demonstrate an understanding of the environmental consequences, particularly the effects on surface water, and groundwater, from unsafe household hazardous waste disposal habits or practices.
- Be able to identify where persistent household hazardous wastes go when they are thrown out
- Be able to state the proper disposal method of different household hazardous wastes

Materials

Examples of commonly used household hazardous products, such as motor oil, pesticides, paint thinner, protective gloves. Material Safety Data Sheets (MSDS) for each product

Background

Hazardous substances can enter our environment in a wide variety of ways. Because the subject is so broad, this activity is primarily informational in nature. Bring to class one or two examples of common household hazardous substances. Motor oil, herbicides, and paint thinners are good examples of products that are known to be persistent and long lasting in the environment. Handle these products with care. Restrict student handling of these products. Wearing gloves for protection will emphasize the hazardous nature of these products.

Explain that some combinations of hazardous chemicals degrade (break down) quickly into safe, naturally occurring substances. Explain that this activity is primarily concerned with persistent hazardous chemical combinations, i.e. those that remain unchanged in the environment for long periods, or with chemicals that combine with natural substances in such a way as to pose a hazard to humans and other living organisms. Show the products that were brought to class. Ask: What should we do with these products when we are through with them? What are the different ways we might dispose of them? Tell students

that some disposal options are not only bad for the environment but illegal in some places. However, for the purposes of this activity the students should think about what happens to substances when they are disposed of in various ways. Discuss with students any disposal directions that are written on the product; for example, most motor oil containers suggest recycling.

Discuss with students that the study of ecology involves the examination and understanding of connections of life. Tell students that the class will now consider how each of the possible ways people might dispose of household hazardous waste could be connected to food and water supplies. Inform students they are now going to consider where wastes go. Point out to the class the various ways a chemical can travel through the environment from our homes.

General categories of hazardous products

Thousands of consumer products are hazardous, but for ease of remembering, they can be broken into the following general categories:

Automotive products

Examples: gasoline, motor oil, antifreeze, windshield wiper fluid, car wax and cleaners, lead-acid batteries, brake fluid, transmission fluid.

Home improvement products

Examples: paint, varnish, stain, paint thinner, paint stripper, caulk, adhesives.

Pesticides

Examples: insecticide and insect repellent, weed killer, rat and mouse poison, pet spray and dip, flea collars, mothballs, disinfectant, wood preservative.

Household cleaners

Examples: furniture polish and wax, drain opener, oven cleaner, tub and tile cleaner, toilet bowl cleaner, spot remover, bleach, ammonia.

Other

Examples: household batteries, cosmetics, pool chemicals, shoe polish, lighter fluid, prescription medicines, arts and crafts materials

Procedure

Divide the students into groups or pairs and assign a different disposal method to each group.

- Incineration
- Storm drain, ditch, hole in the ground
- Sink/toilet; garbage can
- Household hazardous waste collection

Have each group research where substances disposed of by their disposal method might end up. A different hazardous product can be assigned to each group. Pass out the appropriate disposal option sheet to each group. Pass out the respective MSDS for each product (available online by google search). Questions that each group can ask themselves are:

- If we dispose of the product by this method what might happen?
- Is there any way that wildlife might be harmed?
- Is there any way this product could get into our drinking water?
- Is there any way this product could get into our food?

- What will happen if disposed of at the landfill?

Have the groups share their ideas with the rest of the class. After each group presents their ideas, discuss with the class the information contained in disposal option sheets that are included with this activity. A different disposal option can be done each day, if preferred. Ask the class to vote on the best disposal choice for each product.
After all the options have been discussed, review with the class where persistent household hazardous waste goes. Ask: What can we do to reduce the amount of household hazardous waste we produce, in other words, eliminate or reduce the waste before it becomes a problem for us and the environment? Have students brainstorm ways to prevent persistent hazardous substances from harming the environment. Have them think of solutions they themselves might do, such as:

- Buy and use what you need.
- Learn to read product labels.
- Use safe substitutes.
- Use up what you do have or find someone who can use it.
- Take it to a hazardous household waste collection program or recycling center, if appropriate.

