

Lead Concentration Levels in the Drinking Water from Schools in Oakland, California

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Introduction

Lead was often used in plumbing during the past century because of its malleability and ability to ensure water tight pipe connections. However, when this element was discovered to be poisonous, the use of lead pipes was outlawed, nevertheless, lead solder continued to be used until the late 1980's. In 1991, the Environmental Protection Agency (EPA), passed an act lowering the amount of allowable lead in water. The legal limit of lead in drinking water is now 15 micrograms per liter ($\mu\text{g/L}$). Still, any trace of this heavy metal has been determined to be a health risk. Lead contamination in water can cause delays in physical and metal development in children, learning disabilities, kidney failure, and high blood pressure.

Many schools in the Oakland Unified School District have been built close to one century ago. Some schools have survived earthquakes and have been rebuilt or expanded to increase classroom sizes. Nonetheless, these schools have existed during the lead era and as a result are a cause for concern. Therefore, in an effort to assess the drinking water quality in Oakland schools, we collected water samples from 13 schools that were specifically selected because of their age and location. Water was collected from faucets and drinking fountains to test for its lead concentrations and pH levels. We hope our research and results will raise awareness among students, teachers and administrators about the overall quality of the drinking water in their schools.

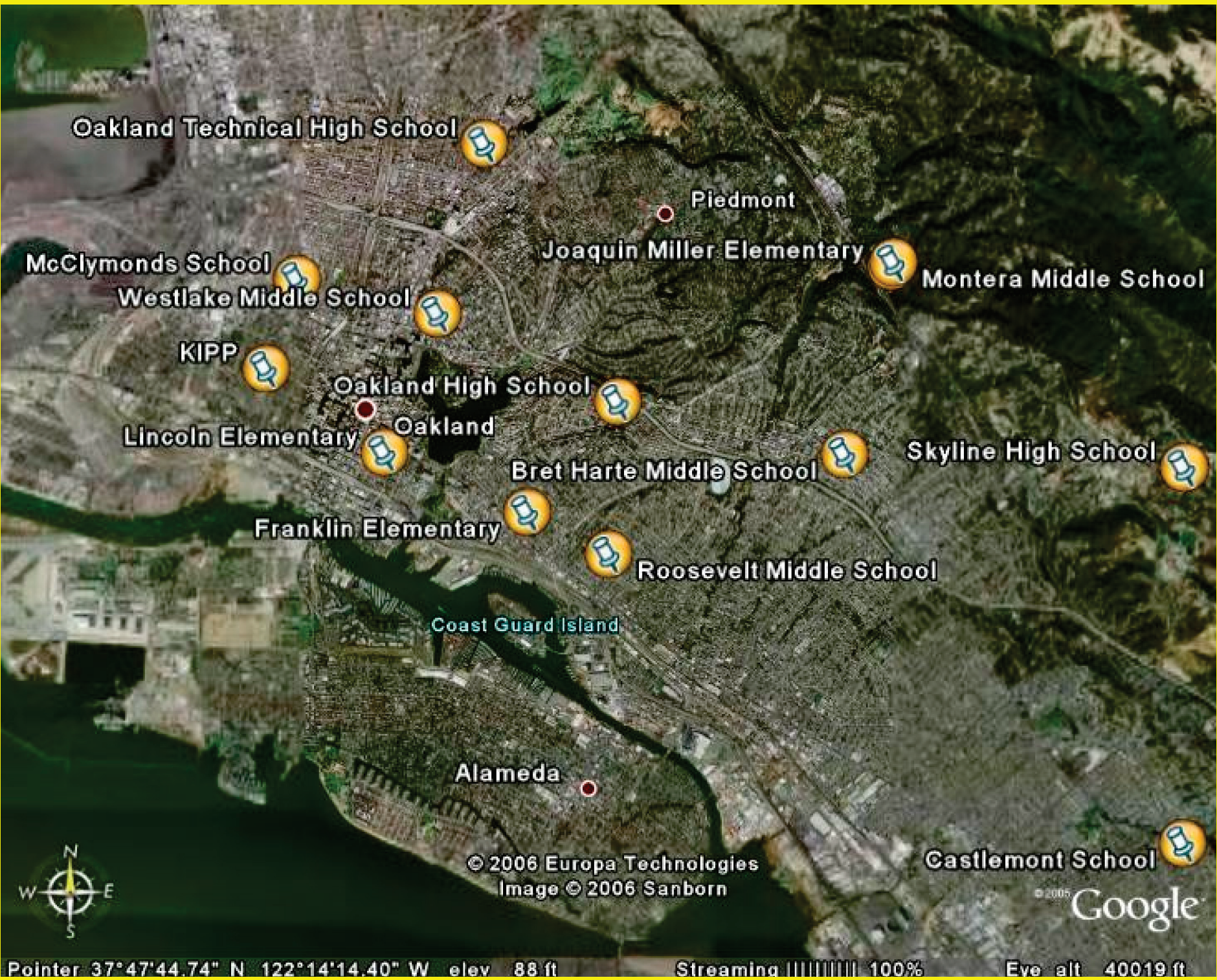


Figure 1: Locations of 13 Oakland schools

Methods

- Researched Schools within the Oakland Unified School District: determined the date of construction, the geographical locations of the schools and selected 13 schools to obtain samples from a wide range of locations in Oakland and a wide range of ages.
- Wrote and presented letters to school administrators to inform them of our research and ask permission to sample.
- Went to schools to collect samples from drinking fountains and sinks--5 from each school.

Sample Collection:

1. Filled 500 ml sample bottle with water.
2. Acidified samples with nitric acid solution to preserve samples.
3. Samples taken to LHS and the lead dithizone method (Lead Trak Fast Column Extraction Method as seen in HACH DR/4000 procedure manual, method 8317) was used to process the sample, which was then analyzed by a spectrophotometer to determine lead concentration in the samples.

Results

- 11 of 13 schools had at least one water sample above the EPA limit (15 $\mu\text{g/L}$).
- Highest single sample measurement, Skyline 115.4802 $\mu\text{g/L}$.
- Lowest single sample measurement, Castlemont 5.0417 $\mu\text{g/L}$.

