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

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Executive Summary

The 1996 Amendments to the Safe Drinking Water Act (SDWA) require that the U.S. Environmental Protection Agency (EPA) "shall, at least once every six years, review and revise, as appropriate, each National Primary Drinking Water Regulation (NPDWR)." The NPDWRs are often referred to as the national drinking water contaminant regulations or drinking water standards. The 'Six-Year Review' process is an assessment of new information on the health effects and national occurrence of the regulated contaminants, as well as new capabilities of treatment technologies and laboratory analytical methods. Through this process, EPA determines whether the new information and technical capabilities provide a scientific basis to support a revision of existing regulations that will improve public health protection.

This report presents the national contaminant occurrence assessments conducted in support of EPA's third Six-Year Review of NPDWRs. Included are 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 contaminant occurrence in public drinking water systems.

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 data call-in from the states, territories and tribes to obtain the data. EPA worked with the states and primacy agencies to receive the states' and agencies' complete records of compliance monitoring data (public drinking water system regulated contaminant occurrence data) for 2006 through 2011. 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 Third Six-Year Review to establish a high quality, national contaminant occurrence dataset consisting of data from 54 states/primacy agencies (46 states plus Washington, D.C. and the tribal data). The contaminant occurrence data for the these 54 states/primacy agencies comprise almost 13 million analytical records from approximately 139,000 public water systems (PWSs), which serve approximately 290 million people nationally. This dataset, the Third Six-Year Review (SYR3) ICR Dataset for the third Six-Year Review (or "SYR3 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 SYR3 ICR Dataset, EPA used a two-stage analytical approach. In the first stage of analysis (the "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 made of 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) (the contaminant's drinking water standard). This Stage 1 analysis, based on maximum sample concentration values, is inherently conservative. It is designed to ensure that contaminant occurrence is not underestimated for the consideration of public health protection. The Stage 1 analysis provides occurrence assessments that may be more reflective of potential acute exposure. Additional parametric statistical estimations (the "Stage 2 analyses") were conducted

on a set of contaminants selected by EPA on the basis of the Six-Year Review Protocol. The Stage 2 analysis estimates long-term mean concentrations of contaminants in all systems nationwide, generating occurrence analyses that are less conservative than the Stage 1 analysis. The Stage 2 analysis also provides occurrence assessments that 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 61 regulated contaminants (57 chemical and 4 radiologicals). Ten regulated chemical contaminants (lead, copper, 1,2-dichloroethane, 1,2-dichloropropane, benzene, carbon tetrachloride, dichloromethane, tetrachloroethylene, trichloroethylene and vinyl chloride), as well as disinfection byproducts (DBPs) and microbial contaminants were being reviewed or revised under other regulatory actions, or included in separate regulatory reviews. EPA also conducted additional Stage 2 analyses using mean concentration measures for 17 of the 61 regulated chemical contaminants. 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.

Additionally, two synthetic organic chemicals (SOCs) were assessed using a more detailed Stage 1 analysis while four inorganic chemicals (IOCs), nine SOCs and five volatile organic chemicals (VOCs) were assessed using the Stage 2 analytical approach. The Stage 2 occurrence analyses conducted in this report, based roughly 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 17 select contaminants is presented in Section 7, with complete detailed Stage 2 occurrence findings for the 17 contaminants included in Appendix B.

Table of Contents

Exhibits

Appendices

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
GWR	Ground Water Rule
GWUDI	Ground Water Under Direct Influence (of Surface Water)
HPC	Heterotrophic Plate Count
ICR	Information Collection Request
IOC	Inorganic Chemical
LCR	Lead and Copper Rule
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	Method Detection Limit
MFL	Million Fibers per Liter
mg/L	Milligrams per Liter
MOR	Monthly Operating Report
mrem/yr	Millirem per year
MRL	Minimum Reporting Level
ND	Non-detect or Non-detection
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 Level
PWS	Public Water System
PWSID	Public Water System Identification Number
QA	Quality Assurance
QC	Quality Control
RfD	Reference Dose
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 Chemical
SP	Sample Point
SW	Surface Water
SWP	Purchased Surface Water
SWTR	Surface Water Treatment Rule

SYR3	Third Six-Year Review
TCR	Total Coliform Rule
TNCWS	Transient Non-Community Water System
TOC	Total Organic Carbon
USEPA	United States Environmental Protection Agency
µg/L	Micrograms per Liter
VOC	Volatile Organic Chemical

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 and second Six-Year Reviews of NPDWRs (68 FR 42908, USEPA, 2003a; 75 FR 15499, USEPA, 2010a) using a systematic approach, or protocol, for the reviews. EPA has applied the same protocol to the current, third Six-Year Review of NPDWRs ("Six-Year Review 3"). This report presents the assessments of national contaminant occurrence in PWSs in the United States in support of EPA's third 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 the states, primacy agencies, territories and tribes ("states" throughout the remainder of the report) to obtain the data using the Information Collection Request (ICR) process. EPA worked with states to obtain their complete compliance monitoring data for 2006 through 2011; 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 high quality, national contaminant occurrence database consisting of data from 54 states/primacy agencies (46 states plus Washington, D.C., American Samoa and tribal data from Region 1, Region 4, Region 5, Region 8, Region 9 and Navajo Nation). This dataset, referred to as the National Compliance Monitoring ICR Dataset for the Third Six-Year Review (or "SYR3 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 third 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; and the Radionuclides Rule. This report presents occurrence assessments for those contaminants with the exception of contaminants currently evaluated under other regulatory actions or included in separate regulatory reviews. Lead and copper occurrence assessments are not included in this report because of ongoing efforts on long-term revisions to the Lead and Copper Rule. Eight chemicals – 1,2-dichloroethane, 1,2-dichloropropane, benzene, carbon tetrachloride, dichloromethane, tetrachloroethylene, trichloroethylene and vinyl chloride – are not included in this review because these chemicals are being evaluated as part of the Group Regulation of Carcinogenic Volatile Organic Compound (VOCs) (USEPA, 2011a; USEPA, 2014).

Acrylamide and epichlorohydrin are not included because there are currently no acceptable laboratory analytical methods for detecting these contaminants in drinking water. Additionally, no states submitted SYR3 data for these two contaminants; however, for the treatment technique review for these two contaminants, see *Support Document for Third Six Year Review of Drinking Water Regulations for Acrylamide and Epichlorohydrin* (USEPA, 2016a).

The microbial contaminant regulations covered in this Six-Year Review include: the Surface Water Treatment Rule (SWTR), the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR), the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR), the Filter Backwash Recycling Rule (FBRR) and the Ground Water Rule (GWR). Occurrence analyses related to these contaminants' data are not included in this report; for more detailed information on the microbial contaminants' occurrence analysis, refer to USEPA (2016b). Based on the Initial Review Branch, EPA excluded the revised Total Coliform Rule (RTCR) from the remaining steps in this Six-Year Review because it was promulgated on February 13, 2013. Furthermore, since most of the 1989 Total Coliform Rule (TCR) requirements are being replaced by the 2013 RTCR, the 1989 rule was excluded from review. EPA is also reviewing the Stage 1 and Stage 2 Disinfectant and Disinfection Byproducts Rules (DBPRs) (USEPA, 1998; USEPA, 2006) as part of the third Six-Year Review. For more information see the technical support document for DBPRs (USEPA, 2016c).

This report describes the extensive data management and data quality checks conducted as part of the development of the SYR3 ICR Dataset; explains the analytical approach used to estimate the various measures of national contaminant occurrence for the 61 contaminants included in this report; and presents and describes the resulting national contaminant occurrence estimates for those contaminants. This report presents many different measures and estimates of national occurrence. Some of the contaminant occurrence measures are presented in this report as "preliminary exposure estimates" meaning they are not formal exposure estimates, but 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 of a NPDWR shall maintain, or provide for greater, protection of public health. Any revision of 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, data management and statistical methods used to develop the national contaminant occurrence estimations in support of EPA's Six-Year Review 3. This report presents occurrence assessments for 61 contaminants regulated under the Phase I, II, IIb and V Rules, the Arsenic Rule and the Radionuclides Rule. As noted above, SDWA compliance monitoring data for some of the regulated contaminants collected under SYR3 (i.e., lead, copper, carcinogenic VOCs, microbials and DBPs) are being assessed separately under other regulatory actions or included in separate regulatory reviews.

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 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.

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 Compliance Period ran from 1996 to 1998 and the third Compliance Period ran from 1999 to 2001. Together, these nine years comprise 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 ends December 31, 2019. The SYR3 period of review (2006 through 2011) falls within the second and third compliance cycles.

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).[1] 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 SYR3 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.
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

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

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 the Six-Year Review 3, EPA conducted the voluntary data call-in described in this report from the 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 third Six-Year Review ICR renewal (75 FR 6023, USEPA, 2010b).

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 2006 and December 2011. Forty-six states and eight other primacy agencies provided compliance monitoring data that included contaminant monitoring records. Through extensive data management efforts and quality assurance evaluations, as well as through communications and consultations with state data management staff, EPA established a high quality contaminant occurrence dataset (the SYR3 ICR Dataset) that consists of data from 54 states/primacy agencies (46 states plus data from Washington, D.C. and the tribes). See Section 2 for additional details on states included in the SYR3 ICR Dataset.

1.3 Data Analysis

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR3 ICR Dataset. The first stage of analysis provides a simple, straightforward evaluation of occurrence of 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.[2] For each contaminant, analyses are conducted focusing on samples, water systems, population served by water systems and system sample point (SP) locations. A typical Stage 1 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 Maximum Contaminant Level (MCL) of the contaminant. 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 estimates 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 a rough approximation of peak occurrence. This fundamental difference between the two analytical approaches has a very 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 will always be greater than, or at most equal to, the Stage 2 analysis

[2] The Stage 1 analyses are conservative in the sense that they are protective of human health (i.e., because 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).

showing the number of systems with a mean concentration of toxaphene greater than the MCL concentration.

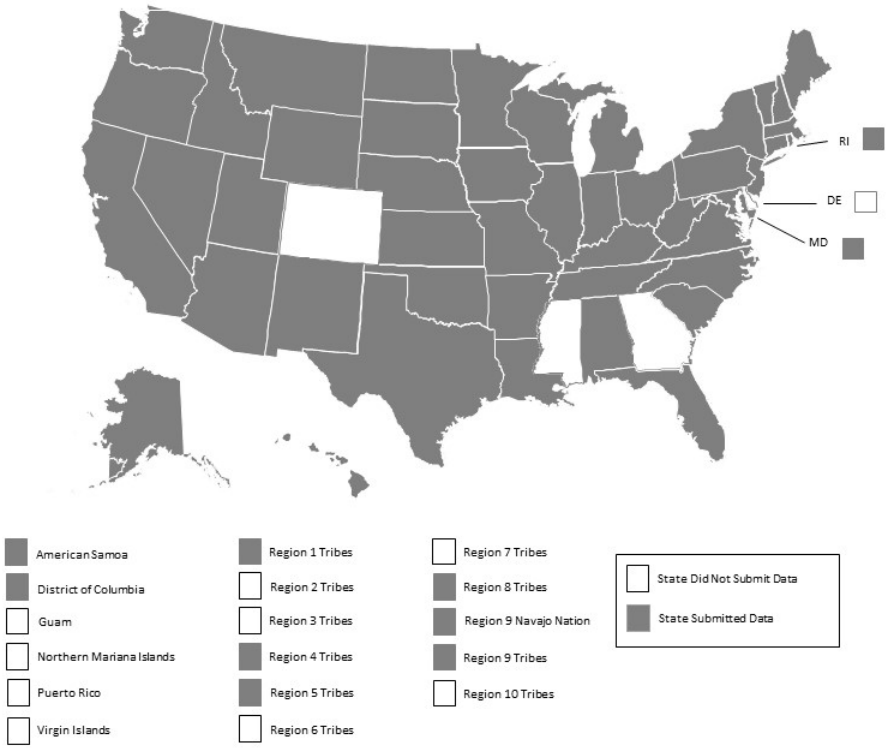
Because the Stage 2 analyses generate long-term (multi-year) mean concentration estimates for contaminant occurrence at systems, the analyses can support assessments of population served by water systems with detections (or "preliminary exposure" assessments) that may be more reflective of potential 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 also used for the second Six-Year Review of NPDWRs and the third 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 third Six-Year Review is consistent with the simplified version of the Stage 2 analysis that was used for the second Six-Year Review (USEPA, 2010c). This was possible because, similar to the second Six-Year Review, a large number of states provided contaminant occurrence data for the third Six-Year Review. See Section 7 for a complete description of the Stage 2 analysis; a selection of contaminants are presented in Appendix B.

2 The National Compliance Monitoring ICR Dataset for the Third 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 54 states/primacy agencies: 46 states; American Samoa; Washington, D.C.; Region 1 tribes; Region 4 tribes; Region 5 tribes; Region 8 tribes; Region 9 tribes and the Navajo Nation. Through extensive data management efforts, quality assurance evaluations and communications with state data management staff, EPA established the SYR3 ICR Dataset (see Exhibit 2.1 below).

Exhibit 2.1: States with Compliance Monitoring Data Included in the SYR3 ICR Dataset



The compliance monitoring contaminant occurrence data from these 54 states/primacy agencies for contaminants evaluated in this report for comprise more than 13 million analytical records from approximately 139,000 water systems. Approximately 290 million people are served by these systems nationally.

Data quality, completeness and representativeness are key considerations for the dataset. Given the size, scope and variety of formats of the datasets received from the states, EPA conducted extensive data management and quality assurance/quality control (QA/QC) assessments on the data to be included in the SYR3 ICR Dataset. A review of completeness and representativeness, details of data management and details of quality assessments are presented in the following three sections. Additional details of the data management measures can be found in the report

titled *The Data Management and Quality Assurance/Quality Control Process for the Third Six-Year Review Information Collection Rule Dataset* (USEPA, 2016d).

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

The final SYR3 ICR Dataset consists of compliance monitoring data received from 54 out of 67 states/primacy agencies. It represents a very large sample and the largest compliance monitoring dataset ever compiled and analyzed by EPA's Drinking Water Program (Exhibit 2.1). The 54 states/primacy agencies that provided data for the SYR3 ICR Dataset comprise 95 percent of all PWSs and 92 percent of the total population served by PWSs nationally and are geographically representative of PWSs nationwide.

The absence of data from the four states and nine primacy agencies in the final SYR3 ICR Dataset could potentially bias the dataset's representation of the national occurrence of particular contaminants. The four states, representing about five percent of PWSs and eight percent of population served by PWSs nationally, have a fairly small influence relative to the PWSs and populations represented by the states that did submit data. The four states that did not provide compliance monitoring contaminant occurrence data (Colorado, Delaware, Georgia and Mississippi) are generally geographically distributed across the United States and reflect a diverse mix of urban, agricultural and industrial areas. No regional geologic terrain, climatic or hydrologic zone, geography or socio-economic activity is unrepresented in the dataset. Although two states in the southeastern U.S., Georgia and Mississippi, did not provide data, all other southeast states did provide data, allowing for significant regional coverage, especially from a population-based perspective. All other regions had at most one state not included in the dataset. The SYR3 ICR Dataset, with 46 of the 50 states represented, is therefore considered reasonably complete and nationally representative as the basis of the contaminant occurrence estimates presented in this report. To further address the issue of potential bias, though, EPA conducted an assessment for each contaminant by comparing occurrence in the 4 states to that in the 46 states.

Because a complete compliance monitoring dataset of all 50 states does not exist, it is not possible to know the true national occurrence for a particular contaminant or how occurrence rates for a particular contaminant in the 4 missing states compare to occurrence in the other 46 states. 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 all 50 states. EPA compiled SDWIS/Fed records of MCL violations, used here as an indicator of contaminant occurrence, by state for the same years (2006-2011) as the SYR3 ICR Dataset.[3] The MCL violation records were used to determine if the violation rate in the 4 missing states was significantly different than the violation rate in the 46 states in the dataset, or if the violation rate in the 46 states could be considered representative (from the same statistical population). EPA conducted this assessment for the IOCs, SOCs, VOCs and radionuclides evaluated under Six-Year Review 3.

[3] 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 March 2014.

The mean MCL violation rate for each contaminant (i.e., the percentage of systems with at least one MCL violation) was calculated for the 46 states in the dataset and separately for the 4 states not in the SYR3 ICR Dataset. For each contaminant, a statistical t-test was used to determine whether these two estimated mean MCL violation rates (46-state vs. 4-state) were significantly different; the t-test had an alpha (α) level of 0.05 and assumed unequal variance.[4] If the p-value resulting from the t-test was less than 0.05, EPA rejected the null hypothesis that the two mean MCL violation rates were from the same population and accepted the alternative hypothesis that they were from different populations.

Of the 61 contaminants evaluated, only nine contaminants had at least one MCL violation listed in the SDWIS/Fed database for the 2006-2011 time period; thus, t-tests were conducted on only these nine contaminants. For five contaminants (fluoride, nitrate, gross alpha, uranium and combined radium), the t-test resulted in a p-value > 0.05 (EPA failed to reject the null hypothesis). This suggests, but does not prove, that the mean MCL violation rates for the 46 states and the 4 states were not statistically different (were from the same population). For three additional contaminants, only one of the four states had MCL violations so the t-test could not be applied.

Arsenic was the only contaminant for which the t-test resulted in a p-value < 0.05 (EPA rejected the null hypothesis); thus, the mean arsenic MCL violation rate for the 46 states appears to be statistically different (come from a different population) than the mean arsenic MCL violation rate for the four states. This suggests that the absence of system compliance monitoring data from the four states might result in some amount of over-estimation of occurrence for that contaminant. These findings, however, are most appropriately used as context or background for the quantitative occurrence findings presented in Sections 6 and 7 of this report.

To further evaluate the completeness of each state's dataset, EPA used the SDWIS/Fed database as a reference and compared the number of water systems by state in the SYR3 ICR Dataset to the number of systems by state in the SDWIS/Fed database (frozen fourth quarter 2011). Only the SDWIS/Fed database records from the 46 states also in the SYR3 ICR Dataset were included. (As described in Section 4.2, systems that purchase 100 percent of their water are accounted for differently than non-purchased water system. To simplify this comparison of number of systems by state, only non-purchased systems were included in the counts.) The SDWIS/Fed version accessed to obtain this inventory data was the fourth quarter of 2011. Although the system inventory information represented in the two data sources is very similar, it is not equivalent. The main difference is that the SYR3 ICR Dataset reflects the total number of systems with compliance monitoring data in any of the six years represented in the dataset (2006-2011), while the SDWIS/Fed 2011 data freeze reflects the number of systems with compliance monitoring data in a single year (2011). 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. This comparison is presented in Exhibit 2.2. In order to be consistent with the SDWIS/Fed counts, the population

[4] The t-test calculation used considered the variance, mean and sample size of each of the two groups of states to estimate the probability that the observed difference in sample means represents an actual difference in contaminant occurrence and not just a statistical inconsistency resulting from low sample sizes.

values listed for the SYR3 ICR Dataset include only the populations directly served by non-purchased systems (retail populations); total adjusted populations are discussed in Section 4.2.

The comparison between the counts of systems in the two data sources indicate that the data in the SYR3 ICR Dataset are reasonably complete. Overall, there is an approximately 11 percent difference between the number of systems listed in a December 2011 SDWIS/Fed freeze compared to the number of systems in the third SYR3 ICR Dataset. (The percent difference is calculated by subtracting the number of systems in SDWIS/Fed from the number in SYR3 ICR and then dividing by the number of systems in the SYR3 ICR Dataset.) In Exhibit 2.2, positive values for percent difference indicate that more systems are reported in the SYR3 ICR Dataset, which negative values indicate that more systems are reported in the 2011 SDWIS/Fed Freeze. Comparing the number of systems for each state, the absolute percentage difference between SDWIS/Fed and the SYR3 ICR Dataset ranges from a zero percent difference (e.g., Region 1 Tribes and Utah) to an approximately 26 percent difference (e.g., Region 5 Tribes) in the number of systems. Based on the population served by systems, there is a three percent difference between the total population served by systems listed in SDWIS/Fed and the population served by systems listed in the SYR3 ICR Dataset. Comparing individual state population served values, the absolute percentage differences between SDWIS/Fed and the Six-Year states ranges from less than a one percent difference (e.g., Alabama and New Mexico) to approximately a 20 percent difference (e.g., Nebraska).

Exhibit 2.2: Comparison of the Total Number of Non-Purchased Systems and Retail Population Served in SDWIS/Fed and the SYR3 ICR Dataset, By State

State	Total Number of Non-Purchased Systems[1]			Retail Population Served by Non-Purchased Systems		
	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]
Alabama	399	415	4%	4,270,460	4,269,317	0.0%
Alaska	1,429	1,403	-2%	718,776	762,190	6%
American Samoa	19	17	-11%	60,958	61,309	1%
Arizona	1,511	1,493	-1%	6,414,815	6,431,456	0.3%
Arkansas	643	639	-1%	1,808,219	1,782,034	-1%
California	7,215	7,540	5%	28,781,357	28,528,121	-1%
Connecticut	2,523	2,971	18%	2,676,429	2,716,577	2%
Florida	5,295	6,350	20%	16,742,435	17,383,116	4%
Hawaii	108	118	9%	1,421,758	1,452,737	2%
Idaho	1,936	1,907	-1%	1,315,860	1,360,791	3%
Illinois	4,097	4,625	13%	8,228,681	8,296,918	1%
Indiana	4,012	4,397	10%	4,886,097	4,946,190	1%
Iowa	1,660	1,763	6%	2,365,619	2,380,108	1%
Kansas	647	642	-1%	2,281,561	2,292,280	0.5%
Kentucky	261	257	-2%	3,268,613	3,299,397	1%
Louisiana	1,287	1,390	8%	4,844,307	4,868,351	0.5%
Maine	1,851	2,198	19%	903,130	964,872	7%

State	Total Number of Non-Purchased Systems[1]			Retail Population Served by Non-Purchased Systems		
	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]
Maryland	3,390	3,886	15%	5,022,871	5,711,914	14%
Massachusetts	1,545	1,674	8%	7,154,525	7,117,276	-1%
Michigan	10,873	13,078	20%	4,809,937	5,087,202	6%
Minnesota	6,943	7,753	12%	4,617,552	4,689,328	2%
Missouri	2,458	2,768	13%	4,463,766	4,515,797	1%
Montana	1,899	1,856	-2%	894,851	902,225	1%
Navajo Nation	146	152	4%	131,031	140,818	7%
Nebraska	1,155	1,283	11%	1,545,502	1,861,572	20%
Nevada	531	584	10%	942,651	984,355	4%
New Hampshire	2,394	2,610	9%	1,124,928	1,156,828	3%
New Jersey	3,686	4,295	17%	7,428,858	7,534,923	1%
New Mexico	1,109	1,089	-2%	1,899,344	1,896,614	-0.1%
New York	8,206	8,945	9%	16,731,989	18,127,928	8%
North Carolina	5,684	6,806	20%	6,945,228	7,131,934	3%
North Dakota	301	279	-7%	513,800	508,028	-1%
Ohio	4,543	5,363	18%	9,056,572	9,232,856	2%
Oklahoma	960	1,102	15%	3,002,063	3,091,513	3%
Oregon	2,484	2,705	9%	2,831,651	2,767,113	-2%
Pennsylvania	8,779	10,128	15%	10,699,485	10,814,930	1%
Region 1 - Tribes	5	5	0%	49,031	49,031	0.0%
Region 4 - Tribes	31	32	3%	28,387	27,889	-2%
Region 5 - Tribes	100	126	26%	139,916	154,489	10%
Region 8 - Tribes	103	101	-2%	91,321	92,432	1%
Region 9 - Tribes	284	314	11%	367,252	353,335	-4%
Rhode Island	459	487	6%	775,182	778,796	0.5%
South Carolina	1,104	1,064	-4%	2,681,749	2,683,477	0.1%
South Dakota	447	463	4%	603,361	609,007	1%
Tennessee	700	673	-4%	5,616,106	5,704,724	2%
Texas	5,635	5,528	-2%	16,682,616	17,119,034	3%
Utah	892	892	0%	1,443,051	1,470,928	2%
Vermont	1,273	1,414	11%	489,778	503,324	3%
Virginia	2,519	2,917	16%	4,769,127	5,340,030	12%
Washington	3,902	4,309	10%	5,038,297	5,149,128	2%
Washington, D.C.	1	1	0%	0	0	0.0%
West Virginia	822	988	20%	1,292,503	1,314,496	2%
Wisconsin	11,345	12,563	11%	4,468,486	4,576,227	2%

State	Total Number of Non-Purchased Systems[1]			Retail Population Served by Non-Purchased Systems		
	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]	2011 SDWIS/Fed Freeze	SYR3 ICR Data	Percent Difference[2]
Wyoming	698	682	-2%	380,269	378,901	-0.4%
Total	**132,299**	**147,040**	**11%**	**225,722,111**	**231,374,166**	**3%**

[1] As indicated in Exhibit 5-3, approximately 57 percent of the total number of water systems whose data were submitted by states for the third Six-Year Review are transient non-community water systems. Because only the nitrate/nitrite regulations require compliance monitoring by these transient systems (Exhibit 4.1), 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 'percent difference' was calculated by subtracting the 2011 SDWIS/Fed Freeze total number of non-purchased systems (or retail population served by systems) from the SYR3 ICR Dataset total number of non-purchased systems (or retail population served by systems). That difference was then divided by the total number of non-purchased systems (or retail population served by systems) from the SYR3 ICR Dataset. The 'percent difference' is less than zero if the SYR3 ICR Dataset indicated a smaller number of systems (or retail population served by systems).

Exhibit 2.3 compares the number of systems and population served by these systems in the December 2011 SDWIS/Fed freeze and the SYR3 ICR Dataset stratified by source water type and system type. (For consistency with SDWIS/Fed data, non-purchased systems and the only the direct or retail population served are included in this comparison. See Section 4.2 for more information.) The overall national 46 state totals indicate about 11 percent more systems and a three percent greater population served is reported in the SYR3 ICR Dataset than is represented in SDWIS/Fed. For community water systems (CWSs), there is about a four percent difference based on the number of systems and a two percent difference based on the population served by systems. Percentage differences were larger for ground water systems than surface water systems. For non-transient non-community water systems (NTNCWSs), there is about a 13 percent difference based on the number of systems and an 8 percent difference based on the population served by systems. For transient non-community water systems (TNCWSs), there is about a 12 percent difference based on the number of systems and a 7 percent difference based on the population served by systems. CWSs account for approximately 93 percent of the total population served by systems in the United States.

Exhibit 2.3: Comparison of the Total Number of Systems and Retail Population Served in SDWIS/Fed and the SYR3 ICR Dataset, By Source Water Type and System Type

Source Water Type	2011 SDWIS/Fed Freeze				SYR3 ICR Dataset				
	CWS	NTNCWS	TNCWS	Total	CWS	NTNCWS	TNCWS	Unknown[1]	Total
Number of Non-Purchased Systems									
Ground Water (GW)	33,247	16,325	77,221	126,793	34,576	18,802	87,816	123	141,317
Surface Water (SW)	4,226	322	958	5,506	4,327	335	1,058	3	5,723
Total	37,473	16,647	78,179	132,299	38,903	19,137	88,874	126	147,040

Source Water Type	2011 SDWIS/Fed Freeze				SYR3 ICR Dataset				
	CWS	NTNCWS	TNCWS	Total	CWS	NTNCWS	TNCWS	Unknown[1]	Total
Retail Population Served									
Ground Water (GW)	77,175,728	4,734,551	9,552,196	91,462,475	79,082,376	5,148,753	10,332,691	2,573	94,566,393
Surface Water (SW)	133,813,746	153,948	291,942	134,259,636	136,398,900	137,898	270,751	224	136,807,773
Total	210,989,474	4,888,499	9,844,138	225,722,111	215,481,276	5,286,651	10,603,442	2,797	231,374,166

[1] Systems with unknown system type (i.e., system type not reported by the state) were included in the third Six-Year Review analyses.

3 Data Management

The data received from the states were 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 USEPA (2016d).

3.1 Dataset Consistency and Restructuring

About 75 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 Extract Tool, developed and provided by EPA, to extract and compile the EPA-requested compliance monitoring data. The Extract Tool enabled a streamlined effort by states to select, compile and format the requested data and generally resulted in state submission of complete datasets that were uniform in format. The states not using SDWIS/State submitted their compliance monitoring 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 Extract Tool. Thirty-three states and three tribes used the SDWIS Query Extract Tool to extract all or some of their chemical data; therefore, those datasets were all submitted in a similar format. States that did not use the SDWIS Query Extract Tool were restructured into a format similar to the data structure achieved by the EPA tool. The SDWIS Query Extract Tool pulls the SDWIS/State data into Microsoft (MS) Access. The 18 states/ primacy agencies that did not use the SDWIS Query Extract Tool submitted data in a variety of file types, including dBase, MS Access, comma delimited, tab delimited, Text and Excel. However, all of these datasets were converted to MS Access to enable a detailed QA/QC review.

Exhibit 3.1: Summary of Compliance Monitoring Data Provided by States for the Third Six-Year Review

	State Name		
States/Entities that DID use the SDWIS Extract Tool	Alabama Alaska Arizona Arkansas Connecticut Idaho Illinois Indiana Iowa Kansas Kentucky Louisiana	Maine Missouri Montana Nebraska Nevada New Jersey[1] New Mexico New York North Carolina[1] North Dakota Ohio Oklahoma	Oregon Region 4 tribes Region 5 tribes Region 8 tribes Rhode Island South Carolina Texas[1] Utah Vermont Virginia West Virginia Wyoming

	State Name		
States/Entities that DID NOT use the SDWIS Extract Tool	American Samoa California Florida Hawaii Maryland Massachusetts	Michigan Minnesota Navajo Nation New Hampshire Pennsylvania Region 1 tribes	Region 9 tribes South Dakota Tennessee Washington Washington, D.C. Wisconsin

[1] North Carolina, New Jersey and Texas submitted their SDWIS/State data in an Oracle database. EPA applied the SDWIS Query Extract Tool to their databases to extract and compile the compliance monitoring data requested by EPA for the Third Six-Year Review.

3.2 Review of Dataset Content

One of the first reviews of the submitted data sets was to verify that all of the necessary data elements were included. Many of the states not using the SDWIS Query Extract Tool submitted datasets with more data elements than necessary. In those cases, EPA determined which data elements were and were not needed for the Six-Year Review 3 occurrence analyses. Exhibit 3.2 provides a detailed list of the data elements requested by EPA for Six-Year Review 3.

