United States
Environmental Protection
Agency

Development of Estimated Quantitation Levels for the Third Six-Year Review of National Primary Drinking Water Regulations (Chemical Phase Rules)

Office of Water (4607M)
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Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
DBCP	1,2-dibromo-3-chloropropane
DEHP	di(2-ethylhexyl)phthalate
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
EQL	estimated quantitation level
ICR	Information Collection Request
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MDL	method detection limit
mg/L	milligrams per liter
µg/L	micrograms per liter
MRL	minimum reporting level
NPDWR	National Primary Drinking Water Regulation
PCBs	polychlorinated biphenyls
PQL	practical quantitation level
PT	proficiency testing
RfD	reference dose
SDWA	Safe Drinking Water Act
SOC	synthetic organic compound
VOC	volatile organic compounds

Executive Summary

The U.S. Environmental Protection Agency (EPA) has completed its third Six-Year Review (Six-Year Review 3) of national primary drinking water regulations (NPDWRs). The 1996 Safe Drinking Water Act (SDWA) Amendments require the U.S. Environmental Protection Agency (EPA or the Agency) to periodically review existing NPDWRs. Section 1412(b)(9) of SDWA reads:

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

The primary goal of the Six-Year Review process is to identify NPDWRs for possible regulatory revision. Although the statute does not define when a revision is "appropriate," as a general benchmark, EPA considered a possible revision to be "appropriate" if, at a minimum, it presents a meaningful opportunity to:

- improve the level of public health protection, and/or
- achieve cost savings while maintaining or improving the level of public health protection.

For Six-Year Review 3, EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2016c), analytical feasibility (USEPA, 2016b and 2009a), and occurrence (USEPA, 2016a). EPA identified new health effects or analytical methods information that indicated it may be possible to revise NPDWRs for several contaminants. Consequently, EPA conducted occurrence and exposure analyses at threshold concentrations that are below current maximum contaminant levels (MCLs) to determine if there is a meaningful opportunity to improve the level of public health protection by reducing MCLs. This document describes the data and method EPA used to establish the threshold values that it used for the occurrence analyses.

For some contaminants, new information on analytical feasibility could affect the NPDWR because these are contaminants for which the MCL equals a practical quantitation limit (PQL). EPA evaluated new information for performance testing data, method minimum detection limits (MDL), and compliance data minimum reporting levels (MRL) to determine whether it could develop an estimated quantitation level (EQL) threshold below the current PQL.EPA's method for developing an EQL has essentially three steps – one for each of the three information sources: PT data, MRL data, and MDL values. The first step is to review the conclusion of the PT analysis. If the PT data indicate potential to revise the PQL, then the objective of the next steps is to identify an EQL (or verify the use of a health-based threshold) for the occurrence analysis. The second step is to determine whether the modal MRL is a feasible EQL and, if so, the third step is to determine whether the MDL multiplier approach supports that EQL value. If the modal MRL is not a feasible EQL, then EPA uses the MDL multiplier approach to establish an EQL.

If the PT data do not indicate potential to revise the PQL, then the objective of the next steps is to determine whether the MRL and MDL data concur with this finding. When the MRL and MDL data confirm the finding, there is no basis for an EQL that is less than the PQL. When these data contradict the finding, however, EPA used these secondary data sources to derive an EQL (or verify the use of a health-based threshold) for the occurrence analysis.

MCL Currently Limited by PQL

The summary in **Exhibit ES-1** shows that these data sources did not support EQL development for seven contaminants. EPA based EQLs on MDL data for five contaminants and MRL data for one. The MDL data indicate the greatest potential to revise PQL values. EPA used the MDL data to derive an EQL for the following contaminants: chlordane, heptachlor, heptachlor epoxide, hexachlorobenzene, and toxaphene. EPA did not use MDL values to develop EQL values for three contaminants despite there being an MDL lower than the PQL: benzo[a]pyrene, DBCP, and pentachlorophenol. For benzo[a]pyrene, an EQL based on the MDL would be the same as the PQL. For DBCP, an EQL based on MDL data was less than 70 percent of the MRL values in the database. For pentachlorophenol, EPA did not develop an EQL because six of the seven MDL values rounded to or exceeded the PQL.

Exhibit ES-1. EQL Threshold Results

Contaminant	PQL (µg/L)	EQL (µg/L)	Basis
Benzo[a]pyrene	0.2	none	Data do not support EQL < PQL
Chlordane	2	1	Based on 10 × MDL
1,2-Dibromo-3-Chloropropane	0.2	none	Data do not support EQL < PQL
Di (2-ethylhexyl)phthalate	6	none	Data do not support EQL < PQL
Ethylene Dibromide	0.05	none	Data do not support EQL < PQL
Heptachlor	0.4	0.1	Based on 10 × MDL
Heptachlor Epoxide	0.2	0.04	Based on 10 × MDL
Hexachlorobenzene	1	0.1	Based on 10 × MDL
Pentachlorophenol	1	none	Data do not support EQL < PQL
Polychlorinated Biphenyls	0.5	none	Data do not support EQL < PQL
Dioxin	3.0×10^{-5}	5.0×10^{-6}	Based on MRL mode
Thallium	2	none	Data do not support EQL < PQL
Toxaphene	3	1	Based on 10 × MDL
1,1,2-Trichloroethane	5	3	Based on MCLG (EQL < MCLG)

MCL Greater than Possible MCLG

For other contaminants, new health effects information indicates a possible lower maximum contaminant level goal (MCLG), which is a non-regulatory, health protection goal. For these contaminants, the MCL is currently equal to the MCLG. A lower MCLG is an opportunity to lower the MCL. Therefore, EPA reviewed quantitation data to evaluate the feasibility of an MCL as low as the potential MCLG.

Exhibit ES-2 provides a summary of the occurrence thresholds for this contaminant group. EPA's analysis indicates that most of the thresholds can be set equal to corresponding possible MCLG values, regardless of whether PQL values exceed possible MCLGs. In five cases, alternative values must be used because analytical feasibility will most likely limit setting an MCL equal to a possible MCLG.

For six contaminants – carbofuran, cyanide, endothall, methoxychlor, oxamyl, and styrene – the PQL potentially limits setting an MCL equal to the possible MCLG. For carbofuran, cyanide, and methoxychlor, the EQL was based on 10 x MDL and supported threshold values that were less than the PQL. For endothall and oxamyl, although the PT data do not support a reduction of the PQLs, the MRL and MDL data do support the use of the possible MCLG values as thresholds for the occurrence analysis.

Finally, for styrene, the modal MRL meets the EQL criteria.

Exhibit ES-2. Occurrence Threshold Results

Contaminant	Possible MCLG (µg/L)	Occurrence Threshold (µg/L)	Basis
Carbofuran	0.6	5	EQL based on 10 × MDL
Cyanide	4	50	EQL based on 10 × MDL
cis-1,2-Dichloroethylene	10	10	possible MCLG
Endothall	50	50	possible MCLG
Fluoride	900	900	Possible MCLG
Hexachlorocyclopentadiene	40	40	possible MCLG
Methoxychlor	0.1	1	EQL based on 10 × MDL
Oxamyl	10	10	possible MCLG
Selenium	40	40	possible MCLG
Styrene	0	0.5	EQL based on MRL mode
Toluene	600	600	possible MCLG
Xylene	1000	1000	possible MCLG

1 Introduction

The U.S. Environmental Protection Agency (EPA or the Agency) has conducted its third Six-Year Review ("Six-Year Review 3") of national primary drinking water regulations (NPDWRs). The 1996 Safe Drinking Water Act (SDWA) Amendments require that the Agency periodically review existing NPDWRs. Section 1412(b)(9) of SDWA reads:

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

The primary goal of the Six-Year Review process is to identify possible regulatory revisions. Although the statute does not define when a revision is "appropriate," as a general benchmark, EPA considered a possible revision to be "appropriate" if, at a minimum, it presents a meaningful opportunity to:

- improve the level of public health protection, and/or
- achieve cost savings while maintaining or improving the level of public health protection.

For Six-Year Review 3, EPA implemented the protocol that it developed for the first Six-Year Review (USEPA, 2003), as revised during the second Six-Year Review (USEPA, 2009c). EPA obtained and evaluated new information on various factors that could indicate potential to revise an NPDWR: health effects (USEPA, 2016c), analytical feasibility (USEPA, 2016b), and occurrence (USEPA, 2016a). This document serves as a bridge between the findings of the health effects and analytical feasibility studies, which identify opportunities for NPDWR revisions, and the occurrence analysis, which identifies whether a revision is a meaningful opportunity for health risk reduction.

1.1 Background

An NPDWR includes a maximum contaminant level (MCL), which is the regulatory limit for the amount of a contaminant allowed in water distributed by public water systems. EPA establishes MCLs after identifying a maximum contaminant level goal (MCLG). The MCLG is a concentration at which no known or anticipated adverse human health effect occurs. For carcinogens, the MCLG is often equal to zero because there is no known safe dosage. For other contaminants, the MCLG is based on a reference dose (RfD) at which EPA does not expect adverse health effects to occur.

After identifying the MCLG, EPA must set the MCL as close to the MCLG as feasible. For some contaminants, it is not feasible to set the MCL equal to the MCLG because of limitations in contaminant measurement capabilities at very low concentrations. EPA identifies a practical quantitation limit (PQL) when it establishes an NPDWR, which is "the lowest achievable level of analytical quantitation during routine laboratory operating conditions within specified limits of precision and accuracy" (50 *Federal Register* 46902, November 13, 1985). Thus, a PQL reflects

both the physical limitation of approved analytical methods and the practical limitations of variability in laboratory performance nationwide.

For a carcinogen, EPA often bases the MCL on the PQL because it is not possible to measure concentrations all the way down to zero. Analytical feasibility can improve over time, however. Consequently, the Six-Year Review process is an opportunity to evaluate whether new information regarding quantitation shows that PQLs for carcinogens can be reduced, which introduces the possibility of reducing the MCLs for carcinogens.

