



Water and Wastewater Regulatory Compliance Corner

Introduction to Arsenic and Clarifications to Compliance and New Source Monitoring Rule

Published June 30, 2021

Drinking Water Regulation in America

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources—rivers, lakes, reservoirs, springs, and ground water wells.

SDWA authorizes the United States Environmental Protection Agency (US EPA) to set national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water. US EPA, states, Tribal Nations and water systems then work together to make sure that these standards are met.

Introduction to Regulation

To protect customers, the EPA has issued specific regulations and rules water utility systems must follow in order to make sure they are providing safe drinking water. EPA issued the Arsenic and Clarifications to Compliance and New Source Monitoring Rule (hereby referred to as the Arsenic Rule) to improve public health by reducing exposure to arsenic in drinking water.

Timeline of Regulation

1942: US Public Health Service sets arsenic drinking water standard of 50 ppb.

1975: EPA adopted that level and issued an interim drinking water regulation for arsenic.

1996: In SDWA Revisions, Congress directed the EPA to propose a new drinking water standard for arsenic by January 1, 2000.

2000: In June 2000, EPA published its proposal to revise the arsenic standard from 50 ppb to 5 ppb and requested comment on options of 3 ppb, 10 ppb, and 20 ppb.

2001: EPA set the final standard at 10 ppb and applied it to non-transient, non-community water systems, as well as community water systems.

Why is this important?

What is arsenic? Arsenic is a semi-metal element in the periodic table. It is odorless and tasteless. It can enter drinking water supplies from natural deposits in the earth or from agricultural and industrial practices.

What are the health effects of arsenic? The consumption of food and water containing arsenic is the major source of human exposure. Exposure to inorganic arsenic carries some health risks. The amount of risk is related to the duration and level of exposure.

The Water and Wastewater Regulatory Compliance Corner provides analyses and details about changes to national drinking water standards and regulations, and national regulatory standards for wastewater discharged to surface waters and sewage treatment plants. These technical analyses are intended for Tribal water and wastewater utility professionals, and do not necessarily reflect USET/USET SPF policy positions about national environmental laws; EPA regulations, rules, and guidance documents; EPA trust and treaty obligations; and EPA strategy for implementing federal environmental programs in the USET region.

ACUTE HEALTH EFFECTS OF ARSENIC CONSUMPTION	LONG-TERM HEALTH EFFECTS OF ARSENIC CONSUMPTION
Vomiting, abdominal pain and diarrhea	Heightened risk of lung, bladder, skin, kidney, nasal, liver and prostate cancer
Numbness and tingling of the extremities, muscle cramping	Changes to the body's cardiovascular, pulmonary, immunological, neurological and endocrine systems (diabetes)

Important Terms and Definitions

Water Table: Underground boundary between the soil surface and the area where groundwater saturates spaces between sediments and cracks in rock.

Aquifers: Underground layers of permeable rock, gravel, sand or clay that water can be extracted from.

Carcinogen: A substance capable of causing cancer in living tissue.

Groundwater Recharge: When water enters and fills aquifers.

Semi-Metal: An element (e.g., arsenic, antimony, or tin) whose properties are intermediate between those of metals and solid non-metals.

Parts per million (PPM): mg/L or milligrams per liter.

Parts per billion (PPB): µg/L or micrograms per liter.

GWS: Ground Water System.

Source Water: Source where water is drawn from to be treated and distributed.

Treatment Techniques: Methods and techniques used for treating raw water before it is distributed to customers.

Organic Arsenic: Organic arsenic compounds the arsenic atom is attached to a carbon. Organic arsenic is harmless.

Inorganic Arsenic: Inorganic arsenic compounds do not contain carbon. These compounds are highly toxic.

Arsenic Rule

SDWA Approach to Public Health Protection

All SDWA Regulations are structured to mitigate and minimize anything that is harmful to public health by targeting four key areas:

- Prevention (Source)
- Standards and Treatment
- Distribution System
- User Information (Use)

Source and Prevention of Arsenic

ARSENIC IN THE WATER

Arsenic is a naturally occurring semi-metal element that is widely distributed in the Earth's crust. It is found in water, air, food, and soil. There are two general forms of arsenic: organic and inorganic.

Organic arsenic compounds exist mainly in fish and shellfish. Inorganic arsenic compounds are in soils, sediments, and groundwater.

The inorganic forms usually exist in water in two chemical states: arsenite (As III), or arsenate (As V).

WHY IS ARSENIC FOUND IN DRINKING WATER?

Arsenic can be found in drinking water as a result of natural processes or human activities. Higher levels of arsenic tend to be found more often in ground water than in surface water.

REGULATING ARSENIC IN WATER

Maximum Contaminant Level Goal (MCLG)

- EPA set MCLG for arsenic at zero.
- Health-based goal at which no known or anticipated adverse effects on human health occur.
- Based on the best available science to prevent potential health problems.

Maximum Contaminant Level (MCL)

- Based on the MCLG.
- EPA set an enforceable regulation for arsenic, at 0.010 mg/L (10 ppb).
- MCLs are set as close to the MCLG as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies.

SOURCE WATER IS HIGH IN ARSENIC

The first step in arsenic treatment is to monitor source water to determine if the system has an arsenic problem at any of its entry points.