Although data dictionaries were not necessary for the review of data from states that used the SDWIS Query Extract Tool, these files (or any other available supporting information provided by the states) were very useful when trying to interpret the data submitted by the states that did not use the SDWIS Query Extract Tool. Data dictionary and supporting information files were reviewed for a definition of the various data elements, field/row headings, codes and acronyms, among others. In addition, field names were standardized and data types were changed to similar formats. Data reported for each field were also standardized.

Exhibit 3.2: Data Elements Requested by EPA for the Third Six-Year Review

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 2-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 • Surface water, or • Ground water under the direct influence of surface water (GWUDI) (Note: Some states may not distinguish GWUDI from surface water sources. In those states, a GWUDI source should be reported as a surface water source type.)
Sanitary Survey Information	Site visit information for Total Coliform Rule (TCR), Ground Water Rule (GWR) and Surface Water Treatment Rules (SWTRs), including: site visit type, date completed, associated deficiencies identified, corrective actions taken.
Treatment Information	

Data Category	Description
Water System Facility	System facility data, including: treatment plant identification number, treatment plant information, treatment unit process/objectives, facility flow, treatment train (train or flow of water through treatment units within the treatment plant).
Filtration Type	Information relating to system filtration, including: filtration status, 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 including: coagulant/coagulant aid type and dose, disinfectant concentration (amounts, types, primary and secondary types of disinfection, disinfection profile/bench mark data), log of viral inactivation/removal, contact time, contact value, pH, 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 enables 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 is 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, etc.).
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, 4-digit SDWIS contaminant identification number or Chemical Abstracts Service (CAS) Registry Number for which the sample is being analyzed.
Sample Analytical Result - Sign	The sign indicates 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." *(Not required for TCR data)*
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, results will indicate presence/absence.*
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 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 data)*
MRL - Unit of Measure	Unit of measure to express the concentration value of a contaminant's MRL. *(Not required for TCR 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 (MOR)) summary records, alternative compliance criteria.
Sample Summary Reports	Sample summaries for Disinfection Byproduct Rules (DBPRs), SWTRs, TCR and 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, Heterotrophic Plate Count (HPC), etc.]

It was also necessary to confirm that all of the requested contaminants were included in each state dataset. EPA requested voluntary submission of compliance monitoring information for chemical contaminants regulated under Phase I, II, IIb and V Rules; the Arsenic Rule; and the Radionuclides Rule. In addition, EPA requested data collected for the Ground Water Rule, Surface Water Treatment Rules, Disinfection Byproduct Rules and Filter Backwash Recycling Rule (FBRR).

Exhibit 3.3 below lists the specific contaminants for which EPA requested monitoring data. Note that all contaminants whose data were requested are listed in the table, though not all were not analyzed as part of this report because they are being evaluated under other regulatory actions or included in separate regulatory reviews. The following contaminants/contaminant groups are not evaluated in this report: lead and copper, cVOCs, acrylamide and epichlorohydrin, disinfectants and their byproducts and microbial contaminants. 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
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

Chemical Contaminants (Phase I, II, IIB and V Rules; Arsenic Rule; Lead and Copper Rule)		
Gross alpha	Strontium-90	
Microbiological Contaminants		
Total coliforms	Fecal coliforms	*Escherichia coli (E. coli)*
Disinfectants and Disinfection Byproducts Rules (DBPRs)[1]		
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)[2]		
Chlorine	*Cryptosporidium*	Heterotrophic Plate Count (HPC)
Chloramines	*Giardia lamblia*	
Filter Backwash Recycling Rule (FBRR)		
No specific occurrence data collected; see Exhibit 3.2 for data elements for FBRR		

[1] Including both Disinfection Byproducts/Treatment Rules: Stage 1 (December 1998) and Stage 2 (January 2006).
[2] Including: Surface Water Treatment Rule (June 1989); Interim Enhanced SWTR (December 1998); Long-Term 1 Enhanced SWTR (January 2002); and, Long-Term 2 Enhanced SWTR (January 2006).

3.3 Establishing Consistent Data Fields for Analytical Results

When preparing the data for the occurrence analysis, as well as a review for potential outliers, etc., it was essential to get the following three data elements into a consistent format: the sample analytical result (sign), sample analytical result (value) and sample analytical result (unit of measure). Many of the state datasets included analytical results signs (e.g., "<" for non-detections or "=" for detections), detection limits and analytical results data in multiple fields. A "DETECT" field was added to all of the state datasets 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, representing a detection. When the analytical result was equal to zero and/or the result sign indicated a non-detection, then DETECT was set equal to 0 (i.e., a non-detect).

Finally, data were received in a variety of units of measure. It was important that all 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, all data for IOCs were converted to mg/L, while all data for the SOCs, VOCs and uranium were converted to µg/L. Data for alpha particles, beta particles and combined

radium-226/228 were analyzed in picocuries per liter (pCi/L).[5] Note that with the exception of asbestos and the radionuclides, all thresholds and concentrations in this report are expressed in µg/L.

[5] Although the MCL for beta particles, 4 mrem/yr, is in the unit of measure of 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. 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.

4 Data Quality Assurance/Quality Control

After the state data sets were converted into a consistent format, a significant effort was undertaken to ensure the quality of the data submitted. This QA/QC effort encountered a range of data quality across the different contaminants and different states. Included below is a summary description of the QA/QC measures that were conducted on the state datasets prior to analysis. Not all QA/QC measures described were conducted on all states, as noted below. For complete details of the data QA/QC measures, refer to USEPA (2016d).

4.1 Quality Assurance Measures

Before the analyses of contaminant occurrence could begin, EPA performed an initial QA/QC review of each state's data. EPA sent emails to each state, asking general questions about their data set, if necessary. 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. It was also necessary to confirm that all of the requested contaminants were included in each state dataset. When a state was missing data for any of the contaminants listed in Exhibit 3.3, EPA asked the state to identify the reason for the omission, such as a statewide waiver for the contaminant(s).

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 systems that are required to monitor for the contaminants within each chemical group. All required data that passed the QA/QC process, given the type of system, were included in the third Six-Year Review 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 transient or non-transient non-community systems), however this data was available inconsistently. To ensure consistent monitoring and to avoid bias, this non-required data were maintained in the SY3 ICR database but were excluded from the third Six-Year Review analyses.

Exhibit 4.1: Chemical Group Monitoring Requirements

Chemical Group	System Types Required to Sample (sample data included in analyses)	System Types Not Required to Sample (sample data excluded from analyses)
Inorganic Chemicals (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.
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 Chemicals (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 Chemicals (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.

Chemical Group	System Types Required to Sample (sample data included in analyses)	System Types Not Required to Sample (sample data excluded from analyses)
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 common data entry errors or numerical inconsistencies. These QA checks flagged records with potential data quality concerns. EPA sent out a detailed report to each state describing its flagged records, which included the counts of flagged records by category (described below) as well as specific questions for each of these categories. 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 the 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 made a decision on what to do with 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.

Of these flagged records, a number of categories addressed sampling concerns. For example, samples that were taken outside of the SYR3 date range, collected from non-public water systems, or identified as non-compliance were excluded from the occurrence analysis. All data from purchased systems were excluded from the occurrence analysis, as well as any sample types other than routine or confirmation. Non-nitrate or nitrite data collected from transient systems were excluded unless a state responded to say 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. Samples with reported units that were not one of the standard units used for the particular contaminant were excluded unless there was strong evidence of the correct standard unit to use. Potential duplicates were included in the occurrence analysis for consistency with the second 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 4th quarter 2011 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 the 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 the contaminant's method detection limit (MDL)[6] and all less than one tenth of the 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 and compliance status.

The review of states responses on 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 in their data system as well, if appropriate. To resolve data quality issues that required significant corrections to the raw 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 SYR3 ICR Dataset included more than 47 million analytical records from approximately 167,000 PWSs that serve approximately 290 million people nationally.[7] More than two-thirds of these records (more than 33 million) were for contaminants that were not analyzed as part of this current Six-Year Review 3 effort (including lead, copper, cVOCs, total coliform, DBPs and others). More than 13 million analytical records underwent QA/QC review in order to be included in the SYR3 ICR Dataset for contaminants evaluated in this report for the Six-Year Review 3. 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 SYR3 ICR Dataset comprise almost 13 million analytical records from approximately 139,000 PWSs that serve approximately 290 million people nationally.[8]

4.2 Adjustments of Population Served by Public Water Systems

"Purchased" water systems are the systems that purchase 100 percent of their water from other systems ("seller" or "wholesaler" systems). Compliance monitoring requirements are different for purchased water systems compared to non-purchased systems because purchased water systems do not have their own water sources (e.g., wells or intakes). As described above, EPA excluded from the analysis data from systems that purchase 100 percent of their water. However, EPA did adjust the population values of the wholesale systems to include the population of the systems that they sell to (the purchased water systems). The population served directly by these wholesale systems is known as the "retail population," while the population served indirectly

[6] 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.

[7] This count of 167,000 PWSs represents all water systems that submitted any SYR3 data (including purchased water systems). In this case, 290 million is the population served directly (retail) by these purchased and non-purchased systems (see Section 4.2).

[8] This count of 139,000 PWSs represents non-purchased systems only. The population served remains at 290 million; however, the number now reflects the total population served directly (retail) and indirectly (wholesale) by non-purchased systems only.

through the purchased systems is known as the "wholesale population." This adjustment ensured that all relevant population were included in the exposure estimates.

For some systems, a slightly more complicated adjustment to the wholesalers' total population served values was required. Many purchased water systems buy water from more than one wholesaler. Because of this, their entire population should not be attributed to a single wholesale system and EPA must instead distribute the population across the wholesale systems. 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 purchased system was assumed to be uniformly distributed across the wholesalers.

To make adjustments across the SYR3 ICR data, EPA compiled a list of all wholesale and purchased systems. This list of buyer-wholesaler relationships was from SDWIS/Fed, fourth quarter of 2010. EPA then created a crosswalk linking the purchased systems to the wholesale systems from which they purchased 100 percent of their water. The population served by each purchased system was then distributed evenly across the relevant wholesale system populations, according to the calculations described above. As a result, the contaminant occurrence measures are associated with the total (retail plus wholesale) population served by these non-purchased systems included in the Six-Year Review data.

4.3 Adjustments of Source Water Type for Public Water Systems

For the third Six-Year Review analysis, each system must have a single source water type and population served designation to define each system in a unique source water type/population size strata. 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 their most frequently occurring population served value.

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 intake or other SW facilities but do purchase some SW; however, in addition, they do have some of 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 very small portion of their water and the rest of the water comes from GW wells. Based on the QA criteria described in Section 4.1, data from these systems should be excluded from the SYR3 data analyses since data from purchased water systems were excluded. However, the GW sources from these systems did provide legitimate (and required) compliance monitoring data. Thus, it was necessary in the SYR3 analyses to consider these SWP systems as GW systems as the compliance monitoring data that were provided by these systems were from GW sources.

5 Summary of the Compliance Monitoring Data

This section provides an overview of the data that were received, passed the QA/QC process and were analyzed for Six-Year Review 3. Also provided is information on the total number of systems in the final SYR3 ICR Dataset; 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 six years was also conducted and is described below.

5.1 Characteristics of the Data - States, Systems and Records

Exhibit 5.1 shows the number and percent of systems and population served by systems according to source water type in the SYR3 ICR Dataset. Exhibit 5.2 shows the number and percent of systems and the population served by systems according to source water type and system size. As discussed in Sections 4.1 and 4.2, purchased water systems were excluded and the populations served by these systems were accounted for in the occurrence analyses for the contaminants evaluated in this report. Population served values and occurrence estimates in all tables in Section 5, 6 and 7 were generated using the total (adjusted) population served, as is described in Section 4.2. Source water types stratified by all classifications, including GWUDI as well as GW and SW groupings, are presented in Exhibit 5.1. For analysis of these data, however, EPA followed its standard practice of treating GWUDI as surface water.

Exhibit 5.1: Number of Systems and Population Served by Systems in the SYR3 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)	133,516	96%	125,617,215	43%
Ground Water Under the Direct Influence of Surface Water (GWUDI)	775	1%	2,075,138	1%
Surface Water (SW)	4,769	3%	162,885,819	56%
Total Number of Systems	**139,060**	**100%**	**290,578,172**	**100%**

Exhibit 5.2: Number of Systems and Population Served by Systems in the SYR3 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	43,588	1,230,003	573	13,343	44,161	1,243,346
50 – 100	35,646	2,611,071	436	32,921	36,082	2,643,992
101 – 500	36,323	8,464,729	891	235,031	37,214	8,699,760
501 – 1,000	7,074	5,194,327	383	294,985	7,457	5,489,312
1,001 – 3,300	6,066	11,206,423	821	1,694,222	6,887	12,900,645
3,301 – 10,000	2,859	16,418,571	944	5,898,160	3,803	22,316,731
10,001 – 50,000	1,600	34,484,799	969	22,454,312	2,569	56,939,111
50,001 – 100,000	229	15,675,332	252	17,594,243	481	33,269,575
100,001 – 1 million	127	23,968,963	255	69,329,070	382	93,298,033
> 1 million	4	6,362,997	20	47,414,670	24	53,777,667
Total	**133,516**	**125,617,215**	**5,544**	**164,960,957**	**139,060**	**290,578,172**

Exhibit 5.3 shows the number and percent of systems in the SYR3 ICR Dataset by system type. Although more than 57 percent of the systems are transient water systems they serve only 3.3 percent of the population; almost 95 percent of the population is served by CWSs. Only a small fraction of transient systems collected data for most of the contaminants requested in the SYR3 ICR data call-in, as transient systems are only required to collect nitrate and nitrite samples.

Exhibit 5.3: Number of Systems and Retail Population Served by Systems in the SYR3 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)	40,196	28.9%	275,436,560	94.8%
Non-Transient Non-Community Water System (NTNCWS)	18,941	13.6%	5,572,922	1.9%
Transient Non-Community Water System (TNCWS)[1]	79,804	57.4%	9,566,002	3.3%
Unknown[2]	119	0.1%	2,688	0.0%
Total Number of Systems	**139,060**	**100%**	**290,578,172**	**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 Six-Year Review 3 analyses. None of the occurrence analyses conducted for the Six-Year Review 3 required specifying the system type.

Exhibit 5.4 lists the total number of records, systems and population served by systems in each of the 54 state/tribal datasets used in the Six-Year Review 3 analyses. In addition, the last column of the table 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 SYR3 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 SYR3 ICR data set. See Exhibit 5.5 for the list of regulated contaminants evaluated for the third Six-Year Review.

Exhibit 5.4: An Inventory of Contaminant Occurrence Data in the SYR3 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 the following regulated contaminants:
Alabama	191,413	452	5,346,899	
Alaska	53,315	1,365	817,479	
American Samoa	5,208	11	62,196	Combined Radium-226 & -228
Arizona	332,193	1,739	6,813,243	
Arkansas	141,835	517	2,643,519	Asbestos; 2,3,7,8-TCDD (Dioxin); Alpha Particles; Uranium; Combined Radium-226 & -228

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 the following regulated contaminants:
California	2,224,544	7,728	42,332,069	
Colorado	133	2	2,047	The State of Colorado did not provide data for any contaminants for the 3rd Six-Year Review. The counts in this row reflect data from two tribal systems located in Colorado.
Connecticut	321,895	2,971	3,018,503	
Florida	550,332	6,338	19,889,742	
Hawaii	50,400	118	1,489,566	Alpha Particles; Combined Radium-226 & -228
Idaho	114,635	1,907	1,364,144	
Illinois	387,634	4,500	11,448,122	2,3,7,8-TCDD (Dioxin)
Indiana	132,072	4,267	5,482,894	
Iowa	76,870	1,828	2,873,105	2,3,7,8-TCDD (Dioxin)
Kansas	75,653	696	2,661,362	
Kentucky	77,124	265	4,244,786	
Louisiana	217,092	1,120	4,978,104	Asbestos
Maine	109,766	2,182	978,294	Glyphosate; 2,3,7,8-TCDD (Dioxin); Beta Particles
Maryland	163,019	3,695	5,421,969	Asbestos; Ethylene Dibromide (EDB)
Massachusetts	259,042	1,666	9,484,435	2,3,7,8-TCDD (Dioxin); Combined Radium-226 & -228
Michigan	400,333	12,934	8,647,270	
Minnesota	261,926	7,808	4,988,096	
Mississippi	1,085	5	6,176	The State of Mississippi did not provide data for any contaminants for the 3rd Six-Year Review. The counts in this row reflect data from five tribal systems located in Mississippi.
Missouri	230,179	2,660	5,463,242	Asbestos; 2,3,7,8-TCDD (Dioxin); Polychlorinated biphenyls (PCBs)
Montana	126,612	966	873,923	2,3,7,8-TCDD (Dioxin)
Nebraska	182,390	740	1,668,159	Nitrate; Nitrite; 2,3,7,8-TCDD (Dioxin); Polychlorinated biphenyls (PCBs)
Nevada	143,882	615	2,725,079	

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 the following regulated contaminants:
New Hampshire	243,533	2,606	1,201,039	Asbestos; 2,3,7,8-TCDD (Dioxin); Polychlorinated biphenyls (PCBs); Beta Particles
New Jersey	369,861	4,337	9,757,926	Toxaphene; Dalapon; Diquat; Endothall; Glyphosate; 2,3,7,8-TCDD (Dioxin); Polychlorinated biphenyls (PCBs); Chlordane; Beta Particles
New Mexico	185,680	902	2,003,572	
New York	799,621	8,844	20,833,578	
North Carolina	646,516	6,747	8,274,437	
North Dakota	10,496	192	610,974	Asbestos; 2,3,7,8-TCDD (Dioxin); Beta Particles
Ohio	265,231	5,343	10,703,302	
Oklahoma	127,513	963	3,617,365	Asbestos; 2,3,7,8-TCDD (Dioxin); Di(2-ethylhexyl)phthalate (DEHP)
Oregon	178,962	2,699	3,652,679	
Pennsylvania	626,314	10,130	12,102,084	Combined Radium-226 & -228
Rhode Island	52,092	493	1,098,288	Diquat; Endothall; Glyphosate; 2,3,7,8-TCDD (Dioxin)
South Carolina	126,052	1,092	3,719,705	Asbestos; Cyanide; Endothall; 2,3,7,8-TCDD (Dioxin); Polychlorinated biphenyls (PCBs); Beta Particles
South Dakota	52,126	488	780,472	2,3,7,8-TCDD (Dioxin)
Tennessee	43,478	667	6,628,308	Beta Particles; Combined Radium-226 & -228
Texas	563,231	6,011	26,068,814	Asbestos; Diquat; Glyphosate; 2,3,7,8-TCDD (Dioxin); Endothall; Polychlorinated biphenyls (PCBs)
Utah	295,231	951	2,909,712	
Vermont	72,624	1,360	590,755	Diquat; Endothall; Glyphosate; 2,3,7,8-TCDD (Dioxin); Beta Particles
Virginia	209,608	1,860	6,964,718	
Washington	342,363	4,170	5,715,708	2,3,7,8-TCDD (Dioxin)
Washington, D.C.	1,335	1	761,124	Combined Radium-226 & -228
West Virginia	60,722	956	1,633,025	
Wisconsin	389,849	8,708	4,732,724	
Wyoming	59,384	443	493,316	2,3,7,8-TCDD (Dioxin)

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 the following regulated contaminants:
Unknown	5	2	124	
Total	**12,552,409**	**139,060**	**290,578,172**	

[1] Quality assurance 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.

Exhibit 5.5 summarizes the SYR3 ICR Dataset by contaminant. For each contaminant, this table includes MCL concentration values, the number of states with data, total number of records, number of systems with data and the population served by systems that have data represented in the SYR3 ICR Dataset. Also presented are the modal MRL values for each contaminant, derived as the mode of state modal MRLs. See Section 7.1 for details regarding modal MRL values.

Exhibit 5.5: An Inventory of the Contaminant Occurrence Data in the SYR3 ICR Dataset, by Contaminant

Contaminant (MCL Concentration)	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MRL
Inorganic Chemicals					
Antimony (6 µg/L)	49	164,961	50,532	254,359,720	1 µg/L
Arsenic (10 µg/L)	50	297,354	54,845	267,062,633	1 µg/L
Asbestos (7 MFL)	39	12,084	5,785	94,380,829	0.2 MFL
Barium (2,000 µg/L)	49	165,387	50,711	254,501,602	100 µg/L
Beryllium (4 µg/L)	49	164,392	50,195	253,512,318	1 µg/L
Cadmium (5 µg/L)	49	165,247	50,583	254,433,966	1 µg/L
Chromium (Total) (100 µg/L)	49	167,251	50,597	254,405,306	1 µg/L
Cyanide (200 µg/L)	49	119,659	36,907	210,427,981	10 µg/L
Fluoride [1] (4,000 µg/L)	49	256,237	47,227	189,186,454	100 µg/L
Mercury (Inorganic) (2 µg/L)	49	164,558	50,552	254,397,552	0.2 µg/L
Nitrate (as N) (10,000 µg/L)	49	1,157,522	132,176	266,378,543	100 µg/L
Nitrite (as N) (1,000 µg/L)	49	445,544	85,742	224,146,056	100 µg/L
Selenium (50 µg/L)	49	165,672	50,568	254,428,296	5 µg/L

Contaminant (MCL Concentration)	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MRL
Thallium (2 µg/L)	49	164,156	50,522	254,265,115	1 µg/L
Synthetic Organic Chemicals[2]					
Alachlor (2 µg/L)	50	153,083	42,955	245,844,381	0.2 µg/L
Atrazine (3 µg/L)	50	162,134	44,310	251,501,740	0.1 µg/L
Benzo(a)pyrene (0.2 µg/L)	50	131,437	34,341	220,684,857	0.02 µg/L
Carbofuran (40 µg/L)	50	122,110	34,614	228,717,933	0.9 µg/L
Chlordane (2 µg/L)	49	128,870	35,685	217,637,369	0.2 µg/L
Dalapon (200 µg/L)	49	146,702	36,005	222,985,164	1 µg/L
Di(2-ethylhexyl)adipate (DEHA) (400 µg/L)	50	133,169	34,628	221,563,794	0.6 µg/L
Di(2-ethylhexyl)phthalate (DEHP) (6 µg/L)	49	133,523	33,923	216,841,935	0.6 µg/L
1,2-Dibromo-3-chloropropane (DBCP) (0.2 µg/L)	50	188,597	37,226	217,765,167	0.02 µg/L
2,4-Dichlorophenoxyacetic acid (2,4-D) (70 µg/L)	50	131,047	37,690	233,873,578	0.1 µg/L
Dinoseb (7 µg/L)	50	126,014	36,701	230,831,397	0.2 µg/L
Diquat (20 µg/L)	46	69,829	17,906	146,939,794	0.4 µg/L
Endothall (100 µg/L)	45	61,972	15,538	136,801,729	9 µg/L
Endrin (2 µg/L)	50	136,623	38,453	229,199,508	0.01 µg/L
Ethylene Dibromide (EDB) (0.05 µg/L)	49	184,784	37,499	221,781,780	0.01 µg/L
Glyphosate (700 µg/L)	45	70,016	18,502	145,203,976	6 µg/L
Heptachlor (0.4 µg/L)	50	137,286	38,691	229,832,285	0.04 µg/L
Heptachlor Epoxide (0.2 µg/L)	50	137,081	38,625	229,832,890	0.02 µg/L
Hexachlorobenzene (1 µg/L)	50	137,816	38,498	230,197,968	0.04 µg/L
Hexachlorocyclopentadiene (50 µg/L)	50	140,004	38,743	229,902,564	0.1 µg/L
Lindane (gamma-Hexachlorocyclohexane) (0.2 µg/L)	50	139,076	39,260	231,972,432	0.02 µg/L
Methoxychlor (40 µg/L)	50	139,744	39,187	233,030,961	0.1 µg/L
Oxamyl (Vydate) (200 µg/L)	50	121,508	34,518	227,520,373	2 µg/L

Contaminant (MCL Concentration)	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MRL
Pentachlorophenol (1 µg/L)	50	140,486	40,322	234,008,187	0.04 µg/L
Picloram (500 µg/L)	50	128,401	37,445	233,036,908	0.1 µg/L
Polychlorinated biphenyls (PCBs) (0.5 µg/L)	44	86,405	21,571	153,248,065	0.1 µg/L
Simazine (4 µg/L)	50	156,862	43,240	247,063,728	0.07 µg/L
Toxaphene (3 µg/L)	49	127,187	37,043	223,888,971	1 µg/L µg/L
2,3,7,8-TCDD (Dioxin) (0.00003 µg/L)	30	20,244	3,216	74,077,780	0.000005 µg/L
2,4,5-Trichlorophenoxypropionic Acid (Silvex) (50 µg/L)	50	126,887	36,897	230,214,788	0.2 µg/L
Volatile Organic Chemicals					
1,2-Dichlorobenzene (600 µg/L)	50	370,929	55,732	263,055,936	0.5 µg/L
1,4-Dichlorobenzene (75 µg/L)	50	371,276	55,739	263,060,364	0.5 µg/L
1,1-Dichloroethylene (7 µg/L)	50	379,522	55,728	263,336,047	0.5 µg/L
cis-1,2-Dichloroethylene (70 µg/L)	50	376,300	55,734	263,344,982	0.5 µg/L
trans-1,2-Dichloroethylene (100 µg/L)	50	371,580	55,633	263,180,210	0.5 µg/L
Ethylbenzene (700 µg/L)	50	372,709	55,754	263,388,439	0.5 µg/L
Monochlorobenzene (100 µg/L)	50	371,311	55,676	262,721,516	0.5 µg/L
Styrene (100 µg/L)	50	370,368	55,731	263,371,533	0.5 µg/L
Toluene (1,000 µg/L)	50	373,021	55,748	263,497,932	0.5 µg/L
1,2,4-Trichlorobenzene (70 µg/L)	50	369,032	55,725	263,373,653	0.5 µg/L
1,1,1-Trichloroethane (200 µg/L)	50	374,181	55,735	263,367,902	0.5 µg/L
1,1,2-Trichloroethane (5 µg/L)	50	371,877	55,733	263,373,568	0.5 µg/L
Xylenes (Total) (10,000 µg/L)	50	323,477	51,074	248,916,224	0.5 µg/L
Radiological Contaminants					
Alpha Particles (15 pCi/L)	47	60,803	13,309	107,091,381	3 pCi/L
Beta Particles (screening level = 50 pCi/L) [3]	41	43,278	11,531	109,503,691	4 pCi/L
Combined Radium-226 & -228 (5 pCi/L)	42	73,018	15,805	120,504,165	1 pCi/L

Contaminant (MCL Concentration)	Number of States with Data	Total Number of Records	Total Number of Systems	Total Population Served by Systems	MRL
Uranium (30 µg/L)	49	86,208	12,155	121,747,100	1 µg/L

[1] Quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.
[2] The reduced number of systems sampling for SOC data, as compared to IOCs and VOCs, likely relates to state waivers 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 95 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

The six years of data collected through the SYR3 ICR were used to develop aggregate measures of occurrence (i.e., a single measure of occurrence that is based on all six years of data). For example, a typical measure is the percent of systems with at least one detection of a particular contaminant greater than its MCL concentration. This single measure would not differentiate between years, but would reflect detections in any of the six years considered. Recognizing that occurrence of a particular contaminant might vary over a six -year period, EPA conducted assessments to determine if the compliance monitoring data in the SYR3 ICR Dataset exhibit significant variability over time.

To make these assessments, it was not possible to simply evaluate yearly sample detection rates for each contaminant at the national level. Monitoring schedules for a particular contaminant can differ from system-to-system and year-to-year (e.g., not all surface water systems monitor all contaminants quarterly). Therefore, a national comparison of system monitoring data from different years will likely result in a comparison of data from different subsets of systems nationally.

The variation in compliance monitoring schedules generally corresponds to the assessed chance of contaminant occurrence based on historic monitoring results at each system. If a contaminant is shown not to occur at a system through a specified period of routine compliance monitoring, that system is authorized to conduct a reduced monitoring schedule for that contaminant. Some systems monitor contaminants as infrequently as once every year, every three years, or even every nine years. Because of this variability in monitoring schedules and its implications (i.e., the frequency and timing of sampling are not random), a simple year-to-year assessment of occurrence across all systems does not provide a clear, unambiguous assessment of occurrence variability. For this variability assessment, EPA identified systems that collected at least one sample in each of the six years of 2006 through 2011. This allowed the evaluation to focus on the observed variability in the occurrence measures due to changes in contaminant occurrence rather than differences or changes in monitoring schedules.

There is no single measure of occurrence for assessing variability. Contaminant occurrence variability can be based on a number of different measures such as contaminant detection rates, concentration averages, or the frequency at which systems find a contaminant above some concentration threshold. Occurrence is also defined by a relatively small number of samples from each system, as expected given compliance monitoring requirements. Because of the small sample size, EPA compared detection rates in two, three-year groups rather than the detection

rates for each individual year. EPA quantified contaminant occurrence at the system level (i.e., calculating the detection rate at each system) for the first three years of data (2006-2008) and then the second three years of data (2009-2011). EPA then used standard statistical t-tests to determine whether system level occurrence in the first three years was significantly different from system level occurrence in the second three years.

EPA conducted variability assessments on a subset of 15 contaminants. The 15 contaminants were: carbofuran; cis-1,2-dichloroethylene; cyanide; DBCP; dioxin; heptachlor; heptachlor epoxide; hexachlorocyclopentadiene; oxamyl; pentachlorophenol; selenium; thallium; toluene; toxaphene and xylenes (total). For each of these 15 select contaminants, the mean detection rate for each system (i.e., the percentage of detections for each system) for each time period was calculated. Results for ground water systems were evaluated separately from the results for surface water systems. For each contaminant, a t-test (paired two sample for means) was used with an alpha (α) level of 0.05 to determine whether these two estimated mean system detection rates were significantly different between the first time period and the second time period. (If the p-value resulting from the t-test was greater than 0.05, EPA did not reject the null hypothesis that the two time periods' mean system detection rates were from the same population.) If so, this would suggest, but does not prove, that the mean system detection rates of that contaminant for 2006-2008 and 2009-2011 were not significantly different (were from the same population).

For 11 of the 15 contaminants assessed, there was no statistically significant variability in system detection rates (for ground water or surface water systems) between the 2006-2008 and 2009-2011 time periods (i.e., the p-value was greater than 0.05 and EPA failed to reject the null hypothesis). For the other four contaminants, either the ground water or surface water systems' detection rates were found to be statistically different in the two time periods (i.e., the p-value was less than 0.05, EPA accepted the alternative hypothesis that the system detection rates were from different populations). Most of the contaminants with occurrence variability over time had a decrease in occurrence over the six-year period including DBCP in GW; xylenes (total) in GW and toluene in GW. Hexachlorocyclopentadiene in SW showed an increase in occurrence over the six-year period. For the four contaminants with at least some statistically significant measure of increasing or decreasing occurrence, these findings are most appropriately used as context or background for the quantitative occurrence findings presented in Sections 6 and 7 of this report.

