



# Water and Wastewater Regulatory Compliance Corner

## Nitrate and Nitrate Federal Regulations

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## Background

### 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 (EPA) to set national health-based standards for drinking water to protect against both naturally occurring and synthetic contaminants that may be found in drinking water. EPA, Tribal Nations, states, and water systems then work together to make sure that these standards are met.

### Introduction to Regulation

To protect customers, the US EPA has issued specific regulations and rules that water utility systems must follow to make sure they are providing safe drinking water. US EPA issued regulations regarding Nitrates and Nitrites in 1991 as Phase II Chemical Contaminant Rules.

These rules regulate over 65 contaminants in three contaminant groups:

- Inorganic Contaminants (IOCs) (including nitrite and nitrate),
- Volatile Organic Contaminants (VOCs)
- Synthetic Organic Contaminants (SOCs)

The rules apply to all public water systems (PWS). PWS type, size, and water source type determine which contaminants require monitoring for that system.

### Terms to know

**Eutrophication:** Eutrophication is the gradual increase and enrichment of an ecosystem by nutrients, such as nitrogen and phosphorus. In aquatic environments, nutrients can enhance growth of choking aquatic vegetation or algae, disrupting normal functioning of the ecosystem, causing a variety of problems.

**Inorganic Chemicals:** Class of substances encompassing all those that do not include carbon as their principal element. Inorganic compounds are obtained from the natural processes which are not related to any of the life forms on earth or any result of human experiments which are conducted in laboratories. Examples include table salt, inorganic arsenic, and gold.

**MCL:** A MCL is the legal threshold limit on the amount of a substance that is allowed in public water systems under the Safe Drinking Water Act (SDWA)

**MCLG:** A MCLG serves as a non-enforceable public health objective – rather than regulatory standard. They are aspirational. These goals allow for a margin of safety, as they limit the level of a contaminant in drinking water to a concentration below which there is no known (or expected) risk to human health. They do not, however, consider

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/USSET 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.

the limit of detection and/or treatment technology effectiveness. As a result, they can be set at levels which water treatment systems cannot meet.

**Nitrification:** Nitrification is a microbial process by which ammonia, or another nitrogen compound are converted to nitrite and nitrate.

**Nitrogenous:** Containing nitrogen in chemical combination.

**Organic Chemicals:** Carbon based chemicals that result from activities of a living being. Examples include grain alcohol and methane.

**Soluble:** Able to be dissolved, such as dissolved in water.

## Regulating Nitrogen

### Nitrogen in water

Nutrients, such as nitrogen and phosphorus, are essential for plant and animal growth and nourishment, but too much can cause adverse health and ecological effects. Nitrogen, in the forms of nitrate, nitrite, or ammonium, is a nutrient needed for plant growth.

Chemical fertilizers or animal manure containing nitrogen are commonly applied to crops to add nutrients. Heavy rains can wash these materials into nearby streams and lakes. Wastewater treatment facilities that do not specifically remove nitrogen can also lead to excess levels of nitrogen in surface water or groundwater.

Since they are very soluble and do not bind to soils, nitrates have a high potential to migrate to groundwater. Because they do not evaporate, nitrates/nitrites are likely to remain in water until consumed by plants or other organisms.

### What are Nitrates and Nitrites and where do they come from?

Nitrates ( $\text{NO}_3^-$ ) and Nitrites ( $\text{NO}_2^-$ ) are nitrogen-oxygen chemical compounds. The main sources of nitrates/nitrite contamination are fertilizers, septic tank waste from failed systems, livestock manure runoff, and erosion of natural deposits. The largest source of nitrates in water comes from nitrogen-based fertilizers that get into shallow drinking water wells in rural areas.

Most nitrogenous materials in water are converted to nitrate, and once consumed, the human body converts them to nitrites.

