Environmental Stewardship

Lesson 7: Introduction to Landfills & Landfill Leachate

Grade Level: 9-12
Time Required: ~50 minutes

Summary/Objective
The purpose of this lesson is for students to gain an understanding of landfill basics. A brief overview of the history of landfills will be given. The primary focus will be on the anatomy of landfills and some of the engineering that goes along with creating & managing them. There will be a specific focus on the leachate that is produced by landfills as well.

Engineering Category: Environmental and Civil Engineering
Landfills require complex engineering.

Keywords
Aquifers, groundwater, leachate, percolation, municipal solid waste (MSW)

Educational Standards

HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics
Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*
HS-ESS3-4 Earth and Human Activity
Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*
HS-ETS1-1 Engineering Design
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
HS-ETS1-3 Engineering Design
Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Learning Objectives
After this lesson, students should be able to:
- Define and correctly use functional vocabulary related to water quality, landfills, and contamination of the water supply.
- Explain how groundwater contamination might occur as a result of leachate leakage from a landfill.

Associated Activities
- Google Slides Presentation

Lesson Closure
Exit Ticket/Other formative assessment for students

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Landfills & Leachate

Warm Up - Discuss with A neighbor

1) What is a landfill?
    a) List or describe some different components of a landfill.

2) What is landfill leachate? How is it produced?

1) Describe some implications that landfill leachate could have on the environment if not properly managed.

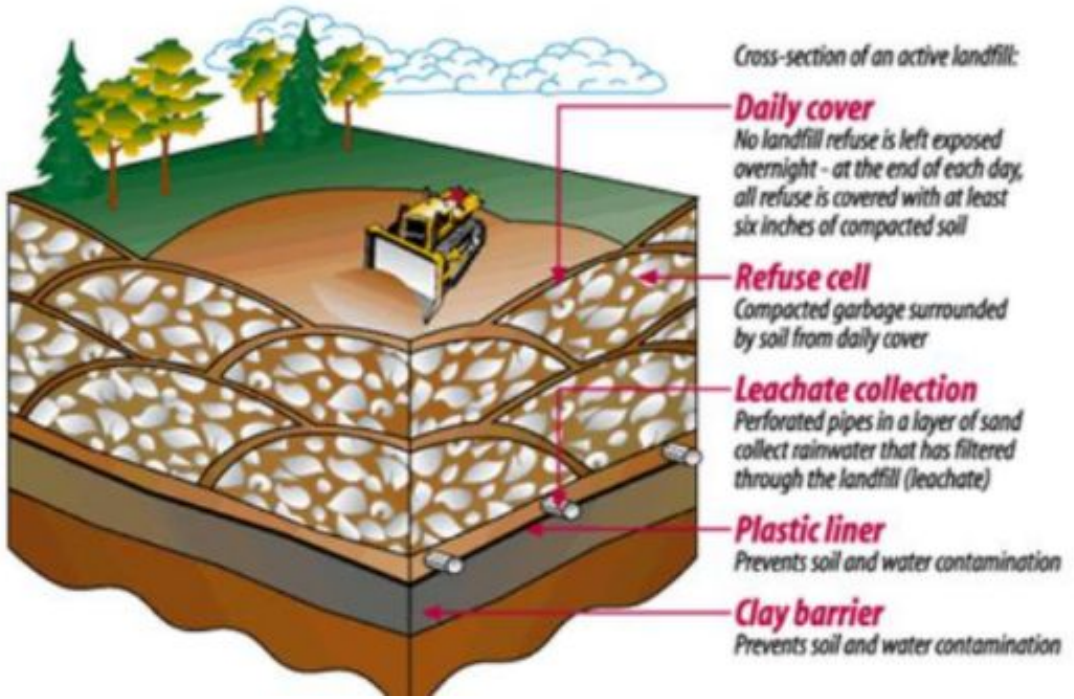
Landfills

- Landfills are defined locations where waste is disposed of & subsequently covered with dirt.
- Landfills have been around for approximately 5000 years!
- Due to the various impact that landfills can have on humans & the environment, they need to be **engineered** & **regulated**.
- Landfills were not regulated by the EPA until 1976

Anatomy of a modern day - Sanitary Landfill

Daily Cover - At the end of each working period, waste is covered with 6-12” of soil.

Why might this be?