1.2 Estimated Quantitation Level Development

When analytical methods information indicates potential to revise an MCL, EPA estimates occurrence to evaluate whether the revision could be a meaningful opportunity for health risk reduction. The occurrence estimates provide information on the number of systems and people a revision might affect. To derive these estimates, EPA identifies a threshold value below the current MCL at which to estimate occurrence. The threshold represents an estimated quantitation level (EQL).[1] This report documents EPA's approach to identifying these thresholds.

EPA used these thresholds to estimate possible system and population impacts in the occurrence and exposure analysis conducted for the third Six-Year Review (USEPA, 2016a). EPA compared contaminant occurrence estimates for these thresholds (i.e., the number of systems with water quality exceeding a threshold) with baseline occurrence estimates at current MCLs. The difference between these two occurrence estimates indicates potential for health risk reduction of an MCL revision. EPA based its determinations about whether a reduction in the MCL for a contaminant would provide a meaningful opportunity to improve the level of public health protection on these estimates.

Analyzing the feasibility of reducing a contaminant's current PQL was one of the review tasks of the Six-Year Review 3. For the PQL assessment, EPA obtained and evaluated new information regarding the potential to revise PQL values. The primary sources of information for the PQL assessment were laboratory proficiency testing (PT) study results obtained during Six-Year Review 2 and Six-Year Review 3. The PT studies involve the use of spiked samples to evaluate laboratory quantitation capabilities. USEPA (2016b) describes the review method, PT data, and findings for the PQL analysis. For Six-Year Review 3, EPA did not always have sufficient PT data below current PQLs to actually recalculate any PQL or derive EQLs for the occurrence and exposure analysis. Instead, EPA used the PT study passing rate results (i.e., the percent of laboratories passing a performance test for a given study) at and below the current PQL and the result of a linear regression analysis to indicate whether the PT data support a reduction in the PQL.

Because the PT results were either not available below the PQL or did not provide conclusive indications regarding a potential to revise a PQL or how far below the PQL quantitation might be feasible, EPA relied on two alternate approaches to estimate EQLs: an approach based on the minimum reporting levels (MRLs) obtained as part of the Six-Year Review 3 Information Collection

[1] Although the EQLs are estimates of quantitation capabilities below a PQL, they do not represent the Agency's intent to promulgate new PQLs. Any revisions to regulatory monitoring requirements such as PQLs will be made as part of future rule-making efforts.

Request (ICR), and an approach based on method detection limits (MDL). While EPA prefers to use laboratory performance data to calculate the PQL, the MRL and MDL information can be valuable to indicate whether it is possible to quantitate at levels below the current PQL.

An MRL is the lowest level or contaminant concentration that a laboratory can reliably achieve within specified limits of precision and accuracy under routine laboratory operating conditions using a given method (USEPA, 2016a). The MRL values provide direct evidence from actual monitoring results about whether quantitation below the PQL using current analytical methods is feasible. An MDL is a measure of analytical method sensitivity (USEPA, 2016b). MDLs have been used in the past to derive PQLs for regulated contaminants. In addition, EPA used MDLs to help identify possible analytical feasibility levels for Six-Year Review 1 (USEPA, 2003b). Consequently, EPA used the MDLs as a second input to the EQL development process. Both sources of data provide additional information on the feasibility of revising PQLs. Therefore, the Agency also evaluated whether MRL and MDL data confirmed or contradicted the conclusions of the PT data review. For most contaminants, the MRL and MDL data supported EPA's conclusion based on PT data.

1.3 Contaminants

For most contaminants, EPA established an EQL, which is an estimate of the possible lower bound for a PQL. The current PQL for a contaminant is based on historical analytical capabilities, generally the quantitation capabilities at the time EPA promulgated the existing NPDWR for the contaminant. When a contaminant has a PQL that is higher than its MCLG, the MCL cannot be lower than the PQL. Thus, improvements in analytical feasibility indicate potential opportunity to lower the PQL for some contaminants that have MCLs limited by PQLs, and, therefore, lower the MCL closer to MCLG.

Exhibit 1-1 shows contaminants for which historical PQLs provided a lower bound on MCLs. Most of the contaminants are carcinogens for which MCLGs are equal to zero. For two, however, MCLGs are nonzero, but PQLs precluded setting MCLs as low as the MCLGs. Findings on the PT data supporting PQL revision from the analytical feasibility studies (USEPA, 2016b) are also included in the able. EPA evaluated whether new information indicated possible EQL values less than the PQLs shown in the table.

Exhibit 1-1. Contaminants Where MCLs Limited by Analytical Feasibility

Contaminant	MCLG (µg/L)	PQL (µg/L)	MCL (µg/L)	Do PT Data Support PQL Revision?
Benzo[a]pyrene	0	0.2	0.2	No
Chlordane	0	2	2	No
1,2-Dibromo-3-Chloropropane	0	0.2	0.2	No
Di (2-ethylhexyl)phthalate	0	6	6	No
Ethylene Dibromide	0	0.05	0.05	No
Heptachlor	0	0.4	0.4	No
Heptachlor Epoxide	0	0.2	0.2	No
Hexachlorobenzene	0	1	1	Yes
Pentachlorophenol	0	1	1	No
Polychlorinated Biphenyls	0	0.5	0.5	No
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	0	3.0×10^{-5}	3.0×10^{-5}	No

Contaminant	MCLG (µg/L)	PQL (µg/L)	MCL (µg/L)	Do PT Data Support PQL Revision?
Thallium	0.5	2	2	No
Toxaphene	0	3	3	No
1,1,2-Trichloroethane	3	5	5	Yes

Source: USEPA, 2016b and 2009a.

For many other contaminants, EPA set the MCL equal to the MCLG. Because the MCLG is based on health risk information, new information such as a new health risk study may indicate that this value should be lower. **Exhibit 1-2** shows contaminants for which new health effects information since EPA promulgated the NPDWRs indicates possible MCLGs that are lower than current MCLGs. For these contaminants, EPA determined whether the threshold for the occurrence analysis could equal the possible MCLG and, if not, determined whether quantitation information supported an EQL below the current MCLG.

Exhibit 1-2. Contaminants Where MCLs are Greater than Possible Lower MCLGs

Contaminant	Current MCLG (µg/L)	PQL (µg/L)	MCL (µg/L)	Possible MCLG (µg/L)	Do PT Data Support PQL Revision?
Carbofuran	40	7	40	0.6	No
Cyanide	200	100	200	4	No
cis-1,2-Dichloroethylene	70	5	70	10	Yes
Endothall	100	90	100	50	No
Fluoride	4000	500	4000	900	No
Hexachlorocyclopentadiene	50	1	50	40	No
Methoxychlor	40	10	40	0.1	Yes
Oxamyl	200	20	200	10	No
Selenium	50	10	50	40	No
Styrene	100	5	100	0	Yes
Toluene	1,000	5	1,000	600	Yes
Xylene	10,000	5	10,000	1,000	No

Source: USEPA, 2016b and 2009a.

This report documents EPA's selection of thresholds for the occurrence analysis of these two groups of drinking water contaminants and contains the following: descriptions of the available data sources (Section 2); a description of the approaches EPA used to evaluate the data and select occurrence thresholds (Section 3): detailed results by contaminant (Section 4); and a summary of the thresholds selected for the occurrence analysis (Section 5).

2 Data Sources

An EQL is an estimate of a possible quantitation limit below a PQL. Therefore, EPA sought to base EQL values on the same type of data that it used to derive PQLs. EPA developed PQLs using two approaches (USEPA, 2009a). The first approach, which EPA prefers, requires laboratory performance testing (PT) data. For a performance test, multiple laboratories quantitate samples that a testing facility has spiked with a known contaminant concentration. The testing facility reviews the results and determines how many laboratories estimate a value within an accuracy range around the spiked value (e.g., plus or minus 20%). The percentage of laboratories in the accuracy range is the passing rate (e.g., if 15 of 20 are in the range, the passing rate is 75%). A PQL based on PT data is the lowest value for which at least 75 percent of laboratories tested can quantitate within prescribed accuracy limits.

When PT data were not available, EPA used a second approach to derive PQLs. This approach utilizes minimum detection level (MDL) data for applicable analytical methods. For this approach, EPA multiplies an MDL by a factor – usually 5 or 10 – to compute a PQL.

For Six-Year Review 3 and the second Six-Year Review, EPA obtained PT study results from testing facilities (USEPA 2016b and 2009a). The value reported for each PT study is a passing rate, which is the percent of laboratories that successfully quantitated samples spiked with a particular concentration within prescribed accuracy limits. Although PT passing rates would seem to be ideal data for developing EQL values, unfortunately the studies were rarely conducted at spiked values that are less than the PQLs. Therefore, the PT data could only provide a general indication of whether there is potential to derive an EQL below the PQL.

Because of insufficient PT data, EPA used minimum reporting levels (MRLs) from the Six-Year Review 3 Information Collection Request (ICR) database along with the MDL approach to derive EQLs. Section 2.1 describes the MRL data. Section 2.2 describes the source of MDLs.

2.1 MRL Data

The Six-Year Review 3 ICR database contains compliance monitoring data for 2006 through 2011. USEPA (2016a) provides a description of the data collection, data management, and quality assurance methods the Agency used to establish a high quality, national contaminant occurrence database consisting of data from 46 states plus Washington, D.C., American Samoa, and many other primacy entities such as Tribes. This database contains several million drinking water compliance monitoring samples.

This Six-Year Review 3 ICR database also contains a substantial number of MRL values. An MRL is the lowest level or contaminant concentration that a laboratory can reliably achieve within specified limits of precision and accuracy under routine laboratory operating conditions using a given method (USEPA, 2016a). In other words, the MRL is the lowest contaminant concentration that can be reliably quantified in the laboratory and reported to primacy agencies.

