

The Human Footprint

Name _____ Station# _____

Homeroom Teacher _____

Discovery Lab
Science Notebook

Pesticide Watch Card Ranking List



RANK	FRUIT OR VEGGIE	AMOUNT OF PESTICIDES
1	Peaches	HIGHEST
2	Apples	HIGH
3	Sweet Bell Peppers	HIGH
4	Celery	HIGH
5	Nectarines	HIGH
6	Strawberries	HIGH
7	Cherries	HIGH
8	Lettuce	HIGH
9	Grapes - Imported	HIGH
10	Pears	HIGH
11	Spinach	HIGH
12	Potatoes	HIGH
13	Carrots	HIGH
14	Green Beans	HIGH
15	Hot Peppers	HIGH
16	Cucumbers	HIGH
17	Raspberries	MEDIUM
18	Plums	MEDIUM
19	Oranges	MEDIUM
20	Grapes - Domestic	MEDIUM
21	Cauliflower	MEDIUM
22	Tangerine	MEDIUM
23	Mushrooms	MEDIUM
24	Cantaloupe	MEDIUM
25	Lemon	MEDIUM
26	Honeydew Melon	MEDIUM
27	Grapefruit	MEDIUM
28	Winter Squash	MEDIUM
29	Tomatoes	MEDIUM
30	Sweet Potatoes	MEDIUM
31	Watermelon	MEDIUM
32	Blueberries	MEDIUM
33	Papaya	MEDIUM
34	Eggplant	LOW
35	Broccoli	LOW
36	Cabbage	LOW
37	Bananas	LOW
38	Kiwi	LOW
39	Asparagus	LOW
40	Sweet Peas - Frozen	LOW
41	Mango	LOW
42	Pineapples	LOW
43	Sweet Corn - Frozen	LOW
44	Avocado	LOWEST
45	Onions	LOWEST

Pesticide Vocabulary



The word pesticide is often used incorrectly to refer to products for controlling insects. Pesticide is a generic term, covering all products used for controlling any kind of pest. Under the broad heading of pesticide, there are many sub-categories, including:

1. Algicide - for controlling algae, such as in swimming pools
2. Bactericide - for controlling bacteria
3. Biocide - for controlling microorganisms
4. Fungicide - for controlling fungi (mushrooms) and molds
5. Herbicide - for controlling pest plants or weeds
6. Insecticide - for controlling various types of insects
7. Miticide - for controlling mites (small insects in the spider family)
8. Molluscicide - for controlling snails and slugs
9. Nematicide - for controlling nematodes (parasitic microscopic worms that live in the soil)
10. Ovicide - for controlling the eggs of insects and mites
11. Rodenticide - for controlling mice, rats, gophers and other rodents

Household Hazards

List Of What you think would be Hazardous Items in Your home	Group ideas of Hazardous Items	Hazardous or Not
1. Baking Soda _____ 2. Lemons _____ 3. Vinegar, Salt, Water _____ 4. Salt and Boiling Water _____ 5. Corn Meal _____ 6. Lemon Oil _____ 7. Olive Oil _____ 8. Cedar Chips _____ 9. Corn Meal _____	A. Bathroom Cleaner B. Room Deodorizer C. Furniture Polish D. Moth Balls E. Abrasive Powder F. Rug Cleaner G. Drain Opener H. Sink Cleaner I. Carpet Cleaner	<p>What items surprised you?</p> <p>Which items do you think you could try to change in your house?</p>

- Bug sprays
- Baking Soda
- Bat teries
- Paint
- Ant Killers
- Cedar Chips
- Borax
- Vinegar
- Sal t
- Moth Ball s
- Lemon Oil
- Mirror Cleaners



