STORM WATER: BEST MANAGEMENT PRACTICES AND POLLUTION

Objectives:
The student will be able to:

- Define storm water runoff
- Identify types of pollutants found in storm water
- Develop a plan on how to prevent the pollution of storm water at the school bus maintenance shop
- Develop a Best Management Practices plan for the maintenance shop.

Suggested Grade Level:
9-12

Subjects:
Science (physical Science, Earth Science, Ecology)

Time:
3-4 class periods

Materials:
- Bus to travel to the school bus maintenance shop (see alternative activity)
- Notebook
- Copies of background
- Information for each student

BACKGROUND INFORMATION

EPA has recognized that certain industries are significant polluters of storm water and has developed the storm water program to aid in reducing the pollutants being discharged into receiving streams via storm water. The main source of storm water is from rain or snow. Water travels from streets, parking lots, and building roofs to storm drains that discharge to nearby bodies of water. Communities are mainly responsible for maintaining or managing storm sewers. One way to manage storm runoff is to locate and permit each sewer and to develop a program to oversee and sample these regularly. The focus of the storm water program is pollution prevention. Federal and state regulations require facilities to develop a pollution prevention plan or a Best Management Practices (BMP) plan. The BMP plan should be designed to reduce pollution at the source before it can cause environmental problems. The BMP plan is like a good housekeeping plan. BMPs can include schedules of activities, prohibition of practices, maintenance procedures, and management practices to reduce or prevent the pollution of runoff from a site.

There are 5 major phases involved in developing a BMP plan for storm water runoff.
1. Planning and Organization
a. Name a pollution prevention team.
b. Review other BMP plans and build on other plans available such as a Spill Prevention Control and Countermeasures (SPCC) plan. The SPCC plan is a plan to help keep petroleum-related products from being discharged into the water.

2. Assessment
a. Develop a site map.
b. Inventory and describe exposed materials.
c. List significant spills and leaks.
d. Test for non-storm water discharges.
e. Evaluate monitoring data.
f. Summarize pollutant sources and risks.

3. BMP Identification Phase
a. Baseline BMPs
1. Good Housekeeping
2. Preventive Maintenance
3. Visual Inspections

4. Spill Prevention and Response
5. Sediment and Erosion Prevention
6. Traditional Storm Water Management Practices (storm water detention ponds, collection of storm water)
7. Other appropriate BMPs
8. Employee Training
b. Select activity and site-specific BMPs

4. Implementation Phase
a. Implement BMPs.
b. Train employees.

5. Evaluation Monitoring
a. Conduct annual site inspection/BMP evaluation.
b. Conduct record keeping and reporting.
c. Review and revise plan.

T E R M S

best management practices (BMPs): techniques that are determined to be currently effective, practical means of preventing or reducing pollutants from point or nonpoint sources, in order to protect water quality. BMPs include, but are not limited to: structural and nonstructural controls, operation and maintenance procedures, and other practices. Usually, BMPs are applied as a system of practices rather than as a single practice.
pollutant (water): any substance suspended or dissolved in water which builds up in sufficient quantity to impair water quality
pollution prevention: preventing the creation of pollutants or reducing the amount created at the source of generation, as well as protecting natural resources through conservation or increased efficiency in the use of energy, water, or other materials
runoff: water (originating as precipitation) that flows across surfaces rather than soaking in; eventually enters a waterbody; may pick up and carry a variety of pollutants
secondary containment for above-ground fuel storage tanks: spill containment facility that will sufficiently contain 110 percent of the capacity of the largest tank located within the area of management
waters of the state: includes every natural or artificial watercourse, stream, river, wetland, pond, lake, coastal, ground or surface water wholly or partially in the state that is not entirely confined and retained on the property of a single landowner

ADVANCE PREPARATION

A. Reserve a school bus for the field trip.

B. Contact the school bus maintenance shop to set up a field trip and secure cooperation in allowing students to develop a BMP plan for the shop. If the shop already has a plan, secure cooperation for the field trip to evaluate existing plan and/or revise existing plan.

C. Copy Background Information and Student Sheets for each student.

D. Go over terms and define.

PROCEDURE

I. Setting the stage

A. Hand out Background Information and Student Sheets. Student sheets show important steps that can be taken in the community (Municipal Program) or by industries (Industrial Program) to prevent storm water pollution. Student sheets also depict common contributors to storm water pollution.

