**COSEE Hands-On Activities**

**USA Science & Engineering Festival**

**Grouping: Chemical Oceanography**

**Lesson/Activity:** Parts Per Thousand/Concentration

<http://www.ucar.edu/learn/1_4_2_14s.htm>

*It doesn't necessarily take a large quantity of a substance to have a significant effect on water quality. Contaminants in water are commonly measured in* ***parts per million (ppm)*** *or* ***parts per billion (ppb)****. In this activity, you will explore how many dilutions of a pure substance (food coloring) are needed to produce a 1 part per million concentration.*

**Materials**

* Ice cube tray
* Permanent marker
* Pipettes
* Food coloring
* Water

**Procedure**

1. Use a marker to label ice cube tray "cells" 1 to 10.
2. Fill your plastic cup about half full of water for eye dropper (or pipette) cleaning.
3. In cell #1, place 10 drops of food coloring. This represents a pure substance, or a concentration of 1 million ppm.
4. Take one drop of the food coloring from cell #1 and place it in cell #2.
5. Rinse the dropper in one of the plastic cups to remove all traces of food coloring.
6. Add 9 drops of clean water to cell #2 and stir the mixture. The mixture is now diluted to 1/10th of the original concentration, or 100,000 parts food coloring per million parts of solution.
7. Take one drop from cell #2 and place it in cell #3.
8. Rinse the dropper again.
9. Add 9 drops of clean water to cell #3 and stir the mixture. How concentrated is the food coloring now, in ppm?
10. Repeat the above procedure for cells #4 to #10 (remember to clean the dropper between uses). After each dilution, record the new concentration in the cell in ppm.

**Observations and Questions**

* In which cell is the color most intense? And why?
* In which cell is the color least intense? And why?
* In which cell did the solution become colorless? Is there any food coloring in this cell? How do you know?

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Cell | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Do you see color? |  |  |  |  |  |  |  |  |  |  |
| ppm | 1,000,000 | 100,000 |  |  |  |  |  |  |  |  |