Consideration of Other Regulatory Revisions in Support of the Fourth Six-Year Review of the National Primary Drinking Water Regulations: Chemical Phase Rules and Radionuclides Rule

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List of Acronyms and Abbreviations

CCR	Consumer Confidence Report
CFR	Code of Federal Regulations
CWS	Community Water System
EPA	United States Environmental Protection Agency
FR	Federal Register
GWUDI	Ground Water under the Direct Influence of Surface Water
ICR	Information Collection Request
IRIS	Integrated Risk Information System
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/L	Milligrams per Liter
MRL	Minimum Reporting Level
NCWS	Non-community Water System
NPDWR	National Primary Drinking Water Regulation
NTNCWS	Non-transient, Non-community Water System
OGWDW	Office of Ground Water and Drinking Water
PN	Public Notification
PWS	Public Water System
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SYR	Six-Year Review
SOC	Synthetic Organic Chemical
TNCWS	Transient Non-Community Water System
VOC	Volatile Organic Compound

1 Introduction and Background

Under the Safe Drinking Water Act (SDWA), as amended in 1996, the U.S. Environmental Protection Agency (EPA) must periodically review existing National Primary Drinking Water Regulations (NPDWRs) and, if appropriate, revise them. Section 1412(b)(9) of SDWA states:

> *The Administrator shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation promulgated under this title. Any revision of a national primary drinking water regulation shall be promulgated in accordance with this section, except that each revision shall maintain, or provide for greater, protection of the health of persons.*

EPA completed and published the results of its first Six-Year Review (Six-Year Review 1) on July 18, 2003 (68 FR 42908; USEPA, 2003) after developing a systematic approach, or protocol, for the review of NPDWRs. EPA has applied the same protocol with some refinements to the second Six-Year Review (Six-Year Review 2) (75 FR 15500; USEPA, 2009), the third Six-Year Review (Six-Year Review 3) (82 FR 3518; USEPA, 2016a), and currently the fourth Six-Year Review (Six-Year Review 4, SYR 4) of NPDWRs.

To facilitate the review of many NPDWRs, EPA performs a series of analyses at the beginning of each review cycle, intended to target those NPDWRs that are the most appropriate candidates for revision. During each review cycle, EPA reviews the following key information and/or factors to determine whether NPDWR revisions are possible and appropriate: health risk assessments; analytical methods and treatment technology assessments; occurrence and exposure analyses; and implementation-related issues . This document focuses on implementation issues related to Chemical Phase Rules and Radionuclides Rule reviewed as part of the Six-Year Review 4.

In addition to the review of the maximum contaminant level goals (MCLGs), maximum contaminant levels (MCLs), and treatment techniques components of the NPDWRs, EPA considers whether other revisions might be appropriate, such as system monitoring and reporting provisions, as part of Six-Year Review process. For the Six-Year Review 4, EPA utilized the Six-Year Review 4 Protocol (USEPA, 2024a) for evaluating which implementation issues to consider. In this review cycle, EPA revised to the Protocol (USEPA, 2024a) to clarify EPA may consider other revisions to an NPDWR, such as monitoring provisions, regardless of whether new health risk information is available or EPA identifies potential to change the MCL, MCLG, or treatment technique. Consistent with previous cycles, EPA considered potential implementation-related revisions if they:

1) Represented a potential change to an NPDWR, as defined under section 1401 of SDWA[1];
2) Were "ready" for rulemaking – that is, the problem to be resolved had been clearly defined and specific option(s) had been formulated to address the problem under the current regulatory framework; and
3) Would provide a meaningful opportunity to improve the level of public health protection; and/or provide a meaningful opportunity for cost savings (either monetary or burden reduction) while not lessening public health protection.

[1] The subject of the Six-Year-Review, as specified in section 1412(b)(9) of the SDWA, is "each national primary drinking water regulation," as defined under section 1401 of SDWA.

2 Implementation Issues for Consideration

EPA reassessed the complete list of initial potential implementation issues identified in Six-Year Review 3 (SYR 3) during Six-Year Review 4 (SYR 4). As part of SYR 3, EPA requested a working group of its regional offices and headquarters staff, involved in assisting primacy agencies with implementing NPDWRs, to gather input regarding concerns that are within the scope of the Six-Year Review. The potential implementation issues selected for consideration were provided in the document entitled "Consideration of Other Regulatory Revisions in Support of the Third Six-Year Review of the National Primary Drinking Water Regulations" (USEPA, 2016a). To select topics for review as part of SYR 4, the working group was given the opportunity to reassess the issues that were previously identified and to provide any additional issues.

The following sections of this document provide background and summary information regarding seven topics selected for detailed review during SYR 4.