When compliance monitoring data are recorded, laboratories should report "<MRL" (i.e., less than the MRL) along with a numeric MRLs when contaminant concentrations are less than the MRL. Because of inconsistencies in data entry or reporting across laboratories or states, EPA

performed a variety of data quality checks and data transformations on the MRL data in consultation with state data management staff. USEPA (2016a) describes the data management process, including measures taken to address data quality concerns that affect the occurrence and exposure analysis.

The MRL values provide EPA with valuable insight into actual analytical capabilities across laboratories and States. MRLs can vary across laboratories because of differences in the analytical method used as well as differences in instrumentation, implementation, and reporting. By examining the distribution of MRL values for a contaminant, EPA can identify whether laboratory performance is relatively uniform (e.g., most MRLs are the same) or highly variable (e.g., MRLs that vary by one or more orders of magnitude). In particular, the mode or most frequently occurring value is a potential candidate for EQL when a substantial share of the MRL values for a contaminant equal the modal MRL[2].

2.2 MDL Data

The MDL multiplier approach for estimating an EQL applies a multiplier usually ranging from five to ten to the MDL. An MDL is a measure of analytical method sensitivity (USEPA, 2016b), defined in 40 CFR Part 136 Appendix B as "the minimum concentration of a substance that can be reported with 99 percent confidence that the analyte concentration is greater than zero" for a given method. Although EPA has used this method to establish PQLs in the past, EPA is not using MDLs for this purpose during Six-Year Review 3. Instead, EPA is using the MDL approach to help identify EQLs below current PQLs for occurrence and exposure analysis.

MDLs can vary by analytical method and contaminant. USEPA (2016b) and USEPA (2009a) provide MDLs by contaminant and analytical method. The MDL values or ranges of values are for the approved analytical methods developed by EPA for drinking water compliance monitoring.

Summary data by contaminant and method in Section 4 of this document includes only upper bound values for any MDL ranges reported in USEPA (2016b) or USEPA (2009a). EPA used only upper bound values for a particular method and contaminant in an effort to derive an EQL that would represent a level at which most laboratories should be able to quantitate; the lower bound value could result in an EQL that is below the analytical capabilities of some laboratories. The multiplier for MDLs is used to account for the variability and uncertainty that can occur at the MDL. Historically, the MDL multiplier method was mostly used in the early years of rule development for NPDWRs when insufficient PT data were available. Once sufficient data became available, most of the PQLs that were developed using the MDL multiplier were validated using PT data.

[2] The modal MRL used in the EQL analysis is the mode across all reported MRL values for a contaminant in the SYR3 ICR dataset. This mode may differ from the mode reported in *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* (USEPA, 2016a), which reports the mode of the state-level modes instead of the mode of all MRL value.

3 Threshold Development Method

This section provides an overview of the method EPA used to identify thresholds for the third Six-Year Review occurrence analysis. For the contaminants shown in Exhibit 1-1 (current MCL based on PQL), EPA evaluated available data to derive an EQL. For the contaminants shown in Exhibit 1-2 (current MCL based on MCLG), EPA first determined whether the possible MCLG (USEPA, 2015c) could be the threshold. When available information did not support quantitation as low as the possible MCLG, EPA evaluated whether it could derive an EQL between the PQL and possible MCLG.

As noted in Section 2, EPA used three sources of information to derive an EQL:

- PT passing rates reported in the analytical methods analysis (USEPA 2016b and 2009a);
- MRL values from the occurrence database; and
- MDL values for EPA-developed analytical methods.

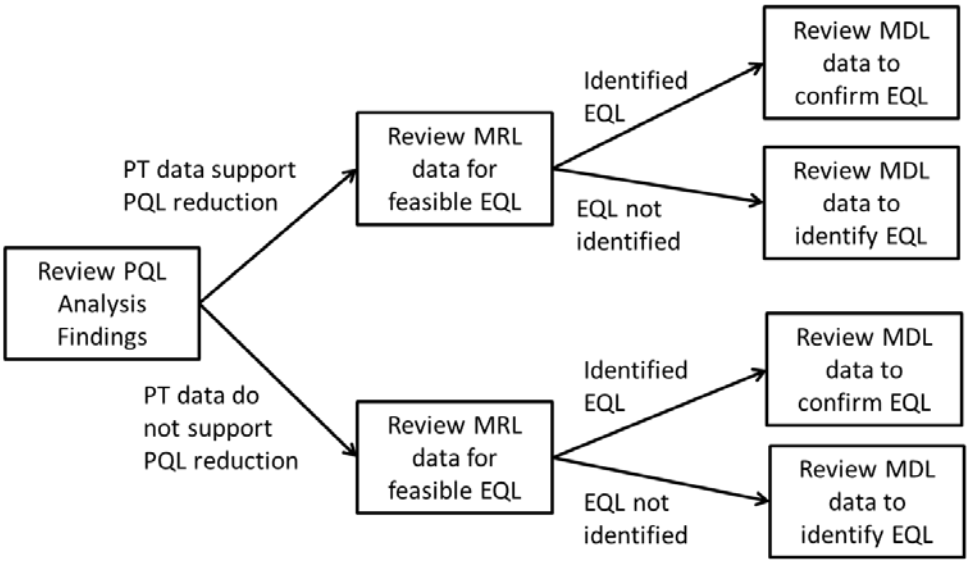
First, EPA evaluated whether the PT data indicated potential to revise the PQL. However, the PT studies were rarely conducted at spiked concentrations lower than current PQLs and thus the data are limited for identifying an EQL. Nevertheless, indications of potential to revise would add credibility to EQLs based on the other two data sources. Therefore, EPA primarily considered whether there were several studies for spiked values less than the PQL with passing rates greater than 75%. This type of PT data would be clear indication of potential to reduce the PQL.

Second, EPA evaluated the MRL data using the analysis method developed for second Six-Year Review (2009b). The Agency identified the mode and estimated the percentage of MRL values less than or equal to the mode. When 80 percent or more of the MRL values were less than or equal to the mode, it was a candidate EQL value as long as it was less than the corresponding PQL.

If the modal MRL was not a feasible EQL candidate, then EPA reviewed the MDL data to determine the feasibility of deriving an EQL by multiplying the MDL by a factor of 10 (or 5 for EDB and dioxin based on the factor used for original PQL development). In some instances, there were multiple MDL values. EPA based the EQL on the highest factor-adjusted MDL value that was less than the PQL.

For the contaminants shown in Exhibit 1-1, if the available data did not support an EQL less than the PQL, then EPA did not develop an EQL. For those shown in Exhibit 1-2, if the data supported an EQL value that was less than the possible MCLG, then EPA noted this and used the possible MCLG as the threshold for the occurrence analysis. **Exhibit 3-1** provides a summary of the EQL steps.

Exhibit 3-1. EQL Development Steps



Note: When the feasible EQL is less than a possible MCLG, then the occurrence threshold is the possible MCLG

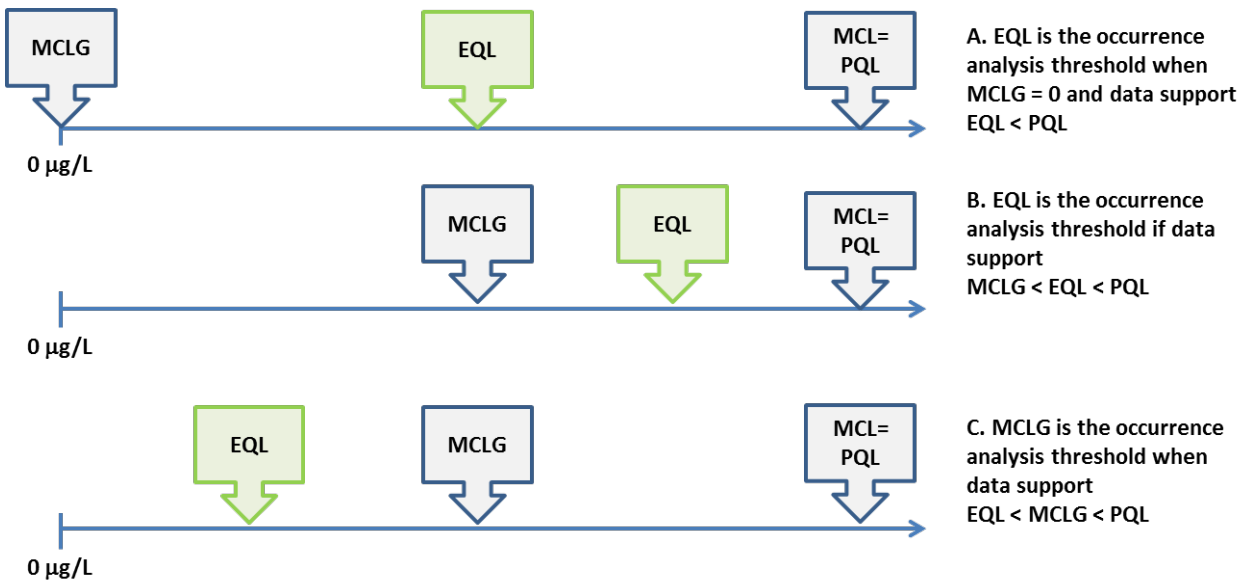
4 Development of Individual EQLs

This section provides a discussion of the occurrence thresholds developed for the contaminants addressed in this report. Where applicable, the discussion for each contaminant contains an overview of the PQL review in USEPA (2016b and 2009a), followed by MRL summary data and MDL values. There are two subsections – one for the contaminants shown in Exhibit 1-1 and one for those shown in Exhibit 1-2.

4.1 MCL Currently Limited by PQL

Most of the contaminants for which the MCL equals the PQL are carcinogens for which MCLGs are zero. **Exhibit 4-1** illustrates the analysis objective for these contaminants – to identify an EQL that is less than the current PQL to use as an occurrence threshold (case A). For two contaminants, however, a PQL limits the MCL, which is greater than a nonzero MCLG. For these contaminants, if data support an EQL that is less than the PQL, then the occurrence threshold depends on whether the EQL is greater than the MCLG (case B) or is less than the MCLG (case C).