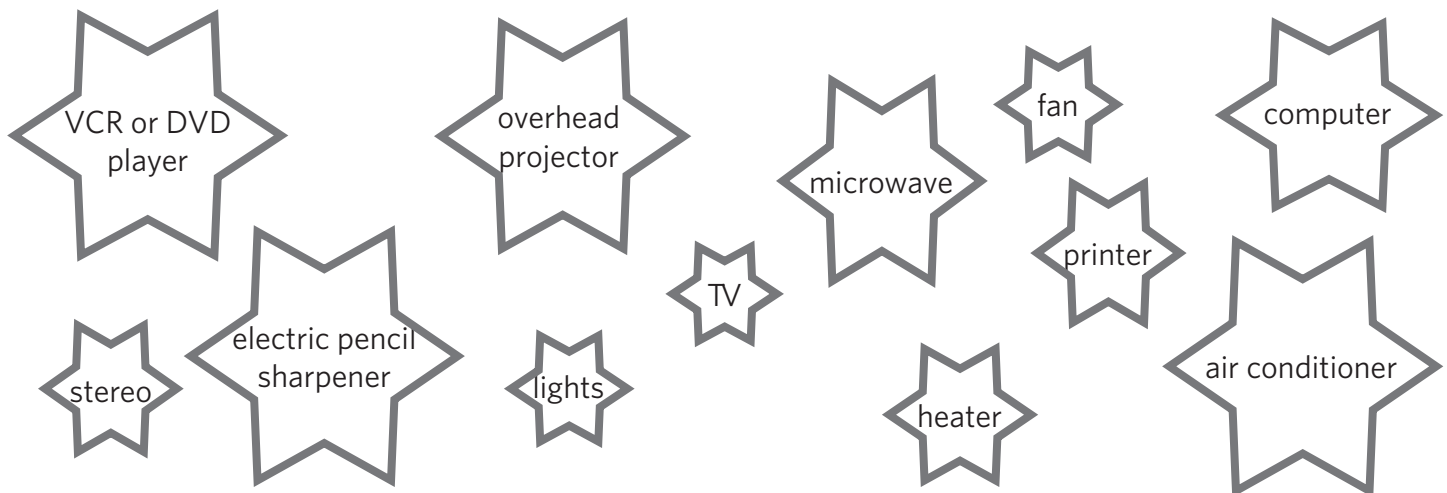
Student Information Sheet

How do the things you do in your classroom affect the environment? Read this sheet to find out.

Electricity

Making electricity can hurt the environment in many ways, including using up natural resources and creating pollution. We need to use electricity for some things, but the less we use, the better.

Things you may have in your classroom that use electricity include:



Transportation

Cars and buses use up fuel and create pollution. In fact, transportation is one of the biggest sources of pollution that adds to global warming.

If every student in your class rides to school in a separate car, that creates a lot of pollution.

Carpooling with two or more students in the same car creates less pollution than riding in separate cars.

Taking the bus with lots of other people creates less pollution than carpooling.

Walking or riding a bike creates no pollution at all!

Reduce, Reuse, Recycle!

Recycling does amazing things to help the environment. It reduces the amount of natural resources we use, cuts down the amount of material dumped into landfills, and even reduces the amount of electricity used to make new materials.

Recycling is only part of the story. Reusing things as many times as possible and reducing the number of things and amount of materials we use in the first place are just as important.

Here are just a few of the things you can recycle:

paper

wrapping paper

cardboard

egg cartons

aluminum foil

newspaper

plastic bottles

envelopes

cans

glass bottles

magazines

glass jars

Water

Earth has a limited amount of fresh water that we can use for drinking and cleaning. We are using, wasting, and polluting more of that water every year. It is important to save water so there will be enough left for our children and grandchildren to use.

Try to reduce the amount of water you use whenever you:

