Western Engineering

Outreach

Oil Spill Simulator

Grade 6-8

Meet Today's ENG HERO!

Jason Gerhard - Professor with Western Environmental Engineering

Dr. Jason Gerhard has nearly 20 years of experience leading research into the fate and remediation of organic contaminant in soils and groundwater. As a Professor at Western, he leads the internationally recognized RESTORE (Research for Subsurface Transport and Remediation Group). Dr. Gerhard is co-inventor of the STAR thermal remediation technology and leads its ongoing emergence.

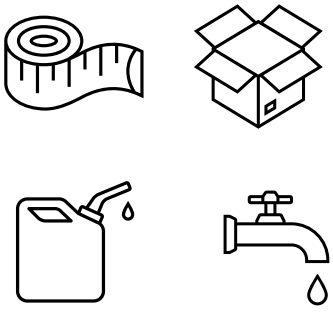
To learn more about Dr. Gerhard, please visit:
https://www.eng.uwo.ca/civil/faculty/gerhard_j/index.html

Learning Goals:

- Grade 6: 1. assess human impacts on biodiversity, and identify ways of preserving biodiversity;
- Grade 7: 1.2 assess the impact on society and the environment of different industrial methods of separating mixtures and solutions
- Grade 8: 1.2 assess the impact of fluid spills on society and the environment, including the cost of the cleanup and the effort involved Sample issues: An oil tanker spills its load in B.C.'s inside coastal waters

Materials:

- Duct tape or other strong tape
- Paper towels
- Bendable straws
- Cardboard
- Cotton balls
- Craft (popsicle) sticks
- Dense foam wedge (makeup sponges)
- Pencils
- Large-mouth buckets
- Name-brand dishwashing soap
- Red food coloring
- Tablespoons
- Vegetable oil
- Water



Engineering and Science Connections:

Background:

Oil enters freshwater and marine ecosystems around the globe daily because of natural leaks and accidental oil spills. Oil leaks from oil transport pipes, boats, and oil wells. Some of the biggest and most publicized spills include the 1989 Exxon Valdez oil spill, the 1979 Ixtoc I spill, the 1991 Arabian Gulf spill, and the 2010 Deepwater Horizon spill. In 1989, the Exxon Valdez tanker ran aground and released 10.8 million gallons of crude oil into Prince William Sound, Alaska. The two- mile-deep well, Ixtoc I, blew out in June 1979 in the Bay of Campeche in Mexico. By the time the well was controlled in March 1980, an estimated 140 million gallons of oil had spilled into the bay. The most oil ever spilled in water occurred in 1991 during the Gulf War. Tankers and oil terminals in Kuwait were destroyed, releasing about 336 million gallons of oil into the Persian Gulf.

2016 Oil Spill in Gulf of Mexico

On April 20, 2010, an oil-drilling rig called the Deepwater Horizon exploded in the Gulf of Mexico, killing 11 people and causing a well deep below the surface to leak for 86 days—the world's largest accidental release of oil into the ocean. The federal task force estimates that 4.9 million barrels of oil were released from the time of the accident until the leak was contained in mid-July 2010. British Petroleum (BP), the company responsible for the spill, uses many different methods for oil cleanup, including booms, skimmers, absorbers, and dispersants. For this particular oil spill, BP used a dispersant called Corexit 9500 (a chemical that causes the oil to clump together). BP maintains that the dispersant is harmless; however, little is known about how it will affect the environment over time. As of October 2010, government scientists estimated that BP had removed a quarter of the oil. They believed another quarter had evaporated or dissolved into scattered molecules. The third quarter was dissolved into smaller molecules by dispersants, and the last quarter remained in slicks or invaded the shorelines and estuaries of Louisiana, Mississippi, Alabama, and Florida.

Oil Spill Simulator

Activity:

Intro: Today we will use a model to simulate an oil spill and its cleanup. Divide students into small groups of 3-6 students each. Have groups move to their assigned stations where materials are set out.

Vocabulary / Definitions:

Types of equipment used to clean up oil spills: *absorbers, booms, dispersants,* and *skimmers.*

Absorber: Material use to make up booms that help absorb oil while it is being contained
Boom: Oil-containment device that floats on the surface of the water and is used as a barrier to keep oil in or out of a specific location
Dispersant: Chemicals sprayed on oil to cause it to break up and sink.
Skimmer: Floating boom system that sweeps oil across the water surface, concentrating the oil.

Observe the supplies you have available and discuss which supplies might represent each type of equipment used to clean up oil spills.

Want to learn more about the 2010 Oil Spill in the Gulf of Mexico? Watch the video down below.

Video Recommendation: https://www.youtube.com/watch?v=ZIw1ANIaeWI

Oil Spill Simulator

Part 1: Simulate the oil spill.

Measure four tablespoons of vegetable oil and use a fork to mix it with 1-4 drops of food coloring. *What do you think the oil and food coloring represent?* Answer: The oil represents crude oil and the food coloring represents chemicals trapped inside of the oil. The food colouring will not mix completely with the oil just as the chemicals don't mix completely with the crude oil, they are trapped by it. Next, carefully pour the dyed oil into the center of the container with water and float a one-inch craft stick in the middle of the oil spill. The craft stick represents a ship (that the oil is spilling from).

Part 2: Simulate cleanup efforts before the use of dispersant.

Devise a plan for clean up given the different materials; pieces of cotton, cardboard, and paper towels smaller than one inch–to try to remove the oil before it reaches the sides of their container. Try to describe what the oil removers are doing based on the material you are using. It would be a good idea for you to make observations about the different properties of the materials to evaluate their effectiveness and type (booms, skimmers, absorbers, or dispersants).

Part 3: Simulate cleanup efforts after the use of dispersant.

After you have tried all other provided materials, add a few drops of name-brand dishwashing soap. Then ask yourself:
What happened to the oil? Why?
What happened to the chemicals (dye)? Why?
What color is the water? Why?

Part 4: Re-test the first set of materials in the water with the dispersant.

Predict what you think will happen now that dispersants have been added. Re-test some of the supplied materials now that the dispersants have entered the environment.

After you have tested all of the materials—both before and after dispersants were added—ask yourself:

- *Did any method completely remove the oil?*
- *What happened to the chemicals (dye)?*
- *Do you think all toxins or chemicals behave the same way? Why or why not?*

Compare your results for each material before and after the dispersants were added. Reflect on some of the successes you experienced and some of the possible flaws that you see with these methods. Ask yourself:

- *Based on your observations, how effective do you think the Gulf oil spill efforts (equipment types) have been?*
- *Did any of your observations change the way you view the cleanup strategies being used in the Gulf?*
- *Did any of your observations change the way you view the effects cleanup strategies may have on the water quality and wildlife of the Gulf*

The Gulf Oil Spill disintegrated this island (National Geographic)

What Did You Learn?

- The environmental impact of oil spills and other human impacts on the environment
- Equipment used to clean up oil spills and how they work
- The lasting effects of oil spills despite clean up efforts

Future Learning

- What are some other oil spills that have happened around the world and how effectively have they been cleaned up?
- Learn about the lasting impacts of these different oil spills on the environment and wildlife in those areas
- What are the new cleaning methods that environmental engineers are developing now?

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