Exhibit 4-1. Occurrence Analysis Threshold Selection Scenarios



4.1.1 Benzo[a]pyrene

The MCL for benzo[a]pyrene equals the PQL of 0.2 µg/L. The MCLG is zero. Although a health effects assessment is in progress, there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There are no PT study results at spiked concentrations below the PQL and several passing rates for the available PT studies at concentrations greater than the PQL are below 75 percent

(USEPA, 2009a). Because of the lack of data below the PQL and passing rate variability, EPA determined that PT data do not support reduction of the PQL.

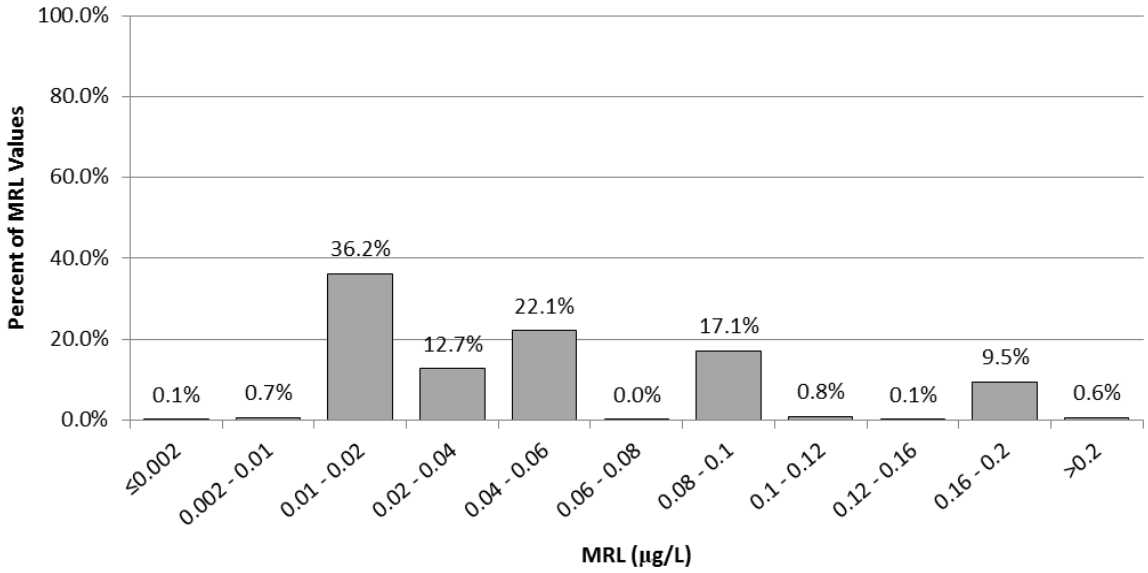
As shown in **Exhibit 4-2**, the modal MRL for benzo[a]pyrene is 0.02 µg/L. Summary data show that 35.6 percent of the MRLs are equal to this value and 37 percent are equal to or less than it. **Exhibit 4-3** shows that there are multiple clusters of MRLs between the mode and the PQL of 0.2 µg/L. Unlike the PT data, the MRL data indicate that there may be potential to lower the PQL because over 99 percent of the MRL values are below the PQL. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold, however. Therefore, EPA did not base the EQL on the modal MRL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-2. Summary of MRL Data for Benzo[a]pyrene

MRL Value Category	Number of Records	Percentage of Records
All	60,569	100%
Less than mode	872	1.4%
Equal to mode (0.02 µg/L)	21,563	35.6%
Greater than mode	38,134	63.0%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-3. MRL Distribution for Benzo[a]pyrene



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-4 shows EPA's approved methods for the detection of benzo[a]pyrene, and corresponding MDLs. Multiplying the MDLs by 10 results in a possible EQL range from 0.16 to 2.3 µg/L. The lower bound of this range rounds to 0.2 µg/L, which is the PQL. Thus, the MDL data do not support an EQL below the PQL.

Exhibit 4-4. Analytical Methods for Benzo[a]pyrene

Method	MDL (µg/L)	MDL x 10 (µg/L)
525.2	0.23	2.3
550	0.029	0.29
550.1	0.016	0.16

Source: USEPA, 2009a (upper bound values when ranges are reported)

EPA concluded that although MRL values are generally below the PQL, the combination of PT and MDL data do not support revision of the PQL for benzo[a]pyrene. Therefore, EPA did not develop an EQL.

4.1.2 Chlordane

The MCL for chlordane equals the PQL of 2 µg/L. The MCLG is zero and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

The PT data does not include studies with spiked concentrations less than the PQL. Passing rates for the studies above the PQL are greater than 75 percent (USEPA, 2016b). Because there are no

studies at concentrations less than the PQL, EPA determined that PT data do not support reduction of the PQL.

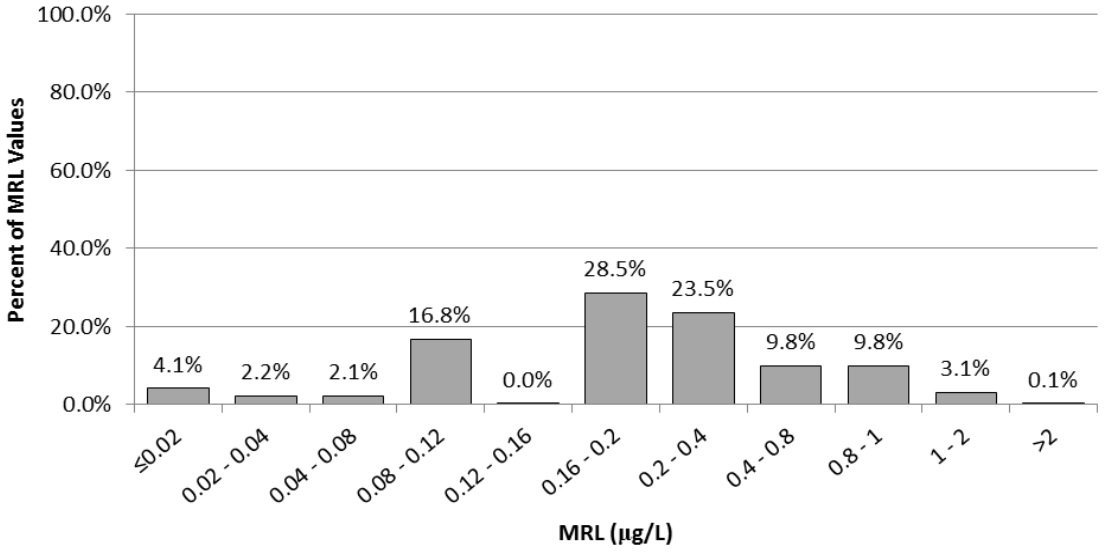
As shown in **Exhibit 4-5**, the modal MRL for chlordane is 0.2 µg/L. Almost 54 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-6** shows that more than 99 percent of the MRL values are less than the PQL of 2 µg/L. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-5. Summary of MRL Data for Chlordane

MRL Value Category	Number of Records	Percentage of Records
All	59,923	100%
Less than mode	15,272	25.5%
Equal to mode (0.2 µg/L)	16,932	28.3%
Greater than mode	27,719	46.3%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-6. MRL Distribution for Chlordane



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-7 shows EPA's approved methods for the detection of chlordane and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.015 to 2.2 µg/L. One of these values is greater than the PQL. EPA used the highest value below the PQL (1.4 µg/L) and rounded to 1 µg/L to obtain an EQL. Almost 97 percent of the MRLs for chlordane in the Six-Year Review 3 ICR database are less than or equal to 1 µg/L.

Exhibit 4-7. Analytical Methods for Chlordane

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	0.14	1.4
508	0.0015	0.015
508.1	0.004	0.04
525.2	0.22	2.2
525.3	0.002	0.02

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.3 1,2-Dibromo-3-chloropropane (DBCP)

The MCL for DBCP equals the PQL of 0.2 µg/L. The MCLG is zero and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

The PT data show greater than 80 percent passing rates for all studies. There are, however, no studies with spiked values below the PQL (USEPA, 2016b). Because there are no studies below the PQL, EPA determined that PT data do not support reduction of the PQL.

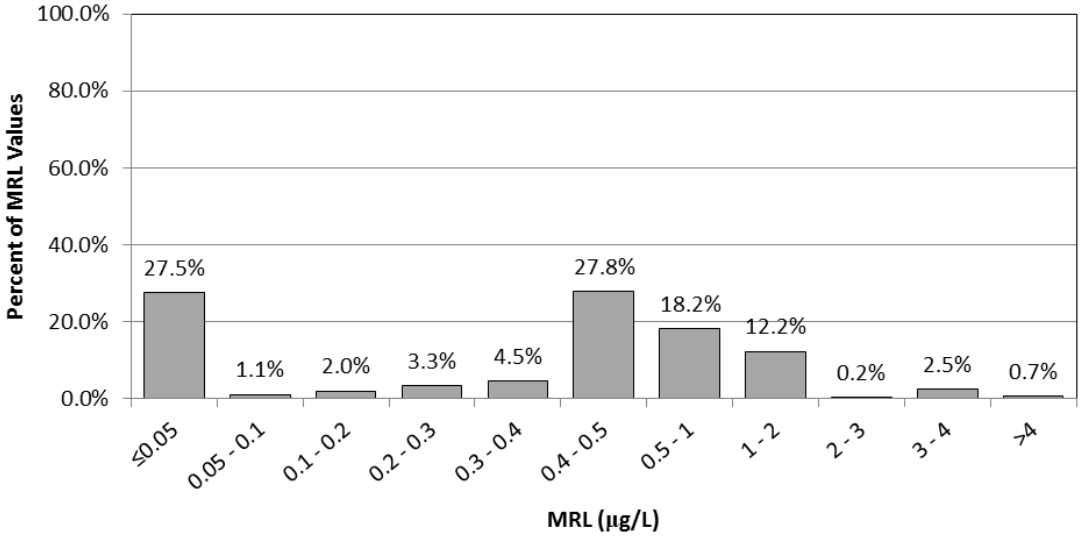
As shown in **Exhibit 4-8**, the modal MRL for DBCP is 0.5 µg/L, which is greater than the PQL of 0.2 µg/L. Therefore, EPA did not base the EQL on the modal MRL regardless of the large proportion of MRL values below the mode. **Exhibit 4-9** shows that almost 70 percent of the MRL values are greater than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-8. Summary of MRL Data for DBCP

MRL Value Category	Number of Records	Percentage of Records
All	126,959	100%
Less than mode	49,261	38.8%
Equal to mode (0.5 µg/L)	34,759	27.4%
Greater than mode	42,939	33.8%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-9. MRL Distribution for DBCP



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-10 shows EPA's approved methods for the detection of DBCP and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.09 to 2.6 µg/L. EPA excluded the highest values, which exceed the PQL. The higher of the two remaining values indicate a potential EQL of 0.1 µg/L.

