Analysis of Regulated Contaminant Occurrence Data from Public Water Systems in Support of the Fourth Six-Year Review of National Primary Drinking Water Regulations: Chemical Phase and Radionuclides Rules

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This report is in support of the revise/take no action decisions for EPA's Fourth Six-Year Review of Existing Drinking Water Standards Federal Register Notice. This report is intended to provide technical background for the fourth Six-Year Review.

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Executive Summary

The 1996 Amendments to the Safe Drinking Water Act (SDWA) require that the Environmental Protection Agency (EPA) "shall, not less often than every 6 years, review and revise, as appropriate, each national primary drinking water regulation." The National Primary Drinking Water Regulations (NPDWRs) are commonly referred to as the national drinking water regulations or drinking water standards. The purpose of the review, called the Six-Year Review, is to evaluate current information for regulated contaminants to determine if there is new information on health effects, treatment technologies, analytical methods, occurrence and exposure, implementation, and/or other factors that provides a health or technical basis to support a regulatory revision that will improve or strengthen public health protection.

This report presents the national contaminant occurrence assessments for chemical contaminants and radionuclides conducted in support of EPA's fourth Six-Year Review (SYR 4) of NPDWRs. Occurrence assessments for the microbial contaminant regulations were conducted as a separate effort and are presented in USEPA (2024a). This report includes detailed descriptions of the national contaminant occurrence dataset, the data management procedures conducted to develop the national dataset, and the statistical analytical methods employed to generate national estimates of regulated chemical and radiological contaminant occurrence in public drinking water systems. Occurrence assessment of 68 chemical contaminants and radionuclides are included in this report. Review of the NPDWRs for acrylamide, epiclorohydrin, and fluoride are included in separate reports (USEPA, 2024b; USEPA, 2024c). The disinfection byproducts (DBPs) and select microbial contaminants, lead, and copper are being reviewed or revised under other regulatory actions.

Because there is no national database that receives and stores all relevant data on the occurrence of regulated contaminants in public drinking water systems, EPA conducted a voluntary call-in from states, territories, and tribes to obtain the data. EPA worked with the states and primacy agencies to receive their complete records of compliance monitoring data (public drinking water system regulated contaminant occurrence data) for 2012 through 2019. The compliance monitoring data were obtained through the Information Collection Request (ICR) process.

EPA conducted data management and quality assurance (QA) evaluations on the data received for contaminants evaluated for the SYR 4 to establish a high-quality, national contaminant occurrence dataset consisting of data from 59 jurisdictions (46 states plus territories, Washington, D.C., and tribes). The initial SYR 4 ICR dataset was comprised of more than 83 million records from approximately 142,000 public water systems serving approximately 303 million people nationally.[1] The final SYR 4 ICR dataset includes 71 million records from approximately 140,000 public water systems (PWSs) serving approximately 301 million people nationally.[2] The compliance monitoring data for the chemical contaminants and radionuclides

[1] This count of 142,000 PWSs represents all water systems with any SYR 4 data, including data for information not specifically requested.
[2] This count of 140,000 PWSs serving 301 million people represents water systems that provided data for requested contaminants that passed QA/QC review.

evaluated in this report collected from these 59 jurisdictions comprise almost 22 million analytical records from approximately 121,000 PWSs, which serve approximately 281 million people nationally. This dataset, the Information Collection Request dataset for the fourth Six-Year Review (SYR 4 ICR dataset), is the largest and most comprehensive contaminant occurrence dataset ever compiled and analyzed by EPA's Drinking Water Program.

To estimate national contaminant occurrence using the SYR 4 ICR dataset, EPA used a two-stage analytical approach. In the first stage of analysis (Stage 1 analysis), the occurrence data were reviewed, quality-checked, characterized and then analyzed to generate simple, non-parametric estimates of national contaminant occurrence in PWSs. Simple counts were calculated for the number and percentage of systems and of the population served by systems that report at least one compliance monitoring sample result greater than a specified contaminant concentration threshold, such as the contaminant's maximum contaminant level (MCL; i.e., the contaminant's drinking water standard). This Stage 1 analysis, based on maximum sample concentration values, is inherently conservative to ensure that contaminant occurrence is not underestimated for public health protection. Additional parametric statistical estimations (Stage 2 analysis) were conducted on a set of contaminants selected by EPA on the basis of the Six-Year Review 4 Protocol (USEPA, 2024d). The Stage 2 analysis estimates long-term mean concentrations of contaminants in all systems nationwide, generating occurrence estimates that are less conservative than those from the Stage 1 analysis. The Stage 1 occurrence analysis may be more reflective of potential acute exposure, while the Stage 2 analysis occurrence assessments may be more reflective of potential chronic exposure.

EPA used the Stage 1 analyses of approximate peak concentration measures to assess the national occurrence of 68 regulated contaminants (64 chemicals and 4 radionuclides). As mentioned above, two regulated chemical contaminants (lead, copper) were not reviewed due to recent and ongoing regulatory action. Three additional regulated chemical contaminants (acrylamide, epichlorohydrin, fluoride) were reviewed in SYR 4, but EPA presents those results in separate reports (USEPA, 2024b; USEPA, 2024c). EPA also conducted additional Stage 2 analyses using mean concentration measures for 29 of the 68 regulated chemical contaminants included in this report. Several different variations of the Stage 1 and Stage 2 analyses were conducted to broadly characterize national occurrence and are described and presented in this report and its appendices.

Two synthetic organic contaminants (SOCs) were assessed using a more detailed Stage 1 analysis while 5 inorganic contaminants (IOCs), 10 SOCs and 14 volatile organic contaminants (VOCs) were assessed using the Stage 2 analytical approach. The Stage 2 occurrence analyses conducted in this report, based on long-term, multi-year average contaminant occurrence, are not the same as the occurrence analyses formally conducted to assess compliance with contaminant drinking water standards, which for most contaminants are based on annual average contaminant occurrence (see Section 7 for details).

Background information regarding the national contaminant occurrence data and data management is presented in Sections 1 through 5 of this report. The summary of the Stage 1 analytical findings is presented in Section 6, with more detailed Stage 1 analyses for two

contaminants in Appendix A. The summary of the Stage 2 analytical findings for 31 select contaminants is presented in Section 7, with complete detailed Stage 2 occurrence findings included in Appendix B. Appendix B also includes the expanded Stage 1 occurrence findings for two contaminants.

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Acronyms

CAS	Chemical Abstracts Service
CWS	Community Water System
DBCP	1,2-Dibromo-3-chloropropane
DBP	Disinfection Byproduct
DBPR	Disinfection Byproduct Rule
DEHA	Di(2-ethylhexyl)adipate
DEHP	Di(2-ethylhexyl)phthalate
EDB	Ethylene dibromide
EPA	Environmental Protection Agency (United States)
EQL	Estimated Quantitation Level
FBRR	Filter Backwash Recycling Rule
GW	Ground Water
GWP	Purchased Ground Water
GWR	Ground Water Rule
GWUDI	Ground Water Under Direct Influence (of Surface Water)
HAA	Haloacetic Acid
HPC	Heterotrophic Plate Count
ICR	Information Collection Request
IOC	Inorganic Contaminant
LCRI	Lead and Copper Rule Improvements
LCRR	Lead and Copper Rule Revisions
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	Method Detection Limit
MFL	Million Fibers per Liter
mg/L	Milligrams per Liter
mrem/yr	Millirem per year
MRL	Minimum Reporting Level
NPDWR	National Primary Drinking Water Regulation
NTNCWS	Non-Transient Non-Community Water System
OGWDW	Office of Ground Water and Drinking Water
PCBs	Polychlorinated Biphenyls
pCi/L	Picocuries per Liter
PQL	Practical Quantitation Limit
PWS	Public Water System
PWSID	Public Water System Identification Number
QA	Quality Assurance
QC	Quality Control
SDWA	Safe Drinking Water Act
SDWIS/Fed	Safe Drinking Water Information System / Federal Version
SDWIS/State	Safe Drinking Water Information System / State Version
SOC	Synthetic Organic Contaminant
SP	Sample Point

SW	Surface Water
SWP	Purchased Surface Water
SWTR	Surface Water Treatment Rule
SYR 4	Fourth Six-Year Review
TCR	Total Coliform Rule
TNCWS	Transient Non-Community Water System
TOC	Total Organic Carbon
TTHM	Total Trihalomethanes
USEPA	United States Environmental Protection Agency
µg/L	Micrograms per Liter
VOC	Volatile Organic Contaminant

1 Introduction

Pursuant to the 1996 Safe Drinking Water Act (SDWA) Amendments, the U.S. Environmental Protection Agency (EPA) conducts, at least every six years, a review of the National Primary Drinking Water Regulations (NPDWRs). For this Six-Year Review of the nation's public drinking water standards, EPA assesses the occurrence of regulated contaminants in public water systems (PWSs or systems) in conjunction with other assessments of health effects, analytical feasibility and treatment feasibility. Assessments are conducted to determine if revisions to the existing NPDWRs (public drinking water standards) are appropriate. EPA completed and published the results of its first, second, and third Six-Year Reviews of NPDWRs (USEPA, 2003a, 68 FR 42908; USEPA, 2010a, 75 FR 15499; USEPA, 2017, 82 FR 3518) using a systematic approach, or protocol, for the reviews. EPA has applied the same protocol to the current, fourth Six-Year Review of NPDWRs (Six-Year Review 4 or SYR 4). This report presents the assessments of national contaminant occurrence in PWSs in the United States in support of EPA's fourth Six-Year Review of NPDWRs.

Because there is no national database of regulated drinking water contaminant occurrence data for public drinking water systems, EPA conducted a voluntary data call-in from states, primacy agencies, territories, and tribes (referred to as "States" throughout the remainder of the report) to obtain the data using the Information Collection Request (ICR) process.[3] EPA worked with States to obtain their complete compliance monitoring data for 2012 through 2019; state data management staff were consulted to resolve any questions about the data submitted. EPA conducted data management and quality assurance (QA) evaluations to establish a national contaminant occurrence database consisting of data from 59 jurisdictions (46 states plus Washington, D.C., American Samoa, Northern Mariana Islands, the Navajo Nation, and tribes from EPA Regions 1, 2, and 4 through 10). This dataset, referred to as the National Compliance Monitoring ICR dataset for the fourth Six-Year Review (SYR 4 ICR dataset), is the largest and most comprehensive compliance monitoring dataset ever compiled and analyzed by EPA's Drinking Water Program. Using this dataset, EPA employed a two-stage analytical approach to estimate a variety of occurrence measures to characterize the national occurrence of regulated contaminants in systems to support the fourth Six-Year Review process.

As part of this ICR effort, EPA requested voluntary submission of States' SDWA compliance monitoring data for chemical contaminants regulated under Phase I, II, IIb, and V Rules; the Arsenic Rule; the Lead and Copper Rule; and the Radionuclides Rule. This report presents occurrence assessments for those contaminants with the exception of contaminants that were recently or are currently evaluated under other regulatory actions or included in separate regulatory reviews. In accordance with the SYR 4 protocol, EPA identified two chemical contaminants (lead and copper) with NPDWRs that were being considered as part of a recently completed action, and which are also currently part of an ongoing or pending regulatory action. EPA published the Lead and Copper Rule Revisions on January 15, 2021 (USEPA, 2021a) and

[3] For more information on the Fourth Six-Year Review ICR process, including the data request letter, refer to the *Data Management and Quality Assurance/Quality Control Process for the Fourth Six-Year Review Information Collection Request Dataset* (USEPA, 2024e).

published the proposed Lead and Copper Rule Improvements on December 6, 2023 (USEPA, 2023).

Acrylamide and epichlorohydrin are not included in this report because there are currently no acceptable laboratory analytical methods for detecting these contaminants in drinking water. For the treatment technique review of these two contaminants, see *Support Document for Fourth Six-Year Review of Drinking Water Regulations for Acrylamide and Epichlorohydrin* (USEPA, 2024b).

Fluoride is not included in this report because additional data processing and analyses steps were taken to account for PWSs that voluntarily add fluoride to drinking water. See *Review of Fluoride Occurrence for the Fourth Six-Year Review* (USEPA, 2024c) for a detailed description of the analysis and results.

Data on the NPDWRs for the microbial contaminant regulations and disinfectants/disinfection byproducts rules (D/DBPRs) were also collected included under SYR 4. For more detailed information on the occurrence analysis for select microbial contaminants', refer to USEPA (2024a) *Six-Year Review 4 Technical Support Document for Microbial Contaminant Regulations*. The D/DBPRs contaminants' occurrence analysis is not included as part of SYR 4, however the occurrence information collected under SYR 4 will be used to inform potential revisions to D/DBPRs that were identified as candidates for revision under Six Year Review 3 (USEPA, 2017).

This report describes the extensive data management and data quality checks conducted as part of the development of the SYR 4 ICR dataset and explains the analytical approach used to estimate the various measures of national occurrence for the 64 chemical contaminants and 4 radionuclides included in this report. This report also presents and describes the resulting national contaminant occurrence estimates. Some of the contaminant occurrence measures are presented in this report as "preliminary exposure estimates" meaning they are not formal exposure estimates but rather estimates of the population served by systems found to have some degree of contaminant occurrence in their drinking water samples.

1.1 Purpose and Scope

EPA's Office of Ground Water and Drinking Water (OGWDW) is responsible for implementing the provisions of SDWA. Under SDWA, OGWDW develops both regulations to address the public health risks from contaminated drinking water and related programs to protect ground water (GW) and surface water (SW) supplies. The 1996 Amendments to SDWA require that EPA shall, at least once every six years, review and revise, as appropriate, each NPDWR promulgated by the agency. SDWA specifies that revision to a NPDWR shall maintain, or provide for greater, protection of public health. Any revision to the regulations will be partially dependent on contaminant occurrence findings, on the reevaluation of the public's exposure to the contaminants and the potential adverse health effects from that exposure. The purpose of this report is to describe the contaminant occurrence data, the management of that data, and the statistical methods used to develop the national contaminant occurrence estimations in support of EPA's SYR 4. This report presents occurrence assessments for 68 contaminants regulated under the Phase I, II, IIb, and V Rules; the Arsenic Rule; and the Radionuclides Rule. As noted above,

the SYR 4 results for acrylamide, epichlorohydrin, fluoride, and select microbial contaminants can be found in separate reports. Compliance monitoring data for some of the regulated contaminants collected under SYR 4 (e.g., lead, copper, select microbials, and DBPs) are being assessed separately under other regulatory actions.

1.2 Data Sources

PWSs must meet health-based federal standards for contaminants, including performing regular monitoring and reporting. Water systems are required to sample and test their water and report the results to the state or agency with primacy for implementing the SDWA. These systems, which may be publicly- or privately-owned, serve at least 15 service connections or 25 persons for at least 60 days per year.

EPA established nine-year fixed compliance cycles to standardize monitoring requirements for the various contaminant rules. Each nine-year compliance cycle is divided into three three-year compliance periods. The first compliance period ran from January 1, 1993 to December 31, 1995, the second from 1996 to 1998, and the third from 1999 to 2001. Together, these nine years comprised one compliance cycle (Compliance Cycle 1). The second compliance cycle began January 1, 2002 and ended December 31, 2010; the third compliance cycle began January 1, 2011 and ended December 31, 2019. The SYR 4 period of review (2012 through 2019) falls within the third compliance cycle.

All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for the Inorganic Contaminants (IOCs), Synthetic Organic Contaminants (SOCs), and Volatile Organic Contaminants (VOCs).[4] States may grant waivers to PWSs to reduce sampling (Exhibit 1-1). Reduced monitoring requirements for contaminants are based on both a vulnerability assessment and previous analytical results. It is possible that systems that had been granted waivers may not have sampled at all during the SYR 4 period of review.

Exhibit 1-1: States Compliance Monitoring Waivers

Contaminant Group / System Source Water Type	Waiver Monitoring Frequency	Waiver Renewal Frequency	Notes[1]
Inorganic Contaminants (IOC)[2] – Ground Water/Surface Water	Once every nine years	Every nine years	Dependent on previous sample results.
Volatile Organic Contaminants (VOC)[3] – Ground Water	Once every six years	Every six years	Vulnerability Assessment must be renewed every three years.
Volatile Organic Contaminants (VOC)[3] – Surface Water	None	Every three years	Vulnerability Assessment must be renewed every three years.

[4] Transient non-community water systems are also required to sample for nitrate and nitrite.

Contaminant Group / System Source Water Type	Waiver Monitoring Frequency	Waiver Renewal Frequency	Notes[1]
Synthetic Organic Contaminants (SOC) – Ground Water/Surface Water	None	Every three years	Vulnerability Assessment must be renewed every three years.

Source: EPA Chemical Contaminant Rules Compliance for Primacy Agencies
[1] There are two bases for vulnerability assessments: (1) The PWS can prove that the contaminant has not been used in the area, or (2) the PWS can prove it is not susceptible to contamination from that contaminant.
[2] There are no waivers allowed for nitrate or nitrite monitoring. Asbestos waiver conditions are different than the rest of the IOCs.
[3] Vinyl chloride is an exception to this waiver policy.

The Federal Safe Drinking Water Information System database (SDWIS/Fed) contains information about PWSs and their violations of EPA's drinking water regulations. However, SDWIS/Fed does not receive or store complete compliance monitoring data (called parametric data), which includes non-detections as well as detections. To estimate national occurrence of regulated contaminants in PWSs, it is necessary to have results from all contaminant occurrence samples, including samples which showed analytical detections *and* non-detections. These data are collected by States but are not required to be submitted to SDWIS/Fed. Therefore, to obtain the necessary compliance monitoring data to support national occurrence assessments for SYR 4, EPA conducted the voluntary data call-in described in this report from States and through the ICR process. For more information on the process undertaken to request the voluntary submission of compliance monitoring data by the States, see the request for approval of the SYR 4 ICR (83 FR 50361, USEPA, 2018).

Through the ICR process, EPA requested that States voluntarily submit compliance monitoring data with records of all sample detections and non-detections collected between January 2012 and December 2019. Forty-six states and 13 other jurisdictions provided compliance monitoring data that included contaminant monitoring records. Through extensive data management efforts and QA evaluations, as well as through communications and consultations with state data management staff, EPA established a contaminant occurrence dataset (the SYR 4 ICR dataset) that consists of data from 59 jurisdictions (46 states plus data from Washington, D.C., territories, and tribes). See Section 2 for additional details on States included in the SYR 4 ICR dataset.

1.3 Data Analysis

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. The first stage of analysis provides a straightforward evaluation of occurrence for all contaminants. The "Stage 1 analysis" assesses the sources, quality and characteristics of the occurrence data and then uses the data to generate summary statistics of each contaminant's occurrence, as well as national estimates of occurrence that are simple, non-parametric and conservative.[5] For each contaminant, analyses are conducted focusing on samples, water systems, population served, and sample point locations. A typical Stage 1

[5] The Stage 1 analyses are conservative in the sense that they are protective of human health (i.e., they are based on a single, maximum sample detection value rather than an average value for each system, the Stage 1 analyses are more likely to overestimate occurrence and potential risks to human health than underestimate them).

analysis is a simple count of the number or percentage of systems reporting at least one sample detection of a specific contaminant, or at least one sample detection with a concentration greater than the MCL. The details of the Stage 1 analysis methods are described in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants for which additional parametric statistical estimations were warranted (referred to as the "Stage 2 analysis"). The Stage 2 analysis assesses national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each water system. This Stage 2 long-term mean analysis is less conservative than the Stage 1 analysis, which reflects an approximation of peak occurrence. This fundamental difference between the two analytical approaches has a direct implication: regardless of the contaminant concentration value assessed, the Stage 1 analysis findings will always exceed, or at most be approximately equal to, the Stage 2 analysis findings. For example, the Stage 1 analysis of the number of systems with at least one detection of toxaphene greater than the MCL concentration (two systems) will always be greater than, or at most equal to, the Stage 2 analysis showing the number of systems with a mean concentration of toxaphene greater than the MCL concentration (zero systems).

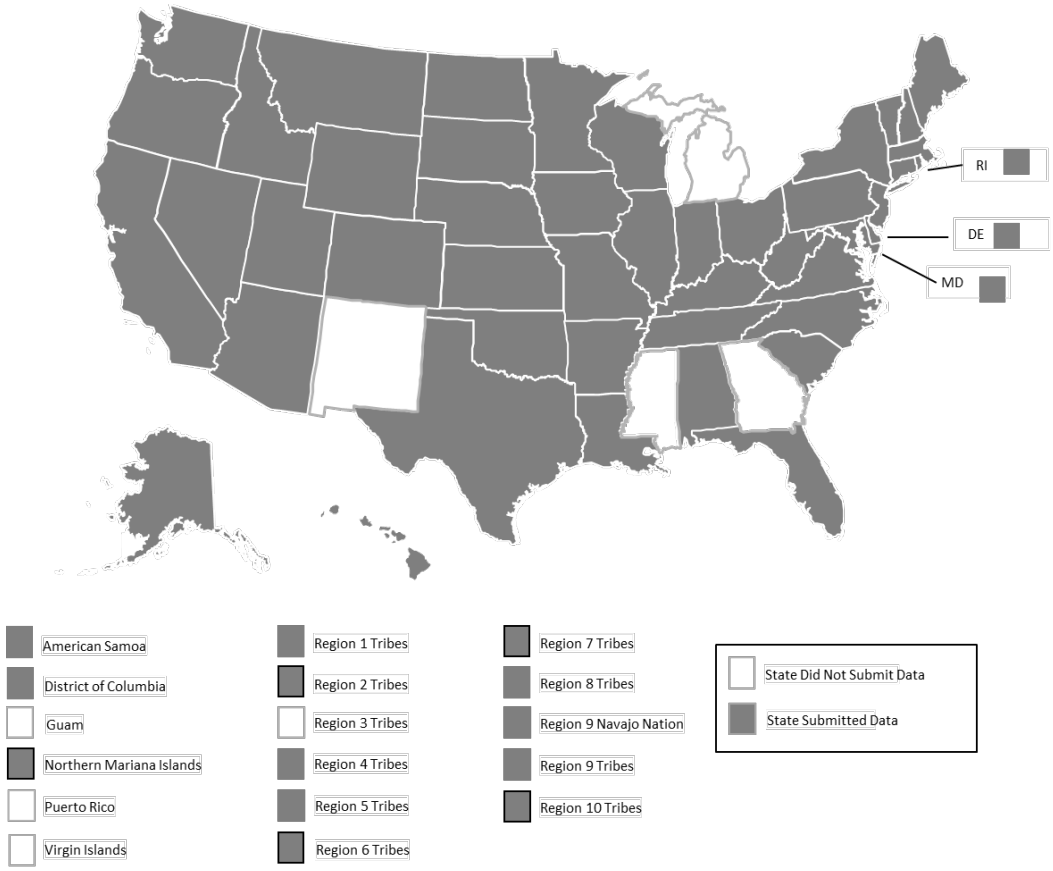
Because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by water systems with detections (or "preliminary exposure" assessments) that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses, which reflect a one-time peak. Section 7 describes the details of the Stage 2 analysis.

This two-stage analytical approach was previously developed for other EPA national occurrence studies, including those conducted for the first Six-Year Review of NPDWRs (USEPA, 2003b) and the first and second Regulatory Determinations for Contaminants from the Drinking Water Contaminant Candidate List (USEPA, 2002, 2008a, and 2008b). The approach was subsequently used for the second and third Six-Year Review of NPDWRs and the third and fourth Regulatory Determinations for Contaminants from the Drinking Water Contaminant Candidate List. The overall data management and general two-stage occurrence analytical approach used for these OGWDW projects was peer-reviewed for use under the first Six-Year Review, which assessed regulated contaminant occurrence data collected from 1993 to 1997. The Stage 2 analysis used for this fourth Six-Year Review is consistent with the simplified version of the Stage 2 analysis that was used for the second and third Six-Year Review (USEPA, 2010b; USEPA, 2016). This was possible because, similar to the second and third Six-Year Review, a large number of States provided contaminant occurrence data for the fourth Six-Year Review. See Section 7 for a complete description of the Stage 2 analysis; a selection of contaminants is presented in Appendix B.

2 The National Compliance Monitoring ICR Dataset for the Fourth Six-Year Review

Through the ICR process, EPA conducted a voluntary data call-in for States' compliance monitoring records and received data from a total of 59 States: 46 states, American Samoa, Washington, D.C., Northern Mariana Islands, the Navajo Nation, and tribes from EPA Regions 1, 2, and 4–10). Through extensive data management efforts, quality assurance evaluations and communications with state data management staff, EPA established the SYR 4 ICR dataset (see Exhibit 2-1).

Exhibit 2-1: States with Compliance Monitoring Data Included in the SYR 4 ICR Dataset



EPA received more than 83 million records from approximately 142,000 systems serving 303 million people represented by these 59 States. The final SYR 4 dataset includes 71 million records from 140,000 systems serving 301 million people. The compliance monitoring data for the chemical and radiological contaminants evaluated in this report comprise around 22 million analytical records from approximately 121,000 water systems that serve 281 million people nationally.

Data quality, completeness and representativeness are key considerations for the SYR 4 ICR dataset. Given the size, scope and variety of formats of the data received from States, EPA conducted extensive data management and quality assurance/quality control (QA/QC) assessments. A review of completeness and representativeness, details of data management and details of QA are presented in the following three sections. Additional details of the data management measures can be found in the report titled *Data Management and Quality Assurance/Quality Control Process for the Fourth Six- Year Review Information Collection Request Dataset* (USEPA, 2024e).

2.1 Completeness and Representativeness of the Six-Year Review ICR Dataset

The final SYR 4 ICR dataset consists of compliance monitoring data and treatment technique information received from 59 of 66 States. It represents a large sample of PWSs across the United States and the largest compliance monitoring dataset ever compiled and analyzed by EPA's drinking water program. The 59 States that provided data for the SYR 4 ICR dataset comprise 88 percent of all PWSs and 92 percent of the total population served by PWSs nationally. The SYR 4 ICR dataset is geographically representative of PWSs nationwide (Exhibit 2-1).

The absence of data from seven States in the final SYR 4 ICR dataset could potentially bias the dataset's representation of the national occurrence of contaminants. However, the seven States, representing 12 percent of PWSs and 8 percent of the population served by PWSs nationally, are expected to have a relatively small influence when compared to the PWSs and populations represented by the States that did submit data. The seven States that did not provide compliance monitoring data or treatment technique information are Georgia, Michigan, Mississippi, New Mexico, Puerto Rico, Guam, and the U.S. Virgin Islands. Although Georgia and Mississippi, two sizeable States in the southeastern United States, did not provide data, all other southeastern States did provide data, allowing for substantial regional coverage, especially from a population-based perspective. All other regions of the conterminous United States had at most one State not included in the dataset. The SYR 4 ICR dataset, with 59 of the 66 States represented, is therefore considered reasonably complete and nationally representative as the basis of the contaminant occurrence estimates for this Six-Year Review. However, to further address the issue of potential bias, EPA assessed the contaminants regulated by the Chemical Phase and Radionuclides Rules by comparing occurrence in the States that contributed data to the SYR ICR dataset to those that did not.

Because a complete compliance monitoring dataset for every PWS was not available to EPA, it was not possible to monitor national occurrence with complete certainty or to confirm that the SYR 4 ICR dataset is representative of the States that did not voluntarily contribute data. Therefore, an indicator of occurrence was developed using data available from the SDWIS/Fed database, which does not have complete compliance monitoring data but does include violation data from all 66 States. EPA compiled SDWIS/Fed records of MCL violations for the Chemical Phase and Radionuclides Rules only, used here as an indicator of contaminant occurrence, by

State for the same years as the SYR 4 ICR dataset (2012–2019).[6] The MCL violation records were used to determine if the violation rate in the 7 missing States was significantly different than the violation rate in the 59 States in the dataset, or if the violation rate in the 59 States could be considered representative (i.e., drawn from the same statistical population). EPA conducted this assessment for select chemical and radiological analytes evaluated under SYR 4.

The MCL violation rate for each contaminant (i.e., the percentage of systems with at least one MCL violation) was calculated for the 59 States in the dataset and separately for the 7 States not in the SYR 4 ICR dataset. For each contaminant, a Mann-Whitney U test, also known as a Wilcoxon rank-sum test, was used to determine whether the population of MCL violation rates by State significantly differs between the two groups (59 States versus 7 States). The non-parametric Mann-Whitney test was chosen, as opposed to a parametric t-test, because the small sample sizes (Exhibit 2-2) do not support an assumption that the data fit a normal distribution. The resulting p-values from the Mann-Whitney U test were first compared to an alpha (α) level of 0.05, a common threshold of significance, then to 0.1, a less-stringent threshold considered to account for small sample sizes. If the p-value resulting from the Mann-Whitney U test was less than 0.1, EPA rejected the null hypothesis that the two populations of MCL violation rates were equal and accepted the alternative hypothesis that they were unequal. Exhibit 2-2 summarizes the results of the Mann-Whitney U test analysis.

Of the 69 chemical and radiological contaminants evaluated, only 10 contaminants had at least one MCL violation listed in the SDWIS/Fed database for the 2012–2019 period for both groups (i.e., 59 States that submitted data to the SYR 4 ICR dataset versus the 7 States that did not).[7] As States are only required to submit MCL violations to SDWIS and are not otherwise required to submit compliance monitoring data, only States with at least one violation in SDWIS/Fed for the specified contaminant were used in this analysis. Therefore, Mann-Whitney U tests were conducted on only these 10 contaminants (Exhibit 2-2). The resulting p-values were greater than 0.1 for 9 of the 10 contaminants: arsenic, combined radium, uranium, fluoride, gross-alpha (excluding radon and uranium), nitrate, nitrite, selenium, and thallium. Thus, EPA failed to reject the null hypothesis that the two populations of MCL violation rates are equal. For one contaminant (chromium), only one State in each group had an MCL violation, and so the Mann-Whitney U test could not be applied effectively.

[6] While the SDWIS/Fed database does not store complete compliance monitoring parametric records, the database does maintain the most current and complete national and state records of contaminant MCL violations. Annual MCL data were extracted from SDWIS/Fed by EPA in November 2021.

[7] In addition to the 68 chemical contaminants and radionuclides evaluated in this report, EPA included the reported MCL violation rates for fluoride to assess of the completeness of the SYR 4 ICR dataset. For the occurrence analysis of fluoride compliance data, see USEPA (2024c).

Exhibit 2-2: Mann-Whitney U Test for MCL Violation Rates in States Included in SYR 4 versus States Not Included

Contaminant Name	Number of States with MCL Violations		Median of State-Level Violation Rates (percent)		p-Value
	States in SYR 4 ICR	States NOT in SYR 4 ICR	States in SYR 4 ICR	States NOT in SYR 4 ICR	
Uranium	26	2	6.68	32.91	0.259
Thallium	7	2	0.30	0.11	0.333
Combined Radium (-226 and -228)	35	4	5.98	4.01	0.460
Selenium	7	1	2.21	6.79	0.500
Arsenic	43	4	8.00	4.61	0.519
Nitrite	10	1	0.22	0.08	0.545
Fluoride	23	3	0.82	0.23	0.648
Nitrate	35	2	4.74	12.11	0.721
Alpha Particles	29	3	1.79	4.53	0.903
Chromium	1	1	0.68	0.08	n/a[1]

[1] The Mann-Whitney test is not appropriate for this small sample size.

To further evaluate the completeness of each State's dataset, EPA used the SDWIS/Fed database as a reference and compared the number of PWSs by State in the SYR 4 ICR dataset to the number of systems by State in the SDWIS/Fed database (frozen fourth quarter 2019). Only the SDWIS/Fed database records from the 59 States that are also in the SYR 4 ICR dataset were included. Although the system inventories represented in the two data sources are similar, they are not equivalent. The main difference is that the SYR 4 ICR dataset counts reflect the total number of active water systems with compliance monitoring data during any of the eight years represented in the dataset (2012–2019), while the SDWIS/Fed 2019 fourth quarter data freeze counts reflect the total number of active water systems in a single year (2019). Since systems open, close, and consolidate over time, the number of systems in each State will understandably be somewhat different between the two data sources. Population changes in system service areas over time could also contribute to differences in population served numbers for systems between the two data sources. Exhibit 2-3 presents this comparison between the SDWIS/Fed and SYR 4 ICR datasets. If a system had more than one specified population served value in the submitted data, the most frequently occurring population served value was included in the SYR 4 ICR dataset.

Exhibit 2-3 compares the number of systems and population served by these systems in the December 2019 SDWIS/Fed freeze and the SYR 4 ICR dataset by State. The counts of systems and population served presented in for the SYR 4 ICR dataset only include systems that provided data for the requested regulated contaminants, including chemicals, radionuclides, microbes, and DBPs, prior to QA/QC review. The comparison between the counts of systems in the two data sources indicates a 9 percent difference between the number of systems listed in the December

2019 SDWIS/Fed freeze compared to the number of systems in the SYR 4 ICR dataset. In Exhibit 2-3, positive values for percent difference indicate that more systems are reported in the SYR 4 ICR dataset, while negative values indicate that more systems are reported in the 2019 SDWIS/Fed freeze. Comparing the number of systems for each State, the absolute percentage difference between SDWIS/Fed and the SYR 4 ICR dataset ranges from 0 percent (e.g., Region 1 tribes, Region 2 tribes, Region 4 tribes, Navajo Nation, Washington, D.C., Kentucky, and Hawaii) to 24 percent (e.g., Oklahoma) in the number of systems. Based on the population served by systems, the absolute percentage difference between the total population served by systems listed in SDWIS/Fed and that listed in the SYR 4 ICR dataset is less than 1 percent. Comparing population served values for individual States, the absolute percentage difference between SDWIS/Fed and the SYR 4 ICR dataset ranges from 0 percent (e.g., Region 2 tribes, Region 4 tribes, and Washington, D.C.) to 30 percent (e.g., Utah).

Exhibit 2-3: Comparison of the Total Number of Systems and Population Served in SDWIS/Fed and the SYR 4 ICR Dataset, By State

State	Total Number of Systems[1,2]			Population Served		
	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]
Alabama	579	592	2%	5,782,465	5,935,212	3%
Alaska	1,378	1,370	-1%	849,984	851,634	0.2%
American Samoa	111	100	-11%	59,379	58,476	-2%
Arizona	1,526	1,528	0.1%	6,739,728	6,777,613	1%
Arkansas	1,051	1,042	-1%	2,909,279	2,932,762	1%
California	7,498	8,394	11%	40,916,430	41,647,398	2%
Commonwealth of the Northern Mariana Islands	70	69	-1%	76,157	74,076	-3%
Connecticut	2,432	2,485	2%	2,877,830	2,882,881	0.2%
Colorado	2,048	2,500	18%	6,745,814	6,397,009	-5%
Delaware	482	521	7%	980,130	1,014,200	3%
Florida	5,241	5,962	12%	20,862,887	20,860,764	0.0%
Hawaii	136	136	0%	1,525,474	1,521,687	-0.2%
Idaho	2,007	1,976	-2%	1,495,882	1,516,508	1%
Illinois	5,353	6,181	13%	12,502,127	12,608,341	1%
Indiana	4,036	4,692	14%	5,512,342	5,658,801	3%
Iowa	1,817	1,982	8%	2,949,070	2,976,894	1%
Kansas	982	979	-0.3%	2,835,829	2,875,770	1%
Kentucky	433	433	0%	4,508,752	4,502,282	-0.1%
Louisiana	1,317	1,486	11%	5,074,387	5,320,364	5%

State	Total Number of Systems[1,2]			Population Served		
	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]
Maine	1,910	2,209	14%	931,352	968,213	4%
Maryland	3,302	3,337	1%	5,867,239	5,861,767	-0.1%
Massachusetts	1,727	1,759	2%	9,811,383	9,788,373	-0.2%
Minnesota	6,703	6,628	-1%	5,037,593	5,027,228	-0.2%
Missouri	2,761	3,045	9%	5,622,969	5,660,127	1%
Montana	2,196	2,176	-1%	1,067,458	1,063,777	-0.3%
Navajo Nation	171	171	0%	176,792	176,750	0.0%
Nebraska	1,339	1,494	10%	1,660,734	1,681,763	1%
Nevada	601	594	-1%	2,891,787	2,899,400	0.3%
New Hampshire	2,513	2,747	9%	1,218,513	1,256,653	3%
New Jersey	3,625	4,180	13%	9,607,693	9,718,394	1%
New York	8,401	9,454	11%	21,265,451	18,006,468	-18%
North Carolina	5,366	5,946	10%	8,975,117	9,047,042	1%
North Dakota	400	502	20%	709,109	718,937	1%
Ohio	4,418	5,241	16%	10,916,586	11,149,543	2%
Oklahoma	1,386	1,822	24%	3,721,779	3,785,103	2%
Oregon	2,496	2,720	8%	3,748,090	3,784,217	1%
Pennsylvania	8,167	9,968	18%	12,670,902	12,931,009	2%
Region 1 tribes	5	5	0%	75,826	75,845	0.0%
Region 2 tribes	9	9	0%	12,565	12,565	0%
Region 4 tribes	30	30	0%	27,571	27,571	0%
Region 5 tribes	106	123	14%	136,541	149,532	9%
Region 6 tribes	87	92	5%	187,255	194,809	4%
Region 7 tribes	14	15	7%	15,926	15,506	-3%
Region 8 tribes	148	147	-1%	140,568	141,174	0.4%
Region 9 tribes	309	302	-2%	530,167	528,365	-0.3%
Region 10 tribes	134	139	4%	132,798	143,367	7%
Rhode Island	483	479	-1%	1,134,075	1,134,759	0.1%
South Carolina	1,410	1,169	-21%	4,081,703	4,078,161	-0.1%
South Dakota	651	749	13%	839,311	849,252	1%
Tennessee	783	921	15%	7,219,007	7,269,841	1%
Texas	7,040	6,955	-1%	28,945,548	29,290,499	1%
Utah	1,046	1,055	1%	3,327,756	4,721,824	30%

State	Total Number of Systems[1,2]			Population Served		
	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]	2019 SDWIS/Fed Freeze	SYR 4 ICR Dataset	Percent Difference[3]
Vermont	1,403	1,539	9%	614,390	628,868	2%
Virginia	2,813	3,218	13%	7,510,864	7,835,414	4%
Washington	4,457	4,386	-2%	8,029,486	8,184,593	2%
Washington, D.C.	6	6	0%	665,602	665,602	0%
West Virginia	857	831	-3%	1,597,832	1,599,584	0%
Wisconsin	11,325	12,835	12%	5,040,624	5,109,898	1%
Wyoming	778	764	-2%	589,509	588,998	-0.1%
Total	**129,873**	**142,190**	**9%**	**301,959,417**	**303,183,463**	**0.4%**

[1] The majority of the water systems with data in the SYR 4 ICR dataset are transient non-community water systems. Because only the nitrate/nitrite regulations require compliance monitoring by these transient systems (see Exhibit 2-4), data from the transient systems were included only for the nitrate and nitrite occurrence analyses and were excluded for all occurrence analyses for IOCs, SOCs, VOCs, and radiological contaminants.

[2] The data shown did not undergo QA procedures.

[3] The percent difference was calculated by subtracting the 2019 SDWIS/Fed freeze total number of systems (or population served by systems) from the SYR 4 ICR dataset total number of systems (or population served by systems). That difference was then divided by the total number of systems (or population served by systems) from the SYR 4 ICR dataset. The percent difference is less than zero if the SYR 4 ICR dataset indicated a smaller number of systems (or population served by systems).

Exhibit 2-4 compares the number of systems and population served by the systems in the December 2019 SDWIS/Fed freeze and the SYR 4 ICR dataset stratified by source water type and system type. The total differences for all 59 States indicate 9 percent more systems and 0.4 percent greater population served is reported in the SYR 4 ICR dataset than in SDWIS/Fed. For CWSs, the difference is 3 percent based on the number of systems and 1 percent based on the population served by systems. For NTNCWSs, the difference is 8 percent based on the number of systems and 3 percent based on the population served by systems. For transient non-community water systems (TNCWSs), the difference is 10 percent based on the number of systems and 9 percent based on the population served by systems. Overall, these comparisons indicate that the SYR 4 ICR dataset is suitable for use as the basis of national contaminant occurrence estimates. As stated earlier in this report, the 59 States that provided data for the SYR 4 ICR dataset comprise 88 percent of all PWSs and 92 percent of the total population served by PWSs, representing a nationwide distribution of PWSs.

Exhibit 2-4: Comparison of the Total Number of Systems and Population Served in SDWIS/Fed and the SYR 4 ICR Dataset, By Source Water Type and System Type

Source Water Type	2019 SDWIS/Fed Freeze				SYR 4 ICR Dataset				
	CWS	NTNCWS	TNCWS	Total	CWS	NTNCWS	TNCWS	Unknown[1]	Total
Number of Systems									
Ground Water (GW)	33,613	14,905	67,564	116,082	35,528	16,181	75,027	745	127,481
Surface Water (SW)	10,807	755	2,172	13,734	10,145	701	2,240	135	13,221
Unknown[1]	27	8	22	57	119	96	312	961	1,488
Total	**44,447**	**15,668**	**69,758**	**129,873**	**45,792**	**16,978**	**77,579**	**1,841**	**142,190**
Population Served									
Ground Water (GW)	81,806,757	4,631,058	8,663,270	95,101,085	107,516,099	4,954,238	9,600,777	49,520	122,120,634
Surface Water (SW)	202,988,465	1,363,942	2,486,544	206,838,951	179,187,202	1,211,353	533,646	4,474	180,936,675
Unknown[1]	11,676	4,855	2,850	19,381	33,000	16,735	75,105	1,314	126,154
Total	**284,806,898**	**5,999,855**	**11,152,664**	**301,959,417**	**286,736,301**	**6,182,326**	**10,209,528**	**55,308**	**303,183,463**

[1] Systems with unknown system type (i.e., system type not reported by the State) were included in the SYR 4 analyses.

3 Data Management

States delivered their data to EPA in a variety of formats and data structures and required reformatting to a uniform structure to enable the national contaminant occurrence analyses. This section provides an overview of the data management efforts that were conducted to enable and facilitate the contaminant occurrence analyses. Additional details of the data management measures can be found in the support document *Data Management and Quality Assurance/Quality Control Process for the Fourth Six-Year Review Information Collection Request Dataset* (USEPA, 2024e).

3.1 Dataset Consistency and Restructuring

About 78 percent of all States currently store and manage at least portions of their compliance monitoring data in the Safe Drinking Water Information System/State Version (SDWIS/State). The majority of States using SDWIS/State that submitted data to EPA used a SDWIS Query Extraction Tool, developed and provided by EPA, to extract and compile the EPA-requested compliance monitoring data. The Extraction Tool enabled a streamlined effort by States to select, compile, and format the requested data and generally resulted in submission of complete datasets that were uniform in format. The States not using SDWIS/State submitted their compliance monitoring and treatment technique data "as is," resulting in a variety of formats of datasets submitted to EPA.

Exhibit 3-1 lists the States that did and did not use the SDWIS Query Extraction Tool. Forty-two states, Washington, D.C., and six regional tribal entities used the SDWIS Query Extraction Tool to extract all or some of their chemical and microbial data; therefore, those datasets were all submitted in a similar format. Data from States that did not use the SDWIS Query Extraction Tool were restructured into a similar format. The SDWIS Query Extraction Tool pulls the SDWIS/State data into Microsoft (MS) Access. The 17 States that did not use the SDWIS Query Extraction Tool submitted data in a variety of file types, including dBase, MS Excel, XML, MS Access, and comma delimited. Apart from California, Colorado, and Florida, whose data were downloaded from their publicly available website, all States submitted their data online via EPA's Central Data Exchange.

Exhibit 3-1: Summary of Compliance Monitoring Data Provided by States for the Fourth Six-Year Review

	State/Entity Name		
States that DID use the SDWIS/State Extraction Tool	Alabama Alaska Arizona Arkansas Connecticut Delaware Hawaii Idaho Illinois Indiana Iowa Kansas Kentucky Louisiana	Maine Maryland Missouri Montana Nebraska Nevada New Jersey New York North Carolina North Dakota Ohio Oklahoma Oregon Region 4 tribes	Region 5 tribes Region 6 tribes Region 7 tribes Region 8 tribes Region 10 tribes Rhode Island South Carolina Texas Utah Vermont Virginia Washington D.C West Virginia Wyoming
States that DID NOT use the SDWIS/State Extraction Tool	American Samoa California[1] Colorado[1] Commonwealth of the Northern Mariana Islands Florida[1]	Massachusetts Minnesota Navajo Nation New Hampshire Pennsylvania Region 1 tribes	Region 2 tribes Region 9 tribes South Dakota Tennessee Washington Wisconsin
States that DID NOT submit any SYR 4 data	Georgia Guam Michigan	Mississippi New Mexico	Puerto Rico U.S. Virgin Islands

[1] CA, CO, and FL compliance monitoring and treatment technique information was extracted from a publicly available website.

3.2 Review of Dataset Content

One of the first reviews of the submitted data was to verify that all the necessary data elements were included. Many of the States not using the SDWIS Query Extraction Tool submitted datasets with more data elements than necessary. In those cases, EPA determined which data elements were not needed for the SYR 4 occurrence analyses. Exhibit 3-2 provides a detailed list of the data elements requested by EPA for SYR 4.

Although data dictionaries were not necessary for the review of data from States that used the SDWIS Query Extraction Tool, supporting information was useful when trying to interpret the data submitted by the States that did not use the SDWIS Query Extraction Tool. Data dictionaries and supporting information files were reviewed for definitions of the various data elements, field/row headings, codes, acronyms, etc. In addition, field names were standardized, and data formats were made uniform for each field which is described in Section 3.3.

