

# Pollution Investigation

## Background Information

The town of Lakeville is a small town with charming old houses located on the banks of Big Lake. The people who live in Lakeville have noticed some changes in Big Lake that concern them.

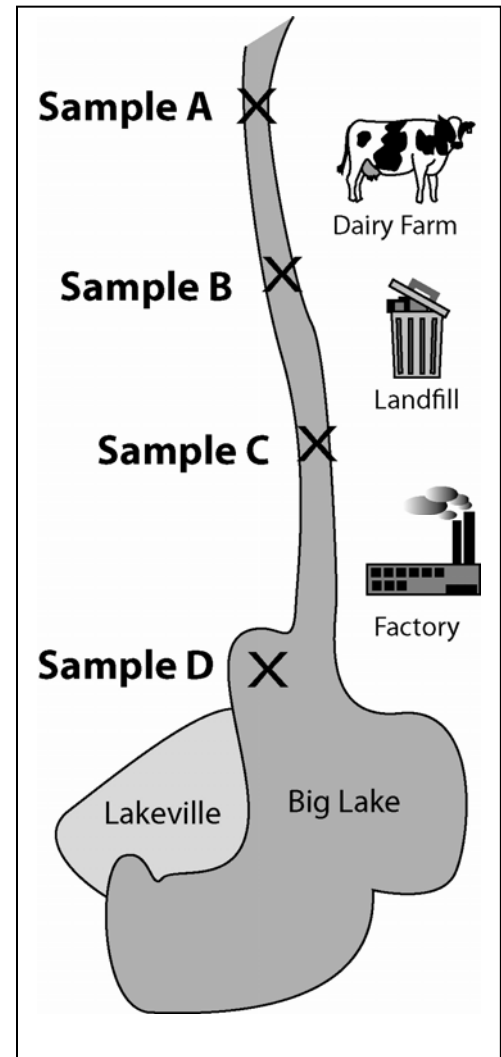
- The fish population has decreased.
- The green algae population has increased.
- Deformed fish and frogs have been observed.

Big Lake is the water source for the people who live in Lakeville. People are worried that pollutants from the large dairy farm, landfill, or factory may have entered the river and been carried into Big Lake.

You work for an ecology company that does water testing. The people of Lakeville want your company to determine if the dairy farm, landfill, and factory are polluting the water in the river that flows into Big Lake. To the right is a map of Lakeville and the surrounding area.

You have water samples collected from specific locations (A–C) along the river and from the lake (D). Your job is to test the water samples for pollutants. You will then interpret the results for a report to the people of Lakeville.

You will use the materials in your water test kit to test the samples (A–D) that you collected for the following pollutant.



Pollutant to be tested	Caused by...
Nitrates	Pollution from sewage or fertilizer run-off
<i>E. coli</i> bacteria	Pollution from untreated sewage
PCB chemicals	Pollution from factories and industrial garbage
Lead	Pollution from factories and old lead-based paint

## Part I: Testing and Interpreting Nitrate Levels

High levels of nitrates may be caused by artificial fertilizers or by nitrogen-rich sewage being washed into rivers, lakes, and aquifers. Nitrates cause an excessive enrichment of the water, leading to a rapid growth of plants such as green algae. Decomposers then feed on the dead green algae and use up a lot of the oxygen in the water. The reduced oxygen content in the water may cause the death of fish and other water animals.

A high level of nitrates in drinking water is harmful to newborn babies, and it is also thought nitrates contribute to stomach cancer, although the evidence for this is unproven.

Read the information on nitrate pollution in the box above.

1. Refer to the *Pollutant Testing Procedures* sheet in your kit. Follow the “Testing for Nitrates” instructions to test each of the water samples (A–D) for the presence of nitrates.

2. Record the results of your tests in the *Water Quality Report* sheet (on the last page of this packet). Write “Safe” or “Unsafe” in each of the appropriate boxes.

*Hint: You should separate your Water Quality Report from the lab packet so that it is easier to record your data.*

3. What is the most likely source of the nitrate pollution in the lake? Support your answer with evidence from the test results.

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4. How does nitrate pollution affect the plant life in the lake?

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5. How does nitrate pollution lead to the decreased populations of fish in the bay.

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6. What human health problems that may result from high levels of nitrates in Lakeville’s water supply?

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## Part 2: Testing and Interpreting Lead Levels

Lead is a highly toxic metal that has many industrial uses. People are exposed to lead from the air, soil, household dust, food, drinking water and some consumer products. Lead gets in the air from factories, smelters and refineries. Lead can also enter some drinking water systems from old lead pipes or lead solder. Old lead-based paint can be a source of lead exposure in homes that were built before 1978 (when it became illegal for house paint to include lead). Some consumer products and toys that are manufactured in other countries and imported to the United States have been found to contain lead.

Exposure to lead can have serious health impacts, and can even be fatal at high doses. Lead builds up in the body, and exposure to even very low levels can be harmful. There is evidence that lead is especially harmful to infants, young children and pregnant women. Lead can permanently affect children's development, including intellectual and behavioral development. Lead has also been found to cause bone problems in older women.