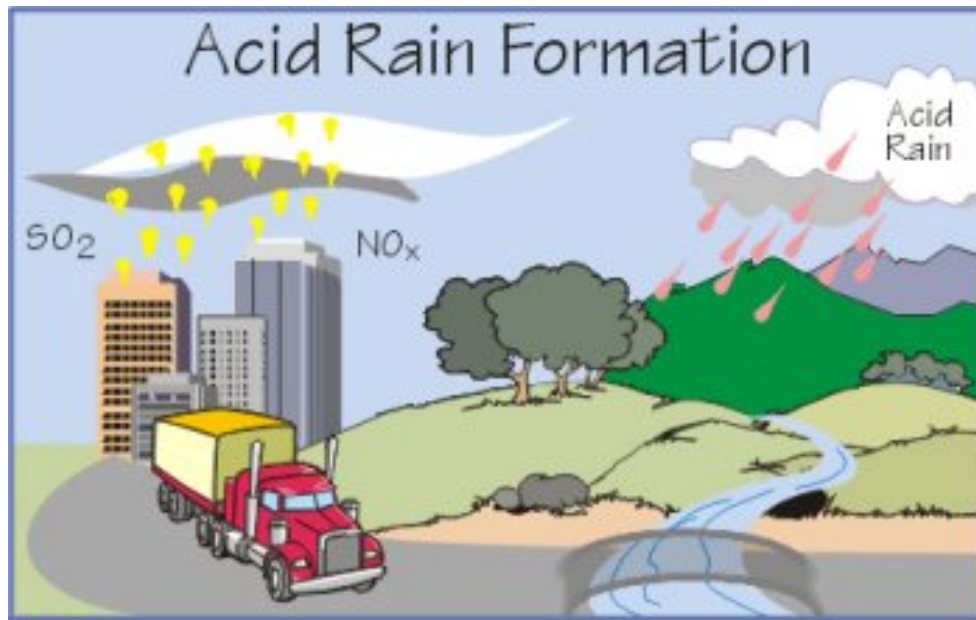
water the lawn

take a shower

wash the dishes

wash your hands

do your laundry



Acid rain is more acidic than normal rain and forms through a complex process of chemical reactions involving air pollution. The two most important pollutants that contribute to the formation of acid rain are oxides of nitrogen and sulfur dioxide, which react with moisture in the atmosphere to form nitric and sulfuric acid. The sulfur and nitrogen compound that contribute to acid rain primarily come from manmade sources, such as industries and utilities. Emissions also come from automobiles and other forms of transportation and industrial processes, such as smelting. Acid rain can harm forests and crops, damage bodies of water, and contribute to the damage of statues and buildings. Researchers are considering the possible effects of acid rain on human health. These acidic pollutants can be deposited through rain, snow, fog, dew, or sleet. Large quantities can also be deposited in a dry form through dust. Pollutants that contribute to acid rain may be carried hundreds of miles before being deposited on the earth. Because of this, it is sometimes difficult to determine the specific sources of these acid rain pollutants.



Greenhouse Gases: Ozone



Ozone can be found in two places in the atmosphere. In the stratosphere, radiation from the sun turns oxygen into ozone. This forms the ozone layer, which protects living things from harmful radiation from the sun. A tiny bit of ozone from the ozone layer mixes into the lower atmosphere, in the troposphere. So, the troposphere contains a tiny amount of ozone naturally. However, human activities have caused more ozone to form in the troposphere. Ozone in the troposphere acts as a greenhouse gas, trapping radiation and leading to warming.

When gasoline is burned in cars and other automobiles, carbon and nitrogen compounds come out of the tailpipe and into the atmosphere. Sunlight breaks apart these carbon and nitrogen compounds to make ozone. The same thing happens to make smoke from factories and power plants that burn fossil fuels. Ozone is one of the main compounds in smog.

The amount of ozone in the troposphere has increased by about 30% since humans have been building factories and automobiles. This increase is so much that scientists think ozone could play an important role in global warming. However, ozone has a short residence time in the atmosphere. Therefore, if people release less ozone into the lower atmosphere, then the amount of ozone in the lower atmosphere should decrease quickly.



The Human Footprint

Global Climate Change and Sea Level Rise

Objectives

In this lesson, you will

1. learn that ice formations on land will cause a rise in sea level when they melt, whereas ice formations on water will not cause a rise in sea level when they melt.
2. learn that ice is less dense than water.
3. learn that ice displaces water equal to the mass of the ice.
4. practice some of the steps involved in a science investigation.



Materials

- two identical clear trays per group
- modeling clay per group
- 1 ruler per group
- 1 tray of ice cubes per group
- 1 liter of water per group
- Science Notebook

Vocabulary

- **global climate change:** the alteration of average global temperature, rainfall, and wind patterns as a result of increased atmospheric greenhouse gases
- **greenhouse gases:** gases in Earth's atmosphere that absorb and reradiate heat near the surface of the planet
- **density:** a measurement of compactness. For solids, this is usually measured as mass per unit volume. For substances dissolved in water, this is usually measured as parts per thousand or million.
- **displacement:** the forced relocation of water due to a submerged or partially submerged object occupying fluid space

Activity



Is there a lot of ice in the world? Is the ice on land or on water? Does it matter whether the ice is on land or water? Will one or both cause sea level to rise when they melt? Which type of melting will cause a greater increase in sea level?

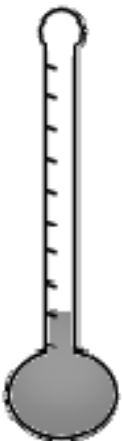
Directions/Procedures

Place half of the clay into one side of each box. Form the clay to represent land rising out of the ocean. In one box, form a level place at the highest part as shown below. Make rivers on the land if you like.