Exhibit 3-2: Data Elements Requested by EPA for the Fourth Six-Year Review[1]

Data Category	Description
System-Specific Information	
Public Water System Identification Number (PWSID)	The code used to identify each PWS. The code begins with the standard two-character postal state abbreviation or Region code; the remaining seven numbers are unique to each PWS in the state.
System Name	Name of the PWS.
Federal Public Water System Type Code	A code to identify whether a system is: • Community Water System; • Non-transient Non-community Water System; or • Transient Non-community Water System.
Population Served	Highest average daily number of people served by a PWS, when in operation.
Federal Source Water Type	Type of water at the source. Source water type can be: • Ground water or purchased ground water; or • Surface water or purchased surface water; or • Ground water under the direct influence of surface water (GWUDI) or purchased GWUDI. (Note: Some states may not distinguish GWUDI from surface water sources. In those states, a GWUDI source should be reported as surface water.)
Treatment Information	
Water System Facility	System facility data including treatment plant identification number, treatment plant information, treatment unit process/objectives, facility flow and treatment train (train or flow of water through treatment units within the treatment plant).
Filtration Type	Information relating to system filtration, including filtration status and types of filtration (e.g., unfiltered, conventional filtration, and other permitted values)
Treatment Technique Information	Information pertaining to treatment processes. Types of treatment technique information include coagulant/coagulant aid type and dose, disinfectant concentration (amounts, types, primary and secondary types of disinfection, disinfection profile/benchmark data), log of viral inactivation/removal, contact time, contact value, pH, and temperature.
Filter Backwash Information	Information about filter backwash that is returned to the treatment plant influent (e.g., information on: recycle/schematic status, alternative return location, corrective action requirements, and recycle flows and frequency).
Sample-Specific Information	
Sampling Point Identification Code	A sampling point identifier established by the state, unique within each applicable facility, for each applicable sampling location (e.g., entry point to the distribution system). This information allows for occurrence assessments that address intra-system variability.
Sample Identification Number	Identifier assigned by state or the laboratory that uniquely identifies a sample.
Sample Collection Date	Date the sample was collected, including month, day and year.
Sample Type	Indicates why the sample is being collected (e.g., compliance, routine, repeat, confirmation, additional routine samples, duplicate, special, special duplicate).

Data Category	Description
Sample Analysis Type Code	Code for type of water sample collected. • Raw (untreated) water sample; • Finished (treated) water sample For lead and copper only: • Source; • Tap For TCR, Repeats only; indicator of sampling location relative to sample point where positive sample was originally collected: • Upstream; • Downstream; • Original
Contaminant	Contaminant name, four-digit SDWIS contaminant identification number or Chemical Abstracts Service (CAS) Registry Number for which the sample is being analyzed.
Sample Analytical Result - Sign	Sign indicating whether the sample analytical result was: • <, "less than," means the contaminant was not detected or was detected at a level "less than" the minimum reporting level (MRL). • =, "equal to" means the contaminant was detected at a level "equal to" the value reported in "Sample Analytical Result - Value." • (+) "positive result" (For RTCR data, only positive E. coli result sign to be included.)
Sample Analytical Result - Value	Actual numeric (decimal) value of the analysis for the chemical results, or the MRL if the analytical result is less than the contaminant's MRL. *(For the TCR and RTCR, TC and E. coli will indicate presence/absence, and positive E. coli will have numeric results.)*
Sample Analytical Result - Unit of Measure	Unit of measurement for the analytical results reported (usually expressed in either µg/L or mg/L for chemicals; or pCi/l or mrem/yr for radiological contaminants). *(Not required for TCR and RTCR data)*
Sample Analytical Method Number	EPA identification number of the analytical method used to analyze the sample for a given contaminant.
Minimum Reporting Level (MRL) - Value	MRL refers to the lowest concentration of an analyte that may be reported. *(Not required for TCR and RTCR data)*
MRL - Unit of Measure	Unit of measure to express the concentration value of a contaminant's MRL. *(Not required for TCR and RTCR data)*
Source Water Monitoring Information	Total organic carbon (TOC), including percent TOC removal, TOC removal summary, pH, alkalinity, monitoring data entered as individual results or included in DBP (or monthly operating report) summary records, alternative compliance criteria, results from round 2 monitoring under LT2 ESWTR (including *Cryptosporidium, E. coli*, turbidity, or state-approved alternate indicators).
Sample Summary Reports	Sample summaries for DBPRs, SWTRs, GWR corrective actions, and the Lead and Copper Rule (LCR) associated with analytical result records. Values used for compliance determination [e.g., turbidity (combined effluent/individual effluent), disinfectant residual levels in treatment plant and distribution system, treatment technique information, HPC, etc.]

Source: Attachment A to the letter EPA sent to each primacy agency to request voluntary submission of its compliance monitoring data and treatment technique information for regulated chemical, radiological, and microbiological contaminants. See Appendix A in USEPA (2024e) for the data request letter.

[1] These are the data elements requested in the SYR 4 ICR. Note that the "Data Category" and "Description" Columns were intentionally descriptive rather than prescriptive. This allowed the states that do not use SDWIS/State flexibility to provide as much information as possible. EPA accepted all data "as is" without prescribing structure or format.

It was also necessary to confirm that all the requested contaminants were included in each State's data. EPA requested voluntary submission of compliance monitoring information for chemical contaminants regulated under Phase I, II, IIb, and V Rules; the Arsenic Rule; the Lead and Copper Rule; and the Radionuclides Rule. In addition, EPA requested data collected for the Total Coliform Rule (TCR), Revised Total Coliform Rule (RTCR), Ground Water Rule (GWR), Surface Water Treatment Rules (SWTR), D/DBPR, and the Filter Backwash Recycling Rule (FBRR).

Exhibit 3-3 lists the specific contaminants for which EPA requested monitoring data. The contaminants whose data were requested are listed in the table, though not all were analyzed as part of this report because they are being evaluated under other regulatory actions or included in separate regulatory reviews. See Section 1 for more details on the contaminants addressed in this report.

Exhibit 3-3: List of Contaminants for Which Data Were Requested from States

Chemical Contaminants (Phase I, II, IIB and V Rules; Arsenic Rule; Lead and Copper Rule)		
Acrylamide	1,1-Dichloroethylene	Methoxychlor
Alachlor	cis-1,2-Dichloroethylene	Monochlorobenzene (Chlorobenzene)
Antimony	trans-1,2-Dichloroethylene	Nitrate (as N)
Arsenic	Dichloromethane (Methylene chloride)	Nitrite (as N)
Asbestos	1,2-Dichloropropane	Oxamyl (Vydate)
Atrazine	Di(2-ethylhexyl) adipate (DEHA)	Pentachlorophenol
Barium	Di(2-ethylhexyl) phthalate (DEHP)	Picloram
Benzene	Dinoseb	Polychlorinated biphenyls (PCBs)
Benzo[a]pyrene	Diquat	Selenium
Beryllium	Endothall	Simazine
Cadmium	Endrin	Styrene
Carbofuran	Epichlorohydrin	2,3,7,8-TCDD (Dioxin)
Carbon tetrachloride	Ethylbenzene	Tetrachloroethylene
Chlordane	Ethylene dibromide (EDB)	Thallium
Chromium (total)	Fluoride	Toluene
Copper	Glyphosate	Toxaphene
Cyanide	Heptachlor	2,4,5-TP (Silvex)
2,4-Dichlorophenoxyacetic acid (2,4-D)	Heptachlor epoxide	1,2,4-Trichlorobenzene

Chemical Contaminants (Phase I, II, IIB and V Rules; Arsenic Rule; Lead and Copper Rule)		
Dalapon	Hexachlorobenzene	1,1,1-Trichloroethane
1,2-Dibromo-3-chloropropane (DBCP)	Hexachlorocyclopentadiene	1,1,2-Trichloroethane
1,2-Dichlorobenzene (*o*-Dichlorobenzene)	Lead	Trichloroethylene
1,4-Dichlorobenzene (*p*-Dichlorobenzene)	Lindane	Vinyl chloride
1,2-Dichloroethane (Ethylene dichloride)	Mercury (inorganic)	Xylenes (total)
Radiological Contaminants		
Combined Radium-226/228; and	Gross beta	Tritium
Radium-226 & Radium-228 *(if available)*	Iodine-131	Uranium
Gross alpha	Strontium-90	
Total Coliform Rule (TCR) and Revised Total Coliform Rule (RTCR)		
Total coliforms	Fecal coliforms	*Escherichia coli (E. coli)*
Disinfectants and Disinfection Byproducts Rules (DBPRs)		
Total Trihalomethanes (TTHMs):	Haloacetic Acids (HAA5):	Bromate
Chloroform	Monochloroacetic acid	Chlorite
Bromodichloromethane	Dichloroacetic acid	Chlorine
Dibromochloromethane	Trichloroacetic acid	Chloramines
Bromoform	Bromoacetic acid	Chlorine dioxide
	Dibromoacetic acid	
Ground Water Rule (GWR)		
Escherichia coli (E. coli)	Enterococci	Coliphage
Surface Water Treatment Rules (SWTRs)		
Chlorine	*Cryptosporidium*	Heterotrophic Plate Count (HPC)
Chloramines	*Giardia lamblia*	
Filter Backwash Recycling Rule (FBRR)		
No specific occurrence data collected.		

3.3 Establishing Consistent Data Fields for Analytical Results

EPA structured the sample analytical result sign, sample analytical result value, and sample analytical result unit of measure in a consistent format to prepare the data for occurrence analysis. EPA conducted this step prior to reviewing the data for potential outliers. Much of the state data included analytical results signs (e.g., "<" for non-detections, "=" for detections), detection limits and analytical results data in multiple fields. A "DETECT" field was added to all of the state data to identify the results sign. Wherever the analytical result was greater than zero and the result sign indicated a detection, then DETECT was set equal to 1. When the analytical

result was equal to zero and/or the result sign indicated a non-detection, then DETECT was set equal to 0.

EPA received data with various units of measure. It was important that data for each individual contaminant be expressed in a single unit in order to facilitate analysis. Chemical monitoring data were received in both milligrams per liter (mg/L) and micrograms per liter (µg/L). For this analysis, EPA converted all data for IOCs, SOCs, VOCs, uranium, trihalomethanes (THMs), and haloacetic acids (HAAs) to µg/L. Data for alpha particles, beta particles,[8] and combined radium-226/228 were analyzed in picocuries per liter (pCi/L). Except for asbestos and radionuclides, all thresholds and concentrations in this report are expressed in µg/L. All records with missing or unusual units in the SYR 4 ICR dataset were sent back to States for input and clarification.

[8] Although the MCL for beta particles is expressed in millirem per year (mrem/yr), the primary unit of analytical measure is picocuries per liter (pCi/L). This unit of measure relates to screening thresholds of 15 pCi/L and 50 pCi/L that are defined in the 2000 Radionuclides Rule. More than 99 percent of all compliance monitoring data for beta particles submitted by the States to EPA were in units of pCi/L.

4 Data Quality Assurance/Quality Control

After EPA had converted all state data into a consistent format, a significant effort was undertaken to ensure the quality of the data submitted. EPA encountered a range of data quality issues across the different contaminants and different States. Included below is a summary description of the QA/QC measures that were conducted on the state data prior to analysis. Not all QA/QC measures described were conducted on all States, as noted in this chapter. For complete details of the data QA/QC measures, refer to the support document *Data Management and Quality Assurance/Quality Control Process for the Fourth Six-Year Review Information Collection Request Dataset* (USEPA 2024e).

4.1 Quality Assurance Measures

Before analyzing contaminant occurrence, EPA performed a rigorous QA/QC evaluation of the data from each State. When necessary, EPA sent emails to each State, asking specific questions about its data, as appropriate. For States that did not use the SDWIS Query Extraction Tool, question topics included descriptions of non-intuitive data element names, definitions of field headings, or non-standard codes that were not described in any documentation files from the State. EPA also confirmed that all of the requested contaminants were included in each State's data. When a State was missing data for any of the contaminants shown in Exhibit 3-3, EPA asked the State to identify the reason for the omission, such as a state-wide waiver of the requirement to monitor for the contaminant(s). The information provided by each State was recorded.

States were asked to provide data for all contaminants listed in Exhibit 3-3, but individual PWSs may be required to sample for a subset of those contaminants depending on the type of system. Exhibit 4-1 lists the system types that are required to monitor for the contaminants evaluated in this report. All data that passed the QA/QC process from these systems were included in the SYR 4 analyses. Some systems provided monitoring data that were not required given their system type (e.g., SOC data from transient systems or radionuclide data from non-community systems); however, this data was available inconsistently. To ensure consistent monitoring and to avoid bias, these non-required data were maintained in the SY4 ICR dataset but were excluded from the SYR 4 analyses.

Exhibit 4-1: Chemical Group Monitoring Requirements

Contaminant Group	System Types Required to Sample (sample data included in analyses)	System Types Not Required to Sample (sample data excluded from analyses)
Inorganic Contaminants (IOCs)	All non-purchased community water systems and non- transient non-community water systems are required to sample for IOCs.	All purchased systems and transient non- community water systems are not required to sample for IOCs.
Lead and Copper	All (non-purchased and purchased) community water systems and non-transient non-community water systems are required to sample for lead and copper.	Transient non-community water systems are not required to sample for lead and copper.

Contaminant Group	System Types Required to Sample (sample data included in analyses)	System Types Not Required to Sample (sample data excluded from analyses)
Nitrate and Nitrite	Non-purchased community water systems, non-transient non-community water systems, and transient non- community water systems are all required to sample for nitrate and nitrite.	All purchased systems are not required to sample for nitrate and nitrite
Synthetic Organic Contaminants (SOCs)	All non-purchased community water systems and non- transient non-community water systems are required to sample for SOCs.	All purchased systems and transient non- community water systems are not required to sample for SOCs.
Volatile Organic Contaminants (VOCs)	All non-purchased community water systems and non- transient non-community water systems are required to sample for VOCs.	All purchased systems and transient non- community water systems are not required to sample for VOCs.
Radiological Contaminants	All non-purchased community water systems are required to sample for the radionuclides.	All purchased systems and non-purchased non- transient non-community and non-purchased transient non-community water systems are not required to sample for radionuclides.

EPA created several automated data QA checks to identify potential data entry errors or numerical inconsistencies. These QA checks identified (i.e., flagged) records with potential data quality concerns. EPA sent out a detailed flagged records report to each State, which included the counts of flagged records by category and specific questions for each category. An attachment identified the specific records that were flagged; EPA requested that each State provide the appropriate disposition (delete, make corrections, etc.) of these flagged records. For all flagged records, input from States was always used as the initial criteria in deciding on the appropriate action or decision to include/exclude the record from analysis. When States did not provide a response or action, EPA used best professional judgement on whether to include or exclude the data in question. Below is a general description of the various QA measures that were used to identify records of potential data quality concerns.

A number of QA measures addressed sampling concerns. For example, samples that were taken outside of the SYR 4 date range (2012–2019), collected from non-public water systems, or identified as non-compliance were excluded from the occurrence analysis. All analytical records from consecutive systems (i.e., systems that purchase 100% of their water from another system) were excluded from the occurrence analysis (Section 4.3), as well as any sample types other than routine or confirmation. Non-nitrate or nitrite data collected from TNCWSs were excluded unless a State responded that the system in question was previously a CWS and NTNCWS at the time of sampling.

Other categories of flagged records included reporting concerns, such as use of correct units, inclusion of duplicates, and missing system inventory data. Records with units that did not match those listed in Section 3.3 were excluded unless the correct unit was obvious. Potential duplicates were included in the occurrence analysis for consistency with the second and third Six-Year Review, unless the State confirmed that the records were in fact duplicates and should be excluded. Samples from systems that did not specify inventory data were supplemented by a

fourth-quarter-2019 SDWIS/Fed data freeze and were included in the occurrence analysis. However, all records from systems whose inventory data were still missing after filling gaps with SDWIS/Fed data were excluded from the analysis.

For all samples, any detected concentrations that were greater than four times a contaminant's MCL and any that were greater than 10 times the MCL were flagged and sent to States for comment. Any changes suggested by the States were implemented for these records. For the States that did not respond, all concentrations less than or equal to 100 times the MCL were included; any greater than 100 times the MCL were excluded. Similarly, all detected concentrations less than a contaminant's minimum method detection limit (MDL)[9] and all less than one tenth of the minimum MDL were sent to States for comment and any changes suggested by the States were implemented. For States that did not respond, all detected concentrations greater than or equal to 1/100 of the MDL were included in the analysis and any with concentrations less than 1/100 of the MDL were excluded. In addition, data collected from raw water samples were considered based on corresponding finished water samples from the same facility.

The review of States' responses to these flagged records was a critical QA step prior to the data analysis. EPA documented all changes made to the compliance monitoring data and suggested to the States that they make corrections to their data systems as well, if appropriate. To resolve data quality issues that required significant corrections to the submitted data, such as identifying and deleting outliers or identifying and changing incorrect units, state data management staff were consulted when appropriate before data corrections were completed.

The initial SYR 4 ICR dataset included more than 83 million analytical records from approximately 142,000 PWSs that serve approximately 303 million people nationally.[10] More than 73 million analytical records for chemical, radionuclide, microbial, and disinfection byproduct contaminants underwent QA/QC review to be included in the SYR 4 ICR dataset to support the SYR 4 analyses. After the QA/QC review was completed on these analytical records and a small percentage of records that did not meet quality standards were omitted from analyses, the final SYR 4 ICR dataset was comprised of almost 71 million analytical records from approximately 140,000 PWSs that serve approximately 301 million people nationally for data related to the Chemical Phase, Radionuclide, Microbial, and Disinfection Byproduct Rules.[11] Specifically for the Chemical Phase and Radionuclides Rules, almost 21 million records from

[9] The Method Detection Limit, MDL, is defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence, based on an analyte concentration being greater than zero as determined from analysis of a sample in a given matrix containing the analyte. In other words, the MDL is the concentration at which presence or absence of an analyte can be dependably determined. This contrasts with the MRL, which is a concentration above the MDL, typically set 2 to 10 times the MDL and enables reporting at specified levels of precision and accuracy of the actual concentration of the analyte present in the sample.

[10] This count of 142,000 PWSs represents all water systems with any SYR 4 data (including data for information not specifically requested).

[11] This count of 140,000 PWSs serving 301 million people represents water systems that provided data for requested contaminants that passed QA/QC review.

approximately 115,000 systems serving approximately 259 million people were included in the final dataset after QA/QC review. These population served estimates only include retail populations, not the adjusted total populations that were calculated for occurrence analyses (Section 4.3).

4.2 Adjustments to Source Water Type for Public Water Systems

For the SYR 4 analysis, each system needed to have a single source water type and population served designation to define each system in a unique source water type/population size class. Systems using both ground water and surface water and systems using ground water under direct influence of surface water were considered surface water systems for analysis. Systems with more than one specified value of their population served in the original data were included using the modal value for population served.

An additional adjustment to source water type was necessary for a select group of systems whose water came from a mix of consecutive connections and their own sources. Specifically, these were systems that do not have their own surface intake or other SW facilities but do purchase some SW, in addition to using their own GW wells. In these cases, because the system does include some purchased surface water (SWP) sources, the federal source water type is listed as SWP in SDWIS/Fed and in the States' compliance monitoring data. This is the case even if the system only purchases a small portion of their water and the rest of the water comes from GW wells. To capture the legitimate (and required) compliance monitoring data from purchased systems (e.g., purchased surface water [SWP], purchased ground water [GWP]) with their own GW wells, EPA reclassified the source water type of these systems prior to occurrence and preliminary exposure analyses. To identify purchased systems with their own GW wells, EPA reviewed all non-emergency, active facilities within a system. When active facilities with GW wells were identified, the system's source water type code was updated to "GW" in the SYR 4 ICR database. When all active, non-emergency facilities were classified as purchased sources based on information from the SDWIS/Fed database (frozen fourth quarter 2019), the system was designated as a consecutive system, which is discussed further in Section 4.3.

4.3 Adjustments to Population Served by Public Water Systems Values

Consecutive water systems are those that purchase 100 percent of their water from other systems (i.e., seller or wholesale system). Compliance monitoring requirements are different for consecutive systems compared to other systems because their water has already been treated and monitored by the wholesale system. To account for consecutive systems, EPA excluded any analytical records submitted by consecutive systems, then adjusted the population values of the wholesale systems to include the populations of their consecutive system(s). The population served directly by these wholesale systems is known as the retail population, while the population served indirectly through the consecutive systems is known as the wholesale population. The sum of the retail and wholesale populations is the adjusted total population. Adjusting for total population served ensured that all relevant populations were included in the exposure estimates.

For some systems, a slightly more complicated adjustment to the wholesalers' total population served values was required. Many consecutive water systems buy water from multiple wholesale

systems. Because of this, their entire population should not be attributed to a single wholesale system and EPA must instead distribute the population across the multiple wholesale systems from which they purchase their water. There are no data available on the actual relative quantities of water purchased from the different wholesalers. In the cases of multiple wholesalers, the population served by the consecutive system was assumed to be uniformly distributed across the wholesale systems.

To make adjustments across the SYR 4 ICR data, EPA compiled a list of all wholesale and consecutive systems. This list of buyer-wholesaler relationships was from SDWIS/Fed, dated the fourth quarter of 2019. EPA then created a crosswalk linking the consecutive systems to the wholesale systems from which they purchased 100 percent of their water. The population served by each consecutive system was then distributed evenly across the relevant wholesale system populations. As a result, the contaminant occurrence measures are associated with the adjusted total population (i.e., retail plus wholesale) served by these wholesale systems included in the SYR 4 data.

5 Summary of the Compliance Monitoring Data

This section provides an overview of the data EPA received, reviewed, and analyzed for Six-Year Review 4. The total number of systems with data for chemical and radiological contaminants in the final SYR 4 ICR dataset is also included; characteristics of the systems such as system types, source water types, population served; the number of records from each State and the number of records for each contaminant. An assessment of contaminant occurrence variability over the eight years is also described below.

5.1 Characteristics of the Data - States, Systems, and Records

Exhibit 5-1 shows the number and percentage of systems and the population served in the SYR 4 ICR dataset by source water type. EPA followed its standard practice of treating GWUDI as surface water for the analysis of these data. Exhibit 5-2 shows the number of systems by source water type and the population served by systems according to system size. As discussed in Section 4.3, analytical records from consecutive water systems were excluded and the populations served by these systems were accounted for in the occurrence analyses by calculating adjusted total populations served. Population served values and occurrence estimates in all tables in Section 5, Section 6, and Section 7 were generated using the adjusted total population served, as described in Section 4.2.

Exhibit 5-1: Number of Systems and Total Population Served by Systems in the SYR 4 ICR Dataset, by Source Water Type

Source Water Type	Systems		Total Population Served by Systems	
	Number	Percent of Total	Number	Percent of Total
Ground Water (GW)	122,446	96%	122,132,927	41%
Ground Water Under the Direct Influence of Surface Water (GWUDI)	1,030	1%	5,318,777	2%
Surface Water (SW)	4,637	4%	167,846,649	57%
Total Number of Systems	**128,113**	**100%**	**295,317,353**	**100%**

Exhibit 5-2: Number of Systems and Total Population Served by Systems in the SYR 4 ICR Dataset, by System Size

System Size (Population Served by the System)	Ground Water (GW)		Surface Water (SW)		Total	
	Number of Systems	Total Population Served by Systems	Number of Systems	Total Population Served by Systems	Number of Systems	Total Population Served by Systems
< 50	38,122	1,123,565	431	12,126	38,553	1,135,691
50 – 100	32,639	2,372,502	496	37,031	33,135	2,409,533

System Size (Population Served by the System)	Ground Water (GW)		Surface Water (SW)		Total	
	Number of Systems	Total Population Served by Systems	Number of Systems	Total Population Served by Systems	Number of Systems	Total Population Served by Systems
101 – 500	34,589	8,000,162	985	256,987	35,574	8,257,149
501 – 1,000	6,650	4,850,834	397	303,569	7,047	5,154,403
1,001 – 3,300	5,717	10,469,492	865	1,794,630	6,582	12,264,122
3,301 – 10,000	2,815	16,220,215	939	5,878,045	3,754	22,098,260
10,001 – 50,000	1,556	33,100,188	1,005	23,349,605	2,561	56,449,793
50,001 – 100,000	226	15,320,767	251	17,778,090	477	33,098,857
100,001 – 1 million	130	26,185,523	271	69,045,200	401	95,230,723
> 1 million	2	4,489,679	27	54,729,143	29	59,218,822
Total	**122,446**	**122,132,927**	**5,667**	**173,184,426**	**128,113**	**295,317,353**

Exhibit 5-3 shows the number and percentage of systems in the SYR 4 ICR dataset by PWS classification. Although more than 50 percent of the systems are TNCWSs, they serve only 3.2 percent of the population; almost 90 percent of the population is served by CWSs. Only a small fraction of TNCWSs collected data for most of the contaminants requested in the SYR 4 ICR, as TNCWSs are only required to monitor for nitrate and nitrite.

Exhibit 5-3: Number of Systems and Total Population Served by Systems in the SYR 4 ICR Dataset, by System Type

System Type	Systems		Total Population Served by Systems	
	Number	Percent of Total	Number	Percent of Total
Community Water System (CWS)	37,204	29.04%	280,615,001	87.47%
Non-Transient Non-Community Water System (NTNCWS)	16,263	12.69%	5,217,991	1.72%
Transient Non-Community Water System (TNCWS)[1]	74,249	57.96%	9,466,255	3.23%
Unknown[2]	397	0.31%	18,106	7.58%
Total Number of Systems	**128,113**	**100%**	**295,317,353**	**100%**

[1] Only the nitrate/nitrite regulations require compliance monitoring by these transient systems; thus, data from the transient systems were included only for the nitrate and nitrite occurrence analyses and were excluded for all occurrence analyses for IOCs, SOCs, VOCs and radiological contaminants.

[2] Systems with unknown system type were included in the SYR 4 analyses. None of the occurrence analyses conducted for the SYR 4 required specifying the system type.

Exhibit 5-4 lists the total number of records, systems, and population served for each of the 59 States that contributed data to the Six-Year Review 4 dataset. In addition, the last column of Exhibit 5-4 lists any contaminant(s) for which the State did not provide data. States might not have submitted data for certain contaminants if they have monitoring waivers for the contaminant. States may grant waivers to PWSs to reduce monitoring frequencies; thus, it is possible that no samples were collected by systems during the SYR 4 period of review. See Section 1.2 for more information on compliance monitoring and waivers. States may have submitted data for these contaminants under the ICR; however, the data were not in a format compatible with the SYR 4 ICR dataset. See Exhibit 5-5 for the response rates and record counts for each regulated contaminant evaluated under the fourth Six-Year Review.

Exhibit 5-4: An Inventory of Contaminant Occurrence Data in the SYR 4 ICR Dataset by State

State	Number of Records for Regulated Contaminants [1]	Number of Systems with Data for Regulated Contaminants	Population Served by Systems with Data for Regulated Contaminants	Did not submit useable data for
AK	94,887	1,270	857,000	
AL	302,422	423	5,716,007	Asbestos; 2,3,7,8-TCDD; Combined Uranium
AR	222,496	579	2,454,714	Asbestos; 2,3,7,8-TCDD; Gross Alpha, excl. Radon & U; Combined Uranium; Combined Radium (-226 & -228)
AS	8,681	10	58,324	Asbestos
AZ	466,667	1,473	6,782,519	
CA	4,375,926	8,119	40,554,027	Gross Alpha, excl. Radon & Uranium
CO	409,989	1,878	6,721,113	Asbestos
CT	482,296	2,433	2,939,447	
DC	585	1	883,658	Asbestos
DE	184,269	509	1,018,566	Diquat; Endothall; Glyphosate; 2,3,7,8-TCDD; Gross Alpha, excl. Radon & Uranium; Combined Uranium
FL	686,835	4,979	20,528,434	Combined Radium (-226 & -228)
HI	93,387	120	1,521,911	
IA	121,298	1,645	2,930,079	2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs)
ID	204,498	1,957	1,515,855	
IL	505,212	4,310	10,153,529	2,3,7,8-TCDD
IN	399,944	4,484	5,680,354	
KS	115,255	635	2,798,628	
KY	92,127	243	4,249,917	
LA	478,700	1,331	5,300,839	

State	Number of Records for Regulated Contaminants [1]	Number of Systems with Data for Regulated Contaminants	Population Served by Systems with Data for Regulated Contaminants	Did not submit useable data for
MA	490,231	1,659	9,804,078	Endothall; 2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs); Gross Alpha, excl. Radon & Uranium; Combined Radium (-226 & -228)
MD	259,919	3,287	5,850,792	
ME	165,999	2,166	965,275	2,3,7,8-TCDD
MN	335,651	6,487	5,025,324	Diquat; Endothall; 2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs); Xylenes, Total; Combined Radium (-226 & -228); Gross Beta Particle Activity
MO	363,232	2,697	5,429,256	Asbestos; Total Polychlorinated Biphenyls (PCBs); Gross Beta Particle Activity
MP	6,945	39	70,641	Asbestos; Gross Beta Particle Activity
MT	229,019	1,918	1,046,725	
NC	893,758	5,446	8,813,201	Endothall; Glyphosate
ND	12,569	235	675,417	Asbestos; 2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs); Gross Beta Particle Activity
NE	304,940	1,243	1,661,410	Total Polychlorinated Biphenyls (PCBs); Xylenes, Total; Gross Beta Particle Activity
NH	285,217	2,484	1,216,924	Asbestos; 2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs)
NJ	585,255	4,078	9,477,809	Gross Beta Particle Activity
NN	42,381	146	156,246	
NV	183,292	542	2,897,879	
NY	1,482,766	8,719	19,544,906	
OH	403,658	4,837	10,850,147	
OK	223,409	1,065	3,691,466	2,3,7,8-TCDD
OR	294,367	2,586	3,736,926	
PA	1,445,585	9,560	12,741,425	Combined Radium (-226 & -228)
RI	81,135	447	1,119,350	Diquat; Endothall; 2,3,7,8-TCDD
SC	171,328	992	3,929,396	Cyanide; Asbestos; Endothall; 2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs)
SD	6,011	448	808,744	Cyanide; Endrin; BHC-Gamma; Methoxychlor; Toxaphene; Dalapon; Diquat; Endothall; Glyphosate; Di(2-Ethylhexyl)adipate; Oxamyl; Simazine; Di(2-ethylhexyl)phthalate; Picloram; Dinoseb; Hexachlorocyclopentadiene; Carbofuran; Atrazine; Alachlor; 2,3,7,8-TCDD; Heptachlor; Heptachlor Epoxide; 2,4-D; 2,4,5-TP; Hexachlorobenzene; Benzo(a)pyrene; Pentachlorophenol; 1,2,4-Trichlorobenzene; Cis-1,2-Dichloroethylene; Total Polychlorinated Biphenyls (PCBs); 1,2-Dibromo-3-Chloropropane; Ethylene Dibromide; Xylenes, Total; Chlordane; O-Dichlorobenzene; P-Dichlorobenzene; 1,1-Dichloroethylene; Trans-1,2-Dichloroethylene; 1,1,1-Trichloroethane; 1,1,2-Trichloroethane; Chlorobenzene; Toluene; Ethylbenzene; Styrene; Dichloromethane; Vinyl

State	Number of Records for Regulated Contaminants [1]	Number of Systems with Data for Regulated Contaminants	Population Served by Systems with Data for Regulated Contaminants	Did not submit useable data for
				Chloride; 1,2-Dichloroethane; 1,2-Dichloropropane; Carbon Tetrachloride; Trichloroethylene; Tetrachloroethylene; Benzene
TN	60,217	694	7,242,315	Combined Uranium; Combined Radium (-226 & -228)
TX	1,862,958	5,916	27,489,672	2,3,7,8-TCDD; Total Polychlorinated Biphenyls (PCBs)
UT	224,999	949	4,704,310	Diquat; Endothall; Glyphosate; 2,3,7,8-TCDD; 1,2-Dibromo-3-Chloropropane; Ethylene Dibromide
VA	328,030	2,924	7,276,281	
VT	109,343	1,450	620,615	
WA	358,919	3,985	7,764,026	
WI	679,200	12,700	4,811,541	
WV	93,642	619	1,578,774	
WY	103,044	666	577,195	
R01 tribes	934	4	37,985	Asbestos; Gross Beta Particle Activity
R02 tribes	686	8	7,565	
R04 tribes	4,926	29	29,131	Gross Beta Particle Activity
R05 tribes	18,998	120	143,122	
R06 tribes	12,800	84	159,211	2,3,7,8-TCDD
R07 tribes	2,349	10	15,330	Gross Beta Particle Activity
R08 tribes	24,590	106	136,830	
R09 tribes	42,732	246	445,100	
R10 tribes	23,612	123	100,092	
Total	**21,464,120**	**128,113**	**295,317,353**	

[1] QA steps were taken to identify and exclude fluoride samples from fluoridated water systems. The number of records presented in this table reflect the number of fluoride records before the exclusion of fluoridated systems. See USEPA (2024c) for details.

Exhibit 5-5 summarizes the SYR 4 ICR dataset by contaminant. For each contaminant, this table includes MCL values, the number of States that submitted data, total number of records, number of systems with data, and the population served by systems that have data represented in the SYR 4 ICR dataset. Also presented are the modal MRL values for each contaminant, derived as the mode of modal MRLs from each State. See Section 7.1 for details regarding modal MRL values.

Exhibit 5-5: An Inventory of the Contaminant Occurrence Data in the SYR 4 ICR Dataset by Contaminant

Contaminant	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MCL	MRL
Inorganic Contaminants						
Antimony	59	230,942	51,063	269,592,223	6 µg/L	1 µg/L
Arsenic	59	452,852	52,505	278,819,817	10 µg/L	1 µg/L
Asbestos	48	24,124	13,772	115,618,448	7 MFL	0.2 MFL
Barium	59	232,216	52,488	269,862,041	2,000 µg/L	100 µg/L
Beryllium	59	229,630	50,225	267,645,012	4 µg/L	1 µg/L
Cadmium	59	230,098	50,989	269,570,338	5 µg/L	1 µg/L
Chromium (Total)	59	238,413	51,357	269,974,659	100 µg/L	1 µg/L
Cyanide	57	163,373	38,760	237,319,733	200 µg/L	10 µg/L
Mercury (Inorganic)	59	226,418	50,990	269,563,242	2 µg/L	0.2 µg/L
Nitrate (as N)	59	1,404,609	105,202	270,665,916	10,000 µg/L	100 µg/L
Nitrate (as N) (Hybrid)[1]	59	1,635,300	127,904	295,005,656	10,000 µg/L	100 µg/L
Nitrite (as N)	59	512,234	73.442	242,410,707	1,000 µg/L	100 µg/L
Selenium	59	232,598	51,317	269,659,074	50 µg/L	5 µg/L
Thallium	59	229,685	51,007	269,580,903	2 µg/L	1 µg/L
Synthetic Organic Contaminants[2]						
Alachlor	58	215,965	42,822	257,269,487	2 µg/L	0.2 µg/L
Atrazine	58	225,827	43,763	261,020,443	3 µg/L	0.1 µg/L
Benzo(a)pyrene	58	190,003	35,877	233,903,742	0.2 µg/L	0.02 µg/L
Carbofuran	58	176,608	37,375	228,477,652	40 µg/L	0.9 µg/L
Chlordane	58	189,512	38,310	230,456,908	2 µg/L	0.2 µg/L
Dalapon	58	232,471	40,062	235,852,202	200 µg/L	1 µg/L
Di(2-ethylhexyl)adipate (DEHA)	58	192,447	36,369	234,911,739	400 µg/L	0.6 µg/L
Di(2-ethylhexyl)phthalate (DEHP)	58	202,419	36,486	235,935,491	6 µg/L	0.6 µg/L
1,2-Dibromo-3-chloropropane (DBCP)	57	244,298	37,153	223,438,789	0.2 µg/L	0.01 µg/L
2,4-Dichlorophenoxyacetic acid (2,4-D)	58	191,658	41,519	248,130,899	70 µg/L	0.1 µg/L
Dinoseb	58	186,403	40,854	240,169,022	7 µg/L	0.2 µg/L
Diquat	54	110,637	22,215	156,013,584	20 µg/L	0.4 µg/L
Endothall	51	98,015	18,624	141,592,258	100 µg/L	9 µg/L
Endrin	58	192,869	38,483	236,415,830	2 µg/L	0.01 µg/L
Ethylene Dibromide (EDB)	57	243,161	38,371	229,383,985	0.05 µg/L	0.01 µg/L
Glyphosate	55	105,084	21,744	149,266,527	700 µg/L	6 µg/L
Heptachlor	58	193,927	38,640	236,922,867	0.4 µg/L	0.04 µg/L
Heptachlor Epoxide	58	193,623	38,638	236,924,732	0.2 µg/L	0.02 µg/L
Hexachlorobenzene	58	195,150	38,311	232,017,188	1 µg/L	0.1 µg/L

Contaminant	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MCL	MRL
Hexachlorocyclopentadiene	58	196,236	38,471	236,641,628	50 µg/L	0.1 µg/L
Lindane (gamma-Hexachlorocyclohexane)	58	195,775	38,843	239,389,254	0.2 µg/L	0.02 µg/L
Methoxychlor	58	196,131	38,834	239,380,900	40 µg/L	0.1 µg/L
Oxamyl (Vydate)	58	175,728	37,235	227,159,826	200 µg/L	2 µg/L
Pentachlorophenol	58	201,636	41,094	242,338,615	1 µg/L	0.04 µg/L
Picloram	58	188,833	41,375	248,613,745	500 µg/L	0.1 µg/L
Polychlorinated biphenyls (PCBs)	49	116,454	23,262	164,024,372	0.5 µg/L	0.1 µg/L
Simazine	58	220,013	43,211	257,634,524	4 µg/L	0.07 µg/L
Toxaphene	58	183,765	37,419	229,216,049	3 µg/L	1 µg/L
2,3,7,8-TCDD (Dioxin)	42	38,934	6,222	82,318,153	0.00003 µg/L	0.000005 µg/L
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	58	187,025	40,954	240,257,293	50 µg/L	0.2 µg/L
Volatile Organic Contaminants						
Benzene	58	487,631	52,207	274,587,312	5 µg/L	0.5 µg/L
Carbon Tetrachloride	58	510,599	52,205	274,593,290	5 µg/L	0.5 µg/L
1,2-Dichlorobenzene	58	480,075	52,200	274,592,094	600 µg/L	0.5 µg/L
1,4-Dichlorobenzene	58	480,247	52,203	274,592,491	75 µg/L	0.5 µg/L
1,2-Dichloroethane	58	493,514	52,209	274,593,936	5 µg/L	0.5 µg/L
1,1-Dichloroethylene	58	508,764	52,206	274,594,147	7 µg/L	0.5 µg/L
cis-1,2-Dichloroethylene	58	495,228	52,210	274,594,729	70 µg/L	0.5 µg/L
trans-1,2-Dichloroethylene	58	488,716	52,194	274,593,175	100 µg/L	0.5 µg/L
Dichloromethane	58	487,166	52,222	274,596,487	5 µg/L	0.5 µg/L
1,2-Dichloropropane	58	481,065	52,197	274,592,711	5 µg/L	0.5 µg/L
Ethylbenzene	58	487,555	52,200	274,583,387	700 µg/L	0.5 µg/L
Monochlorobenzene	58	479,909	52,184	274,581,805	100 µg/L	0.5 µg/L
Styrene	58	479,601	52,187	274,581,373	100 µg/L	0.5 µg/L
Tetrachloroethylene	58	544,460	52,210	274,625,445	5 µg/L	0.5 µg/L
Toluene	58	488,192	52,348	274,615,844	1,000 µg/L	0.5 µg/L
1,2,4-Trichlorobenzene	58	480,039	52,201	274,593,060	70 µg/L	0.5 µg/L
1,1,1-Trichloroethane	58	491,411	52,207	274,594,822	200 µg/L	0.5 µg/L
1,1,2-Trichloroethane	58	482,294	52,200	274,593,032	5 µg/L	0.5 µg/L
Trichloroethylene	58	540,777	52,222	274,596,206	5 µg/L	0.5 µg/L
Vinyl Chloride	58	482,672	52,021	274,471,872	2 µg/L	0.5 µg/L
Xylenes (Total)	56	412,436	46,720	256,321,003	10,000 µg/L	0.5 µg/L
Radiological Contaminants						
Alpha Particles	55	64,413	16,925	135,758,067	15 pCi/L	3 pCi/L
Beta Particles	50	48,520	11,261	113,298,206	screening level = 50 pCi/L [3]	4 pCi/L

Contaminant	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MCL	MRL
Combined Radium-226 & -228	53	86,594	21,972	143,336,885	5 pCi/L	1 pCi/L
Uranium	55	97,663	18,491	154,528,676	30 µg/L	1 µg/L

[1] The information presented as part of the "Nitrate (as N) (Hybrid)" entry includes sampling results for nitrate plus sampling results for total nitrate plus nitrite for systems for which there were no SYR 4 nitrate (only) data.

[2] The reduced number of systems sampling for SOC data, as compared to IOCs and VOCs, is likely influenced by monitoring waivers that some States grant for pesticides and herbicides.

[3] Although the MCL for beta particles, 4 millirem per year (mrem/yr), is in the unit of measure of mrem/yr, the primary unit of analytical measure is picocuries per liter (pCi/L). This unit of measure relates to screening thresholds of 15 pCi/L and 50 pCi/L that are defined in the 2000 Radionuclides Rule. More than 99 percent of all compliance monitoring data for beta particles submitted by the States to EPA were in units of pCi/L. The analyses presented here are based on compliance monitoring data represented in units of pCi/L and are conducted relative to the screening threshold of 50 pCi/L.

5.2 Occurrence Variability Assessment

EPA calculated aggregate measures of occurrence from data collected over a span of eight years (e.g., the percentage of systems with at least one detection greater than the MCL for a particular contaminant over the entire period). Such summary statistics do not capture temporal variability. Recognizing the potential for contaminant occurrence to vary over time, EPA conducted temporal assessments of the chemical and radionuclide compliance monitoring data in the SYR 4 ICR dataset.

To assess temporal variation in occurrence, EPA analyzed the national annual system detection rates from 2012–2019 for select contaminants. Annual detection rates were calculated as the proportion of systems with at least one detection of a given contaminant to the total number of systems that sampled for that contaminant within a given year. A Mann-Kendall test was used to evaluate trends in the annual detection rates for each contaminant analyzed. The Mann-Kendall test is a nonparametric test for a monotonic trend, which produces a test statistic (tau) and a p-value. EPA used an alpha value of 0.05 to determine significance. EPA established the null hypothesis that there is no trend in the annual detection rates for a given contaminant and an alternative hypothesis that the detection rates monotonically increase or decrease over time.

EPA used the Mann-Kendall test to assess trends in the national annual system detections rates of 15 contaminants that were chosen to prioritize frequently detected contaminants while also providing adequate representation of each regulated contaminant group (i.e., IOCs, SOCs, VOCs). The following contaminants were selected: antimony, arsenic, atrazine, barium, chromium, dalapon, di(2-ethylhexyl) phthalate, ethylbenzene, nitrate, nitrite, selenium, simazine, tetrachloroethylene, toluene, and xylenes.

The results of the Mann-Kendall tests are displayed in Exhibit 5-6. Of the 15 contaminants evaluated, 8 contaminants showed p-values less than 0.05, indicating that the associated tau values are significantly different from zero. Those eight contaminants were di(2-ethylhexyl) phthalate, nitrite, toluene, chromium, antimony (total), dalapon, tetrachloroethylene, and ethylbenzene. In each case, the tau value was negative, indicating a decrease in the national annual system detection rate over time. The identified trends are most appropriately considered

as context or background for the quantitative occurrence findings presented in Section 6 and Section 7 of this report. For the remaining seven contaminants, EPA failed to reject the null hypothesis, indicating that there is no trend in the annual detection rates over time.

Exhibit 5-6: Results of Mann-Kendall Test for Occurrence Variability

Contaminant	Median Annual Detection Rate	Tau	P-Value
Antimony	2.80%	-0.643	0.035
Arsenic	36.92%	-0.5	0.108
Atrazine	3.90%	-0.071	0.902
Barium	71.23%	0.071	0.902
Chromium	19.82%	-0.643	0.035
Dalapon	1.66%	-0.643	0.035
Di(2-Ethylhexyl)phthalate	5.05%	-0.857	0.004
Ethylbenzene	1.59%	-0.643	0.035
Nitrate	57.31%	-0.357	0.266
Nitrite	4.03%	-0.786	0.009
Selenium	13.59%	-0.429	0.174
Simazine	1.21%	-0.357	0.266
Tetrachloroethylene	1.91%	-0.643	0.035
Toluene	1.69%	-0.714	0.019
Xylenes	4.68%	0	1

5.3 Threshold Evaluations

EPA assessed the occurrence of the regulated contaminants relative to several different thresholds. Stage 1 and Stage 2 assessments of occurrence were made relative to reported "detections", identifying the simple presence or absence of a contaminant. Contaminant occurrence was also evaluated relative to multiple contaminant concentration thresholds, including a contaminant's MCL. For Stage 1 and Stage 2 assessments of occurrence relative to the MCL, the criterion is that the contaminant concentration is greater than the MCL. The Stage 1 identifies the number of systems with a single result greater than the MCL, and the Stage 2 analysis identifies the number of systems with long-term (multi-year) average concentrations greater than the MCL.

The Stage 1 and Stage 2 analyses conducted relative to the MCL do not necessarily signify actual MCL violations. Both the Stage 1 and Stage 2 analyses are based on sample detection and non-detection results from all years with data in the SYR 4 ICR dataset. The Stage 2 analysis is similar but not identical to the calculation conducted to determine an MCL violation. For most regulated drinking water contaminants, an MCL violation occurs when the concentration threshold equal to a contaminant's MCL is exceeded by the estimated system annual average concentration, based on a limited number of consecutive quarterly compliance monitoring samples (typically four samples for surface water systems and two samples for ground water

systems).[12] Non-detect results are substituted with zero. MCL violations from the sample data are not calculated in this report. In contrast, the Stage 2 analysis identifies systems with estimated long-term average concentrations that exceed the MCL, based on multiple years (not two or four consecutive quarters) of compliance monitoring samples. For Six-Year Review 4, the long-term average concentrations were calculated from eight years of data (2012 – 2019).

