

Lesson A3–4

Selecting Methods of Waste Disposal

Unit A. Agricultural Literacy

Problem Area 3. Identifying the Relationship Between Agriculture and the Environment

Lesson 4. Selecting Methods of Waste Disposal

New Mexico Content Standard:

Pathway Strand: Natural Resources and Environmental Systems

Standard: VIII: Understand environmental service systems.

Benchmark: VIII-B: Apply hazardous materials management principles to assure a safe facility.

Performance Standard: 1. Describe risks related to hazardous materials. 2. Describe health and safety practices to reduce risks from hazardous materials. 3. Describe use appropriate use of Personal Protective Equipment.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Describe and identify sources of waste.
2. Explain how waste materials may be reduced and/or reused.
3. Assess ways to dispose of solid wastes.
4. Describe wastewater treatment methods.
5. Explain manure management practices.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany this lesson:

Camp, William G. and Thomas B. Daugherty. *Managing Our Natural Resources*. Albany, New York: Delmar Publishers, 1994. (Textbook, Chapters 9, 12, and 13)

Porter, Lynn, et al. *Environmental Science and Technology*, Second Edition. Danville, Illinois: Interstate Publishers, Inc., 2003. (Textbook and Activity Manual, Chapters 20, 21, and 22)

Other Resources. The following resources will be useful to students and teachers:

Applied Environmental Science. Alexandria, Virginia: National Council for Agricultural Education, 1996.

Arms, Karen. *Environmental Science*. Austin, Texas: Holt, Rinehart and Winston, Inc., 1996.

List of Equipment, Tools, Supplies, and Facilities

Writing surface
Overhead projector
Transparencies from attached masters
Copies of Student Lab Sheet

Terms. The following terms are presented in this lesson (shown in bold italics):

Agricultural waste
Ash
Bulky solid material
Commercial waste
Domestic wastewater
Garbage
Grey water
Hazardous waste
Industrial waste
Institutional waste
Municipal waste
Residential waste
Rubbish
Septic tank
Sewage
Solid waste

Spent water
Waste
Wastewater

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Ask the students to list all the items they used in the last 24 hours. Identify each item according to the amount of waste material produced. Relate to the students that it is estimated that landfills in some states will be full in 5–10 years. Have students offer suggestions about how these items could be changed to produce less waste.

Summary of Content and Teaching Strategies

Objective 1: Describe and identify sources of waste.

Anticipated Problem: Where does waste come from?

- I. **Waste** is any unwanted or discarded item.
 - A. Natural waste is different than human waste.
 1. Nature processes its own waste.
 2. Human waste requires collection, processing, and storage or disposal.
 3. **Hazardous waste** includes liquid, gaseous, or solid materials that are toxic, reactive, corrosive, or ignitable.
 - B. There are two primary types of waste materials.
 1. **Solid waste** includes garbage, refuse, and other discarded materials.
 - a. **Garbage** is waste discarded from a kitchen—cooked or uncooked food.
 - b. **Rubbish** is dry non-food waste. Paper, plastic, glass, and yard wastes are examples of rubbish.
 - c. **Ash** is residue from burning.
 - d. **Bulky solid materials** are large items like refrigerators and junk cars.
 2. **Wastewater** is used water containing dissolved or suspended matter.
 - a. **Spent water** is water that has been used. It can no longer serve the purpose for which it is intended.
 - b. **Domestic wastewater** is produced by humans in their daily lives. **Grey water** is water produced by bathing, laundering, and cooking.
 - c. **Sewage** is wastewater produced by residential and commercial sources which is then deposited in sewers.

