



# Oil Spills: A Slick Trick to Treat

## A Lesson on Ecology and Environmental Pollution

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Summer 2007

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**Lesson # 8**

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**Appropriate citation:**

Miller, J. Oil Spills: A Slick Trick to Treat A Lesson on Ecology and Environmental Pollution (APS Archive of Teaching Resources Item #3687). [Online]. Bethesda, MD: American Physiological Society, 2007.

<http://www.apsarchive.org/resource.cfm?submissionID=3687>.

**Editor's notes:**

Website URLs listed in this resource were current as of publication, but may now be obsolete. If you know of a replacement URL, please suggest it in the resource's "Comments" section <http://www.apsarchive.org/resource.cfm?submissionID=3687>.

The APS encourages teachers to give students a copy of the "ABC" (Appropriate, Beneficial, Caring) rules for use of animals in the classroom, to discuss the rules, and to ask students to sign the "ABC" rules contract (see References). Also, teachers should have a plan for short term care of the animals (with supporting references for appropriate care guidelines) and for disposal or long-term care of all classroom organisms.

Teachers should carefully review any stimulus or environmental change for an animal being used in experiments or observations before students are allowed to use that stimulus. This is especially important if the stimulus could cause pain or distress to the organism. Teachers may be able to identify a less stressful stimulus for the students to use in their experiment.

Although mammals provide excellent opportunities for observational studies, they require particular care in terms of handling and may cause allergic reactions in some students. The teacher should check local and state guidelines before using mammals in the classroom.

**Disclaimer:**

This activity was created by the author and reviewed by the American Physiological Society. Any interpretations, statements, or conclusions in this publication are those of the author and do not necessarily represent the views of either the American Physiological Society or the funding agencies supporting the professional development program in which the author participated.

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<b>PURPOSE</b>	This set of activities will be used when teaching ecology, specifically environmental pollution/destruction. Students will learn about the impacts oil spills and oil leakage have on the environment. Further, they will explore the difficulties associated developing methods that could be used to clean or contain an oil spill.
<b>OBJECTIVES</b>	Upon completion of this activity, students will be able to: <ul style="list-style-type: none"><li>• experiment with the difficulties associated with oil spill clean up/containment especially on a large scale (lakes, ocean).</li><li>• explain the impact of oil spills on shoreline environments.</li><li>• explore the impact of oil drilling in Arctic National Wildlife Refuge (ANWR) and compare/contrast it with the potential for oil spills. associated with transporting oil across oceans.</li></ul>
<b>GRADE LEVEL</b>	Introductory high school biology (9-10 grades)
<b>PRIOR KNOWLEDGE</b>	General lab skills are needed but no prior environmental learning is required for this lab. However, it is recommended that students do this toward the end of an ecology unit when terms such as ecosystem, biotic/abiotic, community, etc., have been covered.
<b>TIME REQUIRED</b>	These activities will take 2-2.5 block class periods (85 minute) or 4 regular periods (50 minutes). The extension activity could add an additional 45-90 minutes.
<b>INCLUDING ALL STUDENTS</b>	Students should be put into groups of 2 or 3. Each should be assigned roles, e.g.: <i>Group Recorder</i> : writes group's brainstorm ideas <i>Group Logistics Handler</i> : gathers materials <i>Group Secretary</i> : writes official hypothesis and experimental design to submit to teacher (stress that the secretary simply writes what the group has condensed and decided upon after brainstorming)  Activities address tactile, visual, and auditory learning. Extension activities can introduce students to differing views on oil drilling held by native Eskimos in Alaska.
<b>QUESTIONS TO ASK ALONG THE WAY</b>	<ul style="list-style-type: none"><li>• How do oil and water react when mixed?</li><li>• How hard do you think it would be to survive if you were living in water with black petroleum oil in it?</li><li>• What are the major uses for petroleum oil?</li><li>• What is a fossil fuel?</li><li>• How important is petroleum to our everyday lives?</li></ul>
<b>NATIONAL SCIENCE EDUCATION STANDARDS</b>	<i>Grades 9-12</i> <u>Science as Inquiry</u> Abilities necessary to do scientific inquiry Understandings about scientific inquiry <u>Life Science</u> Interdependence of organisms <u>Science in Personal and Social Perspectives</u> Natural resources Environmental quality Natural and human-induced hazards

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**KENTUCKY STATE SCIENCE EDUCATION STANDARDS** These activities will address aspects of Kentucky State Standards from Interdependence, the sub-domain “Unifying Concepts”  
SC-HS-4.7.1: Students will analyze relationships and interactions among organisms in ecosystems.  
SC-HS-4.7.2: Students will evaluate proposed solutions from multiple perspectives to environmental problems caused by human interaction AND justify positions using evidence/data.  
SC-HS-4.7: Propose justifiable solutions to global problems.