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 the MRL, identifying the simple presence/absence of a detection of a contaminant. A sample analytical result is defined as a "detection" if the quantified sample concentration of the contaminant is equal to or greater than that contaminant's MRL. Contaminant occurrence was also evaluated relative to multiple contaminant concentration thresholds including a contaminant's MCL concentration. For Stage 1 and Stage 2 assessments of occurrence relative to the MCL concentration, the criterion is that the sample concentration of the contaminant is greater than that contaminant's MCL. The Stage 1 analyses would identify any single result greater than the MCL concentration and the Stage 2 analyses would identify system estimated long-term (multi-year) average concentrations greater than the MCL concentration.

The Stage 1 and Stage 2 analyses conducted relative to the MCL concentration are not equivalent to the analyses conducted to estimate a potential MCL violation. Calculations of MCL violations from the sample data are not conducted in this report. Both these Stage 1 and Stage 2 analyses are based on sample detection and non-detection results from all years with data in the SYR3 ICR Dataset. The Stage 2 analysis (based on an estimated long-term average concentration) 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).[9] In contrast, a "Stage 2 MCL exceedance" occurs when the concentration threshold equal to a particular contaminant's MCL is exceeded by the estimated system long-term average concentration, based on multiple years (not two or four consecutive quarters) of compliance monitoring samples.

In accordance with the Six-Year Review 3 Protocol, EPA selected 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 level 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 61 contaminants considered in the third Six-Year Review, EPA identified 19 contaminants for which to derive other thresholds (in addition to the MCL). Two of the 19 chemical contaminants (oxamyl and carbofuran) have acute health effects and only the Stage 1 analysis was conducted. (For more details on the Stage 1 analysis, refer to Section 6 of this report.) The remaining 17 contaminants have chronic health effects and were analyzed using the Stage 2 occurrence analysis. (For more details on the Stage 2 analysis, refer to Section 7 of this report.) For 10 contaminants, EPA generated occurrence estimates relative to the estimated quantitation level (EQL). The EQL represents the potential quantitation capabilities below a PQL (USEPA, 2016e). For eight contaminants, EPA generated occurrence estimates relative to the potential MCLG. For one contaminant, EPA generated occurrence estimates relative to the (existing) MCLG and one other contaminant, EPA generated occurrence estimates relative to the PQL. Occurrence analyses relative to these additional thresholds are presented in Appendix A for oxamyl and carbofuran and Appendix B for the remaining 17 contaminants for which Stage 2 analysis was warranted. Exhibit 5.6 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 SYR3 analyses, refer to USEPA (2016e) and (2016f).

Exhibit 5.6: List of Contaminant Thresholds used in Stage 2 Occurrence Analysis[1]

Contaminant	MCL	Alternate Threshold Type	Alternate Threshold Concentration
Carbofuran[1]	40 µg/L	EQL	5 µg/L
Chlordane	2 µg/L	EQL	1 µg/L

[9] 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	Alternate Threshold Type	Alternate Threshold Concentration
cis-1,2-Dichloroethylene	70 µg/L	Potential MCLG	10 µg/L
Cyanide	200 µg/L	EQL	50 µg/L
Endothall	100 µg/L	Potential MCLG	50 µg/L
Fluoride	4,000 µg/L	Potential MCLG	900 µg/L
Heptachlor	0.4 µg/L	EQL	0.1 µg/L
Heptachlor Epoxide	0.2 µg/L	EQL	0.04 µg/L
Hexachlorobenzene	1 µg/L	EQL	0.1 µg/L
Hexachlorocyclopentadiene	50 µg/L	Potential MCLG	40 µg/L
Methoxychlor	40 µg/L	EQL	1 µg/L
Oxamyl (Vydate)[1]	200 µg/L	Potential MCLG	9, 10 µg/L
Selenium	50 µg/L	Potential MCLG	40 µg/L
Styrene	100 µg/L	EQL	0.5 µg/L
2,3,7,8-TCDD (Dioxin)	0.00003 µg/L	EQL	0.000005 µg/L
Toluene	1,000 µg/L	Potential MCLG	600 µg/L
Toxaphene	3 µg/L	EQL	1 µg/L
1,1,2-Trichloroethane	5 µg/L	MCLG	3 µg/L
Xylenes (Total)	10,000 µg/L	Potential MCLG	1,000 µg/L

[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 statistical analysis of the SYR3 ICR Dataset consists of simple counts and descriptive statistics of the occurrence data for each of the regulated contaminants assessed. National contaminant occurrence estimates were conducted relative to contaminant MRLs and MCL concentrations and Section 6.1 presents the results by systems and population served by systems. A comparison of the summary Stage 1 analysis results from the first Six-Year Review with data from 1993-1997, the second Six-Year Review with data from 1998-2005 and the current Six-Year Review with data from 2006-2011, is presented in Section 6.2. A supplemental measure of occurrence, based on occurrence at sample point locations within each system, using the 2006-2011 data is described in Section 6.3 with summary sample point estimates presented in Exhibit 6.3.

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 shows occurrence measures conducted relative to a contaminant's MRL, identifying analytical detections for a broad assessment of the rate of occurrence; Exhibit 6.2 shows occurrence measures relative to each contaminant's MCL concentration, making a preliminary estimate of occurrence and exposure at or above a contaminant's health-based drinking water standard. The percent of systems and population served by systems with at least one detection greater than the MCL concentration 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. Note that this does not indicate an MCL violation. An MCL violation occurs when the MCL is exceeded by the average results from four consecutive quarterly confirmation samples. These Stage 1 analytical findings 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 Detections ≥ MRL		Total Population Served by Systems	Population Served by Systems With Detections ≥ MRL		Range of Detected Concentrations (5^{th} percentile – 95^{th} percentile)
		Number	Percent		Number	Percent	
Inorganic Chemicals							
Antimony	50,532	2,243	4.44%	254,359,720	35,557,081	13.98%	0.06 - 6.4 µg/L
Arsenic	54,845	21,850	39.84%	267,062,633	142,045,436	53.19%	1.00 - 25.4 µg/L
Asbestos	5,785	214	3.70%	94,380,829	7,011,486	7.43%	0.10 - 6.8 MFL
Barium	50,711	37,328	73.61%	254,501,602	215,824,476	84.80%	5.00 - 310 µg/L
Beryllium	50,195	1,051	2.09%	253,512,318	18,768,223	7.40%	0.01 - 4.0 µg/L

Contaminant	Total Number of Systems	Systems With Detections ≥ MRL		Total Population Served by Systems	Population Served by Systems With Detections ≥ MRL		Range of Detected Concentrations (5^{th} percentile – 95^{th} percentile)
		Number	Percent		Number	Percent	
Cadmium	50,583	1,826	3.61%	254,433,966	23,767,870	9.34%	0.05 -4.0 µg/L
Chromium (Total)	50,597	13,609	26.90%	254,405,306	102,850,010	40.43%	0.73 – 20.0 µg/L
Cyanide	36,907	1,580	4.28%	210,427,981	29,827,337	14.17%	1.62 – 150 µg/L
Fluoride [1]	47,227	33,478	70.89%	189,186,454	164,918,799	87.17%	100.0 -2,550 µg/L
Mercury (Inorganic)	50,552	1,610	3.18%	254,397,552	31,509,568	12.39%	0.02 - 1.4 µg/L
Nitrate (as N)	132,176	84,347	63.81%	266,378,543	237,542,569	89.17%	84.00 - 8,339 µg/L
Nitrite (as N)	85,742	10,064	11.74%	224,146,056	72,846,518	32.50%	2.00 – 1,150 µg/L
Selenium	50,568	8,754	17.31%	254,428,296	92,506,459	36.36%	0.60 – 27.0 µg/L
Thallium	50,522	1,828	3.62%	254,265,115	25,659,625	10.09%	0.01 – 2.0 µg/L
Synthetic Organic Chemicals							
Alachlor	42,955	68	0.16%	245,844,381	2,409,101	0.98%	0.03 – 1.30 µg/L
Atrazine	44,310	1,144	2.58%	251,501,740	46,065,991	18.32%	0.10 - 1.73 µg/L
Benzo(a)pyrene	34,341	143	0.42%	220,684,857	8,066,622	3.66%	0.02 - 0.53 µg/L
Carbofuran	34,614	23	0.07%	228,717,933	83,512	0.04%	0.32 - 31.42 µg/L
Chlordane	35,685	61	0.17%	217,637,369	1,959,885	0.90%	0.03 – 2.00 µg/L
Dalapon	36,005	650	1.81%	222,985,164	22,843,243	10.24%	0.45 - 5.3 µg/L
Di(2-ethylhexyl)adipate (DEHA)	34,628	511	1.48%	221,563,794	9,960,923	4.50%	0.12 – 8.74 µg/L
Di(2-ethylhexyl)phthalate (DEHP)	33,923	4,042	11.92%	216,841,935	55,983,264	25.82%	0.29 - 6.84 µg/L
1,2-Dibromo-3-chloropropane (DBCP)	37,226	379	1.02%	217,765,167	11,331,048	5.20%	0.01 – 0.22 µg/L
2,4-Dichlorophenoxyacetic acid (2,4-D)	37,690	193	0.51%	233,873,578	8,842,605	3.78%	0.05 – 2.40 µg/L
Dinoseb	36,701	94	0.26%	230,831,397	878,035	0.38%	0.09 - 5.52 µg/L
Diquat	17,906	106	0.59%	146,939,794	2,804,725	1.91%	0.22 - 6.68 µg/L
Endothall	15,538	25	0.16%	136,801,729	210,779	0.15%	2.70 - 66.2 µg/L
Endrin	38,453	48	0.12%	229,199,508	2,093,675	0.91%	0.002 - 0.77 µg/L
Ethylene Dibromide (EDB)	37,499	155	0.41%	221,781,780	4,779,841	2.16%	0.01 - 0.17 µg/L
Glyphosate	18,502	20	0.11%	145,203,976	238,876	0.16%	3.20 - 32.64 µg/L

Contaminant	Total Number of Systems	Systems With Detections ≥ MRL		Total Population Served by Systems	Population Served by Systems With Detections ≥ MRL		Range of Detected Concentrations (5^{th} percentile – 95^{th} percentile)
		Number	Percent		Number	Percent	
Heptachlor	38,691	62	0.16%	229,832,285	3,729,607	1.62%	0.01 - 0.19 µg/L
Heptachlor Epoxide	38,625	135	0.35%	229,832,890	2,882,874	1.25%	0.01 - 0.11 µg/L
Hexachlorobenzene	38,498	45	0.12%	230,197,968	1,071,688	0.47%	0.00 - 0.84 µg/L
Hexachlorocyclopentadiene	38,743	172	0.44%	229,902,564	9,511,658	4.14%	0.02 - 1.14 µg/L
Lindane (gamma-Hexachlorocyclohexane)	39,260	44	0.11%	231,972,432	3,391,071	1.46%	0.01 - 0.24 µg/L
Methoxychlor	39,187	68	0.17%	233,030,961	2,319,414	1.00%	0.01 - 0.93 µg/L
Oxamyl (Vydate)	34,518	37	0.11%	227,520,373	994,043	0.44%	0.35 - 37.00 µg/L
Pentachlorophenol	40,322	226	0.56%	234,008,187	7,810,865	3.34%	0.01 - 0.98 µg/L
Picloram	37,445	98	0.26%	233,036,908	1,773,249	0.76%	0.01 – 4.59 µg/L
Polychlorinated biphenyls (PCBs)	21,571	32	0.15%	153,248,065	216,797	0.14%	0.02 - 1.17 µg/L
Simazine	43,240	365	0.84%	247,063,728	24,110,287	9.76%	0.07 – 1.30 µg/L
Toxaphene	37,043	28	0.08%	223,888,971	1,097,044	0.49%	0.13 - 6.89 µg/L
2,3,7,8-TCDD (Dioxin)	3,216	8	0.25%	74,077,780	124,178	0.17%	0.000001 – 0.0007 µg/L
2,4,5-Trichlorophenoxypropionic Acid (Silvex)	36,897	59	0.16%	230,214,788	5,445,631	2.37%	0.04 - 4.57 µg/L
Volatile Organic Chemicals							
1,2-Dichlorobenzene	55,732	145	0.26%	263,055,936	5,684,614	2.16%	0.13 - 9.64 µg/L
1,4-Dichlorobenzene	55,739	644	1.16%	263,060,364	7,214,920	2.74%	0.10 – 4.53 µg/L
1,1-Dichloroethylene	55,728	379	0.68%	263,336,047	15,927,038	6.05%	0.50 - 4.70 µg/L
cis-1,2-Dichloroethylene	55,734	516	0.93%	263,344,982	22,180,279	8.42%	0.50 – 11.00 µg/L
trans-1,2-Dichloroethylene	55,633	149	0.27%	263,180,210	5,567,372	2.12%	0.02 - 6.13 µg/L
Ethylbenzene	55,754	1,744	3.13%	263,388,439	17,798,704	6.76%	0.29 - 8.70 µg/L
Monochlorobenzene	55,676	217	0.39%	262,721,516	4,740,559	1.80%	0.04 - 2.71 µg/L
Styrene	55,731	387	0.69%	263,371,533	4,932,664	1.87%	0.01 - 6.60 µg/L
Toluene	55,748	2,485	4.46%	263,497,932	24,438,509	9.27%	0.27 - 10.85 µg/L
1,2,4-Trichlorobenzene	55,725	147	0.26%	263,373,653	4,700,300	1.78%	0.02 - 1.90 µg/L
1,1,1-Trichloroethane	55,735	400	0.72%	263,367,902	12,878,782	4.89%	0.50 - 11.50 µg/L

Contaminant	Total Number of Systems	Systems With Detections ≥ MRL		Total Population Served by Systems	Population Served by Systems With Detections ≥ MRL		Range of Detected Concentrations (5^{th} percentile – 95^{th} percentile)
		Number	Percent		Number	Percent	
1,1,2-Trichloroethane	55,733	116	0.21%	263,373,568	8,374,139	3.18%	0.03 - 2.36 µg/L
Xylenes (Total)	51,074	3,241	6.35%	248,916,224	34,901,941	14.02%	0.50 - 18.42 µg/L
Radiological Contaminants							
Alpha Particles	13,309	8,126	61.06%	107,091,381	77,231,268	72.12%	0.50 – 22 pCi/L
Beta Particles	11,531	6,894	59.79%	109,503,691	76,615,844	69.97%	1.23 - 20.7 pCi/L
Combined Radium-226 & -228	15,805	11,092	70.18%	120,504,165	96,765,143	80.30%	0.20 - 8.2 pCi/L
Uranium	12,155	6,785	55.82%	121,747,100	83,230,946	68.36%	0.49 – 41 µg/L

[1] Quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.

Exhibit 6.2: Number and Percent of Systems and Population Served by Systems with Detections Greater than the MCL Concentration

Contaminant (MCL Concentration)	Systems With Detections > MCL Concentration		Population Served by Systems With Detections > MCL Concentration	
	Number	Percent	Number	Percent
Inorganic Chemicals				
Antimony (6 µg/L)	93	0.184%	899,395	0.354%
Arsenic (10 µg/L)	3,478	6.342%	19,619,428	7.346%
Asbestos (7 MFL)	8	0.138%	190,895	0.202%
Barium (2,000 µg/L)	62	0.122%	1,312,318	0.516%
Beryllium (4 µg/L)	33	0.066%	576,710	0.227%
Cadmium (5 µg/L)	63	0.125%	239,604	0.094%
Chromium (Total) (100 µg/L)	22	0.043%	106,717	0.042%
Cyanide (200 µg/L)	38	0.103%	502,135	0.239%
Fluoride [1] (4,000 µg/L)	343	0.726%	6,156,091	3.254%
Mercury (Inorganic) (2 µg/L)	50	0.099%	1,111,902	0.437%
Nitrate (as N) (10,000 µg/L)	3,016	2.282%	10,406,882	3.907%
Nitrite (as N) (1,000 µg/L)	523	0.610%	2,658,267	1.186%

Contaminant (MCL Concentration)	Systems With Detections > MCL Concentration		Population Served by Systems With Detections > MCL Concentration	
	Number	Percent	Number	Percent
Selenium (50 µg/L)	88	0.174%	626,607	0.246%
Thallium (2 µg/L)	98	0.194%	1,021,116	0.402%
Synthetic Organic Chemicals				
Alachlor (2 µg/L)	4	0.009%	12,793	0.005%
Atrazine (3 µg/L)	64	0.144%	3,507,861	1.395%
Benzo(a)pyrene (0.2 µg/L)	16	0.047%	1,322,607	0.599%
Carbofuran (40 µg/L)	0	0.000%	0	0.000%
Chlordane (2 µg/L)	6	0.017%	2,621	0.001%
Dalapon (200 µg/L)	1	0.003%	125	0.000%
Di(2-ethylhexyl)adipate (DEHA) (400 µg/L)	0	0.000%	0	0.000%
Di(2-ethylhexyl)phthalate (DEHP) (6 µg/L)	352	1.038%	9,060,445	4.178%
1,2-Dibromo-3-chloropropane (DBCP) (0.2 µg/L)	103	0.277%	2,671,550	1.227%
2,4-Dichlorophenoxyacetic acid (2,4-D) (70 µg/L)	1	0.003%	125	0.000%
Dinoseb (7 µg/L)	5	0.014%	68,933	0.030%
Diquat (20 µg/L)	1	0.006%	993	0.001%
Endothall (100 µg/L)	1	0.006%	993	0.001%
Endrin (2 µg/L)	1	0.003%	993	0.000%
Ethylene Dibromide (EDB) (0.05 µg/L)	40	0.107%	810,484	0.365%
Glyphosate (700 µg/L)	0	0.000%	0	0.000%
Heptachlor (0.4 µg/L)	3	0.008%	1,643	0.001%
Heptachlor Epoxide (0.2 µg/L)	7	0.018%	2,503	0.001%
Hexachlorobenzene (1 µg/L)	1	0.003%	6,916	0.003%
Hexachlorocyclopentadiene (50 µg/L)	1	0.003%	10,018	0.004%
Lindane (gamma-Hexachlorocyclohexane) (0.2 µg/L)	5	0.013%	20,440	0.009%
Methoxychlor (40 µg/L)	0	0.000%	0	0.000%

Contaminant (MCL Concentration)	Systems With Detections > MCL Concentration		Population Served by Systems With Detections > MCL Concentration	
	Number	Percent	Number	Percent
Oxamyl (Vydate) (200 µg/L)	0	0.000%	0	0.000%
Pentachlorophenol (1 µg/L)	11	0.027%	88,756	0.038%
Picloram (500 µg/L)	0	0.000%	0	0.000%
Polychlorinated biphenyls (PCBs) (0.5 µg/L)	5	0.023%	36,354	0.024%
Simazine (4 µg/L)	5	0.012%	14,816	0.006%
Toxaphene (3 µg/L)	5	0.013%	714,581	0.319%
2,3,7,8-TCDD (Dioxin) (0.00003 µg/L)	1	0.031%	550	0.001%
2,4,5-Trichlorophenoxypropionic Acid (Silvex) (50 µg/L)	1	0.003%	125	0.000%
Volatile Organic Chemicals				
1,2-Dichlorobenzene (600 µg/L)	0	0.000%	0	0.000%
1,4-Dichlorobenzene (75 µg/L)	2	0.004%	4,574	0.002%
1,1-Dichloroethylene (7 µg/L)	28	0.050%	694,929	0.264%
cis-1,2-Dichloroethylene (70 µg/L)	1	0.002%	54	0.000%
trans-1,2-Dichloroethylene (100 µg/L)	0	0.000%	0	0.000%
Ethylbenzene (700 µg/L)	2	0.004%	282	0.000%
Monochlorobenzene (100 µg/L)	0	0.000%	0	0.000%
Styrene (100 µg/L)	1	0.002%	100	0.000%
Toluene (1,000 µg/L)	2	0.004%	583	0.000%
1,2,4-Trichlorobenzene (70 µg/L)	0	0.000%	0	0.000%
1,1,1-Trichloroethane (200 µg/L)	2	0.004%	1,403	0.001%
1,1,2-Trichloroethane (5 µg/L)	3	0.005%	7,839	0.003%
Xylenes (Total) (10,000 µg/L)	0	0.000%	0	0.000%
Radiological Contaminants				
Alpha Particles (15 pCi/L)	719	5.402%	7,353,592	6.867%
Beta Particles (50 pCi/L)	54	0.468%	725,062	0.662%

Contaminant (MCL Concentration)	Systems With Detections > MCL Concentration		Population Served by Systems With Detections > MCL Concentration	
	Number	Percent	Number	Percent
Combined Radium-226 & -228 (5 pCi/L)	788	4.986%	5,023,247	4.169%
Uranium (30 µg/L)	523	4.303%	8,462,624	6.951%

[1] Quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.

6.2 Comparison of Stage 1 Analysis of First, Second and Third Six-Year Reviews

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) and the third Six-Year Review (2006-2011). Some of the contaminants assessed for the second and third 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). The occurrence estimates from the three rounds of Six-Year Review appear to be broadly similar. Note, however, that comparisons or apparent occurrence changes over time must be somewhat qualified given the differences between the three 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 SYR2 and SYR3 ICR Datasets consist of data from 45 and 46 states, respectively, that serve as a very large sample that is, essentially, nationally representative. Therefore, it is possible that differences in occurrence measures between the first and second or between the first and third Six-Year Review Stage 1 findings summarized in Exhibit 6.3 reflect differences in the respective datasets rather than differences in actual occurrence. Nonetheless, each of the three datasets provide sound assessments of national contaminant occurrence in systems, so significant differences in occurrence estimates generated for the first, second and third 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 the first, second and third 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 the First, Second and Third Six-Year Reviews based on the Percent of Systems

Contaminant (MCL Concentration)	Percent of Systems With Detections ≥ MRL			Percent of Systems With Detections > MCL Concentration		
	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3
Inorganic Chemicals						
Antimony (6 µg/L)	14.40%	5.98%	4.44%	0.62%	0.27%	0.18%
Arsenic (10 µg/L)[3]	13.70%	37.33%	39.84%	0.87%	0.75%	6.34%
Asbestos (7 MFL)	--	3.24%	3.70%	--	0.17%	0.14%
Barium (2,000 µg/L)	71.20%	72.02%	73.61%	0.17%	0.13%	0.12%

Contaminant (MCL Concentration)	Percent of Systems With Detections ≥ MRL			Percent of Systems With Detections > MCL Concentration		
	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3
Beryllium (4 µg/L)	3.32%	3.12%	2.09%	0.22%	0.11%	0.07%
Cadmium (5 µg/L)	17.60%	5.61%	3.61%	0.54%	0.27%	0.12%
Chromium (Total) (100 µg/L)	18.30%	24.21%	26.90%	0.13%	0.09%	0.04%
Cyanide (200 µg/L)	17.00%	4.14%	4.28%	0.17%	0.14%	0.10%
Fluoride [4] (4,000 µg/L)	83.80%	79.28%	70.89%	1.28%	1.07%	0.73%
Mercury (Inorganic) (2 µg/L)	17.30%	3.96%	3.18%	0.26%	0.17%	0.10%
Nitrate (as N) (10,000 µg/L)	--	69.94%	63.81%	--	2.49%	2.28%
Nitrite (as N) (1,000 µg/L)	--	22.32%	11.74%	--	0.74%	0.61%
Selenium (50 µg/L)	22.10%	17.28%	17.31%	0.11%	0.13%	0.17%
Thallium (2 µg/L)	4.22%	3.49%	3.62%	0.68%	0.26%	0.19%
Synthetic Organic Chemicals						
Alachlor (2 µg/L)	0.67%	0.33%	0.16%	0.00%	0.02%	0.01%
Atrazine (3 µg/L)	3.83%	2.39%	2.58%	0.68%	0.26%	0.14%
Benzo(a)pyrene (0.2 µg/L)	0.44%	0.49%	0.42%	0.05%	0.05%	0.05%
Carbofuran (40 µg/L)	0.06%	0.14%	0.07%	0.00%	0.00%	0.00%
Chlordane (2 µg/L)	1.19%	0.21%	0.17%	0.01%	0.01%	0.02%
Dalapon (200 µg/L)	1.10%	1.83%	1.81%	0.00%	0.00%	0.00%
Di(2-ethylhexyl)adipate (DEHA) (400 µg/L)	7.31%	1.75%	1.48%	0.01%	0.01%	0.00%
Di(2-ethylhexyl)phthalate (DEHP) (6 µg/L)	12.50%	11.20%	11.92%	2.20%	1.66%	1.04%
1,2-Dibromo-3-chloropropane (DBCP) (0.2 µg/L)	1.61%	1.03%	1.02%	0.91%	0.39%	0.28%
2,4-Dichlorophenoxyacetic acid (2,4-D) (70 µg/L)	0.12%	0.90%	0.51%	0.02%	0.00%	0.00%
Dinoseb (7 µg/L)	0.24%	0.27%	0.26%	0.02%	0.02%	0.01%
Diquat (20 µg/L)	0.49%	0.44%	0.59%	0.02%	0.00%	0.01%
Endothall (100 µg/L)	0.15%	0.23%	0.16%	0.03%	0.02%	0.01%
Endrin (2 µg/L)	0.18%	0.14%	0.12%	0.02%	0.00%	0.00%

Contaminant (MCL Concentration)	Percent of Systems With Detections ≥ MRL			Percent of Systems With Detections > MCL Concentration		
	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3
Ethylene Dibromide (EDB) (0.05 µg/L)	1.06%	0.54%	0.41%	0.72%	0.24%	0.11%
Glyphosate (700 µg/L)	0.10%	0.18%	0.11%	0.00%	0.00%	0.00%
Heptachlor (0.4 µg/L)	0.08%	0.80%	0.16%	0.01%	0.01%	0.01%
Heptachlor Epoxide (0.2 µg/L)	0.09%	0.22%	0.35%	0.03%	0.02%	0.02%
Hexachlorobenzene (1 µg/L)	0.09%	0.34%	0.12%	0.01%	0.01%	0.00%
Hexachlorocyclopentadiene (50 µg/L)	0.89%	0.69%	0.44%	0.00%	0.00%	0.00%
Lindane (gamma-Hexachlorocyclohexane) (0.2 µg/L)	0.16%	0.25%	0.11%	0.04%	0.01%	0.01%
Methoxychlor (40 µg/L)	0.19%	0.16%	0.17%	0.01%	0.00%	0.00%
Oxamyl (Vydate) (200 µg/L)	0.08%	0.23%	0.11%	0.00%	0.00%	0.00%
Pentachlorophenol (1 µg/L)	0.43%	0.73%	0.56%	0.03%	0.02%	0.03%
Picloram (500 µg/L)	0.41%	0.41%	0.26%	0.00%	0.00%	0.00%
Polychlorinated biphenyls (PCBs) (0.5 µg/L)	0.09%	0.16%	0.15%	0.03%	0.01%	0.02%
Simazine (4 µg/L)	1.80%	0.72%	0.84%	0.06%	0.04%	0.01%
Toxaphene (3 µg/L)	0.08%	0.13%	0.08%	0.01%	0.02%	0.01%
2,3,7,8-TCDD (Dioxin) (0.00003 µg/L)	--	0.71%	0.25%	--	0.04%	0.03%
2,4,5-Trichlorophenoxypropionic Acid (Silvex) (50 µg/L)	0.40%	0.24%	0.16%	0.00%	0.00%	0.00%
Volatile Organic Chemicals						
1,2-Dichlorobenzene (600 µg/L)	0.61%	0.23%	0.26%	0.00%	0.00%	0.00%
1,4-Dichlorobenzene (75 µg/L)	1.76%	1.50%	1.16%	0.00%	0.01%	0.00%
1,1-Dichloroethylene (7 µg/L)	1.58%	0.69%	0.68%	0.24%	0.07%	0.05%
cis-1,2-Dichloroethylene (70 µg/L)	1.37%	0.96%	0.93%	0.03%	0.01%	0.00%
trans-1,2-Dichloroethylene (100 µg/L)	0.53%	0.19%	0.27%	0.00%	0.00%	0.00%
Ethylbenzene (700 µg/L)	3.62%	3.91%	3.13%	0.00%	0.00%	0.00%
Monochlorobenzene (100 µg/L)	0.75%	0.27%	0.39%	0.00%	0.00%	0.00%
Styrene (100 µg/L)	0.99%	1.05%	0.69%	0.00%	0.01%	0.00%

Contaminant (MCL Concentration)	Percent of Systems With Detections ≥ MRL			Percent of Systems With Detections > MCL Concentration		
	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3	Six-Year 1[1]	Six-Year 2[2]	Six-Year 3
Toluene (1,000 µg/L)	4.73%	5.76%	4.46%	0.00%	0.00%	0.00%
1,2,4-Trichlorobenzene (70 µg/L)	0.61%	0.32%	0.26%	0.00%	0.00%	0.00%
1,1,1-Trichloroethane (200 µg/L)	2.50%	1.07%	0.72%	0.01%	0.00%	0.00%
1,1,2-Trichloroethane (5 µg/L)	0.62%	0.18%	0.21%	0.04%	0.01%	0.01%
Xylenes (Total) (10,000 µg/L)	4.16%	7.59%	6.35%	0.00%	0.00%	0.00%
Radiological Contaminants						
Alpha Particles (15 pCi/L)	--	68.08%	61.06%	--	4.58%	5.40%
Beta Particles (50 pCi/L)	--	74.51%	59.79%	--	0.53%	0.47%
Combined Radium-226 & -228 (5 pCi/L)	--	69.97%	70.18%	--	11.46%	4.99%
Uranium (30 µg/L)	--	69.26%	55.82%	--	7.57%	4.30%

[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, 2010c).
[3] For the third Six-Year Review, there was a different MCL for arsenic (0.01 mg/L) compared to the earlier MCL (0.05 mg/L) for the first and second Six-Year Reviews.
[4] For the third Six-Year Review, quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.

6.3 System Sample Point Level Analysis

The basic Stage 1 analytical methodology is a conservative approach; occurrence measures are based on simple counts of whether or not 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 be potentially exposed 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 (30,000) was potentially exposed to the maximum detected levels of the contaminant found in the one SP. In this context, sample points (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, 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 necessary 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.[10] 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 x ½) would be estimated to be potentially exposed to the contaminant.

This 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 six years of data. These 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 six years of data, 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.[11] Exhibit 6.4 presents a summary of the Stage 1 findings based on SPs and population served by SPs.