- C. There are six primary sources of solid waste.
1. **Residential waste** includes materials discarded from homes and apartments.
 2. **Commercial waste** includes materials discarded by stores, offices, restaurants, and other businesses.
 3. **Municipal waste** includes materials generated through the activities of a town or city.
 4. **Institutional waste** includes materials discarded by schools, hospitals, and prisons.
 5. **Industrial waste** includes materials produced by the manufacture of goods for consumers.
 6. **Agricultural waste** includes solid materials discarded from farms and ranches.
- D. There are four primary sources of wastewater.
1. Homes and businesses produce wastewater from human activity.
 2. Manufacturing processes produce wastewater containing food fragments, soil, and other wastes, as well as heated water (thermal pollution).
 3. Farms produce wastewater through cleaning of milking equipment and washing of manure from barns.
 4. Stormwater is the result of runoff from precipitation.

Many techniques can be used to help students master this objective. Students need text materials to help understand the environment and achieve mastery learning. Chapters 21 and 22 in Environmental Science and Technology or Chapter 13 in Managing Our Natural Resources are recommended.

Objective 2: Explain how waste materials may be reduced and/or reused.

Anticipated Problem: How can waste materials be reduced and/or reused?

- II. Solid waste management deals with not only disposal but also with the Three R's.
- A. The Three R's are reduce, reuse, and recycle.
1. Reduction is decreasing the amount of solid waste produced.
 - a. Reject excessive packaging—buy bulk quantities or in large containers.
 - b. Waste exchange—share lawn chemicals, paint, and other products to limit the amount of waste being sent to a landfill.
 - c. Composting—reduce organic solid waste through biological processes.
 - d. Volume reduction—compact, shred, or incinerate solid waste.
 2. Reusing products limits the amount of solid waste being disposed of.
 - a. Use products that can be used multiple times, like rechargeable batteries.
 3. Recycling materials allows new items to be produced using the remains of used products.
 - a. Glass, paper, aluminum, ferrous metals, plastics, used oil, and tires are recyclable.
 - b. Window frames, car parts, flower pots, bottles, street paving, and fencing are examples of new products made from recycled materials.

Many techniques can be used to help students master this objective. TM: A3–4A shows the Three R's of solid waste management. Use TM: A3–4B to show an example of composting. Students need text materials to help understand the environment and achieve mastery learning. Chapter 21 in *Environmental Science and Technology* or Chapter 13 in *Managing Our Natural Resources* are recommended.

Objective 3: Assess ways to dispose of solid wastes.

Anticipated Problem: What are some ways that wastes can be disposed of?

- III. There are two methods for environmentally sound disposal of solid waste.
 - A. Incineration—solid waste is burned to reduce volume.
 - 1. The process can be used to create energy.
 - 2. Scrubbers and monitors are used to reduce the amount of air pollution.
 - B. Sanitary landfill—a specially designed site for disposing of solid waste.
 - 1. Properly planned landfills can be used for parks and other activities later.
 - 2. Leachate is formed when moisture occurs in a landfill. The waste begins to decompose and seeps into groundwater.

Many techniques can be used to help students master this objective. TM: A3–4C shows an example of a hazardous waste landfill. Students need text materials to help understand the environment and achieve mastery learning. Chapter 21 in *Environmental Science and Technology* or Chapter 13 in *Managing Our Natural Resources* are recommended.

Objective 4: Describe wastewater treatment methods.

Anticipated Problem: How can wastewater be treated?

- IV. Goals of wastewater treatment include removal of pathogens, reduction or removal of excess nutrients, and removal or reduction of toxic and organic materials in wastewater.
 - A. The type of wastewater treatment system depends on the volume and contents of the wastewater.
 - 1. Municipal systems treat water from homes, restaurants, and other buildings in a city or town.
 - a. Wastewater from sinks, toilets, and dishwashers is collected by sanitary sewers.
 - b. Preliminary treatment removes large objects that might clog pipes.
 - c. Primary treatment screens solid materials from wastewater.
 - d. Secondary treatment uses biological and chemical processes to treat wastewater.
 - e. Advanced treatment involves additional biological and chemical treatment, including the addition of chlorine.
 - f. Disposal of residue includes releasing liquid and solid products back into the environment.
 - 2. Homes built in rural areas require an individual home system to treat wastewater.

