Simulating an Oil Spill to Understand Environmental Impact

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This issue of *The Earth Scientist* celebrates AGI's Earth Science Week. This year's theme is Earth and Human Activity. The *It's Elementary* column features a professional development video guide (https://www.teachingchannel.org/videos/natural-resources-lesson-plan) from the Teaching Channel that accompanies a grade 5, week-long unit from NSTA Press® Picture-Perfect Science Lessons. The overall unit is described in this article from NSTA's *Science and Children* journal (http://www.nsta.org/publications/news/story.aspx?id=50302). The unit was vetted by NSTA curators and is congruent with the Next Generation Science Standards.

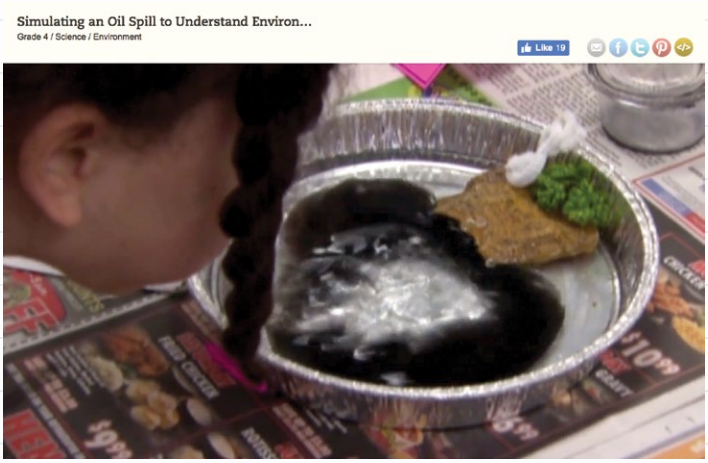

Figure 1 (above). Simulating an Oil Spill Video Guide


Teaching through Trade Books
Activities inspired by children's literature

Oil Spill

An oil spill occurs somewhere in the world almost every day of the year, and the consequences can be devastating. In this month's column, students explore the effects of oil spills on plants, animals, and the environment and investigate oil spill clean-up methods through a simulated oil spill.

This Month's Trade Books

Prince William
By Gloria Rand.
Illustrated by Ted Rand.
32 pp. Henry Holt. 1994.
ISBN 080503384X.

Synopsis

In Alaska's Prince William Sound, a young girl named Denny finds an oil-coated baby seal on a polluted beach. She rushes the pup to a makeshift rescue center set up to help wildlife affected by the Exxon Valdez oil spill. As Denny follows the seal's recovery over the next 10 weeks, she learns about the intense volunteer efforts to clean up the harbor and rehabilitate oiled animals.

Oil Spill!
By Melvin Berger.
Illustrated by Paul Mirocha.
32 pp. HarperTrophy. 1994.
ISBN 0064451216.

Synopsis

Focusing on the 1989 Exxon Valdez oil spill, the simple text and colorful illustrations of this Let's-Read-and-Find-Out Science book describe why oil spills occur and how they are cleaned up. *Oil Spill!* provides information about actual clean-up techniques such as containment booms, skimmers, oil-absorbing pads, burning, chemical dispersants, hot-water sprays, and oil-eating bacteria. A section at the end suggests ways to prevent oil spills.

Curricular Connections

The United States is the largest per-capita consumer of oil in the world. While it is important to understand the causes of oil spills and their effects on the environment, students should also know that the reason we run the risk of oil spills is because our highly technological society relies heavily on oil-based products.

Students might not be aware of the many ways we use oil, besides fueling our vehicles and heating our homes. We also use it to lubricate machinery, to make asphalt for paving our roads, and to make plastics, medicines, ink, fertilizers, pesticides, and paints. Because we use huge quantities of oil, it must be stored and transported in large volumes.

Spills can be caused during storage or transport by people making mistakes or being careless; deliberate acts of war, terrorism, vandalism, or illegal dumping; equipment breaking down or leaking; or natural disasters such as hurricanes. Large oil spills like the Exxon Valdez spill depicted in the featured trade books make headlines, but most of the oil that pollutes aquatic environments each year comes from nonaccidental sources such as drain disposal and road runoff.

This month's trade book selection pairs a fictional story with a narrative informational text. The emotionally engaging story, *Prince William*, "hooks" the readers as they learn about how a baby seal is rescued from the Exxon Valdez oil spill. After reading *Prince William*, students can learn more about oil spill clean-up efforts by reading *Oil Spill!*

The *National Science Education Standards* indicate that students in grades K–4 should understand that pollution is a change in the environment that can influence the health, survival, or activities of organisms, including humans (NRC 1996). Likewise, the *Standards* suggest that students in grades 5–8 should understand the risks associated with chemical hazards such as pollutants in water. Students in these grades should also have experience designing and conducting a scientific investigation. The activity for grades 5–8 combines these two standards as students design investigations to test the effectiveness of various oil spill clean-up materials.