DISCUSSION QUESTIONS

1. Why are persistent hazardous substances of particular concern in waste management?
2. What is bioaccumulation? ***Bioaccumulation*** – "General term describing a process by which chemicals are taken up by an organism either directly from exposure to a contaminated medium or by consumption of food containing the chemical." – U.S. Environmental Protection Agency, 2010

3. Name four different household hazardous wastes disposal options.
   Four basic disposal options for HHW include landfills, injection wells, incineration and bioremediation.

4. How can we reduce the amount of household hazardous waste we produce?

Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration and other high temperature waste treatment systems are described as "thermal treatment". Incineration of waste materials converts the waste into ash, flue gas, and heat. The ash is mostly formed by the inorganic constituents of the waste, and may take the form of solid lumps or particulates carried by the flue gas. The flue gases must be cleaned of gaseous and particulate pollutants before they are dispersed into the atmosphere. In some cases, the heat generated by incineration can be used to generate electric power.

Hazardous Waste Landfill

The most common form of hazardous waste disposal in the United States is landfilling. Hazardous waste landfills are highly regulated and are required to include clay liners, monitoring wells, and groundwater barriers. The 1984 Hazardous Solid Waste Amendments require the monitoring of groundwater near landfills for thirty years.

Critieria for a hazardous waste landfill See
http://www.ospcboard.org/CRITERIA%20FOR%20HAZARDOUS%20WASTE%20LANDFILLS.pdf

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Bioremediation means to use a biological remedy to abate or clean up contamination. This makes it different from remedies where contaminated soil or water is removed for chemical treatment or decontamination, incineration, or burial in a landfill. Microbes are often used to remedy environmental problems found in soil, water, and sediments. Plants have also been used to assist bioremediation processes. This is called phytoremediation. Biological processes have been used for some inorganic materials, like metals, to lower radioactivity and to remediate organic contaminants. With metal contamination the usual challenge is to accumulate the metal into harvestable plant parts, which must then be disposed of in a hazardous waste landfill before or after incineration to reduce the plant to ash. Two exceptions are mercury and selenium, which can be released as volatile elements directly from plants to atmosphere. The concept and practice of using plants and microorganisms to remediate contaminated soil have developed over the past thirty years. The idea of bioremediation has become popular with the onset of the twenty-first century. In principle, genetically engineered plants and microorganisms

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Injection wells use high-pressure pumps to inject liquid wastes into under-ground geologic formations (e.g., sandstone or sedimentary rocks with high porosity). Many geologists believe that wastes may be isolated from drinking water aquifers when injected between impermeable rock strata. However, injection wells are still controversial and many scientists are concerned that leaks from these wells may contaminate groundwater. As of 1994, twenty-two out of 172 deep injection wells contaminated water supplies. There are five classes for injection wells based on the type of fluid injected and the location of the wells. Class I wells inject hazardous or non-hazardous fluids into isolated rock formations, approximately four thousand feet below the surface, and are strictly regulated under the Resource, Conservation and Recovery Act (RCRA). Their use must demonstrate that underground drinking water sources won't be contaminated. Class II wells are commonly used for the disposal of brine created during oil and gas production. Class III wells inject superheated steam or fluids and then extract them from the geologic formation to remove valuable minerals. Class IV wells were used for injection of hazardous or radioactive wastes, but are currently **banned** in the United States due to possible contamination of shallow drinking water sources. Class V wells (those not included in Classes I–IV) inject waste into the ground and allow it to drain by gravity into shallow aquifers , providing little or no protection against groundwater contamination. Examples include drainage wells, septic tanks, and cesspools**.** The Environmental Protection Agency (EPA) estimates that over 400,000 injection wells, receiving nine

billion gallons of hazardous waste annually, exist in the United States. As of 2002, there were 473 Class I injection wells of which 123 were used to dispose of hazardous waste. In the United States, injection well casings must provide double containment to compensate for any structural failure. Wells are tested every five years for integrity (more frequently for hazardous waste) and are monitored continuously for possible contamination. Because of the threat of contaminating underground drinking water sources, the EPA establishes minimum requirements for the location, construction, operation, maintenance, monitoring, testing, and closure of injection wells. All such wells require authorization or specific permits.

Assessment

Students have a basic understanding of household hazardous waste disposal methods and the difficulties associated with each.