**MATERIALS** Students will create an aquatic environment in which an oil spill occurs. They must then develop a method to clean/contain the oil.

*Must have the following:*

- goggles
- newspaper or other table cover
- motor oil
- graduated cylinder
- water
- paper towels
- small rocks
- feathers\*
- fake fur\*
- plants\* (Elodea or plastic)

*\*These represent the biotic parts of the ecosystem and substitutions can be made. Fake fur can be obtained from a craft shop. Carolina Biological Supply carries real fur swatches as do many hunting/fishing stores and some craft stores.*

*Materials for cleaning/containing oil spill. This will be based on your students' creativity. The following are supplies requested by my students:*

- sponges
- gauze
- tulle or other netting material
- straws
- string
- detergent (any soap will do but students specifically asked for Dawn®)
- styrofoam cups
- sand
- coffee filters
- fish tank brush
- fish tank net

*Dawn® is a registered trademark of Proctor & Gamble*

**SAFETY** Students should wear goggles and never eat or drink in a lab. Some students may want to try to burn the oil off the water. Motor oil will not burn. Teachers may elect to use a flammable petroleum product, but this should be done with caution!

**PREPARATION AND PROCEDURE** Teacher will need to gather materials and photocopy student lab papers. Fur, feathers and plants such as Elodea are suggested but may be altered. Teacher should also view all websites to be sure they are still active.

### **ACTIVITY 1**

*Internet access required.*

**Teacher Tip:** *This activity can be done first or last! I did it first to generate interest in petroleum spills. It also allowed me to clarify what fossil fuels are and how we obtain them. Many students were unaware that crude oil comes from the ground and is used to make gasoline. Most of my students were unfamiliar with the term “fossil fuels.” This also allowed me to lead them into a discussion of nonrenewable resources.*

**PREPARATION  
AND  
PROCEDURE**

1. Students will research the Arctic National Wildlife Refuge (ANWR). This can be done in class or as homework prior to class.
2. Students must list 3 reasons we should drill for oil in the ANWR and 3 reasons we should not.
3. Class discusses findings and compares ideas.
4. Have students explore the following sites. The first sites listed under each category have good information but require a lot of reading. The two movies can be shown to the class from a projector if your classroom has that capability. The movies cover a variety of material including the native Eskimo populations' opinion of drilling in the ANWR. There are two major tribes in the ANWR; one tribe supports oil drilling in the region and the other is against it:
  - *Pro ANWR drilling:*  
<http://www.anwr.org/case.htm>  
<http://www.anwr.org/flash.htm> (movie)
  - *Against ANWR drilling:*  
<http://web.ecs.baylor.edu/faculty/newberry/myweb/Ethics/Web%20Pages/seward/dangers.htm>  
<http://www.arcticwildlife.org/arcticflash.htm> (movie)
5. Students are then asked to have parents comment on activity (as homework). This allows students to get their parents' input and it more actively involves parents in student learning. Students may ask parents, grandparents or in special cases, students may be allowed to ask faculty members.

**ACTIVITY 2**

Students should be put in groups of 2-3 as described in the diversity/equity strategies. The teacher will build an aquatic environment and then "spill" oil in it. Students will observe oil spill and devise method for cleaning.

***Teacher Demonstration:***

1. Give students their lab sheets. Have someone in the class read the introduction allowed. When the lab paper instructs students to watch teacher demonstration, do the following.
2. Cover work station with newspaper. This will help minimize clean up.
3. Fill pie pan half way with water.
4. Add small rocks, feathers, fur and plants to make your aquatic environment complete.
5. Measure 10 ml of motor oil.
6. Pour oil into aluminum pie pan (shake slightly to imitate wave action).
7. Have students (in their assigned groups) examine the pie pan and answer the questions below:
  - a. Can the oil now be separated from the water? What percentage of the oil could be removed? How will students determine the amount? (be specific)

**PREPARATION  
AND  
PROCEDURE**

- b. Each group will devise a method for extracting the oil from the water.
- c. On a piece of loose leaf paper, have each group write their experimental design for cleaning the oil spill. Make sure groups include a hypothesis statement and have everything approved by the teacher before they begin. Students' designs should explain how they will determine the amount of oil removed and the materials they will need.
- d. Activity 3 can be started immediately after instructor approves design or may wait until the next day (especially if materials need to be gathered)