- a. A **septic tank** is a concrete or steel container used to contain and treat wastewater.
 - b. The tank contains bacteria that digest solid materials.
 - c. Solids settle to the bottom of the tank. This requires the tank to be pumped out every 2–3 years.
 - d. The liquid waste seeps out through a leaching field.
3. Factories and farms may have a system to treat the wastewater resulting from manufacturing and animal production.
 - a. Lagoons are often used so that sunlight, bacterial action, and oxygen can purify the water.
 - b. Cooling ponds may be used to cool wastewater used in power plants.

Many techniques can be used to help students master this objective. Use TM: A3–4D to show a general diagram of a septic tank system. Utilize TM: A3–4E to illustrate the workings of a septic tank. Students need text materials to help understand the environment and achieve mastery learning. Chapter 20 in Environmental Science and Technology or Chapter 9 in Managing Our Natural Resources are recommended.

Objective 5: Explain manure management practices.

Anticipated Problem: How should manure be managed?

- V. Manure can be a valuable source of plant nutrients.
 - A. Manure can be used to supplement more expensive commercial fertilizers.
 1. Manure provides nitrogen, phosphorus, and potassium.
 2. Manure also adds organic matter and beneficial microorganisms.
 - B. Manure can pollute the environment.
 1. Air pollution occurs through the release of ammonia, methane gas, and noxious odors.
 2. Soil pollution is caused when heavy metals in manure seep into the soil and when excess levels of nitrogen, phosphorus, or potassium are present.
 3. Harmful bacteria that run into surface water and nitrates that leach into the groundwater can also cause water pollution.
 - C. Types of manure management systems depend on the characteristics of the manure being handled.
 1. Liquid manure/slurry is less than 15% solids, made of feces, urine, and water.
 - a. Pits are below-ground containers connected to confinement buildings. The gases created in a pit can kill a person in less than one minute.
 - b. Tanks often store liquid manure pumped from buildings.
 - c. Earth bank storage basins are usually lined with a material to contain and store manure.

- d. Lagoons are pond-like structures that allow biological and chemical treatment of the manure.
2. Solid manure and bedding may be stacked in open-air walled storage units.
- D. Several factors should be considered when applying manure.
 1. Soil texture influences the binding potential of manure.
 2. Soil erosion potential will determine the amount of nutrients attached to soil that can move into water.
 3. The closer the groundwater is to the surface, the greater the potential for groundwater contamination.
 4. The greater the amount of precipitation, the more likely leaching and runoff will occur.
 5. Different crops have varying nutrient needs and rates of nutrient uptake.

Many techniques can be used to help students master this objective. Students need text materials to help understand the environment and achieve mastery learning. Chapter 20 in Environmental Science and Technology or Chapter 12 in Managing Our Natural Resources are recommended.

Review/Summary. Focus the review and summary of the lesson around the student learning objectives. Call on students to explain the content associated with each objective. Questions at the ends of the chapters in the textbooks may also be used in the review/summary.

Application. Application can involve the following student activity using the attached lab sheet:

Source Reduction Worksheet—LS: A3–4A

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activity. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

1=f, 2=h, 3=a, 4=i, 5=e, 6=j, 7=c, 8=g, 9=b, 10=d

Part Two: Completion

1=homes, apartments

2=stormwater

3=reduce, reuse, recycle

4=composting

5=incineration, sanitary landfills

6=groundwater

7=organic matter *or* soil structure *or* nutrient availability

Part Three: Essay

- A. Refer to Objective 5, Letter D on page 6 of this lesson for an appropriate answer.
- B. Refer to Objective 2 on page 4 of this lesson for an appropriate answer.

