



Model Oil Pipeline

Grade Level: 6-12
Length: 90 Minutes
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NGSS Standards

HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Crosscutting Concepts

Structure and Function The way an object is shaped or structured determines many of its properties and functions.

Related Resources

Worksheets Model Oil Pipeline Rubric

Pair With Basic Properties of Oil Lesson; Build an Oil Tanker Lesson

Overview

It is challenging to construct a pipeline to safely transport oil over rugged terrain.

Objectives

- Students will construct a working model of an oil pipeline.
- Students will cooperate to transport oil from drilling areas to a marine terminal.

Materials

- Pencils
- Scratch Paper
- Water
- Food Coloring
- 5 Gallon Buckets
- Sump Pump (optional)
- Rubber Hose with Fitting for Sump Pump (optional)
- PVC Piping
- PVC Pipe Fittings
- Duct Tape
- Wood
- Screws
- Screwdrivers
- Wood Glue
- Scrap Pieces of Rubber Hose
- Rulers
- Tape Measure
- Absorbent Pads, Cloth Rags, or Towels
- Model Oil Pipeline Rubric

Notes

Background

Constructing the Trans Alaska Pipeline System in the 1970s was an incredible endeavor. The pipeline spans 800 miles of rugged Alaskan terrain, much of it aboveground due to permafrost. The pipeline crosses 30 major rivers and streams, three major fault lines, and three mountain ranges. It rises with the land to an altitude of 4,739 feet. Pipelines are generally constructed of steel or plastic tubes. They may be on land, underground, or under water. In this activity, students work in teams to construct a pipeline to transport “oil” from an “oil field” to a mock marine terminal.

Preparation

1. Decide on the location for your oil field, pipeline route, and marine terminal. An outside area is a preferable, but an indoor classroom could also be used. Be sure to find an area with or create varied terrain, including something to simulate mountains and rivers.
2. You will need one 5-gallon bucket and one shallow tub for each group. Place the 5-gallon buckets in the “oil field” area. Each group will use one bucket as their starting point.
3. Distribute the shallow tubs at the far end of the area to be traversed by the pipelines. Each group will use one tub as their ending terminal.
4. Borrow one or more sump pumps to use in the activity. If you do not have access to pumps, students can also just pour the “oil” into the pipeline, although this is less exciting.

Introducing the Lesson

Ask students what they know about the Trans Alaska Pipeline System. Share with students facts about the pipeline. (The pipeline spans 800 miles of rugged Alaskan terrain, much of it above ground due to permafrost. The pipeline crosses 30 major rivers and streams, 3 major fault lines, and 3 mountain ranges. It rises with the land to an altitude of 4,739 feet.) Discuss some of the challenges of constructing a pipeline such as this.

Activity

1. Divide students into groups of 5-7. Assign each group an oil field starting point (5-gallon bucket) and terminal (shallow tub). Provide them with a copy of the Model Oil Pipeline Rubric.
2. Explain that students are going to construct a working model of a pipeline to transport mock “oil” from a simulated oil field to a terminal. Between the start and end points, they can choose any route they would like.
3. Because of permafrost, their pipeline must be elevated above ground at least two inches throughout the length of the pipeline. Once the pipeline is completed, they will use a sump pump to push “oil” into the pipeline. Their goal is to successfully transport the oil through the pipeline to the terminal with no leaks.
4. Show students the materials available to use in construction, but do not allow them to obtain any materials until they have sketched a design for their pipeline.
5. Students should work together to decide upon the safest route and construction plan for their group’s pipeline. Check in with each group to ensure everyone is participating in the challenge.
6. Once you are content that the group has a solid design plan that everyone has contributed to, allow them 45 minutes to construct the actual pipeline using the materials. Check in with groups as they construct, making sure again that all members are included in the process.
7. When the pipelines have been completed, fill the 5-gallon buckets with about four gallons of water and food coloring to simulate oil. Place absorbent pads, rags, or towels below the pipelines to catch any spills or leaks.
8. Attach a short length of hose to the sump pump and submerge the pump in the water. Run the hose into the beginning of the pipeline and plug in the sump pump.
9. Have students watch along the pipeline for leaks or spills. If a pipeline is successful, “oil” should flow out the other end into the shallow tub representing the terminal without any leaks or spills along the way. Test all pipelines in this way. If time permits, allow groups five minutes to fix any leaks or blockages in their pipeline, and retest.

Wrap-up

Once each pipeline has been tested, debrief the experience with students. Ask students to identify the most challenging aspect of constructing a pipeline. What was successful? What was less

successful? What would they do differently next time? What did students learn from the experience? Discuss how this compares to the reality of transporting crude oil. What other challenges might come up?

Have each group discuss among themselves and decide upon at least one change they would make to their pipeline to make it more durable, address problem spots, and/or more efficient. Have them also identify one change they could make in the construction process to minimize disruption to the local environment. Ask groups to present their ideas for improving their pipeline and construction process to the group. Have students deconstruct their pipelines and rinse out the pieces for re-use.

Assessment

Use the Model Oil Pipeline Rubric to evaluate the group projects and assess student understanding. Students who meet the performance expectation will demonstrate during discussion that they are able to evaluate and refine a technological solution in pipeline design and construction to reduce the impact of human activities on the environment.

Pair With

- Basic Properties of Oil Lesson Plan
- Build an Oil Tanker Lesson Plan