

ALASKA OIL SPILL CURRICULUM

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EXXON VALDEZ OIL SPILL PATH



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INVESTIGATING OIL SPILLS

BY: Belle Mickelson

EXTENSION: Geography & Language Arts

DURATION: Three 45 minute periods

OBJECTIVES: Students will discuss the Exxon Valdez oil spill and other recent spills. Students will view video footage about the Exxon Valdez oil spill. Students will begin collecting articles about oil spills and other energy issues. Students will begin journals as they plan for a visit (imaginary in most cases) to southcoastal Alaska.

BACKGROUND: Good Friday, March 24, 1989, the tanker Exxon Valdez hit the rocks of Bligh Reef spilling 11 million gallons of oil on the waters of Prince William Sound. The oil continued on down the coast eventually touching over 1,000 miles of beaches including those of the Alaska Peninsula and Kodiak Island. Exactly what happened varies with the news source. In this activity students will begin individual journals reflecting their feelings about the oil spill - and their hopes for the future.

PROCEDURE:

1. Ask the students what they know about the Exxon Valdez oil spill. Pass out the Alaska Department of Fish and Game "Special Oil Spill Issue," sample news articles, and any other magazines containing articles on the oil spill (see appendices at end of curriculum). Note differences in the reports of what was happening.

2. Announce a "trip" to Prince William Sound to see what is going on this year. Have each student make a journal and write out their first impressions about the spill.

3. Introduce the video Voices of the Sound. This video was made by Mike Lewis and David Grimes shortly after the spill happened. Footage by Joel Bennett at the beginning shows the beauty of Prince William Sound and its wildlife. This video was produced for an adult



MATERIALS:

- Alaska Fish & Game "Special Oil Spill Issue"
- News clippings, magazine articles
- Videos on the Exxon Valdez oil spill
- Other materials available in your local library, museum, or news service
- Paper and covers or notebooks to make journals
- Markers/colored pencils
- Map of Alaska
- Blackboard
- Bulletin board

INVESTIGATING OIL SPILLS

audience, but has been shown very successfully in elementary schools. Terms to mention beforehand include CDFU (Cordova District Fishermen United) whose role in the spill is described in an article in the back of the curriculum. Have the students point on the map to the Sound communities. Cordova is a fishing community; Valdez has oil and tourism industries in addition to fishing; Whittier has tourism and fishing; Chenega and Tatitlek are Native fishing communities which depend upon subsistence hunting and fishing. Outside the Sound, impacted communities include Kodiak, the country's largest fishing port, Seward, Homer, Seldovia, Port Graham, English Bay, on the Kenai Peninsula, and other small villages along the Alaska Peninsula. Ask the students how they would feel if their beaches (ocean, rivers, lakes) were oiled? Then show Voices of the Sound to see how the Cordova fishermen and women felt. Have one of the students read the Cordova City Manager's statement from the articles included at the back of the curriculum, then write some of their impressions in their journals.

4. Show the ARCO and ALYESKA videos. These describe environmental considerations, some of the cleanup procedures and the industry's revised response system for a spill. Explain that, later, students will be studying a variety of clean-up techniques.

5. Encourage students to clip current events about oil spills in their state and in other countries around the world for a class bulletin board.

6. Hand out 5" x 10" cards to each student. Ask students to summarize the three videos they just saw. Collect the cards and evaluate the students' understanding.

EXTENSION:

1. Geography/language arts: Write letters to foreign newspapers asking for articles about the Exxon Valdez oil spill — and oil spills in their country. Research in your library/museum for articles about spills around the world (Suggested by Margaret Ladd, Homer, Alaska).

2. Language Arts: Invite a reporter into class to describe investigative journalism/reporting. Ideally, interview a reporter that worked on the spill or watch video footage made by a news team such as America's Biggest Oil Spill (see appendices).

BIRTHDAY CAKE

BY: Bonnie Jason and Trisha Herminghaus

EXTENSION: Art, Science, Language Arts, Math

DURATION: 1 hour

OBJECTIVES: Students will understand the energy involved in making the ingredients for a birthday cake or other simple food item.

BACKGROUND: March 24, 1990, was the one year anniversary (birthday) of the Exxon Valdez oil spill. It was a tragic event that we do not want to celebrate - but instead, remember for the lessons we can learn. Our oil resources are very precious as is shown by the many oil products we use just to make a cake. Hopefully, by working together we can conserve energy, reduce our need for oil, and prevent more oil spills. This activity is greatly enhanced by showing the movie Toast which describes the energy used to provide the consumer with one slice of toast.



MATERIALS:

- Cake recipe
- Cake or cake ingredients
- Easel paper or blackboard
- Marker or chalk
- Toast movie

PROCEDURE:

1. Begin by brainstorming about the ingredients for a cake, or by breaking the class into small groups to brainstorm a list of ingredients. Compile these lists on the easel or blackboard.
2. From the list, brainstorm what happens to these ingredients in order to make them available to the consumer. Choose one ingredient to demonstrate to the class. For example: sugar= grow cane - harvest - store - transport - process - package - transport - shelve - sell. Have the small groups work in the other ingredients.
3. Once these lists have been compiled, discuss and outline the energy involved at each step. For example:
 - 1) sugar: grow cane - oil and gas for equipment, planting for growing, and fertilizing.
 - 2) harvest - gas and oil to run harvesting equipment, human power.
 - 3) storage - electricity to light, heat or cool.
4. Once again, outline one ingredient as an example then break into small groups. Assign each group 3 or 4 ingredients.

BIRTHDAY CAKE

5. Eat the cake (or make a cake to eat!). Ask the students if it tastes different now that they know how much oil it took to make the cake. Also, imagine trying to do all this by themselves - growing and grinding the wheat, keeping chickens for eggs and cows for milk. What did people in their area do in the old days?
6. Show the movie Toast. Discuss what it takes to get a piece of bread on the table.
7. Have students describe their feelings and reactions in their journals. If the students want to, share their comments.

EXTENSIONS:

1. Art: Draw pictures or design collages to illustrate the energy used to provide consumers with one ingredient.
2. Science: Research cake making to find actual energy use. Write to companies for information. Visit a farm, processing plant, packaging plant, transporting company or store to further investigate energy use. Have the students analyze their parent's grocery lists and estimate energy used to provide the items. The students can attempt to grow, package and sell an item and analyze the energy used as a class project. Try using both normal and alternative energy sources.
3. Language Arts: Students can write and perform a play to show how energy is used to supply consumers with various items. Have students write a newspaper report describing this process, or do a news program. Students can illustrate timelines that describe this process. They can write to related companies and industries to ask for more information.
4. Math: Develop charts and graphs to illustrate energy used in supplying consumers with the ingredients to make a birthday cake or piece of toast. Develop word problems based on the information in the study.

WHERE HAS ALL THE ENERGY GONE?

Adapted from: Energy - It's Everywhere, by Peg Willett; Energy Alternatives Program, SALRM, University of Alaska, Fairbanks.

EXTENSION: Science/Social Studies & Language Arts

DURATION: 3 days (40 min. per day)

OBJECTIVES: Students will investigate the changes in energy consumption from generation to generation. Students will conduct an energy interview with someone at least one generation removed from their own (two or three generations apart is even better).

PROCEDURE:

1. Ask the students to list which forms of energy were used in the past. Show them the Foxfire type books (examples of student interviews of older generations). Explain to students that they will be interviewing an elder (perhaps their grandparent) to find out which types of energy they used when they were growing up. They will need to get information on the type of energy and how much was needed for daily living. Review the interview questions with the students. Discuss interview techniques. Talk about ways to make the person being interviewed feel at ease. Suggest that they photograph the person they are interviewing (with permission). Close up photographs are best. Try to have the person holding something or doing something, i.e. using a canoe paddle, holding a basket.

2. Have each student prepare a chart comparing the results of their interview. Have their own or current energy uses listed, then their parents and then their grandparents.

3. As a class prepare a pie chart showing the differences in energy use.

4. Discuss current and future consequences of an increase in non-renewable energy use.



MATERIALS:

- Paper
- Pencils
- Camera and film (optional)
- Chart paper
- Felt-tip markers
- Foxfire type books (optional)
- Worksheet: Energy in the Past

WHERE HAS ALL THE ENERGY GONE?

5. Have someone who lives without either running water or electricity talk to the class. Ask questions and discuss the similarities and differences between: this lifestyle now and in the past. Have the students imagine how it would be to live without running water or electricity. **Sample questions to ask your guest:**

How do you obtain water? What do you use for light? How does the cost of electric lights compare with propane? Kerosene? What do you do for entertainment? Do you wish you had a television set? Do you have a car? If so, how do you warm it up without electricity in the winter? How do you keep food from spoiling? What are the costs and benefits of living this way?

Add this information to the chart, where applicable.

6. Plan a “pioneer day” in class. Use candles, haul water, share books, have individual slates with chalk to write on (these can be made by wrapping black tape on cardboard).

EXTENSIONS:

1. Science/social studies: Here are some field trip ideas: municipal utility company, power plant, cabin without electricity or running water, house with all modern conveniences, solar or alternative energy home, waste water treatment plant, landfill.

2. Language arts: Have students write themes about the day the power went off in their community.

ENERGY IN THE PAST

An Interview

Name of person being interviewed: _____ Age: _____

Date today: _____

Student name: _____

1. How did you heat your home? _____

What kind of fuel did you use for heating and cooking? _____

2. What did a workweek consist of in days and hours? _____

3. How did you obtain the necessary things: food, clothing, medicines, etc.? _____

4. What kind of work did you do? _____

What did you get as a result of your work? _____

Did your family own a car? _____

If so, do you remember the make of the car and the cost of fuel? _____

If not, how did you get from place to place? _____

5. What kinds of entertainment did you enjoy? _____

6. What was clothing made of? _____

How did you wash your clothes? _____

How did you dry your clothes? _____

How would you heat your water? _____

7. What were the 3 foods which you ate the most? _____

Did they come in packages? _____

If so, what were they like? _____

ENERGY IN THE PAST

Did your home have running water? _____

How did you keep food from spoiling? _____

8. If you went to school, what were the eating facilities like at your school? _____

What were your school supplies? _____

If you didn't go to school, where and from whom did you learn? _____

9. How was your home lighted? _____

Did you have electrical appliances? _____

If so, what were they? _____

10. Did your family travel for fun? _____

Did your family travel as a way of life? (for example - to hunt and find food)

Did you travel on roads? _____

If so, what were the the roads like? _____

If not, what did you travel on? How did you find your way? _____

11. If you went to school, what happened to your old schoolhouse? _____

12. How did the car change your village, town, or city? _____

How did snowmachines, and motorboats change your village, town or city? _____

13. What changes do you like the most? _____

14. What changes do you like the least? _____

OIL IN YOUR COMMUNITY

Adapted from: The Alaska Sea Week Curriculum Guide Vol. 7, by Belle Mickelson

SUBJECTS: Language arts, science, social studies

DURATION: 1 period plus homework

OBJECTIVES: Students will investigate oil use in their community. Students will make a list of products made from oil. Students will take a field trip around the community to investigate oil use. Students will plan an education program about oil conservation and use.

BACKGROUND: Oil and its products are an integral part of our society, from transportation to plastics. Alaska is at the “end of the road.” Little recycling occurs here, and as a result, our dumps are filled with used oil products—many that are harmful to the environment. Oil is hazardous waste. Refer to DEC’s Changing Oil in Changing Times in the appendices. Plastics can be dangerous for animals. Birds mistake styrofoam pellets for food. Often these plastics are retained in their stomachs permanently, taking up room that is better used for food. A high percentage of Alaska seabirds have been found with plastics in their stomachs. Other birds and wildlife end up with plastics (such as monofilament fish nets) wrapped around their necks, cutting off their ability to breathe, eat and flee from predators.

PROCEDURE:

1. Discuss the role of oil in your community. Ask students: What is our source of energy for electricity? for heating? for cooking? to run cars? and buses? How many products do we use in school that are made from oil? (List plastics, styrofoam, movie films, synthetic fabrics, as well as gas and oil). Pass out the Petroleum Tree worksheet to help in making the list. Assign the class to inventory their homes for products made from oil.
2. Pass out old magazines. Have students cut out pictures of oil products for a bulletin board. Use felt-tip markers for picture captions.



MATERIALS:

- Chart paper
- Pencils
- Camera and film
- Old magazines
- Scissors
- Felt-tip markers

Worksheets:

- Petroleum Products Checklist
- Home Energy Worksheet
- Community Energy Worksheet
- Petroleum Tree

OIL IN YOUR COMMUNITY

3. Have students complete the Home Energy Worksheet.
4. Have students make a class list of all the oil and oil-product messes (current and potential) around your community such as: old oil drums, oil storage tank leaks, oil pipeline leaks, gasoline spills at the gas pumps, kerosene that overflows when filling, propane leaks, discarded oil from boat motors, draining oil filters, crankcase oil from vehicles, and oil dumped by boats or ships. Discuss ways oil and oil products could be reused or disposed of properly. Add this information to your bulletin board.
5. Take a field trip around your community to look for oil products and messes. Remind students not to touch any oil they find as it is a toxic substance. Take notes and photograph your findings. Even the simplest camera will work for this exercise. Make sure students get close enough to their target and hold their breath, letting it out slowly as they snap the picture. Use prints to make posters, or create a slide show.
6. Complete the Community Energy Worksheet.
7. What can your class do to help? Remember, oil is a **non-renewable** resource. Once used up, we will not have any more. Discuss conservation. Ask the class for suggestions like the following: Re-use plastic bags; use cups that can be washed rather than styrofoam cups; be careful not to spill oil; reuse old oil for wood stove fire starter (mixed with sawdust, but be **very** careful) or for oiling tools; limit boat, car or snow-go trips to only necessary ones. Note that many communities have specific oil-dump sites where oil is placed in storage tanks and stored for later use as heating fuel. Contact the Alaska Department of Conservation if you have questions on oil disposal.
6. Plan an education program on local oil uses and misuses. Make up cartoons and posters or a slide show and present your findings and suggestions to other classes and the community.

PETROLEUM PRODUCTS CHECKLIST

Check and circle those products that you find in your home and school, or those industries you are involved in:

GASOLINE ___ solvents, lighting, leather industry, motor fuel, heating, dry cleaning.

KEROSENE ___ heating, lighting.

LUBRICATING OIL ___ sewing machine oil, knitting machine oil, engine oil.

RESIDUAL OIL ___ insulation, paint, paving, artists crayons, graphite

PARAFFIN ___ candles, matches, canning industry, wax paper, chewing gum.

GREASE ___ grease, cable grease, railway, track and transmission grease.

FUEL OIL ___ furnaces, power plants, locomotives, diesel engines, industrial establishments.

GAS OIL ___ fuel gas, absorption oil, illuminating gas.

SPECIAL OILS ___ medicinal oil, switch oil for electrical equipment.

ARTIFICIAL RUBBER ___ tires, druggist supplies, cements, clothing.

ALCOHOLS ___ cleaning, solvent, preservatives, acetic acid.

AROMATIC HYDROCARBONS ___ explosives, saccharine, antiseptics, perfumes, dye-stuffs.

FATTY ACIDS ___ butter substitutes, edible fats, soaps.

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HOME ENERGY WORKSHEET

1. How many kilowatts/month does your family use?
Collect one year's worth of data, or compare July's usage to December's usage.

2. Which appliance in your home uses the most energy?

a) Do you own:

- freezer
- refrigerator
- electric stove
- dishwasher
- microwave
- washer
- electric dryer
- hair dryer
- air conditioner
- electric fan
- TV
- stereo

b) Which could you do without?

3. a) Which types of energy does your family use?

ELECTRICITY ____ Name three uses: 1.
2.
3.