The Human Footprint



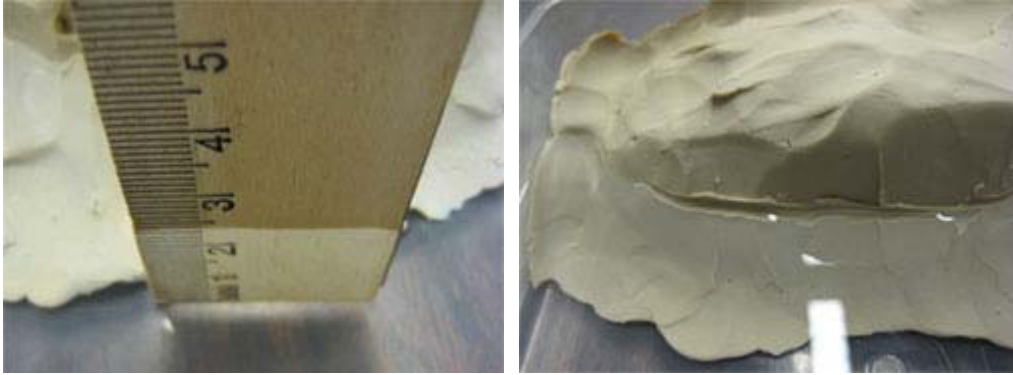
1. Place as many ice cubes as possible on the level place formed with the clay in the first box.
2. Place the same number of ice cubes next to the clay in the second box, so that they are resting on the bottom of the container.



3. Pour water into the container where the ice is resting on the bottom until the ice floats. Be sure the ice is floating, not resting on the bottom. If this occurs, add more water.

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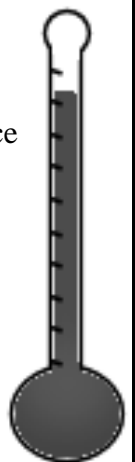
4. Pour water into the second container with the ice resting on the clay (be careful not to disturb the ice cubes) until the water levels in the two containers are approximately equal.
5. On the Sea Level Rise Worksheet, record initial measurements of water height (in mm) using a ruler.



6. Leave the setup. Take measurements every 30 minutes and record the results on their worksheets.



7. Measure new water heights and make observations about what occurred once the ice melted.
8. Answer the following questions in the conclusion on the worksheet.
 - In which “situation” did the water level rise more?
 - How do the results compare with your predictions?
 - Why do you think this happened?



The Human Footprint

Date: _____

1. Is there a lot of ice in the world?
2. Is the ice on land or on water?
3. Does it matter whether the ice is on land or water?
4. Will one or both cause sea level to rise when they melt?
5. Which type of melting will cause a greater increase in sea level?



Measurements:

Time (min)	Water Height (mm)	
	Floating Ice	Landlocked Ice
At set up		
30 min		
45 min		
60 min		

6. In which “situation” did the water level rise more?
7. How do the results compare with your predictions?
8. Why do you think this happened?

The Human Footprint

Great Websites:

National Geographic- Human Footprint

<http://channel.nationalgeographic.com/episode/human-footprint-3224/Overview>

Wildlife Conservation Society-The Human Footprint

<http://www.wcs.org/humanfootprint/>

Global Footprints- <http://www.globalfootprints.org/>

Climate Change- http://www.climatechangenorth.ca/K1_Student.html

Climate Change Kid Site- <http://www.epa.gov/climatechange/kids/>

Watersense Kids- <http://www.epa.gov/watersense/kids/>

Garbage and Recycling- <http://www.epa.gov/kids/garbage.htm>

World Wildlife- <http://www.worldwildlife.org/home-full.html>

Kids' Planet- <http://www.kidsplanet.org/>

EcoKids- <http://www.ecokids.ca/pub/index.cfm>

EekoWorld- <http://pbskids.org/eeeworld/>

The Greens- <http://meetthegreens.pbskids.org/>

The Green Squad- http://www.nrdc.org/greensquad/intro/intro_1.asp

The Big Blue Bus- http://www.dfo-mpo.gc.ca/canwaters-eauxcan/bbb-lgb/index_e.asp

Roofus Solar and Efficient Home- <http://www1.eere.energy.gov/kids/roofus/>

EEK, Environmental Education for Kids-

<http://www.dnr.state.wi.us/org/caer/ce/eeek/index.htm>

Koshland Science Museum- <http://www.koshland-science-museum.org/exhibitgcc/index.jsp>