Read the information on lead pollution in the box above.

1. Refer to the *Pollutant Testing Procedures* sheet in your kit. Follow the "Testing for Lead" instructions to test each of the water samples (A–D) for the presence of lead.
2. Record the results of your tests in the *Water Quality Report* sheet. Write "Safe" or "Unsafe" in each of the appropriate boxes.
3. Tests have shown that many of the children living in Lakeville have high levels of lead in their blood. What is the most likely source of lead? Support your answer with evidence from the test results.

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4. What health problems that may result from high levels of lead in children who live in Lakeville?

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### Part 3: Testing and Interpreting PCBs Levels

PCBs (Polychlorinated Biphenyls) are types of chemicals that were manufactured from 1929 until 1979, when their manufacture was banned. PCBs were used in electrical equipment, paints, plastics, rubber products, pigments, and many other applications. Today, PCBs can still be released into the environment from improper disposal of products made before the use of PCBs was banned. Once in the environment, PCBs do not readily break down and therefore may remain for long periods of time, cycling between air, water, soil and living organisms. PCBs can be absorbed by plants and passed through the food chain to small organisms, fish, and then humans.

PCBs can cause cancer in animals. PCBs have also been shown to cause a number of other serious health effects in animals, including effects on the immune system, reproductive system, nervous system, endocrine system and other health effects. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body.

Read the information on PCB pollution in the box above.

1. Refer to the *Pollutant Testing Procedures* sheet in your kit. Follow the “Testing for PCBs” instructions to test each of the water samples (A–D) for the presence of PCBs.
2. Record the results of your tests in the *Water Quality Report* sheet. Write “Safe” or “Unsafe” in each of the appropriate boxes.
3. What is the most likely source of PCBs contamination in the lake? Support your answer with evidence from the test results.

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4. What health problems that may result from high levels of PCBs in Lakeville’s water supply?

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## Part 4: Testing and Interpreting *E. coli* Bacteria Levels

*E. coli* bacteria are found in the intestines of animals and humans and may get into water as a result of sewage contamination. Most types of *E. coli* bacteria are harmless but some types of *E. coli* are harmful because they cause food poisoning and other gastrointestinal illnesses. If there are high levels of *E. coli* in water it is likely that other harmful types of bacteria are also present in the water.

Read the information on *E. coli* pollution in the box above.

1. Refer to the ***Pollutant Testing Procedures*** sheet in your kit. Follow the “Testing for *E. coli* Bacteria” instructions to test each of the water samples (A–D) for the presence of *E. coli*.
2. Record the results of your tests in the ***Water Quality Report*** sheet. Write “Safe” or “Unsafe” in each of the appropriate boxes.
3. What is the most likely source of *E. coli* contamination in the lake? Support your answer with evidence from the test results.

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4. What health problems that may result from *E. coli* in Lakeville’s water supply?

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## Part 5: Report to the Community

You will be meeting with the Lakeville community members to report on the results of your testing.

1. Complete the *Water Quality Report* by:

- Identifying the source or sources for each of the pollutants.
- Recommending at least 2 actions the community could take to improve the safety of their water supply.

2. One person asked whether it really is safe to conclude that the factory is not a pollution source. Do you think it is safe to conclude that the factory is not a source of pollution that could threaten the health of people who live in Lakeville? Explain your answer.

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Report Prepared by \_\_\_\_\_

### Water Quality Report

Pollutant	Sample Collected at			
	Site A	Site B	Site C	Site D
Nitrates				
Lead				
PCBs				
<i>E. coli</i> bacteria				

Based on the information in the data table and the map, what is the source for each of these pollutants?

- Nitrates: \_\_\_\_\_
- Lead: \_\_\_\_\_
- PCBs: \_\_\_\_\_
- *E. coli* bacteria: \_\_\_\_\_

List two actions that the community could take to reduce their exposure to pollution.

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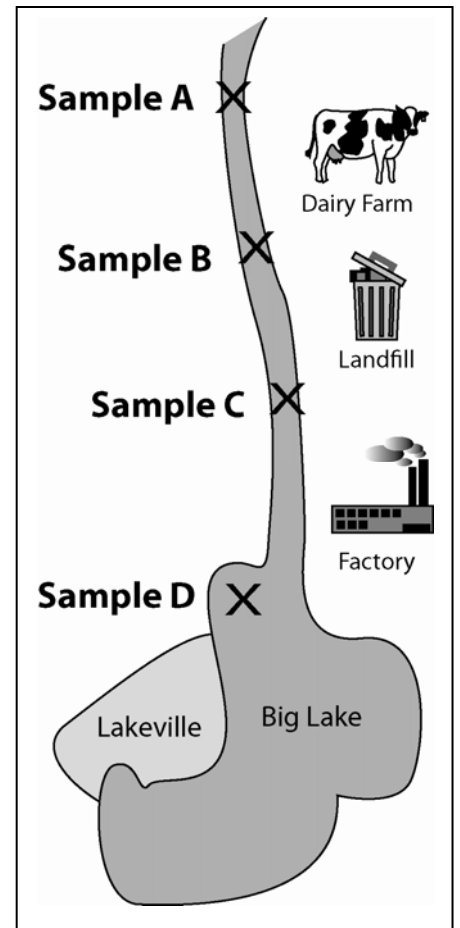
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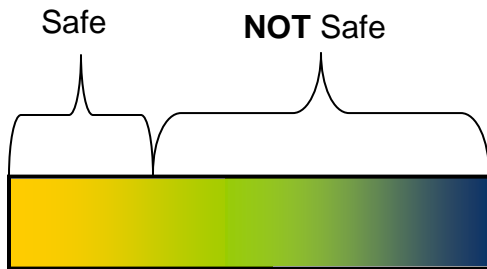
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# Pollutant Testing Procedures