GAS ____ Name three uses: 1.
2.
3.

PROPANE ____ Name three uses: 1.
2.
3.

WOOD ____ Name three uses: 1.
2.
3.

OIL ____ Name three uses: 1.
2.
3.

b) Which costs the most to use?

HOME ENERGY WORKSHEET

4. Name three ways you could help reduce your family's energy consumption level

1.

2.

3.

COMMUNITY ENERGY WORKSHEET

1. a) What is the major source of energy in your community? _____ (diesel, coal, oil, gas, wood)

b) Where does it come from? _____ (i.e. barge, local source, etc.)

2. How do most businesses heat their space?

3. How do most homes heat their space?

4. What are the three most prominent types of vehicles in your community and their gas mileage?

_____m/g
_____m/g
_____m/g

5. How much do each of these types of fuel cost in your community?

electricity	¢ /kh.
oil	¢ /gal.
propane	¢ /lb.
gasoline	¢ /gal.
diesel	¢ /gal.
fuel oil	¢ /gal.

Which is most expensive?

6. Rank the three most important forms of transportation in your community and the cost of their fuel.

1. _____ \$ _____/gal.
2. _____ \$ _____/gal.
3. _____ \$ _____/gal.

7. If all oil products disappeared what things would be left in your community? (name 10)

COMMUNITY ENERGY WORKSHEET

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

EXTENSION: Begin collecting cost and consumption data and publish a quarterly graph in the school newspaper showing cost and consumption rates for your school and community.

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TRANSPORTATION

Adapted from: The Alaska Sea Week Curriculum Guide Vol. 7, by Belle Mickelson

DURATION: Minimum of 10 minutes one day, 40 minutes the next.

OBJECTIVES: Students will trace the origin of goods and services arriving in the community. Students will discuss transportation issues, considering energy conservation needs.

BACKGROUND: Studies have shown that 47 percent of Alaska's energy budget has gone for transportation. Alaskans are great travelers. Each year they log thousands of miles traveling to jobs, meetings, berry picking, hunting, fishing, and to visit friends and relatives in a state so big that it covers five time zones (though for convenience most of the state is now in one time zone). Additionally, most of Alaska's goods and supplies are transported from the Lower 48 by ship, truck or plane.

Each community has a unique transportation system, often consisting of boats, planes, ATVs, and snowmachines. Many communities are deciding whether to tie into the central road system, which would make it easier for them to "get to town," but would also make it easier for "town" to get to them.

PROCEDURE:

1. Ask students to list on the chalkboard different means of transportation. Circle the ones most important to your community.
2. List all the goods and services arriving in your community. Have students inventory the food and materials found at home and school, listing the states or country of origin.
3. Compile your results on the world map. On little slips of paper, write the names of the items on your list of goods imported into Alaska. Place these tags in countries or states on the map that export these products to Alaska. Connect these places to Alaska with yarn.



MATERIALS:

- Alaska map
- World map
- Chalkboard and chalk
- Yarn
- Felt-tip markers
- Thumb tacks
- Slips of paper

TRANSPORTATION

4. Point out on the Alaska map how these products get to your community.
5. Estimate the percentage of transportation that is water-dependent. Also estimate what percentage of the product's cost is from transportation. What would happen if fuel costs escalated tremendously? What would happen to transportation within your community? At what point would products from the "outside" be unaffordable? What jobs would be affected?
6. Have students pick a local transportation issue to explore. Is the barge, ferry or river-boat service adequate? Is your community expecting a new road, airport or harbor? Do you need additional trails along or to the beach, the river or a nearby lake? Are snowmachines and ATVs being used to carry and haul supplies as well as for recreation? Are there conflicts between people who use trails for skiing and hiking and people who drive motorized vehicles along them?
7. Does knowing about the world's need for energy conservation make a difference in the way you think on these issues? Students can collect information from a variety of viewpoints. Visit the site (if possible) and inventory and photograph what is there now; brainstorm alternative solutions; come up with a class solution; develop a plan to implement that solution, which may include talking to the decision makers, writing letters and/or a news article, preparing a slide show or charts and graphs. Discuss what will make the most impact. Often, just talking to the right person is more important than anything else. Then, implement your plan. Evaluate it afterwards. What would the class do differently the next time?

OOZING OIL

Adapted from: "Alaska Resource Kit: Minerals" and Alaska Tidelines

EXTENSIONS: Social Studies/Science, Science

DURATION: Three 40 minute periods

OBJECTIVES: Students will predict how oil is drilled, then read about drilling for oil. Students will build a working model of an oil well and understand how it operates. Students will discuss how oil is refined.



BACKGROUND: In addition to all the familiar animals in our oceans and lakes, there are billions of tiny one-celled animals and plants called plankton. In each miniscule body there are minute droplets of fats and oils (hydrocarbons). After dying, these bodies sink down to the bottom of the ocean. Over the centuries they pile up as layers of mud and ooze. During the rock-forming process these layers are squeezed which forces the drops of oil to move with the water in the sediment. The water and oil move upward to the high points in the layers, where there is a cap rock that halts further passage. It is here that the oil and water separate and the oil nestles in the tiny pores of the rock above the water. Gas usually accompanies the oil and can be found in the spaces in the rock above the oil. An oil field consists of sedimentary rock which is saturated with gas at the top, oil in the middle, and water below. Strike it rich in this activity by actually building your own oil well!

MATERIALS:

- Glass jar
- Dry sand and gravel
- 500 grams of plasticine or modeling clay
- Short length of rubber tubing attached to a funnel
- 2 metal or rubber tubes (slightly longer than the can) (wire screening should be taped with masking tape around the bottom of each tube)
- Can of water

Worksheets:

- From Pterodactyls to Petroleum
- Where Did That Oil Come From?
- Where Does That Oil Go?

PROCEDURE:

1. Read the background information to the students.
2. Distribute the worksheet From Pterodactyls to Petroleum: (Answers: 1-true; 2-true; 3-false; 4-true; 5-false; 6-true; 7-false; 8-true) Remind students that oil originates primarily from decayed plants (plankton), as well as from animals such as the pterodactyl. Mention that oil is a non-renewable resource—once used up, it is gone forever, or at least until more plants and animals decay. Each quart of oil took thousands and thousands of years to form. It really is black gold!

OOZING OIL

3. Place the tubes in the jar. Pack gravel and sand into the bottom half of the jar around the tubes. Firmly pack a 3 centimeter layer of plasticine on top of the gravel and seal tightly around both tubes and the edge of the jar. Fill the rest of the jar with sand. Attach the rubber tubing to one of the tubes. Pour the water slowly into the funnel. Raise the funnel higher above the jar to apply more pressure.

4. Make a sketch of the model and trace the path of the water. What happens as you apply more pressure by raising the funnel?

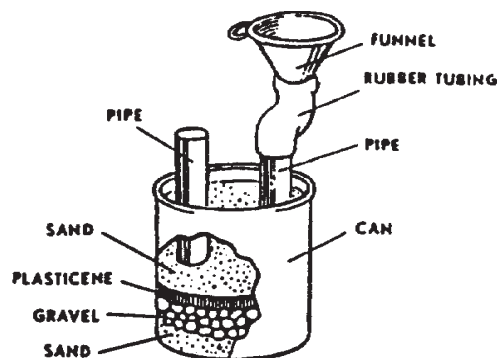
5. This discovery shows that as external pressure is applied to oil reservoirs, the liquid is forced out. The pressure can come from either expanding gas or from water seeking to move into pore spaces vacated as the oil is removed.

6. Complete the Where Does That Oil Go? worksheet. (Answers: 1-down the pipeline to Valdez and onto tankers for shipment outside; 2-chemicals made from oil and gas; 3-hydrogen and carbon; 4a-fuel gas; 4b-gasoline; 4c-jet fuel; 4d-heating oil; 4e-lubricating oil; 5a-gasoline; 5b-lubricating oil; 5c-jet fuel)

EXTENSIONS:

1. Social Studies/Science: Do a project on the great importance of oil and natural gas in everyday life.

2. Science: Plankton are the tiny, one-celled animals that are in the water. Using a biology resource text, see how many different kinds of plankton you can find and draw them. Do you think they will eventually turn into oil?



FROM PTERODACTYLS TO PETROLEUM

How well can you predict the connections between pterodactyls and petroleum? Read the following statements and write true or false, then read Where Did the Oil Come From? and see how many you have right.

1. Some pterodactyls were as big as small planes.

Your prediction _____ Correct Answer _____

2. At one time all of Alaska was under water.

Your prediction _____ Correct Answer _____

3. Tremendous pressures changed the silt, sand and clay sediments into oil.

Your prediction _____ Correct Answer _____

4. Petroleum means "rock oil."

Your prediction _____ Correct Answer _____

5. Petroleum lies in great underground lakes.

Your prediction _____ Correct Answer _____

6. To find oil, scientists look for sedimentary rocks.

Your prediction _____ Correct Answer _____

7. Special mud is used in the drilling operation.

Your prediction _____ Correct Answer _____

8. Once oil is struck, it always has to be pumped out of the ground.

Your prediction _____ Correct Answer _____

Adapted from: Alaska Tidelines Vol. IV, number 4, December 1981/January 1982.

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WHERE DID THE OIL COME FROM?

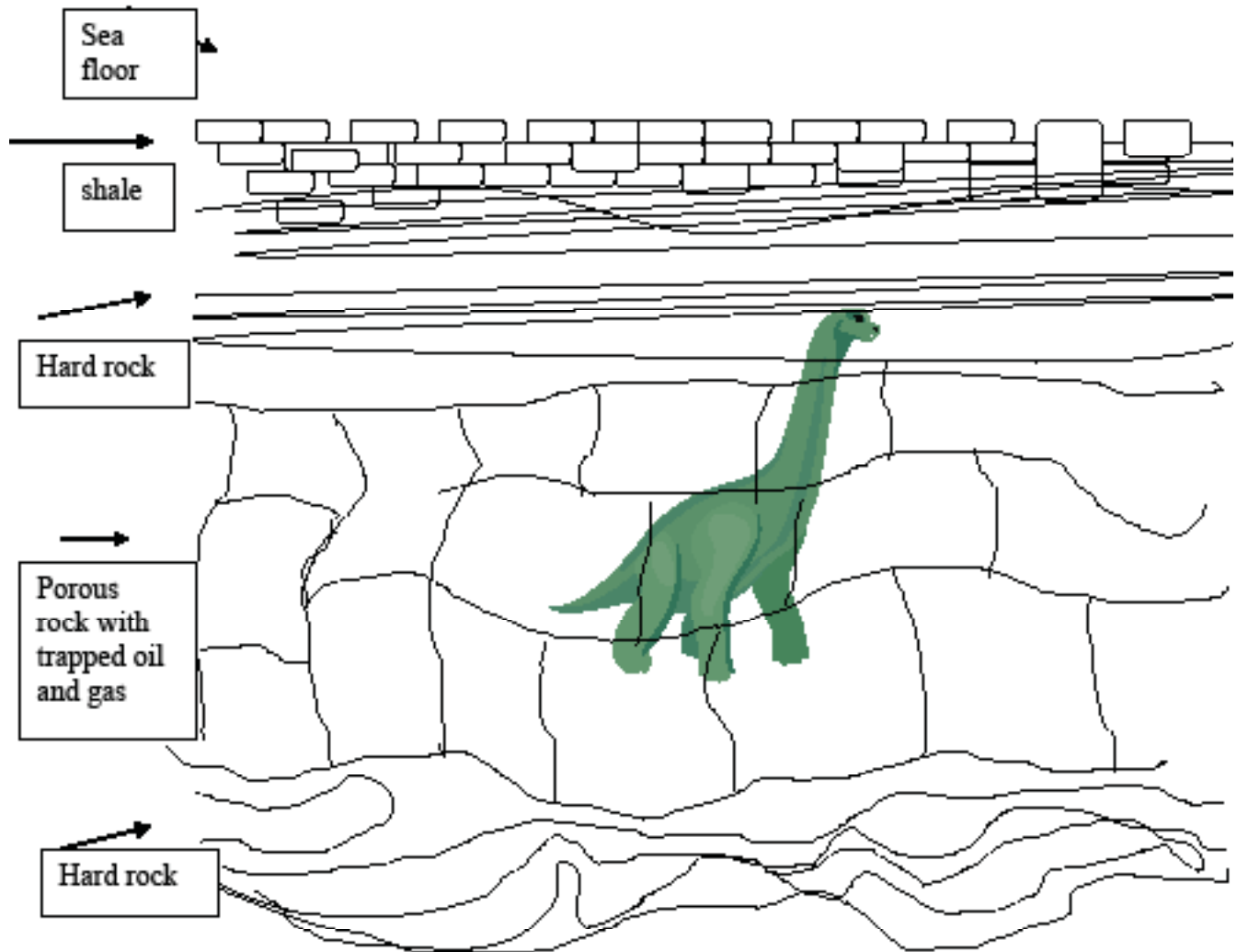
Start with a far-out flying reptile, which glided around in prehistoric times on wings made of skin attached to long-fingered arms in the best TV Batman fashion. It had a pointy head and a nose like a beak. And fossils show that it ranged from the size of a small sparrow to that of a giant with a wing-span like a Piper Super Cub. Its scientific name is pterodactyl (tair-oh-DACK-til) from the Greek *petron*, meaning "wing," and *dactylos*, meaning "finger."



In pterodactyl's day - say, 150 million to 65 million years ago - a warm, shallow sea stretched from what is now the Arctic coast of Alaska almost to the Gulf of Mexico. As zillions of generations of pterodactyls, along with countless other forms of plant and animal life, lived and died over that enormous time span, their remains settled to the bottom of the ancient sea. There they were broken down by bacteria and covered over by silt, sand and clay.

Over the ages, layer upon layer of decaying material and debris crushed down upon each other, forming what are called sedimentary basins, thousands of feet deep. The great pressure, heat and dampness changed the once-living remains of pterodactyl and his like into oil and natural gas, while the silt, sand and clay were molded into rock. So the right name of the kind of oil we're talking about is petroleum which comes from the Latin *petra*, meaning "rock," and *oleum*, meaning "oil."

WHERE DID THE OIL COME FROM?



WHERE DOES THAT OIL GO?

Directions: Read the following story and answer the questions at the end.

Once the oil comes in, the well is capped and equipment is installed to control the flow, and to separate the crude oil from the natural gas. Prudhoe Bay, on the arctic coast of Alaska, is ice-bound most of the year. So the oil must run a long route to market. From the wells, the crude oil moves through small pipelines to the big trans-Alaska pipeline. There it begins the 800-mile journey to Valdez, where it is loaded on tankers for shipment Outside.

Once the oil reaches the Lower 48, modern plants and refineries process the oil and natural gas into gasoline, jet fuel, heating oil, diesel, liquified gas and fertilizer. And those are just a few of the products that can be made from petroleum. Petrochemicals (chemicals made from oil and gas) are used as a base for a wide assortment of things, from plastics to vitamins to detergents, movie films, fabrics, and antifreeze.