NASA Kids' Earth- <http://kids.earth.nasa.gov/>

Clean Sweep USA- <http://www.cleansweepusa.org/>

Acid Rain Students Site- http://www.epa.gov/acidrain/education/site_students/

Wastewater Sewage in Your Face-

<http://www.sandiego.gov/mwwd/kids/index.shtml>

Kids Saving Energy- <http://www.eere.energy.gov/kids/>

The Human Footprint

Cleaning Oiled Feathers

In this experiment, you'll look at the way oil affects bird feathers and try out different cleanup methods to find out which works best.

Materials

- Clean, dry feathers (good places to find feathers are beaches, parks, and pet stores)
- Three bowls
- Vegetable oil
- Dish-washing detergent
- Hot and cold water (the hot water should be about the same temperature you'd use to wash dishes, and not too hot to put your hands in)

Instructions

1. Take a look at the feathers you've collected, then try to answer the following questions:
 - What kinds of water birds can you think of?
 - What kinds of things do water birds do?
 - What do feathers do for water birds?
2. Get a bowl and some vegetable oil. If you'd like, you can mix a little cocoa powder into the vegetable oil to make it show up better and look more like crude oil.
3. Fill the bowl with water to an inch or two below the rim. Pour some oil on the water. The oil will spread out over the surface of the water.
4. Dip some of your feathers into the oil on the water. You're imitating what happens when a bird lands on an oil slick on the ocean. Here's a picture of this step.



The Human Footprint

Oiling feathers

5. Take a look at the feathers now, then try to answer the following questions:
What happened to the feathers when they got oiled?
How do you think this might affect a water bird wearing these feathers?
6. Now try three methods of cleaning feathers:
 - Cold water washing. Put some cold water in a bowl, then try washing some of the oiled feathers in it. Watch what happens.
 - Hot water washing. Put some hot water in a bowl, then try washing some of the oiled feathers in it. Watch what happens.
 - Washing with detergent. Put some hot water and detergent in a bowl, then try washing some of the oiled feathers in it. Watch what happens.

Here's a picture of this step.



Cleaning feathers

Which method worked best? Imagine that you're washing a real, live bird that has been oiled. What things would you need to think about? Which method would you choose to clean the bird?

Cleaning Up

The materials for this experiment are all non-toxic. You can put them in the trash once you've finished your experiment.

NOAA's Oil Spill Response

Surface Washing Agents

Surface washing agents are liquid products designed to make it easier to remove oil from surfaces and structures that have been oiled so that they don't become "secondary sources" of pollution.

Thirty-three surface washing agents are currently listed on the National Contingency Plan Product Schedule, an EPA list of products that have met basic requirements for being considered for use in an oil spill response. Approval from the Regional Response Team is needed before a surface washing agent can be used in a manner that would cause it to be released to the environment.

When Surface Washing Agents are Used

Surface washing agents are used to soften and lift oil off of surfaces or structures that have been oiled, such as beach rocks, rock platforms, artificial structures, and riprap. Typically, conventional cleanup methods are used first to the extent of their utility (e.g., removal of gross oiling).



Surface washing agents also are used to clean and decontaminate response equipment and, less often, vessels that have been oiled. For example, in 2001, the M/V *Genmar Hector* (left) was cleaned with surface washing

agents after its hull and superstructure were oiled.

Surface washing agents typically act relatively quickly and can be used on all types of oil. The application methods vary but the agents are typically sprayed on

the oiled surface, allowed to soak 5 to 15 minutes, followed by a warm water/high pressure wash.

How They Work

Surface washing agents contain surfactants, solvents, and/or other additives that soften and lift oil off the surface. There are two main types. "Lift and float" products lift oil from the surface so it floats on the water as a slick and can be recovered. Booms, sorbents, and vacuum pumps are often used with these products to collect and recover the oil. "Lift and disperse" products act like detergents to lift oil off surfaces, emulsify it (break it into fine droplets), and disperse it into the water.

Because it's not possible to recover the oil directly when using this type of product, responders must contain and recover the washwater.