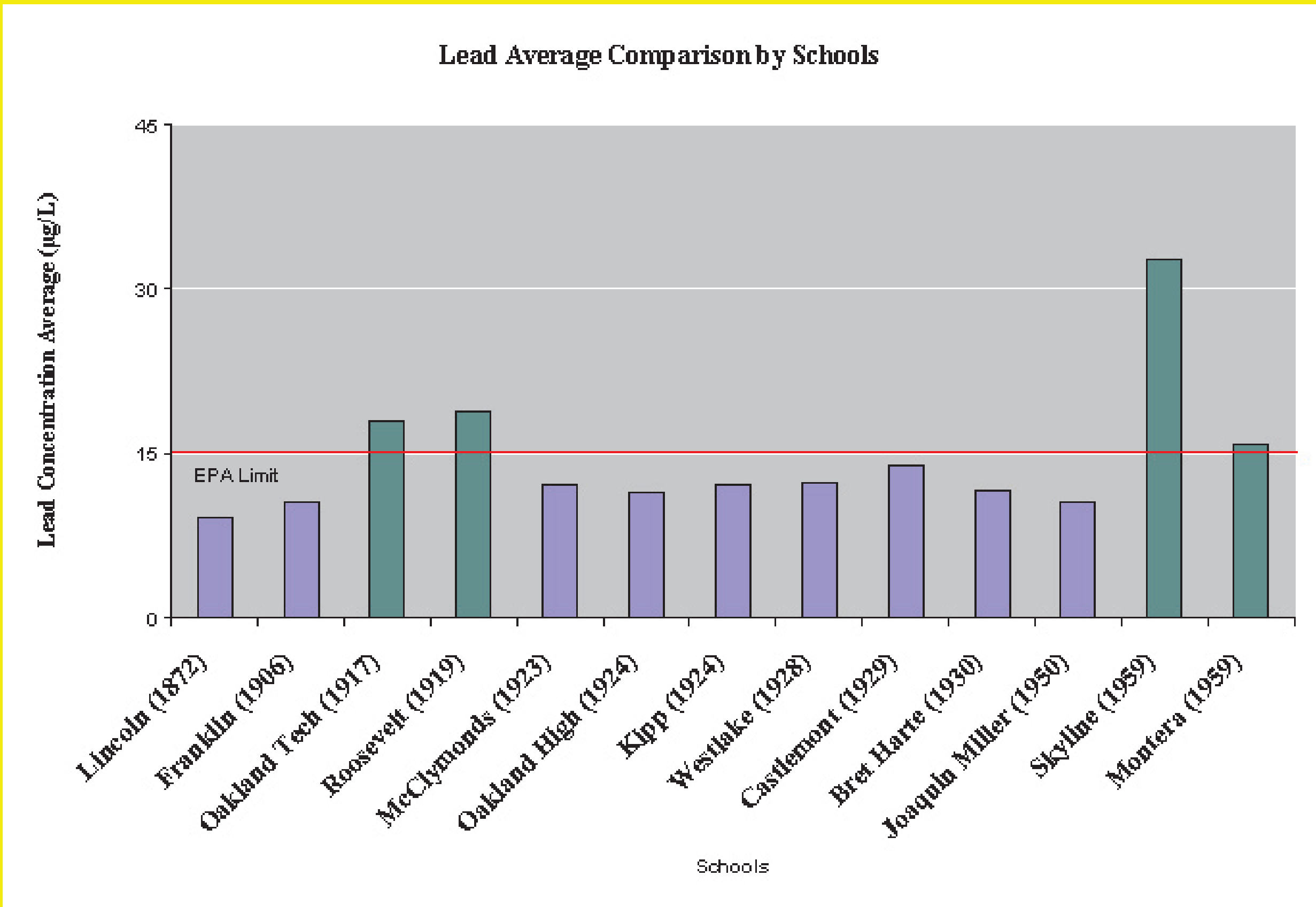


Figure 2: Bar graph of Lead Average Comparison by Schools

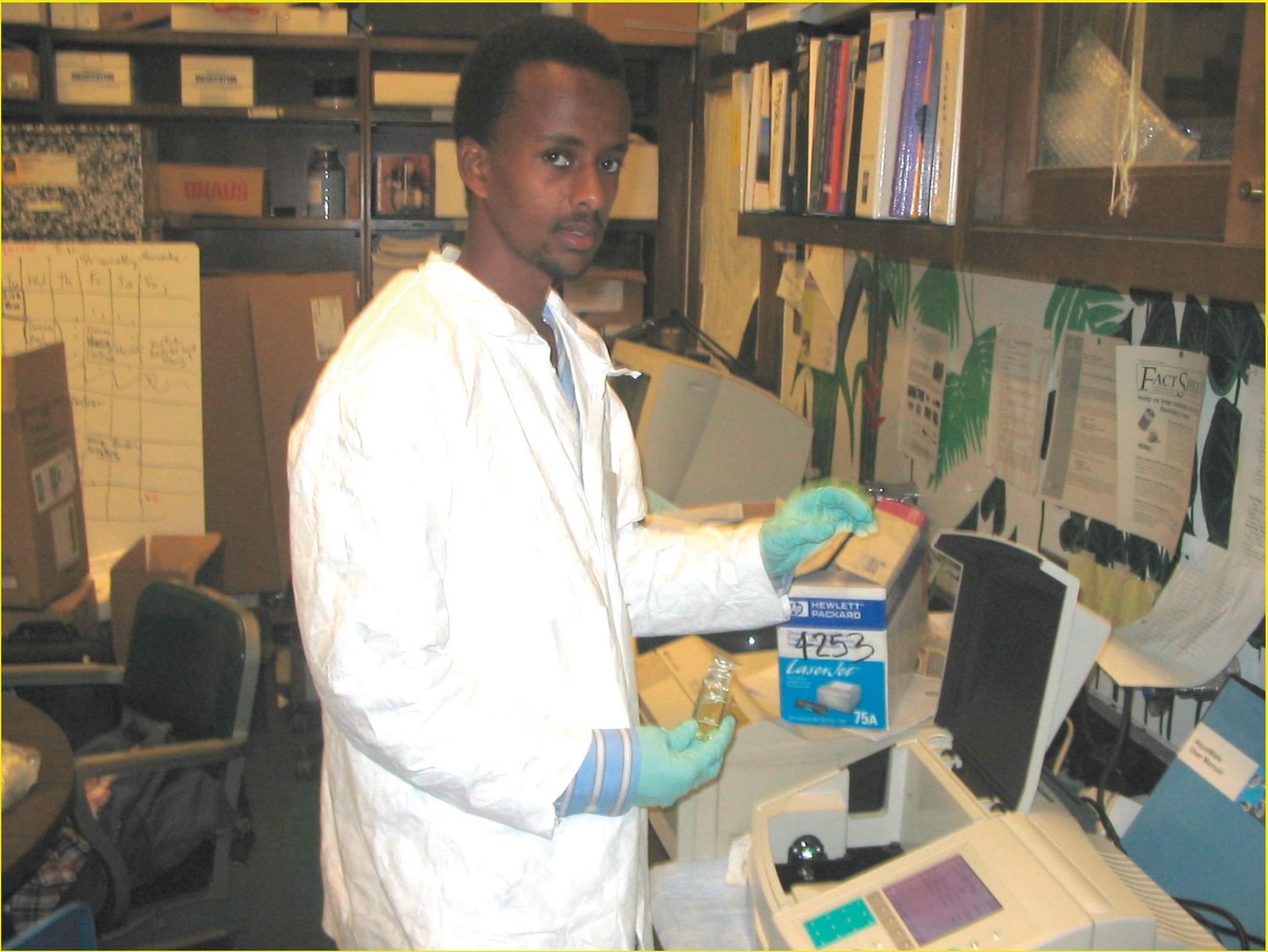


Figure 3: Research student about to measure the lead concentration

Discussion

The water supply for the schools in Oakland is derived from the same source, the Orinda/Upper San Leandro reservoir and treatment plant. Analysis of data reported in a recent study published by the East Bay Municipal Utility District (EBMUD) indicates that the lead concentration at the reservoir is below the detection limit. Therefore, high lead concentrations found in water samples from the tested schools must be derived from other sources. Possible sources for the high concentration include: lead piping and/or lead solder in service lines or faucets inside schools.

Preliminary analysis of data collected so far indicates a correlation between the ages of schools and lead concentration in their water. Lincoln Elementary, built in 1872, had the lowest average (average of all samples collected at one site) lead concentration. The schools built between 1917 and 1919 had an average lead concentration above the EPA limit. The schools built from the 1920-1950 had comparably low amounts of average lead concentration. This may be due to rehabilitation and modernization of schools or removal of the lead piping, whose usage was discontinued in the early 1950's. Schools built after the 1950's had average lead concentration values above the EPA limit. This is likely the case due to the use of lead solder in the plumbing, which was not made illegal until 1987.

The pH values of samples collected from the schools ranged from 7.9 to 9.3pH. This high pH level is possibly due to the use of soda ash or similar substances. Soda Ash and similar substances have been used to raise the pH, which makes water less corrosive and minimizes lead leeching. However, we are not sure whether or not soda ash or something similar is being used in the bay area for this purpose. While the water within the schools have variant pH levels, the range of pH levels between the schools are similar. Furthermore, the difference in pH levels at the schools did not correlate with the lead concentrations. Hence, the pH concentration in the water supply at the school tested does not appear to be a factor affecting the lead concentration.