**ACTIVITY 3**

Students will now implement their experimental designs to clean/contain the oil spill. Each group will receive the following:

<i>goggles</i>	<i>newspaper</i>
<i>aluminum pie pan</i>	<i>water</i>
<i>motor oil</i>	<i>graduated cylinder</i>
<i>paper towels</i>	<i>small rocks</i>
<i>fake fur</i>	<i>feathers</i>
<i>plants</i>	<i>student lab sheet (last page)</i>
<i>student selected materials</i>	

Students will be creating an aquatic environment just like the teacher demo and then cleaning the ecosystem. Students should wet a feather and a fur piece then allow them to dry naturally. These can be used for comparison after students clean their "wildlife."

**ACTIVITY 4**

*Internet access required.* Students will complete an Internet Treasure Hunt to learn more about oil spills and the effects on the environment, along with present methods to correct oil spills. The scavenger hunt is found in the student section.

*Lab materials from Activity 3 may be required.*

After learning more about oil spills, students will evaluate their previous designs for pros and cons of their clean up method. Students are asked to redesign or tweak their previous experiment design. Instructor can design if redesign is sufficient or if students should implement new design. This will affect time required for activity

Students will self test on a "game show" on the Quia website listed below:  
<http://www.quia.com/rr/239636.html>

**WHERE TO GO  
FROM HERE**

- Further examine bioremediation.
- Examine pros and cons of alternate energy sources.
- This unit could segue into another unit dealing with burning fossil fuels, global warming, and the Kyoto Protocol.

**SUGGESTIONS FOR ASSESSMENT** *Material needed: Poster paper, markers, glue, and scissors.*

***Students will make posters following this format:***

1. Divide poster board into four sections. These sections do not need to be equal as different amounts of information will be inserted into each section (this could also be done as independent slides should instructor elect to have students do Power Point projects).
2. In section one, students should explain the dangers oil spills pose to ecosystems and discuss the difficulty in containing/cleaning crude oil.
3. In section two students should place a copy of their lab design
4. In section three students should explain present methods employed for oil spills and discuss how their designed addressed these

In the last sections have students make a chart showing recent oil spills and pipeline leaks. "Recent" can be at the teacher's discretion. During fall 2007 there were 2 oil spills which occurred and a pipeline leak. My students found information on in these in the newspapers.

***Reflection paper:***

Students found themselves torn between wanting to protect ANWR (which means importing more oil) and wanting to stop oil spills (perhaps more pipelines and domestic oil use). Many were shocked at the amount of oil we use each day. Most students wanted to know why the U.S. wasn't actively pursuing alternate energy sources. Students should write a reflection paper expressing their thoughts ideas. Ideally this paper should have scientific merit and so it needs to site sources. Bonus credit could even be given to students for researching alternative energy viability.

***Other:***

Students can be graded for participation in lab design also for thoroughness of design. Each group can also do a mini-presentation on what they learned from the scavenger hunt.

**REFERENCES AND RESOURCES**

1. *Arctic Wildlife*  
<http://www.arcticwildlife.org/flashintro.htm>  
A short Flash movie introduction on the issues in the Arctic National Wildlife Refuge produced by members of the Alaska Coalition. Accessed February 19, 2008.
2. *Drilling in Sensitive Ecosystems*  
<http://web.ecs.baylor.edu/faculty/newberry/myweb/Ethics/Web%20Pages/seward/dangers.htm>  
A website from an engineering ethics course at Baylor University by John Seward, who explains the dangers and problems of drilling in the ANWR. Accessed February 19, 2008.
3. *Ecological Pollution: Oil Spills*  
<http://www.quia.com/rr/239636.html>  
A quiz game on the effects of oil spills on marine life and possible clean up methods. Online activity created by the author, Jonni Miller, and hosted by the Quia Corporation. Accessed February 19, 2008.