[10] 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. How well this assumption reflects actual populations potentially exposed to contaminant occurrence at a system will depend on the distribution system and service population configurations at individual systems.

[11] 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.

Exhibit 6.4: Summary of Stage 1 Contaminant Occurrence Findings – Sample Points and Population Served by Sample Points

Contaminant (MCL Concentration)	Percent of Sample Points		Percent of Population-Served by Sample Points	
	With Detections ≥ MRL	With Detections > MCL Concentration	With Detections ≥ MRL	With Detections > MCL Concentration
Inorganic Chemicals				
Antimony (6 µg/L)	3.397%	0.126%	5.956%	0.068%
Arsenic (10 µg/L)	38.314%	5.840%	37.218%	1.739%
Asbestos (7 MFL)	2.769%	0.086%	3.423%	0.038%
Barium (2,000 µg/L)	69.377%	0.083%	76.789%	0.138%
Beryllium (4 µg/L)	1.653%	0.040%	3.045%	0.024%
Cadmium (5 µg/L)	2.561%	0.079%	3.574%	0.020%
Chromium (Total) (100 µg/L)	25.561%	0.026%	28.044%	0.009%
Cyanide (200 µg/L)	2.973%	0.064%	7.260%	0.209%
Fluoride [1] (4,000 µg/L)	70.639%	0.568%	78.228%	0.313%
Mercury (Inorganic) (2 µg/L)	2.521%	0.062%	4.113%	0.029%
Nitrate (as N) (10,000 µg/L)	61.987%	1.878%	81.103%	0.723%
Nitrite (as N) (1,000 µg/L)	9.622%	0.497%	16.965%	0.601%
Selenium (50 µg/L)	15.896%	0.140%	20.489%	0.059%
Thallium (2 µg/L)	2.817%	0.120%	4.656%	0.137%
Synthetic Organic Chemicals				
Alachlor (2 µg/L)	0.097%	0.006%	0.392%	0.005%
Atrazine (3 µg/L)	2.008%	0.086%	12.350%	0.481%
Benzo(a)pyrene (0.2 µg/L)	0.267%	0.027%	0.702%	0.122%
Carbofuran (40 µg/L)	0.038%	0.000%	0.025%	0.000%
Chlordane (2 µg/L)	0.117%	0.010%	0.337%	0.001%
Dalapon (200 µg/L)	1.475%	0.002%	3.535%	0.000%
Di(2-ethylhexyl)adipate (DEHA) (400 µg/L)	1.080%	0.000%	1.830%	0.000%

Contaminant (MCL Concentration)	Percent of Sample Points		Percent of Population-Served by Sample Points	
	With Detections ≥ MRL	With Detections > MCL Concentration	With Detections ≥ MRL	With Detections > MCL Concentration
Di(2-ethylhexyl)phthalate (DEHP) (6 µg/L)	10.209%	0.640%	12.034%	0.849%
1,2-Dibromo-3-chloropropane (DBCP) (0.2 µg/L)	1.426%	0.213%	1.151%	0.114%
2,4-Dichlorophenoxyacetic acid (2,4-D) (70 µg/L)	0.352%	0.002%	1.925%	0.000%
Dinoseb (7 µg/L)	0.170%	0.008%	0.123%	0.004%
Diquat (20 µg/L)	0.400%	0.003%	0.424%	0.000%
Endothall (100 µg/L)	0.100%	0.003%	0.048%	0.000%
Endrin (2 µg/L)	0.074%	0.002%	0.122%	0.000%
Ethylene Dibromide (EDB) (0.05 µg/L)	0.317%	0.080%	0.436%	0.022%
Glyphosate (700 µg/L)	0.073%	0.000%	0.051%	0.000%
Heptachlor (0.4 µg/L)	0.098%	0.005%	0.236%	0.000%
Heptachlor Epoxide (0.2 µg/L)	0.264%	0.011%	0.202%	0.001%
Hexachlorobenzene (1 µg/L)	0.075%	0.002%	0.084%	0.001%
Hexachlorocyclopentadiene (50 µg/L)	0.289%	0.002%	1.292%	0.004%
Lindane (gamma-Hexachlorocyclohexane) (0.2 µg/L)	0.067%	0.008%	0.490%	0.002%
Methoxychlor (40 µg/L)	0.104%	0.000%	0.132%	0.000%
Oxamyl (Vydate) (200 µg/L)	0.063%	0.000%	0.055%	0.000%
Pentachlorophenol (1 µg/L)	0.389%	0.016%	0.742%	0.016%
Picloram (500 µg/L)	0.174%	0.000%	0.217%	0.000%
Polychlorinated biphenyls (PCBs) (0.5 µg/L)	0.085%	0.013%	0.060%	0.015%
Simazine (4 µg/L)	0.612%	0.007%	5.603%	0.006%
Toxaphene (3 µg/L)	0.048%	0.008%	0.089%	0.048%
2,3,7,8-TCDD (Dioxin) (0.00003 µg/L)	0.107%	0.013%	0.107%	0.001%
2,4,5-Trichlorophenoxypropionic Acid (Silvex) (50 µg/L)	0.103%	0.002%	0.614%	0.000%
Volatile Organic Chemicals				
1,2-Dichlorobenzene (600 µg/L)	0.212%	0.000%	0.472%	0.000%

Contaminant (MCL Concentration)	Percent of Sample Points		Percent of Population-Served by Sample Points	
	With Detections ≥ MRL	With Detections > MCL Concentration	With Detections ≥ MRL	With Detections > MCL Concentration
1,4-Dichlorobenzene (75 µg/L)	0.771%	0.002%	0.900%	0.000%
1,1-Dichloroethylene (7 µg/L)	0.737%	0.030%	1.535%	0.011%
cis-1,2-Dichloroethylene (70 µg/L)	1.083%	0.001%	2.058%	0.000%
trans-1,2-Dichloroethylene (100 µg/L)	0.181%	0.000%	0.489%	0.000%
Ethylbenzene (700 µg/L)	1.949%	0.002%	1.672%	0.000%
Monochlorobenzene (100 µg/L)	0.263%	0.000%	0.528%	0.000%
Styrene (100 µg/L)	0.408%	0.001%	0.639%	0.000%
Toluene (1,000 µg/L)	2.778%	0.002%	2.483%	0.000%
1,2,4-Trichlorobenzene (70 µg/L)	0.154%	0.000%	0.434%	0.000%
1,1,1-Trichloroethane (200 µg/L)	0.587%	0.002%	0.980%	0.000%
1,1,2-Trichloroethane (5 µg/L)	0.129%	0.004%	0.425%	0.001%
Xylenes (Total) (10,000 µg/L)	4.112%	0.000%	3.586%	0.000%
Radiological Contaminants				
Alpha Particles (15 pCi/L)	57.551%	4.248%	60.478%	2.976%
Beta Particles (50 pCi/L)	54.782%	0.319%	59.160%	0.237%
Combined Radium-226 & -228 (5 pCi/L)	67.174%	4.305%	69.367%	2.045%
Uranium (30 µg/L)	57.952%	3.399%	57.905%	0.971%

[1] Quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.

7 Stage 2 Analysis

Based on the initial review under the Third Six-Year Review Protocol, EPA determined that 10 chemical contaminants (lead, copper, 1,2-dichloroethane, 1,2-dichloropropane, benzene, carbon tetrachloride, dichloromethane, tetrachloroethylene, trichloroethylene and vinyl chloride) were being reviewed or revised under other regulatory actions and, therefore, no further action was taken under Six-Year Review 3. EPA reviewed the remaining chemical contaminants for new health effects and analytical feasibility information and 19 chemical contaminants were identified for additional analysis. Two of the 19 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 for which chronic health effects are of concern. (Detailed Stage 1 analyses for oxamyl and carbofuran are included in Appendix A of this report.) The remaining 17 contaminants have chronic health effects and were evaluated via the Stage 2 occurrence analysis. These 19 contaminants fall into two groups: (1) contaminants with analytical limitations – carbofuran; chlordane; cyanide; heptachlor; heptachlor epoxide; hexachlorobenzene; methoxychlor; styrene; 2,3,7,8-TCDD (dioxin); toxaphene; 1,1,2-trichloroethane and (2) non-carcinogens with updated health assessments – cis-1,2-dichloroethylene; endothall; fluoride; hexachlorocyclopentadiene; oxamyl; selenium; toluene and xylenes (total).

The SYR3 ICR Dataset is as large and robust as the dataset used for the second Six-Year Review; thus, similar to SYR2, it was again possible for SYR3 to use a simple analytical approach to estimate system means. System means were calculated using a simple arithmetic average of all detection and non-detection records for each system. The Stage 2 analysis system contaminant long-term mean estimates provide a less conservative contaminant occurrence estimate than does the Stage 1 analysis, which is based on a single maximum sample result exceeding a certain contaminant threshold. As described above, the Stage 2 analyses also provide better occurrence estimates for contaminants for which chronic health effects are of concern.

In order to calculate a contaminant 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 data management approach for this type of analysis (e.g., Helsel and Hirsch, 1991). 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 third 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 ½ 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 SYR3 ICR Dataset, then the percent 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 was described in Section 3.3, in order to conduct the Stage 1 and Stage 2 occurrence analysis, each contaminant sample analytical result must specify a sample analytical result (value) and a sample analytical result (sign) to indicate whether that result is a detection (sample analytical result greater than or equal to the MRL) 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 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 SYR3 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 all the state modal MRL values for that contaminant. If state-modal MRL values were extremely low or high, a process was developed to identify and replace such values with more reasonable MRL values. Reported MRL values that were below the minimum MDL, greater than the national modal MRL, or missing 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 USEPA (2016d).

7.2 Summary of Stage 2 Contaminant Occurrence Estimations

The results from these Stage 2 analyses presented below 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 six-year period of data in the SYR3 ICR Dataset. The results using the zero substitution value are shown because they are 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.) Note: 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.

Please see Appendix B for additional measures of contaminant occurrence based on the Stage 2 analyses, including presentations of the numbers of systems and population served generated using the ½ 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 vs. surface water and present occurrence measures that identify the total number of systems and total population served by systems with estimated system

contaminant means greater than the MCL concentration, as well as many other thresholds. For more information on the potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to Section 5.3.

Exhibit 7.1: Comparison of Stage 1 and Stage 2 Analytical Results - Percent of Systems and Population Served by Systems Greater than the MCL Concentration

Contaminant (MCL Concentration)	Percent of Systems > MCL Concentration		Percent of Population Served by Systems > MCL Concentration	
	Stage 1[1] (one detect	Stage 2[2] (mean > MCL	Stage 1[1] (one detect	Stage 2[2] (mean > MCL
Chlordane (2 µg/L)	0.017%	0.003%	0.001%	0.0005%
cis-1,2-Dichloroethylene (70 µg/L)	0.002%	0.000%	0.00002%	0.000%
Cyanide (200 µg/L)	0.103%	0.019%	0.239%	0.038%
Endothall (100 µg/L)	0.006%	0.006%	0.001%	0.001%
Fluoride [3] (4,000 µg/L)	0.726%	0.284%	3.254%	0.032%
Heptachlor (0.4 µg/L)	0.008%	0.005%	0.001%	0.001%
Heptachlor Epoxide (0.2 µg/L)	0.018%	0.005%	0.001%	0.001%
Hexachlorobenzene (1 µg/L)	0.003%	0.000%	0.003%	0.000%
Hexachlorocyclopentadiene (50 µg/L)	0.003%	0.000%	0.004%	0.000%
Methoxychlor (40 µg/L)	0.000%	0.000%	0.000%	0.000%
Selenium (50 µg/L)	0.174%	0.061%	0.246%	0.008%
Styrene (100 µg/L)	0.002%	0.000%	0.00004%	0.000%
2,3,7,8-TCDD (Dioxin) (0.00003 µg/L)	0.031%	0.031%	0.001%	0.001%
Toluene (1,000 µg/L)	0.004%	0.000%	0.0002%	0.000%
Toxaphene (3 µg/L)	0.013%	0.005%	0.319%	0.104%
1,1,2-Trichloroethane (5 µg/L)	0.004%	0.000%	0.001%	0.000%
Xylenes (10,000 µg/L)	0.000%	0.000%	0.000%	0.000%

[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 ½ MRL (instead of zero), please refer to Appendix B.
[3] Quality assurance steps were taken to identify and exclude fluoride samples from fluoridated water systems.

8 References

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Appendices

APPENDIX A. Background Information and Detailed Stage 1 Analysis Occurrence Measures for 2 Select Regulated Chemical Contaminants

APPENDIX B. Background Information and Detailed Stage 2 Analysis Occurrence Measures for 17 Select Regulated Chemical Contaminants

A Background Information and Detailed Stage 1 Analysis Occurrence Measures for 2 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 Third Six-Year Review (the "SYR3 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 chemical (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 three years, 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 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

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 SYR3 ICR Dataset. These data consist of 122,110 analytical results from 34,614 public water systems (PWSs) during the period from 2006 to

[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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 (the MCL) and 5 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[2] For more information on the new potential thresholds of concern used in the SYR3 analyses for carbofuran, refer to USEPA (2016d) and (2016e).

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 systems had any detections greater than the MCL concentration of 40 µg/L. Three systems, serving 24,258 people, had at least 1 detection greater than the EQL concentration of 5 µg/L.

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

Source Water Type (Number of Systems)	Threshold	Number of Systems with Detections That Are Greater Than the Threshold	Percent of Systems with Detections That Are Greater Than the Threshold
Ground Water (31,375)	> 40 µg/L	0	0.000%
	> 5 µg/L[1]	1	0.003%

[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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 1 analyses.

Source Water Type (Number of Systems)	Threshold	Number of Systems with Detections That Are Greater Than the Threshold	Percent of Systems with Detections That Are Greater Than the Threshold
Surface Water (3,239)	> 40 µg/L	0	0.000%
	> 5 µg/L[1]	2	0.062%
Combined Ground & Surface Water (34,614)	> 40 µg/L	0	0.00%
	> 5 µg/L[1]	3	0.009%

[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, 2016d).

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

Source Water Type (Population Served by Systems)	Threshold	Population Served by Systems with Detections That Are Greater Than the Threshold	Percent of Population Served by Systems with Detections That Are Greater Than the Threshold
Ground Water (90,319,675)	> 40 µg/L	0	0.000%
	> 5 µg/L[1]	993	0.001%
Surface Water (138,398,258)	> 40 µg/L	0	0.000%
	> 5 µg/L[1]	23,265	0.017%
Combined Ground & Surface Water (228,717,933)	> 40 µg/L	0	0.00%
	> 5 µg/L[1]	24,258	0.011%

[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, 2016d).

Data for carbofuran were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit carbofuran data.

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 the MCL concentrations. No systems had detections greater than the MCL. Three systems (one in New Mexico and two in New York) 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 Detections > 5 µg/L[2]		Systems with Detections > 40 µg/L	
		Number	Percent	Number	Percent
AK	9				
AL	383				
AR	459				
AS	11				
AZ	868				
CA	1,320				
CO	1				
CT	1,136				
DC	1				
FL	2,088				
HI	115				
IA	2				
ID	325				
IL	1,467				
IN	1,210				
KS	86				
KY	225				
LA	1,104				
MA	562				
MD	882				
ME	127				
MI	2,423				
MN	921				
MO	1,321				
MS	5				
MT	857				
NC	2,347				
ND	23				

State	Total Number of Systems	Systems with Detections > 5 µg/L[2]		Systems with Detections > 40 µg/L	
		Number	Percent	Number	Percent
NE	656				
NH	1,146				
NJ	80				
NM	718	1	0.14%	0	0.00%
NV	303				
NY	2,115	2	0.09%	0	0.00%
OH	178				
OK	91				
OR	1,118				
PA	1,289				
RI	74				
SC	497				
SD	258				
TN	8				
TX	1,535				
UT	428				
VA	228				
VT	382				
WA	700				
WI	1,912				
WV	302				
WY	318				
Total	**34,614**	**3**	**0.009%**	**0**	**0.00%**

[1] Blank cells within the table indicate that there were no systems with any detections that exceeded either threshold.

[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, 2016d).

Exhibit A-4 presents the population served by systems with at least one detection greater than the MCL concentration by state (40 µg/L). As described above, no systems had any detections greater than the MCL. Three systems, serving 24,258 people, had at least 1 detection greater than the EQL of 5 µg/L.

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

State	Total Population	Population Served by Systems with Detections > 5 µg/L[2]		Population Served by Systems with Detections > 40 µg/L	
		Population	Percent	Population	Percent
AK	39,228				
AL	5,333,035				
AR	2,635,934				
AS	62,196				
AZ	6,473,687				
CA	35,686,301				
CO	2,020				
CT	2,883,135				
DC	761,124				
FL	18,943,131				
HI	1,487,191				
IA	165,864				
ID	885,855				
IL	10,998,351				
IN	4,769,597				
KS	1,685,226				
KY	4,225,473				
LA	4,964,671				
MA	9,163,574				
MD	4,939,512				
ME	362,333				
MI	7,218,130				
MN	3,752,615				
MO	5,232,592				
MS	6,176				
MT	845,014				
NC	7,832,302				
ND	66,229				
NE	1,653,596				

State	Total Population	Population Served by Systems with Detections > 5 µg/L[2]		Population Served by Systems with Detections > 40 µg/L	
		Population	Percent	Population	Percent
NH	949,308				
NJ	5,123,511				
NM	1,940,795	993	0.05%	0	0.00%
NV	2,681,118				
NY	10,480,579	23,265	0.22%	0	0.00%
OH	2,473,669				
OK	338,082				
OR	3,432,212				
PA	10,891,371				
RI	1,017,507				
SC	3,622,250				
SD	678,171				
TN	1,176,648				
TX	22,373,743				
UT	2,752,741				
VA	5,295,906				
VT	387,092				
WA	3,822,877				
WI	4,236,667				
WV	1,499,884				
WY	469,710				
Total	**228,717,933**	**24,258**	**0.011%**	**0**	**0.00%**

[1] Blank cells within the table indicate that there were no systems with any detections that exceeded either threshold.

[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, 2016d).

A.1.3 Summary of Data

A total of 122,110 analytical results from 34,614 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for carbofuran. The Stage 1 analysis of occurrence in drinking water indicated that zero systems had any detections of carbofuran greater than the MCL concentration of 40 µg/L. Three systems (one served by ground water and two served by surface water), serving 24,258 people, had at least 1 detection greater than the EQL (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 Third Six-Year Review (the "SYR3 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 chemical (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 three years, 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 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected (but is less than the MCL), the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

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 SYR3 ICR Dataset. These data consist of 121,508 analytical results from 34,518 public water systems (PWSs) during the period from 2006 to

[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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 two potential MCLGs.

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 (the MCL), 10 µg/L (one potential MCLG value) and 9 µg/L (the other potential MCLG value).[4] The potential MCLG is due to changes in the RfD based on new health effects information. For more information on the new potential thresholds of concern used in the SYR3 analyses, refer to USEPA (2016d) and (2016e).

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 analyses, no systems had any detections greater than the MCL concentration of 200 µg/L. Three systems, serving 28,146 systems, had at least 1 detection greater than the potential MCLG of 10 µg/L. Four systems, serving 42,662 systems, had at least 1 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 12 months at the 90th percentile of 0.15 L/Kg (based on Table 3-19 in USEPA (2011b)). The alternate MCLG for children derived using the normalized exposure factors is 0.009 mg/L (0.0069 mg/kg/day x 0.2/ 0.15 = 0.009 mg/L). There was no difference in the Stage 1 occurrence analysis results between the 9 µg/L and 10 µg/L threshold.

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

Source Water Type (Number of Systems)	Threshold	Systems with Detections That Are Greater Than the Threshold	Systems with Detections That Are Greater Than the Threshold
Ground Water (31,355)	> 200 µg/L	0	0.00%
	> 10 µg/L[1]	2	0.01%
	> 9 µg/L[1]	2	0.01%
Surface Water (3,163)	> 200 µg/L	0	0.00%
	> 10 µg/L[1]	1	0.03%
	> 9 µg/L[1]	2	0.06%
Combined Ground & Surface Water (34,518)	> 200 µg/L	0	0.00%
	> 10 µg/L[1]	3	0.01%
	> 9 µg/L[1]	4	0.01%

[1] The new potential threshold of concern for this contaminant is due to changes 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

Source Water Type (Population Served by Systems)	Threshold	Population Served by Systems with Detections That Are Greater Than the Threshold	Percent of Population Served by Systems with Detections That Are Greater Than the Threshold
Ground Water (90,279,553)	> 200 µg/L	0	0.00%
	> 10 µg/L[1]	19,397	0.02%
	> 9 µg/L[1]	19,397	0.02%
Surface Water (137,240,820)	> 200 µg/L	0	0.000%
	> 10 µg/L[1]	8,749	0.01%
	> 9 µg/L[1]	23,265	0.02%
Combined Ground & Surface Water	> 200 µg/L	0	0.000%
	> 10 µg/L[1]	28,146	0.01%

Source Water Type (Population Served by Systems)	Threshold	Population Served by Systems with Detections That Are Greater Than the Threshold	Percent of Population Served by Systems with Detections That Are Greater Than the Threshold
Combined Ground & Surface Water, cont. **(227,520,373)**	> 9 µg/L[1]	42,662	0.02%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for oxamyl were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit oxamyl data.

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 any detections greater than the potential MCLG and the MCL concentrations. Detection rates of oxamyl were low; no systems had any detections greater than the MCL. Three systems in three states (Florida, New Mexico and New York) had detections greater than the potential MCLG of 10 µg/L. Four systems in three states (Florida, New Mexico and New York) had detections greater than the potential MCLG of 9 µg/L.

Exhibit A-7: Oxamyl Stage 1 Analysis – Summary of Systems with Threshold Exceedances by State[1,2]

State	Total Number of Systems	Systems with Detections > 9 µg/L[3]		Systems with Detections > 10 µg/L[3]		Systems with Detections > 200 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	9						
AL	383						
AR	459						
AS	11						
AZ	856						
CA	1,336						
CO	1						
CT	1,136						
DC	1						
FL	2,087	1	0.05%	1	0.05%	0	0.00%
HI	115						
IA	2						
ID	323						

State	Total Number of Systems	Systems with Detections > 9 µg/L[3]		Systems with Detections > 10 µg/L[3]		Systems with Detections > 200 µg/L	
		Number	Percent	Number	Percent	Number	Percent
IL	1,459						
IN	1,210						
KS	3						
KY	225						
LA	1,104						
MA	564						
MD	873						
ME	126						
MI	2,424						
MN	921						
MO	1,321						
MS	5						
MT	857						
NC	2,346						
ND	23						
NE	656						
NH	1,146						
NJ	80						
NM	718	1	0.14%	1	0.14%	0	0.00%
NV	304						
NY	2,115	2	0.09%	1	0.05%	0	0.00%
OH	178						
OK	90						
OR	1,118						
PA	1,290						
RI	74						
SC	497						
SD	258						
TN	7						
TX	1,535						
UT	428						

State	Total Number of Systems	Systems with Detections > 9 µg/L[3]		Systems with Detections > 10 µg/L[3]		Systems with Detections > 200 µg/L	
		Number	Percent	Number	Percent	Number	Percent
VA	228						
VT	382						
WA	700						
WI	1,914						
WV	302						
WY	318						
Total	**34,518**	**4**	**0.01%**	**3**	**0.01%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit A-8 presents the population served by systems with detections greater than the MCL and MCLG concentrations by state. As described above, no systems had any detections greater than the MCL. Three systems in 3 states (Florida, New Mexico and New York), serving 28,146 people, had detections greater than the potential MCLG of 10 µg/L. Four systems in three states (Florida, New Mexico and New York), serving 42,662 people, had detections greater than the potential MCLG of 9 µg/L.

Exhibit A-8: Oxamyl Stage 1 Analysis – Summary of Population Served by Systems with Threshold Exceedances by State[1,2]

State	Total Population	Population Served by Systems with Detections > 9 µg/L[3]		Population Served by Systems with Detections > 10 µg/L[3]		Population Served by Systems with Detections > 200 µg/L	
		Population	Percent	Population	Percent	Population	Percent
AK	39,228						
AL	5,333,035						
AR	2,635,934						
AS	62,196						
AZ	6,470,039						
CA	35,698,949						
CO	2,020						
CT	2,883,135						
DC	761,124						
FL	18,943,101	18,404	0.10%	18,404	0.10%	0	0.00%
HI	1,487,191						

State	Total Population	Population Served by Systems with Detections > 9 µg/L[3]		Population Served by Systems with Detections > 10 µg/L[3]		Population Served by Systems with Detections > 200 µg/L	
		Population	Percent	Population	Percent	Population	Percent
IA	165,864						
ID	884,736						
IL	10,997,092						
IN	4,769,597						
KS	482,056						
KY	4,225,473						
LA	4,964,671						
MA	9,163,674						
MD	4,936,864						
ME	362,303						
MI	7,218,255						
MN	3,752,615						
MO	5,232,592						
MS	6,176						
MT	845,014						
NC	7,832,272						
ND	66,229						
NE	1,653,596						
NH	949,308						
NJ	5,123,511						
NM	1,940,795	993	0.05%	993	0.05%	0	0.00%
NV	2,681,738						
NY	10,480,579	23,265	0.22%	8,749	0.08%	0	0.00%
OH	2,473,669						
OK	337,997						
OR	3,432,307						
PA	10,895,086						
RI	1,017,507						
SC	3,622,250						
SD	678,171						
TN	1,173,584						

State	Total Population	Population Served by Systems with Detections > 9 µg/L[3]		Population Served by Systems with Detections > 10 µg/L[3]		Population Served by Systems with Detections > 200 µg/L	
		Population	Percent	Population	Percent	Population	Percent
TX	22,373,743						
UT	2,752,741						
VA	5,295,906						
VT	387,092						
WA	3,822,877						
WI	4,236,887						
WV	1,499,884						
WY	469,710						
Total	**227,520,373**	**42,662**	**0.02%**	**28,146**	**0.01%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

A.2.3 Summary of Data

A total of 121,508 analytical results from 34,518 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for oxamyl. The Stage 1 analysis of occurrence in drinking water indicated that zero systems had any detections of oxamyl greater than the MCL concentration of 200 µg/L. Three water systems (two ground water systems and one surface water system), serving a total of 28,146 people, had at least 1 detection greater than the potential MCLG of 10 µg/L. Four water systems (two ground water systems and two surface water systems), serving a total of 42,662 people, had at least 1 detection greater than the potential MCLG of 9 µg/L. These four water systems were located in Florida, New Mexico and New York.

B Background Information and Detailed Stage 2 Analysis Occurrence Measures for 17 Select Regulated Chemical Contaminants

B.1 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.1.1 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 chemical (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 three years, 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.[5] If all 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.1.2 Occurrence in Drinking Water

The analysis of chlordane occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 128,870 analytical results from 35,685 public water systems (PWSs) during the period from 2006 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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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. Two different substitution values –zero and ½ the minimum reporting level (MRL) value– were used to replace each non-detection record. (The national modal MRL for chlordane in the dataset is 0.2 µg/L.) Two arithmetic mean chlordane concentrations were calculated at each system using the zero and ½ MRL substitution values. These mean calculations were performed for all systems with chlordane data in the SYR3 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 (the MCL) and 1 µg/L (EQL). Note that the EQL is equivalent to ½ the MCL. 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 SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

[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, 2016d). 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 chlordane occurrence in drinking water. Exhibit B-2 presents similar information based on population served by the systems. Based on the Stage 2 analyses, 1 system (0.003 percent of all systems), serving 993 people, had an estimated system mean greater than the MCL concentration of 2 µg/L. Three water systems (approximately 0.008 percent of all systems) had an estimated mean greater than the EQL concentration of 1 µg/L. These 3 systems serve approximately 1,353 people.

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

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (32,472)	> 2 µg/L	1	1	0.003%	0.003%
	> 1 µg/L[1]	3	3	0.009%	0.009%
Surface Water (3,213)	> 2 µg/L	0	0	0.000%	0.000%
	> 1 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (35,685)	> 2 µg/L	1	1	0.003%	0.003%
	> 1 µg/L[1]	3	3	0.008%	0.008%

[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, 2016d).

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

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (89,347,451)	> 2 µg/L	993	993	0.001%	0.001%
	> 1 µg/L[1]	1,353	1,353	0.002%	0.002%
Surface Water (128,289,918)	> 2 µg/L	0	0	0.000%	0.000%
	> 1 µg/L[1]	0	0	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Combined Ground & Surface Water	> 2 µg/L	993	993	0.000%	0.000%
(217,637,369)	> 1 µg/L[1]	1,353	1,353	0.001%	0.001%

[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, 2016d).

Data for chlordane were available from 49 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit chlordane data. New Jersey did submit Six-Year data for most contaminants. There is a statewide waiver for chlordane in New Jersey, however, so no chlordane data were available from that state.

Exhibit B-3 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 EQL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) Detection rates were low; only one system in New Mexico had an estimated mean concentration greater than the MCL. Three systems in three states (North Carolina, New Hampshire and New Mexico) had estimated mean concentrations greater than the EQL of 1 µg/L.

Exhibit B-3: 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 > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L	
		Number	Percent	Number	Percent
AK	12				
AL	383				
AR	459				
AS	11				
AZ	873				
CA	1,243				
CO	1				
CT	1,136				

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L	
		Number	Percent	Number	Percent
DC	1				
FL	2,087				
HI	111				
IA	3				
ID	385				
IL	1,467				
IN	1,212				
KS	87				
KY	225				
LA	946				
MA	565				
MD	881				
ME	160				
MI	13				
MN	920				
MO	1,332				
MS	5				
MT	857				
NC	2,348	1	0.04%	0	0.00%
ND	157				
NE	696				
NH	1,146	1	0.09%	0	0.00%
NJ	0				
NM	718	1	0.14%	1	0.14%
NV	309				
NY	2,119				
OH	31				
OK	36				
OR	1,118				
PA	1,267				

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L	
		Number	Percent	Number	Percent
RI	73				
SC	497				
SD	269				
TN	6				
TX	3,925				
UT	428				
VA	254				
VT	380				
WA	1,998				
WI	1,914				
WV	303				
WY	318				
Total	**35,685**	**3**	**0.01%**	**1**	**0.003%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

Exhibit B-4 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for chlordane is presented, as well. New Mexico was the only state with an estimated system mean concentration greater than the MCL. This system served a total population of 993 people. Three systems in 3 states, serving 1,353 people, had estimated mean concentrations greater than EQL (1 µg/L).

