Emerging Contaminants in Drinking Water

The Safe Drinking Water Act (SDWA) defines "contaminant" as any physical, chemical, biological or radiological substance or matter in water. The focus of regulatory agencies and water professionals is to determine which contaminants represent a health risk or negatively impact the aesthetic characteristics of drinking water and how to best manage those contaminants. At present the United States Environmental Protection Agency (EPA) and Illinois Environmental Protection Agency (IEPA) have established legal limits for more than 90 contaminants, with those limits being set to protect human health and reflect the best technologies available for water treatment.

However, the range of chemical compounds used in manufacturing, health care, agriculture, and industries changes continuously; the potential exists for those compounds to find their way into drinking water sources; and our ability to detect contaminants at lower and lower levels continues to improve. As a result, the term "emerging contaminants" has come to represent a class of contaminants identified as potential new sources of concern related to drinking water quality.

The need to investigate emerging contaminants has been recognized for some time. Amendments incorporated into the SDWA in 1996 included a requirement for EPA to develop and periodically review a Contaminant Candidate List (CCL) including contaminants suspected to be present in some drinking waters, but for which health-based standards have not yet been established. Every 5 years, EPA produces a list of up to 30 unregulated contaminants for which data is collected from water systems across the country. Results from this monitoring of unregulated contaminants is then used by the agency to assess the need for development of limits for new contaminants. EPA is currently working through the fourth round of monitoring associated with its Unregulated Contaminant Monitoring Rule (UCMR4), collecting data on algal toxins, metals, pesticides and one pesticide manufacturing byproduct, and other complex chemicals. More information on the contaminants being monitored under the UCMR4 can be found on the EPA's website at: https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule.

Emerging Contaminants of Interest

Several emerging contaminants that have gained increasing visibility and interest as a result of prior UCMR work and media reports include Per- and Polyfluoroalkyl Substances (PFAS), hexavalent chromium, and microplastics.

Per- and Polyfluoroalkyl Substances (PFAS) are a class of human-produced chemicals that have been used in a range of products including non-stick cookware, stain repellent fabric, and fire-fighting foams. Unfortunately, some of the same characteristics that make PFAS highly useful in our day-to-day activities (e.g. stability, resistance to water and oil) make them difficult to manage when they enter the environment. In addition, concerns exist regarding the health effects that PFAS can have on exposed individuals. In 2016, EPA issued health advisories for two specific PFAS compounds (PFOA, PFOS) to make the public aware of the risk that these contaminants may pose to public health. Earlier this year EPA proposed regulatory determinations for these same contaminants as part of its PFAS Action Plan.

The primary sources of PFAS in the environment include PFAS manufacturing and processing facilities and airports or military installations where firefighting foam containing PFAS may have been widely used. States where test results have shown PFAS in samples from a large number of water utilities include New Hampshire, New Jersey, Delaware, Maryland, North Carolina, Michigan, Colorado, and California. Published data for Lake Michigan has indicated that some PFAS compounds may be present in lake water, but at very low levels – on the order of 2-12 parts per trillion (ppt). For reference, EPA's health advisory limit is 70 ppt.

Hexavalent Chromium (Chromium-6) is one of two common forms (Chromium-3, Chromium-6) of the naturally occurring metallic element Chromium. Chromium-6 is the more toxic form of the element. Chromium has also been documented as being released to the environment through discharges resulting

from ineffective control of industrial wastes. Two releases of chromium to Lake Michigan from industrial facilities in northwest Indiana were widely reported in the press in 2017.

A maximum contaminant level (MCL) of 100 parts per billion (ppb) was adopted by EPA in 1991 based on evaluations of potential health risks including allergic dermatitis (skin reactions). Studies of more serious health effects (e.g., cancer) associated with Chromium-6 in drinking water are ongoing.