- Section 2.1 – Nitrate Alternative MCL in Noncommunity Water Systems
- Section 2.2 – Nitrate Monitoring Frequency in Transient Noncommunity Water Systems
- Section 2.3 – Nitrite Monitoring Frequency
- Section 2.4 – Total Nitrate and Nitrite Analysis for Nitrate MCL Monitoring
- Section 2.5 – Free Cyanide Monitoring Considerations
- Section 2.6 – Definition of Reliably and Consistently
- Section 2.7 – Running Annual Average for Inorganic Contaminant Compliance Determination

For the Six-Year Review, EPA collects NPDWR compliance monitoring data from States[2] using the Information Collection Request (ICR) process. The primary purpose of obtaining the compliance monitoring data through the ICR is to assess occurrence of regulated contaminants in finished drinking water. The ICR is necessary because States are not currently required to submit all of the NPDWR compliance monitoring data that they receive from PWSs to EPA. In addition to the occurrence analysis, EPA also used the SYR 4 ICR monitoring data to assess the scale of certain NPDWR implementation issues, as described herein. The SYR 4 ICR was a voluntary request for States to submit historical monitoring data, covering the years 2012 through 2019, and a total of 59 States provided data that included all analytical detection and non-detection records. Further details of the ICR dataset are provided in the "Data Management and Quality Assurance/Quality Control Process for the Fourth Six-Year Review Information Collection Request Dataset" (USEPA, 2024b).

[2] In the remainder of this document, the terms "State" or "States" refers to primacy agencies in states of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, the Trust Territory of the Pacific Islands, or an eligible Indian tribe.

2.1 Nitrate Alternative MCL in Non-community Water Systems

Issue Description

The MCL for nitrate under 40 CFR 141.62 is 10 mg/L. EPA promulgated the MCL based on the critical health endpoint of methemoglobinemia to which children under six months of age are particularly susceptible (blue baby syndrome). 40 CFR 141.11(d) provides discretion for States to approve use of a higher alternative MCL of 20 mg/L for nitrate at non-community water systems (NCWSs) that meet the following criteria:

1. Such water will not be available to children under six months of age;
2. The NCWS is meeting the public notification requirements under §141.209, including continuous posting of the fact that nitrate levels exceed 10 mg/L and the potential health effects of exposure;
3. Local and state public health authorities will be notified annually of nitrate levels that exceed 10 mg/L; and
4. No adverse health effects shall result.

Other provisions related to this issue are included in 40 CFR 141.23 which states:

> *Community water systems shall conduct monitoring to determine compliance with the maximum contaminant levels specified in § 141.62 in accordance with this section. Non-transient, non-community water systems shall conduct monitoring to determine compliance with the maximum contaminant levels specified in § 141.62 in accordance with this section. Transient, non-community water systems shall conduct monitoring to determine compliance with the nitrate and nitrite maximum contaminant levels in §§ 141.11 and 141.62 (as appropriate) in accordance with this section.*

Two concerns with the current rule provisions were identified during SYR 3:

1. The alternative MCL does not address potential health concerns other than methemoglobinemia associated with the ingestion of nitrate-nitrogen, such as possible effects on fetal development.
2. The monitoring provisions in 40 CFR 141.23 imply that Transient Non-Community Water Systems (TNCWS), a subcategory of NCWSs, are the only type of non-community water systems that are eligible for use of the alternative MCL. However, 40 CFR 141.11(d) clearly specifies all NCWSs. Additionally, the preamble to the rule establishing the provision offers the example of entities such as industrial plants, generally considered to be a non-transient non-community water systems (NTNCWS), "because of the limited, adult population consuming the water" (44 FR 42254, USEPA, 1979).

As part of SYR 4, EPA reviewed state drinking water regulations and analyzed SYR 4 ICR nitrate compliance data to estimate how many systems may be using the alternative nitrate MCL of 20 mg/L. First, EPA reviewed state drinking water codes to determine if any States do not allow the alternative MCL to be used. EPA identified nine States with regulations that do not include the alternative MCL for nitrate to be used in NCWSs: Alabama, California, Connecticut, Massachusetts, New Hampshire, Ohio, Oregon, Texas, and Washington. While the remaining state codes include the provision in 40 CFR 141.11(d), EPA recognizes that States have the discretion to not to allow systems to use the alternative MCL.

For the States that include language in their drinking water codes that provides the State with the discretion to allow the alternative nitrate MCL under certain circumstances, EPA estimated how many NCWSs may be using the alternative MCL from 2012 to 2019. EPA identified NCWSs in the SYR 4 ICR dataset with reported nitrate concentrations between 10 mg/L (MCL) and 20 mg/L (alternative MCL) that did not have a subsequent reported MCL violation in the Safe Drinking Water Information System (SDWIS) federal version (SDWIS/Fed). The purpose of this analysis is to estimate the scope of the issue on a national scale. The purpose is not to evaluate compliance or assess the accuracy of system or state reporting.

For the purposes of this analysis, EPA made the following assumptions:

- Any nitrate sample concentrations less than 10.5 mg/L were rounded to 10 mg/L and were not considered to exceed the MCL.
- If a sample concentration exceeds the MCL and an additional sample was taken at the same sample point within 30 days, EPA assumed the additional sample was a confirmation sample. The two values were averaged together for comparison to the MCL in this analysis. This approach is consistent with 40 CFR 141.23(i)(3).
- If a system has a nitrate MCL violation in SDWIS/Fed reported for some samples that exceed 10 mg/L and not for others, EPA assumed the system is not using the alternative MCL.