**REFERENCES  
AND  
RESOURCES**

4. *The Effects of Oil on Wildlife*  
[http://www.amsa.gov.au/marine\\_environment\\_protection/educational\\_resources\\_and\\_information/teachers/the\\_effects\\_of\\_oil\\_on\\_wildlife.asp](http://www.amsa.gov.au/marine_environment_protection/educational_resources_and_information/teachers/the_effects_of_oil_on_wildlife.asp)  
This website gives wonderful information about the affects of oil spills on wildlife but may be more difficult for students to read. Accessed on February 19, 2008.
5. *Habitat Assessment and Marine Chemistry: Contaminants and Oil*  
<http://www.afsc.noaa.gov/abl/OilSpill/oilspill.htm>  
This site describes the Exxon Valdez oil spill plus the long term effects from the spill. From the Alaska Fisheries Science Center. Accessed on February 19, 2008.
6. *Making the Case for ANWR Development*  
<http://www.anwr.org/case.htm> (movie: <http://www.anwr.org/flash.htm>)  
This website from the *Arctic National Wildlife Refuge* describes the case for supporting drilling in the refuge. Accessed on February 19, 2008.
7. *Oil Spills*  
[http://library.thinkquest.org/CR0215471/oil\\_spills.htm](http://library.thinkquest.org/CR0215471/oil_spills.htm)  
This is another educational source about the affects of oil spills on wildlife. Accessed on February 19, 2008.

*Materials and the general design for this lab can be found in many lab books and internet websites. The following are examples:*

8. *Middle School Experiment*  
<http://www.epa.gov/emergencies/content/learning/midlab.htm>  
From the U.S. Environmental Protection Agency Emergency Management. Accessed on February 19, 2008.
9. *Oil Disaster Lab, Scientific Investigation of Natural Phenomena*  
<http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/sc5oil.htm>  
From the North Central Regional Educational Laboratory. Accessed on February 19, 2008.
10. *Oil Spill Lab*  
<http://misterguch.brinkster.net/MLX030.pdf>  
An oil spill lab from a collection of chemistry labs hosted at Cavalcade o' Chemistry (<http://misterguch.brinkster.net/chemfiestanew.html>), produced and copyrighted by Ian Guch. Accessed on February 21, 2008.



**Student Lab Sheet**  
**Environmental Pollution**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Introduction**

You are a young seal pup swimming in a shallow tide pool. Although you are only about two weeks old, your mother has left you alone to go feed on squid and fish in the open. You begin to notice a change occurring in the water. A dark black film appears; it accumulates in places like your tide pool. Your fur is covered with a black, sticky coating. Within days some of the young seal pups begin to die from hypothermia. The oil has destroyed the insulating ability of your fur (lanugo). Some of the pups drown because they are unable to swim.

**What has happened?** An oil spill has drifted to where you live.

Oil spills and oil runoff can wreak havoc on a marine ecosystem. Oil spills can happen when people are careless and tankers wreck. Some people dump oil illegally. Equipment for transporting oil can be faulty or leaking. Oil spills can cost hundreds of thousands of dollars to clean up or contain. They can damage ecosystems and cause death to both plants and animals.

You are no longer a seal pup. Now you are an environmental scientist. In this activity you will explore the dangers of oil spills and the struggle with cleaning/containing them. Watch your teacher for a demonstration on oil spills and aquatic environments

**ACTIVITY 1**

With your group, decide how best to treat both the oil spill and the wildlife affected. You will design an experiment to test your idea. Remember you must also determine how you will calculate the percentage of oil removed from the spill.

**Write your hypothesis:**

**Design your experiment.** Make sure you have teacher approval before beginning experiment.

**Teacher approval signature** \_\_\_\_\_

**Materials:**

goggles  
newspaper or other table cover  
motor oil  
graduated cylinder  
water  
paper towels

small rocks  
feathers\*  
fake fur\*  
plants\* (*elodea* or plastic)

*\*These represent the biotic parts of the ecosystem and substitutions can be made.*

Materials for cleaning/containing oil spill (this will be based on your own creativity).

**List materials needed:**

Remember to wear goggles and tie long hair back before beginning any lab experiment. Do NOT eat or drink while conducting experiment. Clean up any mess and report spills to teacher. Wash your hands thoroughly with soap and warm water when you are done.

1. Cover work station with newspaper. This will help minimize clean up.
2. Fill pie pan half way with water.
3. Add small rocks, feathers, fur and plants to make your aquatic environment complete. This represents wildlife.
4. Students should wet a feather and a fur piece then allow them dry naturally. These can be used for comparison after students clean their “wildlife.”
5. Measure 10 ml of motor oil.
6. Pour oil into aluminum pie pan. Shake gently to simulate wave action,
7. List any observations you make during the experiment below.