Exhibit 4-10. Analytical Methods for DBCP

Method	MDL (µg/L)	MDL x 10 (µg/L)
504.1	0.01	0.1
524.2	0.26	2.6
524.3	0.063	0.63
551.1	0.009	0.09

Source: USEPA, 2016b (upper bound values when ranges are reported)

Neither the MRL nor PT data support establishing an EQL value that is less than the PQL of 0.2 µg/L. Although the MDL data support an EQL of 0.1 µg/L, almost 70 percent of the MRL values are greater than this value. Therefore, EPA did not develop an EQL.

4.1.4 Di(2-ethylhexyl)phthalate (DEHP)

The MCL for DEHP equals the PQL of 6 µg/L. The MCLG is zero. Although a health effects assessment is in progress, there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

Passing rates for several PT studies are below 75 percent, including two studies with spiked concentrations below the PQL (USEPA, 2009a). Because of the low passing rates, EPA determined that PT data do not support reduction of the PQL.

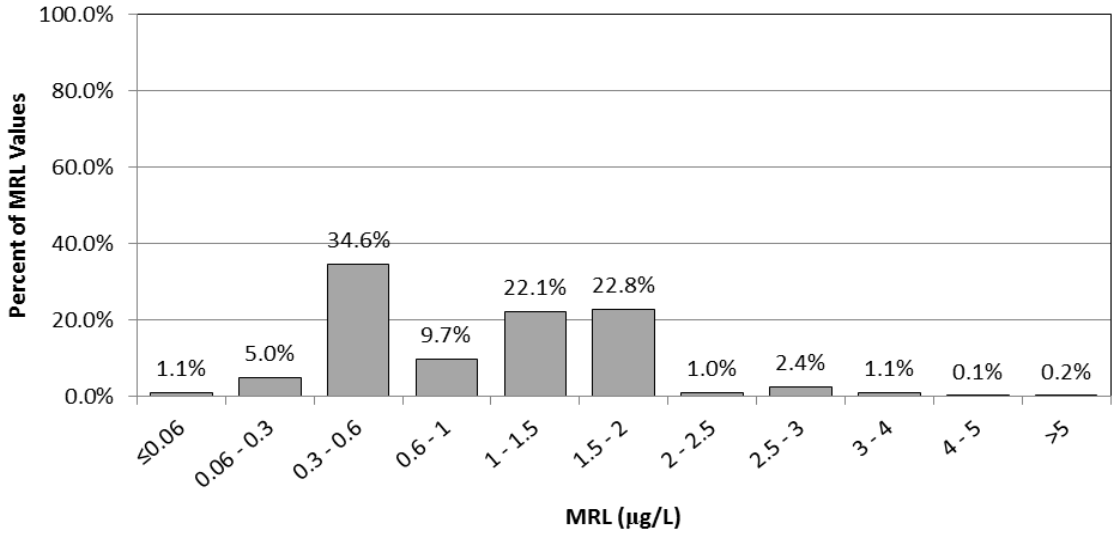
As shown in **Exhibit 4-11** and, the modal MRL for DEHP is 0.6 µg/L. Summary data show that 31.8 percent of the MRLs are equal to this value, and 40.7 percent of the MRL values are equal to or less than it. **Exhibit 4-12** shows multiple clusters of MRLs between the mode and the PQL of 6 µg/L. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because more than 99 percent of values are below the PQL. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-11. Summary of MRL Data for DEHP

MRL Value Category	Number of Records	Percentage of Records
All	55,550	100.0%
Less than mode	4,942	8.9%
Equal to mode (0.6 µg/L)	17,648	31.8%
Greater than mode	32,960	59.3%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-12. MRL Distribution for DEHP



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-13 shows EPA's approved methods for the detection of DEHP, and the MDLs. Applying a multiplier of 10 gives a possible EQL range from 13 to 22.5 µg/L. This range is greater than the PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-13. Analytical Methods for DEHP

Method	MDL (µg/L)	MDL x 10 (µg/L)
506	2.25	22.5
525.2	1.3	13

Source: USEPA, 2009a (upper bound values when ranges are reported)

EPA concluded that although MRL values are generally below the PQL, the combination of PT and MDL data do not support revision of the PQL for DEHP. Therefore, EPA did not develop an EQL.

4.1.5 Ethylene Dibromide (EDB)

The MCL for EDB equals the PQL of 0.05 µg/L. The MCLG is zero and there is no new health effects information that suggests a change in the MCLG. Therefore, the threshold for an occurrence analysis is based on analytical feasibility.

There are no PT study results with spiked concentrations below the PQL. The results for spiked concentrations greater than the PQL are scattered throughout the range from 75 percent to 100 percent (USEPA, 2009a). Therefore, EPA determined that the PT data do not support PQL reduction.

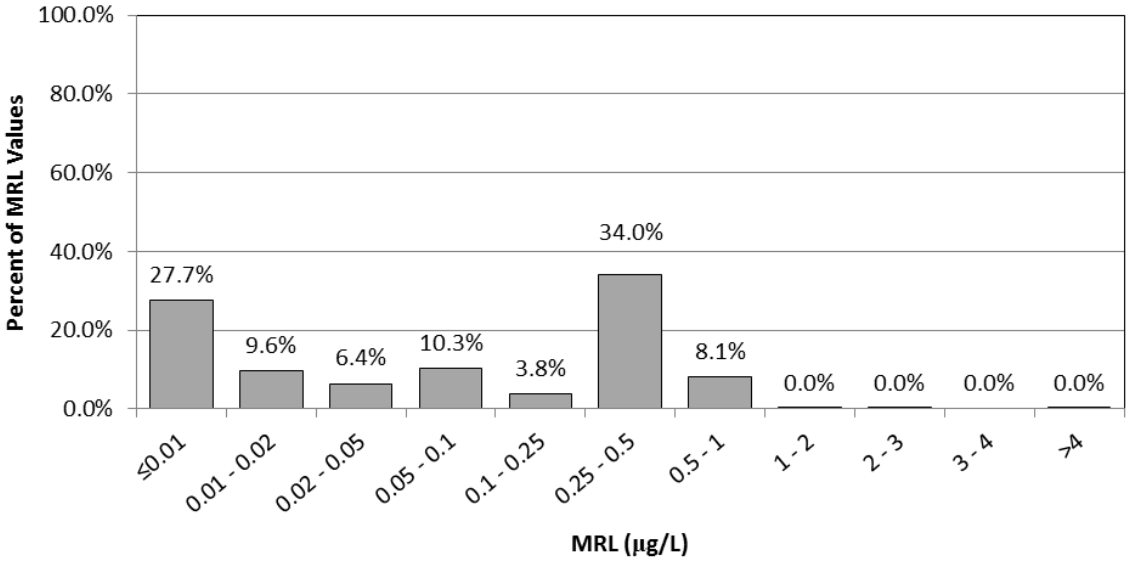
As shown in **Exhibit 4-14**, the modal MRL for EDB is 0.5 µg/L which is greater than the PQL of 0.05 µg/L. Therefore, EPA did not base the EQL on the modal MRL regardless of the large proportion of MRL values below the mode. **Exhibit 4-15** shows that about 56 percent of the MRL values are greater than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-14. Summary of MRL Data for EDB

MRL Value Category	Number of Records	Percentage of Records
All	88,891	100%
Less than mode	55,401	62.3%
Equal to mode (0.5 µg/L)	26,205	29.5%
Greater than mode	7,285	8.2%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-15. MRL Distribution for EDB



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-16 shows EPA's approved methods for the detection of EDB, and the MDLs. Applying a multiplier of 5 would give a possible EQL range from 0.05 to 0.16 µg/L. This range is equal to or greater than the PQL. Thus, the MDL data do not support an EQL below the PQL.

Exhibit 4-16. Analytical Methods for EDB

Method	MDL (µg/L)	MDL x 5 (µg/L)
504.1	0.01	0.05
551.1	0.032	0.16

Source: USEPA, 2009a (upper bound values when ranges are reported)

EPA concluded that all three information sources – PT, MRL, and MDL data – do not support a reduction of the PQL for EDB. Therefore, EPA did not develop an EQL.

4.1.6 Heptachlor

The MCL for heptachlor equals the PQL of 0.4 µg/L. The MCLG is zero, and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There are only two PT studies with spiked values below the PQL, both of which have passing rates greater than 75%. The PT data for spiked values greater than the PQL show passing rates scattered throughout the range from 75 percent to 100 percent (USEPA, 2016b). Because there are only a couple of studies below the PQL, EPA determined that the PT data do not support PQL reduction.