Test

Lesson A3–4: Selecting Methods of Waste Disposal

Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|-------------------------|--------------------|----------------|
| a. ash | e. hazardous waste | i. solid waste |
| b. bulky solid material | f. rubbish | j. wastewater |
| c. garbage | g. septic tank | |
| d. grey water | h. sewage | |

- _____ 1. Dry non-food waste.
- _____ 2. Wastewater produced by residential and commercial sources.
- _____ 3. Residue from burning.
- _____ 4. Garbage, rubbish, and other discarded material.
- _____ 5. Liquid, gaseous, or solid materials that are toxic, reactive, corrosive, or ignitable.
- _____ 6. Used water containing dissolved or suspended matter.
- _____ 7. Waste discarded from a kitchen, cooked or uncooked food.
- _____ 8. Concrete or steel container used to treat rural home sewage.
- _____ 9. Large items like discarded refrigerators and junk cars.
- _____ 10. Water produced by bathing, laundering, and cooking.

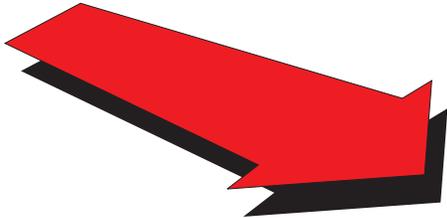
Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. Residential waste includes materials discarded from _____ and _____.
2. _____ is the result of runoff from precipitation.
3. The Three R's are _____, _____, and _____.
4. The reduction of organic substances through biological processes is _____.
5. The two environmentally sound solid waste management methods are _____ and _____.

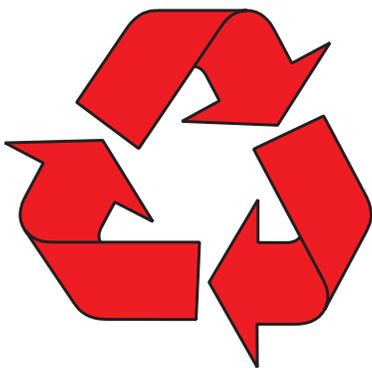
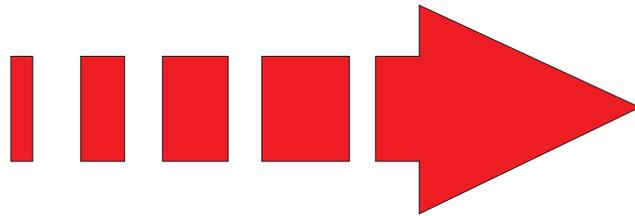
Three R's of Solid Waste