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

State	Total Population	Population Served by Systems with a Mean Concentration> 1 µg/L[3]		Population Served by Systems with a Mean Concentration> 2 µg/L	
		Population	Percent	Population	Percent
AK	39,530				
AL	5,333,035				
AR	2,635,934				
AS	62,196				

State	Total Population	Population Served by Systems with a Mean Concentration> 1 µg/L[3]		Population Served by Systems with a Mean Concentration> 2 µg/L	
		Population	Percent	Population	Percent
AZ	6,487,524				
CA	35,723,529				
CO	2,020				
CT	2,883,135				
DC	761,124				
FL	18,943,101				
HI	1,479,317				
IA	166,302				
ID	976,042				
IL	10,997,826				
IN	4,969,942				
KS	1,817,722				
KY	4,225,473				
LA	4,709,163				
MA	9,163,377				
MD	4,939,436				
ME	356,698				
MI	34,902				
MN	3,752,545				
MO	5,233,314				
MS	6,176				
MT	845,294				
NC	7,832,371	310	0.004%	0	0.00%
ND	592,232				
NE	1,659,899				
NH	949,308	50	0.01%	0	0.00%
NJ	0				
NM	1,940,795	993	0.05%	993	0.05%
NV	2,682,358				
NY	10,481,646				

State	Total Population	Population Served by Systems with a Mean Concentration> 1 µg/L[3]		Population Served by Systems with a Mean Concentration> 2 µg/L	
		Population	Percent	Population	Percent
OH	755,924				
OK	130,809				
OR	3,432,307				
PA	10,887,488				
RI	989,530				
SC	3,623,380				
SD	708,340				
TN	1,168,508				
TX	23,277,937				
UT	2,752,741				
VA	5,685,070				
VT	386,948				
WA	4,947,604				
WI	4,236,887				
WV	1,500,920				
WY	469,710				
Total	**217,637,369**	**1,353**	**0.001%**	**993**	**0.0005%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

B.1.3 Summary of Data

A total of 128,870 analytical results from 35,685 PWSs in 49 states/entities were available in the SYR3 ICR Dataset for chlordane. The Stage 2 analysis of occurrence in drinking water indicated that 1 ground water system in New Mexico, serving 993 people, had an estimated system mean concentration of chlordane greater than the MCL concentration of 2 µg/L. Three ground water systems, serving 1,353 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

B.2 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.2.1 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 compound (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.[7] 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 compound is detected, the system must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are reliably and consistently below the MCL, the system may return to annual sampling. If a compound 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. If a compound is detected, the system must also monitor in a similar fashion for vinyl chloride.

B.2.2 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 SYR3 ICR Dataset. These data consist of 376,300

[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.

analytical results from 55,734 public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For cis-1,2-dichloroethylene, 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 cis-1,2-dichloroethylene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 70 µg/L (the MCL) and 10 µg/L (the potential MCLG). The potential MCLG is due to changes in the RfD based on new health effects information. Since the practical quantitation level (PQL) for cis-1,2-dichloroethylene is less than the possible MCLG, EPA designated the possible MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-5 presents the system-level Stage 2 analysis of estimated mean concentrations for cis-1,2-dichloroethylene occurrence in drinking water. Exhibit B-6 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no systems had an

estimated system mean greater than the MCL concentration of 70 µg/L. Four systems, serving 5,569 people, had an estimated system mean greater than the potential MCLG concentration of 10 µg/L.

Exhibit B-5: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (51,302)	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 10 µg/L[1]	4	4	4	0.008%	0.008%	0.008%
Surface Water (4,432)	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 10 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (55,734)	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 10 µg/L[1]	4	4	4	0.007%	0.007%	0.007%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-6: cis-1,2-Dichloroethylene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (110,779,859)	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 10 µg/L[1]	5,569	5,569	5,569	0.005%	0.005%	0.005%
Surface Water (152,565,123)	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 10 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 70 µg/L	0	0	0	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
(263,344,982)	> 10 µg/L[1]	5,569	5,569	5,569	0.002%	0.002%	0.002%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for cis-1,2-dichloroethylene were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit cis-1,2-dichloroethylene data.

Exhibit B-7 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 potential MCLG and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) No systems had an estimated mean concentration greater than the MCL. Four systems in three states (Illinois, North Carolina and Virginia) had estimated mean concentrations greater than the potential MCLG of 10 µg/L.

Exhibit B-7: 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 > 10 µg/L[3]		Systems with a Mean Concentration > 70 µg/L	
		Number	Percent	Number	Percent
AK	595				
AL	384				
AR	461				
AS	11				
AZ	1,109				
CA	3,811				
CO	1				
CT	1,202				
DC	1				
FL	2,633				
HI	110				
IA	1,045				

State	Total Number of Systems	Systems with a Mean Concentration > 10 µg/L[3]		Systems with a Mean Concentration > 70 µg/L	
		Number	Percent	Number	Percent
ID	839				
IL	1,493	2	0.13%	0	0.00%
IN	1,196				
KS	602				
KY	227				
LA	1,102				
MA	721				
MD	1,054				
ME	784				
MI	2,419				
MN	1,462				
MO	1,445				
MS	5				
MT	897				
NC	2,356	1	0.04%	0	0.00%
ND	160				
NE	705				
NH	1,185				
NJ	1,434				
NM	744				
NV	350				
NY	2,498				
OH	1,922				
OK	685				
OR	1,132				
PA	3,166				
RI	152				
SC	494				
SD	313				
TN	366				
TX	4,532				

State	Total Number of Systems	Systems with a Mean Concentration > 10 µg/L[3]		Systems with a Mean Concentration > 70 µg/L	
		Number	Percent	Number	Percent
UT	471				
VA	1,630	1	0.06%	0	0.00%
VT	634				
WA	2,468				
WI	2,026				
WV	385				
WY	317				
Total	**55,734**	**4**	**0.01%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-8 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for cis-1,2-dichloroethylene is presented, as well. As described above, no systems had an estimated mean concentration greater than the MCL. The 4 systems in 3 states (Illinois, North Carolina and Virginia with an estimated mean concentration greater than the potential MCLG (10 µg/L) serve 5,569 people.

Exhibit B-8: 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	Population Served by Systems with a Mean Concentration > 10 µg/L[3]		Population Served by Systems with a Mean Concentration > 70 µg/L	
		Population	Percent	Population	Percent
AK	719,561				
AL	5,334,584				
AR	2,637,712				
AS	62,196				
AZ	6,669,227				
CA	40,601,783				
CO	2,020				
CT	2,937,643				
DC	761,124				
FL	19,280,091				

State	Total Population	Population Served by Systems with a Mean Concentration > 10 µg/L[3]		Population Served by Systems with a Mean Concentration > 70 µg/L	
		Population	Percent	Population	Percent
HI	1,402,969				
IA	2,743,404				
ID	1,219,635				
IL	11,019,196	5,490	0.05%	0	0.00%
IN	4,940,108				
KS	2,605,030				
KY	4,225,914				
LA	4,966,653				
MA	9,329,953				
MD	5,120,409				
ME	757,984				
MI	3,470,708				
MN	4,373,668				
MO	5,293,851				
MS	6,176				
MT	856,529				
NC	7,827,828	54	0.00%	0	0.00%
ND	592,539				
NE	1,664,802				
NH	961,134				
NJ	9,273,130				
NM	1,962,298				
NV	2,697,555				
NY	10,637,039				
OH	10,209,121				
OK	3,588,559				
OR	3,434,191				
PA	11,234,684				
RI	1,040,737				
SC	3,637,408				
SD	757,925				

State	Total Population	Population Served by Systems with a Mean Concentration > 10 µg/L[3]		Population Served by Systems with a Mean Concentration > 70 µg/L	
		Population	Percent	Population	Percent
TN	6,578,052				
TX	23,863,702				
UT	2,802,068				
VA	6,908,704	25	0.00%	0	0.00%
VT	486,604				
WA	5,535,827				
WI	4,273,462				
WV	1,570,171				
WY	469,314				
Total	**263,344,982**	**5,569**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.2.3 Summary of Data

A total of 376,300 analytical results from 55,734 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for cis-1,2-dichloroethylene. The Stage 2 analysis of occurrence in drinking water indicated that zero systems had an estimated system mean concentration of cis-1,2-dichloroethylene greater than the MCL concentration of 70 µg/L. Four ground water systems, serving 5,569 people, had an estimated mean concentration greater than the potential MCLG (10 µg/L).

B.3 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.3.1 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 chemical (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. Surface water systems must sample annually during the initial three-year compliance period. If all analytical results are less than the MCL, and upon considering other factors which may affect contaminant concentration, a ground water and surface water system may be granted waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[8] If all quarterly samples are reliably and consistently below the MCL, the system may continue at initial monitoring indefinitely until the state or EPA establishes an alternate schedule.

B.3.2 Occurrence in Drinking Water

The analysis of cyanide occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 119,659 analytical results from 36,907 PWSs during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have been reviewed and checked to ensure adequacy of coverage and completeness.

[8] 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 SYR3 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 analyses. 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 SYR3 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 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 (the MCL) and 50 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[9] For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-9 presents the system-level Stage 2 analysis of estimated mean concentrations for cyanide 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 substitution

[9] 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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

for non-detections, 8 systems (0.022 percent of all systems), serving 80,826 people, had an estimated system mean greater than the MCL concentration of 200 µg/L. A total of 98 systems (0.266 percent of all systems), serving 574,038 people, had an estimated system mean greater than the EQL concentration of 50 µg/L.

Exhibit B-9: Cyanide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (33,842)	> 200 µg/L	7	7	6	0.021%	0.021%	0.018%
	> 50 µg/L[1]	93	91	83	0.275%	0.269%	0.245%
Surface Water (3,065)	> 200 µg/L	1	1	1	0.033%	0.033%	0.033%
	> 50 µg/L[1]	7	7	7	0.228%	0.228%	0.228%
Combined Ground & Surface Water (36,907)	> 200 µg/L	8	8	7	0.022%	0.022%	0.019%
	> 50 µg/L[1]	100	98	90	0.271%	0.266%	0.244%

[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, 2016d).

Exhibit B-10: Cyanide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 200 µg/L	2,521	2,521	2,287	0.003%	0.003%	0.003%
(87,768,998)	> 50 µg/L[1]	157,428	157,231	154,877	0.179%	0.179%	0.176%
Surface Water	> 200 µg/L	78,305	78,305	78,305	0.064%	0.064%	0.064%
(122,658,983)	> 50 µg/L[1]	416,807	416,807	416,807	0.340%	0.340%	0.340%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Combined Ground & Surface Water (210,427,981)	> 200 µg/L	80,826	80,826	80,592	0.038%	0.038%	0.038%
	> 50 µg/L[1]	574,235	574,038	571,684	0.273%	0.273%	0.272%

[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, 2016d).

Data for cyanide were available from 49 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit cyanide data. South Carolina did submit Six-Year data for most contaminants. There is a statewide waiver for cyanide in South Carolina, however, so no cyanide data were available from that state.

Exhibit B-11 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 EQL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) The distribution of systems with mean concentrations of cyanide is geographically dispersed. Detection rates were generally low; only four states had an estimated mean concentration greater than the MCL. (Massachusetts, Minnesota, North Carolina and Nebraska each contained a single system with a mean concentration greater than the MCL in each state.) A total of 98 systems in 23 states had estimated mean concentrations greater than the EQL of 50 µg/L.

Exhibit B-11: 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 > 50 µg/L[3]		Systems with a Mean Concentration > 200 µg/L	
		Number	Percent	Number	Percent
AK	491				
AL	385	1	0.26%	0	0.00%
AR	460	6	1.30%	0	0.00%
AS	11				
AZ	1,057				
CA	1,781	6	0.34%	0	0.00%
CO	1				

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L[3]		Systems with a Mean Concentration > 200 µg/L	
		Number	Percent	Number	Percent
CT	1,173	1	0.09%	0	0.00%
DC	1				
FL	2,608	4	0.15%	0	0.00%
HI	110				
IA	10				
ID	126				
IL	1,358	1	0.07%	0	0.00%
IN	1,128	2	0.18%	0	0.00%
KS	5				
KY	226				
LA	1,108				
MA	666	2	0.30%	1	0.15%
MD	8				
ME	742				
MI	1,847	1	0.05%	0	0.00%
MN	1,143	27	2.36%	5	0.44%
MO	832				
MS	5				
MT	54				
NC	2,182	7	0.32%	1	0.05%
ND	23				
NE	689	2	0.29%	1	0.15%
NH	1,155				
NJ	1,401	1	0.07%	0	0.00%
NM	742	4	0.54%	0	0.00%
NV	294	1	0.34%	0	0.00%
NY	2,514	11	0.44%	0	0.00%
OH	1,893	1	0.05%	0	0.00%
OK	187				
OR	856				
PA	1,425				

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L[3]		Systems with a Mean Concentration > 200 µg/L	
		Number	Percent	Number	Percent
RI	153				
SC	0				
SD	33				
TN	242	1	0.41%	0	0.00%
TX	470	13	2.77%	0	0.00%
UT	479				
VA	1,373	1	0.07%	0	0.00%
VT	410				
WA	2,198	3	0.14%	0	0.00%
WI	145	1	0.69%	0	0.00%
WV	391	1	0.26%	0	0.00%
WY	316				
Total	**36,907**	**98**	**0.27%**	**8**	**0.02%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

Exhibit B-12 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for cyanide is presented, as well. As described above, Massachusetts, Minnesota, North Carolina and Nebraska were the only four states with an estimated mean concentration greater than the MCL. A total of 574,038 people were served by the 98 systems in 23 states that had estimated mean concentrations of cyanide greater than the EQL (50 µg/L).

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

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 200 µg/L	
		Population	Percent	Population	Percent
AK	673,570				
AL	5,336,667	1,800	0.03%	0	0.00%
AR	2,636,302	6,366	0.24%	0	0.00%
AS	62,196				
AZ	6,588,496				

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 200 µg/L	
		Population	Percent	Population	Percent
CA	37,838,435	16,380	0.04%	0	0.00%
CO	2,020				
CT	2,933,337	50	0.00%	0	0.00%
DC	761,124				
FL	19,124,265	1,295	0.01%	0	0.00%
HI	1,471,730				
IA	172,941				
ID	515,565				
IL	10,983,267	80	0.00%	0	0.00%
IN	4,555,819	898	0.02%	0	0.00%
KS	627,486				
KY	4,225,513				
LA	4,968,920				
MA	9,275,574	78,353	0.84%	78,305	0.84%
MD	756				
ME	749,486				
MI	982,862	350	0.04%	0	0.00%
MN	3,684,296	11,510	0.31%	2,223	0.06%
MO	2,941,901				
MS	6,176				
MT	95,088				
NC	7,765,979	7,346	0.09%	64	0.00%
ND	66,229				
NE	1,659,463	261	0.02%	234	0.01%
NH	958,187				
NJ	9,150,992	65	0.00%	0	0.00%
NM	1,955,107	3,160	0.16%	0	0.00%
NV	2,678,248	25	0.00%	0	0.00%
NY	10,465,711	107,749	1.03%	0	0.00%
OH	10,202,452	50	0.00%	0	0.00%
OK	592,288				

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 200 µg/L	
		Population	Percent	Population	Percent
OR	3,141,979				
PA	9,952,670				
RI	1,019,797				
SC	0				
SD	53,644				
TN	4,734,392	34,106	0.72%	0	0.00%
TX	6,343,868	301,414	4.75%	0	0.00%
UT	2,816,488				
VA	5,599,685	633	0.01%	0	0.00%
VT	385,881				
WA	5,389,854	443	0.01%	0	0.00%
WI	2,238,852	1,162	0.05%	0	0.00%
WV	1,573,115	542	0.03%	0	0.00%
WY	469,308				
Total	**210,427,981**	**574,038**	**0.27%**	**80,826**	**0.04%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

B.3.3 Summary of Data

A total of 119,659 analytical results from 36,907 PWSs in 49 states/entities were available in the SYR3 ICR Dataset for cyanide. The Stage 2 analysis of occurrence in drinking water indicated that 8 (0.02 percent of all) systems serving 80,826 people (0.038 percent of the population) had an estimated system mean concentration of cyanide greater than the MCL concentration of 200 µg/L. A total of 98 systems, serving 574,038 people, had an estimated mean concentration greater than the EQL (50 µg/L). The majority of systems with mean concentrations greater than the MCL and EQL were ground water systems.

B.4 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.4.1 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 chemical (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 three years, 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.[10] If all 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.4.2 Occurrence in Drinking Water

The analysis of endothall occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 61,972 analytical results from 15,538 public water systems (PWSs) during the period from 2006 to 2011. The

[10] 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.

number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For endothall, 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 endothall are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 100 µg/L (the MCL) and 50 µg/L (the potential MCLG). The potential MCLG is due to changes in the RfD based on new health effects information. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-13 presents the system-level Stage 2 analysis of estimated mean concentrations for endothall occurrence in drinking water. Exhibit B-14 presents similar information based on population served by the systems. Based on the Stage 2 analyses, one water system (approximately 0.006 percent of all systems) had an estimated mean greater than 50 µg/L and 100 µg/L. This system serves 993 people.

Exhibit B-13: Endothall Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (14,033)	> 100 µg/L	1	1	1	0.007%	0.007%	0.007%
	> 50 µg/L[1]	1	1	1	0.007%	0.007%	0.007%
Surface Water (1,505)	> 100 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 50 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (15,538)	> 100 µg/L	1	1	1	0.006%	0.006%	0.006%
	> 50 µg/L[1]	1	1	1	0.006%	0.006%	0.006%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

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

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (61,307,038)	> 100 µg/L	993	993	993	0.002%	0.002%	0.002%
	> 50 µg/L[1]	993	993	993	0.002%	0.002%	0.002%
Surface Water (75,494,691)	> 100 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 50 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (136,801,729)	> 100 µg/L	993	993	993	0.001%	0.001%	0.001%
	> 50 µg/L[1]	993	993	993	0.001%	0.001%	0.001%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for endothall were available from 45 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit endothall data. New Jersey, Rhode Island, South Carolina, Texas and Vermont did submit Six-Year data for most contaminants. There is a statewide waiver for endothall in those states, however, so no endothall data were available from them.

Exhibit B-15 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 potential MCLG and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) Only one system had an estimated mean concentration greater than the MCL and the potential MCLG. This system is located in New Mexico.

Exhibit B-15: 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 > 50 µg/L[3]		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent
AK	9				
AL	383				
AR	459				
AS	11				
AZ	863				
CA	1,157				
CO	1				
CT	29				
DC	1				
FL	2,091				
HI	115				
IA	2				
ID	351				
IL	1,452				
IN	1,210				
KS	2				
KY	225				

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L[3]		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent
LA	1,091				
MA	4				
MD	11				
ME	12				
MI	22				
MN	27				
MO	21				
MS	5				
MT	47				
NC	5				
ND	23				
NE	11				
NH	4				
NJ	0				
NM	717	1	0.14%	1	0.14%
NV	301				
NY	80				
OH	177				
OK	4				
OR	1,118				
PA	1,249				
RI	0				
SC	0				
SD	258				
TN	6				
TX	0				
UT	13				
VA	8				
VT	0				
WA	25				
WI	1,914				

State	Total Number of Systems	Systems with a Mean Concentration > 50 µg/L[3]		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent
WV	18				
WY	6				
Total	**15,538**	**1**	**0.01%**	**1**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-16 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for endothall is presented, as well. As described above, only 1 system in New Mexico, serving 993 people, had an estimated mean concentration and the potential MCLG.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Population	Percent	Population	Percent
AK	39,228				
AL	5,333,035				
AR	2,635,934				
AS	62,196				
AZ	6,468,762				
CA	36,137,032				
CO	2,020				
CT	245,905				
DC	761,124				
FL	18,991,343				
HI	1,487,191				
IA	165,864				
ID	903,523				
IL	10,996,262				
IN	4,769,597				
KS	482,004				
KY	4,225,473				

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Population	Percent	Population	Percent
LA	4,961,515				
MA	108,884				
MD	1,959,910				
ME	48,749				
MI	225,565				
MN	25,573				
MO	1,380,996				
MS	6,176				
MT	25,192				
NC	534,572				
ND	66,229				
NE	933,101				
NH	1,461				
NJ	0				
NM	1,940,555	993	0.05%	993	0.05%
NV	2,681,616				
NY	3,370,044				
OH	2,423,043				
OK	7,343				
OR	3,432,307				
PA	10,883,210				
RI	0				
SC	0				
SD	680,381				
TN	1,168,508				
TX	0				
UT	6,459				
VA	839,004				
VT	0				
WA	695,302				
WI	4,236,887				

State	Total Population	Population Served by Systems with a Mean Concentration > 50 µg/L[3]		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Population	Percent	Population	Percent
WV	379,363				
WY	73,291				
Total	**136,801,729**	**993**	**0.001%**	**993**	**0.001%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.4.3 Summary of Data

A total of 61,972 analytical results from 15,538 PWSs in 45 states/entities were available in the SYR3 ICR Dataset for endothall. The Stage 2 analysis of occurrence in drinking water indicated that 1 ground water system in New Mexico, serving 993 people, had an estimated system mean concentration of endothall greater than the MCL concentration of 100 µg/L and the potential MCLG of 50 µg/L.

B.5 Fluoride

This chapter on fluoride 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.5.1 Background

The United States Environmental Protection Agency (EPA) published the current National Primary Drinking Water Regulations (NPDWR) for fluoride on April 2, 1986 (51 FR 11396; USEPA, 1986). The NPDWR established a maximum contaminant level goal (MCLG) and a maximum contaminant level (MCL) of 4,000 µg/L. EPA based the MCLG on a reference dose (RfD) of 0.11 mg/kg-day (0.025 mg/kg-day) to avoid skeletal fluorosis; fluoride was not classified as carcinogenicity for humans. EPA also established a secondary MCL of 2,000 µg/L to protect against severe dental fluorosis. The secondary MCL is not enforceable, but triggers a public notification requirement.

Fluoride is regulated as an inorganic chemical (IOC) in drinking water. All community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) must sample for the regulated 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. Surface water systems must sample annually during the initial three-year compliance period. If all analytical results are less than the MCL, and upon considering reported concentrations, degrees of variation in reported concentration and other factors which may affect contaminant concentration, a ground water and surface water system may be granted a waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[11] If all quarterly samples are reliably and consistently below the MCL, the system may continue at initial monitoring indefinitely until the state or EPA establishes an alternate schedule.

B.5.2 Occurrence in Drinking Water

The analysis of fluoride occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 256,237 analytical results from regulated public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have been reviewed and checked to ensure adequacy of coverage and completeness.

[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.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence of fluoride in drinking water using the SYR3 ICR Dataset. The "Stage 1" analysis is a simple non-parametric analysis with accompanying descriptive statistics of national contaminant occurrence among regulated public water systems. The results are simple counts of the number and percentage of systems and population served by systems that have at least one compliance monitoring sample result exceeding 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 analyses. Section 6 provides the details for the Stage 1 analysis.

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 fluoride, for which Stage 2 analyses were warranted. The Stage 2 analysis is an assessment of national contaminant occurrence based on estimates of long-term mean concentrations of contaminants for each system. This analysis method provides occurrence estimates that are less conservative than the Stage 1 analysis, which relies 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 that may be more reflective of potential chronic exposure than the assessments from the Stage 1 analyses.

For the Stage 2 analyses, EPA calculated system arithmetic means using all sample detection records and all non-detection records, excluding samples for fluoridated water (i.e., water to which a system adds fluoride to maintain a concentration in the 700 to 1,200 µg/L range).[12] There are three different substitution values –zero, ½ the minimum reporting level (MRL) value and the full MRL value–to replace each non-detection record. (The national modal MRL for the fluoride dataset is 50 µg/L.) Thus, there are three arithmetic mean fluoride concentrations calculated for each system using the zero, ½ MRL and full MRL substitution values. There are mean estimates for all systems with fluoride data in the SYR3 ICR dataset. There are corresponding percentages that reflect the share of all systems with a mean concentration greater than each threshold. For fluoride, 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

This section provides summary results of the Stage 2 analyses for fluoride. Occurrence estimates were generated relative to several thresholds: 4,000 µg/L (the MCL), 900 µg/L (the potential MCLG value) and four interim values – 3,000 µg/L, 2,000 µg/L, 1,500 µg/L and 1,000 µg/L. The potential MCLG is due to changes in the RfD based on new health effects information. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

[12] The fluoridation range during the sample period was 700 to 1,200 µg/L, but the current fluoridation target is 700 µg/L. Thus, historical samples of fluoridated water could exceed of the fluoride concentration thresholds that overlap the fluoridation range, whereas samples that reflect the current target would not. Therefore, EPA excluded samples for fluoridated water to remove an upward bias in the occurrence estimates.

Exhibit B-17 presents the system-level Stage 2 results of estimated mean concentrations for fluoride occurrence in drinking water relative to various thresholds. Exhibit B-18 presents similar information based on population served by the systems. Based on the Stage 2 analyses, 134 systems serving almost 60,000 people had an estimated system mean greater than the MCL concentration of 4,000 µg/L. More than 5,000 systems, serving 13 million people, had an estimated system mean greater than the potential MCLG of 900 µg/L.

Exhibit B-17: Fluoride Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (44,033)	>4,000 µg/L	134	134	134	0.30%	0.30%	0.30%
	>3,000 µg/L	330	330	330	0.75%	0.75%	0.75%
	>2,000 µg/L	964	964	964	2.19%	2.19%	2.19%
	>1,500 µg/L	1,952	1,951	1,950	4.43%	4.43%	4.43%
	>1,000 µg/L	4,218	4,210	4,205	9.58%	9.56%	9.55%
	>900 µg/L[1]	4,898	4,892	4,884	11.12%	11.11%	11.09%
Surface Water (3,194)	>4,000 µg/L	0	0	0	0.00%	0.00%	0.00%
	>3,000 µg/L	3	3	3	0.09%	0.09%	0.09%
	>2,000 µg/L	8	8	8	0.25%	0.25%	0.25%
	>1,500 µg/L	21	20	20	0.66%	0.63%	0.63%
	>1,000 µg/L	139	138	137	4.35%	4.32%	4.29%
	>900 µg/L[1]	163	161	160	5.10%	5.04%	5.01%
Combined Ground & Surface Water (47,227)	>4,000 µg/L	134	134	134	0.28%	0.28%	0.28%
	>3,000 µg/L	333	333	333	0.71%	0.71%	0.71%
	>2,000 µg/L	972	972	972	2.06%	2.06%	2.06%
	>1,500 µg/L	1,973	1,971	1,970	4.18%	4.17%	4.17%
	>1,000 µg/L	4,357	4,348	4,342	9.23%	9.21%	9.19%
	>900 µg/L[1]	5,061	5,053	5,044	10.72%	10.70%	10.68%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-18: Fluoride Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = MRL	Non-detect values = ½ MRL
Ground Water (96,498,333)	>4,000 µg/L	59,911	59,911	59,911	0.06%	0.06%	0.06%
	>3,000 µg/L	582,629	582,629	582,629	0.60%	0.60%	0.60%
	>2,000 µg/L	1,503,017	1,503,017	1,503,017	1.56%	1.56%	1.56%
	>1,500 µg/L	2,755,639	2,743,439	2,743,029	2.86%	2.84%	2.84%
	>1,000 µg/L	8,121,680	8,114,433	8,112,955	8.42%	8.41%	8.41%
	>900 µg/L[1]	10,059,180	10,006,942	9,926,430	10.42%	10.37%	10.29%
Surface Water (92,688,121)	>4,000 µg/L	0	0	0	0.00%	0.00%	0.00%
	>3,000 µg/L	20,512	20,512	20,512	0.02%	0.02%	0.02%
	>2,000 µg/L	33,297	33,297	33,297	0.04%	0.04%	0.04%
	>1,500 µg/L	119,381	102,529	102,529	0.13%	0.11%	0.11%
	>1,000 µg/L	2,223,360	2,222,803	2,219,484	2.40%	2.40%	2.39%
	>900 µg/L[1]	3,522,836	3,397,425	3,394,742	3.80%	3.67%	3.66%
Combined Ground & Surface Water (189,186,454)	>4,000 µg/L	59,911	59,911	59,911	0.03%	0.03%	0.03%
	>3,000 µg/L	603,141	603,141	603,141	0.32%	0.32%	0.32%
	>2,000 µg/L	1,536,314	1,536,314	1,536,314	0.81%	0.81%	0.81%
	>1,500 µg/L	2,875,020	2,845,968	2,845,558	1.52%	1.50%	1.50%
	>1,000 µg/L	10,345,040	10,337,236	10,332,439	5.47%	5.46%	5.46%
	>900 µg/L[1]	13,582,016	13,404,367	13,321,172	7.18%	7.09%	7.04%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for fluoride were available from 49 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the State of Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, this state is included in the state-level results shown below because a handful of tribal water systems located within this state submitted fluoride data.

Exhibit B-19 presents the total number of systems in each state that submitted data for fluoride, excluding systems that only submitted data for fluoridated water. It also shows the exceedance values for the potential MCLG (900 µg/L) and the next two highest thresholds (1,000 µg/L and 1,500 µg/L). (Note: These results reflect the ½ MRL substitution case).