In accordance with the Six-Year Review 4 Protocol (USEPA, 2024d), EPA identified a set of contaminants for which an MCL revision might be feasible: the current MCL is limited by analytical capability (i.e., the MCL equals a practical quantitation limit or PQL) and there is new information indicating improved analytical capability; or the current MCL is set equal to the Maximum Contaminant Level Goal (MCLG) and a new health effects assessment indicates it is possible to revise the MCLG. For the 68 contaminants included in this report, EPA identified 30 contaminants for which alternate thresholds could be derived in addition to the MCL. Two of the 30 chemical contaminants (oxamyl and carbofuran) have acute health effects and only the Stage 1 analysis was conducted. The remaining 28 contaminants have chronic health effects and were analyzed using the Stage 2 occurrence analysis. For more details on the Stage 1 and Stage 2 analyses, refer to Section 6 and Section 7 of this report, respectively. For 23 contaminants, EPA generated occurrence estimates relative to the estimated quantitation level (EQL). The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f). For six contaminants, EPA generated occurrence estimates relative to the potential MCLG. For one contaminant, EPA generated occurrence estimates relative to the current MCLG. Occurrence analyses relative to these additional thresholds are presented in Appendix A for oxamyl and carbofuran and Appendix B for the remaining 28 contaminants for which Stage 2 analysis was warranted. Exhibit 5-7 presents the list of thresholds used to conduct the Stage 2 occurrence analysis. For more information on the new potential thresholds of concern used in the SYR 4 analyses, refer to USEPA (2024f) and USEPA (2024g).

Exhibit 5-7: List of Contaminant Thresholds Used in Stage 2 Occurrence Analysis

Contaminant	MCL (µg/L)	Alternate Threshold Type	Alternate Threshold Concentration (µg/L)
1,1,2-Trichloroethane	5	Current MCLG	3
1,2,4-Trichlorobenzene	70	EQL	0.5
1,2-Dichloroethane	5	EQL	0.5
1,2-Dichloropropane	5	EQL	0.5
2,3,7,8-TCDD (Dioxin)	0.00003	EQL	0.000005
Benzene	5	EQL	0.5
Cadmium	5	EQL	1
Carbofuran[1]	40	EQL	5
Carbon tetrachloride	5	EQL	0.5

[12] For nitrate and nitrite, if a single sample result is greater than or equal to the MCL, the system must collect a confirmation sample and average it with the original sample. If that average is greater than the MCL, then an MCL violation has occurred.

Contaminant	MCL (µg/L)	Alternate Threshold Type	Alternate Threshold Concentration (µg/L)
Chlordane	2	EQL	1
Cis-1,2-dichloroethylene	70	Potential MCLG	10
Cyanide	200	EQL	50
Dichloromethane	5	EQL	0.5
Endothall	100	EQL	50
Heptachlor	0.4	EQL	0.1
Heptachlor epoxide	0.2	EQL	0.1
Hexachlorobenzene	1	EQL	0.1
Hexachlorocyclopentadiene	50	Potential MCLG	40
Methoxychlor	40	EQL	1
Oxamyl[1]	200	Potential MCLG	9
Pentachlorophenol	1	EQL	0.9
Selenium	50	Potential MCLG	30
Styrene	100	EQL	0.5
Tetrachloroethylene	5	EQL	0.5
Thallium	2	EQL	1
Toluene	1,000	Potential MCLG	60
Toxaphene	3	EQL	1
Trichloroethylene	5	EQL	0.5
Vinyl Chloride	2	EQL	0.5
Xylenes	10,000	Potential MCLG	80

[1] Oxamyl and carbofuran have health endpoints that are associated with acute exposure; thus, the Stage 2 analysis was not appropriate. The thresholds presented in this table were used to conduct more detailed Stage 1 occurrence analyses presented in Appendix A.

6 Stage 1 Analysis

The Stage 1 occurrence analysis of the SYR 4 ICR dataset consists of simple counts and other descriptive statistics of the concentration data for each of the regulated contaminants assessed. National contaminant occurrence estimates were conducted relative to contaminant MRLs and MCLs and Section 6.1 presents the results by systems and population served. A comparison of the summary Stage 1 analysis results from the first Six-Year Review (1993–1997), the second Six-Year Review (1998–2005), the third Six-Year Review (2006–2011), and the current Six-Year Review (2012–2019) is presented in Section 6.2. A supplemental measure of occurrence based on sample point locations within each system is described in Section 6.3 with summary sample point estimates presented in Exhibit 6-4.

6.1 Summary of Stage 1 Contaminant Occurrence Findings

Several Stage 1 analyses were conducted to characterize national occurrence of regulated contaminants in public drinking water systems and are summarized in Exhibit 6-1 and Exhibit 6-2. Stage 1 analyses generated general system-level assessments of occurrence, for population served by systems, and for a preliminary assessment of potential exposure to contaminants in drinking water. Exhibit 6-1 presents the contaminants' detection frequency for a broad assessment of the rate of occurrence; Exhibit 6-2 shows occurrence measures relative to each contaminant's MCL, making a preliminary estimate of occurrence and exposure at or above a contaminant's health-based drinking water standard. The percentage of systems and population served by systems with at least one detection greater than the MCL indicates the proportion of the number of systems or the proportion of population served by systems with any analytical results exceeding the concentration value of the MCL. This does not signify an MCL violation. An MCL violation occurs when the MCL is exceeded by the average results from four consecutive quarterly confirmation samples. The Stage 1 analytical findings in Exhibit 6-1 are organized by contaminant group.

Exhibit 6-1: Summary of Stage 1 Contaminant Occurrence Findings – Systems and Population Served by Systems

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	
Inorganic Contaminants							
Antimony	51,063	3,170	6.21%	269,592,223	44,515,072	16.51%	0.069 - 6.28 µg/L
Arsenic	52,505	23,889	45.50%	278,819,817	155,655,122	55.83%	1 - 24 µg/L
Asbestos	13,772	218	1.58%	115,618,448	5,758,387	4.98%	0.16 - 45 MFL
Barium	52,488	41,093	78.29%	269,862,041	229,150,327	84.91%	4.3 - 337 µg/L
Beryllium	50,225	1,106	2.20%	267,645,012	13,550,934	5.06%	0.008 - 2.708 µg/L
Cadmium	50,989	1,790	3.51%	269,570,338	24,273,836	9.00%	0.006 - 5 µg/L
Chromium (Total)	51,357	16,268	31.68%	269,974,659	118,487,833	43.89%	0.633 - 19 µg/L
Cyanide	38,760	2,952	7.62%	237,319,733	50,197,736	21.15%	2 - 163 µg/L
Mercury (Inorganic)	50,990	1,873	3.67%	269,563,242	26,261,693	9.74%	0.026 - 1.9 µg/L
Nitrate (as N)[1]	127,904	91,652	71.66%	295,005,656	273,360,051	92.66%	70 – 9,810 µg/L
Nitrite (as N)	73,442	7,216	9.83%	242,484,551	65,560,187	27.04%	1 - 621 µg/L
Selenium	51,317	11,213	21.85%	269,659,074	104,328,765	38.69%	0.6 - 34 µg/L
Thallium	51,007	2,044	4.01%	269,580,903	27,130,704	10.06%	0.016 - 2 µg/L
Synthetic Organic Contaminants							
Alachlor	42,822	68	0.16%	257,269,487	3,262,265	1.27%	0.032 - 0.845 µg/L
Atrazine	43,763	1,536	3.51%	261,020,443	54,788,648	20.99%	0.082 - 1.5 µg/L
Benzo(a)pyrene	35,877	239	0.67%	233,903,742	12,619,361	5.40%	0.012 - 0.39 µg/L
Carbofuran	37,375	78	0.21%	228,477,652	1,970,477	0.86%	0.2 - 40 µg/L
Chlordane	38,310	146	0.38%	230,456,908	4,236,658	1.84%	0.0216 - 1.11 µg/L
Dalapon	40,062	1,111	2.77%	235,852,202	16,329,559	6.92%	0.49 - 19.422 µg/L
Di(2-ethylhexyl)adipate (DEHA)	36,369	363	1.00%	234,911,739	8,049,669	3.43%	0.034 - 4.06 µg/L
Di(2-ethylhexyl)phthalate (DEHP)	36,486	3,807	10.43%	235,935,491	60,454,978	25.62%	0.22 - 6.5 µg/L
1,2-Dibromo-3-chloropropane (DBCP)	37,153	373	1.00%	223,438,789	10,185,916	4.56%	0.013 - 0.38 µg/L

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	
2,4-Dichlorophenoxyacetic acid (2,4-D)	41,519	372	0.90%	248,130,899	24,207,344	9.76%	0.081 - 1.8 µg/L
Dinoseb	40,854	76	0.19%	240,169,022	2,089,230	0.87%	0.1 - 22.5 µg/L
Diquat	22,215	122	0.55%	156,013,584	5,400,542	3.46%	0.209 - 7.6 µg/L
Endothall	18,624	57	0.31%	141,592,258	1,536,023	1.08%	1.2 - 29.5 µg/L
Endrin	38,483	126	0.33%	236,415,830	4,388,855	1.86%	0.0021 - 0.25 µg/L
Ethylene Dibromide (EDB)	38,371	174	0.45%	229,383,985	5,515,667	2.40%	0.0094 - 0.14 µg/L
Glyphosate	21,744	59	0.27%	149,266,527	2,224,107	1.49%	2.1 - 50 µg/L
Heptachlor	38,640	61	0.16%	236,922,867	1,043,568	0.44%	0.006 - 0.11 µg/L
Heptachlor Epoxide	38,638	201	0.52%	236,924,732	2,813,909	1.19%	0.0056 - 0.13 µg/L
Hexachlorobenzene	38,311	154	0.40%	232,017,188	2,501,796	1.08%	0.0061 - 0.464 µg/L
Hexachlorocyclopentadiene	38,471	366	0.95%	236,641,628	13,102,075	5.54%	0.016 - 0.28 µg/L
Lindane (gamma-Hexachlorocyclohexane)	38,843	94	0.24%	239,389,254	1,960,944	0.82%	0.0028 - 0.1 µg/L
Methoxychlor	38,834	80	0.21%	239,380,900	2,224,755	0.93%	0.0068 - 0.464 µg/L
Oxamyl (Vydate)	37,235	60	0.16%	227,159,826	2,104,011	0.93%	0.18 - 200 µg/L
Pentachlorophenol	41,094	247	0.60%	242,338,615	4,809,210	1.98%	0.02 - 1 µg/L
Picloram	41,375	233	0.56%	248,613,745	8,885,292	3.57%	0.094 - 2.1 µg/L
Polychlorinated biphenyls (PCBs)	23,262	53	0.23%	164,024,372	951,523	0.58%	0.029 - 0.9 µg/L
Simazine	43,211	522	1.21%	257,634,524	28,883,559	11.21%	0.061 - 0.9 µg/L
Toxaphene	37,419	48	0.13%	229,216,049	3,009,955	1.31%	0.058 - 3.5 µg/L
2,3,7,8-TCDD (Dioxin)	6,222	22	0.35%	82,318,153	81,316	0.10%	0.000002 - 0.000019 µg/L
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	40,954	51	0.12%	240,257,293	2,684,000	1.12%	0.04 - 0.652 µg/L
Volatile Organic Contaminants							
Benzene	52,207	318	0.61%	274,587,312	4,960,274	1.81%	0.2 - 57 µg/L
Carbon Tetrachloride	52,205	586	1.12%	274,593,290	17,401,357	6.34%	0.5 - 6.47 µg/L
1,2-Dichlorobenzene	52,200	107	0.20%	274,592,094	1,319,145	0.48%	0.1 - 4.5 µg/L

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	
1,4-Dichlorobenzene	52,203	402	0.77%	274,592,491	3,196,679	1.16%	0.18 - 4.1 µg/L
1,2-Dichloroethane	52,209	298	0.57%	274,593,936	8,898,735	3.24%	0.5 - 2.4 µg/L
1,1-Dichloroethylene	52,206	353	0.68%	274,594,147	16,361,644	5.96%	0.52 - 11 µg/L
cis-1,2-Dichloroethylene	52,210	445	0.85%	274,594,729	19,127,631	6.97%	0.51 - 12.1 µg/L
trans-1,2-Dichloroethylene	52,194	175	0.34%	274,593,175	3,947,990	1.44%	0.25 - 5.2 µg/L
Dichloromethane	52,222	968	1.85%	274,596,487	20,992,917	7.65%	0.35 - 6.04 µg/L
1,2-Dichloropropane	52,197	189	0.36%	274,592,711	3,603,413	1.31%	0.25 - 3.5 µg/L
Ethylbenzene	52,200	1,879	3.60%	274,583,387	17,628,196	6.42%	0.21 - 7.5 µg/L
Monochlorobenzene	52,184	196	0.38%	274,581,805	5,168,430	1.88%	0.16 - 4.2 µg/L
Styrene	52,187	435	0.83%	274,581,373	4,323,101	1.57%	0.12 - 11 µg/L
Tetrachloroethylene	52,210	1,111	2.13%	274,625,445	33,450,423	12.18%	0.53 - 58 µg/L
Toluene	52,348	2,544	4.86%	274,615,844	30,315,943	11.04%	0.23 - 16 µg/L
1,2,4-Trichlorobenzene	52,201	138	0.26%	274,593,060	1,332,546	0.49%	0.0896 - 5 µg/L
1,1,1-Trichloroethane	52,207	288	0.55%	274,594,822	10,633,320	3.87%	0.5 - 10.1 µg/L
1,1,2-Trichloroethane	52,200	113	0.22%	274,593,032	2,517,275	0.92%	0.25 - 4.9 µg/L
Trichloroethylene	52,222	789	1.51%	274,596,206	29,261,117	10.66%	0.54 - 45.6 µg/L
Vinyl Chloride	52,021	176	0.34%	274,471,872	3,447,664	1.26%	0.31 - 7.2 µg/L
Xylenes (Total)	46,720	3,920	8.39%	256,321,003	38,588,960	15.05%	0.5 - 17 µg/L
Radiological Contaminants							
Alpha Particles	16,925	9,624	56.86%	135,758,067	78,091,511	57.52%	0.5 - 19.9 pCi/L
Beta Particles	11,261	6,588	58.50%	113,298,206	80,820,836	71.33%	1.36 – 18 pCi/L
Combined Radium-226 & -228	21,972	15,296	69.62%	143,336,885	102,888,456	71.78%	0.3 - 6.9 pCi/L
Uranium	18,491	8,103	43.82%	154,528,676	88,995,622	57.59%	0.484 - 44.2828 µg/L

[1] The nitrate occurrence numbers include results for total nitrate plus nitrite in cases where systems did not submit any SYR 4 nitrate results.

Exhibit 6-2: Number and Percent of Systems and Population Served by Systems with Detections Greater than the MCL Concentration

Contaminant	MCL	Systems with a Detection > MCL		Population Served with a Detection > MCL	
		Number	Percent	Number	Percent
Inorganic Contaminants					
Antimony	6 µg/L	98	0.190%	667,182	0.247%
Arsenic	10 µg/L	2,890	5.500%	25,390,571	9.106%
Asbestos	7 MFL	13	0.090%	54,990	0.048%
Barium	2,000 µg/L	77	0.150%	395,081	0.146%
Beryllium	4 µg/L	34	0.070%	198,988	0.074%
Cadmium	5 µg/L	58	0.110%	636,815	0.236%
Chromium (Total)	100 µg/L	31	0.060%	4,944,824	1.832%
Cyanide	200 µg/L	62	0.160%	1,595,086	0.672%
Mercury (Inorganic)	2 µg/L	50	0.100%	464,469	0.172%
Nitrate (as N)[1]	10,000 µg/L	3,593	2.810%	18,649,130	6.322%
Nitrite (as N)	1,000 µg/L	153	0.210%	785,186	0.324%
Selenium	50 µg/L	91	0.180%	1,078,495	0.400%
Thallium	2 µg/L	89	0.170%	1,984,054	0.736%
Synthetic Organic Contaminants					
Alachlor	2 µg/L	1	0.000%	900	0.000%
Atrazine	3 µg/L	82	0.190%	2,825,949	1.083%
Benzo(a)pyrene	0.2 µg/L	24	0.070%	228,604	0.098%
Carbofuran	40 µg/L	0	0.000%	0	0.000%
Chlordane	2 µg/L	4	0.010%	1,975	0.001%
Dalapon	200 µg/L	0	0.000%	0	0.000%
Di(2-ethylhexyl)adipate (DEHA)	400 µg/L	0	0.000%	0	0.000%
Di(2-ethylhexyl)phthalate (DEHP)	6 µg/L	314	0.860%	5,913,698	2.506%
1,2-Dibromo-3-chloropropane (DBCP)	0.2 µg/L	79	0.210%	2,348,390	1.051%
2,4-Dichlorophenoxyacetic acid	70 µg/L	1	0.000%	81,457	0.033%
Dinoseb	7 µg/L	2	0.000%	212	0.000%
Diquat	20 µg/L	3	0.010%	227	0.000%
Endothall	100 µg/L	1	0.010%	538,054	0.380%
Endrin	2 µg/L	2	0.010%	790	0.000%
Ethylene Dibromide (EDB)	0.05 µg/L	44	0.110%	1,481,515	0.646%
Glyphosate	700 µg/L	0	0.000%	0	0.000%
Heptachlor	0.4 µg/L	0	0.000%	0	0.000%
Heptachlor Epoxide	0.2 µg/L	8	0.020%	87,234	0.037%
Hexachlorobenzene	1 µg/L	3	0.010%	11,428	0.005%
Hexachlorocyclopentadiene	50 µg/L	0	0.000%	0	0.000%
Lindane (gamma-Hexachlorocyclohexane)	0.2 µg/L	1	0.000%	285	0.000%
Methoxychlor	40 µg/L	1	0.000%	22,536	0.009%
Oxamyl (Vydate)	200 µg/L	0	0.000%	0	0.000%

Contaminant	MCL	Systems with a Detection > MCL		Population Served with a Detection > MCL	
		Number	Percent	Number	Percent
Pentachlorophenol	1 µg/L	3	0.010%	265	0.000%
Picloram	500 µg/L	1	0.000%	2,388	0.001%
Polychlorinated biphenyls (PCBs)	0.5 µg/L	6	0.030%	15,913	0.010%
Simazine	4 µg/L	2	0.000%	11,806	0.005%
Toxaphene	3 µg/L	2	0.010%	335	0.000%
2,3,7,8-TCDD (Dioxin)	0.00003 µg/L	0	0.000%	0	0.000%
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	50 µg/L	0	0.000%	0	0.000%
Volatile Organic Contaminants					
Benzene	5 µg/L	35	0.070%	370,380	0.135%
Carbon Tetrachloride	5 µg/L	56	0.110%	998,765	0.364%
1,2-Dichlorobenzene	600 µg/L	0	0.000%	0	0.000%
1,4-Dichlorobenzene	75 µg/L	1	0.000%	38	0.000%
1,2-Dichloroethane	5 µg/L	27	0.050%	136,300	0.050%
1,1-Dichloroethylene	7 µg/L	40	0.080%	5,804,204	2.114%
cis-1,2-Dichloroethylene	70 µg/L	6	0.010%	181,271	0.066%
trans-1,2-Dichloroethylene	100 µg/L	0	0.000%	0	0.000%
Dichloromethane	5 µg/L	77	0.150%	409,275	0.149%
1,2-Dichloropropane	5 µg/L	6	0.010%	34,380	0.013%
Ethylbenzene	700 µg/L	1	0.000%	100	0.000%
Monochlorobenzene	100 µg/L	0	0.000%	0	0.000%
Styrene	100 µg/L	2	0.000%	485	0.000%
Tetrachloroethylene	5 µg/L	193	0.370%	11,540,789	4.202%
Toluene	1,000 µg/L	3	0.010%	286,190	0.104%
1,2,4-Trichlorobenzene	70 µg/L	0	0.000%	0	0.000%
1,1,1-Trichloroethane	200 µg/L	4	0.010%	49,180	0.018%
1,1,2-Trichloroethane	5 µg/L	5	0.010%	392,172	0.143%
Trichloroethylene	5 µg/L	137	0.260%	11,550,883	4.206%
Vinyl Chloride	2 µg/L	25	0.050%	430,250	0.157%
Xylenes (Total)	10,000 µg/L	0	0.000%	0	0.000%
Radiological Contaminants					
Alpha Particles	15 pCi/L	691	4.080%	4,377,239	3.224%
Beta Particles	50 pCi/L 3	33	0.290%	418,267	0.369%
Combined Radium-226 & -228	5 pCi/L	917	4.170%	7,417,524	5.175%
Uranium	30 µg/L	412	2.230%	9,394,098	6.079%

[1] The nitrate occurrence numbers include results for total nitrate plus nitrite in cases where systems did not submit any SYR 4 nitrate results.

6.2 Comparison of Stage 1 Analyses of Four Rounds of Six-Year Review

Exhibit 6-3 presents a comparison of contaminant occurrence estimates from the first Six-Year Review (based on compliance monitoring data from 1993–1997), the second Six-Year Review

(1998–2005), the third Six-Year Review (2006–2011), and the fourth Six-Year Review (2012–2019). Some of the contaminants assessed for the second, third, and fourth Six-Year Reviews were not assessed for the first Six-Year Review (noted in Exhibit 6-3 by a hyphen in the "Six-Year 1" columns). Eight VOCs that were assessed in the first, second, and fourth Six-Year Reviews were not assessed in the third Six-Year Review as they were evaluated as part of the Group Regulation of Carcinogenic Volatile Organic Compounds (USEPA, 2011; USEPA, 2014). The occurrence estimates from the four rounds of Six-Year Review appear to be broadly similar. However, comparisons and apparent changes in occurrence over time must be somewhat qualified by the differences between the four datasets. The first Six-Year Review dataset consisted of data from 16 States that were assembled into a "national cross-section" that was indicative, though not statistically representative, of national occurrence. In contrast, the SYR 2, SYR 3, and SYR 4 ICR datasets consist of records from 47, 54, and 59 States, respectively, that serve as a large sample that is nationally representative. Therefore, it is possible that differences in occurrence measures between the first and second or between the first and fourth Six-Year Review Stage 1 findings summarized in Exhibit 6-3 reflect differences in data collection rather than differences in actual occurrence. Nonetheless, each of the four datasets provide sound assessments of national contaminant occurrence in systems, so significant differences in occurrence estimates generated for the first, second, third, and fourth Six-Year Reviews may provide information on changes in occurrence over time. Occurrence evaluations specifically designed to assess occurrence trends over time might assess occurrence changes for a particular contaminant only in all the systems that were included in all existing Six-Year Review datasets. These temporal analyses of contaminant occurrence were not conducted for this current assessment.

Exhibit 6-3: Comparison of Stage 1 Analyses of Four Rounds of Six-Year Review – Percent of Systems with Detections

Contaminant	MCL	Systems with a Detection				Systems with a Detection > MCL			
		Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4
Inorganic Contaminants									
Antimony	6 µg/L	14.40%	5.98%	4.44%	6.21%	0.62%	0.27%	0.18%	0.19%
Arsenic[3]	10 µg/L	13.70%	37.33%	39.84%	45.50%	0.87%	0.75%	6.34%	5.50%
Asbestos	7 MFL	Not Evaluated	3.24%	3.70%	1.58%	Not Evaluated	0.17%	0.14%	0.09%
Barium	2,000 µg/L	71.20%	72.02%	73.61%	78.29%	0.17%	0.13%	0.12%	0.15%
Beryllium	4 µg/L	3.32%	3.12%	2.09%	2.20%	0.22%	0.11%	0.07%	0.07%
Cadmium	5 µg/L	17.60%	5.61%	3.61%	3.51%	0.54%	0.27%	0.12%	0.11%
Chromium (Total)	100 µg/L	18.30%	24.21%	26.90%	31.68%	0.13%	0.09%	0.04%	0.06%
Cyanide	200 µg/L	17.00%	4.14%	4.28%	7.62%	0.17%	0.14%	0.10%	0.16%
Mercury (Inorganic)	2 µg/L	17.30%	3.96%	3.18%	3.67%	0.26%	0.17%	0.10%	0.10%
Nitrate (as N)[4]	10,000 µg/L	Not Evaluated	69.94%	63.81%	71.66%	Not Evaluated	2.49%	2.28%	2.81%
Nitrite (as N)	1,000 µg/L	Not Evaluated	22.32%	11.74%	9.83%	Not Evaluated	0.74%	0.61%	0.21%
Selenium	50 µg/L	22.10%	17.28%	17.31%	21.85%	0.11%	0.13%	0.17%	0.18%
Thallium	2 µg/L	4.22%	3.49%	3.62%	4.01%	0.68%	0.26%	0.19%	0.17%
Synthetic Organic Contaminants									
Alachlor	2 µg/L	0.67%	0.33%	0.16%	0.16%	0.00%	0.02%	0.01%	0.00%
Atrazine	3 µg/L	3.83%	2.39%	2.58%	3.51%	0.68%	0.26%	0.14%	0.19%
Benzo(a)pyrene	0.2 µg/L	0.44%	0.49%	0.42%	0.67%	0.05%	0.05%	0.05%	0.07%
Carbofuran	40 µg/L	0.06%	0.14%	0.07%	0.21%	0.00%	0.00%	0.00%	0.00%
Chlordane	2 µg/L	1.19%	0.21%	0.17%	0.38%	0.01%	0.01%	0.02%	0.01%
Dalapon	200 µg/L	1.10%	1.83%	1.81%	2.77%	0.00%	0.00%	0.00%	0.00%
Di(2-ethylhexyl)adipate (DEHA)	400 µg/L	7.31%	1.75%	1.48%	1.00%	0.01%	0.01%	0.00%	0.00%
Di(2-ethylhexyl)phthalate (DEHP)	6 µg/L	12.50%	11.20%	11.92%	10.43%	2.20%	1.66%	1.04%	0.86%

Contaminant	MCL	Systems with a Detection				Systems with a Detection > MCL			
		Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4
1,2-Dibromo-3-chloropropane (DBCP)	0.2 µg/L	1.61%	1.03%	1.02%	1.00%	0.91%	0.39%	0.28%	0.21%
2,4-Dichlorophenoxyacetic acid (2,4-D)	70 µg/L	0.12%	0.90%	0.51%	0.90%	0.02%	0.00%	0.00%	0.00%
Dinoseb	7 µg/L	0.24%	0.27%	0.26%	0.19%	0.02%	0.02%	0.01%	0.01%
Diquat	20 µg/L	0.49%	0.44%	0.59%	0.55%	0.02%	0.00%	0.01%	0.01%
Endothall	100 µg/L	0.15%	0.23%	0.16%	0.31%	0.03%	0.02%	0.01%	0.01%
Endrin	2 µg/L	0.18%	0.14%	0.12%	0.33%	0.02%	0.00%	0.00%	0.01%
Ethylene Dibromide (EDB)	0.05 µg/L	1.06%	0.54%	0.41%	0.45%	0.72%	0.24%	0.11%	0.12%
Glyphosate	700 µg/L	0.10%	0.18%	0.11%	0.27%	0.00%	0.00%	0.00%	0.00%
Heptachlor	0.4 µg/L	0.08%	0.80%	0.16%	0.16%	0.01%	0.01%	0.01%	0.00%
Heptachlor Epoxide	0.2 µg/L	0.09%	0.22%	0.35%	0.52%	0.03%	0.02%	0.02%	0.02%
Hexachlorobenzene	1 µg/L	0.09%	0.34%	0.12%	0.40%	0.01%	0.01%	0.00%	0.01%
Hexachlorocyclopentadiene	50 µg/L	0.89%	0.69%	0.44%	0.95%	0.00%	0.00%	0.00%	0.00%
Lindane (gamma-Hexachlorocyclohexane)	0.2 µg/L	0.16%	0.25%	0.11%	0.24%	0.04%	0.01%	0.01%	0.00%
Methoxychlor	40 µg/L	0.19%	0.16%	0.17%	0.21%	0.01%	0.00%	0.00%	0.00%
Oxamyl (Vydate)	200 µg/L	0.08%	0.23%	0.11%	0.16%	0.00%	0.00%	0.00%	0.00%
Pentachlorophenol	1 µg/L	0.43%	0.73%	0.56%	0.60%	0.03%	0.02%	0.03%	0.01%
Picloram	500 µg/L	0.41%	0.41%	0.26%	0.56%	0.00%	0.00%	0.00%	0.00%
Polychlorinated biphenyls (PCBs)	0.5 µg/L	0.09%	0.16%	0.15%	0.23%	0.03%	0.01%	0.02%	0.03%
Simazine	4 µg/L	1.80%	0.72%	0.84%	1.21%	0.06%	0.04%	0.01%	0.01%
Toxaphene (3 µg/L)	3 µg/L	0.08%	0.13%	0.08%	0.13%	0.01%	0.02%	0.01%	0.01%
2,3,7,8-TCDD (Dioxin)	0.00003 µg/L	Not Evaluated	0.71%	0.25%	0.35%	Not Evaluated	0.04%	0.03%	0.00%
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	50 µg/L	0.40%	0.24%	0.16%	0.12%	0.00%	0.00%	0.00%	0.00%
Volatile Organic Contaminants									
Benzene	5 µg/L	1.31%	0.88%	Not Evaluated	0.61%	0.19%	0.12%	Not Evaluated	0.07%

Contaminant	MCL	Systems with a Detection				Systems with a Detection > MCL			
		Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4
Carbon Tetrachloride	5 µg/L	1.99%	1.29%	Not Evaluated	1.12%	0.20%	0.11%	Not Evaluated	0.11%
1,2-Dichlorobenzene	600 µg/L	0.61%	0.23%	0.26%	0.20%	0.00%	0.00%	0.00%	0.00%
1,4-Dichlorobenzene	75 µg/L	1.76%	1.50%	1.16%	0.77%	0.00%	0.01%	0.00%	0.00%
1,2-Dichloroethane	5 µg/L	1.31%	0.75%	Not Evaluated	0.57%	0.13%	0.07%	Not Evaluated	0.05%
1,1-Dichloroethylene	7 µg/L	1.58%	0.69%	0.68%	0.68%	0.24%	0.07%	0.05%	0.08%
cis-1,2-Dichloroethylene	70 µg/L	1.37%	0.96%	0.93%	0.85%	0.03%	0.01%	0.00%	0.01%
trans-1,2-Dichloroethylene	100 µg/L	0.53%	0.19%	0.27%	0.34%	0.00%	0.00%	0.00%	0.00%
Dichloromethane	5 µg/L	8.59%	3.90%	Not Evaluated	1.85%	0.67%	0.29%	Not Evaluated	0.15%
1,2-Dichloropropane	5 µg/L	0.67%	0.48%	Not Evaluated	0.36%	0.07%	0.02%	Not Evaluated	0.01%
Ethylbenzene	700 µg/L	3.62%	3.91%	3.13%	3.60%	0.00%	0.00%	0.00%	0.00%
Monochlorobenzene	100 µg/L	0.75%	0.27%	0.39%	0.38%	0.00%	0.00%	0.00%	0.00%
Styrene	100 µg/L	0.99%	1.05%	0.69%	0.83%	0.00%	0.01%	0.00%	0.00%
Tetrachloroethylene	5 µg/L	3.36%	2.50%	Not Evaluated	2.13%	0.78%	0.48%	Not Evaluated	0.37%
Toluene	1,000 µg/L	4.73%	5.76%	4.46%	4.86%	0.00%	0.00%	0.00%	0.01%
1,2,4-Trichlorobenzene	70 µg/L	0.61%	0.32%	0.26%	0.26%	0.00%	0.00%	0.00%	0.00%
1,1,1-Trichloroethane	200 µg/L	2.50%	1.07%	0.72%	0.55%	0.01%	0.00%	0.00%	0.01%
1,1,2-Trichloroethane	5 µg/L	0.62%	0.18%	0.21%	0.22%	0.04%	0.01%	0.01%	0.01%
Trichloroethylene	5 µg/L	2.61%	2.01%	Not Evaluated	1.51%	0.65%	0.39%	Not Evaluated	0.26%
Vinyl Chloride	2 µg/L	0.61%	0.41%	Not Evaluated	0.34%	0.11%	0.08%	Not Evaluated	0.05%
Xylenes (Total)	10,000 µg/L	4.16%	7.59%	6.35%	8.39%	0.00%	0.00%	0.00%	0.00%
Radiological Contaminants									
Alpha Particles	15 pCi/L	Not Evaluated	68.08%	61.06%	56.86%	Not Evaluated	4.58%	5.40%	4.08%
Beta Particles	50 pCi/L	Not Evaluated	74.51%	59.79%	58.50%	Not Evaluated	0.53%	0.47%	0.29%

Contaminant	MCL	Systems with a Detection				Systems with a Detection > MCL			
		Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 4
Combined Radium-226 & -228	5 pCi/L	Not Evaluated	69.97%	70.18%	69.62%	Not Evaluated	11.46%	4.99%	4.17%
Uranium	30 µg/L	Not Evaluated	69.26%	55.82%	43.82%	Not Evaluated	7.57%	4.30%	2.23%

[1] The first Six-Year Review occurrence estimate values presented in this table are from the report titled *Occurrence Estimation Methodology and Occurrence Findings for Six-Year Review of National Primary Drinking Water Regulations*. EPA Report 815-R-03-006, Office of Water (USEPA, 2003b).

[2] The second Six-Year Review occurrence estimate values presented in this table are from the report titled *The Analysis of Regulated Contaminant Occurrence Data from Public Water Systems in Support of the Second Six-Year Review of National Primary Drinking Water Regulations*. EPA Report 815-B-09-006, Office of Water (USEPA, 2010b).

[3] For SYR 3 and SYR 4, there was a different MCL for arsenic (10 µg/L) compared to the previous MCL (50 µg/L) for the SYR 1 and SYR 2.

[4] For SYR 4, the nitrate occurrence numbers include results for total nitrate plus nitrite for systems that did not submit any nitrate results.

6.3 System Sample Point Level Analysis

The Stage 1 analytical methodology is a conservative approach; occurrence measures are based on simple counts of whether a system has at least one monitoring sample identified with a contaminant detection greater than a specified concentration threshold. The approach includes another implicit conservative assumption: if a detection is found in a single-entry point to the distribution system or other formal system sample point (SP), then the entire population served by the system is assumed to have potential exposure to the detected contaminant at the system. For example, if a system serves a population of 30,000 and identified a detection of a contaminant in one of its two SPs, the primary Stage 1 analytical methodology would estimate that the entire population served by the system (population of 30,000) was potentially exposed to the maximum detected levels of the contaminant found at the one SP. In this context, SPs are defined as the authorized drinking water sample locations for compliance monitoring of regulated contaminants. SPs primarily are entry points to the distribution system, but a small number of States allow for sampling of raw, untreated ground water wells or surface water intakes as well.

In reality, many systems get water from multiple water sources, such as a mix of purchased and non-purchased water, ground water wells and surface water source intakes, among others. In systems with multiple SPs, such as multiple surface water intakes, multiple wells and/or multiple entry points to the distribution system, contaminant occurrence in one source or one SP does not necessarily mean contaminant occurrence in all sources or SPs that distribute water to consumers. Given this consideration, additional Stage 1 analyses were conducted at the SP-level to provide supplementary details of contaminant occurrence.

The SP analysis is a less conservative estimate of the population served by systems with contaminant detections. To derive this SP-level measure, an assumption was made regarding population served by individual SPs at drinking water systems. The population served by each SP and/or entry point to the distribution system is often difficult to know and is rarely, if ever, reported along with other compliance monitoring records. Therefore, EPA assumed for the analysis that the total population served by a particular system is equally distributed across all SPs at the system.[13] With this assumption, the population served all SPs with a detection of a particular contaminant is calculated by dividing the system's total population served by the number of that system's SPs with a contaminant detection. For example, if a system serves a population of 30,000 and found detections of a contaminant in one of its two SPs, then a population of 15,000 (or 30,000 ÷ 2) would be estimated to be potentially exposed to the contaminant.

The total number of entry points and/or other SPs for each system must be determined in order to calculate the proportional population potentially exposed. This was done by counting the total number of unique SPs for each system over the entire eight-year observation period. These

[13] This "proportional population" assumption is based on the idea that for every PWS, each sample point serves an equal portion of the system's total population. Depending on the distribution system and service population configurations at individual systems, this assumption may over or underestimate the population potentially exposed to contaminant occurrence at a system.

counts were done separately for each contaminant at every system. While conducting these counts, it appeared that some systems may have changed their sample point numbering conventions (i.e., their "SP identification codes" or formal sample point identification number) at some point over the eight years, which would result in a higher number of apparent SPs than the number of actual SPs. If so, this approach to sample point counting could potentially overestimate the total number of SPs for a system, thereby resulting in an underestimate of the population served by each SP.[14] Exhibit 6-4 presents a summary of the Stage 1 findings based on SPs and population served by SPs.

Exhibit 6-4: Summary of Stage 1 Contaminant Occurrence Findings – Percent Sample Points with Detections and Population Served

Contaminant	MCL	Sample Points		Population-Served by Sample Points	
		Detection	> MCL	Detection	> MCL
Inorganic Contaminants					
Antimony	6 µg/L	4.43%	0.14%	8.46%	0.04%
Arsenic	10 µg/L	42.23%	5.28%	39.21%	1.89%
Asbestos	7 MFL	1.34%	0.13%	1.50%	0.02%
Barium	2,000 µg/L	74.03%	0.10%	77.14%	0.11%
Beryllium	4 µg/L	1.61%	0.05%	2.37%	0.02%
Cadmium	5 µg/L	2.57%	0.08%	2.60%	0.03%
Chromium (Total)	100 µg/L	28.29%	0.04%	27.92%	0.10%
Cyanide	200 µg/L	5.54%	0.10%	13.62%	0.27%
Mercury (Inorganic)	2 µg/L	2.71%	0.06%	4.30%	0.02%
Nitrate (as N)[1]	10,000 µg/L	69.23%	2.55%	84.84%	1.21%
Nitrite (as N)	1,000 µg/L	7.91%	0.17%	13.92%	0.10%
Selenium	50 µg/L	18.89%	0.15%	23.62%	0.03%
Thallium	2 µg/L	2.92%	0.11%	3.89%	0.07%
Synthetic Organic Contaminants					
Alachlor	2 µg/L	0.10%	0.00%	0.81%	0.00%
Atrazine	3 µg/L	2.72%	0.11%	14.46%	0.41%
Benzo(a)pyrene	0.2 µg/L	0.43%	0.04%	1.64%	0.02%
Carbofuran	40 µg/L	0.14%	0.00%	0.18%	0.00%
Chlordane	2 µg/L	0.30%	0.01%	0.61%	0.00%
Dalapon	200 µg/L	2.03%	0.00%	3.75%	0.00%
Di(2-ethylhexyl)adipate (DEHA)	400 µg/L	0.76%	0.00%	0.86%	0.00%

[14] Another method was explored for counting the number of SPs. This other method used the maximum number of SPs that sampled in a given year as the system's "total number of SPs." This approach likely avoids the issue of changing SP numbering conventions over time. However, this method has the potential to underestimate the total number of SPs for the system and therefore overestimate the population served by each SP. For example, a system could truly have a total of three SPs but those three SPs might not all sample within the same year, so the number of actual SPs sampled over the six-year period might be underestimated. If a system is on reduced monitoring, each SP might only need to sample as often as once every three years.

Contaminant	MCL	Sample Points		Population-Served by Sample Points	
		Detection	> MCL	Detection	> MCL
Di(2-ethylhexyl)phthalate (DEHP)	6 µg/L	8.66%	0.54%	11.96%	0.29%
1,2-Dibromo-3-chloropropane (DBCP)	0.2 µg/L	1.43%	0.27%	1.35%	0.12%
2,4-Dichlorophenoxyacetic acid (2,4-D)	70 µg/L	0.61%	0.00%	4.44%	0.01%
Dinoseb	7 µg/L	0.13%	0.00%	0.21%	0.00%
Diquat	20 µg/L	0.41%	0.01%	2.09%	0.00%
Endothall	100 µg/L	0.19%	0.00%	0.36%	0.10%
Endrin	2 µg/L	0.20%	0.00%	0.31%	0.00%
Ethylene Dibromide (EDB)	0.05 µg/L	0.35%	0.08%	0.50%	0.04%
Glyphosate	700 µg/L	0.21%	0.00%	0.76%	0.00%
Heptachlor	0.4 µg/L	0.10%	0.00%	0.14%	0.00%
Heptachlor Epoxide	0.2 µg/L	0.38%	0.01%	0.27%	0.01%
Hexachlorobenzene	1 µg/L	0.32%	0.00%	0.31%	0.00%
Hexachlorocyclopentadiene	50 µg/L	0.65%	0.00%	2.18%	0.00%
Lindane (gamma-Hexachlorocyclohexane)	0.2 µg/L	0.15%	0.00%	0.21%	0.00%
Methoxychlor	40 µg/L	0.13%	0.00%	0.29%	0.00%
Oxamyl (Vydate)	200 µg/L	0.12%	0.00%	0.21%	0.00%
Pentachlorophenol	1 µg/L	0.44%	0.00%	0.63%	0.00%
Picloram	500 µg/L	0.39%	0.00%	0.66%	0.00%
Polychlorinated biphenyls (PCBs)	0.5 µg/L	0.14%	0.02%	0.24%	0.00%
Simazine	4 µg/L	0.88%	0.00%	6.55%	0.00%
Toxaphene (3 µg/L)	3 µg/L	0.08%	0.00%	0.27%	0.00%
2,3,7,8-TCDD (Dioxin)	0.00003 µg/L	0.22%	0.00%	0.09%	0.00%
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	50 µg/L	0.09%	0.00%	0.27%	0.00%
Volatile Organic Contaminants					
Benzene	5 µg/L	0.39%	0.04%	0.38%	0.03%
Carbon Tetrachloride	5 µg/L	0.82%	0.08%	1.96%	0.03%
1,2-Dichlorobenzene	600 µg/L	0.13%	0.00%	0.28%	0.00%
1,4-Dichlorobenzene	75 µg/L	0.51%	0.00%	0.60%	0.00%
1,2-Dichloroethane	5 µg/L	0.44%	0.03%	0.65%	0.01%
1,1-Dichloroethylene	7 µg/L	0.85%	0.08%	1.32%	0.22%
cis-1,2-Dichloroethylene	70 µg/L	1.09%	0.01%	1.87%	0.00%
trans-1,2-Dichloroethylene	100 µg/L	0.26%	0.00%	0.41%	0.00%
Dichloromethane	5 µg/L	1.31%	0.10%	1.79%	0.04%
1,2-Dichloropropane	5 µg/L	0.25%	0.01%	0.24%	0.00%
Ethylbenzene	700 µg/L	2.25%	0.00%	1.36%	0.00%
Monochlorobenzene	100 µg/L	0.26%	0.00%	0.69%	0.00%
Styrene	100 µg/L	0.50%	0.00%	0.02%	0.00%
Tetrachloroethylene	5 µg/L	2.85%	0.46%	3.63%	0.71%

Contaminant	MCL	Sample Points		Population-Served by Sample Points	
		Detection	> MCL	Detection	> MCL
Toluene	1,000 µg/L	3.04%	0.00%	0.27%	0.00%
1,2,4-Trichlorobenzene	70 µg/L	0.16%	0.00%	0.19%	0.00%
1,1,1-Trichloroethane	200 µg/L	0.47%	0.00%	0.52%	0.00%
1,1,2-Trichloroethane	5 µg/L	0.15%	0.01%	0.02%	0.00%
Trichloroethylene	5 µg/L	2.11%	0.45%	3.30%	1.16%
Vinyl Chloride	2 µg/L	0.22%	0.04%	0.42%	0.02%
Xylenes (Total)	10,000 µg/L	5.68%	0.00%	3.99%	0.00%
Radiological Contaminants					
Alpha Particles	15 pCi/L	52.38%	3.22%	43.05%	1.21%
Beta Particles	50 pCi/L 3	53.90%	0.18%	7.52%	0.01%
Combined Radium-226 & -228	5 pCi/L	64.21%	3.47%	55.44%	1.53%
Uranium	30 µg/L	45.11%	1.93%	3.80%	0.05%

[1] For SYR 4, the nitrate occurrence numbers include results for total nitrate plus nitrite for systems that did not submit nitrate results.

7 Stage 2 Analysis

Based on the initial review under the Fourth Six-Year Review Protocol (USEPA, 2024d), EPA determined that two chemical contaminants (lead and copper) were recently or currently are being reviewed or revised under other regulatory actions and, therefore, no further action was taken under Six-Year Review 4. The reviews for acrylamide and epiclorohydrin, and fluoride are included in USEPA (2024b) and (2024c) respectively. EPA reviewed the remaining chemical and radiological contaminants for new health effects and analytical feasibility information and 30 of the chemical contaminants evaluated in this report were identified for additional analysis. Two of the 30 chemical contaminants (oxamyl and carbofuran) have health endpoints associated with acute exposure and, therefore, did not require the Stage 2 analysis, which is most appropriate for contaminants with chronic health effects. Detailed Stage 1 analyses for oxamyl and carbofuran are included in Appendix A of this report. The remaining 28 contaminants have chronic health effects and were evaluated via the Stage 2 occurrence analysis. The 28 contaminants fall into three groups: (1) contaminants with new analytical information whose current MCL is greater than their MCLG and their MCL is equal to their PQL – benzene, carbon tetrachloride, chlordane, 1,2-dichloroethane, dichloromethane, 1,2-dichloropropane, heptachlor, heptachlor epoxide, hexachlorobenzene, pentachlorophenol, 2,3,7,8-TCDD (dioxin), tetrachloroethylene, thallium, toxaphene, 1,1,2-trichloroethane, trichloroethylene, and vinyl chloride; (2) contaminants with new health information and the potential MCLG is less than the current PQL – cadmium, cyanide, endothall, methoxychlor, styrene, and 1,2,4-trichlorobenzene; (3) contaminants with new health information and the potential MCLG is not limited by the PQL – cis-1,2-dichloroethylene, hexachlorocyclopentadiene, selenium, toluene, and xylenes (total).

The SYR 4 ICR dataset is as large and robust as the datasets used for the two prior rounds of the Six-Year Review; similar to SYR 2 and SYR 3, it was again possible for SYR 4 to use a simple analytical approach to estimate system means. System means were calculated using the simple arithmetic average of all detection and non-detection records for each system. The long-term mean from the Stage 2 analysis provides a less conservative contaminant occurrence estimate than the Stage 1 analysis, which is based on a single maximum sample result exceeding a certain contaminant threshold. As described above, the Stage 2 analysis also provides better occurrence estimates for contaminants for which chronic health effects are of concern.