Exhibit 1-1. Potential Nationwide Application of the Alternate Nitrate MCL by Noncommunity Water Systems

Non-Community Water System Type	Estimated Number of Systems	Population Served by Systems
Transient	597	58,427
Non-transient	92	30,373
Total	**689**	**88,800**

Exhibit 1-1 shows that a total of 689 NCWSs nationally may have used the alternative MCL of 20 mg/L between 2012 and 2019. This represents approximately 0.8 percent of the 90,415 NCWSs included in the SYR 4 ICR dataset that monitored for nitrate between 2012 and 2019, and 0.6 percent of the total population served. The analysis indicates that the alternative MCL is

applied to transient systems far more often than non-transient systems. This analysis of nationwide compliance monitoring data identified only nominal application of the alternative MCL for nitrate by NCWSs.

Potential Resolution(s)

Any revisions to the nitrate and nitrite NPDWRs could take place if EPA determines in the future that it is appropriate as a result of new and significant information from updated health effects assessments. In November 2023, EPA released the *Protocol for the Nitrate and Nitrite IRIS Assessment (Oral) (Preliminary Assessment Materials)* for public review and comment. The protocol describes methodology for how the assessment will be conducted, including systematic review and dose-response. Section 2.2 of the protocol describes specific assessment needs identified by EPA program offices, which includes the effects of nitrate levels, specifically between 10 and 20 mg/L on all life stages (USEPA, 2023).

The SYR 4 analysis only identified a small number of non-community systems (689) that appeared to apply the alternative MCL between 2012 and 2019. Considering the limited scope of this issue, EPA is not revising the NPDWR to change the alternative nitrate MCL at this time. EPA will reevaluate the possibility of revising the nitrate NPDWR to clarify the appropriate use of the alternative MCL as part of the next Six-Year Review cycle; or at any time, if appropriate.

2.2 Nitrate Monitoring Frequency in Transient Noncommunity Water Systems

Issue Description

All public water systems (PWSs) are required to monitor for nitrate under 40 CFR 141.23(d). CWSs and NTNCWSs are required to monitor for nitrate quarterly if a sample is greater than or equal to 50 percent of the nitrate MCL. For surface water systems, if four consecutive samples are less than 50 percent of the MCL, the system may reduce to annual monitoring. For groundwater systems, the State may allow a system to reduce to annual monitoring after four consecutive samples are reliably and consistently below the MCL. TNCWSs are required to monitor for nitrate annually under § 141.23(d)(4). In the preamble of the 1991 final Phase II Rule, EPA discussed how commenters suggested removing the 50 percent trigger for determining increased or decreased monitoring frequency. EPA stated that "Even though elsewhere in this rule the 50 percent trigger is eliminated, EPA has decided to retain the 50 percent trigger for increased nitrate monitoring in the case of nitrate and also to extend this requirement to TWSs" (56 FR 3566, Jan. 30, 1991). The preamble suggests that the requirement for systems to conduct quarterly monitoring if a nitrate sample is greater than or equal to 50 percent of the MCL applies to transient water systems. However, the requirement in § 141.23(d)(4) states that "each transient non-community water system shall monitor annually." EPA notes the conflict between the regulatory text and the preamble but is also aware that some TNCWSs monitor for nitrate quarterly after a sample result greater than 50 percent of the MCL.

To estimate the scope of this potential issue on a national scale, EPA analyzed compliance monitoring data collected under the SYR 4 ICR. EPA identified sample results greater than 50

percent of the MCL and determined if the system conducted quarterly monitoring in the subsequent three quarters following the initial result or not. Some systems have multiple sample points. For this analysis, if a system conducted quarterly monitoring at one sample point but not another, EPA categorized the system as conducting quarterly monitoring.

Exhibit 2-1. Annual Average Counts of TNCWSs Monitoring for Nitrate between 2012 and 2019 by Monitoring Frequency [1]

Screening Criteria	Monitoring Frequency	Average Number of Systems	Percent of Systems
Detections >= 5 mg/L (50% MCL)	Quarterly	1,118	1.90%
	Non-quarterly	2,349	4.10%
	Total	3,467	5.99%
Detections > 10 mg/L (100% MCL)	Quarterly	205	0.40%
	Non-quarterly	409	0.70%
	Total	614	1.06%
Average number of systems that monitored for nitrate each year		57,883	

[1] Averages are reported because yearly counts were largely consistent from 2012 to 2019.

