



Title: A Look at a Landfill

Grade: Middle School

Subjects: Social Studies, Science, Health

Time: 50 minutes

Objectives:

- Identify and describe the role of an MSW landfill in a solid waste management plan.
- Identify and describe the structure and function of an MSW landfill.
- Justify the importance of enforcing strict environmental standards when constructing MSW landfills.

Standards:

Geography Standard 15: Understand how physical systems affect human systems.

- Benchmark # 1: Know ways in which human systems develop in response to conditions in the physical environment (e.g., site selection for a landfill in relation to water supplies).
- Benchmark # 4: Understand relationships between population density and environmental quality (e.g., the denser the population the greater the amount of waste produced).

Geography Standard 16: Understand the changes that occur in the meaning, use, distribution and importance of resources.

- Benchmark # 2: Know strategies for wise management and use of resources (e.g., community programs for recycling and reuse).
- Benchmark # 5: Understand the role of technology in resource acquisition and use, and its impact on the environment (e.g., rates of resource consumption among countries of high or low levels of technology).

Geography Standard 18: Understand global development and environmental issues.

- Benchmark # 2: Understand the possible impact that present conditions and patterns of consumption, production and population growth might have on the future spatial organization of Earth.
- Benchmark # 4: Understand why different points of view exist regarding contemporary geographic issues (e.g., the UK managing 90% of their solid waste by burying it in landfills as opposed to other countries who are reducing their landfill usage).

Technology Standard 3: Understand the relationship among science, technology, society and the individual.

- Benchmark # 3: Know ways in which technology has influenced the course of history (e.g., improvements in sanitation and waste management- garbage dump vs. sanitary landfill).

Health Standard 2: Know environmental and external factors that affect individual and community health.

- Benchmark # 3: Know ways local, state, federal and international efforts to contain an environmental crisis and prevent recurrence (e.g., solid waste contamination).

Materials:

- MSW Landfill sketch provided below
- Matching handout provided below
- Environmental Impact Study worksheet provided below
- Chart paper
- Poster marker
- Colored pencils
- Paper, both manila art paper and writing paper



Overview: The average US citizen generates approximately one ton of trash annually, but seldom gives it any thought once they throw it away. This trash ends up in the waste stream where it is collected and hopefully, disposed of in a manner that least impacts the environment. This process is known as solid waste management.

The Environmental Protection Agency has designed a plan for this process, which they refer to as “integrated solid waste management”, and has identified five ways to properly handle waste materials: a) source reduction and reusing, b) recycling, c) composting, d) converting to energy, and e) burying it in a sanitary, engineered site. The EPA emphasizes that there is no definitive approach to waste management and encourages communities to combine these five methods to effectively address the issue.

In most communities across the country waste materials end up in at least one of three locations: a) a materials recovery facility, b) a waste-to-energy facility, or c) a landfill. A landfill is a long-term disposal solution that buries trash in as safe and sanitary manner as possible. In a landfill trash is deposited and compacted overtime, burying layer upon layer of waste material and leaving it to decompose. The EPA recommends land filling as a last resort, after all other methods have been exhausted; however many communities find the other options too costly or impractical, and use a landfill solution as one of their primary methods of disposal.

The key components of a typical municipal solid waste (MSW) landfill include: a) a liner system, b) cover materials, and c) an engineered cap system, d) leachate collection system and e) methane collection system. The liner system in a municipal landfill includes a layer of compacted clay, covered by a plastic liner, a layer of material, such as gravel and a geotextile layer. Set into the gravel is a network of pipes that is used to collect and remove the liquids that collect in the landfill. The liquid, know as leachate, is pumped from the landfill before it can leach into the surrounding area and contaminate ground water supplies. Above the gravel layer is a filter and collection layer. Once the liner system is in place waste is deposited into the landfill in small amounts, in controlled areas called cells. Waste is deposited into cells to reduce the chance of creating litter. At the end of each day a six-inch layer of a cover material, usually soil, is placed over the waste material. This cover limits the potential of waste escaping, odors developing, rodents gathering and also helps to compact the waste. When all the cells are filled to capacity the landfill is capped. The cap system prevents erosion and stabilizes the area. Vegetation is usually allowed to grow over the landfill. Often times it is turned into a park, golf course or other type of recreational area, but it is routinely monitored throughout its life cycle.

Kid’s Speak: Modern landfills are located, designed, operated, and monitored to ensure compliance with federal regulations. Municipal solid waste landfills are designed to protect the environment from contaminants, which may be present in the waste stream. A landfill site plan prevents the placement of landfills in environmentally sensitive areas. On site environmental monitoring systems monitor for signs of groundwater contamination and landfill gases. In addition, many new landfills collect potentially harmful landfill gas emissions and convert the gas into energy.

Eco-Fact: According to the EPA approximately 31 percent of the trash in the US is recycled or composted, 14 percent is burned and 55 percent is buried in landfills.

Procedures:

Before Conducting the Lesson:

Explain to students the EPA’s five methods for handling solid waste. Review with students the 3Rs- Reduce, Reuse, Recycle.

To introduce the fifth method the EPA has recommended to communities for handling solid waste, sanitary landfills, ask students if they know the difference between a landfill and a garbage dump.



Compare the two. (A garbage dump is a hole into which trash is dumped. It can attract rats, mice, birds and other small animals produce litter and develop offensive odors. A landfill is much different. It is a carefully engineered site built into or on top of the ground. Trash deposited in the landfill is kept isolated from the environment through the use of various systems. Refer to the Overview for specifics).

Explain to students that in the US, solid waste management, which may include building and managing a landfill, is the responsibility of the local community. Prior to any landfill construction an Environmental Impact Study must be performed. This study looks at the: a) area of land proposed for the site, b) the composition of the soil and bedrock under the site, c) the flow of surface water over the site, d) the potential impact on the local wildlife and ecosystems, and e) the historical or archaeological significance of the proposed site.

Explain to students that once the Environmental Impact Study is complete and the site has been approved, there are still a few steps that have to be taken before work on the landfill can begin. Local, state and federal permits have to be obtained, money has been raised to finance the construction, and access roads have to be built.

Conducting a Diagram of a Landfill:

- Use an enlarged version of the unlabeled diagram provided to explain the structure of a landfill and the function of each component. Introduce the appropriate terms, including: liner system, leachate, methane, cells, cover materials and cap, and provide detailed explanations of each in relation to a municipal solid waste landfill. As each term is explained label the diagram.
- Provide students with copy of the handout and a piece of manila art paper. Students will match the parts of the landfill with the corresponding function. Students will do a quick check with a partner to verify they have correctly matched the parts and functions.
- Students will draw a sketch of a landfill and label each part. These will be retained for use in a follow-up lesson.

After Conducting the Lesson:

- Now that students understand the structure of a landfill the students will reconsider the purpose of the Environmental Impact Study, make a list of the five issues addressed in it, identify what they believe is the purpose of looking into each of the five issues, and follow up by verifying the facts. An Environmental Impact Study worksheet is provided below.
- Students will discuss in a whole group session the importance of conducting the Environmental Impact Study prior to constructing a landfill.

Adaptations: Students may be provided an unlabeled handout of the landfill, which they can label, rather than sketching it themselves. However, it is important to note that many students retain information much easier when they have created their own visual tools.

Extensions:

- Students can write a synopsis explaining the value of an Environmental Impact Study.
- Students can create a visual representation to compare the pros and cons of a sanitary landfill to a garbage dump.