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Figure 2 (right). Unit described in NSTA *Science and Children* journal article, posted online for free

In the video guide, the teacher describes how the 5E instructional model (Engage, Explore, Explain, Elaborate, Evaluate) is used to organize the lesson. To engage the students, 4th/5th grade teacher, Alicia Barrows reads the fiction book, *Prince William*, to her students. The story centers on the effects of the Exon Valdez oil spill. She works with her reading specialist to use appropriate questioning strategies as she discusses the book with students. To explain, Ms. Barrows reads the nonfiction book, Oil Spill, together with her students. The book discusses how an oil spill takes place and the methods that can be used to clean it up.

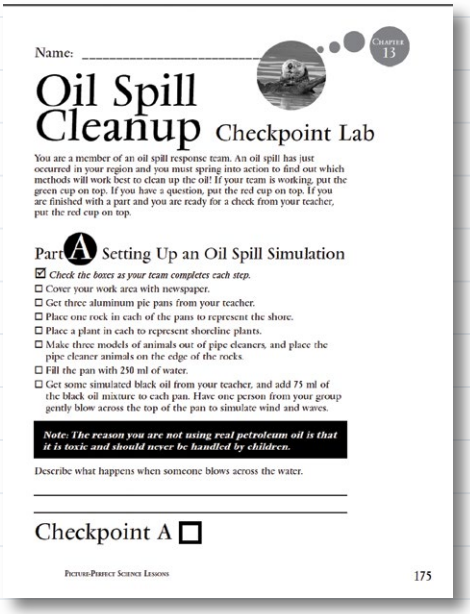
In the next 5E phase, students explore by simulating an oil spill in a pan, that represents model islands surrounded by water. They begin by exploring the properties of oil on water and then exploring various tools to clean up the oil. Students form ideas about which tool works best and the best way to use the tool. Then they design an experiment to test different clean up methods, collecting data and analyzing the effectiveness of the methods. After completing their experiments, student groups explain what happened.

In the elaborate phase, Ms. Barrows rereads the first parts of the two books she began with and discusses issues like how animals are rescued. Student imagine that they are animal rescuers and write a short, illustrated story of how they would rescue an animal from an oil spill.

For the evaluate portion of the unit, students write letters to animal rescue workers and think about ways they can help reduce oil spills. The letters are evaluated with a rubric that requires students to demonstrate their understanding of what they know about oil spills. This unit raises student awareness about the environment. Students suggest that using less oil, will lead to less tankers needing to transport oil and think about ways to reduce their use of oil in their daily lives, such as asking their parents to drive them less places.

Student handouts to accompany the oil spill investigation are posted online at no cost (http://www.nsta.org/images/news/legacy/sc/0503/OilSpill.pdf).

This resource targets grade 3-5 performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts. Further details can be found at NSTA's NGSS hub (http://ngss.nsta.org/Resource.aspx?ResourceID=65).



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CHAPTER 13

Oil Spill Cleanup Checkpoint Lab

You are a member of an oil spill response team. An oil spill has just occurred in your region and you must spring into action to find out which methods will work best to clean up the oil! If your team is working, put the green cup on top. If you have a question, put the red cup on top. If you are finished with a part and you are ready for a check from your teacher, put the red cup on top.

Part A Setting Up an Oil Spill Simulation

☑ *Check the boxes as your team completes each step.*

- ☐ Cover your work area with newspaper.
- ☐ Get three aluminum pie pans from your teacher.
- ☐ Place one rock in each of the pans to represent the shore.
- ☐ Place a plant in each to represent shoreline plants.
- ☐ Make three models of animals out of pipe cleaners, and place the pipe cleaner animals on the edge of the rocks.
- ☐ Fill the pan with 250 ml of water.
- ☐ Get some simulated black oil from your teacher, and add 75 ml of the black oil mixture to each pan. Have one person from your group gently blow across the top of the pan to simulate wind and waves.

Note: The reason you are not using real petroleum oil is that it is toxic and should never be handled by children.

Describe what happens when someone blows across the water.

Checkpoint A ☐

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Figure 3. Oil Spill Clean Up handouts from NSTA Press® Picture-Perfect Science Lessons.

Table 1: Grade 3-5 performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts congruent with *Simulating an Oil Spill to Understand Environmental Impact*

Performance Expectation

5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Science and Engineering Practices
• Use data to evaluate and refine design solutions. • Obtain and combine information from books and other reliable media to explain phenomena.
Disciplinary Core Idea
• Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.
Cross-Cutting Concepts
• A system can be described in terms of its components and their interactions. • Patterns can be used as evidence to support an explanation.

For additional NGSS resources, visit NGSS@NSTA (http://ngss.nsta.org/).

Find out more about NSTA's Picture-Perfect Science Lesson series (http://www.nsta.org/publications/press/picture.aspx)