An average of 57,883 TNCWSs monitored for nitrate per year from 2012 to 2019 in the SYR 4 ICR dataset. The analysis shows that 3,467 TNCWSs per year had a nitrate sample result greater than 50 percent of the MCL, representing approximately 6 percent of the average TNCWSs monitoring for nitrate per year. Of those systems, approximately 32 percent conducted quarterly monitoring in alignment with the requirements for CWSs and NTNCWSs, representing approximately 2 percent of the average number of TNCWSs monitoring for nitrate per year. The remainder of the systems conducted annual monitoring as specified under § 141.23(d)(4). Few TNCWSs (1 percent of those that monitored for nitrate) reported any detection above the MCL of 10 mg/L as nitrogen.

Potential Resolution(s)

To evaluate the concern that nitrate monitoring practices at TNCWSs are less robust than those at NTNCWSs and CWSs, EPA assessed the baseline monitoring practices of TNCWSs. While the majority of TNCWSs (68 percent) that reported detections equal or greater than 50 percent of the nitrate MCL did not conduct quarterly monitoring afterward, the number of these systems (2,349) appears relatively small. Due to the limited scope of this issue, EPA is not revising the monitoring provisions at this time. Monitoring provisions should be evaluated if the nitrate NPDWR were to be revised based on an updated IRIS assessment.

2.3 Nitrite Monitoring Frequency

Issue Description

All PWSs are required to monitor for nitrite under 40 CFR 141.23(e). Systems were required to take an initial sample for nitrite at each sampling point in the compliance period between January 1, 1993 and December 31, 1995. The provision in § 141.23(e)(2) states that if the initial nitrite sample is less than 50 percent of the MCL of 1 mg/L, systems "shall monitor at the frequency specified by the State." EPA's guidance provides that this frequency should be at least once every 9-year compliance cycle (USEPA, 2020b); however, the monitoring frequency is not explicitly stated in the CFR. EPA is aware that some States have not required systems to conduct routine nitrite monitoring if the initial nitrite sample was less than 50 percent of the nitrite MCL. Very few systems have nitrite violations reported in SDWIS/Fed, but EPA is uncertain how many systems are conducting routine nitrite monitoring because States are not required to report sampling results below the MCL to EPA.

As part of SYR 4, EPA conducted an analysis of State regulations and nitrite compliance monitoring data to identify how frequently water systems are conducting nitrite monitoring and to determine the scope of this potential issue.

EPA first reviewed drinking water regulations from States to assess nitrite monitoring requirements, including sampling frequency. EPA examined the state regulations of the 59 States that submitted data as part of SYR 4 (i.e., excluding Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and U.S. Virgin Islands). The review of state codes indicates:

- 14 States specify routine monitoring frequencies for nitrite;
- 45 States either incorporate 40 CFR 141.23(e) by reference or have adopted similar language to the CFR specifying that the sampling frequency is to be determined by the State if the initial sample is < 50% of the nitrite MCL.

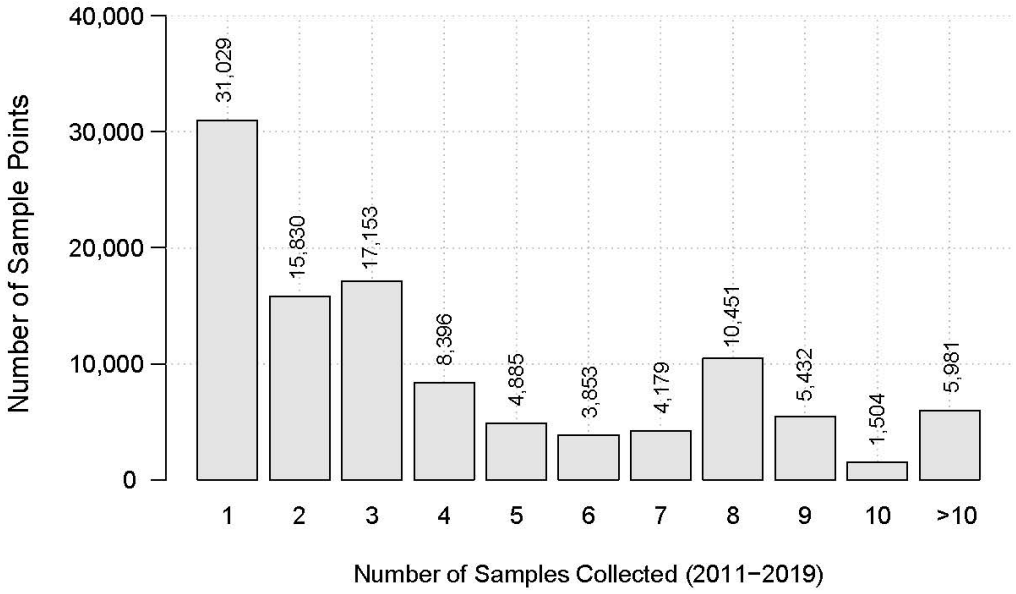
The 14 States that have monitoring frequencies specified in state codes are conducting routine monitoring at various frequencies. For example, Colorado requires systems with nitrite results less than 50 percent of the MCL to monitor for nitrite once every nine years; while California requires monitoring once every three years. The States that incorporate 40 CFR 141.23 by reference may or not be requiring systems to conduct routine monitoring.

