**OIL SPILL SOURCES AND EFFECTS: INTRODUCTION**

Once oil has been extracted from underground, it is transported to a refinery through a pipeline, and then transported to its final destination. Oil can be spilled at any of these steps. Oil spills caused by accidents in moving oil usually involve tankers, barges, pipelines, or storage facilities. A spill may result from carelessness, which was the case in the *Exxon Valdez* spill of 1989 when a tanker collided with Bligh Reef outside of Valdez, Alaska (*Exxon Valdez* Oil Spill Trustee Council). The Deepwater Horizon spill off the Gulf Coast in 2011 was caused by equipment breakdown (BP) . Other causes could be hurricanes and other natural disasters, terrorist acts, and illegal dumpers; however, most man-made sources of oil in the ocean come from small ships and boats.

**KEY WORDS**

Weathering

Emulsification

Oil weathering

Mousse

Petroleum

Penetrate

Abiotic

Biotic

Producers

Consumers

Decomposers

Migration

Spawning

Breeding

**FOCUS QUESTIONS**

1. Which do you think is more dense, oil or water?
2. Name two ways that an oil spill may occur.
3. What special problems arise if an oil spill occurs in the open ocean, on a rocky coast, or near a sandy beach?
4. How does the timing of an oil spill affect animals?

**LEARNING OBJECTIVES**

The student will:

identify potential sources for oil contamination and other marine pollutants.

identify actions that can be taken to reduce or prevent the introduction of pollution in the ocean ecosystem.

define oil weathering and mousse.

demonstrate oil penetration through different sediments.

define the four components of an ecosystem: abiotic (non-living), biotic (living), consumers, decomposers.

define oil's seasonal effects on environment.

identify oil spill problems on different surfaces: open water, rocky, and sandy.

**MATERIALS**

Student lab books with worksheets

* Pre-assessment
* Focus questions
* Slideshow questions
* Lab worksheets

Water and Oil Activity (per group)

* 2 clear plastic cups of water, 1 fresh, 1 salty
* Stopwatch/timer
* Blue food coloring
* Vegetable or mineral oil
* Cocoa powder

Oily Soil Penetration Activity (per group)

* Wide containers for each sediment
* Coarse sediment (gravel or sand)
* Medium sediment (sand)
* Fine sediment (silt, clay, or mud)
* Molasses
* Vegetable or mineral oil

Ecosystem Chorus Activity

* Scarves

**AUDIO-VISUAL MATERIALS**

* Computer, projector/monitor, screen
* Slideshows: “Oil’s Wandering Paths” and “Marine Effects of Oil”

**LEARNING PROCEDURE**

See “Lesson 4 Activity Instructions” for details.

1. Show “Oil’s Wandering Paths” Slideshow. After Slide 2, brainstorm/review with students about products found in the classroom that are made from petroleum. Complete slideshow ***(20 minutes)***
2. Water and Oil Activity ***(15 minutes)***
3. Oily Soil Penetration Activity ***(30 minutes)***
4. Show “Marine Effects of Oil” slideshow and discuss ***(15 minutes)***
5. Have students use notes to complete Seasonal Oil Spill worksheet and Tanker Leak worksheet, which the teacher will go over with the class ***(30 minutes)***
6. Ecosystem Chorus Activity ***(30 minutes)***
7. Wrap-up discussion and review ***(10 minutes)***

**STANDARDS**

**Alaska State Standards:**

**SA**  The student will demonstrate an understanding of the processes and applications of scientific inquiry.

**(5) SA1.1** asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

**(5) SA1.2** using quantitative and qualitative observations to create their own inferences and predictions.

**SA1** The student will develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend arguments.

**SA2** The student will develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

**(5) SA2.1** supporting their statements with facts from a variety of resources and by identifying their sources.

**SA3** The student will develop an understanding that culture, local knowledge, history, and interactions with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

**(5) SA3.1** identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survives.

**National Science Education Standards**

**Content Standard A: Scientific Inquiry**

All students will develop abilities necessary to do scientific inquiry.

Identify questions that can be answered through scientific investigations.

Design and conduct a scientific investigation.

Use appropriate tools and techniques to gather, analyze and interpret data.

Develop descriptions, explanations, predictions and models using evidence.

Think critically and logically to make the relationships between evidence and explanations.

Communicate scientific procedures and explanations.

 All students will gain an understanding about scientific inquiry.

Different kinds of questions suggest different kinds of scientific investigations.

Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.

Scientific explanations emphasize evidence, have logically consistent arguments and use scientific principles, models and theories.

**Content Standard B: Physical Science**

All students will develop an understanding of properties and changes of properties in matter.

A substance has characteristic properties, such as density, a boiling point, and solubility, all of which are independent of the amount of the sample. A mixture of substances often can be separated into the original substances using one or more of the characteristic properties.

Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties. In chemical reactions, the total mass is conserved. Substances often are placed in categories or groups if they react in similar ways; metals are an example of such a group.

**Content Standard E: Science and Technology**

 All students will develop understandings about science and technology.

Technological designs have constraints. Some constraints are unavoidable, for example, properties of materials or effects of weather and friction; other constrains limit choices in the design, for example, environmental protection, human safety and aesthetics.

Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted and others cannot.

**Content Standard G: History and Nature of Science**

All students will develop an understanding of the history of science.

Many individuals have contributed to the traditions of science. Studying some of these individuals provides further understanding of scientific inquiry, science as a human endeavor, the nature of science, and the relationships between science and society.

**Ocean Literacy Standards**

1. The ocean and humans are inextricably interconnected.
2. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
3. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individuals and collective actions are needed to effectively manage ocean resources for all.
4. The ocean is largely unexplored.
5. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.
6. Over the last 40 years, use of ocean resources has increased significantly, therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.
7. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

**RESOURCES**

*Exxon Valdez* Oil Spill Trustee Council, <http://www.evostc.state.ak.us/index.cfm?FA=facts.details>

BP, <http://www.bp.com/en/global/corporate/gulf-of-mexico-restoration/deepwater-horizon-accident-and-response.html>

Ecosystem Chorus Activity Adapted from Alaska Oil Spill Curriculum K-12: [http://www.pwsrcac.org](http://www.pwsrcac.org/)

**FEEDBACK**

We value your feedback on this lesson.

Send us your comments to: khoffman@pwssc.org

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