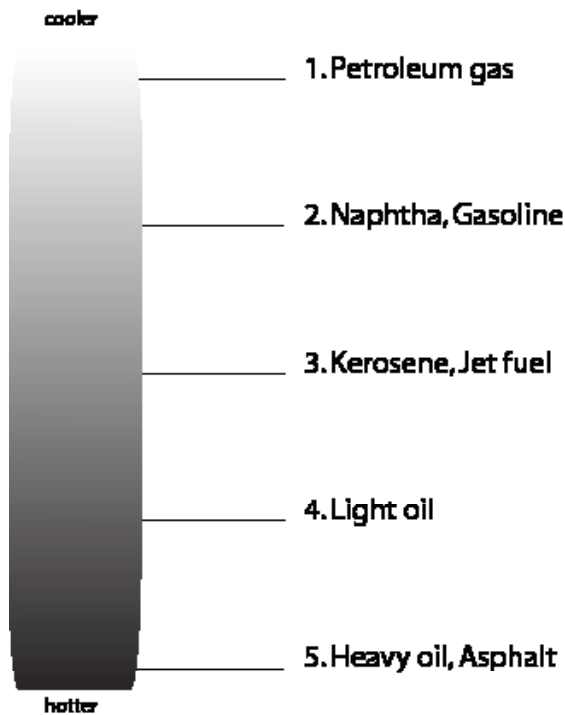
This strange stuff we call petroleum is made up almost entirely of only two elements—hydrogen, a gas-like element that will burn; and carbon, a chemical element that is found in all living matter. If you really want to sound like a pro, you can use the scientific word for petroleum, which is “hydrocarbons.” These hydrocarbons are present in thousands of different combinations that can be separated and purified in the process called “refining.”

The first step in refining is to sort out the major “fractions” or parts of the hydrocarbons that make up crude oil. These fractions boil and vaporize (like steam) at different temperatures. So the simplest form of refining works like this:

- The crude oil is heated in a furnace and the vapor is piped into a tall refinery tower.
- Hot steam is pumped in below to speed up the process.
- The vapors from the different fractions rise, cool off and condense (turn back into liquid) at different levels.
- There they are drawn off and collected for further processing if necessary.

REVIEW:

- Where does the oil from Prudhoe Bay go?
- Define petrochemicals.
- What are the major elements that make up petroleum?
- Here is a representation of a refinery or distillation tower that shows at which points the different products are drawn off and collected. Have the students fill in the blanks. (Hint: products are drawn off from coolest to hottest.)



- Circle the most highly refined fuel in each case:
 - jet fuel or gasoline
 - lubricating oil or asphalt
 - heating oil or jet fuel

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HOW BIG IS A TANKER?

BY: Belle Mickelson

EXTENSIONS: Social Studies/Language Arts/Science & Language Arts/Geography

DURATION: Three 40 minute periods

OBJECTIVES: Students will be able to describe how oil is carried in tankers. Students will measure the size of a tanker with a piece of string. Students will role play different jobs on the tanker. Students will debate single versus double-hulls and other safety features. Students will design and draw a tanker, illustrating each safety feature. Students will understand the connection between energy conservation and tankers.

BACKGROUND: Measuring 987 feet, the Exxon Valdez was just a mid-sized tanker. The largest tanker in the world, the Knock Nevis (formerly called the Jahre Viking and now used as an immobile offshore platform), is 1,504 feet long and 226 feet wide. "The Tankers Full of Trouble" reprint, from the Seattle Times, describes a voyage on the Arco Anchorage. This six part special report covers tanker crews, safety features, the double-bottom debate, inspectors and investigations; tanker traffic in Washington, and what can be done to improve tanker safety. Since the Exxon Valdez oil spill these issues have become very important. For example, some argue that if the Exxon Valdez had had a double-hull, the grounding on Bligh reef would have punctured fewer containers, thus greatly reducing the size of the oil spill in Prince William Sound.



The *Polar Resolution*, a double-hulled tanker operated by ConocoPhillips, made its first voyage into Valdez in the summer of 2002.

MATERIALS:

- Ball of string
- Yardstick or measuring tape
- Paper
- Pencils
- Map of North America
- "Tankers Full of Trouble"
Seattle Times reprint

PROCEDURE:

1. Ask students what are the biggest things they can imagine? Oil tankers are some of the largest ships and they carry a cargo that is very hazardous to our oceans, coastlines, and the people, plants, and animals that inhabit these waters and shores. Yet oil is one of our most valuable resources and one that all of us use daily. In this activity we will be studying one way that oil reaches our homes and schools - by tanker.
2. Ask students if any of them know someone who works on a tanker. Show students pictures of tankers and their crews in the Seattle Times reprint. Trace the route of tankers from Alaska to the West Coast on a map of North America. Show them how some tankers go through the

HOW BIG IS A TANKER?

Panama Canal and on up to the East Coast. Have students read some of the paragraphs that talk about what it is like to be on a tanker. Imagine the wintertime weather in the Gulf of Alaska “100 mph winds, sea swells the size of five story buildings, and numbing cold that can encase the deck in ice.” Read about being a lookout, on the bridge, in the engine room, loading and unloading the oil.

3. Take a piece of string and measure out the length of the Exxon Valdez, 987 feet long and 166 feet wide, on the playground. Is the tanker larger than your playground? Role play some of the crew duties on your playground tanker. Load up oil in Valdez and run the tanker down to Seattle or another port, then unload the oil and get ready to head back up to Alaska.

4. Plan a class debate on tanker safety. Have the students read the articles in the [Seattle Times](#) about safety features and single versus double-hulls. Encourage students to do additional research in the library.

5. Have students design and draw the ultimate tanker including safety features. Encourage creativity.

6. Discuss how preventing oil spills is many times easier than cleaning them up. Ask students if they think transporting oil by pipeline is less dangerous than bringing it by tanker. Explain that Congress was trying to decide whether to run Alaskan oil by pipeline to Valdez and then by tanker to the West Coast and through the Panama Canal to the East Coast or by pipeline through Canada. The vote in the U.S. Senate was tied 50 to 50 and Vice President Spiro Agnew broke the tie vote, so the pipeline went to Valdez and then took the ocean route. Ask the students how they would have voted. Explain that if we conserve energy, then less oil will need to be transported. Ask students to list 10 ways they can conserve energy today.

EXTENSIONS:

1. Social studies/language arts/science: Invite a boat captain to come to class and discuss navigation, weather, crew training, safety and survival, sea stories, and how to become a boat captain.

2. Language arts/geography: Imagine what it would be like to be a tanker crew or captain. Use the World Tanker Route Map on page 14 of the [Seattle Times](#) reprint to follow your routes on a world map. Read sea stories about travels to these foreign destinations.

POPCORN SPILL!

Adapted from: OBIS Oil Spill, Delta Education, Box M, Nashua, New Hampshire 03061, used with permission.

OBJECTIVES: Students will be challenged to estimate the environmental impact of a simulated oil spill.

BACKGROUND: In these days of heightened environmental awareness, great efforts are being made to prevent oil spills. Yet in spite of precautionary measures, oil spills from ships, offshore drilling operations, pipelines, and natural seepage continue. As past spills have so tragically demonstrated, a major oil spill can take a devastating toll on wildlife. Inshore fisheries, shorebirds, intertidal organisms, and shallow subtidal organisms are most often harmed because spills usually occur in the shallow coastal areas where these organisms are concentrated. The environmental impact of an oil spill depends on the size of the spill, the prevailing wind and water conditions during the spill, and the variety and abundance of life (both wild and human) in the affected area.

Although developed for the seashore, this activity may also be conducted at a lake, river, or stream. Reduce the amount of popcorn for smaller bodies of water. The activity will be more exciting if you choose a site with strong dispersal features (such as water currents and wind) and an abundance of life. Breakwaters or docks are convenient places from which to toss popcorn into the water. If you conduct the activity at an inland site where oil spills rarely occur, tell the youngsters that the activity simulates a toxic chemical discharge from an industrial or agricultural source.



MATERIALS:

- 20 liters of popped popcorn (plus another 20 liters for "Extensions")
- Impact Challenge Cards
- Pencils
- Guides for identifying saltwater/freshwater organisms
- 1 plastic bucket or can with a metal handle (about 20 liters in volume)
- 1 50 cm x 50 cm piece of plastic window screen, nylon mosquito netting, or several 50 cm x 50 cm sheets of small mesh cheese cloth
- 1 large rubber band, strip of inner tube, or elastic band that will fit snugly around the plastic bucket
- 3 100-cm lengths of wide duct tape or masking tape
- 25 meters of heavy twine or light rope marked off in 5-meter intervals
- 1 mini-hacksaw, jigsaw, or serrated knife
- Permanent-ink marking pen

POPCORN SPILL!

PROCEDURE:

1. To make a popcorn slinger, cut out the bottom of the bucket with a hacksaw, jigsaw, or knife. With the bucket turned upside down, place the screen material over the open end of the bucket. Let the material drape over the side. With the duct tape or masking tape, tightly tape the edge of the screen material to the bucket. Firmly tie the 25-meter line to the metal handle on the bucket and tie a loop (large enough to go over a nearby rock or post) at the other end of the line.

2. Before you reach the site, discuss safety. Use the buddy system. Keep an eye on nonswimmers.

3. At the site, tell the youngsters that they are going to pretend to be environmental impact experts who have been rushed to the scene of an oil spill to estimate its impact (damage) on the seashore environment. Say that you will simulate the oil spill by tossing out a large bucket of popcorn to represent the oil. Tell the youngsters that you are using popcorn because it will not harm the environment, and it floats like refined oil.

4. Explain to your group of “experts” that they are responsible for estimating the impact of the spill on (a) the landscape, (b) the plant life, (c) the animal life, and (d) human activities. Divide the group into four smaller groups, and give each group an Impact Challenge Card. Ask the youngsters to pick a buddy in their groups to work with at all times. Tell the teams to assume that anything the popcorn touches will be covered with oil.

5. Before you toss out the popcorn, ask the youngsters to predict in which direction the spill will move and how long it will take to reach the shore. Ask someone to measure the time it takes for the spill to reach the shore or some other reference point.

6. Now you are ready to use your popcorn slinger. With the loop of the rope anchored to a rock or post, practice tossing the bucket a few times before putting in the popcorn. Take a strategic but secure position on a dock, breakwater, or large rock. The rope should be loosely coiled on a flat surface below your tossing arm so the rope will fly out freely when the bucket is tossed. Make sure you are not standing on the rope. When you are ready, grab the rope about a meter from the metal handle and start swinging the popcorn slinger over your head. When the bucket has gathered momentum, let it fly out over the water. Try to pick a location where you can toss the bucket with the wind instead of against it.

7. After you have gotten the knack for tossing the bucket, place a small flat rock (about 200 grams) in the bucket and then put in about 20 liters of popcorn. With the teams ready to time and follow the spill, toss out the slinger. After landing, the rock will help pull the bucket under the water and the buoyant popcorn will be forced out the top

POPCORN SPILL!

of the bucket. Let the bucket sink beneath the surface before hauling it in so the spill won't be disturbed.

8. Count the marked intervals on the rope as you haul in the bucket to determine the spill's starting distance from the shore. Ask your environmental experts to begin their investigation.

9. Join in and follow the movement of the spill with the rest of the group.

10. Near the end of the allotted time or after the spill has been thoroughly dispersed, gather the youngsters together to have a SLICK TALK to report their findings. In addition, consider the following questions:

1. How quickly did the spill reach the shore?
2. What agents dispersed the spill? (Wind, tide)
3. How might different wind or water conditions affect the spill?
4. How could an oil spill be prevented from spreading?
5. Who should be responsible for cleaning up a spill?

EXTENSIONS:

1. Science: Create another "oil spill" under different conditions (e.g. when the tide is going out rather than coming in) or at a different site (e.g. a river rather than a lake, or on one side of a breakwater rather than the other side). Compare the effects of the second spill with those of the first.

2. Social studies: Try several methods of keeping an oil spill from spreading. For example:

- Surround the spill with logs or floats.
- Scoop the "popcorn oil" out of the water.
- Clean up the spill after it reaches shore.
- Herd the spill with a giant squeegee into a pen so it can be scooped up. Discuss your results and compare them with the clean-up workers on the Exxon Valdez spill. How would students feel if it was real oil?

3. Science: Use bird field guides to identify the birds that come to clean up your spill. Watch their behavior. Who is dominant? What are the differences/similarities between how these birds feed and your school lunchroom?

IMPACT CHALLENGE CARDS

IMPACT CHALLENGE CARD #1 Landscape

Follow the spill and estimate its impact on the landscape. Get the 25-meter length of rope from the popcorn stringer, and use it to estimate the area the spill covers.

Estimates: Water _____ sq. meters (length x width)
Land _____ sq. meters (length x width)

- Where did most of the popcorn end up? Why?
- How might the underwater landscape be affected?
- How did the spill change the general appearance of the landscape?

IMPACT CHALLENGE CARD #2 Plant Life

Follow the spill and estimate its impact on plant life.

- How many different types of plants were affected?
- Which water plants were hardest hit by the spill? Why?
- How might an oil spill affect land plants?
- How would animals that eat aquatic plants be affected?

IMPACT CHALLENGE CARD #3 Animal Life

Follow the spill and estimate its impact on animal life.

- How many different types of animals were covered with oil?
- Which animals were hardest hit by the spill? Why?
- Which animals do you think would be capable of escaping from a spill? Which animals might not be able to escape?
- How might sand and oil spill affect animals that live under rocks in the water?

IMPACT CHALLENGE CARD #4 Human Activities

Follow the spill and estimate its impact on human activities.

- How might an oil spill affect fishing and recreation activities such as swimming, water skiing, surfing, and diving?
- How might boats, docks, breakwaters, and other structures in the water be affected?
- How might drinking water or food be affected by an oil spill?

ALASKA OIL SPILL

BY: Bill Noomah and Belle Mickelson

DURATION: four sessions:
the first, 15 - 25 mins.
the second, 60 - 90 mins.
the third and fourth, 45 - 60 mins.

OBJECTIVES: Students will develop an experiential knowledge of having to respond to a simulated environmental disaster, and will reflect on the technological and political responses to an oil spill emergency.

BACKGROUND: A major oil spill like that of the Exxon Valdez can take a devastating toll on wildlife. Sea birds are attracted to oil slicks and will try to dive and feed in them, hopelessly oiling their feathers. When oil gets on the fur of seals, sea lions and sea otters, it means a loss of insulation. In the great baleen whales, oil clogs the hairs that filter plankton out of the water, thus impairing their feeding. Eggs and young of many species of fish and shellfish are harmed by extremely small concentrations of oil (as low as 1 to 10 parts per billion!). Larger (but still small) concentrations (10 to 100 parts per billion) can cause reduced feeding or reproduction in adult fish. And as the spill moves onshore, intertidal organisms, as well as shore birds, are affected.

Mechanical clean-up methods include skimmers and booms, suctioning up the oil, or using buckets to skim it up like some of the fishermen did very successfully. Dispersants (detergents or sand) make the oil sink - but not disappear. Oftentimes, the dispersants combine with the oil to form even more dangerous hydrocarbons. Another technique is the use of Corexit, a kerosene derivative. Some scientists are concerned that Corexit may have very harmful effects on wildlife and fisheries.



MATERIALS:

- News clippings
 - 5 1/2 gallon plastic milk containers
 - Aluminum foil/styrofoam
 - Wire/popsicle sticks
 - Detergent
 - String
 - Oil absorbant material
 - Cotton balls
 - Construction paper
 - Wax paper/plastic wrap
 - Scissors/tape/paper clips
 - Eyedropper
 - Sand/gravel
 - Seaweed or pondweed
 - Yard debris containing sticks and leaves
 - Bird feathers
 - Used motor oil
 - Refrigerated salt water (enough to fill tubs)
 - Pencils/Protractor
- Worksheet:
- Ocean Oil Pollution

ALASKA OIL SPILL

The pressurized hot water beach clean-up techniques used during response to the Exxon Valdez spill were quite controversial, because although it took the oil off the rocks, it drove some of the oil deeper into the substrata only to gradually leak out again. Some experts felt, however, that by breaking up the oil it kept pavement from forming on the beach. Some of the citizen clean-up programs initiated oiled seaweed pick-up on the beaches. The seaweed was a natural oil collector and the more that was picked up, the less oil that spread around to other bays and estuaries. Bioremediation, the use of fertilizer to increase the populations of oil-eating bacteria was another technique that was tried. Also a rock washing program was developed where rocks were cleaned by tying them up in specially designed bags - so the ocean's tidal action could wash them. And oil absorbant pads were used to wipe off rocks individually.