To investigate nitrite monitoring practices over the most recent 9-year compliance cycle (2011–2019), EPA merged nitrite compliance monitoring data from the final year of the SYR 3 ICR dataset (2011) with the SYR 4 ICR dataset at the sample-point level and identified 79,362 systems with at least one nitrite monitoring result in the 9-year compliance cycle analyzed. EPA did not consider systems in the SYR 3 ICR dataset that are not included in the SYR 4 ICR dataset. EPA estimated the number of sample points that reflect each frequency type (e.g., annual, triennial, 9-year). EPA assumed annual monitoring if data were available for at least seven of the nine years, triennially if at least one result was present in each of the monitoring periods (e.g., 2011–2013, 2014–2016, 2017–2019), and 9-year if only one sample was collected from the given sample point. The results of this analysis are shown in Exhibits 3-1, 3-2, and 3-3.

Exhibit 3-1. Categorized Nitrite Monitoring Frequency from 2011 to 2019

Sampling frequency	Number of sample points	Percent of sample points
Annual monitoring	24,290	22%
Triennial (3-year) monitoring	10,456	10%
Single sample (9-year cycle)	32,273	30%
Uncategorized frequency (>1 sample)	41,674	38%
Total	**108,693**	**100%**

Exhibit 3-2. Distribution of Nitrite Monitoring Frequency from 2011 to 2019 by Sample Point

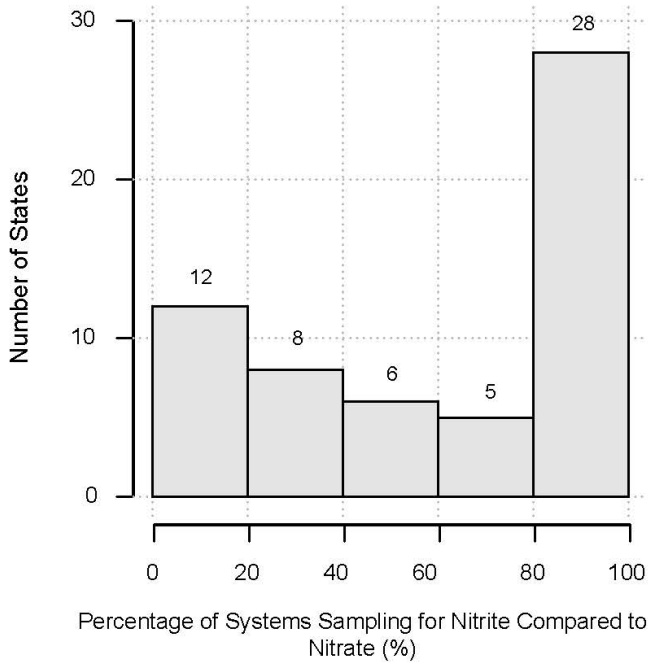


The analysis of nitrite monitoring frequency at a sample-point level (Exhibits 3-1 and 3-2) shows that most points (70 percent) were sampled more than once in the 9-year cycle. However, relatively few sample points were identified as being sampled annually (22 percent) or triennially (10 percent) for nitrite. Many sample points (38 percent) were sampled multiple times during the compliance cycle but did not fit an annual or triennial frequency. For example, a system with 5, 6, or 7 samples at a given sample point over the course of the 9-year period may be sampling annually but missed some years. Exhibit 3-1 displays the categorization results by sample point, and the system-level results are similar. Exhibit 3-2 displays the distribution of nitrite sample

count by sample point, which demonstrates that most of the sample points for nitrite had three or fewer monitoring events during the 2011–2019 compliance period.

Overall, the monitoring data indicate that a majority (58 percent) of the 127,904 systems that reported either nitrate or total nitrate plus nitrite monitoring results also reported nitrite monitoring data at least once during the 2011–2019 compliance period. In 28 States, over 80 percent of the systems that monitored for nitrate also monitored for nitrite (Exhibit 3-3). On the other hand, in 12 States, less than 20 percent of systems that monitored for nitrate submitted nitrite data. The distribution shown in Exhibit 3-3 suggests that approximately half of the States required most systems to do some nitrite monitoring and the other half take various, less-comprehensive approaches to nitrite monitoring.

Exhibit 3-3. State Distribution of Nitrite Monitoring from 2011 to 2019 by Sample Point[1]



[1] EPA substituted total nitrate plus nitrite records for any systems that did not submit nitrate (only) records"

Potential Resolution(s)

The results of this analysis indicate that most systems (57 percent) monitored for nitrite at least once during the last compliance cycle (2011–2019). While repeat frequency is left to the discretion of the State, nitrite and nitrate are not included in 40 CFR 141.23(c)(2) which discusses applicability of waivers for other inorganic contaminants. Additionally, the language "shall monitor at the frequency" in § 141.23(e)(2) implies that some monitoring should be conducted. EPA intends to work with States to encourage more systems to sample for nitrite at

least once during each 9-year compliance cycle. Once an updated health effects assessment (e.g., IRIS) becomes available, EPA can consider a change to 40 CFR 141.2(e) to specify sampling for nitrite at least once every compliance cycle to provide consistency across systems.