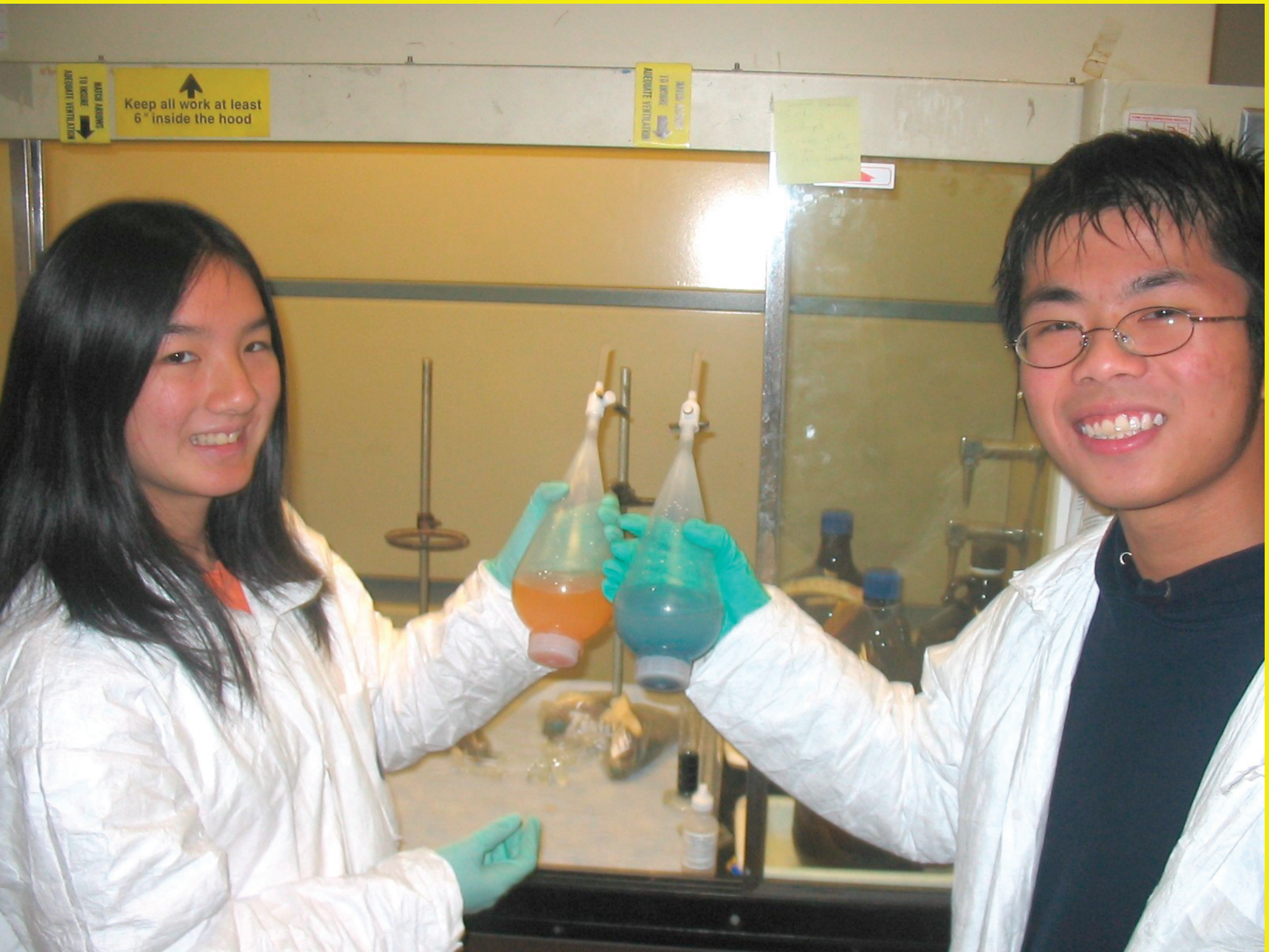


Figure 4: Research students holding up samples that are being tested

Conclusion

Preliminary analysis of data that we have collected so far reveals a correlation between the age of a given school and the lead concentration of the water issuing from its drinking fountains and faucets. Variations in concentration between schools can be explained by both the time period when the schools were built as well as when/if remodelling of the school has occurred. The value we cannot easily explain is the lead concentration level at Skyline High School, which gave one extraordinarily high reading. We are in the process of retesting samples from this site to confirm our results. Based on results generated so far, we can state with confidence that lead concentrations in drinking water at schools in Oakland is an issue that requires immediate attention and possible intervention. As a contribution to such efforts we intend to continue our study by collecting and analyzing more samples from the schools that we have already sampled as well as expanding the geographical range of schools to determine whether or not similar findings occur on a broader basis.