At the end of this activity, students will have a chance to investigate other sources of oil pollution. Even though large spills are the most spectacular and devastating, it is actually the day-to-day operations of oil tankers and daily life in coastal and river communities that do the most damage.

PROCEDURE:

Day 1 - Activating Interest

1. Search school and public libraries for news magazines with articles about the Exxon Valdez oil spill and use the selection of articles at the end of the curriculum. Have enough different magazines so there is at least one different article for each student. Use this as an opportunity to teach about news reporting by comparing and contrasting different accounts of identical events.
2. Before students arrive in the class, soak a feather, a leaf, or a small stuffed animal in thick, used motor oil. Use a plastic glove to hold an oil covered object up and let them guess what it is. Discuss whether they had seen pictures of objects like yours.
3. Show a video about the spill (see appendices).
4. Ask students if they know someone who worked on the Exxon Valdez oil spill clean-up. Ask them to interview the person before the next lesson.

Day 2 - Simulated Oil Spill

5. Before the students arrive in class, set up the mock oil spill. Two tables should be dedicated to materials to be used to clean up oil. There could be at least one oil spill site for every three students.
6. For a class of thirty, cut 5 1/2 gallon milk containers in half lengthwise to make ten tubs. Fill each with refrigerated salt water. (You can make your own salt water by adding 1 teaspoon of sea salt per gallon of water) In three of the tubs, place enough gravel at one end to form a shallow beach. Form sand beaches in three other tubs, and let the other four tubs have open water. Spread these tubs evenly about the room.

ALASKA OIL SPILL

7. The students should be very curious when they arrive. Without any introduction, read a blow-by-blow account of the first hours of the Exxon Valdez oil spill. Without fielding any questions, proceed to introduce the materials at hand: plastic wrap, popsicle sticks, etc. Then, with great dramatic flair, stand in front of a student who has an open water tub on his or her desk and say, “You never know when, like the people of Alaska, you’ll wake up and find oil spilled in your front yard.” With great ceremony, pour one-half a capful of used motor oil into the tub. After the initial wonder is over and someone realizes that the oil has to be cleaned, pour oil in the other nine tubs.
8. For the next hour allow students to generate their own solutions to keeping the oil off the beaches and to clean up the oil. If a group ever looks too successful or confident, pour in more oil or add some seaweed, pondweed, sticks and leaves.
9. Describe clean-up methods used in the Exxon Valdez spill: mechanical (skimmers, buckets, and suction-eyedropper), dispersants (detergent and sand), commercial absorbant, bioremediation, Corexit, and cold and hot water washing of beaches. The pondweed/seaweed and bird feathers can be used to demonstrate what happens to oiled plants and animals.
10. Check with your local Department of Environmental Conservation (DEC) about how to properly dispose of your oily wastes from clean-up.
11. At the end of the hour debrief and have students write in their journals about what went well and what was frustrating.

Day 3 - Follow-up

12. Discuss the experience of the previous day. The children should be eager to share both their journal entries from the day before and their reflections from overnight.
13. Using mapping techniques on the board, explore two issues: the effectiveness of our technology to combat the oil; and the emotional issue of having a seemingly tireless adversary. Often the two webs on either side of the board mingle in the middle.
14. Distribute Ocean Oil Pollution to assist in a discussion of sources of oil pollution. Students will need pencils and protractors. (Answers for pg 2 of worksheet: degrees in column 3 from top to bottom: 36, 79, 11, 36, 112, 47, 4, 36—this totals 361 if students round off the degrees; 1a. tanker accidents; 1b. 3 percent; 2a. coastal facilities; 2b. 13 percent; 3a. tanker operations; 3b. 22 percent; 4. well blowing up, drilling rig sinking, transferring oil from the rig to ship or pipeline; 5a. runoff from roads or trails, people dumping oil, seepage from dumps, vehicle going in water, boat engine use, especially if it’s not working properly, etc.; 5b. rain or snow falling on the road and then dripping into the water; 6a. answers will vary, but one potential increase is from offshore drilling, due to the greatly accelerated leasing and drilling program as well as the difficulty of drilling under northern storm and ice conditions; 6b. answers will vary, but decreases depend a lot on all of us, and also on any changes in oil production and transportation).

ALASKA OIL SPILL

Day Four - Evaluation

15. Ask the students:

a) Which was easier, cleaning the spilled oil or working with others to clean up the oil spill? Why?

b) Write a letter to either an oil company, the U.S. Coast Guard, an environmental group, or the U.S. President. Share your concerns about oil spills and clean-up.

c) Do one of the two drawings below.

1) Design a piece of equipment that can pick up oil off the surface of the ocean. In your drawing show how the equipment will look in the water. Label each part of this piece of equipment to show what it is made of and what it does.

2) Design a piece of equipment that can keep oil off the beach. In your drawing show how the equipment will look in the water. Label each part of this piece of equipment, to show what it is made of and what it does.



OCEAN OIL POLLUTION

What are the sources of ocean oil pollution?

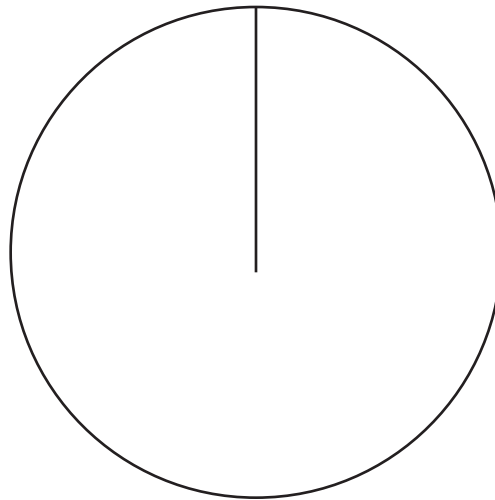
About 37% of oil in the ocean is from a mix of materials and wastes from urban run-off, and industrial plants. Storm drains, creeks and rivers transport these pollutants into the ocean.

About 7% of oil in the ocean is natural oil seeping through fissures in the ocean bottom. After earthquakes more seeps are often visible.

The world's oil industry contributes approximate 14%. These pollutants are from exploration, production and transportation of oil (pipelines) and from incidents involving oil tankers.

Vessels other than oil tankers (fishing vessels, cruise ships, etc.) contribute approximately 33%.

Oceans absorb the final 9% from the atmosphere.



Using the percentages above, use your compass and complete the pie chart above.
le: $.07 \times 360 =$ approximately 25 degrees (360 degrees in a circle.)

OCEAN OIL POLLUTION

Questions to answer:

1a. Most of the oil pollution we know about involve which one of the sources on the chart?

1b. What percentage of ocean oil pollution is caused by that source?

2a. Which source might describe oil spills in harbors?

2b. What percentage is caused by that source?

3. When an oil tanker is carrying no oil, it fills up its cargo space with water so that the ship will be stable. A ship getting ready to load new cargo will dump the water it has been using as "ballast." This ballast will have picked up oil from the hold of the tanker. Ballast water should be pumped into an onshore treatment facility to prevent oil wastes from being flushed into the ocean.

a. Which source describes this type of pollution?

b. What percentage is caused by that source?

4. How could oil get into the water from offshore drilling operations?

5a. List some ways that petroleum could get into rivers.

5b. The next time you are riding on a road or highway, look ahead of you. A well-traveled highway usually has a dark streak running down the center of each lane. The streak is caused by petroleum products, such as crankcase oil, that drip out of vehicles. How could this serve as a source of oil pollution for water?

6a. Which of the ocean oil pollution percentages do you think will increase in the future?

6b. Which do you think will decrease?

For more information go to website

<http://www.world-petroleum.org/education/ocean/index.html>

OIL SPILL RESPONSE

BY: Belle Mickelson

DURATION: 2 hours

OBJECTIVES: Students will read articles about how different individuals, agencies, and organizations responded to the Exxon Valdez spill. Students will discuss the role, and difference, of each group of respondents. Students will write about their response to an oil spill in their community.

BACKGROUND: On Good Friday, March 24, 1989, Alaskans awoke to disaster. Shortly after midnight, the 987-foot-long oil tanker, Exxon Valdez, had run hard aground on Bligh Reef, spilling nearly 11 million gallons of crude oil into Prince William Sound. The worst case had occurred.

This was the tanker catastrophe residents of the Sound had dreaded ever since the trans-Alaska pipeline was proposed in the late 1960s.

Individuals, organizations, communities, agencies, and industry moved into high gear to respond to this emergency. For volunteers and employees alike, this meant long hours and high levels of stress. They worried about their economic future and way of life, dealt with the death of birds and animals, and the oiling of their incredibly beautiful environment. There was a tremendous sense of helplessness and, for many, the need to try to rectify what had gone wrong. Disorganization, greed and infighting also occurred. But most people just wanted to help.

Many people went through the traditional grieving stages that one sees when there is a death in the family. In this case, "family" was an area that they loved and treasured; for many, an area on which their



MATERIALS:

- Paper
- Pencils

Articles:

- "Hard Aground - Disaster in Prince William Sound"
- "PWSAC Watches Over Hatcheries"
- "PWSRCAC's Peer Listener Training Program, part 2"
- "PWSCC Assists Community"
- "Seldovia Puts Up Its Own Defense Against Oil"
- Alaska Fish & Game "Special Oil Spill Issue"

OIL SPILL RESPONSE

“family” was an area that they loved and treasured; for many, an area on which their whole way of life depended.

(Beginning quotes from SPILL, the Report of the Alaska Oil Spill Commission)

PROCEDURE:

1. Ask the students to remember their first thoughts after they heard about the spill. Ask them what people they know did in the weeks that followed.
2. Divide the class into groups. Have each group focus on a certain response group and read the corresponding articles about how different individuals, agencies, and organizations responded to the spill. Come together as a class and have each group report on their response team. Be sure to focus on the type of response action, i.e. volunteer, organizational, agency, individual; the emotional aspects of the response, what the response group hoped to accomplish and what they actually did accomplish (this could range from feelings and personal satisfaction to actual saving of animal lives or fisheries).
3. Have students write a paper about what they would do if an oil spill happened in their community.

EXTENSIONS:

1. Social studies: Invite a social worker or psychologist to talk to the class about the effects of a disaster on communities.
2. Social studies: Go on a field trip to city hall and the fire department to talk about their contingency plans for disasters.
3. View part 2 of PWSRCAC's Peer Listener Training Program

ALASKAN WILDLIFE AND OIL

BY: Belle Mickelson

DURATION: Three 45 minute periods

OBJECTIVES: Students will be able to describe several southcoastal Alaskan animals and their habitats. Students will explain the potential effects of oil on these species. Students will select one species to research and write a report.

BACKGROUND: The Exxon Valdez spill was the 14th largest in the world in terms of size—but number 1 in terms of animals that died. As many as 300,000 birds and several thousand otters perished. Otters died initially from hypothermia caused by oiled fur and by organ degeneration from oil ingestion. They also died from stress-related causes. Over 150 bald eagles were found dead and many more undoubtedly died. Also, their reproductive rates in oiled areas were reduced to zero. Land mammals were affected by browsing in the intertidal area. Resident killer whales that normally have a mortality of 2-3%, had a mortality of 20%. Those that died were reproductive females and young. Gray whales were found dead, but it is impossible to determine if they died from oil or natural causes. Of the seabirds, murrelets died in the largest numbers. Intertidal life, including clams, were completely wiped out in heavily oiled areas. Shrimp, crab, and herring fisheries in western Prince William Sound were shut down. The spill occurred right where the tanner crab were spawning—and herring were just beginning to spawn. Much of the commercial salmon fishery was shut down in 1989--a fishery that in Prince William Sound had an ex-vessel value of \$110 million in 1988. And the 1989 run of pink salmon (the main cash fishery) was predicted to be the largest ever recorded--4 times that of 1988.

Exact mortality figures are difficult to gauge because the spill covered such a vast area of land and water and because animal carcasses have a tendency to sink, drift away, or be eaten by other animals.



MATERIALS:

- Alaska Fish and Game
- "Special Oil Spill issue"
- Wildlife Field Guides
(see bibliography)
- Worksheets:
- Land Mammals
- Birds
- Marine Mammals
- Shellfish/Intertidal Life
- Finfish
- Wildlife and Oil

ALASKAN WILDLIFE AND OIL

PROCEDURE:

1. Ask the students to list animals affected by the oil spill. Show them the Alaska Fish and Game "Special Oil Spill issue."
2. Divide the students into teams to study land mammals, birds, marine mammals, shellfish, finfish, and intertidal life. Pass out the appropriate worksheets to each team. Their assignment is to identify the animals on their worksheets and write a report discussing the effects of oil on each species. Use field guides and other books found in your library or mentioned in the bibliography.
3. Use the worksheet Wildlife and Oil to provide basic information on what happens when animals are oiled. Explain that numbers of animals that died are very difficult to prove as animals sink and disappear and are never found.



WILDLIFE WORKSHEETS - LAND MAMMALS



WILDLIFE WORKSHEETS - BIRDS



WILDLIFE WORKSHEETS - FINFISH



WILDLIFE WORKSHEETS - SHELLFISH/INTERTIDAL LIFE



WILDLIFE WORKSHEETS - MARINE MAMMALS



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WILDLIFE AND OIL WORKSHEET

Oil on beaches damages shoreline life. Oil seeps downward into sand and remains there for years. Rocky shorelines can clean themselves naturally through wave action, but bays, estuaries and marshes have few waves. Oil spills in such areas are very damaging because wetlands are the nursery grounds for fish, birds and shellfish.

Oil causes serious harm to birds by coating their feathers. An oily bird does not float, and it has no insulation against temperature changes. Also, birds poison themselves by eating the oil that coats them.

Oil can smother communities of animals that live on the sea floor. This really affects clams, mussels, shrimp and crabs important to the shellfish industry. Most of these areas will eventually become settled again, but some organisms, like mussels, cannot survive in an oiled area.

Adult fish are not affected by oil pollution as much as other organisms. A massive spill can kill large numbers of fish, but, ordinarily, adult fish are able to escape injury from minor accidents. Smolt and eggs are extremely vulnerable to oil spills, however.

Marine mammals, such as whales, sometimes swim away from oil spills. But the oil affects them internally as they breathe its toxic fumes. Sea otters die when their fur becomes matted; they do not have any protection from the cold ocean water.

Different petroleum products have different affects on organisms. Diesel or heating oils are the most poisonous, while heavy crude and fuel oils are the worst for smothering animals.

Now, answer these questions:

1. Describe a kind of oil spill that could kill large numbers of adult fish, smolt, or eggs.

2. What kinds of petroleum products have the most undesirable effects?

3. How do these affect the organisms?

WILDLIFE AND OIL WORKSHEET

4. Are all areas of the coastline affected in the same way by oil pollution?
If not, explain these differences.

5. Success in cleaning up an oil spill depends upon rapid action by the spiller and by federal, state and local agencies. When a spill occurs, it is reported to the U.S. Coast Guard. To be effective, containment must be done as soon as a spill is detected. In the case of the Exxon Valdez, Exxon headed up the clean-up efforts with suggestions from the Coast Guard and the State of Alaska. Unfortunately, the spill was not contained immediately through the use of booms and mechanical skimmers-so the oil spread over 1,000 miles.

Write a story about what you would do to protect the wildlife if you were in charge of cleaning up a spill.

IMAGINARY ISLAND

BY: Bonnie Jason

EXTENSIONS: Sharing, Geography, Language Arts, Math

DURATION: At least three 45 minute sessions, preferably more

OBJECTIVES: Students will have the opportunity to apply their knowledge of habitats as they invent an imaginary island. Students will reinforce their researching, mapping, conferencing, journaling, planning, brainstorming, revising, and cooperation skills. Students will experience an oil spill on their island.