2.4 Total Nitrate and Nitrite Analysis for Nitrate MCL Monitoring

Issue Description

In 1991, EPA established the MCL for nitrate (NO_3^-) of 10 mg/L (as nitrogen). An MCL for total nitrate and nitrite of 10 mg/L (as nitrogen) was also included in 40 CFR 141.62, but the sampling and analytical requirements in 40 CFR 141.23 only include nitrate, not total nitrate and nitrite (hereafter referred to as total nitrate/nitrite). Therefore, monitoring for total nitrate/nitrite is at the discretion of the States. Based on review of Safe Drinking Water Information System (SDWIS) compliance data, EPA is aware that at least half of the States allow total nitrate/nitrite analysis to determine compliance with the nitrate MCL.

In 2020, EPA released guidance encouraging best practices for using total nitrate/nitrite analytical methods to monitor for the nitrate MCL (USEPA, 2020a). The guidance clarified nitrate monitoring provisions, provided information on analytical methods when using total nitrate/nitrite analysis to comply with the nitrate MCL, clarified requirements for public notification through the Consumer Confidence Reports (CCR), and encouraged better reporting in SDWIS by using the correct reporting code for total nitrate/nitrite, rather than the code for nitrate.

In the current analysis, EPA evaluated monitoring practices for nitrate using the SYR 4 ICR dataset, which contains compliance monitoring data for both nitrate and total nitrate/nitrite. The SYR 4 observation period (2012–2019) precedes the 2020 guidance, so this analysis serves as a baseline of nitrate monitoring practices. In the future, EPA could compare compliance monitoring data to this baseline to evaluate trends in nitrate monitoring practices and assess the need for further action.

Exhibit 4-1: Number and Percent of Systems and Population Served by Systems with a Nitrate, Nitrite, or Total Nitrate/Nitrite Detection (2012 – 2019)

Contaminant	Total Number of Systems	Systems with a Detection		Total Population Served by Systems	Population Served by Systems with a Detection		Range of Detected Concentrations (5th percentile - 95th percentile)
		Number	Percent		Number	Percent	
Nitrate	105,202	76,971	73.16	270,665,916	252,074,433	93.13	85 – 10,000 µg/L
Nitrite	73,442	7,216	9.83	242,484,551	65,560,187	27.04	1 – 621 µg/L
Total Nitrate/ Nitrite	76,530	50,055	65.41	202,367,908	180,245,092	89.07	48 – 8,720 µg/L

Exhibit 4-1 displays the count of systems that monitored for each contaminant, the number of systems with at least one detection, and the total population served by those systems. From 2012 to 2019, more systems monitored for nitrate (105,202) than for total nitrate/nitrite (76,530). In relative terms compared to the 128,113 PWSs represented in the SYR 4 ICR dataset, 82 percent monitored for nitrate and 60 percent monitored for total nitrate/nitrite. Paired analysis of the monitoring data indicates that 45,589 systems (36 percent of PWSs analyzed) reported both nitrate and total nitrate/nitrite monitoring results for the same date and sample point. Most systems with paired results (63 percent) reported identical detected concentrations for nitrate and total nitrate/nitrite. The identical concentration values for nitrate and total nitrate/nitrite could be a result of concurrent sampling or duplicative reporting in SDWIS as both nitrate (code 1040) and total nitrate/nitrite (code 1038). In any case, only 22,702 systems (18 percent of systems in the SYR 4 ICR dataset) reported results for total nitrate/nitrite but not nitrate.

From 2012 to 2019, 71,609 systems (56 percent of systems in the SYR 4 ICR dataset) reported monitoring results for both nitrate and nitrite. The detection frequency among systems that monitored for nitrite (9.8 percent) was lower than those for nitrate (73 percent) and total nitrate/nitrite (65 percent). Similarly, the 95th percentile of reported nitrite concentrations (621 µg/L) was below than those of nitrate (10,000 µg/L) and total nitrate/nitrite (8,720 µg/L). These summary statistics demonstrate that nitrite concentrations are generally much lower than nitrate concentrations, which supports the use of total nitrate/nitrite analysis for nitrate monitoring. However, due to the acute health risk of nitrate and nitrite, EPA encourages prompt confirmation sampling with nitrate methods whenever a total nitrate/nitrite result exceeds 5 mg/L (USEPA, 2020a).

Potential Resolution(s)

EPA published guidance in 2020 outlining best practices when using total nitrate/nitrite analysis for monitoring compliance with the nitrate MCL (USEPA, 2020a). The present evaluation of nitrate monitoring records from 2012 to 2019 could serve as a baseline to assess nitrate monitoring practices in the future. EPA is not revising the monitoring provisions at this time but will consider monitoring provisions in §141.23 if NPDWRs are revised in the future, to incorporate best practices similar to those described in recent guidance (USEPA, 2020a).