In order to calculate a contaminant's arithmetic mean for each system, a numeric value was substituted for each non-detection record. This simple substitution method for the non-detections is a straight-forward and standard analysis approach with precedence in the Six-Year Review. PWSs use this approach for calculating annual, rolling, four-quarter average contaminant concentrations and can substitute zero for each sample non-detection record when generating average concentration values. For the fourth Six-Year Review, three different substitution values were applied: zero, one-half the MRL value, and the full MRL value. Since the true, but unknown, concentration of a contaminant for each non-detection is theoretically between zero and the MRL, using a substitution value of zero for each non-detection generates a lower bound estimated average, substituting the full MRL generates an upper bound estimate and substituting the one-half MRL value generates a mid-range estimate. EPA calculated three arithmetic means for each contaminant at each system using the zero, one-half MRL, and full MRL substitution values. For each of these three substitution values, system contaminant means were calculated

for all systems with data in the SYR 4 ICR dataset, then the percentage of all systems with a long-term mean concentration greater than each contaminant's MCL concentration was calculated.

7.1 Preparing the Data for the Stage 2 Analysis

As described in Section 3.3, in order to conduct the Stage 1 and Stage 2 occurrence analyses, the results for each contaminant sample must specify a "Sample Analytical Result – Value" and a "Sample Analytical Result – Sign" to indicate whether that result is a detection or a non-detection. Sample records reported as non-detections tend to be less uniform and less complete than sample records for analytical detections. Some States reported MRL or MDL data, recording it in the analytical result field and also including a "<" in a corresponding field to identify the record as a non-detection. Other States simply included a zero or negative result in the analytical result field to signify a non-detection and did not include any MRL data. The Stage 1 analyses are not affected by how non-detections are specifically recorded. However, since the Stage 2 analyses were conducted using a "simple substitution" approach that substitutes MRL values for reported analytical non-detections, non-zero MRL numeric values needed to replace all analytical results that were reported either as zero, "non-detection," "ND," etc.

A convention was established where EPA replaced any missing non-detect results with the most common modal MRL value for the State in which the system was located (derived directly from the PWS compliance monitoring data submitted to EPA in the SYR 4 ICR dataset). In some cases, though, all MRL data for a specific contaminant's data from an entire State were missing. The missing values were replaced with the national modal MRL derived as the mode of the modal MRL values for all States for that contaminant. Reported MRL values that were below the minimum MDL or greater than the national modal MRL were replaced with the national modal MRL. For complete details of the data management measures, including the methods used to identify and replace non-numeric or incorrect non-detection records, see *Data Management and Quality Assurance/Quality Control Process for the Fourth Six-Year Review Information Collection Request Dataset* (USEPA, 2024e).

7.2 Summary of Stage 2 Contaminant Occurrence Estimations

The results from the Stage 2 analyses, presented in Exhibit 7-1, reflect the percentage of systems and population served by systems, with an estimated system contaminant mean exceeding the respective MCL concentration for each contaminant over the eight-year period of data in the SYR 4 ICR dataset. The results using the zero-substitution method are shown because the calculation method is equivalent to how States are authorized to calculate system means for compliance determinations. For comparison, the Stage 1 results relative to the MCL concentration are also included. The results in Exhibit 7-1 do not necessarily indicate an MCL violation. The long-term mean in the Stage 2 analysis differs from compliance assessments that calculate a system mean concentration over four consecutive quarters. An MCL violation occurs, for example, when the MCL is exceeded at a sampling point by the average results from the consecutive samples at that sampling point.

Appendix B presents additional measures of contaminant occurrence based on the Stage 2 analysis, including numbers of systems and population served generated using the one-half MRL

and full MRL substitution values, which supplement the calculations using zero substitution values presented in Exhibit 7-1. The appendix summary tables present findings separately for ground water versus surface water and present occurrence measures that identify the total number of systems and total population served by systems with estimated contaminant means greater than the MCL concentration, as well as an alternative threshold for each contaminant. For more information on the thresholds applied in the SYR 4 Stage 2 analyses, refer to Section 5.3.

Exhibit 7-1: Comparison of Stage 1 and Stage 2 Analytical Results – Percentage of Systems and Population Served by Systems Greater than the MCL Concentration

Contaminant	MCL Concentration (µg/L)	Systems > MCL Concentration		Population Served by Systems > MCL Concentration	
		Stage 1 (one detect > MCL)[1]	Stage 2 (mean > MCL)[2]	Stage 1 (one detect > MCL)[1]	Stage 2 (mean > MCL)[2]
1,2,4-Trichlorobenzene	70	0.00%	0.00%	0.00%	0.00%
1,1,2-Trichloroethane	5	0.01%	0.00%	0.14%	0.00%
1,2-Dichloroethane	5	0.05%	0.01%	0.05%	0.00%
1,2-Dichloropropane	5	0.01%	0.00%	0.01%	0.00%
2,3,7,8-TCDD	0.00003	0.00%	0.00%	0.00%	0.00%
Barium	2,000	0.15%	0.02%	0.15%	0.00%
Benzene	5	0.07%	0.02%	0.14%	0.00%
Cadmium	5	0.11%	0.02%	0.24%	0.00%
Carbofuran	40	0.00%	N/A	0.00%	N/A
Carbon Tetrachloride	5	0.11%	0.01%	0.36%	0.00%
Chlordane	2	0.01%	0.00%	0.00%	0.00%
cis-1,2-Dichloroethylene	70	0.01%	0.00%	0.066%	0.00%
Cyanide	200	0.16%	0.02%	0.67%	0.04%
Dichloromethane	5	0.15%	0.00%	0.15%	0.00%
Endothall	100	0.01%	0.00%	0.38%	0.00%
Heptachlor	0.4	0.00%	0.00%	0.00%	0.00%
Heptachlor Epoxide	0.2	0.02%	0.00%	0.04%	0.01%
Hexachlorobenzene	1	0.01%	0.00%	0.01%	0.00%
Hexachlorocyclopentadiene	50	0.00%	0.00%	0.00%	0.00%
Methoxychlor	40	0.00%	0.00%	0.01%	0.00%
Oxamyl	200	0.00%	N/A	0.00%	N/A
Pentachlorophenol	1	0.01%	0.00%	0.00%	0.00%

Contaminant	MCL Concentration (µg/L)	Systems > MCL Concentration		Population Served by Systems > MCL Concentration	
		Stage 1 (one detect > MCL)[1]	Stage 2 (mean > MCL)[2]	Stage 1 (one detect > MCL)[1]	Stage 2 (mean > MCL)[2]
Selenium	50	0.18%	0.04%	0.40%	0.00%
Styrene	100	0.00%	0.00%	0.000%	0.00%
Tetrachloroethylene	5	0.37%	0.05%	4.20%	0.33%
Thallium	2	0.17%	0.03%	0.74%	0.00%
Toluene	1,000	0.01%	0.00%	0.10%	0.00%
Toxaphene	3	0.01%	0.00%	0.00%	0.00%
Trichloroethylene	5	0.26%	0.04%	4.21%	0.27%
Vinyl Chloride	2	0.05%	0.00%	0.16%	0.00%
Xylenes	10,000	0.00%	0.00%	0.00%	0.00%

[1] The Stage 1 results represent the percent of systems with at least one sample analytical result greater than a contaminant's MCL concentration.

[2] The Stage 2 results represent the percent of systems with an estimated long-term mean concentration greater than a contaminant's MCL concentration. The Stage 2 results presented here are based on long-term means generated by substituting zero for each non-detection record. For the Stage 2 results based on substituting the value of the full MRL or one-half MRL, instead of zero, please refer to Appendix B.

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Appendices

APPENDIX A. Background Information and Detailed Stage 1 Analysis Occurrence Measures for Two Select Regulated Chemical Contaminants

APPENDIX B. Background Information and Detailed Stage 2 Analysis Occurrence Measures for 28 Select Regulated Chemical Contaminants

A Background Information and Detailed Stage 1 Analysis Occurrence Measures for Two Select Regulated Chemical Contaminants

A.1 Carbofuran

This chapter on carbofuran includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

A.1.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for carbofuran on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 40 µg/L. EPA based the MCLG on a reference dose (RfD) of 5 µg/kg-day (0.005 mg/kg-day) and a cancer classification of E, evidence of non-carcinogenicity for humans.

Carbofuran is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[1] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

[1] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

A.1.2 Occurrence in Drinking Water

The analysis of carbofuran occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 176,608 analytical results from 37,375 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Carbofuran has health endpoints associated with acute exposure and, therefore, did not require the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6. For carbofuran, EPA generated additional Stage 1 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 1 Occurrence Estimates

Stage 1 analyses for carbofuran are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 40 µg/L (MCL) and 5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[2] For more information on the potential thresholds of concern used in the SYR 4 analyses for carbofuran, refer to USEPA (2024f) and (2024g).

Exhibit A-1 presents the system-level Stage 1 analysis of carbofuran occurrence in drinking water. Exhibit A-2 presents similar information based on population served by the systems. Based on the Stage 1 analysis, no system had any detection greater than the MCL of 40 µg/L. Seven systems, serving 49,409 people, had at least 1 detection greater than the EQL of 5 µg/L.

[2] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 1 analyses.

Exhibit A-1: Carbofuran Stage 1 Analysis – Summary of Systems with a Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with a Detection Greater than the Threshold	Percent of Systems with a Detection Greater than the Threshold
Ground Water	> MCL (40 µg/L)	33,949	0	0.00%
	> EQL (5 µg/L)		6	0.02%
Surface Water	> MCL (40 µg/L)	3,426	0	0.00%
	> EQL (5 µg/L)		1	0.03%
Combined Ground & Surface Water	> MCL (40 µg/L)	37,375	0	0.00%
	> EQL (5 µg/L)		7	0.02%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit A-2: Carbofuran Stage 1 Analysis – Summary of Population Served by Systems with a Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with a Detection Greater than the Threshold	Percent of Population Served by Systems with a Detection Greater than the Threshold
Ground Water	> MCL (40 µg/L)	89,098,325	0	0.00%
	> EQL (5 µg/L)		16,299	0.02%
Surface Water	> MCL (40 µg/L)	139,379,327	0	0.00%
	> EQL (5 µg/L)		33,110	0.02%
Combined Ground & Surface Water	> MCL (40 µg/L)	228,477,652	0	0.00%
	> EQL (5 µg/L)		49,409	0.02%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for carbofuran were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for carbofuran. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit A-3 presents the total number of systems in each State that submitted data for carbofuran. In addition, the geographic distribution of carbofuran occurrence in drinking water is illustrated by showing States with systems with at least one detection greater than the EQL and MCL. Exhibit A-4 presents similar information based on the population served by the systems. No system had a detection greater than the MCL of 40 µg/L. Seven systems in 5 States, serving 49,409 people, had at least one detection greater than the EQL of 5 µg/L.

Exhibit A-3: Carbofuran Stage 1 Analysis – Summary of Systems with Threshold Exceedances by State[1]

State	Total Number of Systems	Systems with a Detection > 40 µg/L		Systems with a Detection > 5 µg/L	
		Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,706	-	0.00%	1	0.06%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	243	-	0.00%	1	0.41%
FL	2,208	-	0.00%	1	0.05%
HI	117	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%
ID	569	-	0.00%	-	0.00%
IL	1,148	-	0.00%	-	0.00%
IN	1,299	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,045	-	0.00%	-	0.00%
MA	696	-	0.00%	-	0.00%
MD	920	-	0.00%	-	0.00%
ME	188	-	0.00%	-	0.00%
MN	891	-	0.00%	-	0.00%
MO	1,366	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%
MT	902	-	0.00%	2	0.22%
NC	2,043	-	0.00%	-	0.00%
ND	8	-	0.00%	-	0.00%
NE	645	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%
NJ	39	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%
NY	2,119	-	0.00%	2	0.09%
OH	115	-	0.00%	-	0.00%
OK	119	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Detection > 40 µg/L		Systems with a Detection > 5 µg/L	
		Number	Percent	Number	Percent
PA	2,981	-	0.00%	-	0.00%
RI	96	-	0.00%	-	0.00%
SC	446	-	0.00%	-	0.00%
TN	2	-	0.00%	-	0.00%
TX	4,536	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%
VA	242	-	0.00%	-	0.00%
VT	280	-	0.00%	-	0.00%
WA	139	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	94	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	7	-	0.00%	-	0.00%
Region 08 tribes	83	-	0.00%	-	0.00%
Region 09 tribes	155	-	0.00%	-	0.00%
Region 10 tribes	83	-	0.00%	-	0.00%
Total	**37,375**	**-**	**0.00%**	**7**	**0.02%**

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit A-4: Carbofuran Stage 1 Analysis – Summary of Population Served by Systems with Threshold Exceedances by State[1]

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 40 µg/L		Population Served by Systems with a Detection > 5 µg/L	
		Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,383,398	-	0.00%	100	<0.01%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 40 µg/L		Population Served by Systems with a Detection > 5 µg/L	
		Number	Percent	Number	Percent
DE	883,220	-	0.00%	7,035	0.80%
FL	19,905,842	-	0.00%	2,109	0.01%
HI	1,519,531	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%
ID	1,242,087	-	0.00%	-	0.00%
IL	9,288,377	-	0.00%	-	0.00%
IN	5,266,171	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,228	-	0.00%	-	0.00%
MA	9,589,805	-	0.00%	-	0.00%
MD	5,486,421	-	0.00%	-	0.00%
ME	344,671	-	0.00%	-	0.00%
MN	4,096,761	-	0.00%	-	0.00%
MO	5,259,875	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%
MT	862,515	-	0.00%	40,101	4.65%
NC	8,504,894	-	0.00%	-	0.00%
ND	86,079	-	0.00%	-	0.00%
NE	1,609,528	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%
NJ	692,198	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%
NV	2,858,446	-	0.00%	-	0.00%
NY	10,035,860	-	0.00%	64	<0.01%
OH	2,211,656	-	0.00%	-	0.00%
OK	1,516,137	-	0.00%	-	0.00%
OR	3,537,703	-	0.00%	-	0.00%
PA	11,677,477	-	0.00%	-	0.00%
RI	1,050,183	-	0.00%	-	0.00%
SC	3,874,273	-	0.00%	-	0.00%
TN	258,680	-	0.00%	-	0.00%
TX	27,190,604	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,746,085	-	0.00%	-	0.00%
VT	364,024	-	0.00%	-	0.00%
WA	1,894,123	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 40 µg/L		Population Served by Systems with a Detection > 5 µg/L	
		Number	Percent	Number	Percent
WY	508,737	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	130,767	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	13,346	-	0.00%	-	0.00%
Region 08 tribes	128,933	-	0.00%	-	0.00%
Region 09 tribes	338,857	-	0.00%	-	0.00%
Region 10 tribes	72,832	-	0.00%	-	0.00%
Total	228,477,652	-	0.00%	49,409	0.02%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

A.1.3 Summary of Data

A total of 176,608 analytical results from 37,375 PWSs in 58 States were available in the SYR 4 ICR dataset for carbofuran. The Stage 1 analysis of occurrence in drinking water indicated that no system had a detection greater than the MCL of 40 µg/L. Seven systems (6 ground water systems and 1 surface water system in 5 States, serving 49,409 people, had at least 1 detection greater than the EQL of 5 µg/L.

A.2 Oxamyl

This chapter on oxamyl includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

A.2.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for oxamyl on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 200 µg/L. EPA based the MCLG on a reference dose (RfD) of 25 µg/kg-day (0.025 mg/kg-day) and a cancer classification of E, evidence of non-carcinogenicity for humans.

Oxamyl is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[3] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

[3] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

A.2.2 Occurrence in Drinking Water

The analysis of oxamyl occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 175,728 analytical results from 37,235 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Oxamyl has health endpoints associated with acute exposure and, therefore, did not require the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6. For oxamyl, since there were no analytical method limitations at the potential MCLG, EPA generated additional Stage 1 occurrence estimates relative to the MCL and the potential MCLG.

Stage 1 Occurrence Estimates

Stage 1 analyses for oxamyl are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 200 µg/L (MCL) and 9 µg/L (potential MCLG). The potential MCLG reflects a change in the RfD based on new health effects information.[4] For more information on the new potential thresholds of concern used in the SYR 4 analyses, refer to USEPA (2024f) and (2024g).

Exhibit A-5 presents the system-level estimates for oxamyl occurrence in drinking water. Exhibit A-6 presents similar information based on population served by the systems. Based on the Stage 1 analysis, no system had a detection greater than the MCL of 200 µg/L. Seven systems, serving 52,677 people, had at least one detection greater than the potential MCLG of 9 µg/L.

[4] The MCLG for oxamyl can be derived using a normalized drinking water intake per unit body weight from birth to less than six years at the 90th percentile of 60.9 mL/kg-day (calculated using https://fcid.foodrisk.org/percentiles) and a relative source contribution of 100 percent as follows: (0.0026 mg/kg/day / 0.0609 L/kg-day) x 1 = 0.009 mg/L = 9 µg/L.

Exhibit A-5: Oxamyl Stage 1 Analysis – Summary of Systems with a Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with a Detection Greater than the Threshold	Percent of Systems with a Detection Greater than the Threshold
Ground Water	> MCL (200 µg/L)	33,889	0	0.00%
	> Potential MCLG (9 µg/L)		6	0.02%
Surface Water	> MCL (200 µg/L)	3,346	0	0.00%
	> Potential MCLG (9 µg/L)		1	0.03%
Combined Ground & Surface Water	> MCL (200 µg/L)	37,235	0	0.00%
	> Potential MCLG (9 µg/L)		7	0.02%

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit A-6: Oxamyl Stage 1 Analysis – Summary of Population Served by Systems with a Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with a Detection Greater than the Threshold	Percent of Population Served by Systems with a Detection Greater than the Threshold
Ground Water	> MCL (200 µg/L)	88,986,900	0	0.00%
	> Potential MCLG (9 µg/L)		19,567	0.02%
Surface Water	> MCL (200 µg/L)	138,172,926	0	0.00%
	> Potential MCLG (9 µg/L)		33,110	0.02%
Combined Ground & Surface Water	> MCL (200 µg/L)	227,159,826	0	0.00%
	> Potential MCLG (9 µg/L)		52,677	0.02%

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for oxamyl were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for oxamyl. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit A-7 presents the total number of systems in each State that submitted data for oxamyl. In addition, the geographic distribution of oxamyl occurrence in drinking water is illustrated by

showing States with systems with at least one detection greater than the MCL and potential MCLGs. Exhibit A-8 presents similar information based on the population served by the systems. No system had a detection greater than the MCL of 200 µg/L. Seven systems in 6 States, serving 52,677 people, had at least one detection greater than the potential MCLG of 9 µg/L.

Exhibit A-7: Oxamyl Stage 1 Analysis – Summary of Systems with Threshold Exceedances by State[1]

State	Total Number of Systems	Systems with a Detection > 200 µg/L		Systems with a Detection > 9 µg/L	
		Number	Percent	Number	Percent
AK	72	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,690	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	243	-	0.00%	1	0.41%
FL	2,208	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%
ID	570	-	0.00%	-	0.00%
IL	1,147	-	0.00%	-	0.00%
IN	1,299	-	0.00%	-	0.00%
KS	3	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,045	-	0.00%	-	0.00%
MA	696	-	0.00%	-	0.00%
MD	913	-	0.00%	-	0.00%
ME	192	-	0.00%	-	0.00%
MN	891	-	0.00%	1	0.11%
MO	1,366	-	0.00%	-	0.00%
MP	27	-	0.00%	-	0.00%
MT	902	-	0.00%	2	0.22%
NC	2,043	-	0.00%	-	0.00%
ND	8	-	0.00%	-	0.00%
NE	645	-	0.00%	1	0.16%
NH	1,073	-	0.00%	-	0.00%
NJ	39	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%
NY	2,111	-	0.00%	1	0.05%
OH	115	-	0.00%	-	0.00%
OK	115	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%
PA	2,980	-	0.00%	1	0.03%
RI	96	-	0.00%	-	0.00%
SC	446	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Detection > 200 µg/L		Systems with a Detection > 9 µg/L	
		Number	Percent	Number	Percent
TN	2	-	0.00%	-	0.00%
TX	4,536	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%
VA	242	-	0.00%	-	0.00%
VT	280	-	0.00%	-	0.00%
WA	139	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	93	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	6	-	0.00%	-	0.00%
Region 08 tribes	83	-	0.00%	-	0.00%
Region 09 tribes	155	-	0.00%	-	0.00%
Region 10 tribes	83	-	0.00%	-	0.00%
Total	**37,235**	**-**	**0.00%**	**7**	**0.02%**

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit A-8: Oxamyl Stage 1 Analysis – Summary of Population Served by Systems with Threshold Exceedances by State[1]

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 200 µg/L		Population Served by Systems with a Detection > 9 µg/L	
		Number	Percent	Number	Percent
AK	80,683	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,387,902	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	883,220	-	0.00%	7,035	0.80%
FL	19,905,842	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%
ID	1,242,641	-	0.00%	-	0.00%
IL	9,287,977	-	0.00%	-	0.00%

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 200 µg/L		Population Served by Systems with a Detection > 9 µg/L	
		Number	Percent	Number	Percent
IN	5,266,171	-	0.00%	-	0.00%
KS	760,270	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,228	-	0.00%	-	0.00%
MA	9,589,805	-	0.00%	-	0.00%
MD	5,483,592	-	0.00%	-	0.00%
ME	344,893	-	0.00%	-	0.00%
MN	4,096,761	-	0.00%	5,334	0.13%
MO	5,259,875	-	0.00%	-	0.00%
MP	68,690	-	0.00%	-	0.00%
MT	862,515	-	0.00%	40,101	4.65%
NC	8,504,894	-	0.00%	-	0.00%
ND	86,079	-	0.00%	-	0.00%
NE	1,609,528	-	0.00%	120	0.01%
NH	948,090	-	0.00%	-	0.00%
NJ	692,198	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%
NV	2,858,446	-	0.00%	-	0.00%
NY	10,033,959	-	0.00%	25	<0.01%
OH	2,211,656	-	0.00%	-	0.00%
OK	1,509,463	-	0.00%	-	0.00%
OR	3,537,703	-	0.00%	-	0.00%
PA	11,676,627	-	0.00%	62	<0.01%
RI	1,050,183	-	0.00%	-	0.00%
SC	3,874,273	-	0.00%	-	0.00%
TN	258,680	-	0.00%	-	0.00%
TX	27,190,604	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,746,085	-	0.00%	-	0.00%
VT	364,024	-	0.00%	-	0.00%
WA	1,894,123	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	128,127	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%

State	Total Population Served by Systems with Data	Population Served by Systems with a Detection > 200 µg/L		Population Served by Systems with a Detection > 9 µg/L	
		Number	Percent	Number	Percent
Region 07 tribes	11,917	-	0.00%	-	0.00%
Region 08 tribes	128,933	-	0.00%	-	0.00%
Region 09 tribes	338,857	-	0.00%	-	0.00%
Region 10 tribes	72,832	-	0.00%	-	0.00%
Total	**227,159,826**	**-**	**0.00%**	**52,677**	**0.02%**

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

A.2.3 Summary of Data

A total of 175,728 analytical results from 37,235 PWSs in 58 States were available in the SYR 4 ICR dataset for oxamyl. The Stage 1 analysis of occurrence in drinking water indicated that no system had a detection greater than the MCL of 200 µg/L. Six water systems (5 ground water, 1 surface water) in 5 States, serving a total of 47,343 people, had at least one detection greater than the potential MCLG of 20 µg/L. Seven water systems (6 ground water, 1 surface water) in 6 States, serving a total of 52,677 people, had at least one detection greater than the potential MCLG of 9 µg/L.

B Background Information and Detailed Stage 2 Analysis Occurrence Measures for 28 Select Regulated Chemical Contaminants

B.1 Benzene

This chapter on benzene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.1.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for benzene on July 8, 1987 (52 FR 25690; USEPA, 1987). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of A, known human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

Benzene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[5] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.1.2 Occurrence in Drinking Water

The analysis of benzene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 487,631 analytical results from 52,207 public water systems (PWSs) during the period from 2012 to

[5] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including benzene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for benzene in the dataset is 0.5 µg/L. Three arithmetic mean benzene concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with benzene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For benzene, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for benzene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[6] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

[6] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-1 presents the system-level Stage 2 analysis of estimated mean concentrations for benzene occurrence in drinking water. Exhibit B-2 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, 9 systems (0.02 percent of all systems), serving 2,455 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 83 water systems (0.16 percent of all systems), serving 319,633 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-1: Benzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,686	9	9	9	0.02%	0.02%	0.02%
	> ½ MCL (2.5 µg/L)		19	18	17	0.04%	0.04%	0.04%
	> 2× EQL (1 ug/L)		45	40	37	0.09%	0.08%	0.08%
	> EQL (0.5 ug/L)		164	80	66	0.34%	0.17%	0.14%
Surface Water	> MCL (5 µg/L)	4,521	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		1	1	1	0.02%	0.02%	0.02%
	> 2× EQL (1 ug/L)		2	2	2	0.04%	0.04%	0.04%
	> EQL (0.5 ug/L)		11	3	3	0.24%	0.07%	0.07%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,207	9	9	9	0.02%	0.02%	0.02%
	> ½ MCL (2.5 µg/L)		20	19	18	0.04%	0.04%	0.03%
	> 2× EQL (1 ug/L)		47	42	39	0.09%	0.08%	0.07%
	> EQL (0.5 ug/L)		175	83	69	0.34%	0.16%	0.13%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-2: Benzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,100,852	2,455	2,455	2,455	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		3,646	3,621	3,521	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 ug/L)		173,152	32,852	32,527	0.16%	0.03%	0.03%
	> EQL (0.5 ug/L)		1,322,283	307,445	190,446	1.19%	0.28%	0.17%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 ug/L)		10,328	10,328	10,328	0.01%	0.01%	0.01%
	> EQL (0.5 ug/L)		1,602,426	12,188	12,188	0.98%	0.01%	0.01%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> MCL (5 µg/L)	274,587,312	2,455	2,455	2,455	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		3,646	3,621	3,521	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 ug/L)		183,480	43,180	42,855	0.07%	0.02%	0.02%
	> EQL (0.5 ug/L)		2,924,709	319,633	202,634	1.07%	0.12%	0.07%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for benzene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for benzene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-3 presents the total number of systems in each State that submitted data for benzene. In addition, the geographic distribution of benzene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-4 presents similar information based on the population served by the systems. Exhibit B-3 and Exhibit B-4 present only the ½ MRL substitution results. Nine systems in 7 States, serving 2,455 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 83 systems in 31 States, serving 319,633 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-3: Benzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	589	-	0.00%	-	0.00%	-	0.00%	1	0.17%
AL	373	-	0.00%	-	0.00%	-	0.00%	1	0.27%
AR	420	-	0.00%	-	0.00%	1	0.24%	1	0.24%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	4,165	2	0.05%	2	0.05%	3	0.07%	6	0.14%
CO	899	-	0.00%	-	0.00%	-	0.00%	1	0.11%
CT	980	-	0.00%	-	0.00%	1	0.10%	1	0.10%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	303	-	0.00%	-	0.00%	1	0.33%	1	0.33%
FL	2,240	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
IA	954	1	0.10%	1	0.10%	1	0.10%	2	0.21%
ID	915	-	0.00%	-	0.00%	-	0.00%	1	0.11%
IL	1,489	-	0.00%	-	0.00%	-	0.00%	1	0.07%
IN	1,312	1	0.08%	1	0.08%	1	0.08%	1	0.08%
KS	564	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	939	-	0.00%	-	0.00%	-	0.00%	1	0.11%
ME	805	1	0.12%	1	0.12%	2	0.25%	4	0.50%
MN	1,344	-	0.00%	-	0.00%	1	0.07%	1	0.07%
MO	1,393	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	1	0.11%
NC	2,044	-	0.00%	-	0.00%	2	0.10%	3	0.15%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%	-	0.00%	1	0.09%
NJ	1,300	-	0.00%	-	0.00%	1	0.08%	3	0.23%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,576	2	0.08%	7	0.27%	10	0.39%	16	0.62%
OH	1,675	-	0.00%	-	0.00%	1	0.06%	2	0.12%
OK	655	-	0.00%	1	0.15%	1	0.15%	2	0.31%
OR	1,156	-	0.00%	-	0.00%	1	0.09%	1	0.09%
PA	3,044	-	0.00%	-	0.00%	1	0.03%	2	0.07%
RI	142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%	1	0.20%
TN	368	-	0.00%	-	0.00%	-	0.00%	1	0.27%
TX	4,530	-	0.00%	1	0.02%	8	0.18%	15	0.33%
UT	490	-	0.00%	-	0.00%	-	0.00%	2	0.41%
VA	1,500	1	0.07%	4	0.27%	5	0.33%	5	0.33%
VT	604	-	0.00%	-	0.00%	-	0.00%	2	0.33%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	2,075	1	0.05%	1	0.05%	1	0.05%	2	0.10%
WV	314	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%	1	0.32%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,207**	**9**	**0.02%**	**19**	**0.04%**	**42**	**0.08%**	**83**	**0.16%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-4: Benzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,133	-	0.00%	-	0.00%	-	0.00%	108	0.01%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%	92,361	1.62%
AR	2,441,580	-	0.00%	-	0.00%	265	0.01%	265	0.01%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	38,534,495	1,570	<0.01%	1,570	<0.01%	13,243	0.03%	47,993	0.12%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%	8,731	0.13%
CT	2,876,884	-	0.00%	-	0.00%	42	<0.01%	42	<0.01%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	958,004	-	0.00%	-	0.00%	800	0.08%	800	0.08%
FL	20,279,328	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	2,852,475	28	<0.01%	28	<0.01%	28	<0.01%	813	0.03%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%	40	<0.01%
IL	9,808,699	-	0.00%	-	0.00%	-	0.00%	2,770	0.03%
IN	5,256,413	475	0.01%	475	0.01%	475	0.01%	475	0.01%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
MD	5,484,983	-	0.00%	-	0.00%	-	0.00%	90	0.00%
ME	748,497	42	0.01%	42	0.01%	266	0.04%	565	0.08%
MN	4,519,439	-	0.00%	-	0.00%	10,328	0.23%	10,328	0.23%
MO	5,286,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%	225	0.03%
NC	8,502,462	-	0.00%	-	0.00%	433	0.01%	920	0.01%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%	-	0.00%	1,688	0.18%
NJ	9,012,096	-	0.00%	-	0.00%	809	0.01%	1,424	0.02%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,185,889	51	<0.01%	932	0.01%	1,178	0.01%	2,187	0.02%
OH	10,243,847	-	0.00%	-	0.00%	200	<0.01%	250	<0.01%
OK	3,660,453	-	0.00%	135	<0.01%	135	<0.01%	1,975	0.05%
OR	3,539,744	-	0.00%	-	0.00%	100	<0.01%	100	<0.01%
PA	11,892,191	-	0.00%	-	0.00%	75	<0.01%	574	<0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	75	<0.01%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	95,501	1.33%
TX	27,188,946	-	0.00%	-	0.00%	14,244	0.05%	37,022	0.14%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%	2,260	0.05%
VA	7,067,153	108	<0.01%	258	<0.01%	378	0.01%	378	0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	845	0.17%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	4,017,600	181	<0.01%	181	<0.01%	181	<0.01%	678	0.02%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%	8,150	1.60%
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,587,312**	**2,455**	**<0.01%**	**3,621**	**<0.01%**	**43,180**	**0.02%**	**319,633**	**0.12%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.1.3 Summary of Data

A total of 487,631 analytical results from 52,207 PWSs in 58 States were available in the SYR 4 ICR dataset for benzene. The Stage 2 analysis of occurrence in drinking water indicated that 9 ground water systems, serving 2,455 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 83 water systems (80 ground water, 3 surface water) in 31 States, serving 319,633 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

B.2 Cadmium

This chapter on cadmium includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.2.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for cadmium on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 0.005 mg/L. Because of inadequate dose response data to determine whether it poses a carcinogenic hazard from oral exposure, the agency regulated cadmium as a Group D carcinogen, not classifiable as to human carcinogenicity by the oral route of exposure. Therefore, EPA developed the MCLG for cadmium based on the reference dose (RfD) of 0.0005 mg/kg-day.

Cadmium is regulated as an inorganic contaminant (IOC) in drinking water. All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for the IOCs. The maximum waiver period for IOCs is one compliance cycle. During this cycle, the system must sample at least once.

Ground water systems must sample once during the initial three-year compliance period. After three compliance periods without a detection, a ground water system may be granted a nine-year waiver. Surface water systems must sample annually during the initial three-year compliance period. After three annual samples without a detection, a surface water system may be granted a nine-year waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[7] If all quarterly samples are below the MCL, the system may continue at initial monitoring indefinitely until the State or EPA establishes an alternate schedule.

B.2.2 Occurrence in Drinking Water

The analysis of cadmium occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 230,098 analytical results from 50,989 PWSs during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

[7] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including cadmium, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for cadmium in the dataset is 1 µg/L. Three arithmetic mean cadmium concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with cadmium data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For cadmium, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for cadmium are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 2 µg/L (2× EQL), and 1 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[8] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-5 presents the system-level Stage 2 analysis of estimated mean concentrations for cadmium occurrence in drinking water. Exhibit B-6 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement,

[8] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

12 systems (0.02 percent of all systems), serving 2,212 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 182 water systems (0.36 percent of all systems), serving 430,823 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-5: Cadmium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	46,684	12	12	10	0.03%	0.03%	0.02%
	> ½ MCL (2.5 µg/L)		42	39	35	0.09%	0.08%	0.07%
	> 2× EQL (2 µg/L)		63	54	47	0.13%	0.12%	0.10%
	> EQL (1 µg/L)		328	177	124	0.70%	0.38%	0.27%
Surface Water	> MCL (5 µg/L)	4,305	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		1	0	0	0.02%	0.00%	0.00%
	> 2× EQL (2 µg/L)		2	2	2	0.05%	0.05%	0.05%
	> EQL (1 µg/L)		35	5	2	0.81%	0.12%	0.05%
Combined Ground & Surface Water	> MCL (5 µg/L)	50,989	12	12	10	0.02%	0.02%	0.02%
	> ½ MCL (2.5 µg/L)		43	39	35	0.08%	0.08%	0.07%
	> 2× EQL (2 µg/L)		65	56	49	0.13%	0.11%	0.10%
	> EQL (1 µg/L)		363	182	126	0.71%	0.36%	0.25%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-6: Cadmium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	109,867,270	2,212	2,212	1,462	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		24,230	14,294	13,398	0.02%	0.01%	0.01%
	> 2× EQL (2 µg/L)		34,928	28,110	16,088	0.03%	0.03%	0.01%
	> EQL (1 µg/L)		3,171,187	425,518	396,247	2.89%	0.39%	0.36%
Surface Water	> MCL (5 µg/L)	159,703,068	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		3,105	0	0	<0.01%	0.00%	0.00%
	> 2× EQL (2 µg/L)		4,605	4,605	4,605	<0.01%	<0.01%	<0.01%
	> EQL (1 µg/L)		5,444,730	5,305	4,605	3.41%	<0.01%	<0.01%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> MCL (5 µg/L)	269,570,338	2,212	2,212	1,462	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		27,335	14,294	13,398	0.01%	0.01%	<0.01%
	> 2× EQL (2 µg/L)		39,533	32,715	20,693	0.01%	0.01%	0.01%
	> EQL (1 µg/L)		8,615,917	430,823	400,852	3.20%	0.16%	0.15%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for cadmium were available from 59 States. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-7 presents the total number of systems in each State that submitted data for cadmium. In addition, the geographic distribution of cadmium occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-8 presents similar information based on the population served by the systems. Exhibit B-7 and Exhibit B-8 present only the ½ MRL substitution results. Twelve systems in 8 States, serving 2,212 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 182 systems in 34 States, serving 430,823 people had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-7: Cadmium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	453	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	371	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	824	1	0.12%	2	0.24%	4	0.49%	5	0.61%
CA	4,220	4	0.09%	11	0.26%	19	0.45%	57	1.35%
CO	892	-	0.00%	-	0.00%	1	0.11%	3	0.34%
CT	959	-	0.00%	1	0.10%	1	0.10%	6	0.63%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	254	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	2,243	1	0.04%	2	0.09%	2	0.09%	6	0.27%
HI	117	-	0.00%	-	0.00%	-	0.00%	1	0.85%
IA	893	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	926	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
IL	1,440	-	0.00%	-	0.00%	1	0.07%	3	0.21%
IN	1,313	-	0.00%	2	0.15%	2	0.15%	4	0.30%
KS	564	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	2	0.95%
LA	1,047	-	0.00%	1	0.10%	1	0.10%	3	0.29%
MA	575	-	0.00%	-	0.00%	-	0.00%	2	0.35%
MD	953	-	0.00%	1	0.10%	1	0.10%	8	0.84%
ME	801	-	0.00%	-	0.00%	-	0.00%	1	0.12%
MN	1,220	-	0.00%	-	0.00%	-	0.00%	2	0.16%
MO	1,397	-	0.00%	2	0.14%	2	0.14%	6	0.43%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	828	-	0.00%	-	0.00%	-	0.00%	1	0.12%
NC	2,038	-	0.00%	-	0.00%	-	0.00%	1	0.05%
ND	128	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	657	1	0.15%	1	0.15%	2	0.30%	2	0.30%
NH	1,077	-	0.00%	-	0.00%	-	0.00%	4	0.37%
NJ	1,305	-	0.00%	-	0.00%	-	0.00%	2	0.15%
NN	138	-	0.00%	-	0.00%	1	0.72%	1	0.72%
NV	288	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,524	1	0.04%	3	0.12%	3	0.12%	14	0.55%
OH	1,665	1	0.06%	2	0.12%	2	0.12%	5	0.30%
OK	621	-	0.00%	-	0.00%	1	0.16%	1	0.16%
OR	1,050	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	3,017	2	0.07%	3	0.10%	3	0.10%	11	0.36%
RI	142	-	0.00%	-	0.00%	-	0.00%	2	1.41%
SC	499	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SD	240	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	101	-	0.00%	1	0.99%	1	0.99%	1	0.99%
TX	4,536	-	0.00%	2	0.04%	2	0.04%	2	0.04%
UT	489	-	0.00%	-	0.00%	1	0.20%	2	0.41%
VA	1,485	-	0.00%	1	0.07%	2	0.13%	3	0.20%
VT	513	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,263	-	0.00%	2	0.09%	2	0.09%	7	0.31%
WI	2,061	-	0.00%	1	0.05%	1	0.05%	12	0.58%
WV	313	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%	1	0.32%
Region 01 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	102	1	0.98%	1	0.98%	1	0.98%	1	0.98%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
Region 06 tribes	57	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	80	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	200	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	96	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**50,989**	**12**	**0.02%**	**39**	**0.08%**	**56**	**0.11%**	**182**	**0.36%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-8: Cadmium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	592,314	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,709,160	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,621,427	203	<0.01%	411	0.01%	701	0.01%	1,091	0.02%
CA	39,695,694	897	<0.01%	1,811	<0.01%	7,857	0.02%	19,888	0.05%
CO	6,449,990	-	0.00%	-	0.00%	84	<0.01%	284	<0.01%
CT	2,873,092	-	0.00%	540	0.02%	540	0.02%	1,447	0.05%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	929,278	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	20,279,463	73	<0.01%	198	<0.01%	198	<0.01%	6,550	0.03%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	45	<0.01%
IA	2,774,912	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	1,380,767	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,797,361	-	0.00%	-	0.00%	1,725	0.02%	3,194	0.03%
IN	5,256,445	-	0.00%	125	<0.01%	125	<0.01%	14,848	0.28%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	3,801	0.09%
LA	5,240,069	-	0.00%	85	<0.01%	85	<0.01%	10,360	0.20%
MA	9,405,030	-	0.00%	-	0.00%	-	0.00%	8,835	0.09%
MD	5,499,258	-	0.00%	40	<0.01%	40	<0.01%	294,765	5.36%
ME	748,387	-	0.00%	-	0.00%	-	0.00%	100	0.01%
MN	4,099,086	-	0.00%	-	0.00%	-	0.00%	319	0.01%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
MO	5,290,894	-	0.00%	6,430	0.12%	6,430	0.12%	15,341	0.29%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	795,529	-	0.00%	-	0.00%	-	0.00%	1,965	0.25%
NC	8,500,612	-	0.00%	-	0.00%	-	0.00%	155	<0.01%
ND	661,495	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,609,621	47	<0.01%	47	<0.01%	761	0.05%	761	0.05%
NH	948,384	-	0.00%	-	0.00%	-	0.00%	668	0.07%
NJ	9,009,147	-	0.00%	-	0.00%	-	0.00%	7,340	0.08%
NN	151,619	-	0.00%	-	0.00%	8,997	5.93%	8,997	5.93%
NV	2,855,806	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,014,532	85	<0.01%	165	<0.01%	165	<0.01%	4,453	0.04%
OH	10,242,921	162	<0.01%	257	<0.01%	257	<0.01%	2,203	0.02%
OK	3,566,676	-	0.00%	-	0.00%	225	0.01%	225	0.01%
OR	3,221,217	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,875,703	525	<0.01%	655	0.01%	655	0.01%	3,959	0.03%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	505	0.05%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SD	668,873	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	2,227,088	-	0.00%	2,304	0.10%	2,304	0.10%	2,304	0.10%
TX	27,178,502	-	0.00%	734	<0.01%	734	<0.01%	734	<0.01%
UT	4,600,180	-	0.00%	-	0.00%	300	0.01%	8,500	0.18%
VA	7,063,277	-	0.00%	50	<0.01%	90	<0.01%	168	<0.01%
VT	461,483	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,213,224	-	0.00%	178	<0.01%	178	<0.01%	1,291	0.02%
WI	4,016,752	-	0.00%	44	<0.01%	44	<0.01%	5,452	0.14%
WV	1,550,856	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,332	-	0.00%	-	0.00%	-	0.00%	55	0.01%
R01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	139,065	220	0.16%	220	0.16%	220	0.16%	220	0.16%
R06 tribes	147,172	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,008	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	428,649	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	78,178	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**269,570,338**	**2,212**	**<0.01%**	**14,294**	**0.01%**	**32,715**	**0.01%**	**430,823**	**0.16%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.2.3 Summary of Data

A total of 230,098 analytical results from 50,989 PWSs in 59 States were available in the SYR 4 ICR dataset for cadmium. The Stage 2 analysis of occurrence in drinking water indicated that 12 ground water systems in 8 States, serving 2,212 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 182 systems (177 ground water, 5 surface water) in 34 States, serving 430,823 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

B.3 Carbon Tetrachloride

This chapter on carbon tetrachloride includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.3.1 Background

The United States Environmental Protection Agency (EPA) published the current maximum contaminant level goal (MCLG) for carbon tetrachloride on July 8, 1987 (52 FR 25690; USEPA, 1987). The National Primary Drinking Water Regulations (NPDWR) established a MCLG of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

Carbon tetrachloride is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[9] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.3.2 Occurrence in Drinking Water

The analysis of carbon tetrachloride occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 510,599 analytical results from 52,205 public water systems (PWSs) during the period from 2012 to

[9] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including carbon tetrachloride, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for carbon tetrachloride in the dataset is 0.5 µg/L. Three arithmetic mean carbon tetrachloride concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with carbon tetrachloride data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For carbon tetrachloride, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for carbon tetrachloride are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below

a practical quantitation level (PQL).[10] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-9 presents the system-level Stage 2 analysis of estimated mean concentrations for carbon tetrachloride occurrence in drinking water. Exhibit B-10 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, 3 systems (0.01 percent of all systems), serving 2,108 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 90 systems (0.17 percent of all systems), serving 766,891 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-9: Carbon Tetrachloride Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,685	3	3	3	0.01%	0.01%	0.01%
	> ½ MCL (2.5 µg/L)		17	15	13	0.04%	0.03%	0.03%
	> 2× EQL (1 µg/L)		58	49	40	0.12%	0.10%	0.08%
	> EQL (0.5 µg/L)		306	86	71	0.64%	0.18%	0.15%
Surface Water	> MCL (5 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		2	2	2	0.04%	0.04%	0.04%
	> EQL (0.5 µg/L)		89	4	3	1.97%	0.09%	0.07%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,205	3	3	3	0.01%	0.01%	0.01%
	> ½ MCL (2.5 µg/L)		17	15	13	0.03%	0.03%	0.02%
	> 2× EQL (1 µg/L)		60	51	42	0.11%	0.10%	0.08%
	> EQL (0.5 µg/L)		395	90	74	0.76%	0.17%	0.14%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[10] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-10: Carbon Tetrachloride Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,106,830	2,108	2,108	2,108	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		9,666	9,535	8,572	0.01%	0.01%	0.01%
	> 2× EQL (1 µg/L)		412,973	85,723	32,958	0.37%	0.08%	0.03%
	> EQL (0.5 µg/L)		3,732,796	542,916	423,950	3.36%	0.49%	0.38%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		2,603	2,603	2,603	<0.01%	<0.01%	<0.01%
	> EQL (0.5 µg/L)		7,010,250	223,975	204,271	4.29%	0.14%	0.12%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,593,290	2,108	2,108	2,108	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		9,666	9,535	8,572	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		415,576	88,326	35,561	0.15%	0.03%	0.01%
	> EQL (0.5 µg/L)		10,743,046	766,891	628,221	3.91%	0.28%	0.23%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for carbon tetrachloride were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for carbon tetrachloride. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-11 presents the total number of systems in each State that submitted data for carbon tetrachloride. In addition, the geographic distribution of carbon tetrachloride occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-12 presents similar information based on the population served by the systems. Exhibit B-11 and Exhibit B-12 present only the ½ MRL substitution results. Three systems in 3 States, serving 2,108 people, had estimated mean concentrations greater than the MCL. A total of 90 systems in 25 States, serving 766,891 people, had an estimated mean concentration greater than the potential EQL.

