*ENVIRONMENTAL CONCERNS*
*(1) ANALYSIS OF LEAD IN PAINT*
*(2) ANALYSIS OF WATER*

# INTRODUCTION

## Description

These open-ended projects involve students in multi-week explorations. Students can choose one of two real-world problems and then develop and implement a plan to address their problem. The plan will be based on standard methods and available equipment.

## Goals for this Experiment

The goals for this experiment are to have students:

1. develop a plan to address real-world environmental problems, and
2. find and use standard methods for carrying out analyses.

## Recommended Placement in the Curriculum

These project labs are intended as a capstone experience at the end of second semester.

**Note:** Instructor notes are not provided due to the open-ended nature of these projects.

## ENVIRONMENTAL CONCERNS
## ANALYSIS OF LEAD IN PAINT—IF THERE IS LEAD, DO YOU SEE RED?

### SCENARIO

Lead in the environment (and therefore humans' exposure to it) is a current concern. One of the remaining sources of lead pollution is lead in paint—where the paint was applied prior to 1978. A spot test kit for painted surfaces is available in some hardware stores, however, the test is difficult to interpret if the painted surface is red. In this scenario, you are challenged to find a protocol to test paint chips for lead that would work even if the paint were red. A paint sample of interest to you may also be analyzed.

### BACKGROUND

Depending on the age of the paint, the analysis of lead in paint can be challenging since the aged hardening oils and/or latex may prevent the lead from easily going into an aqueous solution for analysis. Common qualitative analysis schemes for lead also require clear, colorless solutions so the analysis method should also deal with removing interference from colored pigments. (Although these complicating factors exist for paint, generally analysts must free the substance to be analyzed from its surroundings in any analysis.) It is suggested that a large, 0.3 to 0.5 gram sample of dried paint be used for the analysis so that enough lead will be present for a positive result.

Generally, either a wet chemical treatment can be used to get the lead into solution, or the sample might be ashed (burned in a crucible) and then treated with aqueous solutions. Researchers have reported that better results were obtained for paint when paint chips were ashed completely but at low temperatures (the burner was kept under the crucible and colored flames streaming from the paint sample were avoided). Next, the ashed sample was treated with hot 6M hydrochloric acid. It may be necessary to neutralize and concentrate the ashed paint extract before proceeding with the qualitative analysis of lead ions. (Review previous lab work and/or your text for qualitative analysis schemes.) A centrifuge can be used to separate insoluble ashed materials.

The spot test available from hardware stores as well as various paint samples will be available to you in the laboratory. A successful solution to this scenario is a testing routine that will work on red paint, so be sure to keep careful notes and describe in detail how red paint samples should be treated to determine if lead is present or not. From your work on this scenario, how do you think lead-painted trash (paint chips from restorations or materials from demolished buildings) should be treated? Is this trash hazardous toxic waste, or is it ordinary household waste? Why?

**Safety Notes:**

The paint samples should be ashed in the hood to minimize lead exposure, and the crucible should be allowed to cool before adding the 6M hydrochloric acid to the ash. (This minimizes cracked crucibles.) It is also suggested that clean crucibles be used for this determination.

**References**

B.M. Abraham and R.S. Huffman, *Industrial and Engineering Chemistry,* Analytical Edition, Vol. 12, 1940, pp 656–657.

T.W. Gilbert, *Treatise on Analytical Chemistry,* edited by I.M. Kolthoff and P.J. Elving Part II, Vol. 8, Interscience Publishers, p 98.

S. Hershberger, personal communication.

## ENVIRONMENTAL CONCERNS
## ANALYSIS OF WATER—HOW GOOD IS YOUR WATER?

**SCENARIO**

As communities consider attracting desirable businesses and citizens, one of the resources often overlooked in past considerations is water. (An area of recent growth in Butler County may not be able to continue growing at the current rate due to underdeveloped water support. Also, the Dayton Daily News has gotten involved in a heated comparison of Miami River Aquifer water versus California water sources.) As local water sources experience problems, the marketing of bottled water occurs. How does water vary? Is any water pure water, $H_2O$? An investigation of the Total Dissolved Solids, TDS, present in a water sample may help answer these questions. Other water tests may also be informative.

**BACKGROUND**

Various water samples will be available in the laboratory for analysis. You may also bring in water samples from other sources.

A simple way to analyze natural water samples is to allow all the solvent, water, to evaporate and to measure the amount of residual solids which remain. This type of analysis is called Total Dissolved Solids, TDS. This may be done by distilling the solvent off the sample or by simply allowing the solvent to evaporate. Care must be taken to prevent spattering. The weighing technique used is also important.

Depending upon the scope of your water analysis, you may choose to analyze the residue or the water samples themselves. References are supplied for hard water ions determinations and/or the Barium-Magnesium Group. If a Barium-Magnesium Group analysis is attempted, a concentration of the water samples is suggested.

Another option is exploration of TDS as a function of the conductivity of various water samples. This is discussed in Analysis of Waters. (See references.) Other water analyses may be done after consultation with your instructor.

**References**

V. Dean Adams, *Water and Wastewater Examination Manual,* Total Solids and Total Dissolved Solids, pp 51–52.

Stewart E. Allen, Editor, *Chemical Analysis of Ecological Materials,* Second Edition, Chapter 4, Analysis of Waters, pp 62–80 and pp 71–72.

C.H. Sorum and J.J. Lagowski, *Introduction to Semicro Qualitative Analysis,* Sixth Edition, Prentice-Hall, Inc. Chapter 12, The Barium-Magnesium Group, pp 251–260.

Stephen Thompson, *Chemtrek,* Allyn and Bacon, 1990. Chapter 10, The Chemistry of Natural Waters, pp 176–193.