2.5 Free Cyanide Monitoring Considerations

Issue Description

During Six-Year Review 4, EPA identified several implementation issues related to the NPDWR for cyanide. The MCLG and MCL promulgated for cyanide in the Chemical Phase Rule V (57 FR 31786, July 17, 1992) apply only to free cyanide, the form of cyanide that is of health concern due to its bioavailability and toxicity. Free cyanide is a chemistry-related term that refers to the sum of molecular hydrogen cyanide (HCN) and cyanide ion (CN^-) (ASTM, 2005). The Table in 40 CFR 141.51(b) defines the MCLG for cyanide (as free cyanide) as 0.2 mg/L and a Table in 40 CFR 141.62(b) defines the MCL for cyanide (as free cyanide) as 0.2 mg/L. The implementation issues described in this section primarily relate to the potential for inaccurate reporting of free cyanide data in SDWIS.

Fewer systems monitor for free cyanide than for other IOCs for various reasons. For example, free cyanide reacts with free chlorine disinfectant under acidic conditions to form cyanogen chloride (CNCl), which is not regulated but may be toxic itself (USEPA, 1994). EPA recommends chlorinating under alkaline conditions (pH >= 8.5) to avoid the formation of cyanogen chloride when free cyanide is present in the source water (USEPA, 1994). Additionally, some States have granted waivers from cyanide monitoring to chlorinated systems (USEPA, 2016b). 40 CFR 141.23(c)(2) permits States to grant waivers for cyanide monitoring if the State determines that the system is not vulnerable to contamination due to a lack of industrial source. These cyanide monitoring waivers are reflected in the SYR 4 ICR compliance monitoring dataset. Record counts show that most IOCs were monitored at approximately 51,000 systems nationwide during the 2012–2019 observation period; while only 38,760 systems submitted usable data for cyanide during the same period (USEPA, 2024c).

During SYR 4, EPA released an updated guidance document to clarify free and total cyanide analysis for SDWA compliance (USEPA, 2020c), which covers frequently asked questions about laboratory analytical methods and monitoring provisions. EPA (2020c) addressed some concerns raised during previous Six-Year Reviews about using total cyanide analysis to screen for free cyanide. The approach of screening with total cyanide analysis is discussed in the preamble to the Phase V Rule, but the CFR contains no enabling language. EPA (2020c) also clarified that total cyanide analysis is acceptable to demonstrate compliance with free cyanide if the total cyanide result is less than or equal to the MCL of 0.2 mg/L. If the total cyanide concentration exceeds 0.2 mg/L, a free cyanide measurement must be made to determine compliance. Because total cyanide does not have a separate analyte code in SDWIS, systems report both free and total cyanide under the analyte code for free cyanide (1024). Therefore, EPA is not able to distinguish between free and total cyanide in the SDWA compliance monitoring records.

Delaney and Blodget (2017) reported that free cyanide can form in water samples that contain chloramines when preserved by certain methods specified in 40 CFR 141.23(k)(2). In the laboratory, drinking water samples were simulated in deionized water by adding free chlorine (3.2 mg Cl_2/L), ammonia (0.6 mg N/L), bicarbonate buffer (1 mM), and enough sodium hydroxide to adjust to pH 12. The role of dechlorinating agents, which serve as sample preservatives, was examined by comparing ascorbic acid and sodium thiosulfate. Free cyanide formation was observed at concentrations less than 15 µg/L (0.015 mg/L), except in one experiment with ascorbic acid, where the detected concentration reached approximately 55 µg/L (Delaney and Blodget, 2017). EPA (2020c) described the issue of false-positive results associated with chloramine water samples preserved with ascorbic acid then suggested sodium borohydride as an alternative sample treatment, if the laboratory is certified to use methods that accommodate sodium borohydride. The SYR 4 working group received report that false-positive results for free cyanide were observed at a system in EPA Region 8 that had monochloramine formed by free chlorine disinfectant and naturally occurring ammonia. In that case, the false-positive results were also attributed to preserving samples with ascorbic acid and corrected by switching to sodium borohydride.

Potential Resolution(s)

A potential improvement to help characterize cyanide monitoring practices is to create a SDWIS analyte code for total cyanide analysis to distinguish it from free cyanide. This information

would help States assess if cyanide monitoring practices are consistent with EPA's guidance on using total cyanide analysis to monitor for free cyanide (USEPA, 2020c). EPA may additionally assess the impact of the 2020 guidance on cyanide monitoring practices during Six-Year Review 5.