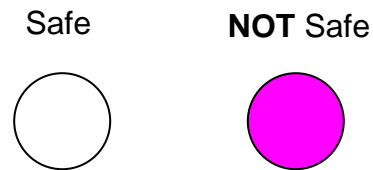
## Testing for Nitrates

1. Quickly dip one end of a piece of **Nitrate Indicator Paper** into the water sample.
2. Compare the color of the Nitrate Indicator Paper to the color scale below.
3. Record whether the nitrate level is safe or not safe.



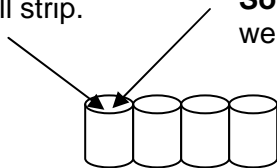
## Testing for PCBs

1. Use the labeled dropper to transfer 2 drops of the water sample onto one of the circles on the white **PCB Test Strip**.
2. A pink reaction indicates that PCBs are present.
3. Record whether the PCB level is safe or not safe.

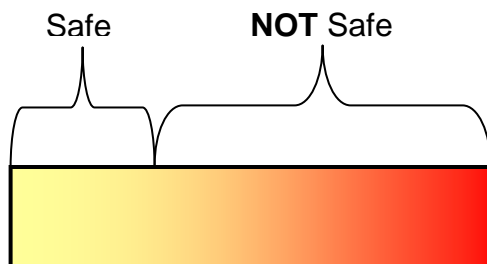


## Testing for Lead

1. Place 4 drops of the water sample into a clean well on a plastic well strip.
2. Add 2 drops of **Lead Indicator Solution** to the well

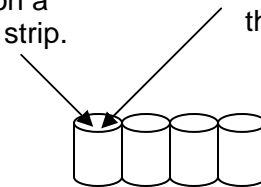


3. Compare the color of the contents of the well to the color scale below.
4. Record whether the lead level is safe or not safe

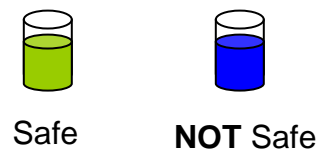


## Testing for *E. coli* Bacteria

1. Place 4 drops of the water sample into a clean well on a plastic well strip.
2. Add 2 drops of ***E. coli* Stain** to the well

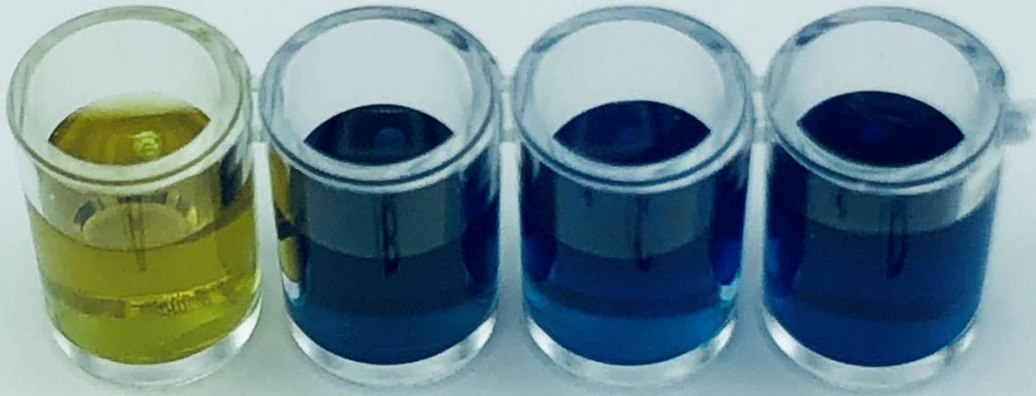


3. If the stain turns the sample blue, *E. coli* are present.
4. Record whether the *E. coli* level is safe or not safe.





## Testing for *E. coli*



**A**

**B**

**C**

**D**

## Testing for Lead



**A**

**B**

**C**

**D**

# Nitrate Indicator Paper



**A**



**B**



**C**



**D**

**PCB Test Strip**



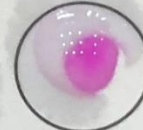
**A**



**B**



**C**



**D**