B. Discuss best management practices.

C. Lead a discussion on how storm water can increase pollution in water bodies.

D. Review the 5 major phases involved in developing a BMP plan.

E. Ask students why it would be important to name a pollution prevention coordinator or team. (Answers: 1. point of contact in an emergency and 2. clearly defines the BMP plan as a part of the coordinator/team job)

F. Explain that many sources of pollutants exist at automotive repair facilities. Some examples are these.
1. fuel
2. engine oil and other lubricants
3. antifreeze
4. refrigerants
5. batteries
6. wash water from the washing of the interior and exterior of buses and other equipment.
7. steam cleaning fluid from the cleaning of engines and other equipment
Explain to students that when it rains at the shop and these types of pollutants come into contact with the rain water, the runoff can become polluted. Ask students about other sources of pollution that might exist at an automobile (bus) repair facility.

II. Activity

A. Take a field trip to school bus maintenance shop.
1. At the shop, identify pollution sources.
2. Is fueling conducted on site? If so, are the fuel tanks above ground or below ground? If they are above ground, do they have secondary containment?
3. Where are used batteries kept?
4. How is used oil managed?
5. Is maintenance conducted on-site?
6. How are used tires managed?
7. If oil, fuel, antifreeze, or other fluids are spilled or leaked, are they cleaned up? If so, how? (Examples: oil dry, kitty litter, sawdust)
8. What types of activities are occurring on-site that might lead to nonstorm water discharges? (Examples: washing of buses and the steam cleaning of engines)
9. After identifying pollution sources, ask students to identify methods that can be used to prevent the pollution of storm water runoff at the shop.

B. For homework, have students develop BMPs to use in developing a class BMP plan the following day.

C. On the following day, divide students into work groups to develop a BMP plan for the shop. Combine the work into a class BMP plan.

D. Present the class BMP plan to school bus maintenance shop.

III. Alternative activity

A. If a field trip is not possible, this activity can be used to show the cumulative pollution effects of storm water runoff.
A. The materials needed are these.

- aquarium half filled with water
- 1 can of cola
- 1 can of orange soda
- 1 bag of hamburger buns
- 1 tube of crackers

B. Sort and distribute among the class members the "contaminants." Make sure no one class member has very much of any single contaminant. Do not let students know that the instructor is putting the same contaminants into the second aquarium.

C. Demonstrate the mess a single pollutant source can make by putting one contaminant into the aquarium. Have the students come one at a time and drop their "little bit" of contaminants into the first aquarium. Discuss how the resulting cumulative impacts of many small sources of pollution are often greater than single sources that are more easily regulated and controlled.

D. Discuss why “discrete” sources (industries and wastewater treatment plants) a r e more easily regulated and why it is easier for these discharges to be controlled and treated.

IV. Follow-Up

A. Visit the maintenance shop in a month to evaluate the BMP plan.

B. Ask the shop manager to evaluate improvements in the BMP plan and to suggest revisions and/or additional improvements to the BMP plan.

V. Extensions

A. Develop other BMP plans for your school (chemistry class chemical disposal, erosion control on school grounds, art class paint disposal).

B. Have a speaker come from the city to explain the city’s BMP plans for storm water management.

R E S O U R C E S

Developing Pollution Prevention Plans and Best Management Practices Plans, EPA Guidance Document 832-R-92-006

Developing Pollution Prevention Plans and Best Management Practices Plans Summary Guidance, EPA Guidance Document 832-R-92-002

When It Rains, It Drains: What Everyone Should Know About Storm Water, EPA Guidance Document 832-F-93-002

Thank you to the Environmental Protection Agency *Water Sourcebook* for this activity!

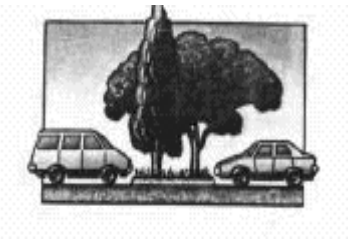
http://water.epa.gov/learn/kids/drinkingwater/wsb_index.cfm

STUDENT SHEET

STORM WATER

MUNICIPAL PROGRAM

Prevent the release into the storm sewer system of hazardous substances such as used oil or household or yard chemicals.