Exhibit B-11: Carbon Tetrachloride Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%	-	0.00%	1	0.27%
AR	420	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AZ	896	-	0.00%	1	0.11%	1	0.11%	1	0.11%
CA	4,165	-	0.00%	2	0.05%	4	0.10%	9	0.22%
CO	900	-	0.00%	-	0.00%	-	0.00%	1	0.11%
CT	981	-	0.00%	-	0.00%	1	0.10%	1	0.10%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	2,240	1	0.04%	3	0.13%	8	0.36%	11	0.49%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	915	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	1,489	-	0.00%	2	0.13%	2	0.13%	2	0.13%
IN	1,313	-	0.00%	1	0.08%	3	0.23%	4	0.30%
KS	564	-	0.00%	-	0.00%	1	0.18%	6	1.06%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%	1	0.10%
MA	741	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%	1	0.10%	3	0.31%
ME	806	-	0.00%	1	0.12%	1	0.12%	1	0.12%
MN	1,344	1	0.07%	1	0.07%	2	0.15%	2	0.15%
MO	1,393	-	0.00%	1	0.07%	2	0.14%	3	0.22%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%	6	0.29%	11	0.54%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	3	0.45%	4	0.61%
NH	1,079	1	0.09%	1	0.09%	1	0.09%	1	0.09%
NJ	1,293	-	0.00%	-	0.00%	1	0.08%	1	0.08%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,563	-	0.00%	1	0.04%	2	0.08%	7	0.27%
OH	1,675	-	0.00%	-	0.00%	1	0.06%	3	0.18%
OK	655	-	0.00%	-	0.00%	2	0.31%	3	0.46%
OR	1,156	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	3,044	-	0.00%	-	0.00%	2	0.07%	3	0.10%
RI	142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,531	-	0.00%	-	0.00%	2	0.04%	2	0.04%
UT	490	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	1,499	-	0.00%	1	0.07%	5	0.33%	7	0.47%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	2	0.08%
WI	2,075	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,205**	**3**	**0.01%**	**15**	**0.03%**	**51**	**0.10%**	**90**	**0.17%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-12: Carbon Tetrachloride Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%	19,704	0.35%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	400	0.01%	400	0.01%	400	0.01%
CA	38,534,495	-	0.00%	600	<0.01%	18,152	0.05%	490,039	1.27%
CO	6,494,092	-	0.00%	-	0.00%	-	0.00%	31	<0.01%
CT	2,876,909	-	0.00%	-	0.00%	25	<0.01%	25	<0.01%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	20,279,328	30	<0.01%	1,896	0.01%	2,160	0.01%	2,948	0.01%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	2,163	0.02%	2,163	0.02%	2,163	0.02%
IN	5,256,563	-	0.00%	2,091	0.04%	6,305	0.12%	7,405	0.14%
KS	2,795,047	-	0.00%	-	0.00%	1,153	0.04%	4,270	0.15%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%	-	0.00%	81	<0.01%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%	1,200	0.02%	3,920	0.07%
ME	748,597	-	0.00%	100	0.01%	100	0.01%	100	0.01%
MN	4,519,439	440	0.01%	440	0.01%	840	0.02%	840	0.02%
MO	5,286,146	-	0.00%	71	<0.01%	106	<0.01%	2,306	0.04%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%	2,428	0.03%	3,292	0.04%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	453	0.03%	673	0.04%
NH	948,457	1,638	0.17%	1,638	0.17%	1,638	0.17%	1,638	0.17%
NJ	9,009,098	-	0.00%	-	0.00%	55	<0.01%	55	<0.01%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
NY	10,183,695	-	0.00%	88	<0.01%	48,088	0.47%	219,668	2.16%
OH	10,243,847	-	0.00%	-	0.00%	90	<0.01%	640	0.01%
OK	3,660,453	-	0.00%	-	0.00%	1,441	0.04%	3,011	0.08%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	-	0.00%	316	<0.01%	789	0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,189,066	-	0.00%	-	0.00%	815	<0.01%	815	<0.01%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	48	<0.01%	398	0.01%	578	0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	1,500	0.02%
WI	4,017,600	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,593,290**	**2,108**	**<0.01%**	**9,535**	**<0.01%**	**88,326**	**0.03%**	**766,891**	**0.28%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.3.3 Summary of Data

A total of 510,599 analytical results from 52,205 PWSs in 58 States were available in the SYR 4 ICR dataset for carbon tetrachloride. The Stage 2 analysis of occurrence in drinking water indicated that 3 systems (all ground water systems) in 3 States, serving 2,108 people, had estimated mean concentrations greater than the MCL of 5 µg/L. Ninety systems (86 ground water, 4 surface water) in 25 States, serving 766,891 people, had estimated mean concentrations greater than the EQL of 0.5 µg/L.

B.4 Chlordane

This chapter on chlordane includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.4.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for chlordane on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 2 µg/L based on analytical feasibility.

Chlordane is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[11] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.4.2 Occurrence in Drinking Water

The analysis of chlordane occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 189,512 analytical results from 38,310 public water systems (PWSs) during the period from 2012 to

[11] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including chlordane, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for chlordane in the dataset is 0.2 µg/L. Three arithmetic mean chlordane concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with chlordane data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For chlordane, EPA generated Stage 2 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for chlordane are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 2 µg/L (MCL) and 1 µg/L (EQL and ½ MCL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[12] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

[12] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-13 presents the system-level Stage 2 analysis of estimated mean concentrations for chlordane occurrence in drinking water. Exhibit B-14 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 2 µg/L. One water system (less than 0.01 percent of all systems), serving 240 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-13: Chlordane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	34,862	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (2 µg/L)	3,448	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (2 µg/L)	38,310	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-14: Chlordane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	91,175,298	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		240	240	240	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (2 µg/L)	139,281,610	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (2 µg/L)	230,456,908	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		240	240	240	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for chlordane were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for chlordane. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-15 presents the total number of systems in each State that submitted data for chlordane. In addition, the geographic distribution of chlordane occurrence in drinking water is

illustrated by showing States with systems with a mean concentration greater than the MCL and EQL. Exhibit B-16 presents similar information based on the population served by the systems. Exhibit B-15 and Exhibit B-16 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 2 µg/L. One system in North Carolina, serving 240 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-15: Chlordane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
AK	73	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,440	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	240	-	0.00%	-	0.00%
FL	2,205	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%
ID	572	-	0.00%	-	0.00%
IL	1,147	-	0.00%	-	0.00%
IN	1,299	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	695	-	0.00%	-	0.00%
MD	920	-	0.00%	-	0.00%
ME	208	-	0.00%	-	0.00%
MN	890	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,045	-	0.00%	1	0.05%
ND	129	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%
NJ	3	-	0.00%	-	0.00%
NN	139	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%
NY	2,117	-	0.00%	-	0.00%
OH	22	-	0.00%	-	0.00%
OK	100	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%
PA	2,995	-	0.00%	-	0.00%
RI	100	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%
TN	3	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
UT	436	-	0.00%	-	0.00%
VA	238	-	0.00%	-	0.00%
VT	281	-	0.00%	-	0.00%
WA	1,319	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	96	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	156	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%
Total	**38,310**	**-**	**0.00%**	**1**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-16: Chlordane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
AK	80,903	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,093,852	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	883,104	-	0.00%	-	0.00%
FL	19,901,692	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%
ID	1,257,631	-	0.00%	-	0.00%
IL	9,291,957	-	0.00%	-	0.00%
IN	5,266,171	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%
MA	9,589,730	-	0.00%	-	0.00%
MD	5,486,421	-	0.00%	-	0.00%
ME	370,306	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
MN	4,094,456	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	240	<0.01%
ND	666,967	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%
NJ	163,591	-	0.00%	-	0.00%
NN	152,399	-	0.00%	-	0.00%
NV	2,858,446	-	0.00%	-	0.00%
NY	10,035,059	-	0.00%	-	0.00%
OH	143,113	-	0.00%	-	0.00%
OK	1,448,678	-	0.00%	-	0.00%
OR	3,536,278	-	0.00%	-	0.00%
PA	11,742,429	-	0.00%	-	0.00%
RI	1,044,048	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%
TN	284,623	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,672,345	-	0.00%	-	0.00%
VT	364,010	-	0.00%	-	0.00%
WA	6,179,542	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	134,402	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	348,439	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%
Total	**230,456,908**	**-**	**0.00%**	**240**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.4.3 Summary of Data

A total of 189,512 analytical results from 38,310 PWSs in 58 States were available in the SYR 4 ICR dataset for chlordane. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 2 µg/L. One ground water system, serving 240 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

B.5 cis-1,2-Dichloroethylene

This chapter on cis-1,2-dichloroethylene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.5.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for cis-1,2-dichloroethylene on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and maximum contaminant level (MCL) of 70 µg/L. The agency developed the MCLG based on a reference dose (RfD) of 10 µg/kg-day (0.01 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

cis-1,2-Dichloroethylene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[13] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.5.2 Occurrence in Drinking Water

The analysis of cis-1,2-dichloroethylene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 495,228 analytical results from 52,210 public water systems (PWSs) during the period from 2012 to

[13] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including cis-1,2-dichloroethylene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for cis-1,2-dichloroethylene in the dataset is 0.5 µg/L. Three arithmetic mean cis-1,2-dichloroethylene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with cis-1,2-dichloroethylene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For cis-1,2-dichloroethylene, EPA generated Stage 2 occurrence estimates relative to the MCL and the potential MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for cis-1,2-dichloroethylene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 70 µg/L (MCL) and 10 µg/L (potential MCLG). The potential MCLG reflects a change in the RfD based on new health effects information. Since the practical quantitation level (PQL) for cis-1,2-dichloroethylene is less than the potential MCLG, EPA designated the potential MCLG as the threshold for the occurrence analysis. For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-17presents the system-level Stage 2 analysis of estimated mean concentrations for cis-1,2-dichloroethylene occurrence in drinking water. Exhibit B-18 presents similar information

based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 70 µg/L. A total of 7 systems (0.01 percent of all systems), serving 42,215 people, had an estimated mean concentration greater than the potential MCLG of 10 µg/L.

Exhibit B-17: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (70 µg/L)	47,690	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		7	7	7	0.01%	0.01%	0.01%
Surface Water	> MCL (70 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (70 µg/L)	52,210	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		7	7	7	0.01%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-18: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (70 µg/L)	111,108,269	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		42,215	42,215	42,215	0.04%	0.04%	0.04%
Surface Water	> MCL (70 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (70 µg/L)	274,594,729	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (10 µg/L)		42,215	42,215	42,215	0.02%	0.02%	0.02%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for cis-1,2-dichloroethylene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for cis-1,2-dichloroethylene. Seven States (Georgia, Guam,

Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-19 presents the total number of systems in each State that submitted data for cis-1,2-dichloroethylene. In addition, the geographic distribution of cis-1,2-dichloroethylene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and potential MCLG. Exhibit B-20 presents similar information based on the population served by the systems. Exhibit B-19 and Exhibit B-20 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 70 µg/L. Seven systems in 5 States, serving 42,215 people, had estimated mean concentrations greater than the potential MCLG of 10 µg/L.

Exhibit B-19: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 70 µg/L		Systems with a Mean Concentration > 10 µg/L	
		Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	4,165	-	0.00%	-	0.00%
CO	900	-	0.00%	-	0.00%
CT	980	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%
ID	915	-	0.00%	-	0.00%
IL	1,489	-	0.00%	3	0.20%
IN	1,312	-	0.00%	1	0.08%
KS	564	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%
MD	957	-	0.00%	-	0.00%
ME	806	-	0.00%	-	0.00%
MN	1,344	-	0.00%	-	0.00%
MO	1,393	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%
NJ	1,299	-	0.00%	1	0.08%
NN	137	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%
NY	2,563	-	0.00%	1	0.04%

State	Total Number of Systems	Systems with a Mean Concentration > 70 µg/L		Systems with a Mean Concentration > 10 µg/L	
		Number	Percent	Number	Percent
OH	1,676	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%
PA	3,044	-	0.00%	1	0.03%
RI	143	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%
UT	490	-	0.00%	-	0.00%
VA	1,499	-	0.00%	-	0.00%
VT	604	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%
Total	**52,210**	**-**	**0.00%**	**7**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-20: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 70 µg/L		Population Served by Systems with a Mean Concentration > 10 µg/L	
		Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%
CA	38,534,485	-	0.00%	-	0.00%
CO	6,494,092	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	957,195	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%
ID	1,349,426	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 70 µg/L		Population Served by Systems with a Mean Concentration > 10 µg/L	
		Number	Percent	Number	Percent
IL	9,808,699	-	0.00%	40,908	0.42%
IN	5,256,413	-	0.00%	1,149	0.02%
KS	2,795,047	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%
MD	5,496,827	-	0.00%	-	0.00%
ME	748,566	-	0.00%	-	0.00%
MN	4,519,439	-	0.00%	-	0.00%
MO	5,286,146	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%
NJ	9,011,231	-	0.00%	70	<0.01%
NN	151,385	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%
NY	10,183,660	-	0.00%	25	<0.01%
OH	10,243,997	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	63	<0.01%
RI	1,064,676	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%
UT	4,600,766	-	0.00%	-	0.00%
VA	7,066,405	-	0.00%	-	0.00%
VT	490,842	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	140,024	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%
Total	**274,594,729**	**-**	**0.00%**	**42,215**	**0.02%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

B.5.3 Summary of Data

A total of 495,228 analytical results from 52,210 PWSs in 58 States were available in the SYR 4 ICR dataset for cis-1,2-dichloroethylene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 70 µg/L. Seven ground water systems, serving 42,215 people, had estimated mean concentrations greater than the potential MCLG of 10 µg/L.

B.6 Cyanide

This chapter on cyanide includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.6.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for cyanide on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) and maximum contaminant level (MCL) of 200 µg/L. The MCLG was developed based on a reference dose (RfD) of 20 µg/kg-day and a cancer classification of D, not classifiable as to human carcinogenicity.

Cyanide is regulated as an inorganic contaminant (IOC) in drinking water. All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for the IOCs. Cyanide waivers may be granted if a State determines that a system is not vulnerable to cyanide contamination due to a lack of industrial cyanide sources. The maximum waiver period for cyanide is one compliance cycle. During this cycle, the system must sample at least once. Statewide waivers for cyanide may be granted if all systems in the State are required to chlorinate.

Ground water systems must sample once during the initial three-year compliance period. After three compliance periods without a detection, a ground water system may be granted a nine-year waiver. Surface water systems must sample annually during the initial three-year compliance period. After three annual samples without a detection, a surface water system may be granted a nine-year waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[14] If all quarterly samples are below the MCL, the system may continue at initial monitoring indefinitely until the State or EPA establishes an alternate schedule.

B.6.2 Occurrence in Drinking Water

The analysis of cyanide occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 163,373 analytical results from 38,760 PWSs during the period from 2012 to 2019. The number of

[14] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including cyanide, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for cyanide in the dataset is 10 µg/L. Three arithmetic mean cyanide concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with cyanide data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For cyanide, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for cyanide are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 200 µg/L (MCL), 100 µg/L (½ MCL), and 50 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[15] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

[15] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-21 presents the system-level Stage 2 analysis of estimated mean concentrations for cyanide occurrence in drinking water. Exhibit B-22 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, 9 systems (0.02 percent of all systems), serving 97,971 people, had estimated mean concentrations greater than the MCL of 200 µg/L. A total of 328 systems (0.85 percent of all systems), serving 8,134,220 people, had an estimated mean concentration greater than the EQL of 50 µg/L.

Exhibit B-21: Cyanide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (200 µg/L)	35,497	8	8	7	0.02%	0.02%	0.02%
	> ½ MCL (100 µg/L)		52	52	51	0.15%	0.15%	0.14%
	> EQL (50 µg/L)		219	214	200	0.62%	0.60%	0.56%
Surface Water	> MCL (200 µg/L)	3,263	1	1	1	0.03%	0.03%	0.03%
	> ½ MCL (100 µg/L)		21	21	21	0.64%	0.64%	0.64%
	> EQL (50 µg/L)		120	114	109	3.68%	3.49%	3.34%
Combined Ground & Surface Water	> MCL (200 µg/L)	38,760	9	9	8	0.02%	0.02%	0.02%
	> ½ MCL (100 µg/L)		73	73	72	0.19%	0.19%	0.19%
	> EQL (50 µg/L)		339	328	309	0.87%	0.85%	0.80%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-22: Cyanide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (200 µg/L)	95,874,303	5,600	5,600	2,800	0.01%	0.01%	0.00%
	> ½ MCL (100 µg/L)		160,042	160,042	157,659	0.17%	0.17%	0.16%
	> EQL (50 µg/L)		717,294	695,550	646,538	0.75%	0.73%	0.67%
Surface Water	> MCL (200 µg/L)	141,445,430	92,371	92,371	92,371	0.07%	0.07%	0.07%
	> ½ MCL (100 µg/L)		1,174,634	1,174,634	1,174,634	0.83%	0.83%	0.83%
	> EQL (50 µg/L)		7,707,123	7,438,670	7,405,222	5.45%	5.26%	5.24%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> MCL (200 µg/L)	237,319,733	97,971	97,971	95,171	0.04%	0.04%	0.04%
	> ½ MCL (100 µg/L)		1,334,676	1,334,676	1,332,293	0.56%	0.56%	0.56%
	> EQL (50 µg/L)		8,424,417	8,134,220	8,051,760	3.55%	3.43%	3.39%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for cyanide were available from 57 States. South Dakota and South Carolina submitted some data for the SYR 4 dataset but none for cyanide. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-23 presents the total number of systems in each State that submitted data for cyanide. In addition, the geographic distribution of cyanide occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL and EQL. Exhibit B-24 presents similar information based on the population served by the systems. Exhibit B-23 and Exhibit B-24 present only the ½ MRL substitution results. Nine systems in 6 States, serving 97,971 people, had estimated mean concentrations greater than the MCL of 200 µg/L. A total of 328 systems in 20 States, serving 8,134,220 people, had an estimated mean concentration greater than the EQL of 50 µg/L.

Exhibit B-23: Cyanide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 200 µg/L		Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	469	-	0.00%	-	0.00%	2	0.43%
AL	371	-	0.00%	-	0.00%	-	0.00%
AR	420	2	0.48%	7	1.67%	8	1.90%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	822	-	0.00%	-	0.00%	-	0.00%
CA	2,056	1	0.05%	2	0.10%	4	0.19%
CO	69	-	0.00%	-	0.00%	-	0.00%
CT	961	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	237	-	0.00%	2	0.84%	5	2.11%
FL	2,247	-	0.00%	-	0.00%	3	0.13%
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	110	-	0.00%	-	0.00%	-	0.00%
ID	40	-	0.00%	-	0.00%	-	0.00%
IL	1,434	-	0.00%	-	0.00%	-	0.00%
IN	1,310	2	0.15%	4	0.31%	8	0.61%
KS	3	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 200 µg/L		Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent	Number	Percent
LA	1,048	-	0.00%	-	0.00%	-	0.00%
MA	573	-	0.00%	1	0.17%	2	0.35%
MD	23	-	0.00%	-	0.00%	-	0.00%
ME	752	-	0.00%	-	0.00%	-	0.00%
MN	1,212	2	0.17%	9	0.74%	44	3.63%
MO	734	-	0.00%	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%	-	0.00%
MT	6	-	0.00%	-	0.00%	-	0.00%
NC	2,038	-	0.00%	-	0.00%	-	0.00%
ND	9	-	0.00%	-	0.00%	1	11.11%
NE	659	-	0.00%	3	0.46%	5	0.76%
NH	17	-	0.00%	-	0.00%	-	0.00%
NJ	1,292	-	0.00%	-	0.00%	-	0.00%
NN	136	-	0.00%	1	0.74%	1	0.74%
NV	286	-	0.00%	-	0.00%	-	0.00%
NY	2,522	1	0.04%	2	0.08%	4	0.16%
OH	1,662	-	0.00%	-	0.00%	-	0.00%
OK	130	-	0.00%	-	0.00%	-	0.00%
OR	1,049	-	0.00%	-	0.00%	-	0.00%
PA	3,015	1	0.03%	1	0.03%	1	0.03%
RI	142	-	0.00%	-	0.00%	-	0.00%
TN	100	-	0.00%	-	0.00%	1	1.00%
TX	4,544	-	0.00%	38	0.84%	232	5.11%
UT	489	-	0.00%	1	0.20%	1	0.20%
VA	1,379	-	0.00%	-	0.00%	-	0.00%
VT	485	-	0.00%	-	0.00%	1	0.21%
WA	2,257	-	0.00%	1	0.04%	2	0.09%
WI	98	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	2	0.64%
WY	310	-	0.00%	1	0.32%	1	0.32%
Region 01 tribes	3	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	6	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	14	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	58	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	6	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	83	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	195	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	96	-	0.00%	-	0.00%	-	0.00%
Total	**38,760**	**9**	**0.02%**	**73**	**0.19%**	**328**	**0.85%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-24: Cyanide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 200 µg/L		Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	598,658	-	0.00%	-	0.00%	177	0.03%
AL	5,709,160	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	143	0.01%	3,462	0.14%	7,362	0.30%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,621,067	-	0.00%	-	0.00%	-	0.00%
CA	36,059,936	92,371	0.26%	92,436	0.26%	92,566	0.26%
CO	2,902,354	-	0.00%	-	0.00%	-	0.00%
CT	2,873,162	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	676,951	-	0.00%	1,365	0.20%	15,372	2.27%
FL	20,279,910	-	0.00%	-	0.00%	852	<0.01%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	973,960	-	0.00%	-	0.00%	-	0.00%
ID	496,183	-	0.00%	-	0.00%	-	0.00%
IL	9,791,130	-	0.00%	-	0.00%	-	0.00%
IN	5,254,885	4,850	0.09%	7,874	0.15%	12,734	0.24%
KS	760,270	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,240,788	-	0.00%	-	0.00%	-	0.00%
MA	9,436,147	-	0.00%	22,250	0.24%	38,843	0.41%
MD	312,080	-	0.00%	-	0.00%	-	0.00%
ME	742,835	-	0.00%	-	0.00%	-	0.00%
MN	4,100,348	281	0.01%	51,383	1.25%	67,033	1.63%
MO	2,870,540	-	0.00%	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%	-	0.00%
MT	83,327	-	0.00%	-	0.00%	-	0.00%
NC	8,500,612	-	0.00%	-	0.00%	-	0.00%
ND	86,104	-	0.00%	-	0.00%	80,555	93.56%
NE	1,609,600	-	0.00%	815	0.05%	1,258	0.08%
NH	233,700	-	0.00%	-	0.00%	-	0.00%
NJ	9,007,536	-	0.00%	-	0.00%	-	0.00%
NN	151,016	-	0.00%	1,229	0.81%	1,229	0.81%
NV	2,857,618	-	0.00%	-	0.00%	-	0.00%
NY	10,014,830	25	<0.01%	85	<0.01%	1,052	0.01%
OH	10,242,669	-	0.00%	-	0.00%	-	0.00%
OK	465,801	-	0.00%	-	0.00%	-	0.00%
OR	3,221,603	-	0.00%	-	0.00%	-	0.00%
PA	11,875,368	301	<0.01%	301	<0.01%	301	<0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%
TN	2,215,325	-	0.00%	-	0.00%	63,128	2.85%
TX	27,194,114	-	0.00%	1,153,289	4.24%	7,750,351	28.50%
UT	4,600,044	-	0.00%	100	<0.01%	100	<0.01%
VA	6,635,009	-	0.00%	-	0.00%	-	0.00%
VT	456,633	-	0.00%	-	0.00%	956	0.21%
WA	7,210,929	-	0.00%	42	<0.01%	114	<0.01%
WI	1,603,924	-	0.00%	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%	192	0.01%
WY	508,872	-	0.00%	45	0.01%	45	0.01%
Region 01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 200 µg/L		Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent	Number	Percent
Region 02 tribes	6,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,535	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	139,065	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	147,772	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	13,117	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	128,933	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	426,055	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	80,898	-	0.00%	-	0.00%	-	0.00%
Total	**237,319,733**	**97,971**	**0.04%**	**1,334,676**	**0.56%**	**8,134,220**	**3.43%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.6.3 Summary of Data

A total of 163,373 analytical results from 38,760 PWSs in 57 States were available in the SYR 4 ICR dataset for cyanide. The Stage 2 analysis of occurrence in drinking water indicated that 9 systems in 6 States, serving 97,971 people, had an estimated mean concentration greater than the MCL of 200 µg/L. A total of 328 systems in 20 States, serving 8,134,220 people, had an estimated mean concentration greater than the EQL of 50 µg/L. The majority of systems with mean concentrations greater than the MCL and EQL were ground water systems.

B.7 1,2-Dichloroethane

This chapter on 1,2-dichloroethane includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.7.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for 1,2-dichloroethane on July 8, 1987 (52 FR 25690; USEPA, 1987). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

1,2-Dichloroethane is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[16] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.7.2 Occurrence in Drinking Water

The analysis of 1,2-dichloroethane occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 493,514 analytical results from 52,209 public water systems (PWSs) during the period from 2012 to

[16] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including 1,2-dichloroethane, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for 1,2-dichloroethane in the dataset is 0.5 µg/L. Three arithmetic mean 1,2-dichloroethane concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with 1,2-dichloroethane data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For 1,2-dichloroethane, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for 1,2-dichloroethane are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below

a practical quantitation level (PQL).[17] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-25 presents the system-level Stage 2 analysis of estimated mean concentrations for 1,2-dichloroethane occurrence in drinking water. Exhibit B-26 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, 3 systems (0.01 percent of all systems), serving 1,064 people, had estimated mean concentrations greater than the MCL of 5 µg/L. Sixty systems (0.11 percent of all systems), serving 181,041 people, had estimated mean concentrations greater than the EQL of 0.5 µg/L.

Exhibit B-25: 1,2-Dichloroethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,689	3	3	3	0.01%	0.01%	0.01%
	> ½ MCL (2.5 µg/L)		9	8	7	0.02%	0.02%	0.01%
	> 2× EQL (1 µg/L)		27	26	23	0.06%	0.05%	0.05%
	> EQL (0.5 µg/L)		163	58	41	0.34%	0.12%	0.09%
Surface Water	> MCL (5 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		2	2	2	0.04%	0.04%	0.04%
	> EQL (0.5 µg/L)		16	2	2	0.35%	0.04%	0.04%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,209	3	3	3	0.01%	0.01%	0.01%
	> ½ MCL (2.5 µg/L)		9	8	7	0.02%	0.02%	0.01%
	> 2× EQL (1 µg/L)		29	28	25	0.06%	0.05%	0.05%
	> EQL (0.5 µg/L)		179	60	43	0.34%	0.11%	0.08%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[17] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-26: 1,2-Dichloroethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,107,476	1,064	1,064	1,064	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		3,759	3,739	3,344	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		7,668	7,558	7,334	0.01%	0.01%	0.01%
	> EQL (0.5 µg/L)		1,583,761	126,971	11,253	1.43%	0.11%	0.01%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		54,070	54,070	54,070	0.03%	0.03%	0.03%
	> EQL (0.5 µg/L)		1,361,068	54,070	54,070	0.83%	0.03%	0.03%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,593,936	1,064	1,064	1,064	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		3,759	3,739	3,344	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		61,738	61,628	61,404	0.02%	0.02%	0.02%
	> EQL (0.5 µg/L)		2,944,829	181,041	65,323	1.07%	0.07%	0.02%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for 1,2-dichloroethane were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for 1,2-dichloroethane. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-27 presents the total number of systems in each State that submitted data for 1,2-dichloroethane. In addition, the geographic distribution of 1,2-dichloroethane occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-28 presents similar information based on the population served by the systems. Exhibit B-27 and Exhibit B-28 present only the ½ MRL substitution results. Three systems in 3 States, serving 1,064 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 60 systems in 26 States, serving 181,041 people had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-27: 1,2-Dichloroethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	1	10.00%	1	10.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	4,166	-	0.00%	-	0.00%	-	0.00%	2	0.05%
CO	899	-	0.00%	1	0.11%	1	0.11%	1	0.11%
CT	980	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%	1	0.33%
FL	2,240	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	1	0.10%	2	0.21%
ID	915	-	0.00%	-	0.00%	-	0.00%	1	0.11%
IL	1,489	-	0.00%	-	0.00%	-	0.00%	2	0.13%
IN	1,312	-	0.00%	-	0.00%	1	0.08%	2	0.15%
KS	564	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	1	0.10%	2	0.19%	4	0.38%
MA	741	-	0.00%	-	0.00%	1	0.13%	1	0.13%
MD	956	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	806	-	0.00%	-	0.00%	1	0.12%	1	0.12%
MN	1,344	-	0.00%	-	0.00%	-	0.00%	1	0.07%
MO	1,393	-	0.00%	-	0.00%	1	0.07%	1	0.07%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%	-	0.00%	2	0.10%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	1	0.15%	1	0.15%	1	0.15%	2	0.30%
NH	1,079	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	1,295	-	0.00%	-	0.00%	1	0.08%	4	0.31%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	299	-	0.00%	-	0.00%	1	0.33%	1	0.33%
NY	2,565	1	0.04%	1	0.04%	5	0.19%	8	0.31%
OH	1,675	-	0.00%	-	0.00%	1	0.06%	2	0.12%
OK	655	-	0.00%	-	0.00%	1	0.15%	1	0.15%
OR	1,157	-	0.00%	1	0.09%	1	0.09%	3	0.26%
PA	3,045	-	0.00%	-	0.00%	-	0.00%	4	0.13%
RI	142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%	1	0.02%	3	0.07%
UT	490	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	1,500	-	0.00%	1	0.07%	4	0.27%	6	0.40%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	2,075	1	0.05%	2	0.10%	2	0.10%	3	0.14%
WV	314	-	0.00%	-	0.00%	1	0.32%	1	0.32%
WY	311	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,209**	**3**	**0.01%**	**8**	**0.02%**	**28**	**0.05%**	**60**	**0.11%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-28: 1,2-Dichloroethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	52,430	89.89%	52,430	89.89%
AZ	6,668,877	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	38,534,535	-	0.00%	-	0.00%	-	0.00%	45,566	0.12%
CO	6,494,061	-	0.00%	30	<0.01%	30	<0.01%	30	<0.01%
CT	2,876,884	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,320	-	0.00%	-	0.00%	-	0.00%	237	0.02%
FL	20,279,328	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	1,703	0.06%	1,873	0.07%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%	40	<0.01%
IL	9,808,699	-	0.00%	-	0.00%	-	0.00%	41,368	0.42%
IN	5,256,413	-	0.00%	-	0.00%	127	<0.01%	383	0.01%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	1,700	0.03%	1,800	0.03%	5,589	0.11%
MA	9,623,760	-	0.00%	-	0.00%	200	<0.01%	200	<0.01%
MD	5,496,771	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	748,522	-	0.00%	-	0.00%	25	<0.01%	25	<0.01%
MN	4,519,439	-	0.00%	-	0.00%	-	0.00%	40	<0.01%
MO	5,286,146	-	0.00%	-	0.00%	30	<0.01%	30	<0.01%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%	-	0.00%	232	<0.01%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
NE	1,607,025	951	0.06%	951	0.06%	951	0.06%	1,252	0.08%
NH	948,457	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	9,009,662	-	0.00%	-	0.00%	30	<0.01%	24,850	0.28%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,279	-	0.00%	-	0.00%	100	<0.01%	100	<0.01%
NY	10,183,767	25	<0.01%	25	<0.01%	2,085	0.02%	2,478	0.02%
OH	10,243,847	-	0.00%	-	0.00%	650	0.01%	1,429	0.01%
OK	3,660,453	-	0.00%	-	0.00%	135	<0.01%	135	<0.01%
OR	3,539,824	-	0.00%	500	0.01%	500	0.01%	617	0.02%
PA	11,892,216	-	0.00%	-	0.00%	-	0.00%	350	<0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%	55	<0.01%	235	<0.01%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	7,067,095	-	0.00%	50	<0.01%	200	<0.01%	410	0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	4,017,600	88	<0.01%	483	0.01%	483	0.01%	1,048	0.03%
WV	1,554,196	-	0.00%	-	0.00%	94	0.01%	94	0.01%
WY	508,924	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,593,936**	**1,064**	**<0.01%**	**3,739**	**<0.01%**	**61,628**	**0.02%**	**181,041**	**0.07%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.7.3 Summary of Data

A total of 493,514 analytical results from 52,209 PWSs in 58 States were available in the SYR 4 ICR dataset for 1,2-dichloroethane. The Stage 2 analysis of occurrence in drinking water indicated that 3 systems in 3 States, serving 1,064 people, had estimated mean concentrations greater than the MCL of 5 µg/L. Sixty systems in 26 States, serving 181,041 people, had estimated mean concentrations greater than the EQL of 0.5 µg/L. The majority of systems with mean concentrations greater than the MCL and EQL were ground water systems.

B.8 Dichloromethane

This chapter on dichloromethane includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.8.1 Background

The United States Environmental Protection Agency (EPA) published the National Primary Drinking Water Regulations (NPDWR) for dichloromethane on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

Dichloromethane is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[18] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, a system may be granted a waiver. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.8.2 Occurrence in Drinking Water

The analysis of dichloromethane occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 487,166 analytical results from 52,222 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

[18] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including dichloromethane, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for dichloromethane in the dataset is 0.5 µg/L. Three arithmetic mean dichloromethane concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with dichloromethane data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For dichloromethane, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for dichloromethane are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[19] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-29 presents the system-level Stage 2 analysis of estimated mean concentrations for dichloromethane occurrence in drinking water. Exhibit B-30 presents similar information based

[19] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, 2 systems (less than 0.01 percent of all systems), serving 109 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 215 systems (0.41 percent of all systems), serving 360,289 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-29: Dichloromethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,702	3	2	2	0.01%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		15	13	12	0.03%	0.03%	0.03%
	> 2× EQL (1 µg/L)		86	63	52	0.18%	0.13%	0.11%
	> EQL (0.5 µg/L)		663	194	129	1.39%	0.41%	0.27%
Surface Water	> MCL (5 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		4	4	3	0.09%	0.09%	0.07%
	> 2× EQL (1 µg/L)		9	7	5	0.20%	0.15%	0.11%
	> EQL (0.5 µg/L)		118	21	11	2.61%	0.46%	0.24%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,222	3	2	2	0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		19	17	15	0.04%	0.03%	0.03%
	> 2× EQL (1 µg/L)		95	70	57	0.18%	0.13%	0.11%
	> EQL (0.5 µg/L)		781	215	140	1.50%	0.41%	0.27%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-30: Dichloromethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,110,027	381	109	109	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		2,433	1,818	1,718	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		57,980	31,029	8,100	0.05%	0.03%	0.01%
	> EQL (0.5 µg/L)		7,622,160	157,729	69,398	6.86%	0.14%	0.06%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		8,691	8,691	5,148	0.01%	0.01%	0.00%
	> 2× EQL (1 µg/L)		110,659	10,210	9,141	0.07%	0.01%	0.01%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
	> EQL (0.5 µg/L)		7,987,498	202,560	116,679	4.89%	0.12%	0.07%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,596,487	381	109	109	<0.01%	<0.01%	<0.01%
	> ½ MCL (2.5 µg/L)		11,124	10,509	6,866	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		168,639	41,239	17,241	0.06%	0.02%	0.01%
	> EQL (0.5 µg/L)		15,609,658	360,289	186,077	5.68%	0.13%	0.07%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for dichloromethane were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for dichloromethane. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-31 presents the total number of systems in each State that submitted data for dichloromethane. In addition, the geographic distribution of dichloromethane occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-32 presents similar information based on the population served by the systems. Exhibit B-31 and Exhibit B-32 present only the ½ MRL substitution results. Two systems in 2 States, serving 109 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 215 systems in 40 States, serving 360,289 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-31: Dichloromethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	589	-	0.00%	1	0.17%	4	0.68%	8	1.36%
AL	373	-	0.00%	-	0.00%	-	0.00%	2	0.54%
AR	420	-	0.00%	-	0.00%	-	0.00%	2	0.48%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	1	0.11%	3	0.33%
CA	4,164	1	0.02%	7	0.17%	16	0.38%	35	0.84%
CO	899	-	0.00%	-	0.00%	-	0.00%	1	0.11%
CT	980	-	0.00%	-	0.00%	1	0.10%	1	0.10%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	303	-	0.00%	-	0.00%	-	0.00%	2	0.66%
FL	2,240	-	0.00%	-	0.00%	1	0.04%	9	0.40%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	1	0.10%	5	0.52%
ID	915	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	1,489	-	0.00%	-	0.00%	-	0.00%	3	0.20%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
IN	1,313	-	0.00%	-	0.00%	2	0.15%	7	0.53%
KS	564	-	0.00%	-	0.00%	-	0.00%	1	0.18%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	1	0.10%	5	0.48%
MA	741	-	0.00%	-	0.00%	-	0.00%	1	0.13%
MD	956	-	0.00%	-	0.00%	-	0.00%	1	0.10%
ME	805	-	0.00%	-	0.00%	-	0.00%	2	0.25%
MN	1,344	-	0.00%	-	0.00%	-	0.00%	2	0.15%
MO	1,393	-	0.00%	-	0.00%	1	0.07%	2	0.14%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	1	0.11%	3	0.33%
NC	2,044	-	0.00%	1	0.05%	3	0.15%	9	0.44%
ND	129	-	0.00%	-	0.00%	-	0.00%	1	0.78%
NE	660	-	0.00%	-	0.00%	1	0.15%	1	0.15%
NH	1,079	-	0.00%	-	0.00%	-	0.00%	2	0.19%
NJ	1,298	-	0.00%	-	0.00%	2	0.15%	6	0.46%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,568	-	0.00%	2	0.08%	8	0.31%	21	0.82%
OH	1,679	-	0.00%	-	0.00%	5	0.30%	18	1.07%
OK	657	1	0.15%	1	0.15%	1	0.15%	3	0.46%
OR	1,156	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	3,045	-	0.00%	-	0.00%	4	0.13%	12	0.39%
RI	143	-	0.00%	-	0.00%	-	0.00%	1	0.70%
SC	499	-	0.00%	-	0.00%	-	0.00%	2	0.40%
TN	368	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,533	-	0.00%	1	0.02%	5	0.11%	15	0.33%
UT	490	-	0.00%	-	0.00%	1	0.20%	3	0.61%
VA	1,499	-	0.00%	3	0.20%	5	0.33%	7	0.47%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	2	0.08%
WI	2,075	-	0.00%	-	0.00%	3	0.14%	4	0.19%
WV	314	-	0.00%	1	0.32%	1	0.32%	3	0.96%
WY	311	-	0.00%	-	0.00%	2	0.64%	7	2.25%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	1	6.67%
R05 tribes	101	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	2	0.94%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,222**	**2**	**<0.01%**	**17**	**0.03%**	**70**	**0.13%**	**215**	**0.41%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-32: Dichloromethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,055	-	0.00%	435	0.06%	16,976	2.24%	17,256	2.28%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%	19,254	0.34%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	782	0.03%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	400	0.01%	1,010	0.02%
CA	38,534,161	59	<0.01%	4,938	0.01%	6,739	0.02%	106,228	0.28%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%	66	<0.01%
CT	2,876,884	-	0.00%	-	0.00%	25	<0.01%	25	<0.01%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,254	-	0.00%	-	0.00%	-	0.00%	104	0.01%
FL	20,279,328	-	0.00%	-	0.00%	80	<0.01%	12,400	0.06%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	326	0.01%	11,484	0.40%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	-	0.00%	-	0.00%	110	<0.01%
IN	5,256,563	-	0.00%	-	0.00%	185	<0.01%	808	0.02%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	5,588	0.20%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%	4,701	0.09%	6,348	0.12%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%	63	<0.01%
MD	5,496,771	-	0.00%	-	0.00%	-	0.00%	435	0.01%
ME	748,497	-	0.00%	-	0.00%	-	0.00%	587	0.08%
MN	4,519,439	-	0.00%	-	0.00%	-	0.00%	7,130	0.16%
MO	5,286,146	-	0.00%	-	0.00%	30	<0.01%	180	<0.01%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	870	0.10%	1,754	0.20%
NC	8,502,462	-	0.00%	122	<0.01%	783	0.01%	15,666	0.18%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	504	0.08%
NE	1,607,025	-	0.00%	-	0.00%	561	0.03%	561	0.03%
NH	948,457	-	0.00%	-	0.00%	-	0.00%	85	0.01%
NJ	9,010,012	-	0.00%	-	0.00%	81	<0.01%	793	0.01%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,185,280	-	0.00%	1,246	0.01%	1,891	0.02%	105,002	1.03%
OH	10,244,162	-	0.00%	-	0.00%	552	0.01%	2,899	0.03%
OK	3,660,529	50	<0.01%	50	<0.01%	50	<0.01%	246	0.01%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,892,216	-	0.00%	-	0.00%	541	<0.01%	5,005	0.04%
RI	1,064,656	-	0.00%	-	0.00%	-	0.00%	100	0.01%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	185	<0.01%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,189,696	-	0.00%	40	<0.01%	1,200	<0.01%	11,589	0.04%
UT	4,600,766	-	0.00%	-	0.00%	83	0.00%	3,543	0.08%
VA	7,067,045	-	0.00%	150	<0.01%	445	0.01%	13,842	0.20%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	107	0.00%
WI	4,017,600	-	0.00%	-	0.00%	155	<0.01%	203	0.01%
WV	1,554,196	-	0.00%	3,528	0.23%	3,528	0.23%	4,097	0.26%
WY	508,924	-	0.00%	-	0.00%	1,037	0.20%	2,108	0.41%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	920	3.34%
R05 tribes	139,986	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	1,222	0.28%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,596,487**	**109**	**<0.01%**	**10,509**	**<0.01%**	**41,239**	**0.02%**	**360,289**	**0.13%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.8.3 Summary of Data

A total of 487,166 analytical results from 52,222 PWSs in 58 States were available in the SYR 4 ICR dataset for dichloromethane. The Stage 2 analysis of occurrence in drinking water indicated that 2 systems in 2 States, serving 109 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 215 systems in 40 States, serving 360,289 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems with mean concentrations greater than the MCL and EQL were ground water systems.

B.9 1,2-Dichloropropane

This chapter on 1,2-dichloropropane includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.9.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for 1,2-dichloropropane on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

1,2-Dichloropropane is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[20] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, a system may be granted a waiver. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.9.2 Occurrence in Drinking Water

The analysis of 1,2-dichloropropane occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 481,065 analytical results from 52,197 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

[20] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including 1,2-dichloropropane, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for 1,2-dichloropropane in the dataset is 0.5 µg/L. Three arithmetic mean 1,2-dichloropropane concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with 1,2-dichloropropane data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For 1,2-dichloropropane, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for 1,2-dichloropropane are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[21] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-33 presents the system-level Stage 2 analysis of estimated mean concentrations for 1,2-dichloropropane occurrence in drinking water. Exhibit B-34 presents similar information

[21] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, no system had an estimated mean concentration greater than the MCL of 5 µg/L. A total of 41 systems (0.08 percent of all systems), serving 34,800 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-33: 1,2-Dichloropropane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,677	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		4	2	2	0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		21	15	14	0.04%	0.03%	0.03%
	> EQL (0.5 µg/L)		98	41	37	0.21%	0.09%	0.08%
Surface Water	> MCL (5 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.5 µg/L)		5	0	0	0.11%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,197	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		4	2	2	0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		21	15	14	0.04%	0.03%	0.03%
	> EQL (0.5 µg/L)		103	41	37	0.20%	0.08%	0.07%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-34: 1,2-Dichloropropane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,106,251	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		1,340	351	351	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		5,068	3,066	2,966	<0.01%	<0.01%	<0.01%
	> EQL (0.5 µg/L)		1,284,226	34,800	34,296	1.16%	0.03%	0.03%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.5 µg/L)		486,520	0	0	0.30%	0.00%	0.00%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> MCL (5 µg/L)	274,592,711	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (2.5 µg/L)		1,340	351	351	<0.01%	<0.01%	<0.01%
	> 2× EQL (1 µg/L)		5,068	3,066	2,966	<0.01%	<0.01%	<0.01%
	> EQL (0.5 µg/L)		1,770,746	34,800	34,296	0.64%	0.01%	0.01%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for 1,2-dichloropropane were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for 1,2-dichloropropane. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-35 presents the total number of systems in each State that submitted data for 1,2-dichloropropane. In addition, the geographic distribution of 1,2-dichloropropane occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-36 presents similar information based on the population served by the systems. Exhibit B-35 and Exhibit B-36 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 5 µg/L. A total of 41 systems in 11 States, serving 34,800 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-35: 1,2-Dichloropropane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	4,166	-	0.00%	-	0.00%	2	0.05%	8	0.19%
CO	899	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	980	-	0.00%	-	0.00%	1	0.10%	2	0.20%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%	1	0.33%
FL	2,240	-	0.00%	-	0.00%	1	0.04%	2	0.09%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	915	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	1,489	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	1,312	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
LA	1,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	805	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	1,344	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	1,393	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	2	0.10%	8	0.39%	17	0.83%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	1,292	-	0.00%	-	0.00%	-	0.00%	1	0.08%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,561	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	1,675	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	3,044	-	0.00%	-	0.00%	-	0.00%	1	0.03%
RI	142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%	2	0.40%
TN	368	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	490	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	1,499	-	0.00%	-	0.00%	3	0.20%	4	0.27%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	2	0.08%
WI	2,075	-	0.00%	-	0.00%	-	0.00%	1	0.05%
WV	314	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,197**	**-**	**0.00%**	**2**	**<0.01%**	**15**	**0.03%**	**41**	**0.08%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-36: 1,2-Dichloropropane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	38,534,535	-	0.00%	-	0.00%	1,704	<0.01%	2,643	0.01%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	-	0.00%	95	<0.01%	183	0.01%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%	60	0.01%
FL	20,279,328	-	0.00%	-	0.00%	158	<0.01%	25,766	0.13%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	5,256,413	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	748,497	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	4,519,439	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	5,286,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	351	<0.01%	959	0.01%	3,437	0.04%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	9,009,043	-	0.00%	-	0.00%	-	0.00%	277	<0.01%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,183,557	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	10,243,847	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	-	0.00%	-	0.00%	200	<0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%	465	0.01%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	-	0.00%	150	<0.01%	270	<0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	1,459	0.02%
WI	4,017,600	-	0.00%	-	0.00%	-	0.00%	40	<0.01%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,592,711**	**-**	**<0.01%**	**351**	**<0.01%**	**3,066**	**<0.01%**	**34,800**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.9.3 Summary of Data

A total of 481,065 analytical results from 52,197 PWSs in 58 States were available in the SYR 4 ICR dataset for 1,2-dichloropropane. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 5 µg/L. Forty-one systems in 11 States, serving 34,800 people, had estimated mean concentrations greater than the EQL of 0.5 µg/L. The majority of systems with mean concentrations greater than the EQL were ground water systems.