Chromium-6 has been detected in water samples from Lake Michigan at multiple points. Data from nine years of City of Chicago quarterly testing for Chromium-6 at its raw water intakes and multiple points in its water system is available on Chicago's website. Chromium-6 data were also collected by multiple water utilities drawing water from the southwestern part of Lake Michigan under round 3 of EPA's UCMR monitoring. Concentrations reported from Chicago's quarterly sampling have consistently been in the range of 0.1- 0.3 ppb. Data extracted during the water quality review performed for Joliet's Alternative Water Source Program found concentrations in Lake Michigan samples ranging from 0.1-13 ppb.

Microplastics in water are generally considered to include plastic particles smaller than 5 millimeters in size or broken down from larger plastic items. Given the widespread use of plastics in household products and packaging, it is no surprise that small plastic fibers, particles, and fragments have been found in surface waters including Lake Michigan. Initial documentation of plastics in Great Lakes water contributed to the ban of certain types of plastics (e.g. microbeads) in personal care products first in Illinois, and later at the Federal level. Legislation phasing out the manufacture and sale of microbeads nationwide was passed in July 2018. However, data related to the presence, characteristics, and health effects of microplastics in raw and treated Lake Michigan water are limited. Additional research is needed to better understand the role and impacts of this contaminant in our water cycle.

Water Treatment Technologies and Emerging Contaminants

Joliet is specifically considering emerging contaminants such as those described above and the future impact they could have on an alternative Lake Michigan water source strategy. An early task completed as part of this year's project included an extensive review of available Lake Michigan water quality data from the City of Chicago, existing water utilities in northwestern Indiana, and multiple sampling sites in the southwestern part of Lake Michigan. Emerging contaminants are also being evaluated as part of current efforts to define the treatment process that Joliet would use to treat water obtained through a new Indiana intake.

Conventional drinking water treatment technologies have historically been shown to be effective at removing particles much smaller than most microplastics. As a result, microplastics are not likely to be a major factor in the consideration of Joliet's treatment options. Conventional water treatment processes including coagulation and filtration are also identified as a "best available technology" for the removal of Chromium-6 from source waters, though advanced treatment process can also be used to treat for Chromium. In contrast, PFAS compounds are not reliably removed from source waters by conventional treatment processes. Technologies that have been found to be effective in the removal of PFAS include advanced processes utilizing granular or powdered activated carbon, reverse osmosis, nanofiltration, or ion exchange.

The current evaluation of alternative water sources for Joliet will carefully consider the risk that regulated and emerging contaminants represent for Joliet. For the Chicago option, available data from the City of Chicago Department of Water Management will be examined to understand the actions and initiatives being taken and planned to provide high quality water throughout the region now and into the future. For the new Indiana Intake option, infrastructure requirements and costs for a new water treatment plant designed to meet current and likely future water quality requirements as well as the expectations of Joliet residents will be fully considered and incorporated into the alternative assessment.

References

Drinking Water Contaminant Candidate List (CCL) and Regulatory Determination. United States Environmental Protection Agency. www.epa.gov/ccl. August 12, 2020.

Per- and Polyfluoroalkyl Substances (PFAS). United States Environmental Protection Agency. www.epa.gov/pfas. August 12, 2020.

Sydney Evans, David Andrews, Tasha Stoiber, Olga Naidenko. *PFAS Contamination of Drinking Water Far More Prevalent than Previously Reported.* EWG. https://www.ewg.org/research/national-pfas-testing/. January 22, 2020.

Chromium-6. Chicago Department of Water Management Water Quality Results and Reports. https://www.chicago.gov/city/en/depts/water/supp_info/water_quality_resultsandreports/chromium-6.html. August 12, 2020.

Microplastics in drinking-water. Geneva: World Health Organization; 2019. License: CC BY-NC-SA 3.0 IGO.

Great Lakes Plastic Pollution. Alliance for the Great Lakes. https://greatlakes.org/great-lakes-plastic-pollution-fighting-for-plastic-free-water/