Exhibit B-19: Fluoride 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 > 1,500 µg/L		Systems with a Mean Concentration > 1,000 µg/L		Systems with a Mean Concentration > 900 µg/L[3]	
		Number	Percent	Number	Percent	Number	Percent
AK	489	1	0.20%	7	1.43%	7	1.43%
AL	343	4	1.17%	16	4.66%	18	5.25%
AR	420	7	1.67%	13	3.10%	14	3.33%
AS	11						
AZ	899	90	10.01%	164	18.24%	197	21.91%
CA	3,902	74	1.90%	145	3.72%	176	4.51%
CT	1,168	11	0.94%	25	2.14%	27	2.31%
DC	1	0	0.00%	0	0.00%	1	100.00%
FL	2,589	38	1.47%	88	3.40%	112	4.33%
HI	113						
IA	370	41	11.08%	78	21.08%	84	22.70%
ID	680	18	2.65%	38	5.59%	45	6.62%
IL	653	80	12.25%	223	34.15%	268	41.04%
IN	942	54	5.73%	201	21.34%	251	26.65%
KS	564	18	3.19%	52	9.22%	62	10.99%
KY	73	6	8.22%	17	23.29%	17	23.29%
LA	1,100	21	1.91%	42	3.82%	51	4.64%
MA	639	9	1.41%	28	4.38%	37	5.79%
MD	164	3	1.83%	9	5.49%	9	5.49%
ME	755	13	1.72%	60	7.95%	75	9.93%
MI	2,259	41	1.81%	167	7.39%	204	9.03%
MN	615	14	2.28%	206	33.50%	216	35.12%
MO	1,386	41	2.96%	113	8.15%	133	9.60%
MS	5	0	0.00%	3	60.00%	5	100.00%
MT	785	39	4.97%	66	8.41%	75	9.55%

State	Total Number of Systems	Systems with a Mean Concentration > 1,500 µg/L		Systems with a Mean Concentration > 1,000 µg/L		Systems with a Mean Concentration > 900 µg/L[3]	
		Number	Percent	Number	Percent	Number	Percent
NC	2,121	45	2.12%	107	5.04%	130	6.13%
ND	146	19	13.01%	56	38.36%	59	40.41%
NE	685	3	0.44%	37	5.40%	47	6.86%
NH	1,170	103	8.80%	168	14.36%	192	16.41%
NJ	1,396	5	0.36%	17	1.22%	22	1.58%
NM	748	78	10.43%	131	17.51%	161	21.52%
NV	330	21	6.36%	39	11.82%	50	15.15%
NY	2,389	15	0.63%	36	1.51%	49	2.05%
OH	1,711	149	8.71%	396	23.14%	436	25.48%
OK	599	26	4.34%	45	7.51%	52	8.68%
OR	847	16	1.89%	25	2.95%	31	3.66%
PA	1,369	3	0.22%	10	0.73%	14	1.02%
RI	151	3	1.99%	10	6.62%	11	7.28%
SC	537	32	5.96%	51	9.50%	55	10.24%
SD	158	21	13.29%	31	19.62%	37	23.42%
TN	126	0	0.00%	12	9.52%	13	10.32%
TX	4,596	507	11.03%	898	19.54%	1,011	22.00%
UT	477	5	1.05%	11	2.31%	12	2.52%
VA	1,524	204	13.39%	260	17.06%	273	17.91%
VT	417	1	0.24%	6	1.44%	7	1.68%
WA	2,196	32	1.46%	53	2.41%	65	2.96%
WI	1,997	22	1.10%	101	5.06%	138	6.91%
WV	297	4	1.35%	13	4.38%	16	5.39%
WY	315	34	10.79%	74	23.49%	88	27.94%
Total	**47,227**	**1,971**	**4.17%**	**4,348**	**9.21%**	**5,053**	**10.70%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded the threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-20 provides the corresponding state-level populations served by systems that have a mean concentration greater than the thresholds show above. Again, these estimates exclude population served by systems that provided only samples for fluoridated water.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 1,500 µg/L		Population Served by Systems with a Mean Concentration > 1,000 µg/L		Population Served by Systems with a Mean Concentration > 900 µg/L[1]	
		Population	Percent	Population	Percent	Population	Percent
AK	653,758	173	0.03%	16,978	2.60%	16,978	2.60%
AL	3,951,346	22,703	0.57%	106,577	2.70%	107,762	2.73%
AR	2,154,639	7,179	0.33%	25,198	1.17%	25,228	1.17%
AS	62,196						
AZ	6,507,196	144,530	2.22%	473,064	7.27%	663,864	10.20%
CA	41,166,323	326,394	0.79%	708,080	1.72%	804,725	1.95%
CT	2,848,818	1,627	0.06%	3,220	0.11%	3,405	0.12%
DC	761,124	0	0.00%	0	0.00%	761,124	100.00%
FL	18,078,815	15,387	0.09%	90,117	0.50%	135,945	0.75%
HI	1,486,472						
IA	905,648	41,299	4.56%	205,076	22.64%	222,603	24.58%
ID	1,152,093	31,922	2.77%	69,957	6.07%	70,542	6.12%
IL	3,702,273	173,654	4.69%	1,365,422	36.88%	1,864,804	50.37%
IN	1,913,536	195,536	10.22%	701,799	36.68%	754,671	39.44%
KS	1,871,086	14,295	0.76%	116,603	6.23%	129,838	6.94%
KY	528,053	12,876	2.44%	184,200	34.88%	184,200	34.88%
LA	4,312,127	108,424	2.51%	144,272	3.35%	155,410	3.60%
MA	7,821,027	676	0.01%	117,086	1.50%	274,799	3.51%
MD	35,504	260	0.73%	3,035	8.55%	3,035	8.55%
ME	445,391	1,537	0.35%	135,959	30.53%	137,673	30.91%
MI	3,038,489	13,690	0.45%	219,941	7.24%	230,257	7.58%
MN	788,703	5,432	0.69%	687,349	87.15%	692,644	87.82%
MO	2,663,227	55,819	2.10%	285,286	10.71%	446,999	16.78%
MS	6,176	0	0.00%	2,092	33.87%	6,176	100.00%
MT	740,136	16,446	2.22%	25,633	3.46%	27,817	3.76%
NC	3,927,168	77,947	1.98%	278,606	7.09%	315,742	8.04%
ND	412,916	8,139	1.97%	317,175	76.81%	318,479	77.13%
NE	1,652,769	2,138	0.13%	116,350	7.04%	163,539	9.89%

State	Total Population	Population Served by Systems with a Mean Concentration > 1,500 µg/L		Population Served by Systems with a Mean Concentration > 1,000 µg/L		Population Served by Systems with a Mean Concentration > 900 µg/L[1]	
		Population	Percent	Population	Percent	Population	Percent
NH	776,183	15,863	2.04%	47,122	6.07%	51,738	6.67%
NJ	9,129,229	14,346	0.16%	117,773	1.29%	157,843	1.73%
NM	1,974,790	127,596	6.46%	234,708	11.89%	315,293	15.97%
NV	2,418,044	16,184	0.67%	89,040	3.68%	97,135	4.02%
NY	4,916,027	11,627	0.24%	71,637	1.46%	77,711	1.58%
OH	1,873,754	97,603	5.21%	513,809	27.42%	544,330	29.05%
OK	2,418,323	23,683	0.98%	86,054	3.56%	192,024	7.94%
OR	2,928,203	11,605	0.40%	13,179	0.45%	14,260	0.49%
PA	5,307,038	173	0.00%	19,316	0.36%	19,837	0.37%
RI	1,019,737	1,678	0.16%	3,008	0.29%	3,931	0.39%
SC	2,376,386	103,163	4.34%	135,290	5.69%	153,744	6.47%
SD	107,316	15,669	14.60%	24,356	22.70%	27,900	26.00%
TN	1,822,566	0	0.00%	102,634	5.63%	124,741	6.84%
TX	23,510,681	928,382	3.95%	1,951,430	8.30%	2,351,648	10.00%
UT	2,816,964	29,158	1.04%	31,543	1.12%	31,813	1.13%
VA	2,653,609	86,467	3.26%	183,087	6.90%	241,509	9.10%
VT	345,674	32	0.01%	787	0.23%	812	0.23%
WA	4,094,793	27,121	0.66%	91,164	2.23%	225,593	5.51%
WI	4,251,831	43,181	1.02%	100,169	2.36%	117,987	2.77%
WV	389,087	2,489	0.64%	66,177	17.01%	74,770	19.22%
WY	469,210	11,865	2.53%	55,878	11.91%	61,489	13.10%
Total	**189,186,454**	**2,845,968**	**1.50%**	**10,337,236**	**5.46%**	**13,404,367**	**7.09%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded the threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.5.3 Summary of Data

A total of 256,237 analytical results from 47,227 PWSs in 49 states/entities were available in the SYR3 ICR Dataset for fluoride. The Stage 2 analysis of occurrence in drinking water indicated that 134 systems had an estimated system mean concentration of fluoride greater than the MCL concentration of 4,000 µg/L. More than 5,000 water systems, serving more than 13 million people had an estimated mean concentration greater than the potential MCLGs of 900 µg/L. These water systems are located in almost every state.

B.6 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.6.1 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 chemical (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 three years, 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.[13] If all 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.6.2 Occurrence in Drinking Water

The analysis of heptachlor occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 137,286 analytical results from 38,691 public water systems (PWSs) during the period from 2006 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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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. Two different substitution values –zero and ½ the minimum reporting level (MRL) value– were used to replace each non-detection record. (The national modal MRL for heptachlor in the dataset is 0.04 µg/L.) Two arithmetic mean heptachlor concentrations were calculated at each system using the zero and ½ MRL substitution values. These mean calculations were performed for all systems with heptachlor data in the SYR3 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, ½ the MCL, the estimated quantitation level (EQL) and twice the 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 (the MCL), 0.2 µg/L (½ the MCL and two times the EQL) and 0.1 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[14] For more information on the new

[14] 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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-21 presents the system-level Stage 2 analysis of estimated mean concentrations for heptachlor occurrence in drinking water. Exhibit B-22 presents similar information based on population served by the systems. Based on the Stage 2 analyses, three water systems (approximately 0.008 percent of all systems) had an estimated mean greater than the MCL of 0.4 µg/L, as well as the EQL of 0.1 µg/L. These 3 systems serve approximately 1,643 people.

Exhibit B-21: Heptachlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (35,408)	> 0.4 µg/L	3	2	0.008%	0.006%
	> 0.2 µg/L[1]	3	3	0.008%	0.008%
	> 0.1 µg/L[2]	3	3	0.008%	0.008%
Surface Water (3,283)	> 0.4 µg/L	0	0	0.000%	0.000%
	> 0.2 µg/L[1]	0	0	0.000%	0.000%
	> 0.1 µg/L[2]	0	0	0.000%	0.000%
Combined Ground & Surface Water (38,691)	> 0.4 µg/L	3	2	0.008%	0.005%
	> 0.2 µg/L[1]	3	3	0.008%	0.008%
	> 0.1 µg/L[2]	3	3	0.008%	0.008%

[1] This threshold is equal to ½ the MCL and two times the EQL.

[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, 2016d).

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

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 0.4 µg/L	1,643	1,543	0.002%	0.002%
(92,583,244)	> 0.2 µg/L[1]	1,643	1,643	0.002%	0.002%
	> 0.1 µg/L[2]	1,643	1,643	0.002%	0.002%
Surface Water	> 0.4 µg/L	0	0	0.000%	0.000%
(137,249,041)	> 0.2 µg/L[1]	0	0	0.000%	0.000%
	> 0.1 µg/L[2]	0	0	0.000%	0.000%
Combined Ground & Surface Water	> 0.4 µg/L	1,643	1,543	0.001%	0.001%
(229,832,285)	> 0.2 µg/L[1]	1,643	1,643	0.001%	0.001%
	> 0.1 µg/L[2]	1,643	1,643	0.001%	0.001%

[1] This threshold is equal to ½ the MCL and two times the EQL.

[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, 2016d).

Data for heptachlor were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit heptachlor data.

Exhibit B-23 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 EQL, ½ MCL (or two times the EQL) and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) Detection rates of heptachlor were low; three states each had a single system with an estimated mean concentration greater than the MCL (Maryland, New Mexico and New York). The same three systems had estimated mean concentrations greater than ½ the MCL and EQL, as well.

Exhibit B-23: 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 > 0.1 µg/L[3]		Systems with a Mean Concentration > 0.2 µg/L[4]		Systems with a Mean Concentration > 0.4 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	13						
AL	383						
AR	459						
AS	11						
AZ	872						
CA	1,279						
CO	1						
CT	1,136						
DC	1						
FL	2,091						
HI	111						
IA	3						
ID	390						
IL	1,468						
IN	1,213						
KS	87						
KY	225						
LA	1,102						
MA	566						
MD	881	1	0.11%	1	0.11%	1	0.11%
ME	173						
MI	2,439						
MN	920						
MO	1,332						
MS	5						
MT	857						
NC	2,348						
ND	157						
NE	703						

State	Total Number of Systems	Systems with a Mean Concentration > 0.1 µg/L[3]		Systems with a Mean Concentration > 0.2 µg/L[4]		Systems with a Mean Concentration > 0.4 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NH	1,146						
NJ	46						
NM	718	1	0.14%	1	0.14%	1	0.14%
NV	310						
NY	2,121	1	0.05%	1	0.05%	1	0.05%
OH	33						
OK	36						
OR	1,119						
PA	1,048						
RI	102						
SC	497						
SD	269						
TN	6						
TX	4,422						
UT	428						
VA	254						
VT	380						
WA	1,996						
WI	1,914						
WV	302						
WY	318						
Total	**38,691**	**3**	**0.01%**	**3**	**0.01%**	**3**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

[4] This threshold is equal to ½ the MCL and two times the EQL.

Exhibit B-24 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for heptachlor is presented, as well. Three states (Maryland, New Mexico and New York) contained a single system with an estimated mean concentration greater than the MCL, ½ MCL and EQL. These 3 systems served a total of 1,643 people.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 0.1 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.2 µg/L[4]		Population Served by Systems with a Mean Concentration > 0.4 µg/L	
		Population	Percent	Population	Percent	Population	Percent
AK	40,300						
AL	5,333,035						
AR	2,635,934						
AS	62,196						
AZ	6,484,144						
CA	35,713,404						
CO	2,020						
CT	2,883,135						
DC	761,124						
FL	18,991,343						
HI	1,479,317						
IA	166,302						
ID	980,149						
IL	10,998,526						
IN	5,017,598						
KS	1,817,722						
KY	4,225,473						
LA	4,966,772						
MA	9,164,737						
MD	4,939,436	100	0.00%	100	0.00%	100	0.00%
ME	367,408						
MI	7,221,983						
MN	3,752,545						
MO	5,233,314						
MS	6,176						
MT	845,294						
NC	7,832,371						
ND	592,232						

State	Total Population	Population Served by Systems with a Mean Concentration > 0.1 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.2 µg/L[4]		Population Served by Systems with a Mean Concentration > 0.4 µg/L	
		Population	Percent	Population	Percent	Population	Percent
NE	1,662,774						
NH	949,308						
NJ	4,123,518						
NM	1,940,795	993	0.05%	993	0.05%	993	0.05%
NV	2,682,465						
NY	10,481,222	550	0.01%	550	0.01%	550	0.01%
OH	756,016						
OK	145,992						
OR	3,432,424						
PA	10,847,346						
RI	1,002,727						
SC	3,623,380						
SD	708,340						
TN	1,168,508						
TX	23,814,787						
UT	2,752,741						
VA	5,685,070						
VT	386,948						
WA	4,947,453						
WI	4,236,887						
WV	1,499,884						
WY	469,710						
Total	**229,832,285**	**1,643**	**0.00%**	**1,643**	**0.00%**	**1,643**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

[4] This threshold is equal to ½ the MCL and two times the EQL.

B.6.3 Summary of Data

A total of 137,286 analytical results from 38,691 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for heptachlor. The Stage 2 analysis of occurrence in drinking water indicated that 3 ground water systems, serving 1,643 people, had an estimated system mean

concentration of heptachlor greater than the MCL concentration of 0.4 µg/L. The same three systems also had an estimated mean concentration greater than ½ the MCL (0.2 µg/L) and the EQL (0.1 µg/L). These systems were located in Maryland, New Mexico and New York.

B.7 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.7.1 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 chemical (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 three years, 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.[15] If all 4 samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.7.2 Occurrence in Drinking Water

The analysis of heptachlor epoxide occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 137,081 analytical results from 38,625 public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have

[15] 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.

been reviewed and checked to ensure adequacy of coverage and completeness. The national modal minimum reporting level (MRL) for heptachlor epoxide in the dataset is 0.02 µg/L.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR3 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 analyses. 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 that were calculated using all sample detection records and all non-detection records. Two different substitution values –zero and ½ the 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.) Two 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 SYR3 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, ½ the MCL, the estimated quantitation level (EQL) and twice the 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 (the MCL), 0.1 µg/L (1/2 the MCL), 0.08 µg/L (two times the EQL) and 0.04 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[16] For more

[16] 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, 2016d). 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 SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-25 presents the system-level Stage 2 analysis of estimated mean concentrations for heptachlor epoxide occurrence in drinking water. Exhibit B-26 presents similar information based on population served by the systems. Based on the Stage 2 analyses, 2 water systems (approximately 0.005 percent of all systems) had an estimated mean greater than 0.2 µg/L (the MCL). These 2 systems serve 1,543 people. Fourteen systems (0.036 percent of all systems), serving 11,659 persons, had an estimated system mean greater than the EQL concentration of 0.04 µg/L.

Exhibit B-25: Heptachlor Epoxide Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (35,355)	> 0.2 µg/L	2	2	0.006%	0.006%
	> 0.1 µg/L	6	6	0.017%	0.017%
	> 0.08 µg/L	7	7	0.020%	0.020%
	> 0.04 µg/L[1]	14	14	0.040%	0.040%
Surface Water (3,270)	> 0.2 µg/L	0	0	0.000%	0.000%
	> 0.1 µg/L	0	0	0.000%	0.000%
	> 0.08 µg/L	0	0	0.000%	0.000%
	> 0.04 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (38,625)	> 0.2 µg/L	2	2	0.005%	0.005%
	> 0.1 µg/L	6	6	0.016%	0.016%
	> 0.08 µg/L	7	7	0.018%	0.018%
	> 0.04 µg/L[1]	14	14	0.036%	0.036%

[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, 2016d).

Exhibit B-26: Heptachlor Epoxide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (92,692,937)	> 0.2 µg/L	1,543	1,543	0.002%	0.002%
	> 0.1 µg/L	2,461	2,461	0.003%	0.003%
	> 0.08 µg/L	2,700	2,700	0.003%	0.003%
	> 0.04 µg/L[1]	11,659	11,659	0.013%	0.013%
Surface Water (137,139,953)	> 0.2 µg/L	0	0	0.000%	0.000%
	> 0.1 µg/L	0	0	0.000%	0.000%
	> 0.08 µg/L	0	0	0.000%	0.000%
	> 0.04 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (229,832,890)	> 0.2 µg/L	1,543	1,543	0.001%	0.001%
	> 0.1 µg/L	2,461	2,461	0.001%	0.001%
	> 0.08 µg/L	2,700	2,700	0.001%	0.001%
	> 0.04 µg/L[1]	11,659	11,659	0.005%	0.005%

[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, 2016d).

Data for heptachlor epoxide were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit heptachlor epoxide data.

Exhibit B-27 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 EQL, two times the EQL, ½ MCL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) Detection rates of heptachlor epoxide were low; only two systems in states (New Mexico and New York) had an estimated mean concentration greater than the MCL. Six systems in six states had estimated mean concentrations greater than ½ the MCL.

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

State	Total Number of Systems	Systems with a Mean Concentration > 0.04 µg/L[2]		Systems with a Mean Concentration > 0.08 µg/L		Systems with a Mean Concentration > 0.1 µg/L		Systems with a Mean Concentration > 0.2 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	13								
AL	383	1	0.26%	1	0.26%	1	0.26%	0	0.00%
AR	459								
AS	11								
AZ	872								
CA	1,280								
CO	1								
CT	1,136								
DC	1								
FL	2,090	3	0.14%	0	0.00%	0	0.00%	0	0.00%
HI	111								
IA	3								
ID	391								
IL	1,467								
IN	1,214								
KS	87								
KY	225								
LA	1,078								
MA	564								
MD	881	1	0.11%	1	0.11%	1	0.11%	0	0.00%
ME	135								
MI	2,439								
MN	920								
MO	1,332								
MS	5								
MT	857								
NC	2,348	4	0.17%	1	0.04%	0	0.00%	0	0.00%
ND	157								

State	Total Number of Systems	Systems with a Mean Concentration > 0.04 µg/L[2]		Systems with a Mean Concentration > 0.08 µg/L		Systems with a Mean Concentration > 0.1 µg/L		Systems with a Mean Concentration > 0.2 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
NE	703	2	0.28%	1	0.14%	1	0.14%	0	0.00%
NH	1,146								
NJ	80								
NM	718	1	0.14%	1	0.14%	1	0.14%	1	0.14%
NV	309								
NY	2,121	1	0.05%	1	0.05%	1	0.05%	1	0.05%
OH	33								
OK	1								
OR	1,119								
PA	1,047	1	0.10%	1	0.10%	1	0.10%	0	0.00%
RI	102								
SC	497								
SD	269								
TN	6								
TX	4,422								
UT	428								
VA	254								
VT	380								
WA	1,996								
WI	1,914								
WV	302								
WY	318								
Total	**38,625**	**14**	**0.04%**	**7**	**0.02%**	**6**	**0.02%**	**2**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 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, 2016d).

Exhibit B-28 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for heptachlor epoxide is presented, as well. As described above, New Mexico and New York were the only states with an estimated mean concentration greater than the MCL. These 2 systems served a total of 1,543 people. Six systems, serving a population of 2,461 people, had estimated mean concentrations greater than ½ the MCL.

Exhibit B-28: Heptachlor Epoxide Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State

State	Total Population	Population Served by Systems with a Mean Concentration > 0.04 µg/L[2]		Population Served by Systems with a Mean Concentration > 0.08 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
AK	40,300								
AL	5,333,035	200	0.004%	200	0.004%	200	0.004%	0	0.00%
AR	2,635,934								
AS	62,196								
AZ	6,484,144								
CA	35,713,444								
CO	2,020								
CT	2,883,135								
DC	761,124								
FL	18,991,163	8,522	0.045%	0	0.00%	0	0.00%	0	0.00%
HI	1,479,317								
IA	166,302								
ID	980,519								
IL	10,998,201								
IN	5,018,298								
KS	1,817,722								
KY	4,225,473								
LA	4,901,263								
MA	9,164,462								
MD	4,939,436	60	0.001%	60	0.001%	60	0.001%	0	0.00%
ME	356,040								
MI	7,221,983								
MN	3,752,545								
MO	5,233,314								
MS	6,176								
MT	845,294								
NC	7,832,371	584	0.007%	239	0.003%	0	0.00%	0	0.00%

State	Total Population	Population Served by Systems with a Mean Concentration > 0.04 µg/L[2]		Population Served by Systems with a Mean Concentration > 0.08 µg/L		Population Served by Systems with a Mean Concentration > 0.1 µg/L		Population Served by Systems with a Mean Concentration > 0.2 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
ND	592,232								
NE	1,662,774	669	0.040%	577	0.035%	577	0.035%	0	0.00%
NH	949,308								
NJ	4,346,209								
NM	1,940,795	993	0.051%	993	0.051%	993	0.051%	993	0.051%
NV	2,682,358								
NY	10,481,222	550	0.005%	550	0.005%	550	0.005%	550	0.005%
OH	756,016								
OK	464								
OR	3,432,424								
PA	10,847,442	81	0.001%	81	0.001%	81	0.001%	0	0.00%
RI	1,002,727								
SC	3,623,380								
SD	708,340								
TN	1,168,508								
TX	23,814,787								
UT	2,752,741								
VA	5,685,070								
VT	386,948								
WA	4,947,453								
WI	4,236,887								
WV	1,499,884								
WY	469,710								
Total	**229,832,890**	**11,659**	**0.005%**	**2,700**	**0.001%**	**2,461**	**0.001%**	**1,543**	**0.001%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 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, 2016d).

B.7.3 Summary of Data

A total of 137,081 analytical results from 38,625 PWSs in 50 states/entities were available for the SYR3 ICR Dataset for heptachlor epoxide. The Stage 2 analysis of occurrence in drinking water indicates that 2 (0.005 percent of all) systems (serving 0.001 percent of the population) had an estimated system mean concentration of heptachlor epoxide greater than the MCL concentration of 0.2 µg/L. Both of the systems, serving a total of 1,543 people, with an estimated mean greater than the MCL concentration were ground water systems. Six systems, serving 2,461 people, had an estimated mean concentration greater than ½ the MCL (0.1 µg/L). These six systems were all served by ground water.

B.8 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.8.1 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 chemical (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 three years, 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.[17] If all 4 samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.8.2 Occurrence in Drinking Water

The analysis of hexachlorobenzene occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 137,816 analytical results from 38,498 public water systems (PWSs) during the period from 2006 to

[17] 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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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. Two different substitution values –zero and½ the minimum reporting level (MRL) value– were used to replace each non-detection record. (The national modal MRL for hexachlorobenzene in the dataset is 0.04 µg/L.) Two 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 SYR3 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, twice the estimated quantitation level (EQL) and 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 (the MCL), 0.2 µg/L (two times the EQL) and 0.1 µg/L (the EQL). The EQL represents the potential quantitation capabilities below

a practical quantitation level (PQL).[18] For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-29 presents the system-level Stage 2 analysis of estimated mean concentrations for hexachlorobenzene occurrence in drinking water. Exhibit B-30 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no systems had an estimated system mean greater than the MCL concentration of 1 µg/L. Six systems, serving 8,703 people, had an estimated system mean greater than the EQL of 0.1 µg/L.

Exhibit B-29: Hexachlorobenzene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (35,255)	> 1 µg/L	0	0	0.000%	0.000%
	> 0.2 µg/L	3	3	0.009%	0.009%
	> 0.1 µg/L[1]	6	5	0.017%	0.014%
Surface Water (3,243)	> 1 µg/L	0	0	0.000%	0.000%
	> 0.2 µg/L	0	0	0.000%	0.000%
	> 0.1 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (38,498)	> 1 µg/L	0	0	0.000%	0.000%
	> 0.2 µg/L	3	3	0.008%	0.008%
	> 0.1 µg/L[1]	6	5	0.016%	0.013%

[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, 2016d).

[18] 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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

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

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 1 µg/L	0	0	0.000%	0.000%
	> 0.2 µg/L	7,546	7,546	0.008%	0.008%
(92,988,313)	> 0.1 µg/L[1]	8,703	8,589	0.009%	0.009%
Surface Water	> 1 µg/L	0	0	0.000%	0.000%
(137,209,655)	> 0.2 µg/L	0	0	0.000%	0.000%
	> 0.1 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water	> 1 µg/L	0	0	0.000%	0.000%
(230,197,968)	> 0.2 µg/L	7,546	7,546	0.003%	0.003%
	> 0.1 µg/L[1]	8,703	8,589	0.004%	0.004%

[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, 2016d).

Data for hexachlorobenzene were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit hexachlorobenzene data.

Exhibit B-31 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 EQL, two times the EQL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) No systems had estimated mean concentrations greater than the MCL. Six systems in five different states had an estimated mean concentration greater than the EQL of 0.1 µg/L.

Exhibit B-31: 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 > 0.1 µg/L[3]		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	10						
AL	383						

State	Total Number of Systems	Systems with a Mean Concentration > 0.1 µg/L[3]		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AR	459						
AS	11						
AZ	869						
CA	1,317	2	0.152%	1	0.076%	0	0.00%
CO	1						
CT	1,135						
DC	1						
FL	2,090						
HI	112						
IA	3						
ID	522						
IL	1,261						
IN	1,213						
KS	87						
KY	225						
LA	1,102	1	0.091%	1	0.091%	0	0.00%
MA	565						
MD	881						
ME	173						
MI	2,439						
MN	920						
MO	1,332						
MS	5						
MT	857						
NC	2,348						
ND	23						
NE	703						
NH	1,146						
NJ	82						
NM	718	1	0.139%	0	0.00%	0	0.00%
NV	312						

State	Total Number of Systems	Systems with a Mean Concentration > 0.1 µg/L[3]		Systems with a Mean Concentration > 0.2 µg/L		Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NY	2,123	1	0.047%	1	0.047%	0	0.00%
OH	34						
OK	1						
OR	1,120						
PA	1,049						
RI	103						
SC	497						
SD	269						
TN	6						
TX	4,422	1	0.023%	0	0.000%	0	0.00%
UT	428						
VA	254						
VT	382						
WA	1,994						
WI	1,914						
WV	279						
WY	318						
Total	**38,498**	**6**	**0.016%**	**3**	**0.008%**	**0**	**0.000%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

Exhibit B-32 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for hexachlorobenzene is presented, as well. As described above, no systems had estimated mean concentrations greater than the MCL. Six systems, serving 8,703 people, had an estimated mean concentration greater than the EQL of 0.1 µg/L.

Exhibit B-32: 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 > 0.1 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	39,878						
AL	5,333,035						
AR	2,635,934						
AS	62,196						
AZ	6,471,242						
CA	36,681,076	130	0.000%	80	0.000%	0	0.000%
CO	2,020						
CT	2,882,395						
DC	761,124						
FL	18,945,034						
HI	1,479,717						
IA	166,302						
ID	1,052,952						
IL	10,925,340						
IN	5,017,598						
KS	1,817,722						
KY	4,225,473						
LA	4,966,772	6,916	0.139%	6,916	0.139%	0	0.000%
MA	9,164,636						
MD	4,939,436						
ME	367,408						
MI	7,221,983						
MN	3,752,545						
MO	5,233,314						
MS	6,176						
MT	845,294						
NC	7,832,371						
ND	66,229						

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.1 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.2 µg/L		Population Served by Systems with a Mean Concentration > 1 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NE	1,662,774						
NH	949,308						
NJ	4,366,309						
NM	1,940,795	993	0.051%	0	0.000%	0	0.000%
NV	2,688,765						
NY	10,481,573	550	0.005%	550	0.005%	0	0.000%
OH	758,784						
OK	464						
OR	3,432,479						
PA	10,854,480						
RI	1,003,245						
SC	3,623,380						
SD	708,340						
TN	1,168,508						
TX	23,814,787	114	0.000%	0	0.000%	0	0.000%
UT	2,752,741						
VA	5,685,070						
VT	387,157						
WA	4,949,076						
WI	4,236,887						
WV	1,368,134						
WY	469,710						
Total	**230,197,968**	**8,703**	**0.004%**	**7,546**	**0.003%**	**0**	**0.000%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

B.8.3 Summary of Data

A total of 137,816 analytical results from 38,498 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for hexachlorobenzene. The Stage 2 analysis of occurrence in drinking water indicated that no systems had an estimated system mean concentration of hexachlorobenzene

greater than the MCL concentration of 1 µg/L. Six systems had an estimated mean concentration greater than the EQL of 0.1 µg/L.

B.9 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.9.1 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 chemical (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 three years, 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.[19] If all 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.9.2 Occurrence in Drinking Water

The analysis of hexachlorocyclopentadiene occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 140,004 analytical results from 38,743 public water systems (PWSs) during the period from

[19] 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.

2006 to 2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For hexachlorocyclopentadiene, 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 hexachlorocyclopentadiene are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 50 µg/L (the MCL) and 40 µg/L (the potential MCLG). The potential MCLG is due to changes in the RfD based on new health effects information. Since the practical quantitation level (PQL) for hexachlorocyclopentadiene is less than the possible MCLG, EPA designated the possible MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-33 presents the system-level Stage 2 analysis of estimated mean concentrations for hexachlorocyclopentadiene occurrence in drinking water. Exhibit B-34 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no systems had estimated system means greater than the MCL concentration of 50 µg/L or the potential MCLG concentration of 40 µg/L.

Exhibit B-33: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (35,479)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water (3,264)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (38,743)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-34: Hexachlorocyclopentadiene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = 1/2 MRL	Non-detect values = 0
Ground Water (92,695,520)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water (137,207,044)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = 1⁄2 MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = 1/2 MRL	Non-detect values = 0
Combined Ground & Surface Water (229,902,564)	> 50 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 40 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for hexachlorocyclopentadiene were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit hexachlorocyclopentadiene data.