BACKGROUND: This activity is designed to allow students to put to use all of their understanding of habitats that they have acquired throughout the previous lessons. The students will be developing a map of habitats on an imaginary island of their design. The map work involved in this activity may seem quite advanced, but developing precise maps is not integral to the success of the lesson. A child that comes into this activity with no map skills may, upon completion, recognize a map as a picture of an area. A child with sophisticated map skills might realize that only certain habitats can exist at specific lines of longitude and latitude and thus create a map that reflects this understanding. Students can work individually or in small groups. Student-teacher and peer conferences need to be held regularly throughout the activity. Base your evaluation on individual growth and participation.

PROCEDURE:

1. Explain that the students are going to design an imaginary island incorporating as many habitats as they can. Later they can populate their island with appropriate animal species.

MATERIALS:

- Various art supplies
- Journals
- Various maps
- Research books for information on habitats and maps

IMAGINARY ISLAND

2. Brainstorm items that can be included in their drawing. As a whole group or in small teams the children should list as many types of habitats as they can. Compile the list onto the board or easel. Next ask the children to brainstorm what types of vegetation might be found in each habitat. Perhaps a list of other non-living things could be formed as well (i.e. boulders, houses, roads).
3. Ask the children to quickly sketch the shape of their island, decide what types of habitats they would like to include and draw these in. If appropriate, refer them to a map of the world and have them decide where their island could be located. Introduce or use longitude and latitude for referring to the locations the children have chosen.
4. During conferences ask the students why they chose the area and whether or not the habitats they have included would be feasible there. For example, if a student wants to include a meadow as a habitat but has chosen to place their island in the Antarctic this may not be feasible.
5. Referring the student as often as possible to maps, have them begin designing a rough draft of their island, including all the various habitats and vegetation. The use of a key or legend may keep the task less complicated. Ask the students to be as specific as you see fit (spruce grove rather than woods, willow rather than bushes, lupine rather than flowers).
6. Conference with the children frequently to see how they're doing and if they need any help. Refer them to other students and to reference books for advice.
7. After every session, have the students reflect in their journal about what they worked on that day and what they would like to do next. Always refer them back to these entries before beginning work again. The final draft of the island might include: designated habitats, colors, longitude and latitude lines, compass rose, elevation lines and numbers, legend and a name. However, it could also simply be a drawing. Perhaps a written caption or paragraph could be presented with the map.
8. Once the map is completed, students may populate it with animal species. Rather than drawing these onto the map, use a small symbol to represent each species and define the symbol in the legend. Or students can bring in from home miniatures or models of animals and set these upon their map.
9. Be sure to conference with students while they are working on populating their maps. It is important that students be certain their habitats fulfill the species requirements. Also, with older students, you may want to discuss population density and impacts of the species upon one another.

IMAGINARY ISLAND

10. While the students are away from the classroom, use black construction paper and tape to simulate an oil spill on the island's shores. How do students feel on their return? What cleaning methods will they use? Can they work together? How does the smell and feel of real oil differ from this oil?

EXTENSIONS:

1. Sharing: Invite other classes into your room to visit the children's display of islands and oil spills. Take the show on the road (set it up in the cafeteria, foyer or library). Invite parents in, or grandparents or people from the local nursing home. Have the local newspaper come and take pictures.

2. Geography: Design a map of the world and have students display their island upon it (kids could design the world map instead of you). Remind students that oil travels. Tar balls can be found even on remote islands.

3. Language arts: Ask the children to make up a story, poem song or rap about their island. It could be an adventure or a description of their island and the oil spill. Publish and/or perform these. Have the children design a book for younger children about their islands. It could be an alphabet book, a picturebook, a number book, an animal book or a concept of their choice.

4. Math: Use the maps for work with measurements, scale, shapes and geometry. Set up challenges for the kids such as: Can you measure the perimeter of your island using your thumb? Your toe? Your ear? Your nose? Can you compare these measurements to a friend's and get usable information? Can you find the square footage of your imaginary island? (They'll first have to establish scale). Can you draw the perimeter of your island using only straight lines without changing its area? With only curved lines? Can you draw your island with exactly half its area without changing its shape? Can you make a graph to show the areas of all the maps in the class? Can you make a graph to show the numbers of various species?

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THE ALASKA OIL SPILL GAME

BY: John Stark, for Project WILD

EXTENSIONS: Social Studies, Language Arts, Mathematics

DURATION: three 40 minute periods

OBJECTIVES: Students will be able to describe the general events of the March 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. Students will draw a mural of PWS. Students will play a game simulating conditions for cleaning up a maritime oil spill. Students will discuss the feelings of workers in the Alaskan clean-up effort. Students will identify energy conservation ideas.

PROCEDURE:

1. Show pictures of Prince William Sound with its majestic mountains and glaciers, blue water and diversity of plant and animal life. Help students locate a) Alaska on the globe and b) the Sound on the Alaska state map.
2. Have students form teams of five to ten. Each group paints and draws a large newsprint mural of a scene on the Sound.
3. Teacher(s) and/or students perform a skit to reenact the day of the spill. Students hold up the murals as a backdrop for the skit. The characters can include the captain, first mate, sea otters, birds, fish, oil industry officials, Alaska government officials, fishermen and environmentalists. As the actual moment of the spill is reenacted, a teacher comes up and smears black paint over the murals to dramatize the fouling of the water and beaches by oil.
4. Students play a game to simulate conditions

MATERIALS:

- Newsprint
- Crayons
- Colored magic markers
- Tempera paint (include the color black)
- Globe
- State map of Alaska
- Paper
- Pencils
- 100-150 plastic balls or other small objects
- Red and blue ribbon or flagging tape
- Pictures of Prince William Sound (see bibliography)

THE ALASKA OIL SPILL GAME

of the cleanup effort and explore the feelings of the cleanup workers. The game characters are as follows:

Beach cleaners:	individuals who collect oil on the beach (they wear red ribbons or tape on their belts)
Cleanup boats:	groups of five students who collect on the water (also wear red ribbons)
Squalls:	small storms (wear blue ribbons around waist)
Dumping site supervisor:	one or two students or teachers
Harbor master:	a student or teacher

5. The rules of the game are as follows:

- a. Teacher(s) spread the plastic balls over a large area such as a playground or football field. The field symbolizes the beach of the Sound, and the balls are the tar balls fouling it.
- b. Some students play the part of beach cleaners. They go out individually, pick up one ball and deliver it to the dumping site, which is supervised by the dumping site supervisor(s), and return to the beach for more.
- c. In the case of cleanup boats, four students play the part of "collection devices." They put one hand on the shoulder of the fifth student, who is the "oil waste holder." The five of them move from place to place as a unit. The four collection devices reach down and grab plastic balls and hand them to the oil waste holder. When the holder has five balls, the "boat" must move together to the "dumping site" to release the balls.
- d. While workers collect tar balls the squall(s) chases them. If he/she can steal the red ribbon from a cleanup worker or all five ribbons from a boat, the worker or the boat has been caught by a squall on the Sound and must return to "port" to wait out the storm.
- e. While cleanup workers are collecting tar balls the dump supervisor(s) throws some of them back onto the water and beach to symbolize the vastness of the volume of oil spilled.
- f. As the game progresses and the bad weather of September approaches, more students are assigned as squalls, and clean-up efforts become more difficult and dangerous. Finally, in September weather conditions are so bad and the Sound so full of squalls that all clean-up efforts must be suspended until the following spring. The game portion of the game ends.

6. Teacher leads a discussion based on the following questions:

What emotion did you feel when you saw how big the beach and the spill are?

THE ALASKA OIL SPILL GAME

What emotions did you experience when the waves washed the oil back out into the water?

How do you think a real oil spill clean-up employee would feel seeing the dead and oiled animals on the beach and floating in the water?

Do you think it will be possible for the workers to restore the Sound to the way it was before the spill? Why? Why not?

Oil from Prudhoe Bay is shipped through Prince William Sound and other areas in order to supply some of our energy needs. Can you say that your own family's use of oil products is the partial cause of this oil spill? If so, why is this true? If not, why not?

Are you willing to change your own energy use habits in order to make such spills less likely? If so, what kinds of changes would you make?

7. At this point the teacher may invite the students to write letters to express what they would say to clean-up workers to express thanks for their hard work and to encourage them in the clean-up effort. Letters may be written to the President or to congressional representatives or other officials expressing concern over the spill. Students may explore ways to encourage energy conservation in their own families and in their community.

EXTENSIONS:

Social Studies: Students may identify other environmental disasters or potential disasters in their area. They may find ways to help out in those situations by writing letters, raising public awareness, or raising money.

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OFFSHORE OIL DRILLING

BY: Belle Mickelson, adapted from Alaska Sea Week Curriculum, Vol. VI

EXTENSION: Social Studies/Science

DURATION: four 40 minute periods

OBJECTIVES: Students will write to congressional representatives to find out what areas are coming up for leases in the near future. Students will produce an imaginary TV special about the effects of offshore drilling. Students will research opinions about offshore drilling in their own community. Students will invite people concerned with offshore leasing to visit their class. Students will write to their congressional representatives with the results of their research.

BACKGROUND: The 1989 Exxon Valdez oil spill, like the 1969 Santa Barbara oil spill, released a powerful surge of public concern about the environmental effects of exploring for and producing oil and gas from the outer continental shelf. This focus on oil spills, while understandable and legitimate, has obscured other subtler issues regarding offshore oil.

At the root of the problem is what resources we should give priority to: offshore oil and gas? Onshore oil and gas? Coal? Nuclear? Hydro? Conservation? Solar and other renewables? Commitments to offshore leasing by governmental and industrial resources means that those resources cannot be devoted to other energy sources. Several national energy analyses have concluded that foreign oil imports could be eliminated if the nation were aggressively pursuing energy conservation.

Are the risks arising from offshore oil and gas acceptable in light of other sources? Do we know enough about the cumulative effects of oil operations at sea to expand the offering of offshore lands by (say) twenty times in the next five years? More than half the U.S. total—more than 500 million acres—is off Alaska's coast.

Headline-grabbing catastrophic oil spills like the Exxon Valdez can definitely have significant and long-term adverse effects on ecosystems, but routine discharges are even more serious. They can amount to millions of gallons over the life of a single well, and because their stressful affects are cumulative over a long period, they are more difficult to observe and measure. And today, when economic analysis is so prevalent, how do we quantify the value of a healthy ecosystem? For instance, estuaries and other coastal wetlands provide nursery grounds for 70 percent of the nation's commercial fish. But how can one calculate the value of wetlands in comparison to a barrel of oil, which has a price fixed in the marketplace?

MATERIALS:

- Paper/pencils/pens
- Addresses of congressional representatives
- Stamps/envelopes
- Map of United States showing coastline

Worksheet:

- A Tidelines TV News Special: Oil in Troubled Waters

OFFSHORE OIL DRILLING

What should our national offshore oil policy be? Should we continue at the present pace? Should we expand? Should we slow down while further research is conducted and alternatives explored? Oil is a mighty precious commodity, as well as a nonrenewable resource. What we use now will not be there for future generations. But any way we look at it, oil will be an important issue for students to grapple with both today and in succeeding years. What will be their solution?

(Adapted from "OCS Development: What Value—What Cost" by Michael Weber in Environmental Education Report, June/July 1982.)

PROCEDURE:

1. Ask students to point out the coastlines of the United States. Explain that oil is found on the continental shelf which follows that coastline. Explain that a whole series of offshore lease sales are planned by the government. How can you find out what sales are planned in the near future? One way is to write your congressional representatives.
2. Use the paper and pen to compose a class letter to your representatives asking for information on upcoming lease sales in your area or areas of interest to your students. Discuss protocol for writing to members of congress.
3. Use the worksheet A Tidelines TV News Special: Oil in Troubled Waters to produce an imaginary TV news documentary. This was written in 1982, but these same issues are being discussed today. You may want to have students dress their parts and videotape the results for a more realistic atmosphere.
4. Have students prepare a short survey form about offshore drilling and leasing and solicit community opinions.
5. Invite those concerned with offshore drilling to make presentations to your class: oil companies, Native corporations, Alaska Department of Fish and Game, U.S. Fish & Wildlife Service, National Marine Fisheries, the Bureau of Land Management, fishermen, environmental groups, etc. Discuss community changes resulting from offshore drilling operations, environmental effects of drilling, safety considerations, and national energy needs. An Alaskan video on this topic is Uncertain Summer. Ocean Ranger by CBC describes a drilling rig that went down off the coast of Newfoundland.
6. Write individual or class letters to your Congressional representatives with the results of your research on offshore drilling.

EXTENSION:

1. Social studies/science: Show and discuss films/videos on offshore drilling. Uncertain Summer is a film based on reactions of Alaskans concerning leasing of the northeast Gulf of Alaska for oil exploration and production. Ocean Ranger is a film about an offshore drilling rig that went down off Newfoundland. (See appendices for information on obtaining these).

A TIDELINES TV NEWS SPECIAL

"OIL IN TROUBLED WATERS" is excerpted from *Alaska Tidelines*, Volume IV, Number 5, February 1982. Virginia Sims, editor. Copyright 1982, The Alaska Geographic Society, Box 4-EEE, Anchorage, Alaska 99509. Used with permission.

(Note: Before this article appeared in February of 1982, it was circulated to representatives of fishing, oil and gas, environmental and Native groups for critical review as to content and balance. Some changes have been made in the original text in an effort to present all sides as fairly as possible.)

Winds of change are blowing over Alaska. When the largest oil field in North America was discovered at Prudhoe Bay in the late 1960s, few doubted that the state would ever be quite the same again.

This is an imaginary TV News Special about the problems and promises of future oil development. The people in it are imaginary, too. But their questions and concerns are very real. And they have been discussed in such widely scattered places as an oil company board room, the wheelhouse of a fishing boat, and the community hall of an isolated village on the shores of the Bering Sea.

Read the script through. Then choose members of your class for each part and let them select a team of "advisors." Each part represents a different point of view, and there are other arguments you might think of as you go along.

Cast of Characters:

MODERATOR

CARRIE, spokesperson for the U.S. Interior Department

MIKE, oil and gas company official

JIM, member, Alaska chapter, Friends of the Environment

OLAF, commercial fisherman

JOE, North Slope Borough official

BARB, member of the governor's staff

JACOB, Mayor of a village on the Bering Sea coast

FAY, marine biologist

MODERATOR: Good evening, ladies and gentlemen.

Prudhoe Bay seems far away to most Alaskans. Still, the oil income from that great discovery has touched people in all parts of the state. It has meant less taxes, more jobs, better airports, low-cost loans, satellite TV, new village schools with basketball courts and hot showers, and a lot of other things we didn't think we'd get for awhile.

Oil development always has its risks, especially where unspoiled seas and coasts and wilderness areas are concerned. But so far the damage has been limited to an occasional spill along the trans-Alaska pipeline to Valdez.

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Then last spring the U.S. Interior Department announced a plan for oil development that would bring the risks of Prudhoe Bay to more than two-thirds of Alaska's coastline. In a move to make the nation less dependent on foreign oil, the government said it would speed up lease sales on hundreds of millions of acres of offshore lands in the Bering, Chukchi and Beaufort seas. Most of these waters not only have been called the most dangerous in the world, but they also hold some of the richest fisheries in the world.

That announcement touched off a storm of protest—from fishermen, from environmentalists, and from the people who live along those isolated coasts. Is it possible to drill safely in such treacherous waters? Can you clean up a spill in 40-foot seas? Are we moving too far too fast?