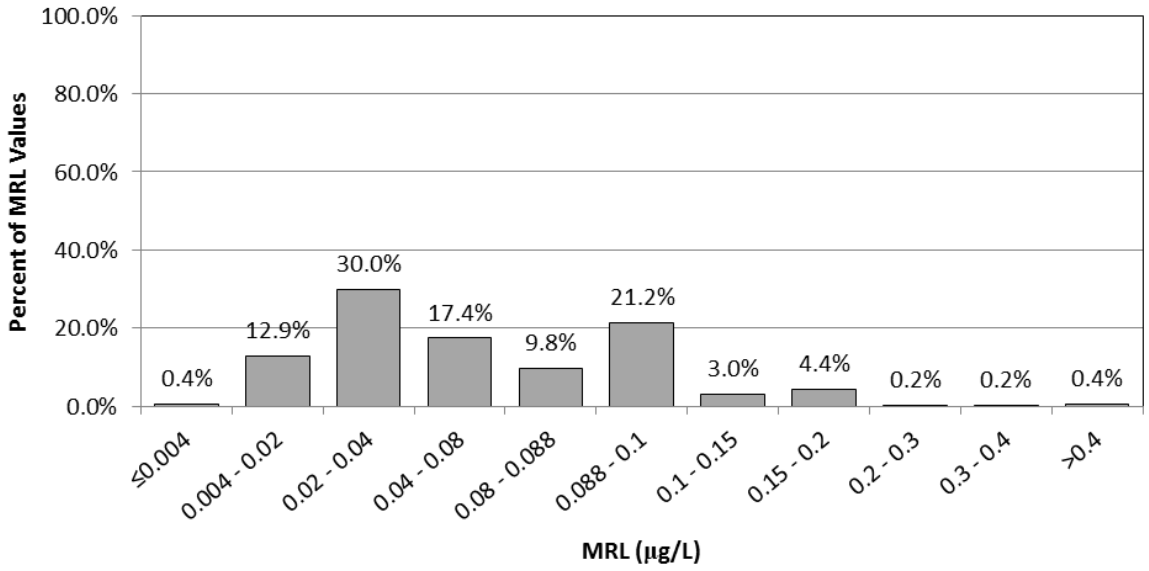
As shown in **Exhibit 4-17,** the modal MRL for heptachlor is 0.04 µg/L. Summary data show that 27.9 percent of the MRLs are equal to this value, and 43.4 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-18** shows that more than 99 percent of the MRL values are less than the PQL of 0.4 µg/L. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-17. Summary of MRL Data for Heptachlor

MRL Value Category	Number of Records	Percentage of Records
All	63,810	100%
Less than mode	9,863	15.5%
Equal to mode (0.04 µg/L)	17,794	27.9%
Greater than mode	36,153	56.7%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-18. MRL Distribution for Heptachlor



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-19 shows EPA's approved methods for the detection of heptachlor, and the MDLs. Applying a multiplier of 10 to the MDL values results in a possible EQL range from 0.015 to 3.4 µg/L. Three of these values are greater than the PQL. EPA used the highest value below the PQL (0.05 µg/L) and rounded up to 0.1 µg/L to establish an EQL. Almost 92 percent of the MRLs in the Six-Year Review 3 ICR database are less than or equal to this value.

Exhibit 4-19. Analytical Methods for Heptachlor

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	0.003	0.03
508	0.0015	0.015
508.1	0.005	0.05
525.2	0.15	1.5
525.3	0.34	3.4
551.1	0.081	0.81

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.7 Heptachlor Epoxide

The MCL for heptachlor epoxide equals the PQL of 0.2 µg/L. The MCLG is zero, and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There are no PT studies with spiked values below the PQL. The PT data above the PQL show passing rates close to 100 percent for most of the studies although one study has a passing rate less than 75 percent (USEPA, 2016b). Given the lack of data below the PQL, EPA determined that the PT data do not support a reduction of the PQL.

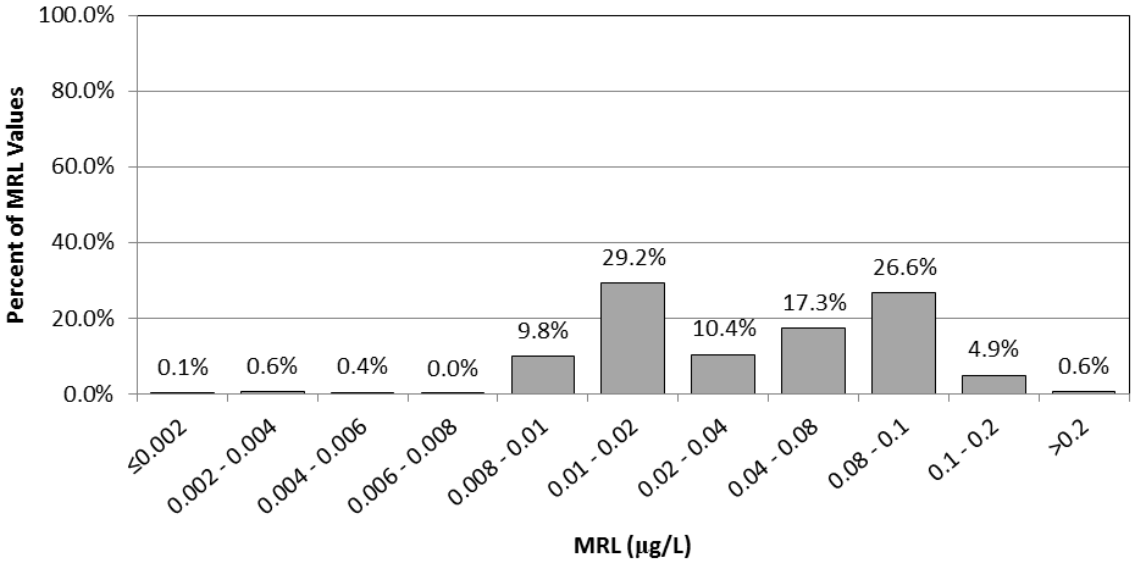
As shown in **Exhibit 4-20**, the modal MRL for heptachlor epoxide is 0.02 µg/L. Summary data show that 28.9 percent of the MRLs are equal to this value, and 40.2 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-21** shows that more than 99 percent of the MRL values are less than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-20. Summary of MRL Data for Heptachlor Epoxide

MRL Value Category	Number of Records	Percentage of Records
All	63,667	100%
Less than mode	7,184	11.3%
Equal to mode (0.02 µg/L)	18,370	28.9%
Greater than mode	38,113	59.9%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-21. MRL Distribution for Heptachlor Epoxide



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-22 shows EPA's approved methods for the detection of heptachlor epoxide, and the MDLs. Applying a multiplier of 10 to the MDL values results in a possible EQL range from 0.001 to 2.02 µg/L. Two of these values are greater than the PQL and one is approximately the same. EPA used the highest value below the PQL (0.04 µg/L) to establish an EQL.

Exhibit 4-22. Analytical Methods for Heptachlor Epoxide

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	0.004	0.04
508	0.015	0.15
508.1	0.0001	0.001
525.2	0.13	1.3
525.3	0.0026	0.026
551.1	0.202	2.02

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.8 Hexachlorobenzene

The MCL for hexachlorobenzene equals the PQL of 1 µg/L. The MCLG is zero, and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There are several PT studies with a spiked value below the PQL and passing rates greater than 80%, although one study has a passing rate below 75%. Above the PQL, the PT data show greater than 75 percent passing rates for most of the studies (USEPA, 2009a). EPA determined that the PT data support reduction of the PQL.

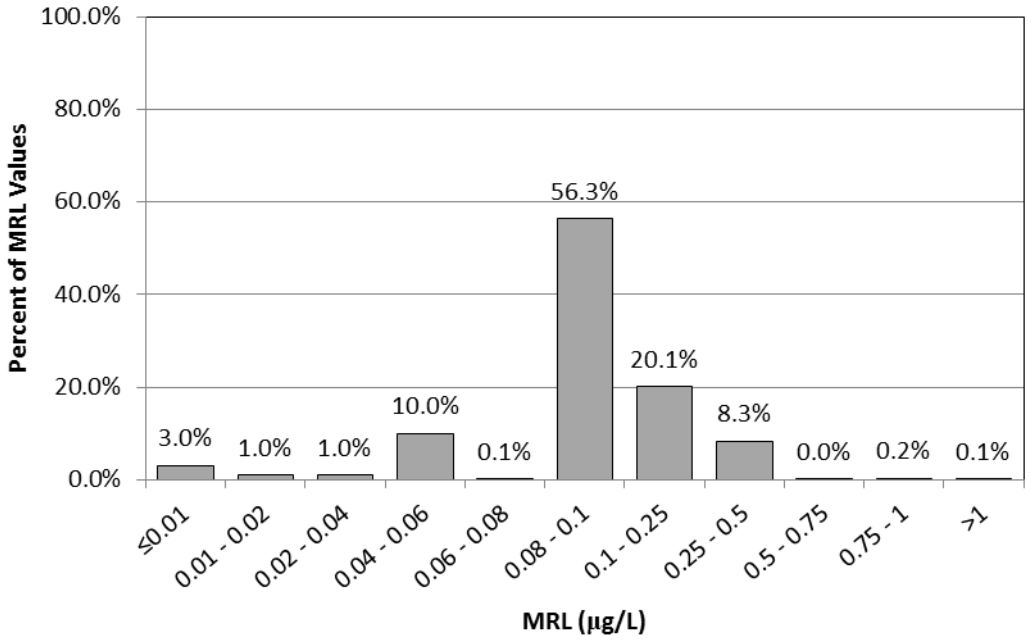
As shown in **Exhibit 4-23**, the modal MRL for hexachlorobenzene is 0.1 µg/L. Approximately 71 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-24** shows that more than 99 percent of the MRL values are less than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-23. Summary of MRL Data for Hexachlorobenzene

MRL Value Category	Number of Records	Percentage of Records
All	62,752	100%
Less than mode	13,418	21.4%
Equal to mode (0.1 µg/L)	31,338	49.9%
Greater than mode	17,996	28.7%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-24. MRL Distribution for Hexachlorobenzene



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-25 shows EPA's approved methods for the detection of hexachlorobenzene, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.01 to 1.3 µg/L. One of these values (1.3 µg/L) is greater than the PQL. EPA used the highest value below the PQL (0.077 µg/L) and rounded up to 0.1 µg/L to establish the EQL.