Exhibit B-35 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 potential MCLG and the MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) As is described above, no systems had estimated system means greater than the MCL concentration of 50 µg/L or the potential MCLG concentration of 40 µg/L.

Exhibit B-35: 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 > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
AK	10				
AL	383				
AR	459				
AS	11				
AZ	869				
CA	1,318				
CO	1				
CT	1,135				
DC	1				
FL	2,089				
HI	112				

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
IA	3				
ID	521				
IL	1,261				
IN	1,214				
KS	86				
KY	225				
LA	1,102				
MA	566				
MD	881				
ME	173				
MI	2,439				
MN	920				
MO	1,332				
MS	5				
MT	857				
NC	2,348				
ND	23				
NE	703				
NH	1,146				
NJ	38				
NM	718				
NV	312				
NY	2,123				
OH	34				
OK	1				
OR	1,120				
PA	1,317				
RI	103				
SC	497				
SD	269				
TN	6				

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
TX	4,420				
UT	428				
VA	254				
VT	382				
WA	1,994				
WI	1,914				
WV	302				
WY	318				
Total	**38,743**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-36 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for hexachlorocyclopentadiene is presented, as well. No systems had estimated system means greater than the MCL concentration of 50 µg/L or the potential MCLG concentration of 40 µg/L.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
AK	39,878				
AL	5,333,035				
AR	2,635,934				
AS	62,196				
AZ	6,471,242				
CA	36,666,576				
CO	2,020				
CT	2,882,395				
DC	761,124				

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
FL	18,944,969				
HI	1,479,717				
IA	166,302				
ID	1,052,868				
IL	10,925,340				
IN	5,032,598				
KS	1,685,226				
KY	4,225,473				
LA	4,966,772				
MA	9,164,737				
MD	4,939,436				
ME	367,408				
MI	7,221,983				
MN	3,752,545				
MO	5,233,314				
MS	6,176				
MT	845,294				
NC	7,832,371				
ND	66,229				
NE	1,662,774				
NH	949,308				
NJ	4,027,741				
NM	1,940,795				
NV	2,688,765				
NY	10,481,569				
OH	758,784				
OK	464				
OR	3,432,479				
PA	10,898,082				
RI	1,003,245				

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
SC	3,623,380				
SD	708,340				
TN	1,168,508				
TX	23,814,647				
UT	2,752,741				
VA	5,685,070				
VT	387,157				
WA	4,949,076				
WI	4,236,887				
WV	1,499,884				
WY	469,710				
Total	**229,902,564**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.9.3 Summary of Data

A total of 140,004 analytical results from 38,743 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for hexachlorocyclopentadiene. The Stage 2 analysis of occurrence in drinking water indicated that zero systems had an estimated system mean concentration of hexachlorocyclopentadiene greater than the MCL concentration (50 µg/L) or the potential MCLG (40 µg/L).

B.10 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.10.1 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 chemical (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 three years, 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.[20] If all 4 samples are non-detections, then a system serving less than 3,300 persons may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 persons may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.10.2 Occurrence in Drinking Water

The analysis of methoxychlor occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 139,744 analytical results from 39,187 public water systems (PWSs) during the period from 2006 to

[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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 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, twice the estimated quantitation level (EQL) and 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 (the MCL), 2 µg/L (two times the EQL) and 1 µg/L (the 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 SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-37 presents the system-level Stage 2 analysis of estimated mean concentrations for methoxychlor occurrence in drinking water. Exhibit B-38 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no systems had an estimated system mean greater than the MCL concentration of 40 µg/L. One system, serving 993 people, had an estimated system mean greater than the EQL of 1 µg/L.

Exhibit B-37: Methoxychlor Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water (35,867)	> 40 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 2 µg/L	1	1	1	0.003%	0.003%	0.003%
	> 1 µg/L[1]	1	1	1	0.003%	0.003%	0.003%
Surface Water (3,320)	> 40 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 2 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (39,187)	> 40 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 2 µg/L	1	1	1	0.003%	0.003%	0.003%
	> 1 µg/L[1]	1	1	1	0.003%	0.003%	0.003%

[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, 2016d).

[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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

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

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 40 µg/L	0	0	0	0.000%	0.000%	0.000%
(92,942,500)	> 2 µg/L	993	993	993	0.001%	0.001%	0.001%
	> 1 µg/L[1]	993	993	993	0.001%	0.001%	0.001%
Surface Water	> 40 µg/L	0	0	0	0.000%	0.000%	0.000%
(140,088,461)	> 2 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 40 µg/L	0	0	0	0.0000%	0.0000%	0.0000%
(233,030,961)	> 2 µg/L	993	993	993	0.0004%	0.0004%	0.0004%
	> 1 µg/L[1]	993	993	993	0.0004%	0.0004%	0.0004%

[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, 2016d).

Data for methoxychlor were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit methoxychlor data.

Exhibit B-39 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 EQL, two times the EQL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) No systems had estimated mean concentrations greater than the MCL. One system in New Mexico had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-39: 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 > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	13						
AL	383						
AR	459						
AS	11						
AZ	872						
CA	1,327						
CO	1						
CT	1,137						
DC	1						
FL	2,088						
HI	111						
IA	8						
ID	392						
IL	1,468						
IN	1,214						
KS	87						
KY	225						
LA	1,102						
MA	564						
MD	881						
ME	173						
MI	2,439						
MN	920						
MO	1,332						
MS	5						
MT	857						
NC	2,348						
ND	157						
NE	703						

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NH	1,146						
NJ	42						
NM	718	1	0.139%	1	0.139%	0	0.000%
NV	311						
NY	2,121	0	0.000%	0	0.000%	0	0.000%
OH	228						
OK	39						
OR	1,119						
PA	1,320						
RI	103						
SC	497						
SD	269						
TN	6						
TX	4,422						
UT	428	0	0.000%	0	0.000%	0	0.000%
VA	254						
VT	380						
WA	1,998						
WI	1,914						
WV	276						
WY	318						
Total	**39,187**	**1**	**0.003%**	**1**	**0.003%**	**0**	**0.000%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

Exhibit B-40 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for methoxychlor is presented, as well. As described above, no systems had estimated mean concentrations greater than the MCL. One system in New Mexico, serving 993 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

Exhibit B-40: 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 > 1 µg/L[3]		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	40,300						
AL	5,333,035						
AR	2,635,934						
AS	62,196						
AZ	6,484,144						
CA	36,060,067						
CO	2,020						
CT	2,925,135						
DC	761,124						
FL	18,944,904						
HI	1,479,317						
IA	301,990						
ID	980,589						
IL	10,998,526						
IN	5,032,598						
KS	1,817,722						
KY	4,225,473						
LA	4,966,772						
MA	9,164,462						
MD	4,939,436						
ME	367,408						
MI	7,221,983						
MN	3,752,545						
MO	5,233,314						
MS	6,176						
MT	845,294						
NC	7,832,371						
ND	592,232						

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 1 µg/L[3]		Population Served by Systems with a Mean Concentration > 2 µg/L		Population Served by Systems with a Mean Concentration > 40 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NE	1,662,774						
NH	949,308						
NJ	4,006,631						
NM	1,940,795	993	0.051%	993	0.051%	0	0.000%
NV	2,682,815						
NY	10,481,222	0	0.000%	0	0.000%	0	0.000%
OH	3,536,843						
OK	152,140						
OR	3,432,424						
PA	10,900,135						
RI	1,003,245						
SC	3,623,380						
SD	708,340						
TN	1,168,508						
TX	23,814,787						
UT	2,752,741	0	0.000%	0	0.000%	0	0.000%
VA	5,685,070						
VT	386,948						
WA	4,947,604						
WI	4,236,887						
WV	1,481,587						
WY	469,710						
Total	**233,030,961**	**993**	**0.000%**	**993**	**0.000%**	**0**	**0.000%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

B.10.3 Summary of Data

A total of 139,744 analytical results from 39,187 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for methoxychlor. The Stage 2 analysis of occurrence in drinking water indicated that no systems had an estimated system mean concentration of methoxychlor greater than the MCL concentration of 40 µg/L. The only system with an estimated mean concentration greater than the EQL of 1 µg/L was a ground water system in New Mexico.

B.11 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.11.1 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[22] of 400 µg/person/day and a cancer classification of D, not classifiable as to human carcinogenicity.

Selenium is regulated as an inorganic chemical (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. Surface water systems must sample annually during the initial three-year compliance period. If all analytical results are less than the MCL, and upon considering reported concentrations, degrees of variation in reported concentration and other factors which may affect contaminant concentration, a ground water and surface water system may be granted a waiver. If the results are greater than the MCL, the public water system (PWS) must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems).[23] If all quarterly samples are reliably and consistently below the MCL, the system may continue at initial monitoring indefinitely until the state or EPA establishes an alternate schedule.

B.11.2 Occurrence in Drinking Water

The analysis of selenium occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 165,672 analytical results from 50,568 PWSs during the period from 2006 to 2011. The number of

[22] 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, 1991b) posted an RfD of 5 µg/kg-day for selenium using the same data that are the basis of the regulation.

[23] 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 datasets 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 SYR3 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 analyses. 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 SYR3 ICR dataset. Then, the percentages of all systems with a mean concentration greater than each threshold were calculated. For selenium, 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 selenium are summarized in this section. Occurrence estimates were generated relative to the following thresholds: 50 µg/L (the MCL) and 40 µg/L (the potential MCLG). The potential MCLG is due to changes in the reference dose (RfD) based on new health effects information. Since the practical quantitation level (PQL) for selenium is less than the possible MCLG, EPA designated the possible MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-41 presents the system-level Stage 2 analysis of estimated mean concentrations for selenium occurrence in drinking water. Exhibit B-42 presents similar information based on population served by the systems. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, 31 systems (0.061 percent of all systems), serving 21,489 people, had an

estimated system mean greater than the MCL concentration of 50 µg/L. Forty-nine systems (0.097 percent of all systems), serving 135,685 people, had an estimated system mean greater than the potential MCLG concentration of 40 µg/L.

Exhibit B-41: Selenium Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 50 µg/L	31	30	30	0.067%	0.065%	0.065%
(46,378)	> 40 µg/L[1]	49	48	48	0.106%	0.103%	0.103%
Surface Water	> 50 µg/L	1	1	1	0.024%	0.024%	0.024%
(4,190)	> 40 µg/L[1]	1	1	1	0.024%	0.024%	0.024%
Combined Ground & Surface Water	> 50 µg/L	32	31	31	0.063%	0.061%	0.061%
(50,568)	> 40 µg/L[1]	50	49	49	0.099%	0.097%	0.097%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

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

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 50 µg/L	21,101	21,039	21,039	0.020%	0.020%	0.020%
(105,367,702)	> 40 µg/L[1]	135,421	135,235	135,235	0.129%	0.128%	0.128%
Surface Water	> 50 µg/L	450	450	450	0.000%	0.000%	0.000%
(149,060,594)	> 40 µg/L[1]	450	450	450	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Combined Ground & Surface Water	> 50 µg/L	21,551	21,489	21,489	0.008%	0.008%	0.008%
(254,428,296)	> 40 µg/L[1]	135,871	135,685	135,685	0.053%	0.053%	0.053%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for selenium were available from 49 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the State of Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, this state is included in the table below because a handful of tribal water systems located within this state did submit selenium data. There were no selenium data submitted by tribal communities in Colorado.

Exhibit B-43 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 potential MCLG and the MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) The distribution of systems with mean concentrations of selenium is geographically dispersed. Detection rates were generally low; only 14 states had systems with an estimated mean concentration greater than the MCL. Forty-nine systems in 15 states had estimated mean concentrations greater than the potential MCLG.

Exhibit B-43: 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 > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
AK	508				
AL	385				
AR	460				
AS	11				
AZ	1,097	1	0.09%	1	0.09%
CA	3,978	5	0.13%	3	0.08%
CO	0				
CT	1,173				
DC	1				

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
FL	2,605				
HI	112				
IA	350				
ID	721				
IL	1,358				
IN	1,191				
KS	601	4	0.67%	2	0.33%
KY	226				
LA	1,110				
MA	665				
MD	595				
ME	780				
MI	2,126				
MN	1,144				
MO	1,444	1	0.07%	1	0.07%
MS	5				
MT	774				
NC	2,180	2	0.09%	2	0.09%
ND	181				
NE	687	10	1.46%	7	1.02%
NH	1,167				
NJ	1,402				
NM	750	4	0.53%	3	0.40%
NV	307	1	0.33%	1	0.33%
NY	2,528	1	0.04%	1	0.04%
OH	1,893				
OK	625	2	0.00%	2	0.32%
OR	856				
PA	1,408				
RI	153				
SC	559				

State	Total Number of Systems	Systems with a Mean Concentration > 40 µg/L[3]		Systems with a Mean Concentration > 50 µg/L	
		Number	Percent	Number	Percent
SD	201				
TN	242	1	0.41%	0	0.00%
TX	4,580	13	0.28%	5	0.11%
UT	481	1	0.21%	1	0.21%
VA	1,609	1	0.06%	1	0.06%
VT	429				
WA	2,203				
WI	1,998				
WV	394				
WY	315	2	0.63%	1	0.32%
Total	**50,568**	**49**	**0.10%**	**31**	**0.06%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-44 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for selenium is presented, as well. As described above, 14 states had systems with an estimated mean concentration greater than the MCL. These systems served a total of 21,489 people. A total of 49 systems in 15 states, serving 135,685 people, had estimated mean concentrations greater than the potential MCLG (40 µg/L).

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

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
AK	677,666				
AL	5,336,667				
AR	2,636,302				
AS	62,196				
AZ	6,659,383	144	0.00%	144	0.00%
CA	41,064,051	169	0.00%	119	0.00%
CO	0				

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
CT	2,933,337				
DC	761,124				
FL	19,110,546				
HI	1,481,171				
IA	1,320,723				
ID	1,157,142				
IL	10,983,227				
IN	4,934,479				
KS	2,605,369	1,245	0.05%	614	0.02%
KY	4,225,513				
LA	4,970,924				
MA	9,274,922				
MD	163,520				
ME	757,647				
MI	6,079,096				
MN	3,684,918				
MO	5,278,387	145	0.00%	145	0.00%
MS	6,176				
MT	795,027				
NC	7,759,220	6,941	0.09%	6,941	0.09%
ND	582,630				
NE	1,656,731	10,527	0.64%	10,178	0.61%
NH	959,233				
NJ	9,151,032				
NM	1,973,494	777	0.04%	412	0.02%
NV	2,684,168	110	0.00%	110	0.00%
NY	10,481,957	450	0.00%	450	0.00%
OH	10,202,691				
OK	3,512,817	1,026	0.00%	1,026	0.03%
OR	3,141,336				
PA	9,935,296				

State	Total Population	Population Served by Systems with a Mean Concentration > 40 µg/L[3]		Population Served by Systems with a Mean Concentration > 50 µg/L	
		Population	Percent	Population	Percent
RI	1,019,797				
SC	3,653,359				
SD	406,820				
TN	4,734,392	65	0.00%	0	0.00%
TX	23,797,890	113,626	0.48%	990	0.00%
UT	2,818,359	240	0.01%	240	0.01%
VA	6,907,783	30	0.00%	30	0.00%
VT	405,823				
WA	5,384,657				
WI	4,256,823				
WV	1,573,265				
WY	469,210	190	0.04%	90	0.02%
Total	**254,428,296**	**135,685**	**0.05%**	**21,489**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.11.3 Summary of Data

A total of 165,672 analytical results from 50,568 PWSs in 49 states/entities were available in the SYR3 ICR Dataset for selenium. The Stage 2 analysis of occurrence in drinking water indicated that 31 systems, serving 21,489 people, had an estimated system mean concentration of selenium greater than the MCL concentration of 50 µg/L. A total of 49 systems, serving 135,685 people, had an estimated mean concentration greater than the potential MCLG of 40 µg/L. All but one of the systems with a mean concentrations exceeding the MCL and potential MCLG were ground water systems.

B.12 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.12.1 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 compound (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.[24] 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 compound is detected, the system must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are reliably and consistently below the MCL, the system may return to annual sampling. If a compound 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.12.2 Occurrence in Drinking Water

The analysis of styrene occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 370,368 analytical results from 55,731 public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have been reviewed and checked to ensure adequacy of coverage and completeness.

[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.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR3 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 analyses. 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 SYR3 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, twice the estimated quantitation level (EQL) and 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 (the MCL), 1 µg/L (two times the EQL) and 0.5 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[25] For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-45 presents the system-level Stage 2 analysis of estimated mean concentrations for styrene occurrence in drinking water. Exhibit B-46 presents similar information based on population served by the systems. Based on the Stage 2 analyses, one ground water system had

[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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

an estimated system mean greater than the MCL concentration of 100 µg/L. A total of 117 systems, serving 571,425 people, had an estimated system mean greater than the EQL of 0.5 µg/L.

Exhibit B-45: Styrene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 100 µg/L	1	1	0	0.002%	0.002%	0.000%
(51,299)	> 1 µg/L	59	48	43	0.115%	0.094%	0.084%
	> 0.5 µg/L[1]	235	114	84	0.458%	0.222%	0.164%
Surface Water	> 100 µg/L	0	0	0	0.000%	0.000%	0.000%
(4,432)	> 1 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 0.5 µg/L[1]	19	3	0	0.429%	0.068%	0.000%
Combined Ground & Surface Water	> 100 µg/L	1	1	0	0.002%	0.002%	0.000%
(55,731)	> 1 µg/L	59	48	43	0.106%	0.086%	0.077%
	> 0.5 µg/L[1]	254	117	84	0.456%	0.210%	0.151%

[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, 2016d).

Exhibit B-46: Styrene Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 100 µg/L	100	100	0	0.000%	0.000%	0.000%
(110,770,943)	> 1 µg/L	26,448	20,242	17,199	0.024%	0.018%	0.016%
	> 0.5 µg/L[1]	602,074	80,116	36,835	0.544%	0.072%	0.033%
Surface Water	> 100 µg/L	0	0	0	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Surface Water, cont. (152,600,590)	> 1 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 0.5 µg/L[1]	930,047	491,309	0	0.609%	0.322%	0.000%
Combined Ground & Surface Water (263,371,533)	> 100 µg/L	100	100	0	0.000%	0.000%	0.000%
	> 1 µg/L	26,448	20,242	17,199	0.010%	0.008%	0.007%
	> 0.5 µg/L[1]	1,532,121	571,425	36,835	0.582%	0.217%	0.014%

[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, 2016d).

Data for styrene were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit styrene data.

Exhibit B-47 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 EQL, two times the EQL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) No systems had estimated mean concentrations greater than the MCL. One system in Michigan had an estimated mean concentration greater than the MCL of 100 µg/L. A total of 117 systems had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-47: 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 > 0.5 µg/L[3]		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	595	0	0.000%	0	0.000%	0	0.000%
AL	384						
AR	461	0	0.000%	0	0.000%	0	0.000%
AS	11						
AZ	1,110	2	0.180%	1	0.090%	0	0.00%
CA	3,811	1	0.026%	0	0.000%	0	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 0.5 µg/L[3]		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
CO	1						
CT	1,202	0	0.000%	0	0.000%	0	0.00%
DC	1						
FL	2,633	0	0.000%	0	0.000%	0	0.00%
HI	110						
IA	1,043	0	0.000%	0	0.000%	0	0.00%
ID	839	0	0.000%	0	0.000%	0	0.00%
IL	1,493	2	0.134%	0	0.000%	0	0.00%
IN	1,196	7	0.585%	4	0.334%	0	0.00%
KS	602	0	0.000%	0	0.000%	0	0.000%
KY	227						
LA	1,102	3	0.272%	0	0.000%	0	0.00%
MA	721	1	0.139%	0	0.000%	0	0.00%
MD	1,054	3	0.285%	2	0.190%	0	0.00%
ME	784	8	1.020%	5	0.638%	0	0.00%
MI	2,419	41	1.695%	13	0.537%	1	0.04%
MN	1,463	8	0.547%	6	0.410%	0	0.00%
MO	1,445	1	0.069%	0	0.000%	0	0.00%
MS	5						
MT	897	0	0.000%	0	0.000%	0	0.00%
NC	2,356	7	0.297%	3	0.127%	0	0.00%
ND	160						
NE	705	1	0.142%	1	0.142%	0	0.00%
NH	1,185	1	0.084%	0	0.000%	0	0.00%
NJ	1,434	5	0.349%	3	0.209%	0	0.00%
NM	744	1	0.134%	0	0.00%	0	0.00%
NV	350						
NY	2,498	2	0.080%	2	0.080%	0	0.00%
OH	1,922	14	0.728%	6	0.312%	0	0.00%
OK	685	0	0.000%	0	0.000%	0	0.000%

State	Total Number of Systems	Systems with a Mean Concentration > 0.5 µg/L[3]		Systems with a Mean Concentration > 1 µg/L		Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
OR	1,132	1	0.088%	0	0.000%	0	0.00%
PA	3,166	2	0.063%	0	0.000%	0	0.00%
RI	152	0	0.000%	0	0.000%	0	0.00%
SC	494	0	0.000%	0	0.000%	0	0.00%
SD	313	0	0.000%	0	0.000%	0	0.00%
TN	366						
TX	4,532	0	0.000%	0	0.000%	0	0.00%
UT	468	0	0.000%	0	0.000%	0	0.00%
VA	1,630	2	0.123%	0	0.000%	0	0.00%
VT	634	0	0.000%	0	0.000%	0	0.00%
WA	2,468	0	0.000%	0	0.000%	0	0.00%
WI	2,026	4	0.197%	2	0.099%	0	0.00%
WV	385	0	0.000%	0	0.000%	0	0.00%
WY	317						
Total	**55,731**	**117**	**0.210%**	**48**	**0.086%**	**1**	**0.002%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

Exhibit B-48 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for styrene is presented, as well. As described above, 1 system in Michigan, serving 100 people, had an estimated mean concentration greater than the MCL of 100 µg/L. A total of 117 systems, serving 571,425, had an estimated mean concentration greater than the EQL of 0.5 µg/L.

Exhibit B-48: 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 > 0.5 µg/L[3]		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AK	719,561	0	0.000%	0	0.000%	0	0.000%
AL	5,334,584						

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.5 µg/L[3]		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
AR	2,637,712	0	0.000%	0	0.000%	0	0.000%
AS	62,196						
AZ	6,669,277	398	0.006%	348	0.005%	0	0.000%
CA	40,638,035	564	0.001%	0	0.000%	0	0.000%
CO	2,020						
CT	2,937,643	0	0.000%	0	0.000%	0	0.000%
DC	761,124						
FL	19,280,091	0	0.000%	0	0.000%	0	0.000%
HI	1,402,969						
IA	2,734,678	0	0.000%	0	0.000%	0	0.000%
ID	1,219,635	0	0.000%	0	0.000%	0	0.000%
IL	11,019,196	775	0.007%	0	0.000%	0	0.000%
IN	4,940,108	1,452	0.029%	268	0.005%	0	0.000%
KS	2,605,030	0	0.00%	0	0.00%	0	0.00%
KY	4,225,914						
LA	4,966,653	2,483	0.050%	0	0.000%	0	0.000%
MA	9,329,953	100	0.001%	0	0.000%	0	0.000%
MD	5,120,409	3,295	0.064%	2,950	0.058%	0	0.000%
ME	757,984	613	0.081%	463	0.061%	0	0.000%
MI	3,470,708	102,788	2.962%	5,761	0.166%	100	0.003%
MN	4,374,468	441,937	10.103%	1,226	0.028%	0	0.000%
MO	5,293,851	200	0.004%	0	0.000%	0	0.000%
MS	6,176						
MT	856,529	0	0.000%	0	0.000%	0	0.000%
NC	7,827,828	2,585	0.033%	971	0.012%	0	0.000%
ND	592,539						
NE	1,664,802	390	0.023%	390	0.023%	0	0.000%
NH	961,134	485	0.050%	0	0.000%	0	0.000%
NJ	9,273,130	1,032	0.011%	825	0.009%	0	0.000%
NM	1,962,298	993	0.051%	0	0.000%	0	0.000%
NV	2,697,555						

State	Total Population Served by Systems	Population Served by Systems with a Mean Concentration > 0.5 µg/L[3]		Population Served by Systems with a Mean Concentration > 1 µg/L		Population Served by Systems with a Mean Concentration > 100 µg/L	
		Number	Percent	Number	Percent	Number	Percent
NY	10,637,039	4,725	0.044%	4,725	0.044%	0	0.000%
OH	10,209,121	4,641	0.045%	1,825	0.018%	0	0.000%
OK	3,588,559	0	0.000%	0	0.000%	0	0.000%
OR	3,434,191	90	0.003%	0	0.000%	0	0.000%
PA	11,234,684	484	0.004%	0	0.000%	0	0.000%
RI	1,040,737	0	0.000%	0	0.000%	0	0.000%
SC	3,637,408	0	0.000%	0	0.000%	0	0.000%
SD	757,925	0	0.000%	0	0.000%	0	0.000%
TN	6,578,052						
TX	23,863,702	0	0.000%	0	0.000%	0	0.000%
UT	2,800,243	0	0.000%	0	0.000%	0	0.000%
VA	6,908,704	700	0.010%	0	0.000%	0	0.000%
VT	486,604	0	0.000%	0	0.000%	0	0.000%
WA	5,535,827	0	0.000%	0	0.000%	0	0.000%
WI	4,273,462	695	0.016%	490	0.011%	0	0.000%
WV	1,570,171	0	0.000%	0	0.000%	0	0.000%
WY	469,314						
Total	**263,371,533**	**571,425**	**0.217%**	**20,242**	**0.008%**	**100**	**0.000%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] 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, 2016d).

B.12.3 Summary of Data

A total of 370,368 analytical results from 55,731 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for styrene. The Stage 2 analysis of occurrence in drinking water indicated that one system in Michigan had an estimated system mean concentration of styrene greater than the MCL concentration of 100 µg/L. A total of 117 systems, serving 571,425 people, had an estimated mean concentration greater than the EQL of 0.5 µg/L. All but three of those systems were served by ground water.

B.13 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.13.1 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 chemical (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 three years, 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 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a chemical is detected, the system must monitor quarterly until results are reliably and consistently below the MCL (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 chemical 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.

B.13.2 Occurrence in Drinking Water

The analysis of dioxin occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 20,244 analytical results from 3,216 public water systems (PWSs) during the period from 2006 to 2011. The number of sample

[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.

results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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. Two different substitution values –zero and ½ the minimum reporting level (MRL) value– were used to replace each non-detection record. (The national modal MRL for dioxin in the dataset is 0.000005 µg/L.) Two arithmetic mean dioxin concentrations were calculated at each system using the zero and ½ MRL substitution values. These mean calculations were performed for all systems with dioxin data in the SYR3 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, ½ 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 (the MCL), 0.000015 µg/L (½ the MCL), 0.00001 µg/L (two times the EQL) and 0.000005 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[27] For more information on

[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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-49 presents the system-level Stage 2 analysis of estimated mean concentrations for dioxin 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, one water system (approximately 0.031 percent of all systems) had an estimated mean greater than the MCL of 0.00003 µg/L. This system serves approximately 550 people. Two water systems (approximately 0.062 percent of all systems) had estimated means greater than the EQL of 0.000005 µg/L. These 2 systems serve approximately 1,450 people.

Exhibit B-49: Dioxin Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = 1/2 MRL	Non-detect values = 0	Non-detect values = 1/2 MRL	Non-detect values = 0
Ground Water (2,653)	> 0.00003 µg/L	1	1	0.038%	0.038%
	> 0.000015 µg/L	1	1	0.038%	0.038%
	> 0.00001 µg/L	1	1	0.038%	0.038%
	> 0.000005 µg/L[1]	2	1	0.075%	0.038%
Surface Water (563)	> 0.00003 µg/L	0	0	0.000%	0.000%
	> 0.000015 µg/L	0	0	0.000%	0.000%
	> 0.00001 µg/L	0	0	0.000%	0.000%
	> 0.000005 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (3,216)	> 0.00003 µg/L	1	1	0.031%	0.031%
	> 0.000015 µg/L	1	1	0.031%	0.031%
	> 0.00001 µg/L	1	1	0.031%	0.031%
	> 0.000005 µg/L[1]	2	1	0.062%	0.031%

[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, 2016d).

Exhibit B-50: Dioxin Stage 2 Analysis – Summary of Population Served by Systems with a Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = 1/2 MRL	Non-detect values = 0	Non-detect values = 1/2 MRL	Non-detect values = 0
Ground Water (27,816,835)	> 0.00003 µg/L	550	550	0.002%	0.002%
	> 0.000015 µg/L	550	550	0.002%	0.002%
	> 0.00001 µg/L	550	550	0.002%	0.002%
	> 0.000005 µg/L[1]	1,450	550	0.005%	0.002%
Surface Water (46,260,945)	> 0.00003 µg/L	0	0	0.000%	0.000%
	> 0.000015 µg/L	0	0	0.000%	0.000%
	> 0.00001 µg/L	0	0	0.000%	0.000%
	> 0.000005 µg/L[1]	0	0	0.000%	0.000%
Combined Ground & Surface Water (74,077,780)	> 0.00003 µg/L	550	550	0.001%	0.001%
	> 0.000015 µg/L	550	550	0.001%	0.001%
	> 0.00001 µg/L	550	550	0.001%	0.001%
	> 0.000005 µg/L[1]	1,450	550	0.002%	0.001%

[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, 2016d).

Data for dioxin were available from 30 states/entities. (There were no dioxin data from 20 states/entities.) Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the State of Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, this state is included in the table below because a handful of tribal water systems located within Mississippi did submit dioxin data. Twenty states/entities included in the table below did provide Six-Year data for most contaminants but did not submit dioxin data because waivers had been granted.

Exhibit B-51 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 EQL, two times the EQL, ½ MCL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) Detection rates were low; only one system in Maryland an estimated mean concentration greater than the MCL. Two systems (one in Florida and one in Maryland) had an estimated mean concentration greater than the EQL of 0.000005 µg/L.