Our panel here tonight is made up of people who will try to answer some of those questions, and may raise some more of their own. Let's start with you, Carrie. Tell us about this new plan. And why the big rush to drill offshore?

CARRIE: The President feels very strongly that we need to find out as soon as possible how much oil the United States has within its borders. We think more than half of the nation's undiscovered oil may lie in Alaska and its outer continental shelf. But we won't know for sure until we look. So we want to give the oil and gas people a chance to discover what's out there and where it is.

MODERATOR: How much offshore land are we talking about?

CARRIE: Some changes still are being made. But our original plan is to offer about 200 million acres for leasing each year for the next five years. All that land certainly won't be leased. But the oil companies will be able to develop the most promising tracts.

JIM: One billion acres in five years is far too much. That adds up to an area about the size of the whole land mass of Alaska. You even took the oil companies by surprise. Some of them said it might be more than their experts and equipment could handle.

MIKE: Oh, no. We can handle it. We're ready. We've more than doubled our offshore surveying over the past two years. We wouldn't be out there if we didn't know what we were doing.

CARRIE: You see, Jim, most of these areas were already set for future leasing. We just increased the number of sales, changed some of the dates, and rearranged a few boundaries so that they line up better with the best potential oil basins.

OLAF: You sure did a job on some of those boundaries. You enlarged the North Aleutian Basin to take in Bristol Bay, which has the biggest red salmon runs in the world. Think of the damage a spill out there might do! And that's not all. During the height of the season we hardly have room for our own fishing fleet—and think of the foul-up of boats and nets and drilling rigs and seismograph tows. . .

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MIKE: (interrupting) We would hold up exploration during the peak of the runs.

OLAF: Well, how about St. George Basin? There are year-round fisheries out there—for pollock, cod, yellowfin sole. Millions of tons of whitefish are harvested each year in that area by foreign fishing fleets. It's a major source of food fish for the world. And it's also one of the state's prime crab-fishing grounds.

The point is that fish are renewable resources. Oil isn't. These fisheries can last for thousands of years if we don't goof. But the life of an oil field is only 20 to a top of 50 years.

BARB: The governor went through the roof when he heard that Bristol Bay was included. And he didn't like the idea of leasing in St. George Basin much better. But at his request, Interior Secretary Watt said he might change or delay some of the sales in those two areas.

CARRIE: Interior Secretary Watt is a reasonable man. He's aware of Alaska's concerns. He will listen to facts presented to him about possible risks. But because of the nation's pressing need for oil, he won't listen to fears unsupported by facts or experience.

OLAF: But we fishermen are about the only ones who have had experience in the southeast Bering Sea. And we know how wild those waters can be. Winds to 130 miles an hour. Snow, sleet, rain, fog. It isn't called the worst weather in the world for nothing.

JACOB: We know, too. We hunt on the moving ice pack farther north. And we have been caught in snowstorms where you cannot see ten feet, with winds so strong you have to get down and crawl to move. How would you clean up an oil spill in weather like that?

JIM: The government itself has made some pretty frightening forecasts for oil development in the Bering, Chukchi and Beaufort seas. It says right here in its own Environmental Impact Statement that we can expect 30 oil spills of more than one thousand barrels and 10 oil spills of more than ten thousand barrels during the probable life of these basins.

CARRIE: Those reports have to consider the whole range of possibilities—from no spills at all to the worst that can be expected. And, of course, everybody seems to leap on the worst possibilities.

JIM: Well, my understanding was that those figures were "best guesses."

MIKE: Actually, Jim, we have a very clean record offshore. Let me give you a few figures. In the past ten years there have only been two spills of more than 1,000 barrels from all of the offshore rigs operating in U.S. waters. Probably the worst spill we've ever had was in 1969 off Santa Barbara, California. And even that did no lasting damage. The fish were still there—although the fishermen didn't want to put their nets down through the oil. And the shellfish re-established themselves within a year or two.

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JACOB: The idea of trying to fish in oily waters is sickening. Who would want the fish? Our only cash income comes from commercial fishing. How could we make any money? We could not go to the bank. The Bering Sea is our bank. Furthermore, anything that affects the food chain of the sea would do far more damage here, because the growth rate of marine life is far slower in cold water.

MIKE: I was talking about the worst case, Jacob. We've learned a lot since then. And we've found that in the long run, oil development has had very little effect on the fisheries.

BARB: The governor says he'd sleep better at night if he heard that from a marine biologist instead of a petroleum engineer.

MODERATOR: Well, let's hear from our marine biologist. What do scientists think, Fay?

FAY: Frankly, scientists disagree on the effects of oil on fish and shellfish. Some say that fish like salmon wouldn't be affected because they could swim away from a spill. Others think the oil might disrupt their migrations—even plugging up their nostrils and throwing off their homing instincts.

Deepwater bottom-dwellers such as crab probably wouldn't be directly affected because in very cold water the oil usually stays on the surface. But an oil spill certainly could kill young crabs and other free-swimming larvae. And if storms or breaking waves churn the oil into bottom sediments, intertidal life could be smothered.

We do know that oil is disastrous to seabirds. It gets into their systems when they preen their feathers, and it destroys their insulation so that they freeze or drown. Marine mammals that depend on their fur for insulation, such as fur seals, sea otters and polar bears, also would suffer. We need to know much more about this. But unfortunately, federal funds for such studies are being cut back severely.

MIKE: Believe me, we don't want any oil spills either. And we haven't had any to speak of up here. We've developed new drilling techniques for the Beaufort Sea. And as Joe knows, that's hazardous environment. We've been operating safely in the upper Cook Inlet for more than 20 years. Cook Inlet has a silty bottom, much like the Bering and Chukchi seas. And there we've learned to deal with some of the biggest tides in the world and chunks of ice churning around all winter.

FAY: But what if you did get a spill, Mike. How could you clean it up?

MIKE: It would be tough and tricky. No question about that. But we've done a lot of research of Beaufort Sea conditions, and we've learned from our Canadian neighbors who have drilled in broken ice farther offshore than we have.

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Actually, we've found that our cold climate is a help, so far as cleaning up oil is concerned. Oil in very cold water will thicken and stay on the surface where it can be skimmed up or soaked up. Cold water also keeps it from spreading. For example, a spill of as much as 40,000 barrels in calm cold would cover less than a mile up here, where the same spill in warmer waters might cover up to 100 miles.

JOE: What if the oil is trapped beneath the ice, or is caught in the moving ice as Jacob was talking about?

MIKE: That's a bigger problem. But floating ice sometimes acts as a natural barrier to contain the oil until we get to it . . .

JOE: . . . if you can get to it . . .

JACOB: . . . if you could find it. You would probably find it washed up on our beaches after break-up.

OLAF: How about trying to clean up a spill in 40-foot seas with waves breaking all over the place.

MIKE: Well, no, we wouldn't even try it. But that's where nature takes over for us. In stormy seas, the oil breaks up and evaporates very rapidly. The open ocean has a great ability to absorb oil.

OLAF: Listen, Mike, we don't want to sound totally negative because we all need the gas and oil. We need it for our fishing boats, our snowmachines, our trucks, our planes. We just wish you'd get it somewhere else. And what I would like to know is this: Can anything be done to stop these offshore sales?

CARRIE: Well, the plan still must be approved by the President and passed by the Congress.

JOE: But the President is the one who asked for it in the first place, and he certainly seems to be able to get what he wants from Congress.

CARRIE: Well, it's federal land. All offshore land outside the state's three-mile limit belongs to the federal government. And so does the oil from those lands. You've got to realize that that oil doesn't belong to Alaskans any more than it belongs to somebody in Nebraska.

BARB: And unlike the Prudhoe Bay oil, the state won't get a penny for it—except possibly in a few cases where the oil fields might extend out under state lands.

MIKE: Now wait a minute, Barb. This state has been running on oil dollars ever since Prudhoe Bay began producing. We've spent hundreds of millions of dollars to find the oil and you take

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all the profits.

OLAF: Not all the profits. The oil companies are still making plenty of money.

MIKE: But the state has raised our taxes to the point where we can hardly afford to operate up here. So you shouldn't be surprised that we're willing to move offshore.

JACOB: Still it seems strange. Our lives depend on the fish and animals that live in those waters. You could not find a place to drill that could do us more harm. Yet because it is federal land, we have nothing to say about what you do out there. And we will get nothing for it.

MIKE: Well, talk to Joe here. The North Slope Borough has certainly benefited from the jobs and dollars oil development has brought in.

JOE: Fortunately, Prudhoe Bay is far away from most of our villages. So we are able to benefit without the bad direct effects of a boom-town. Some of our people hold jobs at Prudhoe. But their tours of duty allow for time off so that they can go home to hunt and fish. And some of our villages have invested in the construction of drilling rigs.

FAY: That's odd, since you've been fighting oil development because of its possible effects on the bowhead whale.

JOE: The oil industry is there. That is a fact of life. So to survive, we must make trade-offs.

We're an organized borough, of course, so we can tax oil and gas facilities on lands within our borders. And what we have done is to use this tax money to hire our own people to build new homes, public buildings, light plants and other things that we need—not just in Barrow but in all of our villages.

JACOB: But we don't have any regional government. Our villages are on their own. What will we do when the oil companies move in? What will happen to our lifestyle and our culture? Will it be like Unalaska after the fishing industry moved in at Dutch Harbor? Unalaska isn't an Aleut village any more. It is just a village with some Aleuts living in it.

MIKE: No, no. It doesn't have to be like that. You and your village can decide whether you want to be involved. And if you don't, we'll go somewhere else.

For example, Yakutat chose not to get involved when we were exploring for oil off the North Gulf Coast. So our drilling crews just flew in and out of the airport and never even went into town. On the other hand, Kenai chose to participate, and our plants and refineries there have 90 percent local hire.

And it isn't just the jobs. If we plan together, some of the oil company's needs might be help-

A TIDELINES TV NEWS SPECIAL

ful to you in the future. Like enlarging the airport or the boat harbor, or improving your roads and water systems. Maybe even building our warehouse with slanted floors so that you can use it later as a fish processing plant. You might think of these things, too, when you talk about “quality of life.”

JACOB: Well, we heard about a recent poll in Barrow that made us wonder. The people were asked about changes that had occurred since oil development began. And even though Prudhoe Bay is more than 200 miles away, they said there was more fighting, drinking and drug abuse in Barrow than there used to be, and not as much helping and sharing. They said prices had risen sharply and fish and game stocks had declined. They still rated the quality of life as “good,” but not as good as it was in 1970.

So we worry about what it would be like in our villages. We are so small and the oil companies are so big. And the travelling salesman has been here before.

MIKE: We are not travelling salesmen. Alaska is our home, too, and we are going to be here for many years. We can work together. It isn't oil versus fisheries, or oil versus lifestyles or oil versus anything else. It's oil and fish and whales and seals and people . . .

BARB: Sometimes it seems as though the outside world is asking the impossible of Alaska. They want us to provide the oil for their industrial economy. They want our prime fish products from unpolluted waters. And they still want us to remain the great unspoiled wilderness area of their dreams.

FAY: Well, we've lived through all kinds of “rushes” before—for gold, for furs, for fish.

CARRIE: And there will be more in the future—for coal, for minerals . . .

JIM: Which means we've got to handle this one better than it's ever been handled before.

JOE: And we can do it if we're careful—if we don't cut any corners.

JACOB: The oil has been there for millions of years. It will last a little longer.

OLAF: Which brings us back to the first question: What's the big hurry?

The story of development of Alaska's offshore oil resources is just beginning. Find out what has happened since this imaginary debate took place in 1982, and watch for TV and newspaper reports on the current situation

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HOME ELECTRICAL AUDIT

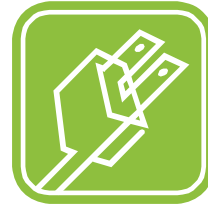
BY: Bonnie Jason, Janet Fink and Bill Morisette

EXTENSIONS: Sharing, Math, Geography, Social Studies, Language Arts

DURATION: 3 weeks, minimum of 15 mins. daily

OBJECTIVES: The students will learn how to monitor their electrical consumption and suggest how to make reductions. The students will practice appropriate small group behavior and communication skills. The students will practice designing and interpreting graphs.

BACKGROUND: This project requires a commitment of a few weeks. Daily time, however, is minimal. It is imperative, for a successful study, that you receive permission from a few families to monitor their electricity consumption. This can be done by sending home a letter soliciting volunteers prior to the beginning of the project. For best results six homes should participate. Three of these will be your control group, three will be your experimental group. The control group will be asked to keep their energy consumption as normal as possible for the duration of the study. The experimental group will, based upon the recommendations of the children, attempt to reduce their energy consumption. With permission from the families, ask the local electric company for their past records (perhaps asking for the records of the same month of the previous year). Also, line up an expert from the company to visit your class on at least two occasions. Dedicate one bulletin board to a display of graphs showing the daily results of your study. Organize your bulletin board as follows:



MATERIALS:

- Bulletin board
 - Graph paper
 - Resources on electricity use
 - Journals
- Worksheet:
- Energy Hog or Energy Hoarder

HOME ELECTRICAL AUDIT

	CONTROL GROUPS			*	EXPERIMENTAL GROUPS		
	Group A	B	C		D	E	F
Month last_yr	_____	_____	_____		_____	_____	_____
Month this_yr	_____	_____	_____		_____	_____	_____
week 1	_____	_____	_____		_____	_____	_____
week 2	_____	_____	_____		_____	_____	_____
week 3	_____	_____	_____		_____	_____	_____

PROCEDURE:

1. Week previous to start of project: Send letter home to families. Ask families for permission to obtain their past records from the electric company. Notify families as to which group their home will be placed (control or experimental). Line up an expert from the electric company to visit your class the following Monday and Friday. Ask the expert to bring copies of families' electric records with him/her on Monday. Use the Energy Hog or Hoarder worksheet to get students thinking about energy saving measures.

2. Week one of project:

Monday: Describe the project to the class. Tell them that they will be monitoring the electrical consumption of some of the families in the class. They will be keeping daily records and making recommendations for how some of these families can reduce their electrical use. As these families incorporate these suggestions, their consumption records will be compared to the homes whose electrical use remains unchanged. Have your expert from the electric company teach the children how to read an electricity meter and what information the meter provides. Also, ask the expert to teach the children how to read the electricity records. Now break the class into six small groups. Each group should contain one child whose home is being monitored. The groups could be named for the last name of the family being studied (i.e. the Smiths, the Browns, etc.). Hand out the electricity records from the same month of the previous year to the appropriate groups. With the help of the expert have each group design a graph that depicts the information on the record. Display these on the bulletin board and discuss the similarities and differences. Describe the daily routine for this project. Each day's homework assignment, for the children whose homes are being monitored, will be to read the electricity meter at their house. This must be done at exactly the same time each day. These children will report their reading to the group the following school day. The group will record the results on a graph for that week, and keep the graph on display on the bulletin board. After completing this task, the children must briefly write in their journal about what they believe the results reflect and what results they expect for the following day.

Tuesday: Children whose homes are being monitored should share their first meter reading with their group. Groups will design a graph for week one of the project and include day one's reading. Children will briefly write in their journals.

HOME ELECTRICAL AUDIT

Wednesday and Thursday: Groups will add results from day 2 and 3 to their week one graph, and in their journals, reflect upon the results. Keep in mind that the expert from the electric company is visiting again on Friday.

Friday: Groups should complete their daily assignment. As a full group discuss the similarities and differences observed in the graphs. Use the expert to help you and the class understand what these similarities and differences mean. Using the expert as a resource, ask the children to brainstorm suggestions on how families can reduce their electric consumption. Decide on a reasonable number of useful suggestions to recommend to the families in the experimental group. For the next week of the study these families will attempt to implement these suggestions into their daily life. It will also now be the responsibility of the children in these homes to report back to the group on how successfully their families are able to do this.