Example Surface Washing Agents

Corexit 9580 and PES-51 are both "lift and float" surface washing agents. PES-51 is composed mainly of surfactants and d-limonene, a chemical with a lemon-like odor produced naturally by citrus plants and some coniferous trees. PES-51 has been used or tested at many oil spills. A good summary of surface washing agents can be found at

[http://www.nrt.org/Production/NRT/RRTHome.nsf/resources/RRT%20IV%20Meeting%20Summaries/\\$file/SurfaceWashingAgents.pdf](http://www.nrt.org/Production/NRT/RRTHome.nsf/resources/RRT%20IV%20Meeting%20Summaries/$file/SurfaceWashingAgents.pdf).

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

June 7, 2010



NOAA's Oil Spill Response

Understanding Tar Balls

What are Tar Balls and How Do They Form?

Tar balls, the little, dark-colored pieces of oil that stick to our feet when we go to the beach, are actually remnants of oil spills. When crude oil (or a heavier refined product) floats on the ocean surface, its physical characteristics change.

During the first few hours of a spill, the oil spreads into a thin slick. Winds and waves tear the slick into smaller patches that are scattered over a much wider area. Various physical, chemical, and biological processes change the appearance of the oil. These processes are generally called “weathering.”

Initially, the lighter components of the oil evaporate much like a small gasoline spill. In the cases of heavier types of oil, such as crude oil or home heating oil, much of the oil remains behind. At the same time, some crude oils mix with water to form an emulsion that often looks like chocolate pudding.

This emulsion is much thicker and stickier than the original oil. Winds and waves continue to stretch and tear the oil patches into smaller pieces, or tar balls. While some tar balls may be as large as pancakes, most are coin-sized. Tar balls are very persistent in the marine environment and can travel hundreds of miles.



How Long Will Tar Balls Remain Sticky?

Weathering processes eventually create a tar ball that is hard and crusty on the outside and soft and gooey on the inside, not unlike a toasted marshmallow. Turbulence in the water or beach activity from people or animals may break open tar balls, exposing their softer, more fluid centers.

Scientists have not been very successful at creating weathered tar balls in the laboratory and measuring the thickness of the crusty outer layer. Therefore, we don't know how much energy is needed to rupture a tar ball.

We do know that temperature has an important effect on the stickiness of tar balls. As air and water temperatures increase, tar balls become more fluid and, therefore, sticky — similar to an asphalt road warmed by the summer sun.

Another factor influencing stickiness is the amount of particulates and sediments present in the water or on the shoreline, which can adhere to tar balls. The more sand and debris attached to a tar ball, the more difficult it is to break the tar ball open. These factors make it extremely difficult to predict how long a tar ball will remain sticky.



(continued on back)





Are Tar Balls Hazardous to Your Health?

For most people, an occasional brief contact with a small amount of oil, while not recommended, will do no harm. However, some people are especially sensitive to chemicals, including

the hydrocarbons found in crude oil and petroleum products. They may have an allergic reaction or develop rashes even from brief contact with oil. In general, we recommend that contact with oil be avoided.

If contact occurs, wash the area with soap and water, baby oil, or a widely used, safe cleaning compound such as the cleaning paste sold at auto parts stores. Avoid using solvents, gasoline, kerosene, diesel fuel, or similar products on the skin. These products, when applied to skin, present a greater health hazard than the smeared tar ball itself.

Tar Ball Bits and Pieces

Beach Cleanup

There is no magic trick to making tar balls disappear. Once tar balls hit the beaches, they may be picked up by hand or by beach-cleaning machinery. If the impact is severe, the top layer of sand containing the tar balls may be removed and replaced with clean sand.

Are there more tar balls on beaches along the East Coast than on the West Coast?

The number of tar balls found on the beach depends on several factors: tanker traffic, wind patterns, sea currents, whether an oil spill occurred recently, and how often the beach is cleaned.

Obviously, some beaches may have more tar balls than others, but to our knowledge, East Coast beaches are not necessarily more polluted with tar balls than beaches along the West Coast of the United States.

Can Dispersants Cause Tar Balls?

No. Dispersants do the exact opposite- they break oil up into tiny droplets, much smaller than the head of a pin, which do not re-form or re-congeal into a visible mass of oil.

Tar balls are weathered oil that has lost its lighter components. Thus they are denser than fresh oil and closer to the density of seawater. They still float, but in estuarine (less dense) waters like Lakes Pontchartrain and Borgne, they would float very low in the water and be easily entrained by currents, as well as roll under or around booms and barges. They are also widely scattered and may not be noticeable at sea or floating, but may accumulate on shorelines.