- If there is a problem, then systems should first consider an alternate source or blending source waters.
- If an alternate source or blending is not feasible, then the system should consider optimizing its existing treatment.

TREATMENT FOR REMOVING ARSENIC

If there are no alternative water sources and the arsenic level still exceeds the MCL, the system should next determine whether it has existing treatment that could be modified for arsenic treatment.

SMALL SYSTEM COMPLIANCE TECHNOLOGIES FOR ARSENIC REMOVAL IN 40 CFR 141.62 (D)	
TREATMENT TECHNOLOGY	MAXIMUM % REMOVAL
Activated Alumina	95
Ion Exchange	95
Coagulation Filtration	95
Reverse Osmosis	>95
Lime Softening	90
Oxidation/Filtration	80

EPA anticipates that most small systems will use activated alumina (or another type of adsorptive media), reverse osmosis devices, or modified lime softening.

PRE-TREATMENT

Most technologies may require pre-treatment (e.g., chlorination) to effectively remove arsenic from drinking water. The need for pre-treatment depends on source water quality.

Municipally treated waters containing free available chlorine (FAC) will generally oxidize As III to the As V form. As V is much easier to remove than As III. Utilizing only monochloramine will not completely oxidize As III to As V.

DISPOSING OF ARSENIC WASTE

All arsenic treatment technologies, other than zero-treatment options such as alternate source use and blending, produce waste in the form of liquid residuals, solid residuals, or both. These residuals contain concentrated arsenic and other contaminants that must be disposed of properly.

Water systems should work with your primacy agency to determine the best waste disposal option for your system based on your treatment processes, the type of waste generated, and the contaminant levels in the waste streams.

Monitoring Distribution System

SAMPLING AT EACH ENTRY POINT IN DISTRIBUTION SYSTEM

EPA requires sampling at each sampling point to ensure that enough samples are drawn to be representative of each source and of the water being served to each customer.

Because there may be temperature or seasonal variation in arsenic levels, this monitoring should ideally occur over an extended period.

MONITORING LEVELS

If arsenic is below 10 mg/L at all entry points to the distribution system, then the system will be in compliance with the revised MCL and does not need to consider or revise current arsenic mitigation strategies.

If arsenic is above 10 mg/L at even one entry point to the distribution system, then the system will need to revise or develop mitigation strategies.

MONITORING FREQUENCY

IF MCL HAS NOT BEEN EXCEEDED	Ground Water: Sample every 3 years. Surface Water: Sample annually.
IF MCL HAS BEEN EXCEEDED	Any system that has a sampling point monitoring result that exceeds the MCL must increase the frequency of monitoring at that sampling point to quarterly sampling. If a system is collecting samples more than once a year (i.e., quarterly or more), then compliance with the MCL is determined by calculating a Running Annual Average.

RUNNING ANNUAL AVERAGE (RAA)

A running average is an average that continually changes as more data points are collected.

DATE	RESULT A (MG/L)	RESULT B (MG/L)
12-Oct	22	19
12-Jan	3	18
12-Apr	2	9
12-Jul	11	11
RAA	9.5	14.25

For Result A, even though the October 12 and July 12th exceeded the MCL, the RAA did not, so the system is in compliance. For Result B, the RAA exceeds the MCL and is not in compliance.

ENSURE PROPER MONITORING

- Collect the correct number of samples for each sampling period.
- Report monitoring results to your primacy agency on time.
- Know when your system is in violation of the arsenic MCL.
- Report MCL violations to your primacy agency and your customers on time.

User Information

REPORTING VIOLATIONS

Keeping the primacy agency and your customers informed is part of your responsibility as a public water system. The primacy agency needs to know if your system poses any health risks so it can help you protect your customers. Informed customers are more likely to understand the need for a new treatment system, infrastructure changes, and rate increases.

DETERMINING A VIOLATION

IF...	THEN...	ACTIONS
Running annual average (RAA) of arsenic at any sampling point is greater than 0.01 mg/l	You have an MCL violation	<ul style="list-style-type: none"> Report violation to primacy agency within 48 hours of receiving lab results. Notify customers within 30 days. Continue quarterly sampling until primacy agency determines that your system is reliably below the MCL.
Fail to take sample, or Do not sample from each sampling point, or Do not report your results to the primacy agency on time	You have an M&R violation	<ul style="list-style-type: none"> Report this violation to the primacy agency within 48 hours of when the violation occurs. Notify your customers within a year. You may be able to incorporate this information into your CCR instead of a separate report.

CONSUMER CONFIDENCE REPORT (CCR)

Water systems must prepare annual CCRs. These reports tell your customers where their drinking water comes from, what is in it, and how they can help protect it.

IF...	THEN YOU MUST INCLUDE IN YOUR CCR...
If your arsenic sampling results are greater than 0.010 mg/L (10 µg/L, or 10 ppb)	"Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system and may have an increased risk of getting cancer."
If your arsenic sampling results are equal to or less than 0.010 mg/L (10 µg/L, or 10 ppb), but greater than 0.005 mg/L (5 µg/L, or 5 ppb)	"While your drinking water meets EPA's standards for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic, which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems."
If your arsenic sampling results are equal to or less than 0.005 mg/L (5 µg/L, or 5 ppb)	No special language is required.