**Observations:**

**Analysis:**

1. What percentage of the oil were you successfully able to clear?
2. How is the “wildlife” in your pie pan?
3. Observe the feathers specifically. Do they look like they did before you spilled oil on them? Do they look like the feather that was wet with just water?
4. Do you think your method would work for a large spill in the ocean? Why or why not?
5. What will happen to the oil that you were not able to remove? Will it eventually have to be cleaned? Why or why not?
6. If you left oil behind accidentally or if you chose to just contain the oil and not remove it, what would happen to this oil during a storm? Shake your pie pan just enough to emulate the strong waves a storm might bring. Will your containment method withstand normal storms?

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**ACTIVITY 2: Internet Treasure Hunt**

Americans are dependent on oil for many things. We use approximately 20 million barrels of oil a day. That amounts to about 30% of the world's oil reserves, yet our country produces only about 3% of the world's oil. Therefore much of this oil has to be transported across the ocean. Alaska and Texas are the largest sources of U.S. oil. Although Alaska is part of the United States, it is far from the mainland. The oil in Alaska must be transported through a pipeline.

What happens when there are oil spills in the ocean or pipeline leaks? Have you ever considered how difficult it would be to clean 100,000 gallons of oil spilled into lakes or the ocean? Go to the websites listed on the following worksheets and find the information to answer the following questions. You may NOT select sites of your own!

This web info search will help you find information about how oil spills affect wildlife. You will be looking at pre-selected web sites to answer each question. It is important to not only find the information at the site, but also to consider who wrote the site, what their purpose is in writing it, and how credible (accurate) you think the information is.

<b>Question 1: How does an oil spill affect wildlife?</b>		
	<b>Site 1</b> <i>Effects of Oil Spills on Wildlife and Habitat</i> <a href="http://alaska.fws.gov/media/unalaska/Oil%20Spill%20Fact%20Sheet.pdf">http://alaska.fws.gov/media/unalaska/Oil%20Spill%20Fact%20Sheet.pdf</a>	<b>Site 2</b> <i>How Oil Affects Birds</i> <a href="http://www.ibrrc.org/oil_affects.html">http://www.ibrrc.org/oil_affects.html</a>
Who created this web site (organization, etc.)?		
Why did they create it? (check all that apply)	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure
How credible (accurate) do you think the info is?	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure
What did you learn?		

**Internet Treasure Hunt**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

This web info search will help you find information about how oil spills affect wildlife. You will be looking at pre-selected web sites to answer each question. It is important to not only find the information at the site, but also to consider who wrote the site, what their purpose is in writing it, and how credible (accurate) you think the information is.

<b>Question 2: What is petroleum and how is an oil spill treated?</b>		
	<b>Site 1</b> <i>Responding to Oil Spills</i> <a href="http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic_topic%29=entry_id,subtopic_id,topic_id&amp;entry_id(entry_subtopic_topic)=184&amp;subtopic_id(entry_subtopic_topic)=8&amp;topic_id(entry_subtopic_topic)=1">http://response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY%28entry_subtopic_topic%29=entry_id,subtopic_id,topic_id&amp;entry_id(entry_subtopic_topic)=184&amp;subtopic_id(entry_subtopic_topic)=8&amp;topic_id(entry_subtopic_topic)=1</a>	<b>Site 2</b> <i>Oil Spills and Disasters</i> <a href="http://www.infoplease.com/ipa/A0001451.html">http://www.infoplease.com/ipa/A0001451.html</a>
Who created this web site (organization, etc.)?		
Why did they create it? (check all that apply)	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure	<input type="checkbox"/> To provide factual information <input type="checkbox"/> To influence the reader's opinion <input type="checkbox"/> To sell a product or service <input type="checkbox"/> I'm not sure
How credible (accurate) do you think the info is?	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure	<input type="checkbox"/> Very accurate <input type="checkbox"/> Somewhat accurate <input type="checkbox"/> Not very accurate <input type="checkbox"/> I'm not sure
What did you learn?		

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**ACTIVITY 3: Experiment Re-design and Poster Making**

Review the information you just learned about oil spills. Now consider your method for extracting the oil from water (from activity 1). Would this work on a large scale to clear and oil spill like the Exxon Valdez? Discuss reasons your method would work AND reasons it would not.

Reasons our method would be useful:

Reasons our method would not work:

Analyze your method for treating the oil spill. Based on what you have learned how can you improve your experimental design? Rewrite your design in the space below but include any modification to the experiment.

**ACTIVITY 4: Test Your Knowledge**

Go to the following website and test what you have learned about oil spills and the environment: <http://www.quia.com/rr/239636.html>