Make sure new commercial and residential developments include storm water management controls, such as reducing areas of paved surfaces to allow storm water to seep into the ground.

Promote practices such as street sweeping, limiting use of road salt, picking up litter, and disposing of leaves and yard wastes quickly.

Collect samples of storm water from industrial sites to see whether pollutants are being released. If so, identify the type and quantity of pollutants being released.

Design and institute flood control projects in a way that does not impair water quality.

MUNICIPAL PROGRAM

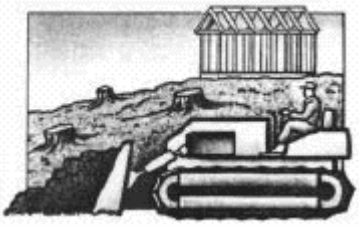
Prevent runoff of excess pesticides, fertilizers, and herbicides by using them properly and efficiently. (Commercial, institutional, and residential landscapes can be designed to prevent pollution, conserve water, and look beautiful at the same time.)

Make sure that construction sites control the amount of soil that is washed off by rain into waterways.

Promote citizen participation and public group activity to increase awareness and education at all levels. Encourage local collection pick-up days and recycling of household hazardous waste materials to prevent their disposal into storm water drains.

INDUSTRIAL PROGRAM

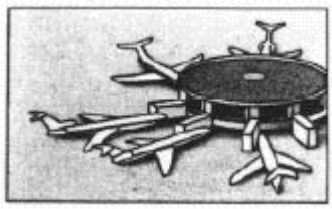
Owners of construction sites that disturb 5 or more acres must develop a plan before beginning construction. The plan must limit that area of disturbed soil and provide controls--like sediment basins--to keep sediment from running off.



Operators of saw mills can reduce pollution by storing their materials and processing their products indoors; and removing any by-products from outdoor areas before these products come in contact with storm water runoff.

Operators of landfills should keep the storm water runoff from flowing over the pollutants and carrying them off the landfill sites.

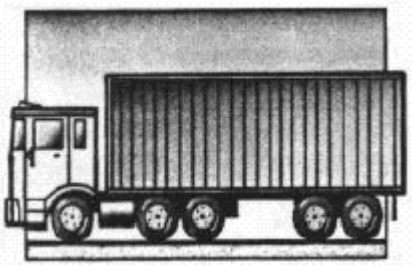
Airport employees can reduce storm water runoff pollution by using deicing chemicals only in designated collection areas and by cleaning oil and grease spills from pavement immediately.



Chemical plant operators should develop spill prevention plans and use types of containers that do not rust or leak, eliminating exposure of materials to storm water runoff.

INDUSTRIAL PROGRAM

Owners of automobile junkyards should drain fluids from junked cars and properly dispose of hazardous chemicals.



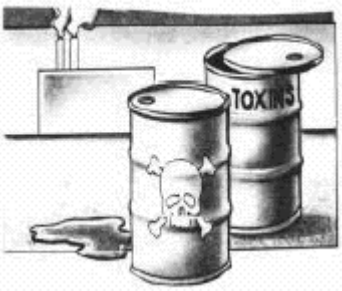
Operators of trucking terminals should develop good housekeeping practices that clean up leaks and spills of oil and grease from the path of storm water runoff.

Power plant operators often store piles of coal and other fuels that have toxic components. Runoff from coal piles must be treated; other substances should be stored away from any possible contact

with storm water runoff.

COMMON CONTRIBUTORS TO STORM WATER POLLUTION

Industry - At industrial sites, chemicals spills that contain toxic substances, smoke stacks that spew emissions, and uncovered or unprotected outdoor storage or waste areas can contribute pollutants to storm water runoff.



Construction - Waste from chemicals and materials used in construction can wash into our waterways during wet weather. Soil that erodes from construction sites can contribute to environmental degradation as well.

Agriculture - Pesticides, fertilizers, and herbicides used in crop production can be toxic to aquatic life and can contribute to over-enrichment of the water, causing excess algae growth, and oxygen depletion. Although storm water runoff from agriculture areas is not regulated under the EPA storm water permitting program, it is a nonpoint source of storm water pollution addressed by other EPA programs.