9-12 HOME RECYCLING OF GRAYWATER

OBJECTIVES

The student will do the following:

1. Design a home that recycles graywater.

2. Compute the cost effectiveness of reusing graywater.

SUBJECTS:
Science (Physics, Physical Science), Social Studies (Economics)

TIME:
2 class periods

MATERIALS:
large sheets of paper
drafting pencils
calculators
student sheets
water bills for 1 year
resource materials on basic plumbing

BACKGROUND INFORMATION

Home watering of plants and gardens accounts for 65 percent of domestic water use in the southwestern states. Only 35% is actually used inside the home. Of this amount, after the usage, approximately 60 percent ends up as graywater (water not in contact with sewage). A family of three can irrigate 100 square feet of lawn with two inches of graywater a week and not use fresh drinking water.

Sources of graywater are: wastewater from sinks, bathtubs, showers, and the clothes washer (though washer water may be pathogen-containing "blackwater" if laundry includes diapers). Graywater does not come from toilets, but may be used to supply toilets.

Most existing homes would be difficult (but not impossible) to retrofit for graywater reuse, but new homes could be designed to use graywater on the lawn, flowers, or a garden.

Terms

blackwater: domestic wastewater containing human or animal waste or other sources of pathogens

graywater: wastewater from households which does not come into contact with sewage

sewage: waste and wastewater produced by residential, commercial, and light industrial establishments; typically discharged into sewers and sometimes, into septic tanks

ADVANCE PREPARATION

A. Copy Student Sheets

B. Discuss Background Information with students.

PROCEDURE

I. Setting the stage

A. Hand out Student Sheet: Graywater Guidelines.

B. Discuss problems those guidelines may cause in designing a system for home recycling of graywater.

II. Activity

A. As a design project, divide the class into teams and have each team design an approach it would follow if building a new home with the intent to reuse all sources of graywater mentioned in the Background Information section. Include necessary collection, piping, and distribution of the water in the design plan, keeping in mind that long term storage of the water would not be desirable, oversaturation of a given use area must be avoided, materials of construction must be considered, nuisance conditions must not be created, and year-round disposal must be accommodated. Cost of the system should be estimated.

B. Students should determine the cost of watering lawns, house plants, and gardens at their homes before designing the graywater system. (The 65 percent figure could be used to do this, or a difference in July and January water bills could also add some insight.) If sewage treatment is also a cost to the residence, then the student should figure a 60 percent reduction in cost if the graywater is totally recycled or a percent of that if the design recycles less than 100 percent of the water. A total savings cost for one year by reusing graywater should be computed. How long will it take to pay for the cost of construction of a graywater reuse home?

Real cost-benefit analysis would consider how much money would be made assuming a certain % rate that the construction money would earn if invested instead and subtracting this figure to get the real benefit. Example of project cost $1,000, and earned $100 per year in water costs - pay back would not be 10 years. If we assumed a 6% interest rate, the benefit would be $100-($60 lost interest) or only $40 per year. Thus it would take 25 years to pay for the project.

III. Follow-up

A. Have student groups present their graywater recycling home plan to class.

1. How did they solve the problem of graywater storage, pumping, and overabundance?

2. Did they consider the winter months?

3. What was each student's total cost savings in a year if his/her residence had the system designed for graywater use?

B. Give students copy of Student Sheet: A Graywater System. How do they think their design compared to this one?

C. Have students figure the average amount of water used each time someone showers or takes a tub bath, runs a dishwasher or washing machine, brushes teeth or washes hands. Figure this amount used for one week. Compare to how much of this amount would be needed for watering lawns, and flowers. (Make sure the design has the capability of sending water through the usual municipal water system when graywater is not needed so extensively - as in winter, long periods of rain, etc.)

IV. Extensions

A. Have a wastewater engineer speak to the class about graywater use.

B. Visit a residence or business that recycles graywater. Before the trip, have students make a list of questions about cost savings and problems to ask the owners.

RESOURCES

Kourik, R., Hill, A., Gray Water Use in the Landscape: How to Use Gray Water to Save Your Landscape During Droughts, Metamorphic Press, P. O. Box 1841, Santa Rosa, CA 95402, ed. 1988.

"Recycle Grey Water for Home Irrigation," Water and Wastes Engineering, September 1979, pp. 62-66.

GRAYWATER GUIDELINES

1. Use graywater promptly so that it doesn't accumulate in the storage tank.

2. Apply graywater below the soil surface, never with a sprinkler.

3. Plumb your graywater system with a valve to allow convenient switching back to the sewer or septic tank.

4. Avoid using graywater on acid-loving plants such as blueberry, heather, spruce, pin oak, crape myrtle, lily-of-the-valley, holly, mountain ash, and hemlock.

5. Use liquid detergents instead of powdered kinds because they have much less sodium. Avoid bleach and products that contain boron.

6. If you live where rainfall averages less than 12 inches a year, soak graywater-irrigated soil with six or more inches of clean water every three to five years to wash away accumulated salts.

A GRAYWATER SYSTEM