Remind the appropriate children that they must take meter readings over the weekend and report back to the group on Monday.

3. Week two of project: Continue on with the daily routine, but add in more large group discussion time in order to evaluate the success of the implemented suggestions for reducing the electricity consumption in the experimental group. You may want to once again invite your expert in to help in this process. Do not, until Friday, make any changes to your electricity reduction plan unless it is unavoidable. Come Friday, based upon the week's results, make a final evaluation and change your plan as needed.

4. Week three of project: Continue on with the daily routine, making time for frequent discussions. On Monday ask each group to put together a presentation of their information to give to the class on Friday. This presentation should provide the results of their study and explain how these results compare to other groups. It should also include an interpretation of the results, an evaluation of the process, and a description of how the project has altered their views, if indeed it has.

Finally, the presentation should include a description of what they intend to do with what they have learned. Be sure to leave time for this sharing on Friday. Also, save time this week for writing thank you notes to the expert and to the families involved in the study. You may want to include the results of the study in these letters.

EXTENSIONS:

1. Sharing: Notify the newspaper about the project and the results of your study (get permission from the families before giving their names to the press). Have the groups give their presentations during an assembly. Invite members of the community in to educate them about ways of reducing electricity consumption. Have your children write their suggestions and make a brochure available to the public (include the brochures in the newspaper, hand them out door to door, leave a pile at the public library, ask the electric company to

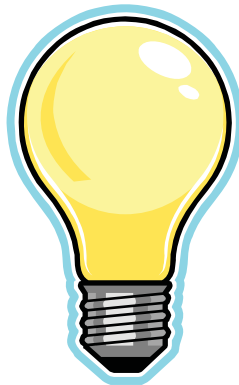
HOME ELECTRICAL AUDIT

send them out in their next billing, etc.). Make sure your brochure is printed on recycled paper! Make up a video news presentation to be shown to other classes, schools or interested groups.

2. Math: Use your graphs to do some studies on interpreting graphs. Ask your class to design a different type of graph depicting the results of the study. Use electricity meters to work on place value. Make up word problems using the information on the graphs or the information on the electricity records.

3. Geography/social studies/language arts: Have students write to schoolchildren in other states or countries and compare their energy use. Chart similarities and differences. Discuss the energy advantages and disadvantages of living in different areas. Have an energy saving contest with the other school. Suggested by Peg Willett.

4. Social studies: Have students list all the electrical appliances in their home and find the wattage for each. Then pick 3 and record how much time they are used for a 3 day period. Read the meter before and after. Using information from the utility company on the cost of kilowatt hours, compute the cost: per day, per week, per year. This could also be multiplied by the amount of households in this city. For the next 3 days students should make a special attempt to limit use of those 3 appliances. Have students predict the effect this will have on consumption figures. Take a reading before and after to check their prediction. Suggested by Peg Willett.



ENERGY HOG OR ENERGY HOARDER

(Reprinted from the Alaska Sea Week Curriculum Series, Volume VII)

Read and mark the answers that best describe what you do to save or use energy. Then total up your points: 70 points or more and you're an energy hoarder; 30 to 69 points you're not too bad; 29 to -29 need some improvement; and -30 points or less you're an energy hog!

1. Do you turn the heat down and use lots of quilts and blankets at night? (7 pts) _____
....an electric blanket? (4 pts) _____
....or just keep the whole house warm? (-2 pts) _____
2. Do you grow some of your own vegetables? (5 pts) _____
....pick berries? (5 pts) _____
....hunt or fish for food? (5 pts) _____
....rely only on food from the Lower 48? (1 pt) _____
3. Do you eat food from the four basic food groups everyday? (5 pts) _____
....sometimes eat from the four basic food groups? (3 pts) _____
....like pop, candy and potato chips? (-1 pt) _____
4. In your spare time, do you always have your nose in a book? (5 pts) _____
....bicycle, hike, swim, jog, canoe, sail, or cross country ski? (5 pts) _____
....ride a three wheeler, in a car, motorboat, or on a snowmachine? (-5 pts) _____
....feel that your nose may one day become permanently glued to the tube (TV)? (-3 pts) _____
5. Is your house weatherstripped and caulked? (5 pts) _____
....real drafty? (-3 pts) _____
....or does it have holes big enough for voles (Alaskan mice!) to come in through? (-5 pts) _____
(subtract another 3 pts if the holes are big enough for weasels!)
6. Are your windows single-paned? (1 pt) _____
....visqueened? (1 pt) _____
....double-paned? (5 pts) _____
....triple-paned? (8 pts) _____
....heat mirrored? (10 pts) _____
....argon filled? (10 pts) _____
7. Give yourself a point for each inch of insulation (or equivalent)
....in your roof _____
....in your floor _____
....in your walls _____
(if you have log walls, figure 1/2 pt for each inch of thickness)

ENERGY HOG OR ENERGY HOARDER

8. Add 4 pts if your house has a vapor barrier _____
9. Is the temperature in your house in wintertime*
....warm enough for bikinis? (-7 pts) _____
....OK for T-shirts and shorts? (-5 pts) _____
....cool enough for light sweaters? (3 pts) _____
....requires heavy sweaters and wool shirts (5 pts) _____
- *If your house is well insulated, you can still have it warm and be saving lots of energy, but there is such a thing as overheating!
10. Do you have a hot water heater? (-12 pts) _____
...add 5 pts if it is insulated _____
...add 5 pts if it is set at 120 F or less _____
...add 10 pts if it only heats "on demand" rather than having a tank continually filled with hot water. _____
11. Do you cook several dishes in the oven at once? (5 pts) _____
....use the oven for one large dish? (2 pts) _____
....or use it to make toast in the morning? (-1pt) _____
12. Do you boil water with the lid on the pan? (3 pts) _____
13. After washing clothes, do you hang them up to dry rather than using the electric dryer?
....never (-1 pt) _____
....in good weather (3 pts) _____
....in any weather (5 pts) _____
14. Do you turn off lights when you are not using them?
....never (-2 pts) _____
....sometimes (3 pts) _____
....always (5 pts) _____
15. Do you repair things when they break? (10 pts) _____
....or throw them away? (-5 pts) _____
16. Are your clothes
....from second-hand stores or hand-me downs? (8 pts) _____
....almost always new? (1 pt) _____
....only the finest designer specials? (-3 pts) _____

ENERGY HOG OR ENERGY HOARDER

17. Do you recycle or reuse newspapers, cans, bottles, paper? (10 pts)_____

18. Do you shut off the TV or radio when you're not using them?
....always (3 pts) _____
....sometimes (-1 pt) _____
....never (-3 pts)_____

19. Subtract 3 pts for each gas or electric appliance in your house. _____

20. Do you have solar panels, wind generator, geothermal, hydropower, air-to-air heat exchanger, or a heat pump in your house? (15 pts)_____

21. Add 3 pts for each additional way you save energy. Write them here. _____

22. Bonus question (15 pts). List at least 5 new ways you can save energy in the future.

Now total your points. _____

Are you an _____energy hoarder?
_____not too bad?
_____need some improvement?
_____an energy hog?

23. What changes could you make to improve your score?

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HOW MANY BARRELS DOES MY HOUSE USE ?

BY: P.J. Bauer and Claudia Bain

EXTENSION: Math

DURATION: 10-15 minutes

OBJECTIVE: By calculating the number of barrels of oil used by their own households in one year, students will make the connection between their personal energy consumption and the cargo of the *Exxon Valdez*.

PROCEDURE:

1. Write this formula on the board: 22 barrels per person per year.
2. Begin by explaining that all of the energy used by a person each year can be expressed in oil equivalents. Experts tell us that in the U.S., on the average, a person consumes 22 barrels each year.
3. Have each child calculate how many barrels of oil his/her family consumes each year. How many barrels are used by the whole class together? By all of the families represented in the class? How can you calculate how many tanker equivalents come to your town in a year? Have the children compare their town's energy consumption to the 11 million gallons spilled in Alaska. (1 barrel = 42 gallons)
4. Using the formula, calculate the energy consumption, in barrels of oil, of your school, too. What else can you think of to measure this way?

EXTENSION:

1. Math: Use the worksheet How Much Oil? to figure out how much 11 million gallons of oil is in descriptions that your students can understand.



MATERIALS:

- Pencil
 - Paper
- Worksheet:
- How Much Oil?

HOW MUCH OIL?

Homer High School chemistry and physics students wondered just how much 10 or 11 million gallons of oil really is. They got busy with some calculations designed to make it a little easier to visualize, and instructor Richard Ingels shared it **with the community**.

- The oil would fill up over 4.5 Homer High School Commons to the top.
- The oil would fill up over 3.5 Homer High School gyms to the top.
- The oil would fill over 44 Homer High swimming pools.
- If one left the kitchen faucet running at full volume it would take over 9.7 years to get the same volume as the oil spill.
- The oil spill is equivalent in volume to 8.8 million cars draining their oil.
- If 45 percent of the oil was converted to gasoline, a car using the gas could go around the world almost 4,000 times.
- If 45 percent of the oil was converted to gasoline, it would take a person 7,933 years to use the gasoline (filling up once a week).
- The oil would fill 92 average houses to the ceiling.
- It would take over 15,300 pickup trucks to haul the oil.
- It would require a fleet of 3,143 large fuel trucks to carry the oil.
- If the oil were spread out on the Sterling Highway half an inch deep and 24 feet wide it would stretch about 279 miles (from Homer to Wasilla).
- If the oil were soda pop, every person in Homer would be able to consume one can every day for about 82 years.
- It would take about 332 million boxes of Kleenex to soak up the oil.

Now - figure some examples for your community.

SCHOOL ENERGY DETECTIVES

BY: Belle Mickelson

DURATION: three 40 minute periods

OBJECTIVES: Students will investigate energy sources for their school. Students will suggest energy saving measures. Students will tabulate the cost savings from saving energy.

BACKGROUND: Schools in the north are traditionally overheated. Temperatures can be reduced during the day—and even more on the weekends. Windows are often sources of drafts. Hot water heaters are usually left on at night and on weekends. Most classes use vast amounts of paper. Lunchrooms often waste paper and styrofoam. Leftover food from student plates can be used to feed animals. Other items can be recycled. Once your student detectives begin to look, they may find many other ways to reduce waste and save energy.

PROCEDURE:

1. Ask the students to list ways the school could save energy. Tell them this is their chance to be school energy detectives.
2. Have students predict how much energy would be saved if the school started an energy saving program.
3. Find out how much money the school spends now for heating, electricity, paper and styrofoam products.
4. Weigh the amount of trash produced each day in the lunchroom. Weigh the amount of trash produced each day in your room. Then institute energy and waste saving measures and compare the savings.



MATERIALS:

- Thermometers
- Measuring tape
- Pencils
- Paper
- Tape

SCHOOL ENERGY DETECTIVES

5. Measure and record the window and wall temperatures in the classroom. Record thermostat settings. How do they compare?
6. Make a draftometer by taping a piece of paper on a pencil. Check for drafty windows and doors. Give your findings to the janitor. Maybe parents can help with caulking and weather stripping.
7. Measure the total areas of the windows. Measure the total area of the floor. Divide the floor measurement into the window measurement to get the window to floor ratio. A ratio greater than 10% is an energy waster. Are your windows on the north or south side of the building? What difference would that make? What is the importance of windows? How can windows be improved to reduce heat loss?
8. Tour the furnace room with the janitor. Is there any way the heat can be reduced? Would students be willing to wear sweaters during the winter? Could someone turn the heat down at night and on weekends? What temperature is the hot water heater set on? Could someone turn the hot water heater off at night and on weekends? Ask the janitor for other suggestions to save energy.
9. What other suggestions does your class have? Can paper be used on both sides? What about using the blackboard for lessons to save on paper? Or attempting to do more activities that don't require paper?
10. Compile your detective report and compare energy use and costs from one day to the next. Present your information to other classes, the principal, the school board, and the school newspaper.

(Procedures 5,6, and 7 adapted from the U.S. Dept. of Energy's [Science Activities in Energy.](#))

SUN TEA

BY: Bonnie Jason, adapted from Energy it's Everywhere curriculum. Used with permission.

EXTENSIONS: Sharing, Language Arts, Social Studies, Science, Math

DURATION: Total of 1 hour, divided into short segments throughout a single day

OBJECTIVES: Students will attempt to determine the usefulness of the sun as an energy source. Students will develop graphs to describe their data. Students will practice good observation techniques and group cooperation skills. Students will discuss energy sources using the terms renewable and non-renewable.

BACKGROUND: This is a very simple experiment in which students use the energy of the sun to make tea. Before beginning this activity you may want to discuss the concept of energy as defined by something that causes light, heat, and movement. The children will probably be very aware of the sun as a form of energy, but the clues for detection may seem subtle.

PROCEDURE:

1. Have a brainstorming session in which students list ways they can prove the sun produces energy (they see plants grow, people get hot when they sit in the sun, it causes the wind to blow, warms the water in their pools, makes the hood of the car hot, etc.).

2. Divide the class into 6 small groups. Give each group one jar of water and 6 tea bags (more or less depending on the size of the jars). Explain to the groups that they will be making tea, each using a slightly different procedure. Assign one group to place their jar in direct sunlight outdoors, place the tea bags into the jar and secure the top. The second group should place their jar in the shade outdoors. The third should



MATERIALS:

- 6 large glass jars with lids (jars must be the same size)
- Box of 100 tea bags
- Enough room temperature water to fill jars
- Cardboard piece at least 1 square foot
- Tinfoil
- Thermometers
- Spoons
- Honey
- Lemon juice
- Cups
- Ice
- Graph paper
- Writing equipment
- A sunny day

SUN TEA

place theirs on the window sill. The fourth, in a cabinet free from light. The fifth, in the classroom away from sunlight. And the sixth should make a reflector from the tinfoil and cardboard, place their jar in direct sunlight, and position the reflector beside it.

3. The groups should now observe their tea and write their observations into their journals. They should focus on the color and the movement of the tea and water. Ask them to take the temperature of the water and record this in their journals. Using spoons have them sip the tea and record their description of the taste. Encourage them to do these procedures very rapidly, so as to minimize disruption of the experiment.

4. Repeat this process once every half hour or forty-five minutes. Be sure to have the children mark down the time of their journal entries. Take the last reading approximately forty-five minutes prior to the end of the day. Then, ask the groups to make graphs that reflect the results of their study. These can be simple line or bar graphs, one representing color, one temperature, one taste. Display graphs where children can easily see them.

5. While you are enjoying your iced tea, discuss the similarities and differences that the graphs reflect. Compare the taste of the different teas. To help generate conversation ask questions similar to these: Which group's tea is the strongest? Why? Which group's tea is the next strongest? Why? Which group's tea is the weakest? What caused the water to turn to tea at different rates? What are the pros and cons of using the sun as a source of energy?

6. Discuss other forms of energy. Which energy sources are renewable? (sun, wind, wood, water) Which energy sources are non-renewable? (coal, oil, gas)

7. Science/social studies: Plan a field trip to a solar collector. Use a check list like the one enclosed ([Sun Tour](#)) to keep students looking for renewable and non-renewable energy sources. Have students interview the owner regarding the advantages/disadvantages of solar heat.

EXTENSIONS:

1. Sharing: Designate a bulletin board for the groups to display their graphs. Make large quantities of sun tea to share with the school at lunch or recess. Use herbal teas and flavored teas.

2. Language arts/social studies: Have the children write up a recipe for successful sun tea. Have children interview someone who uses the sun to get energy for their home or work place.

3. Science: Have the children develop other sun recipes and try them. Try some other sun experiments. Compare evaporation of water indoors and out. Plant some seeds and compare their growth indoors and out.

