



# Oil Spill Clean-up: An Engineering Challenge

## Overview

In this lesson students will review the BP oil spill and learn about current ways we are cleaning it up. They will test different methods that are currently being used in the gulf clean-up. After testing they will analyze the different methods and determine the most efficient way to clean up the oil spill. This activity is appropriate for grades 6<sup>th</sup>-8<sup>th</sup>.

## Objectives

Students will be able to:

- Analyze and examine the current methods of clean-up
- Explain benefits and drawbacks for each particular method
- Describe the different methods of oil spill clean-up in the Gulf of Mexico

## Oregon State Science Standards 2009

### Interaction and Change

7.2E.1 Describe and evaluate the environmental and societal effects of obtaining, using, and managing waste of renewable and non-renewable resources.

### Engineering Design

7.4D.1 Define a problem that addresses a need and identify constraints that may be related to possible solutions.

7.4D.2 Design, construct, and test a possible solution using appropriate tools and materials. Evaluate the proposed solutions to identify how design constraints are addressed.

7.4D.3 Explain how new scientific knowledge can be used to develop new technologies and how new technologies can be used to generate new scientific knowledge.

### **Student Pre-requisite Knowledge**

Students should be familiar with the gulf oil spill.

### **Materials**

Each group requires

- 1 plastic container that holds approximately 5 cups
- Water
- Olive oil
- Paper cups or beakers to distribute oil
- Syringe
- Plastic fork
- Gloves
- Bags of clean up materials including
  - Oil absorbing polymer (0.5 g)
  - Loose Wool (1 g)
  - Wool Blanket (1 g)
  - Boom Materials
    - Raw Wool (1 g)
    - Nylon stocking (cut into 6")
  - Cellulose (3 g)
- Soap in a squirt bottle to act as dispersant

### **Tea cheer Preparation**

Make sure to read through the PowerPoint. Be able to describe and define the different clean-up methods in the Gulf of Mexico. There are You Tube videos that describe each of the clean-up methods.

- Dispersant: [http://www.youtube.com/watch?v=v1\\_iJksSSIQ](http://www.youtube.com/watch?v=v1_iJksSSIQ)
- Oil Absorbing Polymer: <http://www.youtube.com/watch?v=xpd1k-88PTk>
- Plant Cellulose: <http://www.youtube.com/watch?v=g-48o0HiUYE>
- Wool: <http://www.youtube.com/watch?v=9hVhJCOJcJ8>
- Boom Sock with Wool: <http://www.youtube.com/watch?v=lrtChaTXnfs>

### **Procedure**

1. **Anticipatory Activity.** Start with a discussion about the Gulf of Mexico BP oil spill. Show the first picture of the presentation and start a discussion about what happened.
2. Continue the provided slide show, Oil Spill PowerPoint, on oil spills and the situation in the Gulf of Mexico to add visuals to the discussion. Highlighting the different materials used to clean up the oil. Also make sure to point out key terms like oleophilic, hydrophobic, and adsorb versus absorb.

3. Have students get into groups of 3 or 4. The students also need gloves as the oil clean-up can be messy.
4. Hand out the lab sheets to each group.
5. Have the students read the lab sheet all the way through before starting.
6. Hand out the materials to students: plastic Tupperware, premeasured clean-up materials, syringe, and approximately 50 mL of olive oil in a cup or beaker.
7. Have students fill up their plastic containers half full with water. This will be their Gulf of Mexico.
8. Have students test each clean-up method one at a time. Students should determine how much oil each material can hold by squirting 3 mL of oil into their Gulf of Mexico at a time and seeing if the material soaks up all the oil. If so, then add more 3 mL at a time. Have students calculate the absorbency ratio for each material. Students should test the polymer and dispersant last. The polymer can be difficult to remove and the dispersant stays in the water.
9. Students should also determine if the oil is recoverable. This is important to determine which clean-up method would be most beneficial. This is a good opportunity for discussion:
  - a. Dispersant: Remains with the oil and water.
  - b. Wool: The oil can be removed and the wool reused. If the wool does not need to be reused it can be disposed of and will biodegrade. The oil can be used once removed from the wool. This is something that oil companies like BP will like because they can get the oil back.
  - c. Cellulose: The oil cannot be taken out of the cellulose and just has to be thrown away. The material though is now toxic and has the oil in it. One way to get rid of it is to burn it, but this will cause some harmful gases.
  - d. Oil absorbing polymer: The polymer absorbs the oil and does not release it. It will most likely end up in a landfill. Because it is a polymer burning it is not a viable option.
  - e. Boom: The material from the boom can be removed and disposed of in the ways listed above.
10. After the students are finished have them complete the question at the end of the worksheet.
11. The expected results from the various medias:
  - a. Dispersant: break up the oil into smaller pieces when a few drops are added. Once a lot is added the oil is in droplets that can be seen but is still all together with these oil droplets. This is the main method of clean up in the Gulf of Mexico. The dispersant can be toxic to some wildlife.

- b. Wool: Adsorbs the oil with very little material. The oil can be removed from the wool once absorbed. The water does not absorb to the wool. A slide on the PowerPoint explains why this happens.
  - c. Cellulose: Absorbs the oil while absorbing little water. The oil cannot be taken out once finished but just stays in the material. Some water can be removed from the oil and cellulose once the material is removed showing that it picks up some water.
  - d. Oil absorbing polymer: Granular substance that absorbs the oil without absorbing the water. The polymer was specifically designed to absorb just oil. Oil cannot be removed and the polymer turns hard and joins together once taken out of the water. Removing it from the water is difficult because it is a granular substance.
  - e. Boom: The boom can be filled with any of the absorbing methods. It shows that there are easier ways to take the oil absorbing material from the water. This will probably be the best method to use. The boom though can absorb some of the water so this may be an issue.
12. **Clean up.** Once the entire activity is done tell the students to clean up their area by placing their Gulf of Mexico, syringes, forks, and bag of clean up in a Tupperware tote. After they wipe their table down with a Clorox wipe and the area is cleaned of oil they can remove their gloves.
13. **Closure.** Topics of discussion: absorbency ratio, the various cleaning methods and if the oil is recoverable. Ask the class to weigh the costs and benefits and come up with a clean-up suggestion they would give to an oil company like BP.