Exhibit 4-25. Analytical Methods for Hexachlorobenzene

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	0.002	0.02
508	0.0077	0.077
508.1	0.001	0.01
525.2	0.13	1.3
551.1	0.003	0.03

Source: USEPA, 2009a (upper bound values when ranges are reported)

4.1.9 Pentachlorophenol

The MCL for pentachlorophenol equals the PQL of 1 µg/L. The MCLG is zero, and a recent health effects assessment did not indicate a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There were no PT studies with spiked concentrations less than the PQL. Above the PQL, passing rates ranged from 70 percent to 100 percent (USEPA, 2016b). Because of the lack of results below the PQL, EPA determined that the PT data do not support reduction of the PQL.

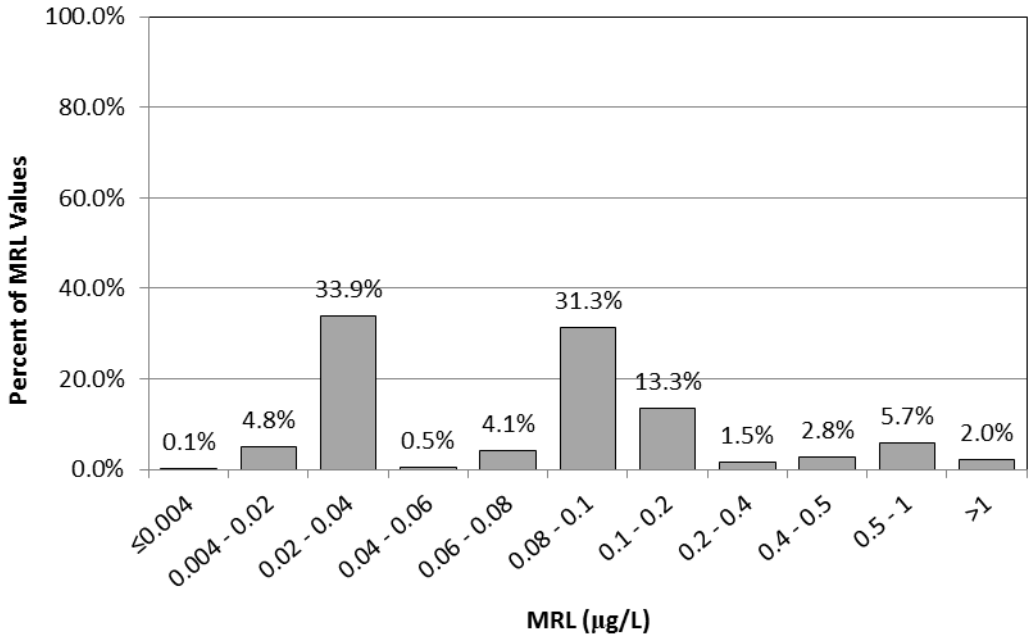
As shown in **Exhibit 4-26** the modal MRL for pentachlorophenol is 0.04 µg/L. Summary data show that 33.1 percent of the MRLs are equal to this value, and 38.8 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-27** shows that 98 percent of the MRL values are less than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-26. Summary of MRL Data for Pentachlorophenol

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	63,532	100%
Value < Modal MRL	3,649	5.7%
Value = Modal MRL (0.04 µg/L)	21,012	33.1%
Value > Modal MRL	38,871	61.2%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-27. MRL Distribution for Pentachlorophenol



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-28 shows EPA's approved methods for the detection of pentachlorophenol, and the MDLs. Applying a multiplier of 10 would give a range from 0.32 to 16 µg/L. All but one of these values exceed or approximate the PQL of 1 µg/L. Thus, the MDL data do not support an EQL below the PQL.

Exhibit 4-28. Analytical Methods for Pentachlorophenol

Method	MDL (µg/L)	MDL x 10 (µg/L)
515.1	0.032	0.32
515.2	0.16	1.6
515.3	0.085	0.85
515.4	0.084	0.84
525.2	1.0	10
525.3	0.069	0.69
528	0.25	2.5
555	1.6	16

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.10 Polychlorinated Biphenyls (PCBs)

The MCL for PCBs equals the PQL of 0.5 µg/L. The MCLG is zero, and although a health effects assessment is in progress, there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

The only PT study with a spiked concentration below the PQL had a passing rate below 75%. The passing rates at higher concentrations ranged from 80 percent to 100 percent (USEPA, 2009a). Because of the low passing rate below the PQL, EPA determined that the PT data do not support reduction of the PQL.

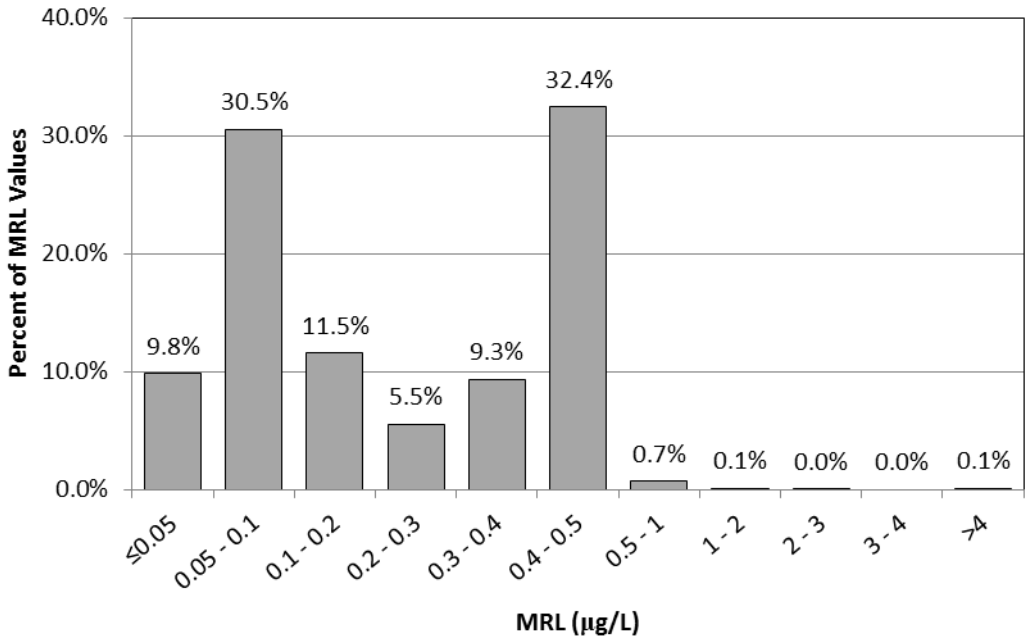
As shown in **Exhibit 4-29**, the modal MRL for PCBs is 0.5 µg/L, which equals the PQL. Summary data show that 32 percent of the MRLs are equal to this value, and 99.2 percent of the MRL values are equal to or less than it. As shown in **Exhibit 4-30,** the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-29. Summary of MRL Data for PCBs

MRL Value Category	Number of Records	Percentage of Records
All	32,755	100%
Less than mode	21,999	67.2%
Equal to mode (0.5 µg/L)	10,478	32.0%
Greater than mode	278	0.8%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-30. MRL Distribution for PCBs



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL. Percentages shown here may not match summary data in the prior table because of independent rounding.

Exhibit 4-31 shows EPA's approved method for the compliance monitoring of PCBs (as decachlorobiphenyl), and the MDL. Applying a multiplier of 10 would give a possible EQL of 0.8 µg/L, which is greater than the PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-31. Analytical Methods for PCBs

Method	MDL (µg/L)	MDL x 10 (µg/L)
508A	0.08	0.8

Source: USEPA, 2009a. This document also reports methods and MDLs for aroclors, but these screening methods are not sufficient for compliance monitoring.

EPA concluded that although MRL values are generally below the PQL, the combination of PT and MDL data do not support revision of the PQL for PCBs. Therefore, EPA did not develop an EQL.

4.1.11 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (Dioxin)

The MCL for dioxin equals the PQL of 3×10^{-5} µg/L. The MCLG is zero and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

There is only one PT study. It has a passing rate greater than 75 percent and the spiked concentration is greater than the PQL (USEPA, 2016b). Given the lack of data, EPA determined that the PT data do not support revision of the PQL.

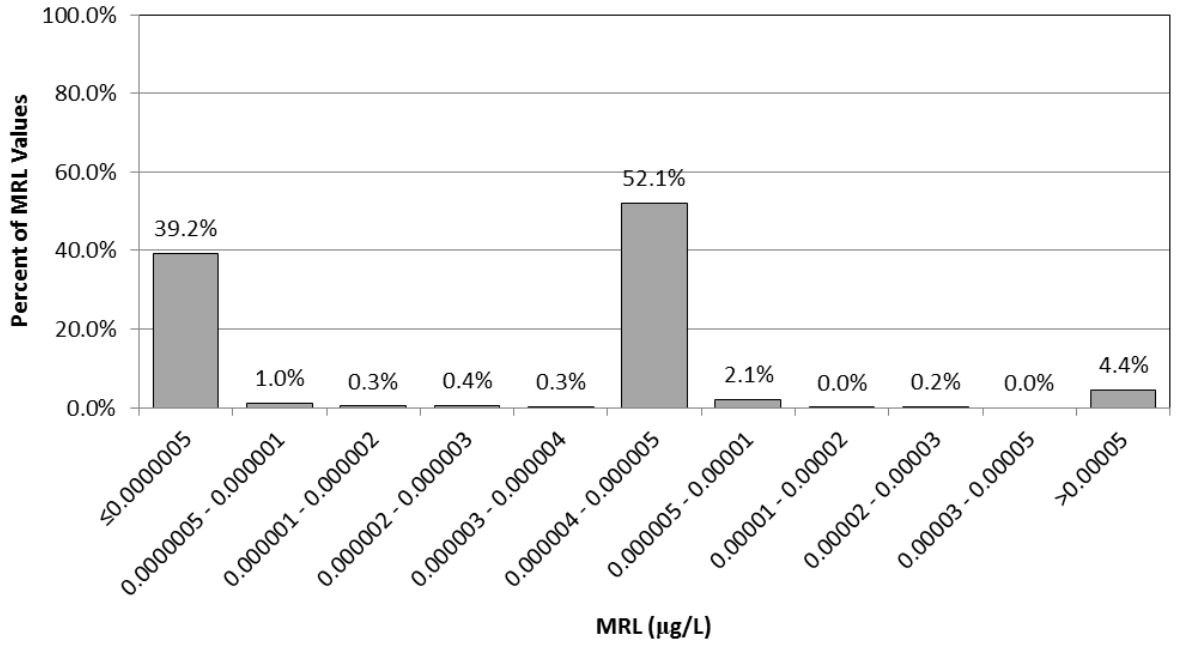
As shown in **Exhibit 4-32** the modal MRL for dioxin is 5×10^{-6} µg/L. Summary data show that 52 percent of the MRLs are equal to this value, and 93.3 percent of the MRL values are equal to or less than it. Because more than 80 percent of the MRL values are less than or equal to 5×10^{-6} µg/L, EPA identified the mode as the EQL. In **Exhibit 4-33**, the MRL data indicate that there is potential to lower the PQL because most of the MRL values are below the PQL. EPA also reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-32. Summary of MRL Data for Dioxin

