MINNESOTA EXTENSION SERVICE
UNIVERSITY OF MINNESOTA
WATER QUALITY

IS DILUTION THE SOLUTION TO POLLUTION?

Objectives:

1. To show that dilution takes a very long time and that it may not be a good solution to a pollution problem. Students will understand that even after they can't detect color in the water there are still low levels of pollutants in it.
2. To illustrate the concept of renewal time (also called retention time, detention time, or recharge rate). Students will understand that incoming water from rain or runoff gradually replaces the water in a lake and that polluted water may be discharged through an outlet.

Materials:

a clear one gallon container (jar or aquarium)
a one quart jar or measure
5-6 gallons of water
red food color, representing dissolved pollution

Procedure:

Fill the gallon container to the top with water. Add a few drops of red color and mix so the entire container is filled with bright red water. Have students estimate how many times the water in the container will have to be diluted before they can no longer see the red color.

Use the quart measure to replace the water in the original container by pouring fresh water in and letting the overflow run out over the top of the container. As clean water is poured in, it will mix with the polluted (red) water, gradually diluting it. Keep track of how many quarts of water you pour into the container.

It will typically take 3-4 complete replacements (3-4 gallons, a quart at a time) for the red color to drop below a visible level. Discuss that fact that there is still some "pollutant" in the container, but that it is too faint to be seen with the naked eye.

The time it takes for all the water in the container to be completely replaced (one gallon) is one renewal time. Generally, scientists estimate that it takes 3 renewal times before a pollutant is reduced to 5% of its original level. Renewal times may range from less than one year to nearly 200 years (for Lake Superior). Typical renewal times for Minnesota's lakes are on the order of 3-10 years. This means pollution may not be naturally removed from our lakes for <u>many</u> years and we need to do something about clean-up now.

Renewal or recharge times in groundwater are much longer, from tens to thousands of years, so we need to be even more concerned about groundwater. The contaminationwe cause today will be around a long time.

B. Liukkonen, Water Quality Agent

University of Minnesota, U.S. Department of Agriculture, and Minnesota Counties Cooperating