Source Reduction



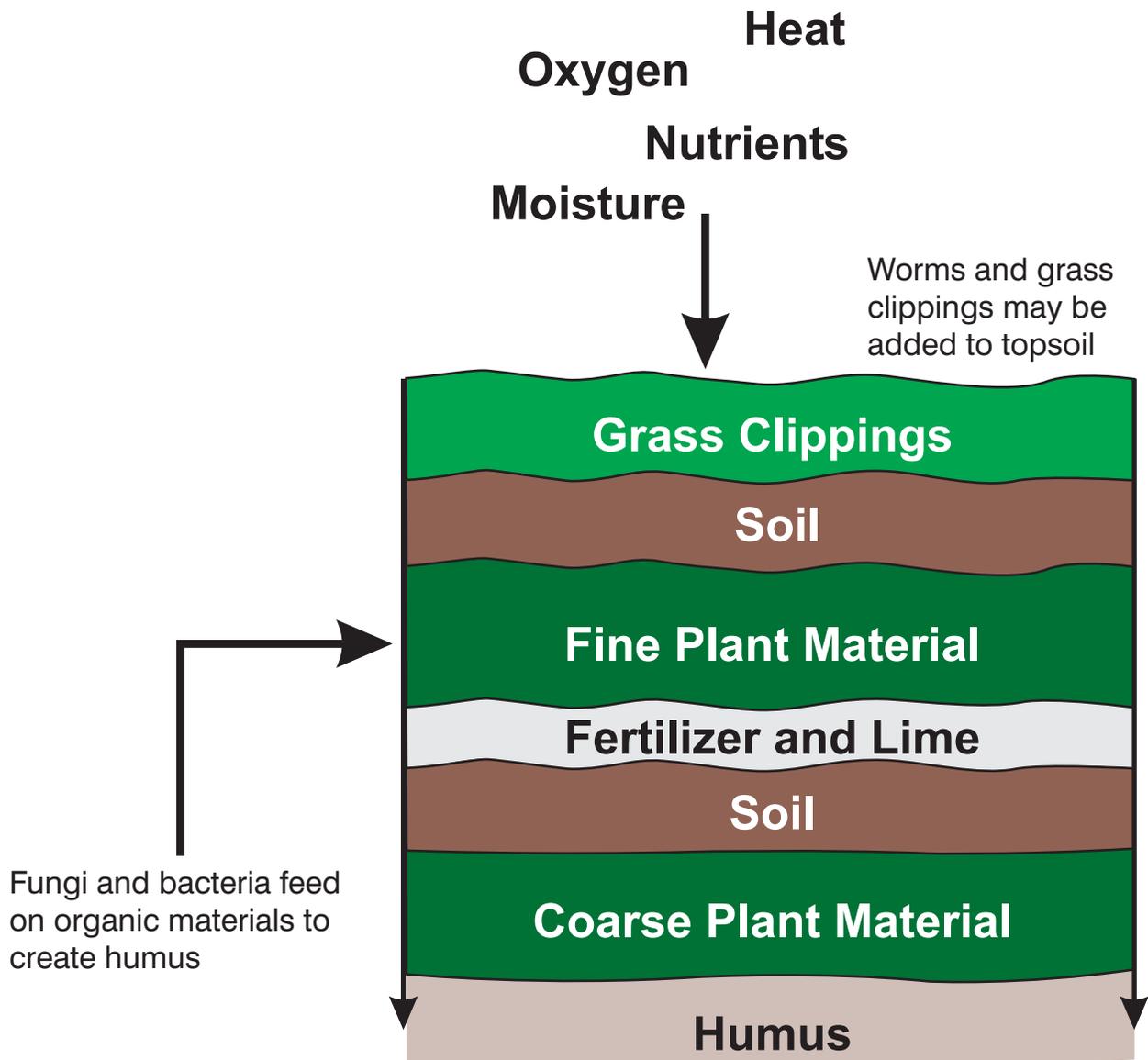
Reduce

Reuse

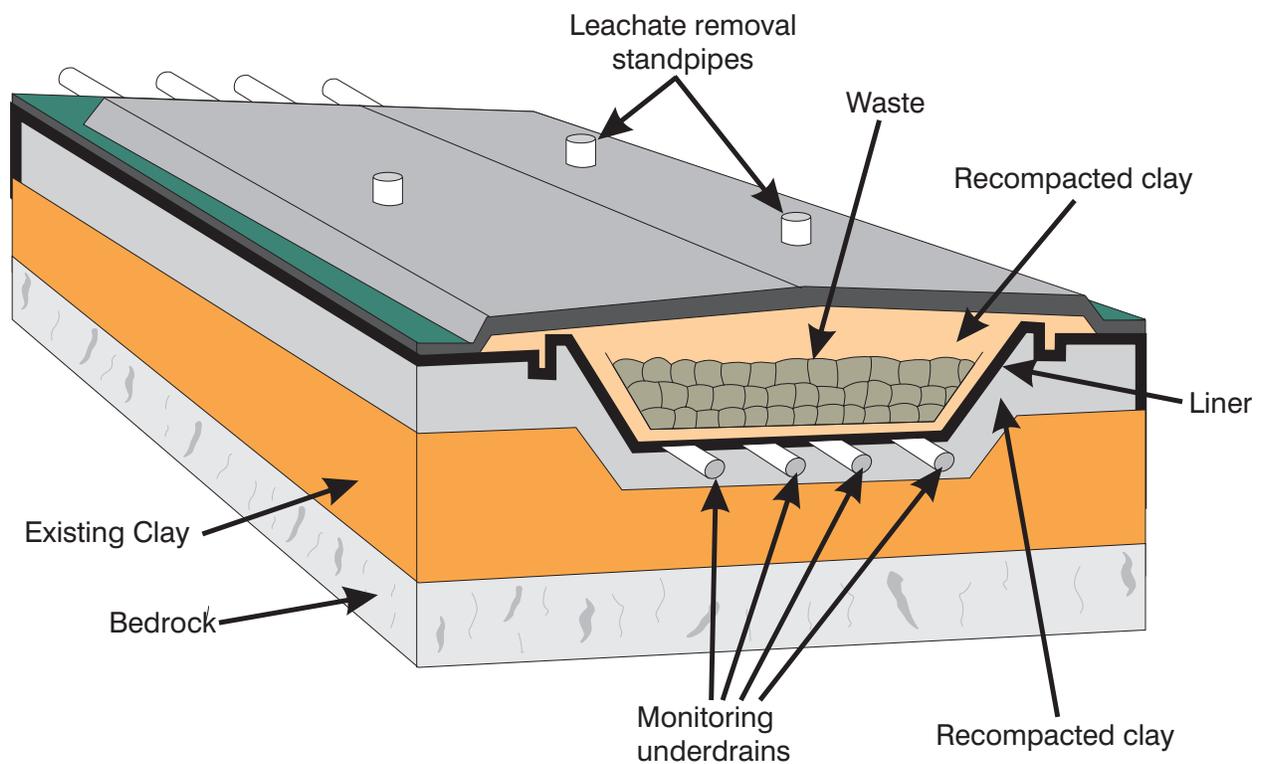


Recycle

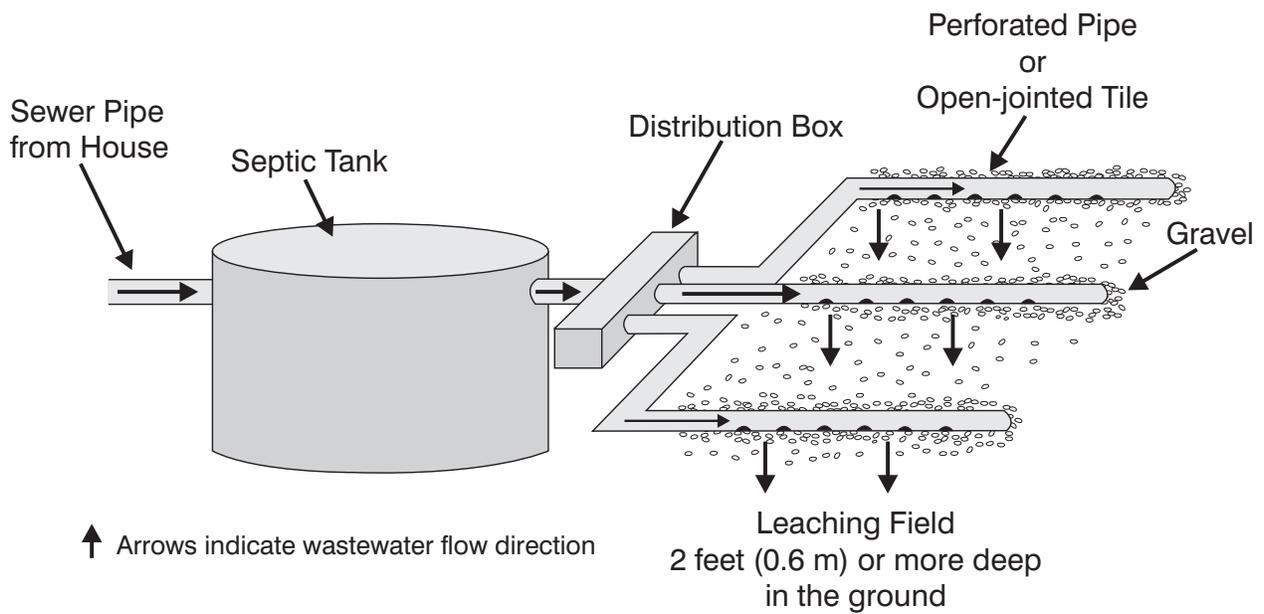
Composting