Exhibit B-51: 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 > 0.000005 µg/L[3]		Systems with a Mean Concentration > 0.00001 µg/L		Systems with a Mean Concentration > 0.000015 µg/L		Systems with a Mean Concentration > 0.00003 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	6								
AL	1								
AR	0								
AS	11								
AZ	829								
CA	534								
CO	0								
CT	10								
DC	1								
FL	264	1	0.38%	0	0.00%	0	0.00%	0	0.00%
HI	115								
IA	0								
ID	1								
IL	0								
IN	55								
KS	2								
KY	56								
LA	4								
MA	0								
MD	2	1	50.00%	1	50.00%	1	50.00%	1	50.00%
ME	0								
MI	13								
MN	27								
MO	0								
MS	5								
MT	0								
NC	6								
ND	0								

State	Total Number of Systems	Systems with a Mean Concentration > 0.000005 µg/L[3]		Systems with a Mean Concentration > 0.00001 µg/L		Systems with a Mean Concentration > 0.000015 µg/L		Systems with a Mean Concentration > 0.00003 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
NE	0								
NH	0								
NJ	0								
NM	60								
NV	117								
NY	60								
OH	18								
OK	0								
OR	6								
PA	895								
RI	0								
SC	0								
SD	0								
TN	3								
TX	0								
UT	12								
VA	4								
VT	0								
WA	0								
WI	98								
WV	1								
WY	0								
Total	**3,216**	**2**	**0.06%**	**1**	**0.03%**	**1**	**0.03%**	**1**	**0.03%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

Exhibit B-52 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for dioxin is presented, as well. As described above, 1 system in Maryland had an estimated mean concentration greater than the MCL; this system served 550 people. Two

systems, serving a total population of 1,450 people, had an estimated mean concentration greater than the EQL of 0.000005 µg/L.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 0.000005 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.00001 µg/L		Population Served by Systems with a Mean Concentration > 0.000015 µg/L		Population Served by Systems with a Mean Concentration > 0.00003 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
AK	36,711								
AL	750								
AR	0								
AS	62,196								
AZ	6,395,030								
CA	29,120,942								
CO	0								
CT	49,751								
DC	761,124								
FL	9,131,313	900	0.01%	0	0.00%	0	0.00%	0	0.00%
HI	1,487,191								
IA	0								
ID	30								
IL	0								
IN	2,343,163								
KS	482,004								
KY	2,771,859								
LA	32,844								
MA	0								
MD	1,800,550	550	0.03%	550	0.03%	550	0.03%	550	0.03%
ME	0								
MI	34,902								
MN	25,573								
MO	0								
MS	6,176								

State	Total Population	Population Served by Systems with a Mean Concentration > 0.000005 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.00001 µg/L		Population Served by Systems with a Mean Concentration > 0.000015 µg/L		Population Served by Systems with a Mean Concentration > 0.00003 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
MT	0								
NC	15,984								
ND	0								
NE	0								
NH	0								
NJ	0								
NM	82,348								
NV	2,577,238								
NY	1,822,971								
OH	1,099,358								
OK	0								
OR	910,206								
PA	9,393,195								
RI	0								
SC	0								
SD	0								
TN	954,057								
TX	0								
UT	6,159								
VA	785,888								
VT	0								
WA	0								
WI	1,888,147								
WV	120								

State	Total Population	Population Served by Systems with a Mean Concentration > 0.000005 µg/L[3]		Population Served by Systems with a Mean Concentration > 0.00001 µg/L		Population Served by Systems with a Mean Concentration > 0.000015 µg/L		Population Served by Systems with a Mean Concentration > 0.00003 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
WY	0								
Total	**74,077,780**	**1,450**	**0.002%**	**550**	**0.001%**	**550**	**0.001%**	**550**	**0.001%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

B.13.3 Summary of Data

A total of 20,244 analytical results from 3,216 PWSs in 30 states/entities were available in the SYR3 ICR Dataset for dioxin. The Stage 2 analysis of occurrence in drinking water indicated that 1 ground water system in Maryland, serving 550 people, had an estimated system mean concentration of dioxin greater than the MCL concentration of 0.00003 µg/L. Two ground water systems, serving a total population of 1,450 people, had an estimated mean concentration greater than the EQL of 0.000005 µg/L. These two ground water systems were located in Florida and Maryland.

B.14 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.14.1 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 compound (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.[28] 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 compound is detected, the system must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are reliably and consistently below the MCL, the system may return to annual sampling. If a compound 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.14.2 Occurrence in Drinking Water

The analysis of toluene occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 373,021 analytical results from 55,748 public water systems (PWSs) during the period from 2006 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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 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 (the MCL) and 600 µg/L (the potential MCLG). The potential MCLG is due to changes in the RfD based on new health effects information. Since the practical quantitation level (PQL) for toluene is less than the possible MCLG, EPA designated the possible MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-53 presents the system-level Stage 2 analysis of estimated mean concentrations for toluene occurrence in drinking water. Exhibit B-54 presents similar information based on population served by the systems. No systems had an estimated system mean greater than the MCL concentration of 1,000 µg/L or the potential MCLG concentration of 600 µg/L.

Exhibit B-53: Toluene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
(51,316)	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
(4,432)	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
(55,748)	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

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

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
(110,897,342)	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
(152,600,590)	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 1,000 µg/L	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water, cont.	> 600 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
(263,497,932)							

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for toluene were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit toluene data.

Exhibit B-55 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 potential MCLG and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) No water systems had an estimated mean greater than 1,000 µg/L (the MCL) or the potential MCLG of 600 µg/L.

Exhibit B-55: 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 > 600 µg/L[3]		Systems with a Mean Concentration > 1,000 µg/L	
		Number	Percent	Number	Percent
AK	596				
AL	384				
AR	461				
AS	11				
AZ	1,110				
CA	3,814				
CO	1				
CT	1,202				
DC	1				
FL	2,633				
HI	111				
IA	1,048				

State	Total Number of Systems	Systems with a Mean Concentration > 600 µg/L[3]		Systems with a Mean Concentration > 1,000 µg/L	
		Number	Percent	Number	Percent
ID	839				
IL	1,493				
IN	1,196				
KS	604				
KY	227				
LA	1,102				
MA	721				
MD	1,056				
ME	784				
MI	2,419				
MN	1,462				
MO	1,445				
MS	5				
MT	897				
NC	2,356				
ND	160				
NE	705				
NH	1,186				
NJ	1,434				
NM	744				
NV	350				
NY	2,498				
OH	1,922				
OK	685				
OR	1,131				
PA	3,166				
RI	152				
SC	494				
SD	313				
TN	366				
TX	4,532				

State	Total Number of Systems	Systems with a Mean Concentration > 600 µg/L[3]		Systems with a Mean Concentration > 1,000 µg/L	
		Number	Percent	Number	Percent
UT	471				
VA	1,629				
VT	634				
WA	2,469				
WI	2,026				
WV	386				
WY	317				
Total	**55,748**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-56 presents the population served by systems with a mean concentration greater than the MCL concentration by state. As stated above, no water systems had an estimated mean greater than the MCL or the potential MCLG.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 600 µg/L[3]		Population Served by Systems with a Mean Concentration > 1,000 µg/L	
		Population	Percent	Population	Percent
AK	719,618				
AL	5,334,584				
AR	2,637,712				
AS	62,196				
AZ	6,669,277				
CA	40,642,888				
CO	2,020				
CT	2,937,643				
DC	761,124				
FL	19,280,091				
HI	1,479,317				

State	Total Population	Population Served by Systems with a Mean Concentration > 600 µg/L[3]		Population Served by Systems with a Mean Concentration > 1,000 µg/L	
		Population	Percent	Population	Percent
IA	2,753,930				
ID	1,219,635				
IL	11,019,196				
IN	4,940,108				
KS	2,628,748				
KY	4,225,914				
LA	4,966,653				
MA	9,329,953				
MD	5,120,669				
ME	757,984				
MI	3,470,708				
MN	4,373,668				
MO	5,293,851				
MS	6,176				
MT	856,529				
NC	7,827,828				
ND	592,539				
NE	1,664,802				
NH	962,134				
NJ	9,273,130				
NM	1,962,298				
NV	2,697,555				
NY	10,637,039				
OH	10,209,121				
OK	3,588,559				
OR	3,434,141				
PA	11,234,684				
RI	1,040,737				
SC	3,637,408				
SD	757,925				

State	Total Population	Population Served by Systems with a Mean Concentration > 600 µg/L[3]		Population Served by Systems with a Mean Concentration > 1,000 µg/L	
		Population	Percent	Population	Percent
TN	6,578,052				
TX	23,863,702				
UT	2,802,068				
VA	6,908,525				
VT	486,604				
WA	5,535,917				
WI	4,273,462				
WV	1,570,196				
WY	469,314				
Total	**263,497,932**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.14.3 Summary of Data

A total of 373,021 analytical results from 55,748 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for toluene. The Stage 2 analysis of occurrence in drinking water indicated that zero systems had an estimated system mean concentration of toluene greater than the MCL concentration of 1,000 µg/L or the potential MCLG of 600 µg/L.

B.15 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.15.1 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 chemical (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 three years, 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.[29] If all 4 samples are non-detections, then a system serving less than 3,300 people may reduce its collection frequency to 1 sample during each consecutive compliance period; a system serving more than 3,300 people may reduce its collection frequency to 2 quarterly samples within a 12-month period during each repeat compliance period. If a contaminant is detected, the system must monitor quarterly to demonstrate that results are reliably and consistently below the MCL (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 concentrations 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.

B.15.2 Occurrence in Drinking Water

The analysis of toxaphene occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 127,187 analytical results from 37,043 public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have been reviewed and checked to ensure adequacy of coverage and completeness.

[29] 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 SYR3 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 analyses. 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. Two different substitution values –zero and ½ the minimum reporting level (MRL) value– were used to replace each non-detection record. (The national modal MRL for toxaphene in the dataset is 1 µg/L.) Two arithmetic mean toxaphene concentrations were calculated at each system using the zero and ½ MRL substitution values. These mean calculations were performed for all systems with toxaphene data in the SYR3 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, ½ 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 (the MCL), 1.5 µg/L (1/2 the MCL), 2 µg/L (two times the EQL) and 1 µg/L (the EQL). The EQL represents the potential quantitation capabilities below a practical quantitation level (PQL).[30] For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-57 presents the system-level Stage 2 analysis of estimated mean concentrations for toxaphene occurrence in drinking water. Exhibit B-58 presents similar information based on population served by the systems. Two systems (0.005 percent of all systems), serving 233,219

[30] 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, 2016d). The EQL is the threshold used to evaluate occurrence and exposure for the Stage 2 analyses.

people, had an estimated system mean greater than the MCL concentration of 3 µg/L. Based on the Stage 2 analyses using the ½ MRL substitution for non-detections, six water systems (approximately 0.016 percent of all systems) had an estimated mean greater than the EQL of 1 µg/L. These 6 systems serve 715,106 people.

Exhibit B-57: Toxaphene Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold		Percent of Systems with Mean Concentrations That Are Greater Than the Threshold	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 3 µg/L	1	1	0.003%	0.003%
(33,812)	> 1.5 µg/L	2	2	0.006%	0.006%
	> 2 µg/L	2	2	0.006%	0.006%
	> 1 µg/L[1]	4	2	0.012%	0.006%
Surface Water	> 3 µg/L	1	1	0.031%	0.031%
(3,231)	> 1.5 µg/L	2	2	0.062%	0.062%
	> 2 µg/L	2	1	0.062%	0.031%
	> 1 µg/L[1]	2	2	0.062%	0.062%
Combined Ground & Surface Water	> 3 µg/L	2	2	0.005%	0.005%
(37,043)	> 1.5 µg/L	4	4	0.011%	0.011%
	> 2 µg/L	4	3	0.011%	0.008%
	> 1 µg/L[1]	6	4	0.016%	0.011%

[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, 2016d).

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

Source Water Type (Population Served by Systems)	Threshold	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	
		Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 3 µg/L	993	993	0.001%	0.001%
Ground Water, cont. **(91,710,210)**	> 1.5 µg/L	1,298	1,298	0.001%	0.001%
	> 2 µg/L	1,298	1,298	0.001%	0.001%
	> 1 µg/L[1]	8,739	1,298	0.010%	0.001%
Surface Water **(132,718,761)**	> 3 µg/L	232,226	232,226	0.175%	0.175%
	> 1.5 µg/L	706,367	706,367	0.532%	0.532%
	> 2 µg/L	706,367	232,226	0.532%	0.175%
	> 1 µg/L[1]	706,367	706,367	0.532%	0.532%
Combined Ground & Surface Water **(223,888,971)**	> 3 µg/L	233,219	233,219	0.104%	0.104%
	> 1.5 µg/L	707,665	707,665	0.316%	0.316%
	> 2 µg/L	707,665	233,524	0.316%	0.104%
	> 1 µg/L[1]	715,106	707,665	0.319%	0.316%

[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, 2016d).

Data for toxaphene were available from 49 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit toxaphene data. New Jersey did submit Six-Year data for most contaminants. There is a statewide waiver for toxaphene in New Jersey, however, so no toxaphene data were available from that state.

Exhibit B-59 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 EQL, two times the EQL, ½ MCL and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) The distribution of systems with mean concentrations of toxaphene is geographically dispersed. Detection rates were generally low; only two states had an estimated mean concentration greater than the MCL. (New Mexico and North Carolina each contained a

single system with a mean concentration greater than the MCL in each state.) Six systems in five states had estimated mean concentrations greater than the EQL.

Exhibit B-59: 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 > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1.5 µg/L		Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
AK	12								
AL	382								
AR	459								
AS	11								
AZ	872								
CA	1,271	1	0.08%	1	0.08%	1	0.08%	0	0.00%
CO	1								
CT	1,137								
DC	1								
FL	2,086								
HI	111								
IA	1								
ID	386								
IL	1,466								
IN	1,212								
KS	87								
KY	225								
LA	946	1	0.11%	0	0.00%	0	0.00%	0	0.00%
MA	565								
MD	45								
ME	160								
MI	2,439								
MN	920								
MO	1,332								
MS	5								
MT	857								
NC	2,347	2	0.09%	2	0.09%	2	0.09%	1	0.04%

State	Total Number of Systems	Systems with a Mean Concentration > 1 µg/L[3]		Systems with a Mean Concentration > 2 µg/L		Systems with a Mean Concentration > 1.5 µg/L		Systems with a Mean Concentration > 3 µg/L	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent
ND	157								
NE	639								
NH	1,146								
NJ	0								
NM	718	1	0.14%	1	0.14%	1	0.14%	1	0.14%
NV	303								
NY	2,117								
OH	18								
OK	38								
OR	1,118								
PA	1,045	1	0.10%	0	0.00%	0	0.00%	0	0.00%
RI	73								
SC	497								
SD	269								
TN	6								
TX	3,981								
UT	428								
VA	254								
VT	380								
WA	1,996								
WI	1,914								
WV	292								
WY	318								
Total	**37,043**	**6**	**0.02%**	**4**	**0.01%**	**4**	**0.01%**	**2**	**0.01%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

Exhibit B-60 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for toxaphene is presented, as well. As described above, North Carolina and New Mexico were the only two states with an estimated mean concentration greater than the MCL of

3 µg/L. Six systems in 5 states, serving 715,106 people, had estimated mean concentrations greater than the EQL of 1 µg/L.

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

State	Total Population	Population Served by Systems with a Mean Concentration > 1 µg/L[3]		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 > 3 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
AK	39,530								
AL	5,332,585								
AR	2,635,934								
AS	62,196								
AZ	6,487,437								
CA	35,717,333	474,141	1.33%	474,141	1.33%	474,141	1.33%	0	0.00%
CO	2,020								
CT	2,925,135								
DC	761,124								
FL	18,943,061								
HI	1,479,317								
IA	438								
ID	976,182								
IL	10,997,746								
IN	4,969,942								
KS	1,817,722								
KY	4,225,473								
LA	4,709,163	6,916	0.15%	0	0.00%	0	0.00%	0	0.00%
MA	9,163,377								
MD	3,991,250								
ME	356,698								
MI	7,221,983								
MN	3,752,545								
MO	5,233,314								
MS	6,176								
MT	845,294								

State	Total Population	Population Served by Systems with a Mean Concentration > 1 µg/L[3]		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 > 3 µg/L	
		Population	Percent	Population	Percent	Population	Percent	Population	Percent
NC	7,832,302	232,531	2.97%	232,531	2.97%	232,531	2.97%	232,226	2.96%
ND	592,232								
NE	1,646,746								
NH	949,308								
NJ	0								
NM	1,940,795	993	0.05%	993	0.05%	993	0.05%	993	0.05%
NV	2,681,668								
NY	10,480,954								
OH	676,533								
OK	136,313								
OR	3,432,307								
PA	10,853,332	525	0.00%	0	0.00%	0	0.00%	0	0.00%
RI	989,530								
SC	3,622,250								
SD	708,340								
TN	1,168,508								
TX	23,671,855								
UT	2,752,741								
VA	5,685,070								
VT	386,948								
WA	4,942,339								
WI	4,236,887								
WV	1,379,328								
WY	469,710								
Total	**223,888,971**	**715,106**	**0.32%**	**707,665**	**0.32%**	**707,665**	**0.32%**	**233,219**	**0.10%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded any of the thresholds.

[3] 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, 2016d).

B.15.3 Summary of Data

A total of 127,187 analytical results from 37,043 PWSs in 49 states/entities were available in the SYR3 ICR Dataset for toxaphene. The Stage 2 analysis of occurrence in drinking water indicated that 2 water systems (1 ground water system and 1 surface water system), serving a total population of 233,219 people, had an estimated system mean concentration of toxaphene greater than the MCL concentration of 3 µg/L. Six water systems, serving 715,106 people, had an estimated mean concentration greater than the EQL of 1 µg/L.

B.16 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.16.1 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 compound (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.[31] 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 compound is detected, the system must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are reliably and consistently below the MCL, the system may return to annual sampling. If a compound 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.16.2 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 SYR3 ICR Dataset. These data consist of 371,877 analytical results from 55,733 public water systems (PWSs) during the period from 2006 to 2011. The number of sample results and systems vary by state, although the state datasets have been reviewed and checked to ensure adequacy of coverage and completeness.

[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.

EPA used a two-stage analytical approach to estimate the national contaminant occurrence using the SYR3 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 analyses. 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 that 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. 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 SYR3 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 MCLG. Note: The national modal MRL for 1,1,2-trichloroethane in the dataset is 0.5 µg/L.

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 (the MCL) and 3 µg/L (the MCLG). Because the current MCLG of 3 µg/L is lower than the PQL for 1,1,2-trichloroethane of 5 µg/L, the threshold of interest for the occurrence analysis is the current MCLG of 3 µg/L. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-61 presents the system-level Stage 2 analysis of estimated mean concentrations for 1,1,2-trichloroethane occurrence in drinking water. Exhibit B-62 presents similar information based on population served by the systems. Based on the Stage 2 analyses, zero water systems had an estimated system mean greater than the MCL concentration of 5 µg/L or the MCLG of 3 µg/L.

Exhibit B-61: 1,1,2-Trichloroethane Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(51,300)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(4,433)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(55,733)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

[1] The threshold of interest for this contaminant is the current MCLG.

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

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0
Ground Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(110,769,873)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Surface Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(152,603,695)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water	> 5 µg/L	0	0	0	0.000%	0.000%	0.000%
(263,373,568)	> 3 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

[1] The threshold of interest for this contaminant is the current MCLG.

Data for 1,1,2-trichloroethane were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the table below because a handful of tribal water systems located within these two states did submit 1,1,2-trichloroethane data.

Exhibit B-63 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 MCLG and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) As is described above, no systems had an estimated mean concentration greater than the MCL or the MCLG.

Exhibit B-63: 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 > 3 µg/L[3]		Systems with a Mean Concentration > 5 µg/L	
		Number	Percent	Number	Percent
AK	595				
AL	384				
AR	461				
AS	11				
AZ	1,109				
CA	3,814				
CO	1				
CT	1,202				
DC	1				
FL	2,633				
HI	110				
IA	1,043				
ID	839				
IL	1,493				
IN	1,196				
KS	602				
KY	227				
LA	1,102				
MA	721				
MD	1,053				

State	Total Number of Systems	Systems with a Mean Concentration > 3 µg/L[3]		Systems with a Mean Concentration > 5 µg/L	
		Number	Percent	Number	Percent
ME	784				
MI	2,419				
MN	1,462				
MO	1,445				
MS	5				
MT	897				
NC	2,356				
ND	160				
NE	705				
NH	1,185				
NJ	1,434				
NM	743				
NV	350				
NY	2,498				
OH	1,922				
OK	685				
OR	1,132				
PA	3,166				
RI	152				
SC	494				
SD	313				
TN	366				
TX	4,532				
UT	471				
VA	1,630				
VT	634				
WA	2,468				
WI	2,026				
WV	385				
WY	317				
Total	**55,733**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The threshold of interest for this contaminant is the current MCLG.

Exhibit B-64 presents the population served by systems with a mean concentration greater than the MCL concentration by state. As described above, no systems had an estimated mean concentration greater than the MCL or the MCLG.

Exhibit B-64: 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	Population Served by Systems with a Mean Concentration > 3 µg/L[3]		Population Served by Systems with a Mean Concentration > 5 µg/L	
		Population	Percent	Population	Percent
AK	719,561				
AL	5,334,584				
AR	2,637,712				
AS	62,196				
AZ	6,669,227				
CA	40,641,146				
CO	2,020				
CT	2,937,643				
DC	761,124				
FL	19,280,091				
HI	1,402,969				
IA	2,734,678				
ID	1,219,635				
IL	11,019,196				
IN	4,940,108				
KS	2,605,030				
KY	4,225,914				
LA	4,966,653				
MA	9,329,953				
MD	5,120,409				
ME	757,984				
MI	3,470,708				
MN	4,373,668				

State	Total Population	Population Served by Systems with a Mean Concentration > 3 µg/L[3]		Population Served by Systems with a Mean Concentration > 5 µg/L	
		Population	Percent	Population	Percent
MO	5,293,851				
MS	6,176				
MT	856,529				
NC	7,827,828				
ND	592,539				
NE	1,664,802				
NH	961,134				
NJ	9,273,130				
NM	1,960,247				
NV	2,697,555				
NY	10,637,039				
OH	10,209,121				
OK	3,588,559				
OR	3,434,191				
PA	11,234,684				
RI	1,040,737				
SC	3,637,408				
SD	757,925				
TN	6,578,052				
TX	23,863,702				
UT	2,802,068				
VA	6,908,704				
VT	486,604				
WA	5,535,827				
WI	4,273,462				
WV	1,570,171				
WY	469,314				
Total	**263,373,568**	**0**	**0.00%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The threshold of interest for this contaminant is the current MCLG.

B.16.3 Summary of Data

A total of 371,877 analytical results from 55,733 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for 1,1,2-trichloroethane. The Stage 2 analysis of occurrence in drinking water indicated that zero systems had an estimated system mean concentration of 1,1,2-trichloroethane greater than the MCL concentration of 5 µg/L or the MCLG concentration of 3 µg/L.

B.17 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 Third Six-Year Review (the "SYR3 ICR Dataset").

B.17.1 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 compounds (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.[32] 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 compound is detected, the system must take one sample per quarter until results are below the MCL (minimum of two quarterly samples for ground water systems and four quarterly samples for surface water systems). If all quarterly samples are reliably and consistently below the MCL, the system may return to annual sampling. If a compound 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.17.2 Occurrence in Drinking Water

The analysis of xylenes occurrence presented in the following section is based on state compliance monitoring data from the SYR3 ICR Dataset. These data consist of 323,477 analytical results from 51,074 public water systems (PWSs) during the period from 2006 to

[32] 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.

2011. The number of sample results and systems vary by state, although the state datasets 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 SYR3 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 analyses. 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 SYR3 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 (the MCL) and 1,000 µg/L (the potential MCLG). The potential MCLG is due to changes in the RfD based on new health effects information. Since the practical quantitation level (PQL) for xylenes is less than the possible MCLG, EPA designated the possible MCLG as the threshold for the occurrence analysis. For more information on the new potential thresholds of concern used in the SYR3 Stage 2 analyses, refer to USEPA (2016d) and (2016e).

Exhibit B-65 presents the system-level Stage 2 analysis of estimated mean concentrations for xylenes occurrence in drinking water. Exhibit B-66 presents similar information based on population served by the systems. Based on the Stage 2 analyses, no systems had an estimated system mean greater than the MCL concentration of 10,000 µg/L. Two systems, serving 825 people, had an estimated system mean greater than the potential MCLG concentration of 1,000 µg/L.

Exhibit B-65: Xylenes Stage 2 Analysis – Summary of Systems with a Mean Threshold Exceedance

Source Water Type (Number of Systems)	Threshold	Number of Systems with Mean Concentrations That Are Greater Than the Threshold			Percent of Systems with Mean Concentrations That Are Greater Than the Threshold		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = 1/2 MRL	Non-detect values = 0
Ground Water (47,037)	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	2	2	2	0.004%	0.004%	0.004%
Surface Water (4,037)	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	0	0	0	0.000%	0.000%	0.000%
Combined Ground & Surface Water (51,074)	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	2	2	2	0.004%	0.004%	0.004%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-66: Xylenes Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = 1/2 MRL	Non-detect values = 0
Ground Water (106,335,621)	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	825	825	825	0.0008%	0.0008%	0.0008%
Surface Water	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	0	0	0	0.000%	0.000%	0.000%

Source Water Type (Population Served by Systems)	Threshold	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		
		Non-detect values = MRL	Non-detect values = ½ MRL	Non-detect values = 0	Non-detect values = MRL	Non-detect values = 1/2 MRL	Non-detect values = 0
Combined Ground & Surface Water (248,916,224)	> 10,000 µg/L	0	0	0	0.000%	0.000%	0.000%
	> 1,000 µg/L[1]	825	825	825	0.0003%	0.0003%	0.0003%

[1] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Data for xylenes were available from 50 states/entities. Four states did not submit data for use in the Six-Year Review (Colorado, Delaware, Georgia and Mississippi). Although the States of Colorado and Mississippi did not provide data for any contaminants for the SYR3 ICR Dataset, these states are included in the count of 50 states because a handful of tribal water systems located within these 2 states did submit xylenes data.

Exhibit B-67 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 potential MCLG and MCL concentrations. (Note: Only the ½ MRL substitution results are presented in this exhibit.) As was stated above, no systems had an estimated mean concentration greater than the MCL. Two systems in two states (Michigan and Pennsylvania) had estimated mean concentrations greater than the potential MCLG of 1,000 µg/L.

Exhibit B-67: 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 > 1,000 µg/L[3]		Systems with a Mean Concentration > 10,000 µg/L	
		Number	Percent	Number	Percent
AK	596				
AL	384				
AR	461				
AS	11				
AZ	1,111				
CA	3,790				
CO	1				
CT	5				

State	Total Number of Systems	Systems with a Mean Concentration > 1,000 µg/L[3]		Systems with a Mean Concentration > 10,000 µg/L	
		Number	Percent	Number	Percent
DC	1				
FL	2,633				
HI	18				
IA	1,085				
ID	839				
IL	1,493				
IN	1,196				
KS	608				
KY	227				
LA	1,102				
MA	721				
MD	1,055				
ME	749				
MI	2,419	1	0.04%	0	0.00%
MN	1,466				
MO	1,445				
MS	5				
MT	897				
NC	2,356				
ND	160				
NE	705				
NH	1,185				
NJ	1,428				
NM	744				
NV	350				
NY	20				
OH	1,922				
OK	685				
OR	1,132				
PA	3,166	1	0.03%	0	0.00%

State	Total Number of Systems	Systems with a Mean Concentration > 1,000 µg/L[3]		Systems with a Mean Concentration > 10,000 µg/L	
		Number	Percent	Number	Percent
RI	152				
SC	494				
SD	313				
TN	366				
TX	3,826				
UT	471				
VA	1,629				
VT	465				
WA	2,458				
WI	2,026				
WV	386				
WY	317				
Total	**51,074**	**2**	**0.004%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

Exhibit B-68 presents the population served by systems with a mean concentration greater than the MCL concentration by state. The total population served by systems in each state that submitted data for xylenes is presented, as well. As described above, no systems had an estimated mean concentration greater than the MCL. Two systems, serving 825 people, had estimated mean concentrations greater than the potential MCLG (1,000 µg/L).

Exhibit B-68: Xylenes Stage 2 Analysis – Summary of Population Served by Systems with a Mean Threshold Exceedance by State[1,2]

State	Total Population	Population Served by Systems with a Mean Concentration > 1,000 µg/L[3]		Population Served by Systems with a Mean Concentration > 10,000 µg/L	
		Population	Percent	Population	Percent
AK	719,618				
AL	5,334,584				
AR	2,637,712				
AS	62,196				
AZ	6,669,311				

State	Total Population	Population Served by Systems with a Mean Concentration > 1,000 µg/L[3]		Population Served by Systems with a Mean Concentration > 10,000 µg/L	
		Population	Percent	Population	Percent
CA	40,638,016				
CO	2,020				
CT	193,473				
DC	761,124				
FL	19,280,091				
HI	1,094,345				
IA	2,759,457				
ID	1,219,635				
IL	11,019,196				
IN	4,940,108				
KS	2,608,108				
KY	4,225,914				
LA	4,966,653				
MA	9,329,953				
MD	5,120,434				
ME	754,554				
MI	3,470,708	25	0.001%	0	0.00%
MN	4,375,774				
MO	4,975,051				
MS	6,176				
MT	856,529				
NC	7,827,828				
ND	592,539				
NE	1,664,802				
NH	961,134				
NJ	9,272,654				
NM	1,962,298				
NV	2,697,555				
NY	32,600				
OH	10,209,121				
OK	3,588,559				

State	Total Population	Population Served by Systems with a Mean Concentration > 1,000 µg/L[3]		Population Served by Systems with a Mean Concentration > 10,000 µg/L	
		Population	Percent	Population	Percent
OR	3,434,191				
PA	11,234,684	800	0.01%	0	0.00%
RI	1,040,737				
SC	3,637,408				
SD	757,925				
TN	6,578,052				
TX	23,407,822				
UT	2,802,068				
VA	6,908,536				
VT	436,629				
WA	5,535,245				
WI	4,273,462				
WV	1,570,321				
WY	469,314				
Total	**248,916,224**	**825**	**0.0003%**	**0**	**0.00%**

[1] Results are based on setting all non-detection results equal to ½ the MRL values in the SYR3 ICR dataset.

[2] Blank cells within the table indicate that there were no systems with a mean concentration that exceeded either threshold.

[3] The new potential threshold of concern for this contaminant is due to changes in the RfD based on new health effects information.

B.17.3 Summary of Data

A total of 323,477 analytical results from 51,074 PWSs in 50 states/entities were available in the SYR3 ICR Dataset for xylenes. The Stage 2 analysis of occurrence in drinking water indicated that zero systems had an estimated system mean concentration of xylenes greater than the MCL concentration of 10,000 µg/L. Two ground water systems, serving a total of 825 people, had an estimated mean concentration greater than the potential MCLG (1,000 µg/L). These two systems were located in Michigan and Pennsylvania.