Water Quality Update

2/19/2025

Arsenic is a naturally occurring element that is present in Cleveland's groundwater. The EPA has set a maximum contaminant level (MCL) for arsenic in drinking water at 10 parts per billion (ppb). Quarterly arsenic samples at each of the wells (entry points) have been taken since 2019. Average arsenic levels over that time at Well 1 were 6.3 ppb, and Well 2 was 3.8 ppb. All individual samples were under the MCL of 10 ppb.

On November 15, 2024, the village was notified of test results conducted by a resident who occasionally had discolored water. Test results showed that the discolored water had arsenic levels of 52 ppb as well as elevated levels of iron, manganese and copper. A sample was taken on that same day after the water had cleared and the results had arsenic levels of 15 ppb. A sample was taken approximately one month later from the same residence and the arsenic level in the water was 3.6 ppb per the Milwaukee Journal Sentinel.

For compliance determinations, testing for arsenic levels is only required at the entry points and not in the distribution system. After receiving the test results research was conducted on how arsenic levels in the distribution system could be higher than what the levels are at the entry points. Several studies have been reviewed that demonstrate that arsenic has a high affinity for iron. The source water contains 0.184 mg/l at well 1 and 0.243 mg/L of iron, both of which are under the Secondary MCL of 0.3 mg/L. Secondary MCL's are non-enforceable standards set by the EPA that could affect aesthetics in drinking water. When soluble iron present in the water is oxidized it will precipitate out into a solid form and cause deposits on the walls of pipes and storage facilities. The distribution water is oxidized through the contact with air in the water tower as well as by the chlorine used for disinfection purposes. Arsenic in the drinking water will bind to the precipitated iron deposits in the system which explains why the discolored water which was high in iron was also high in arsenic. These deposits under normal flows should remain settled in the distribution system but when any type of hydraulic disturbance happens the deposits can get stirred up and could end up at an end user's tap. It is believed that arsenic levels in clear water will be under the MCL for safe drinking water.

The first treatment option the village explored was to add a phosphate to the drinking water. The idea was that a phosphate would put a coating on the soluble iron present in the water so that it couldn't oxidize and adsorb arsenic. The theory was that this would take care of the potential for elevated arsenic levels as well as the discolored water complaints. Our water treatment supplier, Hawkins Inc., was contacted to determine if this was an approach that was feasible. After two months of meetings and testing of the water it was determined that this approach would just be a band aid, and that the problem would most likely not go away. Phosphates tend to have limited success in controlling problems like this. They will slow the precipitation process but cannot prevent it from happening. Any hydraulic disturbances in the pipe would still scrub any deposits

that did happen to form. There were also concerns with phosphates sitting in mains where water does not move frequently enough which turns them to orthophosphates which have no effect on treatment.

Their recommended approach now is to filter arsenic out at the source to be sure the problem is gone. The village has been in contact with a company called Water Surplus which specializes in filtering contaminants from water. Water Surplus has presented two approaches to removing arsenic at the source. The first approach uses a filter media that can be backwashed, or cleaned, when it becomes fouled. This type of media will remove arsenic, iron and manganese from the water but is not a viable option due to a couple of potential issues. The pH of the water is a little higher than optimal and the iron-to-arsenic ratio is incorrect. The Village currently has a variance in the WPDES discharge permit for the wastewater facility of 4.1 ppb of arsenic. The WPDES discharge permit, which we expect to become valid mid-year 2025, has proposed an arsenic discharge variance limit of 3.1 ppb. Cleveland applied for a variance in the wastewater effluent due to the DNR's proposed arsenic discharge limit of 0.2 ppb, which the plant would not be able to meet without investment in additional treatment equipment at the plant. Since this type of filter backwashes adsorbed arsenic and iron off the media, sending the backwash with its high levels of arsenic down the sewer would violate the WPDES wastewater discharge permit, and storing the backwash water on site will add trucking costs and treatment costs at another facility.

The second option to treat arsenic at the sources is to use a filter media made of ferric hydroxide, or granular rust. Since arsenic has an affinity for iron, the arsenic will adsorb to the granules as it passes through the filter. The drawback to this type of media is that when the media is spent (not able to adsorb any additional arsenic), it must be removed and hauled to a landfill that accepts a hazardous waste and new media then needs to be installed. This type of media will not be as good at removing iron from the water so additional treatment may be necessary (possibly a phosphate) to treat that.

With either of these types of filtration systems, an additional footprint may need to be added to the existing well houses to house the filters. Well 1 does have half of the structure that was an 80,000-gallon wet well which is currently only used as a holding tank for water for firefighting. It may be possible that some square footage of that area could be utilized to house the filter at that site.

Water Surplus is working on providing pricing for a pilot study as well as full-scale equipment costs. The village has contacted its utility engineer to move this project forward as all DNR submittals will need to be done by a professional engineer.

Currently the village is flushing the known problem areas weekly to keep fresh, clean water in those mains. Water samples from representative hydrants throughout the village will be taken weekly and tested for arsenic to gauge the severity, frequency and potential problem areas; and to verify that arsenic levels in the distribution system remain at levels under the MCL for safe drinking water. Results will be plotted on a map of the water system for reference.

A requirement of the arsenic variance in the WPDES wastewater discharge permit is a pollutant minimization plan to investigate methods to reduce the amount of arsenic present in the discharge from the plant and implement them if economically feasible. One of the requirements is to investigate the removal of arsenic at the source. Two options were looked at in 2022 by Donohue and Associates to treat arsenic at the wells. Reverse osmosis and vertical pressure contactors were looked at and were estimated at capital costs of $6.55 Million and $6.96 Million respectively.

Keeping drinking water safe for the residents is of the utmost importance. While staff and outside sources try to determine how extensive a problem elevated arsenic levels in the distribution system are, the village will proceed with investigating treatment at the source. If the DNR is trying to lower the discharge limit of arsenic to Lake Michigan to a small fraction of what the current drinking water standards are, then it is feasible to believe that a reduction in drinking water limits could be imposed in the future.

Chris Jost
Deputy Director of Public Works
Village of Cleveland