Water Quality Research Project

In 2014, residents of Flint, Michigan discovered their municipal water supply had been contaminated with dangerous levels of lead, a crisis that affected thousands of children and exposed deep failures in water monitoring and public health response. Similar problems were exposed in the Syracuse municipal water supply in 2025. Water quality impacts us all and it varies by region, changes over time, and is shaped by local geology, agricultural practices, industrial history, and the decisions of water treatment authorities. In this project, you will investigate the water quality of your own community using real data from the same sources that regulators and public health officials rely on.

Finding Your Data

Water authorities across the United States are required by the EPA to publish annual Consumer Confidence Reports (CCRs), which include the results of water quality testing for a wide range of contaminants. You will locate the most recent CCR from your home or regional water authority. These reports are publicly available and searchable by zip code through the EPA's website.

Students who live in rural areas and rely on well water will identify the closest available municipal or county dataset. International students may use water quality data from their home region or select a U.S. region of their choice. In all cases, the goal is the same: to work with authentic, publicly reported data rather than a textbook example.

What You Will Analyze

Within your water quality report, you will locate reported levels for the following contaminants, where present:

- **Metals:** lead, copper, and chromium
- **Radionuclides**: uranium, radium
- **Per- and polyfluoroalkyl substances (PFAS)**: including PFOS and PFOA (often called "forever chemicals")
- **Pharmaceuticals**, if reported

For each contaminant present in your report, you will also locate the corresponding EPA Maximum Contaminant Level (MCL) and, where applicable, the Action Level (AL).

Understanding the difference between these two thresholds, what triggers regulatory action versus what constitutes a cause for concern?

Chemical Analysis

Contaminant levels in water reports are expressed in a variety of units depending on the substance: parts per million (ppm), parts per billion (ppb), or micrograms and nanograms per liter (µg/L, ng/L). You will work with these values directly and convert between them, expressing each concentration in ppb, µg/L, g/L, and mol/L. These conversions connect directly to the stoichiometry, unit conversions, and solution chemistry concepts covered in this course.

Beyond unit conversion, you will use your data to explore questions with real public health relevance:

- **Exposure calculations.** The EPA uses a standard reference intake of 2 liters of water per day for risk assessment purposes. Using your local contaminant levels, calculate a person's estimated exposure to lead, copper, or chromium over one week, one month, and one year. How do those cumulative values compare to known health thresholds?
- **Action Level vs. cause for concern.** What is the chemical and regulatory basis for these two different benchmarks? Why might a contaminant be present above a "cause for concern" threshold but below its Action Level, and what does that mean for residents?
- **Regional and source-based differences.** Does your region show elevated levels of any contaminant? Can those levels be explained by local geology, agricultural runoff, industrial history, or water treatment practices? For PFAS contamination in particular: is there an identifiable local source, such as a military installation, industrial facility, or airport?

The Collective Dataset

Your individual findings will be combined with data from across the class to build a national map of contaminant levels. This collective dataset is the authentic scientific contribution of the project: no single student could generate it alone, and the patterns that emerge at a regional scale, differences between surface water and groundwater systems, urban and rural communities, industrial and agricultural regions, are questions without predetermined answers.

At the end of the project, a written report summarizing your analysis will serve as your individual deliverable.

Water quality data is not just a chemistry exercise. It is a record of the choices communities have made, the infrastructure they have built or neglected, and the tradeoffs that regulators navigate every day. By the end of this project, you will be able to read and critically evaluate a public water quality report, a skill with lifelong practical value.

Resources to get started:

- **EPA Safe Drinking Water Information System (SDWIS)**: searchable by zip code, shows violation history and contaminant levels (https://www.epa.gov/ground-water-and-drinking-water/)
- **USGS Water Quality Portal**: surface and groundwater monitoring data
- **Consumer Confidence Report**: required annually by EPA
- **NY State Department of Health**: NYS has good public databases
- **PFAs database:** https://www.ewg.org/interactive-maps/pfas_contamination/map/