2.6 Definition of Reliably and Consistently

Issue Description

The monitoring provisions for chemical contaminants in Title 40 Part 141 of the CFR provide the State with the discretion to reduce monitoring frequency when results are "reliably and consistently below the maximum contaminant level." The term "reliably and consistently below the maximum contaminant level" is used in various locations in Part 141 but is not explicitly defined. For example, 40 CFR 141.23(c)(8) states that:

> *The State may decrease the quarterly monitoring requirement to the frequencies specified in paragraphs (c)(1) and (c)(2) of this section provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case can a State make this determination unless a groundwater system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.*

The SDWA includes a definition for "reliably and consistently below the maximum contaminant level" pertaining to the section entitled Permanent Monitoring Relief Authority (SDWA section 1418(b)(2)(B)). The phrase as defined in the SDWA is similar to the language in the CFR but includes specific criteria that a State must consider when determining if the if results are reliably and consistently below the MCL:

> *For purposes of subparagraph (A), the phrase ''reliably and consistently below the maximum contaminant level'' means that, although contaminants have been detected in a water supply, the State has sufficient knowledge of the contamination source and extent of contamination to predict that the maximum contaminant level will not be exceeded. In determining that a contaminant is reliably and consistently below the maximum contaminant level, States shall consider the quality and completeness of data, the length of time covered and the volatility or stability of monitoring results during that time, and the proximity of such results to the maximum contaminant level. Wide variations in the analytical results, or analytical results close to the maximum contaminant level, shall not be considered reliably and consistently below the maximum contaminant level.*

Currently, 40 CFR Part 141 does not specify what factors a State must consider when determining if a system can reduce monitoring frequency, which could lead to inconsistent implementation across water systems.

Potential Resolution(s)

One resolution could be to add the SDWA definition into 40 CFR 141.2 *Definitions* such that it would apply to monitoring provisions in 40 CFR Part 141. Alternatively, EPA could include a special primacy requirement under 40 CFR 142.16 to require States as a condition of primacy, to consider a set of factors in making a determination to reduce monitoring frequency. While this issue is within the scope of Six-Year Review, EPA is not currently aware of States inappropriately reducing monitoring frequency. While a change could provide consistency and ensure that reductions in monitoring are aligned with the intent of the regulation, this issue does not merit an immediate rule change. This issue can be considered if the Phase II/V rules are revised in the future for more substantive reasons.

2.7 Running Annual Average for Inorganic Contaminant Compliance Determination

Issue Description

The most-recently promulgated IOC rule revision, the "Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring Final Rule", describes revisions to "[clarify] the compliance determination section for the IOCs (including arsenic), the SOCs, and the VOCs in §§ 141.23(i), 141.24(f)(15), and 141.24(h)(11), respectively" (66 FR 6990, January 22, 2001). The notice describes a requirement for systems that monitoring more than once per year, compliance with the MCL is based on the annual running average of sample results at each sampling point. If a system is monitoring annually or less frequently, that "exceeds the MCL for any inorganic contaminant in § 141.23(c), or whose sample results exceeds the trigger level for any organic contaminant listed in § 141.24(f) or § 141.24(h), must revert to quarterly sampling for that contaminant the next quarter. The system is not considered in violation of the MCL until the system has completed one year of quarterly sampling, or if any individual sample result would result in the annual average exceeding the MCL. The description of compliance procedure is clearly reflected in 40 CFR 141.24(f)(15) and 141.24(h)(11) for SOCs and VOCs.

The compliance procedure for IOCs (except for nitrate and nitrite) under 40 CFR 141.23(i) states that systems must use the running annual average of samples collected at a sampling point for compliance determination if the system is conducting monitoring more frequently than annually. However, for systems monitoring annually or less frequently, 40 CFR 141.23(i)(2) states:

> "For systems which are monitoring annually, or less frequently, the system is out of compliance with the maximum contaminant levels for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium or thallium if the level of a contaminant is greater than the MCL. If confirmation samples are required by the State, the determination of compliance will be based on the annual average of the initial MCL exceedance and any State-required confirmation samples. If a system fails to collect the required number of samples,

> compliance (average concentration) will be based on the total number of samples collected." (underline added for emphasis).

Consistency in compliance determinations across contaminants could be beneficial to rule implementation and increase clarity. To be consistent with the preamble, the current regulatory text in 40 CFR 141.23(i) would need to be revised to reflect the language in 40 CFR 141.24(f)(15) and (h)(11) to indicate any system monitoring annually or less frequency must start quarterly monitoring at the sampling point if the result is greater than the MCL, and then determine compliance based on the subsequent "running annual average," rather than a single sampling result. EPA notes that this change would not be appropriate for acute contaminants, such as nitrate, in which short-term exposures can cause adverse health effects.

Potential Resolution(s)

EPA could modify the CFR to allow systems that monitor on an annual or less-frequent basis to increase sampling frequency to quarterly and determine compliance by calculating a running annual average, rather than determining compliance based on any single sample. This modification should apply to all IOCs except for nitrate and nitrite, which are acute contaminants, and should include a provision to require quarterly monitoring following an exceedance of the MCL for IOCs as appears to have been the intent in 2001 (66 FR 6990, January 22, 2001). While a revision to this provision of the NPDWR could improve clarity and provide consistency, this issue does not merit an immediate rule change. This issue can be considered if the Phase II/V rules are revised in the future for more substantive reasons.

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