### What are the effects?

Human Health Effects:

- Excessive levels of nitrate in drinking water have caused serious illness and sometimes death.
- Consuming too much nitrate can affect how blood carries oxygen and can cause methemoglobinemia (also known as blue baby syndrome).
- Bottle-fed babies under six months old are at the highest risk of getting methemoglobinemia when nitrate contaminated drinking water is used to dilute formula.
- Methemoglobinemia can cause skin to turn a bluish color and can result in serious illness or death.
- Other symptoms connected to methemoglobinemia include decreased blood pressure, increased heart rate, headaches, stomach cramps, and vomiting.

Environmental Health Effects:

- Increased levels of nitrogen in surface waterways can cause excessive growth of aquatic plants and algae. Excessive growth of these organisms, in turn, can clog water intakes, use up dissolved oxygen as they decompose, and block light to deeper waters.
- Lake and reservoir eutrophication can occur, which produces unsightly films of algae on the water surface, can occasionally result in fish kills, and can even “kill” a lake by depriving it of oxygen.

## Measuring Nitrates and Nitrites in drinking water

Maximum Contaminant Level (MCL):

- The EPA has set the MCL for nitrate and nitrite to the following for the safety of drinking water:
- Nitrates MCL = 10 mg/L or 10 ppm
- Nitrites MCL = 1 mg/L or 1 ppm

	Monitoring Frequency	Sampling Location
Groundwater	<p>Annually</p> <p>Increases to quarterly for one year if any sample is greater than 50% of the MCL</p> <ul style="list-style-type: none"> <li>• =&gt;5 mg/L for nitrate</li> <li>• =&gt; 0.5 mg/L for nitrite</li> </ul>	<ul style="list-style-type: none"> <li>• Take at least one sample at every entry point to the distribution system which is representative of each well / water source after treatment.</li> <li>• The system shall take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.</li> </ul>
Surface Water	<p>Quarterly</p> <ul style="list-style-type: none"> <li>• For public water systems using groundwater, after four consecutive quarterly samples are less than the MCL, a system may request that the US EPA reduce monitoring frequency to annual sampling.</li> <li>• For public water systems using surface water, after four consecutive quarterly samples are less than 50 percent of the MCL, a system may request that the US EPA reduce monitoring frequency to annual sampling. A system using approved surface water shall return to quarterly monitoring if any one sample is greater than or equal to 50 percent of the MCL.</li> </ul>	<ul style="list-style-type: none"> <li>• Take at least one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment.</li> <li>• The system shall take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.</li> </ul>

If a system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions (i.e., when water is representative of all sources being used).

### What to do when sample exceeds MCL

1. Notify EPA as soon as practicable, but no later than 24 hours after the public water system learns of the violation or situation, to determine additional public notice requirements. Give your name, date, the nitrate, or nitrite level, and when you received the data. Confirm you are taking a confirmation sample and checking with the lab to confirm.
2. Take a confirmation sample within 24 hrs. of violation notification.
  - Compliance determination is based on the average of the results of the initial and confirmation samples
  - If unable to comply with 24-hour sampling requirement, system must immediately notify customers and issue Tier 1 public notification. System must take and analyze a confirmation sample within two weeks of notification.
3. If needed, post Tier 1 Public Notice (PN). Do not issue boil water notice, this increases nitrate / nitrite concentrations
4. Develop Action Plan for remedying violation; consider professional engineering assistance.
5. Issue a Public Notice following instructions in chart below.

If...	Then issue a...	Deliver Via...
A sample has exceeded the nitrate and/or nitrite maximum contaminant level	Tier 1 violation (PN issued within 24 hours)	<ul style="list-style-type: none"> <li>• Radio</li> <li>• TV</li> <li>• Hand Delivery</li> <li>• Posting</li> <li>• Other methods specified by Tribal Nation or State</li> </ul>

## 6. Developing an Action Plan

- If a water supply exceeds the primary standards the water system must either:
  - Cease using water from the contaminated source
  - Provide adequate treatment to remove the contaminants
  - Locate a new source of supply that meets the standards
- Blending may be done under certain conditions:
  - Blending water with another source to reduce nitrates before point of entry (POE)
  - Must notify EPA