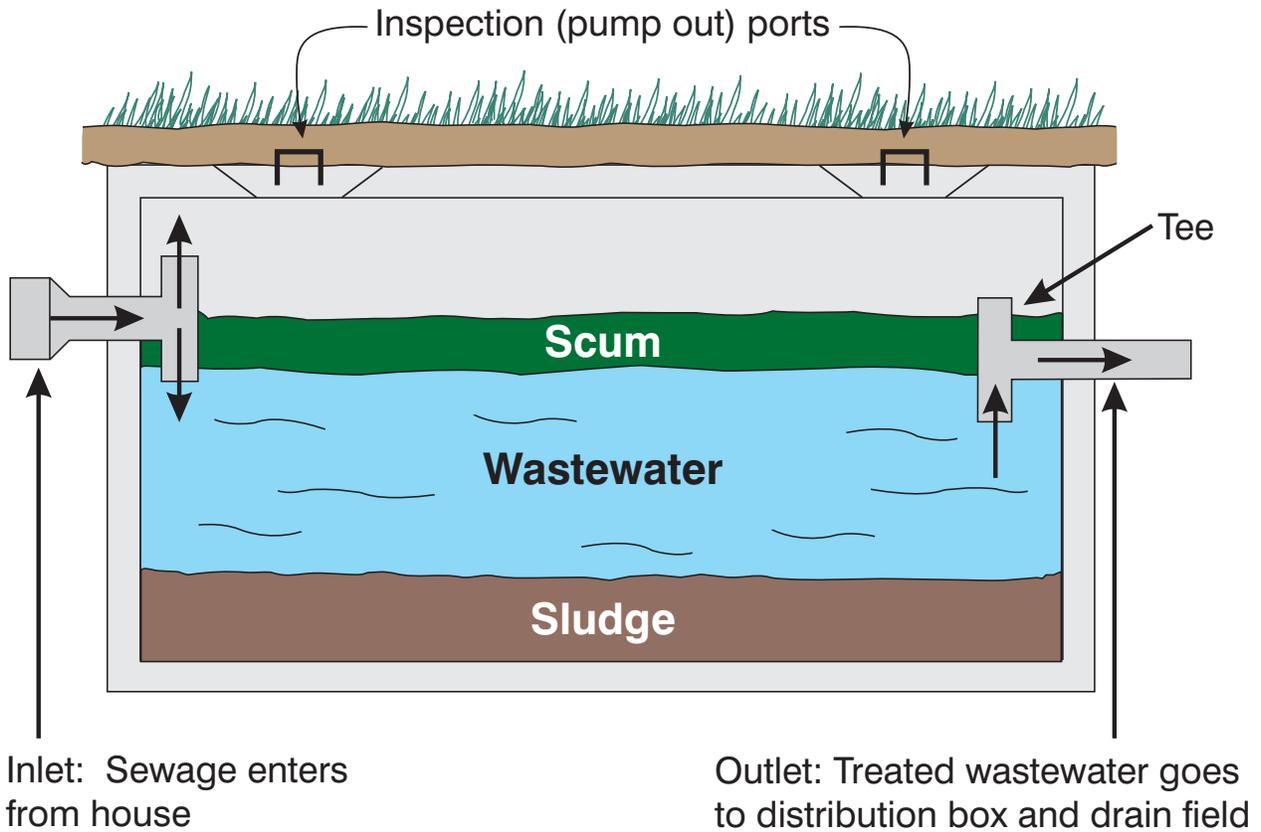
Hazardous Waste Landfill Structure



Septic Tank System



Septic Tank



↑ Arrows indicate wastewater flow direction

Lab Sheet

Source Reduction Worksheet

Waste Item	How can this waste be REDUCED?	How can this waste be REUSED?	How can this waste be RECYCLED?
Car tires			
Batteries			
Junk cars			
Glass bottles			
Aluminum cans			
Cardboard			
Grass clippings			