Leachate Vocabulary

Percolate - filter gradually through a porous surface

Leachate - water that has percolated through a solid and leached out some of the constituents

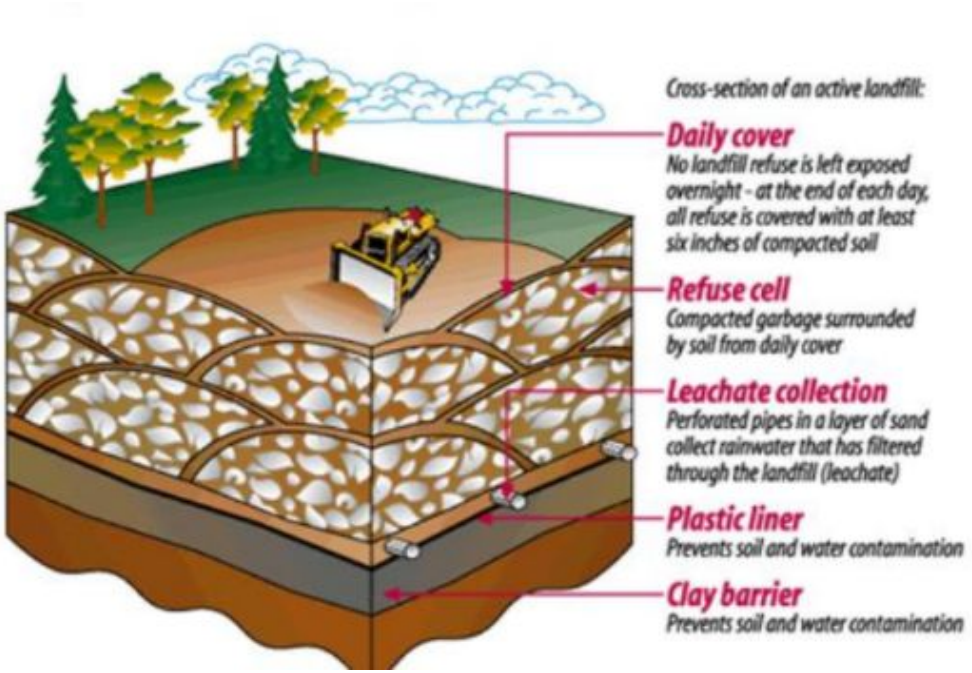
Groundwater - freshwater that soaks through soil and is stored beneath the surface in the spaces between soils and rocks.

Aquifer - Underground layer of water-bearing permeable rock. These can be tapped into to obtain water.

Leachate Collection

Perforated pipes are placed at the bottom of landfills to collect the leachate.

This helps protect the soil and groundwater supply.



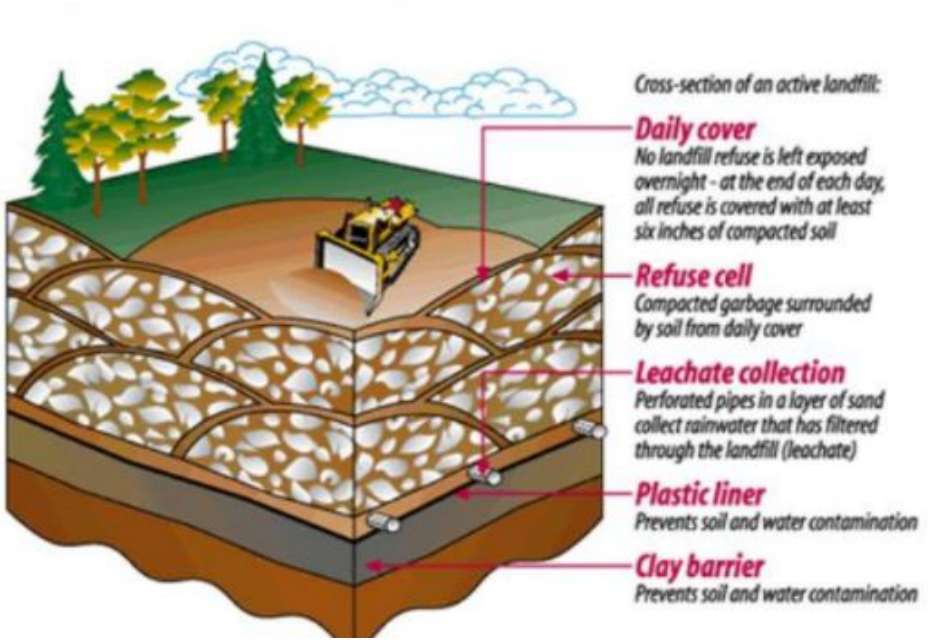
Leachate Collection

- Leachate is collected by the perforated tubes & pumped to the surface.
- In landfills that do not receive much precipitation, the leachate may be recycled through the landfill.
  - This assists in the decomposition of the waste.
- In other circumstances, the leachate is analyzed and treated to be returned to a natural body of water.

Landfill Anatomy -

The base of landfills are lined with plastic to help maintain the contaminated leachate.

There is also a clay barrier that prevents contamination.



Exit Ticket - 5 min

- On a half sheet of paper:

- Draw a cross section of a landfill.
- Briefly describe each of the components you have in your drawing and what purpose they serve.