Name _____ Class _____ Date _____

Inquiry Lab

Modeling Pesticide Pollution

After being hired by the Fluterton County Water Safety Service as a research assistant, you are assigned is to respond to a letter from a concerned county resident. The writer, Ms. Tracy Watson, explains that she recently had the well water on her property tested for the first time in several years. The results showed contaminants that were not present in the water previously: trace amounts of a pesticide that was used many years ago on some nearby farms, as well as small amounts of several petroleum products. Ms. Watson wonders: "How could a pesticide that was used 20 years ago affect the water today?" She also expressed concerns about whether litter (solid waste) could be contaminating her water, too.

In the course of your research, you discover this passage in a water safety journal: "In the United States, about one-fifth of our fresh water comes from underground sources. Homes that rely on wells are just one example of groundwater use. Wells are drilled down to where the ground is saturated, and the water stored there is pumped up to the surface. Aquifers and other groundwater sources are replenished gradually by surface water that seeps down through the soil; unfortunately, this water can often contain particulates, dissolved chemicals, and other substances that contaminate the water."

You decide to build a model well before responding. The model you design in this lab will allow you to investigate not only the process by which groundwater sources become polluted, but also to see how different types of pollution from the surface eventually end up in well water.

OBJECTIVES

Develop hypothesis about what will happen when proposed materials are introduced into a model well.

Create a model and calculate the differential rate at which solid and liquid pollutants affect water supplies.

Explain how different pollutant sources affect water supplies.

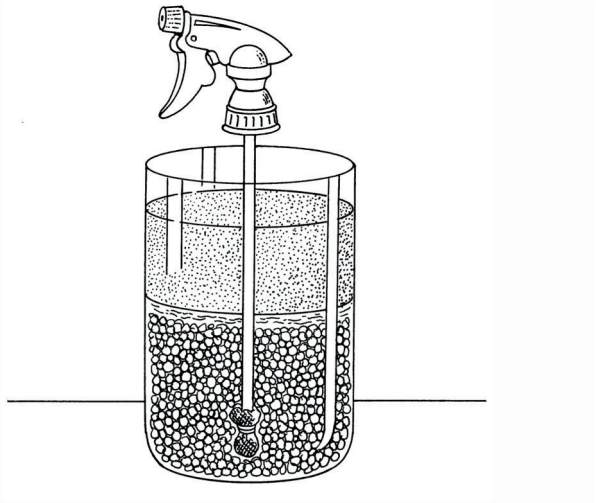
MATERIALS

- aquarium gravel, light-colored
- beaker, 500 mL
- food coloring, red
- nylon stocking or cheesecloth
- paper cup
- rubber band, small
- sand, light-colored
- soda bottle (2 L), clear, bottom two-thirds
- spray nozzle and tube from a spray bottle
- water
- watercolor paint in solid form, blue

Procedure

PART I—BUILD A MODEL WELL

1. Fill the bottom two-thirds of a soda bottle about half full with aquarium gravel.
2. Fold the piece of nylon stocking several times, and place it across the open end of the sprayer tube. Secure the nylon stocking tightly to the tube with the rubber band. Insert the tube into the gravel along the side of the bottle. The end of the tube should be about 3 cm from the bottom.
3. Add water until it just covers the gravel. Then add sand to about 3 cm from the top of the bottle. Pump the spray nozzle a few times to get the flow of water started. Spray the water into the beaker.



4. Pump the nozzle and observe the water level in the soda bottle. What happens?

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5. With your pencil, punch a few small holes in the bottom of the paper cup. To simulate precipitation, fill the cup with water and let the water drizzle out through the holes onto the sand. Try to avoid stirring up the sand, because this may cause the sand to seep down and clog the tube. While you pump the nozzle, practice adding precipitation until you can add and remove water at about the same rate.

PART II—ADD SOME POLLUTION

6. Place 10 drops of red food coloring on top of the sand. This represents pollution, such as pesticides or other chemicals, that is dissolved in surface runoff. Begin pumping the well and adding precipitation. As you proceed, be sure that the water level stays between the surface of the sand and the end of the tube. Watch for red coloration to appear in your discharge beaker. How many squeezes of the trigger does it take for the food coloring to pass through the well?

7. Is your well polluted permanently? Explain.

8. Place a few crumbled bits of blue paint on top of the sand. This represents waste or other solid pollutants that contaminate groundwater by dissolving in surface water that seeps into the ground. Repeat the process described in step 6. How many squeezes does it take for the color to appear this time?

9. Explain why the food coloring passed through the well at a different rate than the crumbled paint did.

10. Predict how a different rate of precipitation would affect the speed at which a pollutant shows up in the pumped water.

Analysis

1. **Explaining Events** In Ms. Watson's letter, she asked: "How could a pesticide used 20 years ago affect the water today?" Using what you've learned about groundwater pollution, how would you answer this question?

2. **Analyzing Results** She also asked if the growing litter problem in the area could affect her water supply. Do you think this is a valid concern? Explain.

Conclusions

3. **Applying Conclusions** Write a brief response to Ms. Watson summarizing your conclusions about her water supply.