Reporting

New tar balls appearing on a beach may indicate an oil spill. If you notice unusual numbers of tar balls on the beaches, call the U. S. Coast Guard any time at 800-424-8802.

For additional information:



<http://response.restoration.noaa.gov>

<http://response.restoration.noaa.gov/adios>

NOAA's Office of Response and Restoration Emergency Response

Division: 206-526-6317

Learn more about NOAA's response to the BP oil spill at <http://response.restoration.noaa.gov/deepwaterhorizon>.

To learn more about NOAA, visit <http://www.noaa.gov>. 

Fair Play:

Steps to Conducting a Science Fair Project

Did you ever notice something and wonder why it happens or see something and wonder what causes it? Do you ever want to know how or why something works? Do you ask questions about what you observe in the world? If so, you are on your way to conducting a science project! The following guidelines offer some steps to follow.

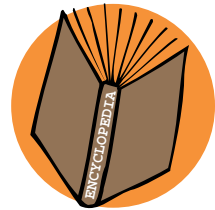


Make Initial Observations

Write down something interesting you noticed and want to investigate in more detail. Make a list of questions about the topic.

Gather Information

Research the topic you want to investigate. Search the Internet, go to the library, read books and magazines, or talk to others to learn about what you are studying. Keep track of where you obtained your information.



Give the Project a Title

Choose a title that describes what you are investigating. The title should summarize what the investigation will cover.



State the Purpose of the Project

What do you want to find out? Write a statement describing what you want to do. Use your observations and questions to write the statement.

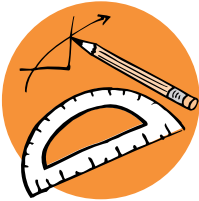
Craft a Hypothesis

Make a list of answers to the questions you have. This can be a list of statements describing how or why you think the subject of your experiment works. The hypothesis must be stated so that it can be tested by an experiment.



Design an Experimental Procedure to Test the Hypothesis

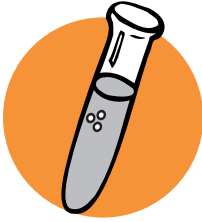
Design an experiment to test each hypothesis. Make a step-by-step list of what you will do to address the hypothesis. This list is called an experimental procedure.



Obtain Materials and Equipment

Make a list of items you need to do the experiments and prepare the items. Try to use everyday, household items. If you need special equipment, ask your teacher for assistance. Local colleges or businesses might be able to loan materials to you.



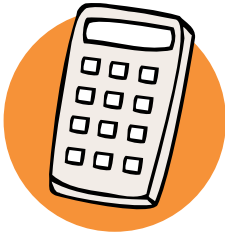


Perform the Experiment and Record Data

Conduct the experiment and record all numerical measurements made, including quantity, length, or time. If you are not measuring something, you probably are not doing an experimental science project.

Record Observations

Record all your observations while conducting your science project. Observations can be written descriptions of what you noticed during an experiment or the problems encountered. You can also photograph or videotape your experiment to create a visual record of what you observed. Keep careful notes of everything you do and everything that happens. Observations are valuable when drawing conclusions and useful for locating experimental errors.



Perform Calculations

Perform calculations that turn raw data recorded during experiments into numbers you will need to make tables or graphs to draw conclusions.

Summarize Results

Summarize what happened. This summary could be a table of numerical data, graphs, or a written statement of what occurred during the experiments.





Draw Conclusions

Using the trends in your experimental data and your experimental observations, try to answer your original questions. Is your hypothesis correct? Now is the time to pull together what happened and assess the experiments you conducted.

Prepare a Presentation

To prepare a presentation, ask yourself, “What is most interesting about this project, what will people want to read about, and how can I best communicate this information?” Most of the time, students prepare a poster or three-sided display to give their audience a quick overview of the question asked, the method used, results, and conclusions. You can draw charts, diagrams, or illustrations to explain your information.



Some science fairs require oral presentations. Use an outline or note cards to assist you in your presentation. Although individual science fairs might have different rules, you will most likely be required to introduce yourself and your topic; state what your investigation attempted to discover; describe your procedure, results, and conclusions; and acknowledge those who helped you.

What to Do if a Project Does Not Work

No matter what happens, you will learn something. Science is not only about finding “the answer.” Knowing that something did not work is actually quite valuable. Experiments that do not turn out as planned are an important step in finding an answer.