B.10 Endothall

This chapter on endothall includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.10.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for endothall on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 100 µg/L. EPA developed the MCLG based on a reference dose (RfD) of 20 µg/kg-day (0.02 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

Endothall is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period , but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[22] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.10.2 Occurrence in Drinking Water

The analysis of endothall occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 98,015 analytical

[22] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

results from 18,624 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including endothall, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for endothall in the dataset is 9 µg/L. Three arithmetic mean endothall concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with endothall data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For endothall, EPA generated Stage 2 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for endothall are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 100 µg/L (MCL) and 50 µg/L (EQL). The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).[23] For more

[23] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-37 presents the system-level Stage 2 analysis of estimated mean concentrations for endothall occurrence in drinking water. Exhibit B-38 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the EQL of 50 µg/L or MCL of 100 µg/L.

Exhibit B-37: Endothall Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (100 µg/L)	16,772	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (100 µg/L)	1,852	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (100 µg/L)	18,624	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-38: Endothall Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (100 µg/L)	59,600,753	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (100 µg/L)	81,991,505	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (100 µg/L)	141,592,258	0	0	0	0.00%	0.00%	0.00%
	> EQL (50 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for endothall were available from 51 States. Eight States (Delaware, Massachusetts, Minnesota, North Carolina, Rhode Island, South Carolina, South Dakota, and Utah) submitted

some data for the SYR 4 dataset but none for endothall. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-39 presents the total number of systems in each State that submitted data for endothall. In addition, the geographic distribution of endothall occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and EQL. Exhibit B-40 presents similar information based on the population served by the systems. Exhibit B-39 and Exhibit B-40 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 100 µg/L or EQL of 50 µg/L.

Exhibit B-39: Endothall Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,505	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	28	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
FL	2,209	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	2	-	0.00%	-	0.00%
ID	568	-	0.00%	-	0.00%
IL	1,148	-	0.00%	-	0.00%
IN	1,299	-	0.00%	-	0.00%
KS	2	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,045	-	0.00%	-	0.00%
MD	9	-	0.00%	-	0.00%
ME	12	-	0.00%	-	0.00%
MO	30	-	0.00%	-	0.00%
MP	3	-	0.00%	-	0.00%
MT	3	-	0.00%	-	0.00%
ND	8	-	0.00%	-	0.00%
NE	17	-	0.00%	-	0.00%
NH	12	-	0.00%	-	0.00%
NJ	3	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%
NY	60	-	0.00%	-	0.00%
OH	109	-	0.00%	-	0.00%
OK	75	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%
PA	2,979	-	0.00%	-	0.00%
TN	2	-	0.00%	-	0.00%
TX	5	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
VA	9	-	0.00%	-	0.00%
VT	1	-	0.00%	-	0.00%
WA	26	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	5	-	0.00%	-	0.00%
WY	307	-	0.00%	-	0.00%
Region 01 tribes	1	-	0.00%	-	0.00%
Region 02 tribes	3	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	86	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	5	-	0.00%	-	0.00%
Region 08 tribes	83	-	0.00%	-	0.00%
Region 09 tribes	153	-	0.00%	-	0.00%
Region 10 tribes	89	-	0.00%	-	0.00%
Total	**18,624**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-40: Endothall Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,647,019	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	427,395	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
FL	19,909,428	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	165,838	-	0.00%	-	0.00%
ID	1,242,667	-	0.00%	-	0.00%
IL	9,287,182	-	0.00%	-	0.00%
IN	5,266,171	-	0.00%	-	0.00%
KS	619,117	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,416	-	0.00%	-	0.00%
MD	2,132,341	-	0.00%	-	0.00%
ME	96,265	-	0.00%	-	0.00%
MO	1,998,423	-	0.00%	-	0.00%
MP	55,407	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
MT	1,353	-	0.00%	-	0.00%
ND	86,079	-	0.00%	-	0.00%
NE	920,921	-	0.00%	-	0.00%
NH	3,323	-	0.00%	-	0.00%
NJ	163,591	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%
NV	2,858,446	-	0.00%	-	0.00%
NY	1,670,304	-	0.00%	-	0.00%
OH	2,189,996	-	0.00%	-	0.00%
OK	1,370,955	-	0.00%	-	0.00%
OR	3,537,703	-	0.00%	-	0.00%
PA	11,674,992	-	0.00%	-	0.00%
TN	258,680	-	0.00%	-	0.00%
TX	1,206,005	-	0.00%	-	0.00%
VA	1,284,869	-	0.00%	-	0.00%
VT	88	-	0.00%	-	0.00%
WA	574,307	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	25,691	-	0.00%	-	0.00%
WY	506,813	-	0.00%	-	0.00%
Region 01 tribes	37,807	-	0.00%	-	0.00%
Region 02 tribes	6,084	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	114,627	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	11,009	-	0.00%	-	0.00%
Region 08 tribes	128,933	-	0.00%	-	0.00%
Region 09 tribes	339,271	-	0.00%	-	0.00%
Region 10 tribes	77,989	-	0.00%	-	0.00%
Total	**141,592,258**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.10.3 Summary of Data

A total of 98,015 analytical results from 18,624 PWSs in 51 States were available in the SYR 4 ICR dataset for endothall. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 100 µg/L or EQL of 50 µg/L.

B.11 Heptachlor

This chapter on heptachlor includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.11.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for heptachlor on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 0.4 µg/L based on analytical feasibility.

Heptachlor is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[24] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.11.2 Occurrence in Drinking Water

The analysis of heptachlor occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 193,927

[24] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

analytical results from 38,640 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including heptachlor, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for heptachlor in the dataset is 0.04 µg/L. Three arithmetic mean heptachlor concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with heptachlor data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For heptachlor, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for heptachlor are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 0.4 µg/L (MCL), 0.2 µg/L (½ MCL), and 0.1 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation

level (PQL).[25] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-41 presents the system-level Stage 2 analysis of estimated mean concentrations for heptachlor occurrence in drinking water. Exhibit B-42 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 0.4 µg/L. One water system (less than 0.01 percent of all systems) had an estimated mean concentration greater than the EQL of 0.1 µg/L. This system served 900 people.

Exhibit B-41: Heptachlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.4 µg/L)	35,149	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (0.4 µg/L)	3,491	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (0.4 µg/L)	38,640	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-42: Heptachlor Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.4 µg/L)	92,267,648	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		900	900	900	<0.01%	<0.01%	<0.01%

[25] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Surface Water	> MCL (0.4 µg/L)	144,655,219	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (0.4 µg/L)	236,922,867	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		900	900	900	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for heptachlor were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for heptachlor. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-43 presents the total number of systems in each State that submitted data for heptachlor. In addition, the geographic distribution of heptachlor occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, and EQL. Exhibit B-44 presents similar information based on the population served by the systems. Exhibit B-43 and Exhibit B-44 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 0.4 µg/L. One system from Region 4 tribes had an estimated mean concentration greater than the EQL of 0.1 µg/L.

Exhibit B-43: Heptachlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 0.4 µg/L		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%
CA	1,446	-	0.00%	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	244	-	0.00%	-	0.00%	-	0.00%
FL	2,208	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%	-	0.00%
ID	571	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 0.4 µg/L		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
IL	1,151	-	0.00%	-	0.00%	-	0.00%
IN	1,301	-	0.00%	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%
MA	696	-	0.00%	-	0.00%	-	0.00%
MD	919	-	0.00%	-	0.00%	-	0.00%
ME	246	-	0.00%	-	0.00%	-	0.00%
MN	889	-	0.00%	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%
NC	2,045	-	0.00%	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%	-	0.00%
NJ	199	-	0.00%	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%	-	0.00%
NV	292	-	0.00%	-	0.00%	-	0.00%
NY	2,117	-	0.00%	-	0.00%	-	0.00%
OH	29	-	0.00%	-	0.00%	-	0.00%
OK	141	-	0.00%	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%	-	0.00%
PA	2,989	-	0.00%	-	0.00%	-	0.00%
RI	138	-	0.00%	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%	-	0.00%
TN	5	-	0.00%	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%	-	0.00%
VA	239	-	0.00%	-	0.00%	-	0.00%
VT	281	-	0.00%	-	0.00%	-	0.00%
WA	1,310	-	0.00%	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%	-	-
Region 02 tribes	7	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	1	6.67%
Region 05 tribes	96	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	158	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%	-	0.00%
Total	**38,640**	**-**	**0.00%**	**-**	**0.00%**	**1**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-44: Heptachlor Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.4 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%	-	0.00%
CA	33,112,616	-	0.00%	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	895,444	-	0.00%	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%	-	0.00%
ID	1,257,581	-	0.00%	-	0.00%	-	0.00%
IL	9,293,135	-	0.00%	-	0.00%	-	0.00%
IN	5,266,230	-	0.00%	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%	-	0.00%
MA	9,589,788	-	0.00%	-	0.00%	-	0.00%
MD	5,486,381	-	0.00%	-	0.00%	-	0.00%
ME	375,308	-	0.00%	-	0.00%	-	0.00%
MN	4,094,416	-	0.00%	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%	-	0.00%
NJ	5,651,299	-	0.00%	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%	-	0.00%
NV	2,858,731	-	0.00%	-	0.00%	-	0.00%
NY	10,035,311	-	0.00%	-	0.00%	-	0.00%
OH	234,113	-	0.00%	-	0.00%	-	0.00%
OK	2,319,994	-	0.00%	-	0.00%	-	0.00%
OR	3,536,278	-	0.00%	-	0.00%	-	0.00%
PA	11,694,840	-	0.00%	-	0.00%	-	0.00%
RI	1,063,121	-	0.00%	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%	-	0.00%
TN	271,236	-	0.00%	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%	-	0.00%
VA	5,673,316	-	0.00%	-	0.00%	-	0.00%
VT	364,010	-	0.00%	-	0.00%	-	0.00%
WA	6,178,527	-	0.00%	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.4 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
WV	1,554,136	-	0.00%	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%	900	3.27%
Region 05 tribes	134,402	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	363,193	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%	-	0.00%
Total	**236,922,867**	**-**	**0.00%**	**-**	**0.00%**	**900**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.11.3 Summary of Data

A total of 193,927 analytical results from 38,640 PWSs in 58 States were available in the SYR 4 ICR dataset for heptachlor. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 0.4 µg/L. One ground water system from Region 4 tribes, serving 900 people, had an estimated mean concentration greater than the EQL of 0.1 µg/L.

B.12 Heptachlor Epoxide

This chapter on heptachlor epoxide includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.12.1 Background

On January 30, 1991, the United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for heptachlor epoxide, a product of heptachlor degradation (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 0.2 µg/L based on analytical feasibility.

Heptachlor epoxide is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[26] If all four samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.12.2 Occurrence in Drinking Water

The analysis of heptachlor epoxide occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 193,623

[26] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

analytical results from 38,638 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including heptachlor epoxide, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the MRL value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for heptachlor epoxide in the dataset is 0.02 µg/L. Three arithmetic mean heptachlor epoxide concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For heptachlor epoxide, EPA generated Stage 2 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for heptachlor epoxide are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 0.2 µg/L (MCL) and 0.1 µg/L (EQL and ½ MCL). The EQL represents the potential quantitation capabilities below a practical quantitation

level (PQL).[27] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-45 presents the system-level Stage 2 analysis of estimated mean concentrations for heptachlor epoxide occurrence in drinking water. Exhibit B-46 presents similar information based on population served by the systems. Based on the Stage 2 analyses, 1 system (less than 0.01 percent of all systems) had an estimated mean concentration greater than the MCL of 0.2 µg/L. This system serves 24,343 people. Three systems (0.01 percent of all systems), serving 32,710 people, had estimated mean concentrations greater than the EQL of 0.1 µg/L.

Exhibit B-45: Heptachlor Epoxide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.2 µg/L)	35,147	1	1	1	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		3	3	3	0.01%	0.01%	0.01%
Surface Water	> MCL (0.2 µg/L)	3,491	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (0.2 µg/L)	38,638	1	1	1	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		3	3	3	0.01%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-46: Heptachlor Epoxide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.2 µg/L)	92,269,513	24,343	24,343	24,343	0.03%	0.03%	0.03%
	> EQL (0.1 µg/L)		32,710	32,710	32,710	0.04%	0.04%	0.04%
Surface Water	> MCL (0.2 µg/L)	144,655,219	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.1 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> MCL (0.2 µg/L)	236,924,732	24,343	24,343	24,343	0.01%	0.01%	0.01%

[27] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> EQL (0.1 µg/L)		32,710	32,710	32,710	0.01%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for heptachlor epoxide were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for heptachlor epoxide. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-47 presents the total number of systems in each State that submitted data for heptachlor epoxide. In addition, the geographic distribution of heptachlor epoxide occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and EQL. Exhibit B-48 presents similar information based on the population served by the systems. Exhibit B-47 and Exhibit B-48 present only the ½ MRL substitution results. One system in Massachusetts, serving 24,343 people, had an estimated mean concentration greater than the MCL of 0.2 µg/L. Three systems in 3 States, serving 32,710 people, had estimated mean concentrations greater than the EQL of 0.1 µg/L.

Exhibit B-47: Heptachlor Epoxide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,446	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	244	-	0.00%	-	0.00%
FL	2,208	-	0.00%	1	0.05%
HI	117	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%
ID	571	-	0.00%	-	0.00%
IL	1,150	-	0.00%	-	0.00%
IN	1,301	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	696	1	0.14%	1	0.14%
MD	920	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent
ME	246	-	0.00%	-	0.00%
MN	889	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,045	-	0.00%	1	0.05%
ND	129	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%
NJ	199	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%
NV	292	-	0.00%	-	0.00%
NY	2,116	-	0.00%	-	0.00%
OH	29	-	0.00%	-	0.00%
OK	140	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%
PA	2,989	-	0.00%	-	0.00%
RI	138	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%
TN	5	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%
VA	239	-	0.00%	-	0.00%
VT	281	-	0.00%	-	0.00%
WA	1,310	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	96	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	158	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%
Total	**38,638**	**1**	**<0.01%**	**3**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-48: Heptachlor Epoxide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,114,976	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	895,444	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	8,136	0.04%
HI	1,519,531	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%
ID	1,257,581	-	0.00%	-	0.00%
IL	9,292,975	-	0.00%	-	0.00%
IN	5,266,230	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%
MA	9,589,788	24,343	0.25%	24,343	0.25%
MD	5,486,421	-	0.00%	-	0.00%
ME	375,308	-	0.00%	-	0.00%
MN	4,094,416	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	231	<0.01%
ND	666,967	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%
NJ	5,651,299	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%
NV	2,858,731	-	0.00%	-	0.00%
NY	10,035,011	-	0.00%	-	0.00%
OH	234,113	-	0.00%	-	0.00%
OK	2,319,919	-	0.00%	-	0.00%
OR	3,536,278	-	0.00%	-	0.00%
PA	11,694,840	-	0.00%	-	0.00%
RI	1,063,121	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%
TN	271,236	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,673,316	-	0.00%	-	0.00%
VT	364,010	-	0.00%	-	0.00%
WA	6,178,527	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	134,402	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	363,193	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%
Total	**236,924,732**	**24,343**	**0.01%**	**32,710**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.12.3 Summary of Data

A total of 193,623 analytical results from 38,638 PWSs in 58 States were available for the SYR 4 ICR dataset for heptachlor epoxide. The Stage 2 analysis of occurrence in drinking water indicates that one system in Massachusetts, serving 24,343 people, had an estimated mean concentration greater than the MCL of 0.2 µg/L. Three ground water systems in 3 States, serving 32,710 people, had an estimated mean concentration greater than the EQL of 0.1 µg/L.

B.13 Hexachlorobenzene

This chapter on hexachlorobenzene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.13.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for hexachlorobenzene on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 1 µg/L based on analytical feasibility.

Hexachlorobenzene is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[28] If all four samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.13.2 Occurrence in Drinking Water

The analysis of hexachlorobenzene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 195,150 analytical results from 38,311 public water systems (PWSs) during the period from 2012 to

[28] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including hexachlorobenzene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for hexachlorobenzene in the dataset is 0.1 µg/L. Three arithmetic mean hexachlorobenzene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with hexachlorobenzene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For hexachlorobenzene, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for hexachlorobenzene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 1 µg/L (MCL), 0.5 µg/L (½ MCL), 0.2 µg/L (2× EQL), and 0.1 µg/L (EQL). The EQL represents the potential quantitation capabilities below

a practical quantitation level (PQL).[29] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-49 presents the system-level Stage 2 analysis of estimated mean concentrations for hexachlorobenzene occurrence in drinking water. Exhibit B-50 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, no system had an estimated mean concentration greater than the MCL of 1 µg/L. A total of 6 systems (representing 0.02 percent of all systems), serving 17,278 people, had an estimated mean concentration greater than the EQL of 0.1 µg/L.

Exhibit B-49: Hexachlorobenzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1 µg/L)	34,851	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.2 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
	> EQL (0.1 µg/L)		8	3	3	0.02%	0.01%	0.01%
Surface Water	> MCL (1 µg/L)	3,460	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		1	1	1	0.03%	0.03%	0.03%
	> 2× EQL (0.2 µg/L)		2	1	1	0.06%	0.03%	0.03%
	> EQL (0.1 µg/L)		5	3	3	0.14%	0.09%	0.09%
Combined Ground & Surface Water	> MCL (1 µg/L)	38,311	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
	> 2× EQL (0.2 µg/L)		3	2	2	0.01%	0.01%	0.01%
	> EQL (0.1 µg/L)		13	6	6	0.03%	0.02%	0.02%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[29] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-50: Hexachlorobenzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1 µg/L)	91,561,318	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.2 µg/L)		100	100	100	<0.01%	<0.01%	<0.01%
	> EQL (0.1 µg/L)		50,926	5,850	5,850	0.06%	0.01%	0.01%
Surface Water	> MCL (1 µg/L)	140,455,870	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		4,100	4,100	4,100	<0.01%	<0.01%	<0.01%
	> 2× EQL (0.2 µg/L)		6,428	4,100	4,100	<0.01%	<0.01%	<0.01%
	> EQL (0.1 µg/L)		48,775	11,428	11,428	0.03%	0.01%	0.01%
Combined Ground & Surface Water	> MCL (1 µg/L)	232,017,188	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.5 µg/L)		4,100	4,100	4,100	<0.01%	<0.01%	<0.01%
	> 2× EQL (0.2 µg/L)		6,528	4,200	4,200	<0.01%	<0.01%	<0.01%
	> EQL (0.1 µg/L)		99,701	17,278	17,278	0.04%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for hexachlorobenzene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for hexachlorobenzene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-51 presents the total number of systems in each State that submitted data for hexachlorobenzene. In addition, the geographic distribution of hexachlorobenzene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-52 presents similar information based on the population served by the systems. Exhibit B-51 and Exhibit B-52 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 1 µg/L. Six systems in 3 States, serving 17,278 people, had an estimated mean concentration greater than the EQL of 0.1 µg/L.

Exhibit B-51: Hexachlorobenzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	1,467	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	899	-	0.00%	1	0.11%	1	0.11%	1	0.11%
CT	960	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	244	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	2,208	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	633	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	1,033	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	1,301	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	1	0.10%	4	0.38%
MA	696	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	920	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	245	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	889	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ND	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	65	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,116	-	0.00%	-	0.00%	-	0.00%	1	0.05%
OH	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OK	140	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	1,153	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	2,989	-	0.00%	-	0.00%	-	0.00%	-	0.00%
RI	138	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	5	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	240	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	280	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	1,307	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	300	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	95	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	64	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	83	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R09 tribes	157	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	85	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**38,311**	**-**	**0.00%**	**1**	**<0.01%**	**2**	**0.01%**	**6**	**0.02%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-52: Hexachlorobenzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	33,518,268	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	6,494,419	-	0.00%	4,100	0.06%	4,100	0.06%	4,100	0.06%
CT	2,873,802	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	895,444	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	1,272,180	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,244,245	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	5,266,230	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%	100	<0.01%	12,528	0.24%
MA	9,589,788	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	5,486,421	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	375,198	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	4,094,416	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ND	86,079	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	1,483,709	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,858,471	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,034,364	-	0.00%	-	0.00%	-	0.00%	650	0.01%
OH	156,409	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
OK	2,319,919	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	3,536,643	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,694,105	-	0.00%	-	0.00%	-	0.00%	-	0.00%
RI	1,063,121	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	271,236	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	5,674,592	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	363,963	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	6,177,694	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	1,108,414	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	134,242	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,077	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	128,933	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	363,153	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	74,512	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**232,017,188**	**-**	**0.00%**	**4,100**	**<0.01%**	**4,200**	**<0.01%**	**17,278**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.13.3 Summary of Data

A total of 195,150 analytical results from 38,311 PWSs in 58 States were available in the SYR 4 ICR dataset for hexachlorobenzene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 1 µg/L. Six systems in 3 States, serving 17,278 people, had estimated mean concentrations greater than the EQL of 0.1 µg/L.

B.14 Hexachlorocyclopentadiene

This chapter on hexachlorocyclopentadiene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.14.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for hexachlorocyclopentadiene on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 50 µg/L. EPA based the MCLG on a reference dose (RfD) of 7 µg/kg-day (0.007 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

Hexachlorocyclopentadiene is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[30] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

[30] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

B.14.2 Occurrence in Drinking Water

The analysis of hexachlorocyclopentadiene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 196,236 analytical results from 38,471 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including hexachlorocyclopentadiene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for hexachlorocyclopentadiene in the dataset is 0.1 µg/L. Three arithmetic mean hexachlorocyclopentadiene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with hexachlorocyclopentadiene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. EPA generated Stage 2 occurrence estimates relative to the MCL and the potential MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for hexachlorocyclopentadiene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 50 µg/L (MCL) and 40 µg/L (potential MCLG). The potential MCLG reflects a change in the RfD based on new health effects information. Since the practical quantitation level (PQL) for hexachlorocyclopentadiene is less than the potential MCLG, EPA designated the potential MCLG as the threshold for the

occurrence analysis. For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-53 presents the system-level Stage 2 analysis of estimated mean concentrations for hexachlorocyclopentadiene occurrence in drinking water. Exhibit B-54 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 50 µg/L or potential MCLG of 40 µg/L.

Exhibit B-53: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (50 µg/L)	34,987	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (50 µg/L)	3,484	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (50 µg/L)	38,471	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-54: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (50 µg/L)	92,120,251	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (50 µg/L)	144,521,377	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (50 µg/L)	236,641,628	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (40 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for hexachlorocyclopentadiene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for hexachlorocyclopentadiene. Seven States (Georgia,

Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-55 presents the total number of systems in each State that submitted data for hexachlorocyclopentadiene. In addition, the geographic distribution of hexachlorocyclopentadiene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and EQL. Exhibit B-56 presents similar information based on the population served by the systems. Exhibit B-55 and Exhibit B-56 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 50 µg/L or EQL of 40 µg/L.

Exhibit B-55: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L		Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,472	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	244	-	0.00%	-	0.00%
FL	2,208	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%
ID	633	-	0.00%	-	0.00%
IL	1,041	-	0.00%	-	0.00%
IN	1,301	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	696	-	0.00%	-	0.00%
MD	919	-	0.00%	-	0.00%
ME	246	-	0.00%	-	0.00%
MN	889	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,045	-	0.00%	-	0.00%
ND	8	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%
NJ	199	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%
NY	2,118	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L		Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent
OH	11	-	0.00%	-	0.00%
OK	140	-	0.00%	-	0.00%
OR	1,152	-	0.00%	-	0.00%
PA	2,990	-	0.00%	-	0.00%
RI	138	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%
TN	5	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%
VA	239	-	0.00%	-	0.00%
VT	280	-	0.00%	-	0.00%
WA	1,305	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	95	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	83	-	0.00%	-	0.00%
Region 09 tribes	157	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%
Total	**38,471**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-56: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 50 µg/L		Population Served by Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,519,043	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	895,444	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 50 µg/L		Population Served by Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent
IA	166,085	-	0.00%	-	0.00%
ID	1,272,180	-	0.00%	-	0.00%
IL	9,245,812	-	0.00%	-	0.00%
IN	5,266,230	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%
MA	9,589,788	-	0.00%	-	0.00%
MD	5,486,381	-	0.00%	-	0.00%
ME	375,308	-	0.00%	-	0.00%
MN	4,094,416	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	-	0.00%
ND	86,079	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%
NJ	5,651,299	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%
NV	2,858,471	-	0.00%	-	0.00%
NY	10,035,426	-	0.00%	-	0.00%
OH	177,638	-	0.00%	-	0.00%
OK	2,319,919	-	0.00%	-	0.00%
OR	3,535,143	-	0.00%	-	0.00%
PA	11,694,040	-	0.00%	-	0.00%
RI	1,063,121	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%
TN	271,236	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,673,316	-	0.00%	-	0.00%
VT	363,963	-	0.00%	-	0.00%
WA	6,167,378	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	134,242	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	128,933	-	0.00%	-	0.00%
Region 09 tribes	363,153	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%
Total	**236,641,628**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

B.14.3 Summary of Data

A total of 196,236 analytical results from 38,471 PWSs in 58 States were available in the SYR 4 ICR dataset for hexachlorocyclopentadiene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 50 µg/L or potential MCLG of 40 µg/L.

B.15 Methoxychlor

This chapter on methoxychlor includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.15.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for methoxychlor on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 40 µg/L. The agency based the MCLG on a reference dose (RfD) of 5 µg/kg-day (0.005 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

Methoxychlor is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[31] If all four samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.15.2 Occurrence in Drinking Water

The analysis of methoxychlor occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 196,131

[31] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

analytical results from 38,834 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including methoxychlor, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for methoxychlor in the dataset is 0.1 µg/L. Three arithmetic mean methoxychlor concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with methoxychlor data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For methoxychlor, EPA generated Stage 2 occurrence estimates relative to the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for methoxychlor are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 40 µg/L (MCL), 2 µg/L (2× EQL), and 1 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation

level (PQL).[32] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-57 presents the system-level Stage 2 analysis of estimated mean concentrations for methoxychlor occurrence in drinking water. Exhibit B-58 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 40 µg/L. One system (less than 0.01 percent of all systems), serving 22,536 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-57: Methoxychlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (40 µg/L)	35,322	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
	> EQL (1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (40 µg/L)	3,512	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (40 µg/L)	38,834	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%
	> EQL (1 µg/L)		1	1	1	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[32] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-58: Methoxychlor Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (40 µg/L)	92,601,363	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		22,536	22,536	22,536	0.02%	0.02%	0.02%
	> EQL (1 µg/L)		22,536	22,536	22,536	0.02%	0.02%	0.02%
Surface Water	> MCL (40 µg/L)	146,779,537	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (40 µg/L)	239,380,900	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		22,536	22,536	22,536	0.01%	0.01%	0.01%
	> EQL (1 µg/L)		22,536	22,536	22,536	0.01%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for methoxychlor were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for methoxychlor. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-59 presents the total number of systems in each State that submitted data for methoxychlor. In addition, the geographic distribution of methoxychlor occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, 2× EQL, and EQL. Exhibit B-60 presents similar information based on the population served by the systems. Exhibit B-59 and Exhibit B-60 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 40 µg/L. One system in California, serving 22,536 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-59: Methoxychlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	74	-	0.00%	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%
CA	1,516	-	0.00%	1	0.07%	1	0.07%
CO	898	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
CT	960	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	244	-	0.00%	-	0.00%	-	0.00%
FL	2,208	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%	-	0.00%
ID	571	-	0.00%	-	0.00%	-	0.00%
IL	1,149	-	0.00%	-	0.00%	-	0.00%
IN	1,301	-	0.00%	-	0.00%	-	0.00%
KS	106	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%
MA	696	-	0.00%	-	0.00%	-	0.00%
MD	920	-	0.00%	-	0.00%	-	0.00%
ME	246	-	0.00%	-	0.00%	-	0.00%
MN	889	-	0.00%	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%
NC	2,045	-	0.00%	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%	-	0.00%
NE	662	-	0.00%	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%	-	0.00%
NJ	199	-	0.00%	-	0.00%	-	0.00%
NN	140	-	0.00%	-	0.00%	-	0.00%
NV	292	-	0.00%	-	0.00%	-	0.00%
NY	2,117	-	0.00%	-	0.00%	-	0.00%
OH	139	-	0.00%	-	0.00%	-	0.00%
OK	145	-	0.00%	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%	-	0.00%
PA	2,991	-	0.00%	-	0.00%	-	0.00%
RI	138	-	0.00%	-	0.00%	-	0.00%
SC	444	-	0.00%	-	0.00%	-	0.00%
TN	5	-	0.00%	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%	-	0.00%
VA	239	-	0.00%	-	0.00%	-	0.00%
VT	281	-	0.00%	-	0.00%	-	0.00%
WA	1,320	-	0.00%	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	96	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	157	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%	-	0.00%
Total	**38,834**	**-**	**0.00%**	**1**	**<0.01%**	**1**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-60: Methoxychlor Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 40 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	81,013	-	0.00%	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%	-	0.00%
CA	33,483,599	-	0.00%	22,536	0.07%	22,536	0.07%
CO	6,494,001	-	0.00%	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	895,444	-	0.00%	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%	-	0.00%
ID	1,257,581	-	0.00%	-	0.00%	-	0.00%
IL	9,292,275	-	0.00%	-	0.00%	-	0.00%
IN	5,266,230	-	0.00%	-	0.00%	-	0.00%
KS	2,066,153	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%	-	0.00%
MA	9,589,788	-	0.00%	-	0.00%	-	0.00%
MD	5,486,421	-	0.00%	-	0.00%	-	0.00%
ME	375,308	-	0.00%	-	0.00%	-	0.00%
MN	4,094,416	-	0.00%	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%	-	0.00%
NE	1,612,786	-	0.00%	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%	-	0.00%
NJ	5,651,299	-	0.00%	-	0.00%	-	0.00%
NN	153,459	-	0.00%	-	0.00%	-	0.00%
NV	2,858,731	-	0.00%	-	0.00%	-	0.00%
NY	10,035,311	-	0.00%	-	0.00%	-	0.00%
OH	2,305,366	-	0.00%	-	0.00%	-	0.00%
OK	2,334,301	-	0.00%	-	0.00%	-	0.00%
OR	3,536,278	-	0.00%	-	0.00%	-	0.00%
PA	11,696,319	-	0.00%	-	0.00%	-	0.00%
RI	1,063,121	-	0.00%	-	0.00%	-	0.00%
SC	3,874,369	-	0.00%	-	0.00%	-	0.00%
TN	271,236	-	0.00%	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 40 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
VA	5,673,316	-	0.00%	-	0.00%	-	0.00%
VT	364,010	-	0.00%	-	0.00%	-	0.00%
WA	6,179,822	-	0.00%	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%	-	0.00%
WV	1,554,136	-	0.00%	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	134,402	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	362,729	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%	-	0.00%
Total	**239,380,900**	**-**	**0.00%**	**22,536**	**0.01%**	**22,536**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.15.3 Summary of Data

A total of 196,131 analytical results from 38,834 PWSs in 58 States were available in the SYR 4 ICR dataset for methoxychlor. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 40 µg/L. One ground water system in California, serving 22,536 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

B.16 Pentachlorophenol

This chapter on pentachlorophenol includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.16.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for pentachlorophenol on July 1, 1991 (56 FR 30266; USEPA, 1991b). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 1 µg/L, based on analytical feasibility.

Pentachlorophenol is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[33] If all four samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.16.2 Occurrence in Drinking Water

The analysis of pentachlorophenol occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 201,636

[33] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

analytical results from 41,094 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including pentachlorophenol, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for pentachlorophenol in the dataset is 0.04 µg/L. Three arithmetic mean pentachlorophenol concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with pentachlorophenol data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For pentachlorophenol, EPA generated Stage 2 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for pentachlorophenol are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 1 µg/L (MCL) and 0.9 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level

(PQL).[34] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-61 presents the system-level Stage 2 analysis of estimated mean concentrations for pentachlorophenol occurrence in drinking water. Exhibit B-62 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 1 µg/L or EQL of 0.9 µg/L.

Exhibit B-61: Pentachlorophenol Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1 µg/L)	37,521	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (1 µg/L)	3,573	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (1 µg/L)	41,094	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-62: Pentachlorophenol Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1 µg/L)	95,268,088	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%
Surface Water	> MCL (1 µg/L)	147,070,527	0	0	0	0.00%	0.00%	0.00%
	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> MCL (1 µg/L)	242,338,615	0	0	0	0.00%	0.00%	0.00%

[34] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Combined Ground & Surface Water	> EQL (0.9 µg/L)		0	0	0	0.00%	0.00%	0.00%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for pentachlorophenol were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for pentachlorophenol. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-63 presents the total number of systems in each State that submitted data for pentachlorophenol. In addition, the geographic distribution of pentachlorophenol occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and EQL. Exhibit B-64 presents similar information based on the population served by the systems. Exhibit B-63 and Exhibit B-64 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 1 µg/L or EQL of 0.9 µg/L.

Exhibit B-63: Pentachlorophenol Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.9 µg/L	
		Number	Percent	Number	Percent
AK	75	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	1,909	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	238	-	0.00%	-	0.00%
FL	2,209	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	954	-	0.00%	-	0.00%
ID	659	-	0.00%	-	0.00%
IL	1,152	-	0.00%	-	0.00%
IN	1,300	-	0.00%	-	0.00%
KS	3	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	697	-	0.00%	-	0.00%
MD	921	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.9 µg/L	
		Number	Percent	Number	Percent
ME	229	-	0.00%	-	0.00%
MN	892	-	0.00%	-	0.00%
MO	1,352	-	0.00%	-	0.00%
MP	28	-	0.00%	-	0.00%
MT	903	-	0.00%	-	0.00%
NC	2,043	-	0.00%	-	0.00%
ND	128	-	0.00%	-	0.00%
NE	648	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%
NJ	188	-	0.00%	-	0.00%
NN	139	-	0.00%	-	0.00%
NV	292	-	0.00%	-	0.00%
NY	2,117	-	0.00%	-	0.00%
OH	115	-	0.00%	-	0.00%
OK	207	-	0.00%	-	0.00%
OR	1,153	-	0.00%	-	0.00%
PA	2,992	-	0.00%	-	0.00%
RI	111	-	0.00%	-	0.00%
SC	448	-	0.00%	-	0.00%
TN	21	-	0.00%	-	0.00%
TX	4,534	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%
VA	249	-	0.00%	-	0.00%
VT	282	-	0.00%	-	0.00%
WA	2,276	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%
WV	299	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	96	-	0.00%	-	0.00%
Region 06 tribes	64	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	156	-	0.00%	-	0.00%
Region 10 tribes	85	-	0.00%	-	0.00%
Total	**41,094**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-64: Pentachlorophenol Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.9 µg/L	
		Number	Percent	Number	Percent
AK	81,125	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%
CA	33,808,376	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	880,542	-	0.00%	-	0.00%
FL	19,909,428	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,852,573	-	0.00%	-	0.00%
ID	1,264,780	-	0.00%	-	0.00%
IL	9,293,300	-	0.00%	-	0.00%
IN	5,266,205	-	0.00%	-	0.00%
KS	760,270	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,600	-	0.00%	-	0.00%
MA	9,589,840	-	0.00%	-	0.00%
MD	5,486,671	-	0.00%	-	0.00%
ME	357,931	-	0.00%	-	0.00%
MN	4,098,528	-	0.00%	-	0.00%
MO	5,241,581	-	0.00%	-	0.00%
MP	68,860	-	0.00%	-	0.00%
MT	862,635	-	0.00%	-	0.00%
NC	8,504,894	-	0.00%	-	0.00%
ND	663,709	-	0.00%	-	0.00%
NE	1,609,753	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%
NJ	5,590,389	-	0.00%	-	0.00%
NN	152,399	-	0.00%	-	0.00%
NV	2,858,731	-	0.00%	-	0.00%
NY	10,035,766	-	0.00%	-	0.00%
OH	2,211,656	-	0.00%	-	0.00%
OK	2,601,788	-	0.00%	-	0.00%
OR	3,536,643	-	0.00%	-	0.00%
PA	11,694,090	-	0.00%	-	0.00%
RI	1,054,152	-	0.00%	-	0.00%
SC	3,874,563	-	0.00%	-	0.00%
TN	717,848	-	0.00%	-	0.00%
TX	27,190,009	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%
VA	5,706,537	-	0.00%	-	0.00%
VT	364,094	-	0.00%	-	0.00%
WA	7,347,603	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%
WV	1,108,214	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.9 µg/L	
		Number	Percent	Number	Percent
WY	508,737	-	0.00%	-	0.00%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	134,402	-	0.00%	-	0.00%
Region 06 tribes	154,077	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	349,621	-	0.00%	-	0.00%
Region 10 tribes	74,512	-	0.00%	-	0.00%
Total	**242,338,615**	**-**	**0.00%**	**-**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.16.3 Summary of Data

A total of 201,636 analytical results from 41,094 PWSs in 58 States were available in the SYR 4 ICR dataset for pentachlorophenol. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 1 µg/L or EQL of 0.9 µg/L.

B.17 Selenium

This chapter on selenium includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.17.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for selenium on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 50 µg/L. EPA based the MCLG on a maximum safe intake[35] of 400 µg/person/day and a cancer classification of D, not classifiable as to human carcinogenicity.

Selenium is regulated as an inorganic contaminant (IOC) in drinking water. All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for the IOCs. The maximum waiver period for IOCs is one compliance cycle. During this cycle, the system must sample at least once.

Ground water systems must sample once during the initial three-year compliance period. After three compliance periods without a detection, a ground water system may be granted a nine-year waiver. Surface water systems must sample annually during the initial three-year compliance period. After three annual samples without a detection, a surface water system may be granted a nine-year waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[36] If all quarterly samples are below the MCL, the system may continue at initial monitoring indefinitely until the State or EPA establishes an alternate schedule.

[35] The 400 µg/day safe level was based on data (Yang *et al.*, 1989a and 1989b) that extrapolated from blood selenium levels to estimated dietary intake in the studied population. As described in USEPA (1991a), EPA partially considered selenium's status as a nutrient and did not use the typical procedure for deriving the MCLG. Hence, there is no specific reference to a reference dose (RfD) for selenium in the 1991 FR notice. After the publication of the regulation, IRIS (USEPA, 1991c) posted an RfD of 5 µg/kg-day for selenium using the same data that are the basis of the regulation.

[36] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

B.17.2 Occurrence in Drinking Water

The analysis of selenium occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 232,598 analytical results from 51,317 PWSs during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including selenium, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for selenium in the dataset is 5 µg/L. Three arithmetic mean selenium concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with selenium data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. EPA generated Stage 2 occurrence estimates relative to the MCL and the potential MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for selenium are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 50 µg/L (MCL) and 30 µg/L (potential MCLG). The potential MCLG reflects a change in the reference dose (RfD) based on new health effects information. Since there were no analytical method limitations at the potential MCLG, EPA designated the potential MCLG as the threshold for the occurrence analysis. For more

information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-65 presents the system-level Stage 2 analysis of estimated mean concentrations for selenium occurrence in drinking water. Exhibit B-66 presents similar information based on population served by the systems. Based on the Stage 2 analyses, 23 systems (0.04 percent of all systems), serving 6,455 people, had estimated mean concentrations greater than the MCL of 50 µg/L. A total of 91 systems (0.18 percent of all systems), serving 84,988 people, had an estimated mean concentration greater than the potential MCLG of 30 µg/L.

Exhibit B-65: Selenium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (50 µg/L)	47,003	21	21	21	0.04%	0.04%	0.04%
	> Potential MCLG (30 µg/L)		88	87	87	0.19%	0.19%	0.19%
Surface Water	> MCL (50 µg/L)	4,314	2	2	2	0.05%	0.05%	0.05%
	> Potential MCLG (30 µg/L)		4	4	4	0.09%	0.09%	0.09%
Combined Ground & Surface Water	> MCL (50 µg/L)	51,317	23	23	23	0.04%	0.04%	0.04%
	> Potential MCLG (30 µg/L)		92	91	91	0.18%	0.18%	0.18%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-66: Selenium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (50 µg/L)	109,947,347	6,205	6,205	6,205	0.01%	0.01%	0.01%
	> Potential MCLG (30 µg/L)		83,438	83,088	83,088	0.08%	0.08%	0.08%
Surface Water	> MCL (50 µg/L)	159,711,727	250	250	250	<0.01%	<0.01%	<0.01%
	> Potential MCLG (30 µg/L)		1,900	1,900	1,900	<0.01%	<0.01%	<0.01%
Combined Ground & Surface Water	> MCL (50 µg/L)	269,659,074	6,455	6,455	6,455	<0.01%	<0.01%	<0.01%
	> Potential MCLG (30 µg/L)		85,338	84,988	84,988	0.03%	0.03%	0.03%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for selenium were available from 59 States. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-67 presents the total number of systems in each State that submitted data for selenium. In addition, the geographic distribution of selenium occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and potential MCLG. Exhibit B-68 presents similar information based on the population served by the systems. Exhibit B-67 and Exhibit B-68 present only the ½ MRL substitution results. A total of 23 systems in 8 States, serving 6,455 people, had an estimated mean concentration greater than the MCL of 50 µg/L. A total of 91 systems in 12 States, serving 84,988 people, had an estimated mean concentration greater than the potential MCLG of 30 µg/L.

Exhibit B-67: Selenium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L		Systems with a Mean Concentration > 30 µg/L	
		Number	Percent	Number	Percent
AK	453	-	0.00%	-	0.00%
AL	371	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	828	1	0.12%	2	0.24%
CA	4,218	7	0.17%	19	0.45%
CO	898	-	0.00%	7	0.78%
CT	962	-	0.00%	1	0.10%
DC	1	-	0.00%	-	0.00%
DE	254	-	0.00%	-	0.00%
FL	2,246	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	894	1	0.11%	1	0.11%
ID	926	-	0.00%	-	0.00%
IL	1,442	-	0.00%	-	0.00%
IN	1,313	-	0.00%	-	0.00%
KS	564	3	0.53%	8	1.42%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	575	-	0.00%	-	0.00%
MD	952	-	0.00%	-	0.00%
ME	803	-	0.00%	-	0.00%
MN	1,220	-	0.00%	-	0.00%
MO	1,395	-	0.00%	-	0.00%
MP	30	-	0.00%	-	0.00%
MT	828	-	0.00%	-	0.00%
NC	2,038	-	0.00%	-	0.00%
ND	135	1	0.74%	1	0.74%
NE	659	3	0.46%	13	1.97%
NH	1,077	-	0.00%	-	0.00%
NJ	1,336	-	0.00%	-	0.00%
NN	138	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L		Systems with a Mean Concentration > 30 µg/L	
		Number	Percent	Number	Percent
NV	291	-	0.00%	1	0.34%
NY	2,535	-	0.00%	1	0.04%
OH	1,666	-	0.00%	-	0.00%
OK	621	-	0.00%	-	0.00%
OR	1,051	-	0.00%	-	0.00%
PA	3,017	-	0.00%	-	0.00%
RI	142	-	0.00%	-	0.00%
SC	500	-	0.00%	-	0.00%
SD	240	-	0.00%	-	0.00%
TN	101	-	0.00%	-	0.00%
TX	4,740	6	0.13%	33	0.70%
UT	538	-	0.00%	-	0.00%
VA	1,486	-	0.00%	-	0.00%
VT	513	-	0.00%	-	0.00%
WA	2,263	-	0.00%	1	0.04%
WI	2,061	-	0.00%	-	0.00%
WV	313	-	0.00%	-	0.00%
WY	312	-	0.00%	1	0.32%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	100	-	0.00%	-	0.00%
Region 06 tribes	58	-	0.00%	-	0.00%
Region 07 tribes	8	1	12.50%	1	12.50%
Region 08 tribes	80	-	0.00%	-	0.00%
Region 09 tribes	200	-	0.00%	1	0.50%
Region 10 tribes	96	-	0.00%	-	0.00%
Total	**51,317**	**23**	**0.04%**	**91**	**0.18%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-68: Selenium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 50 µg/L		Population Served by Systems with a Mean Concentration > 30 µg/L	
		Number	Percent	Number	Percent
AK	592,314	-	0.00%	-	0.00%
AL	5,709,160	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,621,822	208	<0.01%	443	0.01%
CA	39,694,826	1,975	<0.01%	46,662	0.12%
CO	6,451,703	-	0.00%	2,208	0.03%
CT	2,873,412	-	0.00%	55	<0.01%
DC	883,658	-	0.00%	-	0.00%
DE	929,278	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 50 µg/L		Population Served by Systems with a Mean Concentration > 30 µg/L	
		Number	Percent	Number	Percent
FL	20,279,703	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,774,946	266	0.01%	266	0.01%
ID	1,380,767	-	0.00%	-	0.00%
IL	9,797,358	-	0.00%	-	0.00%
IN	5,256,491	-	0.00%	-	0.00%
KS	2,795,047	731	0.03%	1,527	0.05%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,239,170	-	0.00%	-	0.00%
MA	9,405,030	-	0.00%	-	0.00%
MD	5,509,174	-	0.00%	-	0.00%
ME	748,513	-	0.00%	-	0.00%
MN	4,099,086	-	0.00%	-	0.00%
MO	5,290,725	-	0.00%	-	0.00%
MP	69,679	-	0.00%	-	0.00%
MT	795,529	-	0.00%	-	0.00%
NC	8,500,612	-	0.00%	-	0.00%
ND	661,808	100	0.02%	100	0.02%
NE	1,609,676	1,769	0.11%	16,386	1.02%
NH	948,384	-	0.00%	-	0.00%
NJ	9,014,453	-	0.00%	-	0.00%
NN	151,619	-	0.00%	-	0.00%
NV	2,856,045	-	0.00%	110	<0.01%
NY	10,016,083	-	0.00%	25	<0.01%
OH	10,242,916	-	0.00%	-	0.00%
OK	3,566,676	-	0.00%	-	0.00%
OR	3,221,247	-	0.00%	-	0.00%
PA	11,875,703	-	0.00%	-	0.00%
RI	1,064,556	-	0.00%	-	0.00%
SC	3,894,913	-	0.00%	-	0.00%
SD	668,873	-	0.00%	-	0.00%
TN	2,227,088	-	0.00%	-	0.00%
TX	27,228,679	806	<0.01%	16,403	0.06%
UT	4,621,800	-	0.00%	-	0.00%
VA	7,063,302	-	0.00%	-	0.00%
VT	461,483	-	0.00%	-	0.00%
WA	7,211,592	-	0.00%	83	<0.01%
WI	4,016,752	-	0.00%	-	0.00%
WV	1,550,856	-	0.00%	-	0.00%
WY	509,543	-	0.00%	70	<0.01%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	136,746	-	0.00%	-	0.00%
Region 06 tribes	147,772	-	0.00%	-	0.00%
Region 07 tribes	15,146	600	3.96%	600	3.96%
Region 08 tribes	132,008	-	0.00%	-	0.00%
Region 09 tribes	428,649	-	0.00%	50	0.01%
Region 10 tribes	78,178	-	0.00%	-	0.00%
Total	**269,659,074**	**6,455**	**<0.01%**	**84,988**	**0.03%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

B.17.3 Summary of Data

A total of 232,598 analytical results from 51,317 PWSs in 59 States were available in the SYR 4 ICR dataset for selenium. The Stage 2 analysis of occurrence in drinking water indicated that 23 systems in 8 States, serving 6,455 people, had estimated mean concentrations greater than the MCL of 50 µg/L. A total of 91 systems in 12 States, serving 84,988 people, had an estimated mean concentration greater than the potential MCLG of 30 µg/L. The majority of systems exceeding both the MCL and potential MCLG were ground water systems.