4. Math: Use the graphs for graph making and interpreting activities. Generate a graph to compare the success of various energy sources. Develop word problems based on the information in the graphs.

SUN TOUR

How many of the things will you see on your field trip?

The Sun	An insulated building
A solar collector with roots	A building with icicles
A flying solar collector	Arctic entryway
A building with south-facing windows	Closed curtains
An uninsulated building	Log house
Storm windows	A car with 6 people in it
Wood smoke	Somebody walking
Visqueened windows	A hitchhiker
A car with one person in it	A stop sign
People riding a bus just like us (wave)	A store with lots of lights on
A truck with dual exhausts	A river
A paddle wheel	Sidewalk
A street light	Airport
Bike path	Neon sign
Airplane	Railroad
Parking lot	Stop light
Yield sign	Telephone pole
Train	Wind
Transformer	Somebody bicycling
Coal-fired power plant	Radio tower
Grocery store	A park
Fast-food store	Dumpster
A forest	Waste paper
Taxi	Television
Aluminum can	Somebody wasting energy
Flourescent lights	Somebody saving energy
Laundromat	A working solar collector
Something plastic	

How are these items related to energy?

How many renewable energy sources did you see?

How many non-renewable energy sources?

Circle all the renewable energy sources, or things that help save energy.

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WIND POWERED BOATS

BY: Bonnie Jason

EXTENSIONS: Social Studies, Art, Math, Sharing, Language Arts, Science, Math

DURATION: Three 45 minute periods, three different days

OBJECTIVES: Students will explore wind as an alternative energy source. Students will make wind-powered boats for a class race.

BACKGROUND: Any use we can make of the wind reduces our dependence on oil. Cooperation is an effective use of energy. This activity is designed to promote creative thinking and imagination. Allow the children great freedom in the design of their boats, restricting only the size of the vessel. If you don't have easy access to a pond where you teach, have the children design land boats, which can be sailed in the parking lot. If you do have a nearby pond, use it. The children will want to be certain that their boats will float, so keep a basin of water in the classroom where the children can test out their inventions as they create them. The list of materials is just a suggestion. You will want to develop your own based on the materials that are available. Use scraps and throw-aways as an example to students of ways materials can be recycled.

PROCEDURE:

1. Explain to the class that to help reduce our dependence on oil, they are going to invent wind powered boats (Use this term rather than sail boat in hopes that the students may invent other means of capturing the wind's power). After the boats have been constructed they may be entered into the GREAT TOY BOAT RACE. Mention the location of the race, the materials at hand and any restrictions on size of the boat such as one foot long and two feet tall.



MATERIALS:

- Cardboard scraps
- Styrofoam, plastic or tinfoil trays and scraps
- Scrap cloth (sheets, etc.)
- Popsicle sticks/toothpicks/straws
- Lego pieces (especially wheels)
- Wood scraps
- Construction paper
- Straight pins
- Rubber cement/glue
- Plastic wrap
- Egg cartons
- Needles and thread/string
- Rubber scraps (old rubber boots)
- Strong scissors/Exacto knife (you use it, not the kids)
- Wire/coat hangers
- Rulers/pencils
- 1 whistle
- 1 bag of peanuts
- Fan (for wind)
- Basin of water

WIND POWERED BOATS

2. Group the students in twos or threes, and allow them to investigate the pile of materials.
3. Before allowing students to begin the construction of their boats, ask them to draft up an idea and list the materials they will need. Allow them to bring things in from home. On this first day students draft, conference with the teacher, redraft, collect materials and write in their journal about what they are going to do the next day.
4. On day two, the construction process takes place. Allow the students to have trial runs of their boats using a fan to create wind. If the boats are for water, have the trial runs in a basin. Don't place the fan near the water, instead have students blow through straws to create wind.
5. Have students write in their journal about their experiences constructing the boats and predict how their boats will fare in the race. If time permits, let them share their journal entries and talk about their projects.
6. Day three is the big event. If day three is windless you may want to postpone the event, but be certain to discuss this with the children. You want them to realize that relying on the wind for energy means either waiting for the wind to blow or learning how to store the energy.
7. Structure the race as follows: Each group is given a peanut. The boat must carry the peanut from the starting line over the finish line. The object is to be the first boat to cross the finish line. At any point that a boat capsizes or goes off the racetrack or gets stuck on a pebble or in grass, the group involved must pick up the boat and bring it back to the starting line. (Lost peanuts can be replaced at the starting line). Races in ponds may require boots or long poles or rowboats with lifejackets for rescue. The race begins on the whistle and ends when the last boat has crossed the line or withdrawn from the competition.
8. At the completion of the race, display the boats and allow students to compare and contrast their designs and discuss how this affected their success. Also discuss how it felt to rely on the wind to power their inventions. Talk about the variety of ways the students harnessed the wind and how successful these methods proved to be. Talk about old-time sailing boats that were used for trade, transportation and for fishing. What kinds of boats/cars do you think we will use in the future?
9. Have the children reflect in their journals once again about the project, the race and their feelings.

EXTENSIONS:

1. Social studies/art/math: Imagine your family is planning to buy a sailboat or a power boat for recreation. Discuss which would use the least oil/gas. How much does oil and gas

WIND POWERED BOATS

cost now? How much gas does your boat burn in an hour? What is the cost per hour of running a power boat? What other considerations will be important? Draw a picture of your choice.

2. Sharing: Display the boats and the blueprints. If you can do so without hurting feelings, display them in terms of first, second, third place, etc. or have prizes and categories for each boat. Encourage students to name their boats and design a nice sign to go with their display. Take the boat show on the road. Display it in the library, foyer, cafeteria, a local marina or yacht club. Invite the press to photograph your race. Be sure you take pictures for a hallway bulletin board. Have a boat show and invite the parents, administrators, and the press.

3. Language Arts: Have the children write about their projects and publish their work in the school newspaper. Use the boats as inspiration for creative writing. Learn some yachting terminology and add these to your spelling and vocabulary lists.

4. Science: Study ways in which people harness the power of the wind. Discuss the pros and cons. Visit a wind generated energy supply. Do comparative studies of energy sources and their pros and cons.

5. Math: Make graphs showing the results of the race. Design graphs comparing various energy sources. Make up work problems based on the information in the graphs. Use cuisinere rods to approximate the area of the boats. Do scale drawings, and change the scale.

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HAMSTER POWER

BY: Bonnie Jason

EXTENSIONS: Sharing, Science, Math

DURATION: Variable

OBJECTIVES: Students will investigate animals as an alternative source of energy and draw conclusions about their usefulness. Students will practice group cooperation skills.

BACKGROUND: Admittedly, this is an unusual experiment. The children will be harnessing the power of the hamster by rigging up a contraption to the hamster's exercise wheel. The success of the experiment does rely on the willingness of the hamster to cooperate. Harnessing the power of animals is a realistic alternative to other energy sources, but it certainly has its limitations.

To prepare for this activity, ask one of the students to bring to school a pet hamster.

PROCEDURE:

1. Rig up the coat hanger to the outer edge of the exercise wheel. Bend it over the edge of the cage and onto the cranker of the egg beater. Prepare the ingredients for the cake as instructed. Place the egg beater into the bowl. Either balance the beater or have the children take turns holding it. As the hamster exercises on its wheel, the beater ought to mix the ingredients. Obviously, the hamster will not perform upon request so this activity may take a good part of the day to complete.

2. Bake and eat the cake. While snacking, discuss the pros and cons of such an energy source. Consider its usefulness, practicality, dependability, etc. Discuss the use of dog teams rather than snowmachines in arctic Alaska. Ask local dog team handlers and snowmachiners for their ideas on advantages and disadvantages.



MATERIALS:

- Hamster (or other small rodent)
- Cage with exercise wheel
- Coat hanger or strong, light-weight wire
- Egg beater
- Cake mix and ingredients
- Mixing bowl
- Baking pan
- Access to oven

HAMSTER POWER

EXTENSIONS:

1. Sharing: Have students write in their journal about their experiences in this activity. Share, if the students consent. Invite others in to snack with your class.
2. Science: Have the students invent other ways of using the hamster's energy. Have them write these up as experiments and carry out the procedures, if possible. Experiment with other ways of using animal power. If possible, visit someone who uses animals as an energy source.
3. Math: As students prepare the cake focus on measuring liquid and dry ingredients. Have students develop graphs to reflect the energy output of the hamster. Or, develop graphs that compare the energy output of the hamster to other forms of energy. Have them develop a hamster unit of energy. Make up word problems based on your experiment.

JUNK SCULPTURE FOR ETERNITY

BY: Janet Fink

EXTENSIONS: Language Arts, Science, Science/
Social Studies

DURATION: 45 - 60 min

OBJECTIVES: Students will create a sculpture that is non-biodegradable.

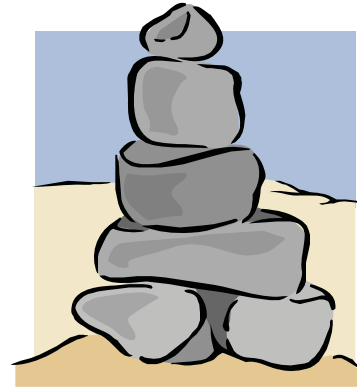
BACKGROUND: Discuss products that come from oil. Try to generate plastic, styrofoam and rubber. Discuss the future of each of these products emphasizing that plastic and styrofoam do not biodegrade. At this point an expert in the field may be invited to discuss the properties of petroleum based products.

PROCEDURE:

1. Place the pile of "trash" in the middle of the room. Discuss with the class the possibilities of the future of this pile. The discussion will probably center around the sending of the trash to the dump and it being buried. What would its future be? Keeping in mind that plastics do not decay, what are the options? Since this plastic will be around in thousands of years, propose the possibility of creating an art project using only plastic and styrofoam.

2. Break the class into groups of 3 to 4 students each. Divide up the plastic. Allow each group to design a sculpture using their share of the plastics. Cooperative learning enters at this point. Use a glue gun to attach the pieces. Do not attach any pieces unless the whole group agrees. The group dynamics are enjoyable as students determine together their end product.

In conclusion, with the pieces on display, discuss their future.



MATERIALS:

- Plastic trash
- Glue gun

JUNK SCULPTURE FOR ETERNITY

EXTENSIONS:

1. Language arts/science: Have students write in their journals for a week, keeping track of all plastic that is used in his/her household.
2. Science/social studies: Take a field trip to the supermarket. Record items that can be purchased in "environmentally safe packaging."
3. Social studies/language arts: Share your sculptures with the community, perhaps at the local supermarket, museum or in the hallways of the school. Write an article for the local newspaper.

ENERGY CONSCIOUS LIFESTYLE

BY: Janet Fink and Bonnie Jason

DURATION: Variable

OBJECTIVES: Students will establish an environmental consciousness. Students will design their own future houses.

BACKGROUND: One result of the *Exxon Valdez* oil spill is that many people are becoming much more conscious of their lifestyle - and the amount of energy used in their daily life. The less energy used, the smaller number of tankers that will be traveling the oceans of the world - and the less spills we will have. Recycling can really help to save energy, because it takes much less energy to produce an item the second time around. In the case of an aluminum can - it only takes 5% as much energy as the first time: And each can recycled is like saving half that can filled with gasoline in terms of btu's saved!

PROCEDURE:

1. Brainstorms ways that your students can reduce their use of petroleum products and their energy consumption. Go over the worksheet 50 Things You Can Do.
2. Choose one of these as a class project:
 - a. Start a recycling bin at your school or participate in one in your community.
 - b. Try to change the packaging at a local fast food outlet.
 - c. Focus on plastic usage within your school. Could it be reduced? Lunchrooms seem to be a good area for this (styrofoam trays, plastic silverware etc.).
 - d. Focus on local grocery stores. Do they offer paper or plastic bags? Perhaps a poster campaign will encourage shoppers to choose paper. Or better yet, make bags out of cloth for the students' families to use when they go grocery shopping.



MATERIALS:

- Variable
- Worksheets:
 - 50 Things You Can Do

ENERGY CONSCIOUS LIFESTYLE

- e. Start a letter-writing campaign to food companies to try to get them to reconsider their packaging techniques. Many food companies have recently switched to plastic instead of glass.
 - f. Make mugs to be used by your students in the lunchroom, or at class parties.
 - g. Write, print and distribute leaflets that educate the public on ways that they can reduce their energy consumption. Be sure to use recycled paper.
 - h. Have an Energy Awareness Fair, open to the public, to promote responsible energy use, alternative energy use, and reductions in energy use. Invite the press.
 - i. Write editorials to the local newspaper focusing on how energy is used or misused in your community.
 - j. Make a video that describes ways that families can reduce their energy consumption. Make this available in the public library. Be sure to do a little advertising so that it will be well circulated.
3. Have students design their own future houses — taking into consideration alternative energy and energy conservation.

50 THINGS YOU CAN DO

IN YOUR HOME

- Learn where the energy for your home comes from.
- Investigate local recycling centers.
- Recycle everything you can: newspapers, cans, glass, aluminum foil and pans, motor oil, scrap metal, etc.
- Save your kitchen scraps for the compost pile.
- Try to use phosphate-free laundry and dish soaps.
- Avoid the use of household pesticides. Flyswatters work very well.
- Clean your windows with vinegar and water instead of chemical products. Crumpled up newspapers are great for washing windows.
- Hang your clothes out to dry.
- Use washable rags, not paper towels, for cleaning up spills and other household chores.
- Use cloth diapers.
- Use cloth, not paper, napkins.
- Don't use electrical appliances for things you can easily do by hand.
- Re-use brown paper bags to line your trash can instead of plastic liners. Re-use bread bags, butter tubs, etc.
- Use re-usable containers to store food, not plastic wraps and foil.
- Write to companies that send unwanted junk mail. Ask them to take you off their list.
- Take unwanted, re-usable items to a charitable organization or thrift shop.
- Don't leave water running needlessly.
- Turn off the water when you brush your teeth.
- Install a water saving shower head.
- Take shorter showers.
- Set your water heater at 130 degrees.
- Turn the heat down and wear a sweater.
- Turn lights off when you're out of the room.
- Burn only seasoned wood in your stove or fire-place.

50 THINGS YOU CAN DO

IN YOUR CAR

- Drive sensibly...don't waste gas.
- Keep your car tuned up.
- Carpool.
- Ride your bike or walk instead.
- Drive a more efficient car.
- Recycle your engine oil.
- Keep your tires properly inflated to save your tires.
- Don't litter.

WHEN YOU'RE SHOPPING

- Don't buy food or household products in plastic or Styrofoam containers if there is an alternative. They can't be recycled and they don't breakdown in the environment.
- Don't buy "disposable" anything. Paper plates and towels, Styrofoam cups, etc. are extravagant wastes of the world resources.
- If you buy disposables, buy paper products rather than plastics or Styrofoam.
- Buy durable products and keep them longer. Cheap furniture, clothes and appliances often have a short life span.
- Check the energy rating on major appliances.
- Read labels and buy the least toxic product available for cleaning, pest control, etc.
- Put your parcels in one big sack instead of collecting several small ones - or better yet, use a re-usable string or canvas bag. Don't buy things with excess packaging.
- Buy in bulk.
- Ask questions...don't buy products that are hazardous to the environment or that were manufactured at the expense of important animal habitat.
- Buy locally grown food and locally made products when possible to save on transportation costs.

PERSONAL EFFORTS

- Join a conservation organization.
- Volunteer your time to conservation projects.
- Give money to worthy conservation/ environmental causes.
- Check your lifestyle...think about the effects of your daily actions on the environment.
- Read books and articles on wildlife and environmental issues.
- Watch nature programs on T.V.
- Subscribe to conservation or environmental publications. Purchase them as gifts for others.
- Pick up litter along highways and near your home.