B.18 Styrene

This chapter on styrene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.18.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for styrene on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 100 µg/L. The agency based the MCLG on a reference dose (RfD) of 200 µg/kg-day (0.2 mg/kg-day).

Styrene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[37] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.18.2 Occurrence in Drinking Water

The analysis of styrene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 479,601 analytical results from 52,187 public water systems (PWSs) during the period from 2012 to

[37] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including styrene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for styrene in the dataset is 0.5 µg/L. Three arithmetic mean styrene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with styrene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For styrene, EPA generated Stage 2 occurrence estimates relative to the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for styrene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 100 µg/L (MCL), 1 µg/L (2× EQL) and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[38] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

[38] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-69 presents the system-level Stage 2 analysis of estimated mean concentrations for styrene occurrence in drinking water. Exhibit B-70 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution to replace non-detections, no system had an estimated mean concentration greater than the MCL of 100 µg/L. A total of 89 systems (0.17 percent of systems), serving 27,473 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-69: Styrene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (100 µg/L)	47,667	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		42	39	35	0.09%	0.08%	0.07%
	> EQL (0.5 µg/L)		268	86	60	0.56%	0.18%	0.13%
Surface Water	> MCL (100 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		1	1	1	0.02%	0.02%	0.02%
	> EQL (0.5 µg/L)		27	3	2	0.60%	0.07%	0.04%
Combined Ground & Surface Water	> MCL (100 µg/L)	52,187	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		43	40	36	0.08%	0.08%	0.07%
	> EQL (0.5 µg/L)		295	89	62	0.57%	0.17%	0.12%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-70: Styrene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (100 µg/L)	111,094,913	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		10,184	8,620	8,100	0.01%	0.01%	0.01%
	> EQL (0.5 µg/L)		920,061	26,880	18,141	0.83%	0.02%	0.02%
Surface Water	> MCL (100 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		40	40	40	<0.01%	<0.01%	<0.01%
	> EQL (0.5 µg/L)		1,797,963	593	65	1.10%	<0.01%	<0.01%
Combined Ground & Surface Water	> MCL (100 µg/L)	274,581,373	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		10,224	8,660	8,140	<0.01%	<0.01%	<0.01%
	> EQL (0.5 µg/L)		2,718,024	27,473	18,206	0.99%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for styrene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for styrene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-71 presents the total number of systems in each State that submitted data for styrene. In addition, the geographic distribution of styrene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, 2× EQL, and EQL. Exhibit B-72 presents similar information based on the population served by the systems. Exhibit B-71 and Exhibit B-72 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 100 µg/L. A total of 89 systems in 24 States, serving 27,473 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-71: Styrene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	1	0.17%	2	0.34%
AL	373	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	1	0.11%	1	0.11%
CA	4,166	-	0.00%	2	0.05%	6	0.14%
CO	899	-	0.00%	-	0.00%	-	0.00%
CT	980	-	0.00%	-	0.00%	1	0.10%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	1	0.10%	3	0.31%
ID	915	-	0.00%	-	0.00%	-	0.00%
IL	1,489	-	0.00%	3	0.20%	5	0.34%
IN	1,312	-	0.00%	9	0.69%	14	1.07%
KS	564	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	1	0.10%	1	0.10%
MA	741	-	0.00%	-	0.00%	-	0.00%
MD	939	-	0.00%	-	0.00%	1	0.11%
ME	806	-	0.00%	1	0.12%	9	1.12%
MN	1,344	-	0.00%	3	0.22%	6	0.45%
MO	1,393	-	0.00%	-	0.00%	1	0.07%
MP	29	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	2	0.10%	3	0.15%
ND	129	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%	-	0.00%
NJ	1,295	-	0.00%	1	0.08%	3	0.23%

State	Total Number of Systems	Systems with a Mean Concentration > 100 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NN	137	-	0.00%	-	0.00%	-	0.00%
NV	299	-	0.00%	1	0.33%	1	0.33%
NY	2,564	-	0.00%	2	0.08%	7	0.27%
OH	1,675	-	0.00%	4	0.24%	7	0.42%
OK	655	-	0.00%	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%	-	0.00%
PA	3,044	-	0.00%	-	0.00%	1	0.03%
RI	142	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%	2	0.04%
UT	490	-	0.00%	-	0.00%	-	0.00%
VA	1,499	-	0.00%	5	0.33%	7	0.47%
VT	604	-	0.00%	-	0.00%	2	0.33%
WA	2,388	-	0.00%	-	0.00%	1	0.04%
WI	2,075	-	0.00%	3	0.14%	4	0.19%
WV	314	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	6	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%	1	0.98%
Region 06 tribes	67	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%	-	0.00%
Total	**52,187**	**-**	**0.00%**	**40**	**0.08%**	**89**	**0.17%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-72: Styrene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	935	0.12%	965	0.13%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	813	0.01%	813	0.01%
CA	38,534,535	-	0.00%	91	<0.01%	747	<0.01%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	-	0.00%	48	<0.01%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 100 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
FL	20,279,328	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	100	<0.01%	3,882	0.14%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	375	<0.01%	585	0.01%
IN	5,256,413	-	0.00%	1,111	0.02%	1,898	0.04%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	1,391	0.03%	1,391	0.03%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%
MD	5,484,983	-	0.00%	-	0.00%	87	0.00%
ME	748,664	-	0.00%	100	0.01%	2,009	0.27%
MN	4,519,439	-	0.00%	224	<0.01%	406	0.01%
MO	5,286,146	-	0.00%	-	0.00%	3,900	0.07%
MP	69,045	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	372	<0.01%	516	0.01%
ND	666,967	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%	-	0.00%
NJ	9,009,164	-	0.00%	33	<0.01%	474	0.01%
NN	151,385	-	0.00%	-	0.00%	-	0.00%
NV	2,860,179	-	0.00%	1,000	0.03%	1,000	0.03%
NY	10,183,719	-	0.00%	425	<0.01%	2,750	0.03%
OH	10,243,847	-	0.00%	471	<0.01%	1,411	0.01%
OK	3,660,453	-	0.00%	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	-	0.00%	57	<0.01%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%	573	<0.01%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	511	0.01%	758	0.01%
VT	490,842	-	0.00%	-	0.00%	691	0.14%
WA	7,384,691	-	0.00%	-	0.00%	29	<0.01%
WI	4,017,600	-	0.00%	708	0.02%	743	0.02%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	6,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	140,024	-	0.00%	-	0.00%	1,740	1.24%
Region 06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%
Total	**274,581,373**	**-**	**0.00%**	**8,660**	**<0.01%**	**27,473**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.18.3 Summary of Data

A total of 479,601 analytical results from 52,187 PWSs in 58 States were available in the SYR 4 ICR dataset for styrene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 100 µg/L. A total of 89 systems in 24 States, serving 27,473 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems exceeding both the MCL and EQL were ground water systems.

B.19 1,2,4-Trichlorobenzene

This chapter on 1,2,4-trichlorobenzene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.19.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for 1,2,4-trichlorobenzene on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 70 µg/L. The agency based the MCLG on a reference dose (RfD) of 10 µg/kg-day (0.01 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

1,2,4-Trichlorobenzene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[39] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.19.2 Occurrence in Drinking Water

The analysis of 1,2,4-trichlorobenzene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 480,039 analytical results from 52,201 public water systems (PWSs) during the period from 2012 to

[39] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including 1,2,4-trichlorobenzene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for 1,2,4-trichlorobenzene in the dataset is 0.5 µg/L. Three arithmetic mean 1,2,4-trichlorobenzene concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with 1,2,4-trichlorobenzene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For 1,2,4-trichlorobenzene, EPA generated Stage 2 occurrence estimates relative to the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for 1,2,4-trichlorobenzeneare summarized in this section. Occurrence estimates were generated relative to the following thresholds: 70 µg/L (MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical

quantitation level (PQL).[40] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-73 presents the system-level Stage 2 analysis of estimated mean concentrations for 1,2,4-trichlorobenzene occurrence in drinking water. Exhibit B-74 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, no system had an estimated mean concentration greater than the MCL of 70 µg/L. A total of 15 systems (0.03 percent of all systems), serving 126,201 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-73: 1,2,4-Trichlorobenzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (70 µg/L)	47,682	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		7	7	7	0.01%	0.01%	0.01%
	> EQL (0.5 µg/L)		40	13	10	0.08%	0.03%	0.02%
Surface Water	> MCL (70 µg/L)	4,519	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		2	1	1	0.04%	0.02%	0.02%
	> EQL (0.5 µg/L)		6	2	2	0.13%	0.04%	0.04%
Combined Ground & Surface Water	> MCL (70 µg/L)	52,201	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		9	8	8	0.02%	0.02%	0.02%
	> EQL (0.5 µg/L)		46	15	12	0.09%	0.03%	0.02%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-74: 1,2,4-Trichlorobenzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (70 µg/L)	111,106,661	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		940	940	940	<0.01%	<0.01%	<0.01%

[40] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
	> EQL (0.5 µg/L)		179,108	2,604	1,071	0.16%	<0.01%	<0.01%
Surface Water	> MCL (70 µg/L)	163,486,399	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		123,597	119,913	119,913	0.08%	0.07%	0.07%
	> EQL (0.5 µg/L)		173,335	123,597	123,597	0.11%	0.08%	0.08%
Combined Ground & Surface Water	> MCL (70 µg/L)	274,593,060	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (1 µg/L)		124,537	120,853	120,853	0.05%	0.04%	0.04%
	> EQL (0.5 µg/L)		352,443	126,201	124,668	0.13%	0.05%	0.05%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for 1,2,4-trichlorobenzene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for 1,2,4-trichlorobenzene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-75 presents the total number of systems in each State that submitted data for 1,2,4-trichlorobenzene. In addition, the geographic distribution of 1,2,4-trichlorobenzene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, 2× EQL, and EQL. Exhibit B-76 presents similar information based on the population served by the systems. Exhibit B-75 and Exhibit B-76 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 70 µg/L. A total of 15 systems in 6 States, serving 126,201 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-75: 1,2,4-Trichlorobenzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 70 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%
CA	4,165	-	0.00%	-	0.00%	-	0.00%
CO	899	-	0.00%	-	0.00%	-	0.00%
CT	980	-	0.00%	1	0.10%	1	0.10%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%	2	0.09%

State	Total Number of Systems	Systems with a Mean Concentration > 70 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	3	0.31%
ID	915	-	0.00%	-	0.00%	-	0.00%
IL	1,490	-	0.00%	-	0.00%	1	0.07%
IN	1,312	-	0.00%	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%	-	0.00%
ME	805	-	0.00%	-	0.00%	-	0.00%
MN	1,344	-	0.00%	-	0.00%	-	0.00%
MO	1,393	-	0.00%	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%	-	0.00%
NJ	1,293	-	0.00%	-	0.00%	-	0.00%
NN	137	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%
NY	2,564	-	0.00%	2	0.08%	3	0.12%
OH	1,675	-	0.00%	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%	-	0.00%
PA	3,044	-	0.00%	-	0.00%	-	0.00%
RI	142	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%	-	0.00%
UT	490	-	0.00%	-	0.00%	-	0.00%
VA	1,499	-	0.00%	5	0.33%	5	0.33%
VT	604	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%	-	0.00%
Total	**52,201**	**-**	**0.00%**	**8**	**0.02%**	**15**	**0.03%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-76: 1,2,4-Trichlorobenzene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems Served by Systems	Population Served by Systems with a Mean Concentration > 70 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	-	0.00%
CA	38,534,474	-	0.00%	-	0.00%	-	0.00%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	119,913	4.17%	119,913	4.17%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%	203	<0.01%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	5,094	0.18%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%
IL	9,808,724	-	0.00%	-	0.00%	25	<0.01%
IN	5,256,413	-	0.00%	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%	-	0.00%
ME	748,497	-	0.00%	-	0.00%	-	0.00%
MN	4,519,439	-	0.00%	-	0.00%	-	0.00%
MO	5,286,146	-	0.00%	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%	-	0.00%
NJ	9,009,077	-	0.00%	-	0.00%	-	0.00%
NN	151,385	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%
NY	10,183,908	-	0.00%	325	<0.01%	351	<0.01%
OH	10,243,847	-	0.00%	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	-	0.00%	-	0.00%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%	-	0.00%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	615	0.01%	615	0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems Served by Systems	Population Served by Systems with a Mean Concentration > 70 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
Region 01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%
Total	**274,593,060**	**-**	**0.00%**	**120,853**	**0.04%**	**126,201**	**0.05%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.19.3 Summary of Data

A total of 480,039 analytical results from 52,201 PWSs in 58 States were available in the SYR 4 ICR dataset for 1,2,4-trichlorobenzene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 70 µg/L. A total of 15 systems in 6 States, serving 126,201 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems exceeding both the MCL and EQL were ground water systems.

B.20 2,3,7,8-TCDD (Dioxin)

This chapter on 2,3,7,8-TCDD (dioxin) includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.20.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for dioxin on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 0.00003 µg/L based on analytical feasibility.

Dioxin is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but this waiver can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[41] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.20.2 Occurrence in Drinking Water

The analysis of dioxin occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 38,934 analytical results

[41] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

from 6,222 public water systems (PWSs) during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including dioxin, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for dioxin in the dataset is 0.000005 µg/L. Three arithmetic mean dioxin concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with dioxin data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For dioxin, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for dioxin are summarized in this section. Occurrence estimates were generated relative to four thresholds: 0.00003 µg/L (MCL), 0.000015 µg/L (½ MCL), 0.00001 µg/L (2× EQL) and 0.000005 µg/L (EQL). The EQL represents the potential quantitation capabilities

below a practical quantitation level (PQL).[42] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-77 presents the system-level Stage 2 analysis of estimated mean concentrations for dioxin occurrence in drinking water. Exhibit B-78 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, no system had an estimated mean concentration greater than the MCL of 0.00003 µg/L. Seven water systems (0.11 percent of all systems) had estimated mean concentrations greater than the EQL of 0.000005 µg/L. These systems serve 2,311 people.

Exhibit B-77: Dioxin Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.00003 µg/L)	5,497	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		14	7	1	0.25%	0.13%	0.02%
Surface Water	> MCL (0.00003 µg/L)	725	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (0.00003 µg/L)	6,222	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		14	7	1	0.23%	0.11%	0.02%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[42] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-78: Dioxin Stage 2 Analysis – Summary of Population Served by Systems with a Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (0.00003 µg/L)	31,260,372	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		13,144	2,311	70	0.04%	0.01%	<0.01%
Surface Water	> MCL (0.00003 µg/L)	51,057,781	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (0.00003 µg/L)	82,318,153	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (0.000015 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (0.00001 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.000005 µg/L)		13,144	2,311	70	0.02%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential

Data for dioxin were available from 42 States. Seventeen States did not submit dioxin data for use in the Six-Year Review. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-79 presents the total number of systems in each State that submitted data for dioxin. In addition, the geographic distribution of dioxin occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-80 presents similar information based on the population served by the systems. Exhibit B-79 and Exhibit B-80 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 0.00003 µg/L. Seven systems in 2 States, serving 2,311 people, had estimated mean concentrations greater than the EQL of 0.000005 µg/L.

Exhibit B-79: Dioxin Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 0.00003 µg/L		Systems with a Mean Concentration > 0.000015 µg/L		Systems with a Mean Concentration > 0.00001 µg/L		Systems with a Mean Concentration > 0.000005 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	72	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	797	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	76	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	251	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 0.00003 µg/L		Systems with a Mean Concentration > 0.000015 µg/L		Systems with a Mean Concentration > 0.00001 µg/L		Systems with a Mean Concentration > 0.000005 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	135	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	2	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	54	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	357	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	135	-	0.00%	-	0.00%	-	0.00%	6	4.44%
NV	108	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	56	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	28	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	2,707	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	2	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	69	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	2	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	6	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	139	-	0.00%	-	0.00%	-	0.00%	1	0.72%
R10 tribes	73	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**6,222**	**-**	**0.00%**	**-**	**0.00%**	**-**	**0.00%**	**7**	**0.11%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-80: Dioxin Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.00003 µg/L		Population Served by Systems with a Mean Concentration > 0.000015 µg/L		Population Served by Systems with a Mean Concentration > 0.00001 µg/L		Population Served by Systems with a Mean Concentration > 0.000005 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	71,617	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	30,285,680	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	1,471,087	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	398,496	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	9,990,459	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	16,804	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	2,905,614	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	619,117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	2,899,715	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	3,566,663	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	2,042,393	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	651,866	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	163	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	1,001	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	8,294	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	6,138	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	150,861	-	0.00%	-	0.00%	-	0.00%	2,241	1.49%
NV	2,742,021	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,363,497	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	317,876	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	267,102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	9,110,221	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	256,989	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	928,587	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	88	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	194	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	1,448,094	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	11,096	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	77,744	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	37,807	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	5,852	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	6,534	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	114,311	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	11,777	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	9,972	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	324,418	-	0.00%	-	0.00%	-	0.00%	70	0.02%
R10 tribes	68,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**82,318,153**	**-**	**0.00%**	**-**	**0.00%**	**-**	**0.00%**	**2,311**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.20.3 Summary of Data

A total of 38,934 analytical results from 6,222 PWSs in 42 States were available in the SYR 4 ICR dataset for dioxin. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 0.00003 µg/L. Seven ground water systems from 2 States, serving a total population of 2,311 people, had estimated mean concentrations greater than the EQL of 0.000005 µg/L. These seven ground water systems were located in Region 9 tribes and the Navajo Nation.

B.21 Tetrachloroethylene

This chapter on tetrachloroethylene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.21.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for tetrachloroethylene on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

Tetrachloroethylene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[43] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.21.2 Occurrence in Drinking Water

The analysis of tetrachloroethylene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 544,460 analytical results from 52,210 public water systems (PWSs) during the period from 2012 to

[43] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including tetrachloroethylene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for tetrachloroethylene in the dataset is 0.5 µg/L. Three arithmetic mean tetrachloroethylene concentrations were calculated at each system using the zero, ½ MRL, and MRL substitution values. These mean calculations were performed for all systems with tetrachloroethylene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For tetrachloroethylene, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for tetrachloroethylene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL), 2.5 µg/L (½MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below

a practical quantitation level (PQL).[44] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-81 presents the system-level Stage 2 analysis of estimated mean concentrations for tetrachloroethylene occurrence in drinking water. Exhibit B-82 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL replacement, 25 systems (0.05 percent of all systems), serving 906,663 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 432 systems (0.83 percent of all systems), serving 15,811,810 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-81: Tetrachloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,690	23	23	22	0.05%	0.05%	0.05%
	> ½ MCL (2.5 µg/L)		65	62	55	0.14%	0.13%	0.12%
	> 2× EQL (1 µg/L)		220	186	171	0.46%	0.39%	0.36%
	> EQL (0.5 µg/L)		794	388	305	1.66%	0.81%	0.64%
Surface Water	> MCL (5 µg/L)	4,520	2	2	2	0.04%	0.04%	0.04%
	> ½ MCL (2.5 µg/L)		4	4	3	0.09%	0.09%	0.07%
	> 2× EQL (1 µg/L)		20	15	12	0.44%	0.33%	0.27%
	> EQL (0.5 µg/L)		115	44	32	2.54%	0.97%	0.71%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,210	25	25	24	0.05%	0.05%	0.05%
	> ½ MCL (2.5 µg/L)		69	66	58	0.13%	0.13%	0.11%
	> 2× EQL (1 µg/L)		240	201	183	0.46%	0.38%	0.35%
	> EQL (0.5 µg/L)		909	432	337	1.74%	0.83%	0.65%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[44] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-82: Tetrachloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,138,985	628,552	628,552	628,501	0.57%	0.57%	0.57%
	> ½ MCL (2.5 µg/L)		1,152,343	1,123,911	983,882	1.04%	1.01%	0.89%
	> 2× EQL (1 µg/L)		3,411,603	2,948,317	2,652,780	3.07%	2.65%	2.39%
	> EQL (0.5 µg/L)		15,701,141	6,397,187	4,048,460	14.13%	5.76%	3.64%
Surface Water	> MCL (5 µg/L)	163,486,460	278,111	278,111	278,111	0.17%	0.17%	0.17%
	> ½ MCL (2.5 µg/L)		302,815	302,815	283,111	0.19%	0.19%	0.17%
	> 2× EQL (1 µg/L)		5,603,399	5,273,369	615,095	3.43%	3.23%	0.38%
	> EQL (0.5 µg/L)		15,425,112	9,414,623	8,967,268	9.44%	5.76%	5.49%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,625,445	906,663	906,663	906,612	0.33%	0.33%	0.33%
	> ½ MCL (2.5 µg/L)		1,455,158	1,426,726	1,266,993	0.53%	0.52%	0.46%
	> 2× EQL (1 µg/L)		9,015,002	8,221,686	3,267,875	3.28%	2.99%	1.19%
	> EQL (0.5 µg/L)		31,126,253	15,811,810	13,015,728	11.33%	5.76%	4.74%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for tetrachloroethylene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for tetrachloroethylene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-83 presents the total number of systems in each State that submitted data for tetrachloroethylene. In addition, the geographic distribution of tetrachloroethylene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-84 presents similar information based on the population served by the systems. Exhibit B-83 and Exhibit B-84 present only the ½ MRL substitution results. A total of 25 systems in 9 States, serving 906,663 people, had an estimated mean concentration greater than the MCL of 5 µg/L. A total of 432 systems in 43 States, serving 15,811,810 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-83: Tetrachloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%	1	0.17%
AL	373	-	0.00%	1	0.27%	3	0.80%	7	1.88%
AR	420	-	0.00%	-	0.00%	1	0.24%	2	0.48%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	1	0.11%	1	0.11%	3	0.33%	6	0.67%
CA	4,167	11	0.26%	30	0.72%	63	1.51%	119	2.86%
CO	900	1	0.11%	1	0.11%	2	0.22%	5	0.56%
CT	981	3	0.31%	3	0.31%	8	0.82%	13	1.33%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%	2	0.66%
FL	2,240	-	0.00%	-	0.00%	2	0.09%	4	0.18%
HI	117	-	0.00%	-	0.00%	-	0.00%	1	0.85%
IA	954	-	0.00%	1	0.10%	1	0.10%	5	0.52%
ID	915	-	0.00%	-	0.00%	1	0.11%	6	0.66%
IL	1,489	-	0.00%	-	0.00%	3	0.20%	9	0.60%
IN	1,312	1	0.08%	3	0.23%	3	0.23%	5	0.38%
KS	564	-	0.00%	-	0.00%	-	0.00%	5	0.89%
KY	210	-	0.00%	-	0.00%	1	0.48%	2	0.95%
LA	1,047	-	0.00%	-	0.00%	-	0.00%	1	0.10%
MA	743	-	0.00%	-	0.00%	3	0.40%	15	2.02%
MD	939	-	0.00%	-	0.00%	4	0.43%	9	0.96%
ME	805	-	0.00%	-	0.00%	-	0.00%	1	0.12%
MN	1,344	-	0.00%	-	0.00%	1	0.07%	5	0.37%
MO	1,394	-	0.00%	-	0.00%	4	0.29%	8	0.57%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	4	0.44%
NC	2,044	1	0.05%	1	0.05%	6	0.29%	17	0.83%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	1	0.15%	2	0.30%
NH	1,079	-	0.00%	1	0.09%	2	0.19%	4	0.37%
NJ	1,302	2	0.15%	3	0.23%	7	0.54%	11	0.84%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	1	0.34%	2	0.67%
NY	2,571	-	0.00%	3	0.12%	22	0.86%	35	1.36%
OH	1,678	-	0.00%	2	0.12%	9	0.54%	17	1.01%
OK	655	-	0.00%	-	0.00%	1	0.15%	2	0.31%
OR	1,156	-	0.00%	-	0.00%	5	0.43%	12	1.04%
PA	3,044	4	0.13%	10	0.33%	24	0.79%	52	1.71%
RI	142	-	0.00%	-	0.00%	-	0.00%	1	0.70%
SC	499	-	0.00%	-	0.00%	1	0.20%	2	0.40%
TN	368	-	0.00%	-	0.00%	-	0.00%	1	0.27%
TX	4,529	-	0.00%	-	0.00%	-	0.00%	2	0.04%
UT	490	-	0.00%	-	0.00%	1	0.20%	3	0.61%
VA	1,500	1	0.07%	4	0.27%	5	0.33%	7	0.47%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	2,075	-	0.00%	1	0.05%	7	0.34%	18	0.87%
WV	314	-	0.00%	1	0.32%	4	1.27%	5	1.59%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
WY	311	-	0.00%	-	0.00%	1	0.32%	1	0.32%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	6	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	1	0.47%	3	1.42%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**52,210**	**25**	**0.05%**	**66**	**0.13%**	**201**	**0.38%**	**432**	**0.83%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-84: Tetrachloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%	470	0.06%
AL	5,710,005	-	0.00%	19,704	0.35%	314,967	5.52%	351,294	6.15%
AR	2,441,580	-	0.00%	-	0.00%	21,178	0.87%	21,205	0.87%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	2,139	0.03%	2,139	0.03%	9,407	0.14%	10,381	0.16%
CA	38,535,035	896,603	2.33%	1,251,013	3.25%	6,618,081	17.17%	11,501,129	29.85%
CO	6,494,092	31	<0.01%	31	<0.01%	181	<0.01%	29,433	0.45%
CT	2,876,909	144	0.01%	144	0.01%	18,572	0.65%	76,873	2.67%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%	42,872	4.48%
FL	20,279,328	-	0.00%	-	0.00%	110	<0.01%	24,623	0.12%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	23,943	1.58%
IA	2,852,472	-	0.00%	777	0.03%	777	0.03%	79,240	2.78%
ID	1,349,426	-	0.00%	-	0.00%	14,125	1.05%	18,543	1.37%
IL	9,808,699	-	0.00%	-	0.00%	561	0.01%	64,521	0.66%
IN	5,256,413	85	<0.01%	2,674	0.05%	2,674	0.05%	33,904	0.65%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	54,440	1.95%
KY	4,246,283	-	0.00%	-	0.00%	15,842	0.37%	22,074	0.52%
LA	5,241,660	-	0.00%	-	0.00%	-	0.00%	18,741	0.36%
MA	9,660,934	-	0.00%	-	0.00%	65,397	0.68%	329,760	3.41%
MD	5,484,983	-	0.00%	-	0.00%	14,370	0.26%	21,971	0.40%
ME	748,497	-	0.00%	-	0.00%	-	0.00%	90	0.01%
MN	4,519,439	-	0.00%	-	0.00%	75	<0.01%	7,121	0.16%
MO	5,286,171	-	0.00%	-	0.00%	10,394	0.20%	43,313	0.82%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
MT	862,485	-	0.00%	-	0.00%	-	0.00%	237	0.03%
NC	8,502,462	110	<0.01%	110	<0.01%	2,649	0.03%	23,088	0.27%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	4,479	0.28%	7,216	0.45%
NH	948,457	-	0.00%	5,000	0.53%	6,638	0.70%	6,801	0.72%
NJ	9,013,144	252	<0.01%	569	0.01%	82,007	0.91%	113,588	1.26%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	40	<0.01%	240	0.01%
NY	10,185,380	-	0.00%	68,637	0.67%	790,078	7.76%	1,033,622	10.15%
OH	10,244,865	-	0.00%	20,094	0.20%	52,018	0.51%	95,073	0.93%
OK	3,660,453	-	0.00%	-	0.00%	600	0.02%	22,728	0.62%
OR	3,539,744	-	0.00%	-	0.00%	9,507	0.27%	18,262	0.52%
PA	11,892,191	6,499	0.05%	47,159	0.40%	89,770	0.75%	1,300,770	10.94%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	40	<0.01%
SC	3,894,833	-	0.00%	-	0.00%	70	<0.01%	3,780	0.10%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	915	0.01%
TX	27,188,946	-	0.00%	-	0.00%	-	0.00%	205	<0.01%
UT	4,600,766	-	0.00%	-	0.00%	33,000	0.72%	60,601	1.32%
VA	7,067,845	800	0.01%	950	0.01%	1,070	0.02%	1,831	0.03%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	4,740	0.12%	19,484	0.48%	319,314	7.95%
WV	1,554,196	-	0.00%	2,985	0.19%	23,462	1.51%	26,090	1.68%
WY	508,924	-	0.00%	-	0.00%	55	0.01%	55	0.01%
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	6,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	48	0.01%	1,413	0.32%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**274,625,445**	**906,663**	**0.33%**	**1,426,726**	**0.52%**	**8,221,686**	**2.99%**	**15,811,810**	**5.76%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.21.3 Summary of Data

A total of 544,460 analytical results from 52,210 PWSs in 58 States were available in the SYR 4 ICR dataset for tetrachloroethylene. The Stage 2 analysis of occurrence in drinking water indicated that 25 systems in 9 States, serving 906,663 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 432 systems from 43 States, serving a total population of 15,811,810 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems exceeding the MCL and EQL were ground water systems.

B.22 Thallium

This chapter on thallium includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.22.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for thallium on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) of 0.5 µg/L based on a reference dose (RfD) of 0.00007 mg/kg-day and a cancer classification of D, not classifiable as to human carcinogenicity. The NPDWR also established a maximum contaminant level (MCL) of 2 µg/L based on analytical feasibility.

Thallium is regulated as an inorganic contaminant (IOC) in drinking water. All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for the IOCs. The maximum waiver period for IOCs is one compliance cycle. During this cycle, the system must sample at least once.

Ground water systems must sample once during the initial three-year compliance period. After three compliance periods without a detection, a ground water system may be granted a nine-year waiver. Surface water systems must sample annually during the initial three-year compliance period. After three annual samples without a detection, a surface water system may be granted a nine-year waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[45] If all quarterly samples are below the MCL, the system may continue at initial monitoring indefinitely until the State or EPA establishes an alternate schedule.

B.22.2 Occurrence in Drinking Water

The analysis of thallium occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 229,685 analytical results from 51,007 PWSs during the period from 2012 to 2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

[45] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including thallium, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for thallium used in the analysis is 0.5 µg/L. Three arithmetic mean thallium concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with thallium data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For thallium, EPA generated Stage 2 occurrence estimates relative to the MCL and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for thallium are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 2 µg/L (MCL) and 1 µg/L (EQL and ½ MCL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[46] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-85 presents the system-level Stage 2 analysis of estimated mean concentrations for thallium occurrence in drinking water. Exhibit B-86 presents similar information based on

[46] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution to replace non-detections, 15 water systems (0.03 percent of all systems), serving 2,286 people, had estimated mean concentrations greater than the MCL of 2 µg/L. Seventy-one systems (0.14 percent of all systems), serving 57,541 people, had estimated mean concentrations greater than the EQL of 1 µg/L.

Exhibit B-85: Thallium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	46,693	14	14	12	0.03%	0.03%	0.03%
	> EQL (1 µg/L)		76	67	52	0.16%	0.14%	0.11%
Surface Water	> MCL (2 µg/L)	4,314	1	1	1	0.02%	0.02%	0.02%
	> EQL (1 µg/L)		5	4	3	0.12%	0.09%	0.07%
Combined Ground & Surface Water	> MCL (2 µg/L)	51,007	15	15	13	0.03%	0.03%	0.03%
	> EQL (1 µg/L)		81	71	55	0.16%	0.14%	0.11%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-86: Thallium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	109,870,875	2,286	2,286	2,232	<0.01%	<0.01%	<0.01%
	> EQL (1 µg/L)		69,443	57,073	42,581	0.06%	0.05%	0.04%
Surface Water	> MCL (2 µg/L)	159,710,028	0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		2,951	468	438	<0.01%	<0.01%	<0.01%
Combined Ground & Surface Water	> MCL (2 µg/L)	269,580,903	2,286	2,286	2,232	<0.01%	<0.01%	<0.01%
	> EQL (1 µg/L)		72,394	57,541	43,019	0.03%	0.02%	0.02%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for thallium were available from 59 States. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-87 presents the total number of systems in each State that submitted data for thallium. In addition, the geographic distribution of thallium occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and ½ MCL. Exhibit B-88 presents similar information based on the population served by the systems. Exhibit B-87 and Exhibit B-88 present only the ½ MRL substitution results. Fifteen systems in 9 States, serving 2,286 people, had estimated mean concentrations greater than the MCL of 2 µg/L. A total of 71 systems in 22 States, serving 57,541 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-87: Thallium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
AK	468	-	0.00%	1	0.21%
AL	371	-	0.00%	1	0.27%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	824	-	0.00%	1	0.12%
CA	4,223	5	0.12%	13	0.31%
CO	893	-	0.00%	-	0.00%
CT	959	-	0.00%	1	0.10%
DC	1	-	0.00%	-	0.00%
DE	254	1	0.39%	1	0.39%
FL	2,243	1	0.04%	6	0.27%
HI	117	-	0.00%	-	0.00%
IA	894	-	0.00%	-	0.00%
ID	926	-	0.00%	1	0.11%
IL	1,441	2	0.14%	3	0.21%
IN	1,312	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,048	-	0.00%	2	0.19%
MA	576	-	0.00%	-	0.00%
MD	950	-	0.00%	2	0.21%
ME	802	-	0.00%	-	0.00%
MN	1,220	1	0.08%	1	0.08%
MO	1,395	-	0.00%	1	0.07%
MP	30	-	0.00%	-	0.00%
MT	852	-	0.00%	-	0.00%
NC	2,038	-	0.00%	-	0.00%
ND	128	-	0.00%	-	0.00%
NE	659	-	0.00%	-	0.00%
NH	1,077	-	0.00%	-	0.00%
NJ	1,294	-	0.00%	1	0.08%
NN	138	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
NV	286	-	0.00%	-	0.00%
NY	2,516	1	0.04%	3	0.12%
OH	1,662	-	0.00%	-	0.00%
OK	621	-	0.00%	-	0.00%
OR	1,049	-	0.00%	-	0.00%
PA	3,017	-	0.00%	-	0.00%
RI	142	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%
SD	239	-	0.00%	-	0.00%
TN	101	-	0.00%	-	0.00%
TX	4,535	-	0.00%	3	0.07%
UT	488	-	0.00%	-	0.00%
VA	1,485	-	0.00%	4	0.27%
VT	513	-	0.00%	1	0.19%
WA	2,264	1	0.04%	16	0.71%
WI	2,062	2	0.10%	5	0.24%
WV	313	-	0.00%	-	0.00%
WY	311	-	0.00%	1	0.32%
Region 01 tribes	3	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	100	-	0.00%	-	0.00%
Region 06 tribes	57	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	80	-	0.00%	-	0.00%
Region 09 tribes	200	1	0.50%	3	1.50%
Region 10 tribes	97	-	0.00%	-	0.00%
Total	**51,007**	**15**	**0.03%**	**71**	**0.14%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-88: Thallium Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
AK	597,936	-	0.00%	415	0.07%
AL	5,709,160	-	0.00%	1,071	0.02%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,621,427	-	0.00%	30	<0.01%
CA	39,702,781	513	<0.01%	3,251	0.01%
CO	6,450,240	-	0.00%	-	0.00%
CT	2,873,092	-	0.00%	55	<0.01%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
DC	883,658	-	0.00%	-	0.00%
DE	929,278	114	0.01%	114	0.01%
FL	20,279,503	59	<0.01%	732	<0.01%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,774,962	-	0.00%	-	0.00%
ID	1,380,767	-	0.00%	100	0.01%
IL	9,797,258	104	<0.01%	10,564	0.11%
IN	5,256,420	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,239,245	-	0.00%	15,905	0.30%
MA	9,405,210	-	0.00%	-	0.00%
MD	5,498,706	-	0.00%	111	<0.01%
ME	748,418	-	0.00%	-	0.00%
MN	4,099,086	45	<0.01%	45	<0.01%
MO	5,290,725	-	0.00%	14,709	0.28%
MP	69,679	-	0.00%	-	0.00%
MT	809,032	-	0.00%	-	0.00%
NC	8,500,612	-	0.00%	-	0.00%
ND	661,495	-	0.00%	-	0.00%
NE	1,609,600	-	0.00%	-	0.00%
NH	948,384	-	0.00%	-	0.00%
NJ	9,007,325	-	0.00%	238	0.00%
NN	151,619	-	0.00%	-	0.00%
NV	2,857,498	-	0.00%	-	0.00%
NY	10,014,118	35	<0.01%	341	<0.01%
OH	10,242,669	-	0.00%	-	0.00%
OK	3,566,676	-	0.00%	-	0.00%
OR	3,221,147	-	0.00%	-	0.00%
PA	11,875,703	-	0.00%	-	0.00%
RI	1,064,556	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%
SD	657,765	-	0.00%	-	0.00%
TN	2,227,088	-	0.00%	-	0.00%
TX	27,178,202	-	0.00%	1,184	<0.01%
UT	4,599,821	-	0.00%	-	0.00%
VA	7,063,277	-	0.00%	245	<0.01%
VT	461,483	-	0.00%	105	0.02%
WA	7,211,390	51	<0.01%	3,143	0.04%
WI	4,016,908	165	<0.01%	2,356	0.06%
WV	1,550,856	-	0.00%	-	0.00%
WY	508,332	-	0.00%	30	0.01%
Region 01 tribes	37,882	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	137,776	-	0.00%	-	0.00%
Region 06 tribes	147,172	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,008	-	0.00%	-	0.00%
Region 09 tribes	428,649	1,200	0.28%	2,797	0.65%
Region 10 tribes	78,640	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent
Total	**269,580,903**	**2,286**	**<0.01%**	**57,541**	**0.02%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.22.3 Summary of Data

A total of 229,685 analytical results from 51,007 PWSs in 59 States were available in the SYR 4 ICR dataset for thallium. The Stage 2 analysis of occurrence in drinking water indicated that 15 systems in 9 States, serving 2,286 people, had estimated mean concentrations greater than the MCL of 2 µg/L. A total of 71 ground water systems from 22 States, serving a total population of 57,541 people, had an estimated mean concentration greater than the ½ MCL of 1 µg/L. The majority of systems exceeding the MCL and ½ MCL were ground water systems.

B.23 Toluene

This chapter on toluene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.23.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for toluene on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 1,000 µg/L. The agency based the MCLG on a reference dose (RfD) of 200 µg/kg-day (0.2 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

Toluene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[47] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.23.2 Occurrence in Drinking Water

The analysis of toluene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 488,192 analytical results from 52,348 public water systems (PWSs) during the period from 2012 to

[47] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including toluene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for toluene in the dataset is 0.5 µg/L. Three arithmetic mean toluene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with toluene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For toluene, since there were no analytical method limitations at the potential MCLG, EPA generated Stage 2 occurrence estimates relative to the MCL and the potential MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for toluene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 1,000 µg/L (MCL) and 60 µg/L (potential MCLG). The potential MCLG reflects a change in the RfD based on new health effects information. Since the practical quantitation level (PQL) for toluene is less than the potential MCLG, EPA designated the potential MCLG as the threshold for the occurrence analysis. For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-89 presents the system-level Stage 2 analysis of estimated mean concentrations for toluene occurrence in drinking water. Exhibit B-90 presents similar information based on population served by the systems. No system had an estimated mean concentration greater than

the MCL of 1,000 µg/L. Fourteen systems (0.03 percent of systems), serving 5,256 people, had estimated mean concentrations greater than the potential MCLG of 60 µg/L.

Exhibit B-89: Toluene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1,000 µg/L)	47,828	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		13	13	13	0.03%	0.03%	0.03%
Surface Water	> MCL (1,000 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		1	1	1	0.02%	0.02%	0.02%
Combined Ground & Surface Water	> MCL (1,000 µg/L)	52,348	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		14	14	14	0.03%	0.03%	0.03%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-90: Toluene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (1,000 µg/L)	111,129,384	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		4,741	4,741	4,741	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (1,000 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		515	515	515	<0.01%	<0.01%	<0.01%
Combined Ground & Surface Water	> MCL (1,000 µg/L)	274,615,844	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (60 µg/L)		5,256	5,256	5,256	<0.01%	<0.01%	<0.01%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for toluene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for toluene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-91 presents the total number of systems in each State that submitted data for toluene. In addition, the geographic distribution of toluene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and potential MCLG. Exhibit B-92 presents similar information based on the population served by the systems. Exhibit B-91and Exhibit B-92 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 1,000 µg/L. Fourteen systems in 9 States, serving 5,256 people, had estimated mean concentrations greater than the potential MCLG of 60 µg/L.

Exhibit B-91: Toluene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 1,000 µg/L		Systems with a Mean Concentration > 60 µg/L	
		Number	Percent	Number	Percent
AK	589	-	0.00%	-	0.00%
AL	374	-	0.00%	-	0.00%
AR	421	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	4,166	-	0.00%	2	0.05%
CO	899	-	0.00%	-	0.00%
CT	981	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	303	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	957	-	0.00%	1	0.10%
ID	915	-	0.00%	-	0.00%
IL	1,489	-	0.00%	-	0.00%
IN	1,312	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%
MD	957	-	0.00%	-	0.00%
ME	830	-	0.00%	1	0.12%
MN	1,344	-	0.00%	1	0.07%
MO	1,393	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%
MT	903	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%
NJ	1,312	-	0.00%	-	0.00%
NN	137	-	0.00%	-	0.00%
NV	299	-	0.00%	-	0.00%
NY	2,614	-	0.00%	3	0.11%
OH	1,691	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%
PA	3,046	-	0.00%	3	0.10%

State	Total Number of Systems	Systems with a Mean Concentration > 1,000 µg/L		Systems with a Mean Concentration > 60 µg/L	
		Number	Percent	Number	Percent
RI	145	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%
TX	4,534	-	0.00%	-	0.00%
UT	492	-	0.00%	-	0.00%
VA	1,511	-	0.00%	1	0.07%
VT	605	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%
WV	314	-	0.00%	1	0.32%
WY	311	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	1	6.67%
Region 05 tribes	102	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%
Total	**52,348**	**-**	**0.00%**	**14**	**0.03%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-92: Toluene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1,000 µg/L		Population Served by Systems with a Mean Concentration > 60 µg/L	
		Number	Percent	Number	Percent
AK	759,835	-	0.00%	-	0.00%
AL	5,710,030	-	0.00%	-	0.00%
AR	2,441,621	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%
CA	38,534,535	-	0.00%	740	<0.01%
CO	6,494,061	-	0.00%	-	0.00%
CT	2,876,909	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	958,004	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,852,715	-	0.00%	1,034	0.04%
ID	1,349,426	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	-	0.00%
IN	5,256,413	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1,000 µg/L		Population Served by Systems with a Mean Concentration > 60 µg/L	
		Number	Percent	Number	Percent
MA	9,623,760	-	0.00%	-	0.00%
MD	5,496,851	-	0.00%	-	0.00%
ME	750,731	-	0.00%	33	<0.01%
MN	4,519,439	-	0.00%	90	<0.01%
MO	5,286,146	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%
MT	862,736	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%
NJ	9,012,782	-	0.00%	-	0.00%
NN	151,385	-	0.00%	-	0.00%
NV	2,860,179	-	0.00%	-	0.00%
NY	10,190,352	-	0.00%	1,590	0.02%
OH	10,247,047	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%
PA	11,892,241	-	0.00%	284	<0.01%
RI	1,065,103	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%
TX	27,190,278	-	0.00%	-	0.00%
UT	4,600,986	-	0.00%	-	0.00%
VA	7,067,711	-	0.00%	50	<0.01%
VT	490,892	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	515	0.03%
WY	508,924	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	920	3.34%
Region 05 tribes	140,024	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%
Total	**274,615,844**	**-**	**0.00%**	**5,256**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

B.23.3 Summary of Data

A total of 488,192 analytical results from 52,348 PWSs in 58 States were available in the SYR 4 ICR dataset for toluene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 1,000 µg/L. Fourteen systems (13 ground water and 1 surface water) in 9 States, serving 5,256 people, had an estimated mean concentration greater than the potential MCLG of 60 µg/L.

B.24 Toxaphene

This chapter on toxaphene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.24.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for toxaphene on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 3 µg/L based on analytical feasibility.

Toxaphene is regulated as a synthetic organic contaminant (SOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for SOCs. Waivers are available to all systems upon a favorable vulnerability assessment and/or prior analytical results. The maximum waiver period for SOCs is one compliance period, but waivers can be renewed indefinitely, if it is reconfirmed that the source is not vulnerable.

All CWSs and NTNCWSs without an SOC waiver must collect four consecutive quarterly samples during the initial three-year compliance period.[48] If all four samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to one sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to two quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take quarterly samples until four consecutive quarters are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling. If three consecutive annual samples are non-detections, the system may apply to the State for a waiver.

B.24.2 Occurrence in Drinking Water

The analysis of toxaphene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 183,765 analytical results from 37,419 public water systems (PWSs) during the period from 2012 to

[48] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including toxaphene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for toxaphene in the dataset is 1 µg/L. Three arithmetic mean toxaphene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with toxaphene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For toxaphene, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for toxaphene are summarized in this section. Occurrence estimates were generated relative to four thresholds: 3 µg/L (MCL), 2 µg/L (2× EQL), 1.5 µg/L (½ MCL), and 1 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[49] For more information on the potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

[49] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-93 presents the system-level Stage 2 analysis of estimated mean concentrations for toxaphene occurrence in drinking water. Exhibit B-94 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, no system had an estimated mean concentration greater than the MCL of 3 µg/L. Two systems (0.01 percent of all systems) had estimated mean concentrations greater than the EQL of 1 µg/L. These 2 systems serve 335 people.

Exhibit B-93: Toxaphene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (3 µg/L)	33,999	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		1	0	0	<0.01%	0.00%	0.00%
	> EQL (1 µg/L)		5	2	0	0.01%	0.01%	0.00%
Surface Water	> MCL (3 µg/L)	3,420	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (1 µg/L)		1	0	0	0.03%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (3 µg/L)	37,419	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		1	0	0	<0.01%	0.00%	0.00%
	> EQL (1 µg/L)		6	2	0	0.02%	0.01%	0.00%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-94: Toxaphene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (3 µg/L)	90,398,340	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		287	0	0	<0.01%	0.00%	0.00%
	> EQL (1 µg/L)		135,415	335	0	0.15%	<0.01%	0.00%
Surface Water	> MCL (3 µg/L)	138,817,709	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		0	0	0	0.00%	0.00%	0.00%

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
	> EQL (1 µg/L)		119,913	0	0	0.09%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (3 µg/L)	229,216,049	0	0	0	0.00%	0.00%	0.00%
	> 2× EQL (2 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1.5 µg/L)		287	0	0	<0.01%	0.00%	0.00%
	> EQL (1 µg/L)		255,328	335	0	0.11%	<0.01%	0.00%

[1] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for toxaphene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for toxaphene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-95 presents the total number of systems in each State that submitted data for toxaphene. In addition, the geographic distribution of toxaphene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-96 presents similar information based on the population served by the systems. Exhibit B-95 and Exhibit B-96 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 3 µg/L. A total of 2 systems in North Carolina, serving 335 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-95: Toxaphene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 3 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1.5 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	73	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	372	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	419	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	1,442	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	898	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	960	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	240	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	2,208	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	572	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	1,151	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 3 µg/L		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1.5 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
IN	1,299	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	105	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	695	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	45	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	208	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	890	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	1,370	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	27	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,045	-	0.00%	-	0.00%	-	0.00%	2	0.10%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	655	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	1,073	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	139	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	291	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,118	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	23	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OK	100	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	1,151	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	2,987	-	0.00%	-	0.00%	-	0.00%	-	0.00%
RI	100	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	447	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,528	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	436	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	238	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	281	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	1,320	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	2,064	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	300	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	309	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R01 tribes	3	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	96	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	64	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	156	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	85	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**37,419**	**-**	**0.00%**	**-**	**0.00%**	**-**	**0.00%**	**2**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-96: Toxaphene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 3 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	80,903	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AL	5,709,610	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AR	2,441,440	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,667,507	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CA	33,100,358	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CO	6,494,001	-	0.00%	-	0.00%	-	0.00%	-	0.00%
CT	2,873,802	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	883,104	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	19,905,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IA	166,085	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ID	1,257,631	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IL	9,293,075	-	0.00%	-	0.00%	-	0.00%	-	0.00%
IN	5,266,171	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KS	2,064,142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%	-	0.00%
LA	5,241,303	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MA	9,589,730	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MD	4,710,630	-	0.00%	-	0.00%	-	0.00%	-	0.00%
ME	370,306	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MN	4,094,456	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MO	5,260,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MP	68,690	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	862,515	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,505,082	-	0.00%	-	0.00%	-	0.00%	335	<0.01%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,610,445	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NH	948,090	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NJ	164,585	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NN	152,399	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,858,446	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,035,821	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OH	164,342	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OK	1,453,915	-	0.00%	-	0.00%	-	0.00%	-	0.00%
OR	3,536,278	-	0.00%	-	0.00%	-	0.00%	-	0.00%
PA	11,687,415	-	0.00%	-	0.00%	-	0.00%	-	0.00%
RI	1,044,048	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,874,423	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TN	284,623	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,186,551	-	0.00%	-	0.00%	-	0.00%	-	0.00%
UT	3,149,733	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VA	5,672,345	-	0.00%	-	0.00%	-	0.00%	-	0.00%
VT	364,010	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	6,179,822	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WI	4,017,150	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WV	1,108,414	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WY	508,737	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 3 µg/L		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
R01 tribes	37,882	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	7,365	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	134,402	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,077	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	348,439	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	74,512	-	0.00%	-	0.00%	-	0.00%	-	0.00%
Total	**229,216,049**	**-**	**0.00%**	**-**	**0.00%**	**-**	**0.00%**	**335**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.24.3 Summary of Data

A total of 183,765 analytical results from 37,419 PWSs in 58 States were available in the SYR 4 ICR dataset for toxaphene. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 3 µg/L. Two ground water systems in North Carolina, serving 335 people, had estimated mean concentrations greater than the EQL of 1 µg/L.

B.25 1,1,2-Trichloroethane

This chapter on 1,1,2-trichloroethane includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.25.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for 1,1,2-trichloroethane on July 17, 1992 (57 FR 31776; USEPA, 1992). The NPDWR established a maximum contaminant level goal (MCLG) of 3 µg/L based on a reference dose (RfD) of 4 µg/kg-day (0.004 mg/kg-day) and a cancer classification of C, possible human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

1,1,2-Trichloroethane is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[50] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.25.2 Occurrence in Drinking Water

The analysis of 1,1,2-trichloroethane occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 482,294 analytical results from 52,200 public water systems (PWSs) during the period from 2012 to

[50] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including 1,1,2-trichloroethane, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for 1,1,2-trichloroethane in the dataset is 0.5 µg/L. Three arithmetic mean 1,1,2-trichloroethane concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For 1,1,2-trichloroethane, EPA generated Stage 2 occurrence estimates relative to the MCL and the current MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for 1,1,2-trichloroethane are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 5 µg/L (MCL) and 3 µg/L (MCLG). For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-97 presents the system-level Stage 2 analysis of estimated mean concentrations for 1,1,2-trichloroethane occurrence in drinking water. Exhibit B-98 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 5 µg/L. Two systems (less than 0.01 percent of all systems), serving 50 people, had estimated mean concentrations greater than the MCLG of 3 µg/L.

Exhibit B-97: 1,1,2-Trichloroethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,680	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		2	2	2	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (5 µg/L)	4,520	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,200	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		2	2	2	<0.01%	<0.01%	<0.01%

[1] The threshold of interest for this contaminant is the current MCLG.

Exhibit B-98: 1,1,2-Trichloroethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,106,572	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		50	50	50	<0.01%	<0.01%	<0.01%
Surface Water	> MCL (5 µg/L)	163,486,460	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		0	0	0	0.00%	0.00%	0.00%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,593,032	0	0	0	0.00%	0.00%	0.00%
	> Current MCLG (3 µg/L)		50	50	50	<0.01%	<0.01%	<0.01%

[1] The threshold of interest for this contaminant is the current MCLG.

Data for 1,1,2-trichloroethane were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for 1,1,2-trichloroethane. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-99 presents the total number of systems in each State that submitted data for 1,1,2-trichloroethane. In addition, the geographic distribution of 1,1,2-trichloroethane occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and MCLG. Exhibit B-100 presents similar information based on the population served by the systems. Exhibit B-99 and Exhibit B-100 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 5 µg/L. A total

of 2 systems in Virginia, serving 50 people, had an estimated mean concentration greater than the MCLG of 3 µg/L.

Exhibit B-99: 1,1,2-Trichloroethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%
CA	4,166	-	0.00%	-	0.00%
CO	899	-	0.00%	-	0.00%
CT	980	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%
ID	915	-	0.00%	-	0.00%
IL	1,489	-	0.00%	-	0.00%
IN	1,312	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%
ME	805	-	0.00%	-	0.00%
MN	1,344	-	0.00%	-	0.00%
MO	1,393	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%
ND	129	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%
NJ	1,295	-	0.00%	-	0.00%
NN	137	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%
NY	2,561	-	0.00%	-	0.00%
OH	1,675	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%
OR	1,156	-	0.00%	-	0.00%
PA	3,044	-	0.00%	-	0.00%
RI	142	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%
TX	4,529	-	0.00%	-	0.00%
UT	490	-	0.00%	-	0.00%
VA	1,499	-	0.00%	2	0.13%
VT	604	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent
WA	2,388	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%
Region 02 tribes	7	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%
Total	**52,200**	**-**	**0.00%**	**2**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The threshold of interest for this contaminant is the current MCLG.

Exhibit B-100: 1,1,2-Trichloroethane Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%
CA	38,534,535	-	0.00%	-	0.00%
CO	6,494,061	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%
ID	1,349,426	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	-	0.00%
IN	5,256,413	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%
ME	748,497	-	0.00%	-	0.00%
MN	4,519,439	-	0.00%	-	0.00%
MO	5,286,146	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent
MP	69,045	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%
ND	666,967	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%
NJ	9,009,364	-	0.00%	-	0.00%
NN	151,385	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%
NY	10,183,557	-	0.00%	-	0.00%
OH	10,243,847	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	-	0.00%
PA	11,892,191	-	0.00%	-	0.00%
RI	1,064,556	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	-	0.00%
UT	4,600,766	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	50	<0.01%
VT	490,842	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%
Region 02 tribes	7,365	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%
Region 05 tribes	140,024	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%
Total	**274,593,032**	**-**	**0.00%**	**50**	**<0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The threshold of interest for this contaminant is the current MCLG.

B.25.3 Summary of Data

A total of 482,294 analytical results from 52,200 PWSs in 58 States were available in the SYR 4 ICR dataset for 1,1,2-trichloroethane. The Stage 2 analysis of occurrence in drinking water indicated that no system had an estimated mean concentration greater than the MCL of 5 µg/L. Two systems in Virginia, serving 50 people, had estimated mean concentrations greater than the MCLG of 3 µg/L.

B.26 Trichloroethylene

This chapter on trichloroethylene includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.26.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for trichloroethylene on July 8, 1987 (52 FR 25690; USEPA, 1987). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of B2, probable human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 5 µg/L based on analytical feasibility.

Trichloroethylene is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[51] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.26.2 Occurrence in Drinking Water

The analysis of trichloroethylene occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 540,777 analytical results from 52,222 public water systems (PWSs) during the period from 2012 to

[51] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including trichloroethylene, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for trichloroethylene in the dataset is 0.5 µg/L. Three arithmetic mean trichloroethylene concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with trichloroethylene data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For trichloroethylene, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, the estimated quantitation level (EQL), and twice the EQL.

Stage 2 Occurrence Estimates

Stage 2 analyses for trichloroethylene are summarized in this section. Occurrence estimates were generated relative to four thresholds: 5 µg/L (MCL), 2.5 µg/L (½ MCL), 1 µg/L (2× EQL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical

quantitation level (PQL).[52] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-101 presents the system-level Stage 2 analysis of estimated mean concentrations for trichloroethylene occurrence in drinking water. Exhibit B-102 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, 22 systems (0.04 percent of systems), serving 730,055 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 297 systems (0.57 percent of all systems), serving 12,755,926 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-101: Trichloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	47,702	19	19	19	0.04%	0.04%	0.04%
	> ½ MCL (2.5 µg/L)		55	53	49	0.12%	0.11%	0.10%
	> 2× EQL (1 µg/L)		177	160	146	0.37%	0.34%	0.31%
	> EQL (0.5 µg/L)		523	274	225	1.10%	0.57%	0.47%
Surface Water	> MCL (5 µg/L)	4,520	3	3	3	0.07%	0.07%	0.07%
	> ½ MCL (2.5 µg/L)		5	5	5	0.11%	0.11%	0.11%
	> 2× EQL (1 µg/L)		15	13	12	0.33%	0.29%	0.27%
	> EQL (0.5 µg/L)		80	23	17	1.77%	0.51%	0.38%
Combined Ground & Surface Water	> MCL (5 µg/L)	52,222	22	22	22	0.04%	0.04%	0.04%
	> ½ MCL (2.5 µg/L)		60	58	54	0.11%	0.11%	0.10%
	> 2× EQL (1 µg/L)		192	173	158	0.37%	0.33%	0.30%
	> EQL (0.5 µg/L)		603	297	242	1.15%	0.57%	0.46%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[52] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-102: Trichloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (5 µg/L)	111,109,746	483,048	483,048	483,048	0.43%	0.43%	0.43%
	> ½ MCL (2.5 µg/L)		854,939	842,471	818,298	0.77%	0.76%	0.74%
	> 2× EQL (1 µg/L)		3,329,057	2,998,438	2,556,024	3.00%	2.70%	2.30%
	> EQL (0.5 µg/L)		10,513,256	4,738,654	3,543,305	9.46%	4.26%	3.19%
Surface Water	> MCL (5 µg/L)	163,486,460	247,007	247,007	247,007	0.15%	0.15%	0.15%
	> ½ MCL (2.5 µg/L)		4,503,759	4,503,759	4,503,759	2.75%	2.75%	2.75%
	> 2× EQL (1 µg/L)		7,111,279	5,263,229	5,186,786	4.35%	3.22%	3.17%
	> EQL (0.5 µg/L)		14,831,712	8,017,272	7,668,405	9.07%	4.90%	4.69%
Combined Ground & Surface Water	> MCL (5 µg/L)	274,596,206	730,055	730,055	730,055	0.27%	0.27%	0.27%
	> ½ MCL (2.5 µg/L)		5,358,698	5,346,230	5,322,057	1.95%	1.95%	1.94%
	> 2× EQL (1 µg/L)		10,440,336	8,261,667	7,742,810	3.80%	3.01%	2.82%
	> EQL (0.5 µg/L)		25,344,968	12,755,926	11,211,710	9.23%	4.65%	4.08%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for trichloroethylene were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for trichloroethylene. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-103 presents the total number of systems in each State that submitted data for trichloroethylene. In addition, the geographic distribution of trichloroethylene occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, 2× EQL, and EQL. Exhibit B-104 presents similar information based on the population served by the systems. Exhibit B-103 and Exhibit B-104 present only the ½ MRL substitution results. Twenty-two systems in 11 States, serving 730,055 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 297 systems in 40 States, serving 12,755,926 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-103: Trichloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	589	-	0.00%	-	0.00%	1	0.17%	1	0.17%
AL	373	1	0.27%	1	0.27%	4	1.07%	5	1.34%
AR	420	-	0.00%	-	0.00%	1	0.24%	2	0.48%
AS	10	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	2	0.22%	5	0.56%
CA	4,167	10	0.24%	22	0.53%	50	1.20%	72	1.73%
CO	900	1	0.11%	1	0.11%	1	0.11%	1	0.11%
CT	981	-	0.00%	-	0.00%	3	0.31%	5	0.51%
DC	1	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%	1	0.04%	1	0.04%
HI	117	-	0.00%	-	0.00%	1	0.85%	1	0.85%
IA	954	-	0.00%	-	0.00%	2	0.21%	3	0.31%
ID	915	-	0.00%	-	0.00%	1	0.11%	3	0.33%
IL	1,489	1	0.07%	1	0.07%	6	0.40%	12	0.81%
IN	1,312	-	0.00%	1	0.08%	2	0.15%	3	0.23%
KS	564	-	0.00%	-	0.00%	-	0.00%	2	0.35%
KY	210	1	0.48%	1	0.48%	1	0.48%	1	0.48%
LA	1,047	-	0.00%	-	0.00%	1	0.10%	1	0.10%
MA	741	1	0.13%	1	0.13%	4	0.54%	6	0.81%
MD	957	-	0.00%	-	0.00%	2	0.21%	2	0.21%
ME	805	1	0.12%	1	0.12%	2	0.25%	3	0.37%
MN	1,344	-	0.00%	-	0.00%	2	0.15%	4	0.30%
MO	1,393	-	0.00%	-	0.00%	-	0.00%	3	0.22%
MP	29	-	0.00%	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	2	0.10%	7	0.34%	10	0.49%
ND	129	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	660	1	0.15%	1	0.15%	1	0.15%	1	0.15%
NH	1,079	-	0.00%	-	0.00%	-	0.00%	2	0.19%
NJ	1,300	1	0.08%	2	0.15%	5	0.38%	9	0.69%
NN	137	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	2,571	1	0.04%	2	0.08%	20	0.78%	37	1.44%
OH	1,675	-	0.00%	1	0.06%	2	0.12%	7	0.42%
OK	655	-	0.00%	-	0.00%	-	0.00%	1	0.15%
OR	1,156	-	0.00%	-	0.00%	-	0.00%	1	0.09%
PA	3,044	3	0.10%	13	0.43%	26	0.85%	41	1.35%
RI	142	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	1	0.20%	4	0.80%
TN	368	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	4,529	-	0.00%	1	0.02%	1	0.02%	4	0.09%
UT	491	-	0.00%	-	0.00%	-	0.00%	3	0.61%
VA	1,500	-	0.00%	4	0.27%	9	0.60%	11	0.73%
VT	604	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	3	0.13%	11	0.46%
WI	2,075	-	0.00%	3	0.14%	6	0.29%	11	0.53%
WV	314	-	0.00%	-	0.00%	3	0.96%	4	1.27%

State	Total Number of Systems	Systems with a Mean Concentration > 5 µg/L		Systems with a Mean Concentration > 2.5 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
WY	311	-	0.00%	-	0.00%	2	0.64%	2	0.64%
R01 tribes	4	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	6	-	0.00%	-	0.00%	-	0.00%	1	16.67%
R04 tribes	15	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	102	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	67	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	8	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	84	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	212	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	97	-	0.00%	-	0.00%	-	0.00%	1	1.03%
Total	**52,222**	**22**	**0.04%**	**58**	**0.11%**	**173**	**0.33%**	**297**	**0.57%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-104: Trichloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	758,237	-	0.00%	-	0.00%	212	0.03%	212	0.03%
AL	5,710,005	395	0.01%	395	0.01%	84,106	1.47%	355,282	6.22%
AR	2,441,580	-	0.00%	-	0.00%	175	0.01%	2,788	0.11%
AS	58,324	-	0.00%	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	318	<0.01%	111,108	1.67%
CA	38,535,035	663,341	1.72%	5,246,343	13.61%	7,129,010	18.50%	9,899,980	25.69%
CO	6,494,092	31	<0.01%	31	<0.01%	31	<0.01%	31	<0.01%
CT	2,876,909	-	0.00%	-	0.00%	18,434	0.64%	26,505	0.92%
DC	883,658	-	0.00%	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%	30	<0.01%	30	<0.01%
HI	1,519,531	-	0.00%	-	0.00%	37,920	2.50%	37,920	2.50%
IA	2,852,573	-	0.00%	-	0.00%	3,134	0.11%	3,304	0.12%
ID	1,349,426	-	0.00%	-	0.00%	9,000	0.67%	17,528	1.30%
IL	9,808,699	70	<0.01%	70	<0.01%	46,784	0.48%	436,655	4.45%
IN	5,256,413	-	0.00%	89	<0.01%	229	<0.01%	2,729	0.05%
KS	2,795,047	-	0.00%	-	0.00%	-	0.00%	5,217	0.19%
KY	4,246,283	19,192	0.45%	19,192	0.45%	19,192	0.45%	19,192	0.45%
LA	5,241,660	-	0.00%	-	0.00%	908	0.02%	908	0.02%
MA	9,623,760	26,147	0.27%	26,147	0.27%	68,145	0.71%	114,631	1.19%
MD	5,496,827	-	0.00%	-	0.00%	1,977	0.04%	1,977	0.04%
ME	748,497	65	0.01%	65	0.01%	153	0.02%	653	0.09%
MN	4,519,439	-	0.00%	-	0.00%	3,891	0.09%	5,709	0.13%
MO	5,286,146	-	0.00%	-	0.00%	-	0.00%	8,529	0.16%
MP	69,045	-	0.00%	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 5 µg/L		Population Served by Systems with a Mean Concentration > 2.5 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
MT	862,485	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	228	<0.01%	1,987	0.02%	16,073	0.19%
ND	666,967	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	230	0.01%	230	0.01%	230	0.01%	230	0.01%
NH	948,457	-	0.00%	-	0.00%	-	0.00%	63	0.01%
NJ	9,010,817	400	<0.01%	1,209	0.01%	1,359	0.02%	52,894	0.59%
NN	151,385	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%	-	0.00%
NY	10,184,428	20,000	0.20%	20,305	0.20%	683,474	6.71%	1,111,792	10.92%
OH	10,243,847	-	0.00%	200	<0.01%	17,488	0.17%	26,535	0.26%
OK	3,660,453	-	0.00%	-	0.00%	-	0.00%	358	0.01%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%	37,505	1.06%
PA	11,892,191	184	<0.01%	18,553	0.16%	45,749	0.38%	257,241	2.16%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	110	<0.01%	5,715	0.15%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%	-	0.00%
TX	27,188,946	-	0.00%	318	<0.01%	318	<0.01%	6,284	0.02%
UT	4,600,866	-	0.00%	-	0.00%	-	0.00%	17,402	0.38%
VA	7,067,845	-	0.00%	950	0.01%	3,070	0.04%	3,318	0.05%
VT	490,842	-	0.00%	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	24,326	0.33%	43,447	0.59%
WI	4,017,600	-	0.00%	11,905	0.30%	23,770	0.59%	83,688	2.08%
WV	1,554,196	-	0.00%	-	0.00%	35,912	2.31%	41,672	2.68%
WY	508,924	-	0.00%	-	0.00%	225	0.04%	225	0.04%
R01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R02 tribes	6,365	-	0.00%	-	0.00%	-	0.00%	296	4.65%
R04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%	-	0.00%
R10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%	300	0.37%
Total	**274,596,206**	**730,055**	**0.27%**	**5,346,230**	**1.95%**	**8,261,667**	**3.01%**	**12,755,926**	**4.65%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.26.3 Summary of Data

A total of 540,777 analytical results from 52,222 PWSs in 58 States were available in the SYR 4 ICR dataset for trichloroethylene. The Stage 2 analysis of occurrence in drinking water indicated

that 22 systems in 11 States, serving 730,055 people, had estimated mean concentrations greater than the MCL of 5 µg/L. A total of 297 systems from 40 States, serving a total population of 12,755,926 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems exceeding the MCL and EQL were ground water systems.

B.27 Vinyl Chloride

This chapter on vinyl chloride includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.27.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for vinyl chloride on July 8, 1987 (52 FR 25690; USEPA, 1987). The NPDWR established a maximum contaminant level goal (MCLG) of zero based on a cancer classification of A, known human carcinogen. The NPDWR also established a maximum contaminant level (MCL) of 2 µg/L based on analytical feasibility.

Vinyl chloride is regulated as a volatile organic contaminant (VOC) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[53] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.27.2 Occurrence in Drinking Water

The analysis of vinyl chloride occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 482,672 analytical results from 52,021 public water systems (PWSs) during the period from 2012 to

[53] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including vinyl chloride, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for vinyl chloride in the dataset is 0.5 µg/L. Three arithmetic mean vinyl chloride concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with vinyl chloride data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For vinyl chloride, EPA generated Stage 2 occurrence estimates relative to the MCL, half the MCL, and the estimated quantitation level (EQL).

Stage 2 Occurrence Estimates

Stage 2 analyses for vinyl chloride are summarized in this section. Occurrence estimates were generated relative to four thresholds: 2 µg/L (MCL), 1 µg/L (½ MCL), and 0.5 µg/L (EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level

(PQL).[54] For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-105 presents the system-level Stage 2 analysis of estimated mean concentrations for vinyl chloride occurrence in drinking water. Exhibit B-106 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, 1 system (less than 0.01 percent of all systems), serving 45 people, had an estimated mean concentration greater than the MCL of 2 µg/L. Twenty-four systems (0.05 percent of all systems), serving 307,275 people, had estimated mean concentrations greater than the EQL of 0.5 µg/L.

Exhibit B-105: Vinyl Chloride Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	47,513	2	1	1	<0.01%	<0.01%	<0.01%
	> ½ MCL (1 µg/L)		16	13	8	0.03%	0.03%	0.02%
	> EQL (0.5 µg/L)		71	22	18	0.15%	0.05%	0.04%
Surface Water	> MCL (2 µg/L)	4,508	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.5 µg/L)		9	2	0	0.20%	0.04%	0.00%
Combined Ground & Surface Water	> MCL (2 µg/L)	52,021	2	1	1	<0.01%	<0.01%	<0.01%
	> ½ MCL (1 µg/L)		16	13	8	0.03%	0.02%	0.02%
	> EQL (0.5 µg/L)		80	24	18	0.15%	0.05%	0.03%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

[54] When it is not possible to measure concentrations at the MCLG level, EPA often bases the MCL on an analytical feasibility level, known as a PQL. However, analytical feasibility can improve over time. As part of the Six-Year Review process, EPA evaluates whether new information regarding quantitation shows that PQLs may be reduced. The EQL represents quantitation capabilities below a PQL (USEPA, 2024f). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

Exhibit B-106: Vinyl Chloride Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (2 µg/L)	111,022,279	2,815	45	45	<0.01%	<0.01%	<0.01%
	> ½ MCL (1 µg/L)		111,791	37,450	15,529	0.10%	0.03%	0.01%
	> EQL (0.5 µg/L)		1,083,678	299,425	118,948	0.98%	0.27%	0.11%
Surface Water	> MCL (2 µg/L)	163,449,593	0	0	0	0.00%	0.00%	0.00%
	> ½ MCL (1 µg/L)		0	0	0	0.00%	0.00%	0.00%
	> EQL (0.5 µg/L)		177,461	7,850	0	0.11%	<0.01%	0.00%
Combined Ground & Surface Water	> MCL (2 µg/L)	274,471,872	2,815	45	45	<0.01%	<0.01%	<0.01%
	> ½ MCL (1 µg/L)		111,791	37,450	15,529	0.04%	0.01%	0.01%
	> EQL (0.5 µg/L)		1,261,139	307,275	118,948	0.46%	0.11%	0.04%

[1] The new potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Data for vinyl chloride were available from 58 States. South Dakota submitted some data for the SYR 4 dataset but none for vinyl chloride. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset.

Exhibit B-107 presents the total number of systems in each State that submitted data for vinyl chloride. In addition, the geographic distribution of vinyl chloride occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL, ½ MCL, and EQL. Exhibit B-108 presents similar information based on the population served by the systems. Exhibit B-107 and Exhibit B-108 present only the ½ MRL substitution results. One system in Illinois, serving 45 people, had an estimated mean concentration greater than the MCL of 2 µg/L. A total of 24 systems in 11 States, serving 307,275 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-107: Vinyl Chloride Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	588	-	0.00%	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%	-	0.00%
AR	420	-	0.00%	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%	-	0.00%
AZ	896	-	0.00%	-	0.00%	-	0.00%
CA	4,165	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
CO	899	-	0.00%	-	0.00%	-	0.00%
CT	980	-	0.00%	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%	-	0.00%
DE	302	-	0.00%	-	0.00%	-	0.00%
FL	2,240	-	0.00%	1	0.04%	3	0.13%
HI	117	-	0.00%	-	0.00%	-	0.00%
IA	953	-	0.00%	-	0.00%	2	0.21%
ID	915	-	0.00%	-	0.00%	-	0.00%
IL	1,489	1	0.07%	3	0.20%	4	0.27%
IN	1,312	-	0.00%	-	0.00%	-	0.00%
KS	564	-	0.00%	1	0.18%	1	0.18%
KY	210	-	0.00%	-	0.00%	-	0.00%
LA	1,047	-	0.00%	1	0.10%	1	0.10%
MA	741	-	0.00%	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%	-	0.00%
ME	805	-	0.00%	-	0.00%	-	0.00%
MN	1,344	-	0.00%	-	0.00%	1	0.07%
MO	1,393	-	0.00%	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%	-	0.00%
NC	2,044	-	0.00%	-	0.00%	1	0.05%
ND	129	-	0.00%	-	0.00%	-	0.00%
NE	660	-	0.00%	-	0.00%	-	0.00%
NH	1,079	-	0.00%	-	0.00%	-	0.00%
NJ	1,292	-	0.00%	-	0.00%	-	0.00%
NN	137	-	0.00%	-	0.00%	-	0.00%
NV	298	-	0.00%	-	0.00%	-	0.00%
NY	2,562	-	0.00%	1	0.04%	2	0.08%
OH	1,676	-	0.00%	1	0.06%	3	0.18%
OK	655	-	0.00%	2	0.31%	2	0.31%
OR	1,156	-	0.00%	-	0.00%	-	0.00%
PA	2,857	-	0.00%	-	0.00%	-	0.00%
RI	142	-	0.00%	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%	-	0.00%
TX	4,540	-	0.00%	-	0.00%	-	0.00%
UT	490	-	0.00%	-	0.00%	-	0.00%
VA	1,499	-	0.00%	3	0.20%	4	0.27%
VT	604	-	0.00%	-	0.00%	-	0.00%
WA	2,388	-	0.00%	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%	-	0.00%
WV	314	-	0.00%	-	0.00%	-	0.00%
WY	311	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	6	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	15	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	102	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	8	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
Total	**52,021**	**1**	**<0.01%**	**13**	**0.02%**	**24**	**0.05%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

Exhibit B-108: Vinyl Chloride Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	758,025	-	0.00%	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%	-	0.00%
AR	2,441,580	-	0.00%	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%	-	0.00%
AZ	6,668,877	-	0.00%	-	0.00%	-	0.00%
CA	38,534,499	-	0.00%	-	0.00%	-	0.00%
CO	6,494,061	-	0.00%	-	0.00%	-	0.00%
CT	2,876,884	-	0.00%	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%	-	0.00%
DE	957,204	-	0.00%	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	19,000	0.09%	199,274	0.98%
HI	1,519,531	-	0.00%	-	0.00%	-	0.00%
IA	2,852,447	-	0.00%	-	0.00%	7,607	0.27%
ID	1,349,426	-	0.00%	-	0.00%	-	0.00%
IL	9,808,699	45	<0.01%	14,633	0.15%	17,558	0.18%
IN	5,256,413	-	0.00%	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	2,281	0.08%	2,281	0.08%
KY	4,246,283	-	0.00%	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	500	0.01%	500	0.01%
MA	9,623,760	-	0.00%	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%	-	0.00%
ME	748,497	-	0.00%	-	0.00%	-	0.00%
MN	4,519,439	-	0.00%	-	0.00%	47,221	1.04%
MO	5,286,146	-	0.00%	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%	-	0.00%
NC	8,502,462	-	0.00%	-	0.00%	83	<0.01%
ND	666,967	-	0.00%	-	0.00%	-	0.00%
NE	1,607,025	-	0.00%	-	0.00%	-	0.00%
NH	948,457	-	0.00%	-	0.00%	-	0.00%
NJ	9,009,043	-	0.00%	-	0.00%	-	0.00%
NN	151,385	-	0.00%	-	0.00%	-	0.00%
NV	2,859,179	-	0.00%	-	0.00%	-	0.00%
NY	10,183,753	-	0.00%	196	<0.01%	5,121	0.05%
OH	10,243,997	-	0.00%	150	<0.01%	26,820	0.26%
OK	3,660,453	-	0.00%	540	0.01%	540	0.01%
OR	3,539,744	-	0.00%	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 0.5 µg/L	
		Number	Percent	Number	Percent	Number	Percent
PA	11,737,228	-	0.00%	-	0.00%	-	0.00%
RI	1,064,556	-	0.00%	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%	-	0.00%
TX	27,223,760	-	0.00%	-	0.00%	-	0.00%
UT	4,600,766	-	0.00%	-	0.00%	-	0.00%
VA	7,067,045	-	0.00%	150	<0.01%	270	<0.01%
VT	490,842	-	0.00%	-	0.00%	-	0.00%
WA	7,384,691	-	0.00%	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	-	0.00%	-	0.00%
WY	508,924	-	0.00%	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%	-	0.00%
Region 02 tribes	6,365	-	0.00%	-	0.00%	-	0.00%
Region 04 tribes	27,560	-	0.00%	-	0.00%	-	0.00%
Region 05 tribes	140,024	-	0.00%	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%	-	0.00%
Region 07 tribes	15,146	-	0.00%	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%	-	0.00%
Total	**274,471,872**	**45**	**<0.01%**	**37,450**	**0.01%**	**307,275**	**0.11%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant is based on the EQL. The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2024f).

B.27.3 Summary of Data

A total of 482,672 analytical results from 52,021 PWSs in 58 States were available in the SYR 4 ICR dataset for vinyl chloride. The Stage 2 analysis of occurrence in drinking water indicated that 1 system in Illinois, serving 45 people, had an estimated mean concentration greater than the MCL of 2 µg/L. A total of 24 systems from 11 States, serving a total population of 307,275 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. The majority of systems exceeding the MCL and EQL were ground water systems.

B.28 Xylenes

This chapter on xylenes includes background information such as the regulatory history and a summary of monitoring requirements, as well as occurrence and exposure estimates in drinking water. All drinking water occurrence estimates are based on data from the National Compliance Monitoring Information Collection Request (ICR) dataset for the fourth Six-Year Review (SYR 4 ICR dataset).

B.28.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for total xylenes on January 30, 1991 (56 FR 3526; USEPA, 1991a). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 10,000 µg/L. The agency based the MCLG on a reference dose (RfD) of 2,000 µg/kg-day (2 mg/kg-day) and a cancer classification of D, not classifiable as to human carcinogenicity.

Xylenes are regulated as volatile organic contaminants (VOCs) in drinking water. All non-purchased community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) are required to sample for VOCs. The maximum waiver period for VOCs is two compliance periods for ground water systems and one compliance period for surface water systems.

All CWSs and NTNCWSs must collect four consecutive quarterly samples during the initial three-year compliance period.[55] If all four samples are non-detections, then the system may reduce to annual sampling. After three annual samples without a detection, and upon conducting a vulnerability assessment, a system may be granted a waiver. During the waiver period, the ground water system must sample at least once, while surface water system must sample at the frequency specified by the State. If a contaminant is detected, the system must take one sample per quarter until results are reliably and consistently below the MCL (i.e., minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are below the MCL, the system may return to annual sampling. If a contaminant is detected at a level greater than the MCL, the system (whether ground water or surface water) must take four consecutive quarterly samples until all are below the MCL. If all quarterly samples are below the MCL, the system may return to annual sampling.

B.28.2 Occurrence in Drinking Water

The analysis of xylenes occurrence presented in the following section is based on state compliance monitoring data from the SYR 4 ICR dataset. These data consist of 412,436 analytical results from 46,720 public water systems (PWSs) during the period from 2012 to

[55] All new systems or systems using a new water source that began operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure that a system can demonstrate compliance with the MCL.

2019. The number of sample results and systems vary by State, although the state data have been reviewed and checked to ensure adequacy of coverage and completeness.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR 4 ICR dataset. In the Stage 1 analysis, the occurrence data were analyzed to generate simple non-parametric estimates and descriptive statistics of national contaminant occurrence in public water systems. Simple counts were made of the number and percentage of systems and population served by systems with at least one compliance monitoring sample result greater than a specified concentration threshold. The Stage 1 analysis provides occurrence assessments that are more conservative and may be more reflective of potential acute exposure than the assessments from the Stage 2 analysis. Details on the Stage 1 analysis are presented in Section 6.

Based on the evaluation of the health effects and analytical methods as part of the Six-Year Review protocol, EPA selected a set of contaminants, including xylenes, for which Stage 2 analyses were warranted. The Stage 2 analysis estimates national contaminant occurrence by generating estimated long-term mean concentrations of contaminants for each system. This provides occurrence analyses that are less conservative than the Stage 1 analysis since the Stage 2 analysis is based on estimated mean concentrations rather than on a single maximum concentration. Also, because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by systems with detections or potential exposure assessments that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, system arithmetic means were calculated using all sample detection records and all non-detection records. Three different substitution values – zero, ½ the minimum reporting level (MRL) value, and the full MRL value – were used to replace each non-detection record. The national modal MRL for xylenes in the dataset is 0.5 µg/L. Three arithmetic mean xylenes concentrations were calculated at each system using the zero, ½ MRL, and full MRL substitution values. These mean calculations were performed for all systems with xylenes data in the SYR 4 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For xylenes, since there were no analytical method limitations at the potential MCLG, EPA generated Stage 2 occurrence estimates relative to the MCL and the potential MCLG.

Stage 2 Occurrence Estimates

Stage 2 analyses for xylenes are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 10,000 µg/L (MCL) and 80 µg/L (potential MCLG). The potential MCLG reflects a change in the RfD based on new health effects information. Since the practical quantitation level (PQL) for xylenes is less than the potential MCLG, EPA designated the potential MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR 4 Stage 2 analyses, refer to USEPA (2024f) and (2024g).

Exhibit B-109 presents the system-level Stage 2 analysis of estimated mean concentrations for xylenes occurrence in drinking water. Exhibit B-110 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no system had an estimated mean concentration greater than the MCL of 10,000 µg/L. Twenty-three systems (0.05 percent of all systems), serving 34,728 people, had estimated mean concentrations greater than the potential MCLG of 80 µg/L.

Exhibit B-109: Xylenes Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Number of Systems	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (10,000 µg/L)	42,600	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		20	20	20	0.05%	0.05%	0.05%
Surface Water	> MCL (10,000 µg/L)	4,120	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		3	3	3	0.07%	0.07%	0.07%
Combined Ground & Surface Water	> MCL (10,000 µg/L)	46,720	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		23	23	23	0.05%	0.05%	0.05%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-110: Xylenes Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance[1]

Source Water Type	Threshold	Total Population Served by Systems	Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold			Population Served by Systems with Mean Concentrations That Are Greater Than the Threshold		
			MRL	½ MRL	Zero	MRL	½ MRL	Zero
Ground Water	> MCL (10,000 µg/L)	103,931,052	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		28,563	28,563	28,563	0.03%	0.03%	0.03%
Surface Water	> MCL (10,000 µg/L)	152,389,951	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		6,165	6,165	6,165	<0.01%	<0.01%	<0.01%
Combined Ground & Surface Water	> MCL (10,000 µg/L)	256,321,003	0	0	0	0.00%	0.00%	0.00%
	> Potential MCLG (80 µg/L)		34,728	34,728	34,728	0.01%	0.01%	0.01%

[1] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Data for xylenes were available from 56 States. Three States (Minnesota, Nebraska, South Dakota) submitted some data for the SYR 4 dataset but none for xylenes. Seven States (Georgia, Guam, Michigan, Mississippi, New Mexico, Puerto Rico, and the U.S Virgin Islands) did not submit any data to the SYR 4 ICR dataset. Exhibit B-111 presents the total number of systems in each State that submitted data for xylenes. In addition, the geographic distribution of xylenes occurrence in drinking water is illustrated by showing States with systems with a mean concentration greater than the MCL and potential MCLG. Exhibit B-112 presents similar information based on the population served by the systems. Exhibit B-111 and Exhibit B-112 present only the ½ MRL substitution results. No system had an estimated mean concentration greater than the MCL of 10,000 µg/L. A total of 23 systems in 13 States, serving 34,728 people, had an estimated mean concentration greater than the potential MCLG of 80 µg/L.

Exhibit B-111: Xylenes Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Number of Systems	Systems with a Mean Concentration > 10,000 µg/L		Systems with a Mean Concentration > 80 µg/L	
		Number	Percent	Number	Percent
AK	590	-	0.00%	-	0.00%
AL	373	-	0.00%	-	0.00%
AR	421	-	0.00%	-	0.00%
AS	10	-	0.00%	-	0.00%
AZ	897	-	0.00%	1	0.11%
CA	4,164	-	0.00%	-	0.00%
CO	900	-	0.00%	4	0.44%
CT	130	-	0.00%	-	0.00%
DC	1	-	0.00%	-	0.00%
DE	300	-	0.00%	-	0.00%
FL	2,240	-	0.00%	-	0.00%
HI	117	-	0.00%	-	0.00%
IA	956	-	0.00%	-	0.00%
ID	915	-	0.00%	-	0.00%
IL	1,489	-	0.00%	-	0.00%
IN	1,312	-	0.00%	-	0.00%
KS	564	-	0.00%	-	0.00%
KY	210	-	0.00%	-	0.00%
LA	1,047	-	0.00%	-	0.00%
MA	741	-	0.00%	-	0.00%
MD	956	-	0.00%	-	0.00%
ME	805	-	0.00%	-	0.00%
MO	1,396	-	0.00%	-	0.00%
MP	29	-	0.00%	-	0.00%
MT	902	-	0.00%	-	0.00%
NC	2,046	-	0.00%	1	0.05%
ND	129	-	0.00%	-	0.00%
NH	1,079	-	0.00%	1	0.09%
NJ	1,299	-	0.00%	-	0.00%
NN	137	-	0.00%	-	0.00%
NV	299	-	0.00%	1	0.33%
NY	29	-	0.00%	1	3.45%
OH	1,678	-	0.00%	-	0.00%
OK	655	-	0.00%	-	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 10,000 µg/L		Systems with a Mean Concentration > 80 µg/L	
		Number	Percent	Number	Percent
OR	1,156	-	0.00%	1	0.09%
PA	3,044	-	0.00%	7	0.23%
RI	142	-	0.00%	-	0.00%
SC	499	-	0.00%	-	0.00%
TN	368	-	0.00%	-	0.00%
TX	4,533	-	0.00%	-	0.00%
UT	492	-	0.00%	1	0.20%
VA	1,501	-	0.00%	1	0.07%
VT	488	-	0.00%	-	0.00%
WA	2,387	-	0.00%	-	0.00%
WI	2,075	-	0.00%	-	0.00%
WV	314	-	0.00%	2	0.64%
WY	311	-	0.00%	-	0.00%
Region 01 tribes	4	-	0.00%	-	0.00%
Region 02 tribes	6	-	0.00%	1	16.67%
Region 04 tribes	15	-	0.00%	1	6.67%
Region 05 tribes	102	-	0.00%	-	0.00%
Region 06 tribes	67	-	0.00%	-	0.00%
Region 07 tribes	7	-	0.00%	-	0.00%
Region 08 tribes	84	-	0.00%	-	0.00%
Region 09 tribes	212	-	0.00%	-	0.00%
Region 10 tribes	97	-	0.00%	-	0.00%
Total	**46,720**	**-**	**0.00%**	**23**	**0.05%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

Exhibit B-112: Xylenes Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 10,000 µg/L		Population Served by Systems with a Mean Concentration > 80 µg/L	
		Number	Percent	Number	Percent
AK	759,860	-	0.00%	-	0.00%
AL	5,710,005	-	0.00%	-	0.00%
AR	2,441,621	-	0.00%	-	0.00%
AS	58,324	-	0.00%	-	0.00%
AZ	6,668,907	-	0.00%	15,783	0.24%
CA	38,534,017	-	0.00%	-	0.00%
CO	6,495,081	-	0.00%	3,965	0.06%
CT	249,536	-	0.00%	-	0.00%
DC	883,658	-	0.00%	-	0.00%
DE	957,135	-	0.00%	-	0.00%
FL	20,279,328	-	0.00%	-	0.00%
HI	1,519,531	-	0.00%	-	0.00%
IA	2,853,409	-	0.00%	-	0.00%
ID	1,349,426	-	0.00%	-	0.00%
IL	9,808,699	-	0.00%	-	0.00%

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 10,000 µg/L		Population Served by Systems with a Mean Concentration > 80 µg/L	
		Number	Percent	Number	Percent
IN	5,256,413	-	0.00%	-	0.00%
KS	2,795,047	-	0.00%	-	0.00%
KY	4,246,283	-	0.00%	-	0.00%
LA	5,241,660	-	0.00%	-	0.00%
MA	9,623,760	-	0.00%	-	0.00%
MD	5,496,771	-	0.00%	-	0.00%
ME	748,497	-	0.00%	-	0.00%
MO	5,286,281	-	0.00%	-	0.00%
MP	69,045	-	0.00%	-	0.00%
MT	862,485	-	0.00%	-	0.00%
NC	8,502,987	-	0.00%	144	<0.01%
ND	666,967	-	0.00%	-	0.00%
NH	948,457	-	0.00%	88	0.01%
NJ	9,011,070	-	0.00%	-	0.00%
NN	151,385	-	0.00%	-	0.00%
NV	2,860,179	-	0.00%	1,000	0.03%
NY	690,061	-	0.00%	175	0.03%
OH	10,244,381	-	0.00%	-	0.00%
OK	3,660,453	-	0.00%	-	0.00%
OR	3,539,744	-	0.00%	150	<0.01%
PA	11,892,191	-	0.00%	8,750	0.07%
RI	1,064,556	-	0.00%	-	0.00%
SC	3,894,833	-	0.00%	-	0.00%
TN	7,182,704	-	0.00%	-	0.00%
TX	27,189,746	-	0.00%	-	0.00%
UT	4,601,393	-	0.00%	2,000	0.04%
VA	7,067,595	-	0.00%	323	<0.01%
VT	459,814	-	0.00%	-	0.00%
WA	7,384,620	-	0.00%	-	0.00%
WI	4,017,600	-	0.00%	-	0.00%
WV	1,554,196	-	0.00%	1,142	0.07%
WY	508,924	-	0.00%	-	0.00%
Region 01 tribes	37,985	-	0.00%	-	0.00%
Region 02 tribes	6,365	-	0.00%	288	4.52%
Region 04 tribes	27,560	-	0.00%	920	3.34%
Region 05 tribes	140,024	-	0.00%	-	0.00%
Region 06 tribes	154,870	-	0.00%	-	0.00%
Region 07 tribes	13,346	-	0.00%	-	0.00%
Region 08 tribes	132,961	-	0.00%	-	0.00%
Region 09 tribes	437,829	-	0.00%	-	0.00%
Region 10 tribes	81,428	-	0.00%	-	0.00%
Total	**256,321,003**	**-**	**0.00%**	**34,728**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR 4 ICR dataset.

[2] The potential threshold of concern for this contaminant reflects a change in the RfD based on new health effects information.

B.28.3 Summary of Data

A total of 412,436 analytical results from 46,720 PWSs in 56 States were available in the SYR 4 ICR dataset for xylenes. The Stage 2 analysis of occurrence in drinking water indicated that no

system had an estimated mean concentration greater than the MCL of 10,000 µg/L. Twenty-three systems in 13 States, serving a total of 34,728 people, had estimated mean concentrations greater than the potential MCLG of 80 µg/L. The majority of systems exceeding either the MCL or potential MCLG were ground water systems.