MRL Value Category	Number of Records	Percentage of Records
All	2,620	100%
Less than mode	1,082	41.3%
Equal to mode (5×10^{-6} µg/L)	1,362	52.0%
Greater than mode	176	6.7%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-33. MRL Distribution for Dioxin



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-34 shows EPA's approved method for the detection of dioxin, and the minimum detection level (MDL). Applying a multiplier of five would give a possible EQL of 2.2×10^{-5} µg/L, which is less than the PQL, but not as low as the modal MRL. EPA instead used the modal MRL to establish the EQL.

Exhibit 4-34. Analytical Methods for Dioxin

Method	MDL (µg/L)	MDL x 5 (µg/L)
1613	4.4×10^{-6}	2.2×10^{-5}

Source: USEPA, 2016b

4.1.12 Thallium

The MCL for thallium equals the PQL of 2 µg/L. The MCLG is 0.5 µg/L, and a recent health effects assessment did not indicate any changes to the MCLG. Therefore, the threshold for an occurrence analysis depends on analytical feasibility.

There are no studies with spiked concentrations less than the PQL. The passing rates for the PT studies above the PQL generally range from 80 percent to 100 percent (USEPA, 2016b). Given the lack of data below the PQL, EPA determined that the PT data do not support revision of the PQL.

As shown in **Exhibit 4-35,** the modal MRL for thallium is 1 µg/L. Summary data show that 48.3 percent of the MRLs are equal to this value, and 74.5 percent of the MRL values are equal to or

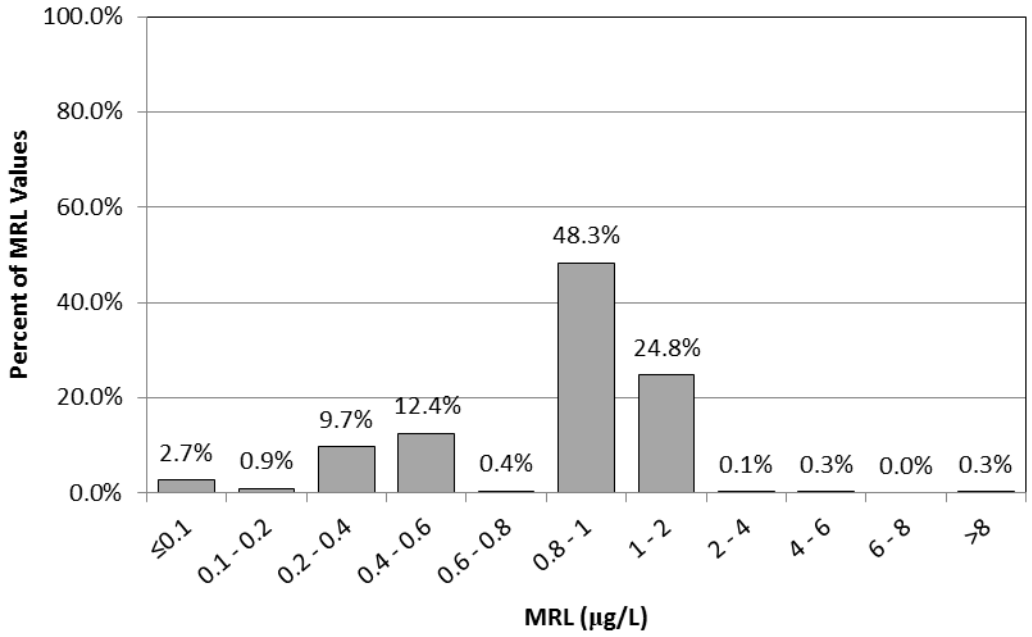
less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-36** shows that more than 99 percent of the MRL values are less than or equal to the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL less than the PQL.

Exhibit 4-35. Summary of MRL Data for Thallium

MRL Value Category	Number of Records	Percentage of Records
All	75,776	100%
Less than mode	19,855	26.2%
Equal to mode (1 µg/L)	36,589	48.3%
Greater than mode	19,332	25.5%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-36. MRL Distribution for Thallium



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-37 shows EPA's approved methods for the detection of thallium, and the MDLs. Applying a multiplier of 10 would give a possible EQL range of 3.0 to 10 µg/L. The PQL is less than this range. The MDL data do not support an EQL below the PQL.

Exhibit 4-37. Analytical Methods for Thallium

Method	MDL (µg/L)	MDL x 10 (µg/L)
200.7	no MDL	no MDL
200.8	0.3	3
200.9	1.0	10

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.13 Toxaphene

The MCL for toxaphene equals the PQL of 3 µg/L. The MCLG is zero, and there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis is based on analytical feasibility.

One PT study has a spiked value below the PQL and a passing rate just above 75%. The passing rates for the PT studies generally exceed 75 percent although the rates are below this threshold for several studies (USEPA, 2016b). Given the single data point below the PQL, EPA determined that the PT data do not support reduction of the PQL.

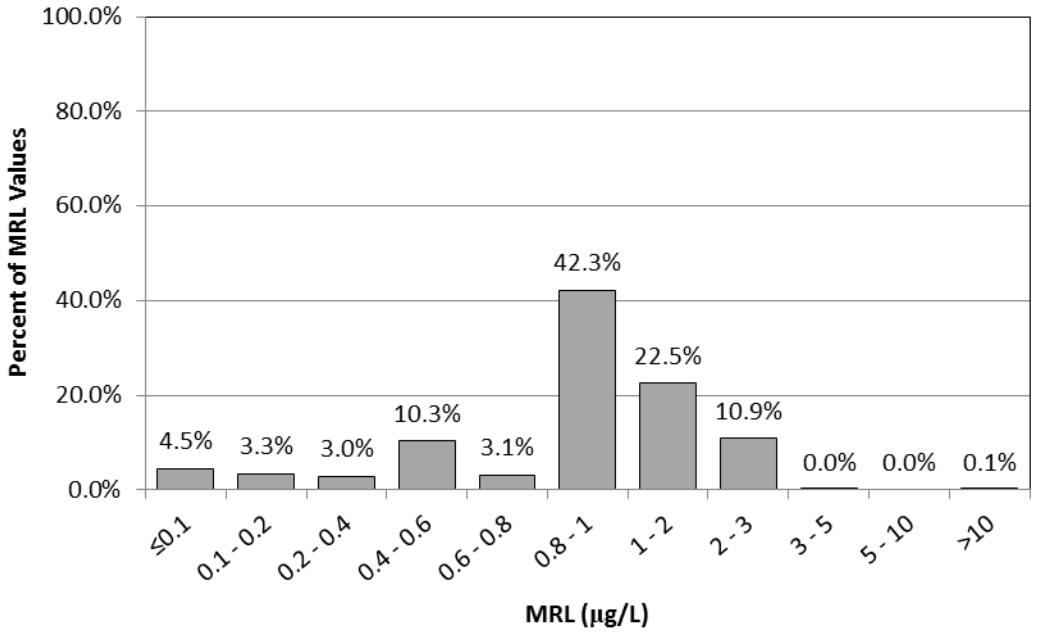
As shown in **Exhibit 4-38**, the modal MRL is 1 µg/L. Approximately 66.5 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-39** shows that more than 99 percent of the MRL values are less than the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-38. Summary of MRL Data for Toxaphene

MRL Value Category	Number of Records	Percentage of Records
All	57,208	100%
Less than mode	14,117	24.7%
Equal to mode (1 µg/L)	23,918	41.8%
Greater than mode	19,173	33.5%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-39. MRL Distribution for Toxaphene



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-40 shows EPA's approved methods for the detection of toxaphene, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 1.3 to 17 µg/L. Three of the values are greater than the PQL. EPA used the value below the PQL (1.3 µg/L) and rounded down to 1 µg/L to establish an EQL.

Exhibit 4-40. Analytical Methods for Toxaphene

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	1.0	10
508	no MDL	no MDL
508.1	0.13	1.3
525.2	1.7	17
525.3	0.32	3.2

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.1.14 1,1,2-Trichloroethane

The MCL for 1,1,2-trichloroethane equals the PQL of 5 µg/L. The MCLG is 3 µg/L, and there is no new health effects information that suggests a change in the MCLG. Therefore, the threshold for an occurrence analysis depends on analytical feasibility.

There are several studies with spiked concentrations less than the PQL that have passing rates greater than 90%. The PT results above the PQL also have passing rates in the 90 to 100 percent

range (USEPA, 2009a). Given the high passing rates below the PQL, EPA determined that the PT data support reduction of the PQL.

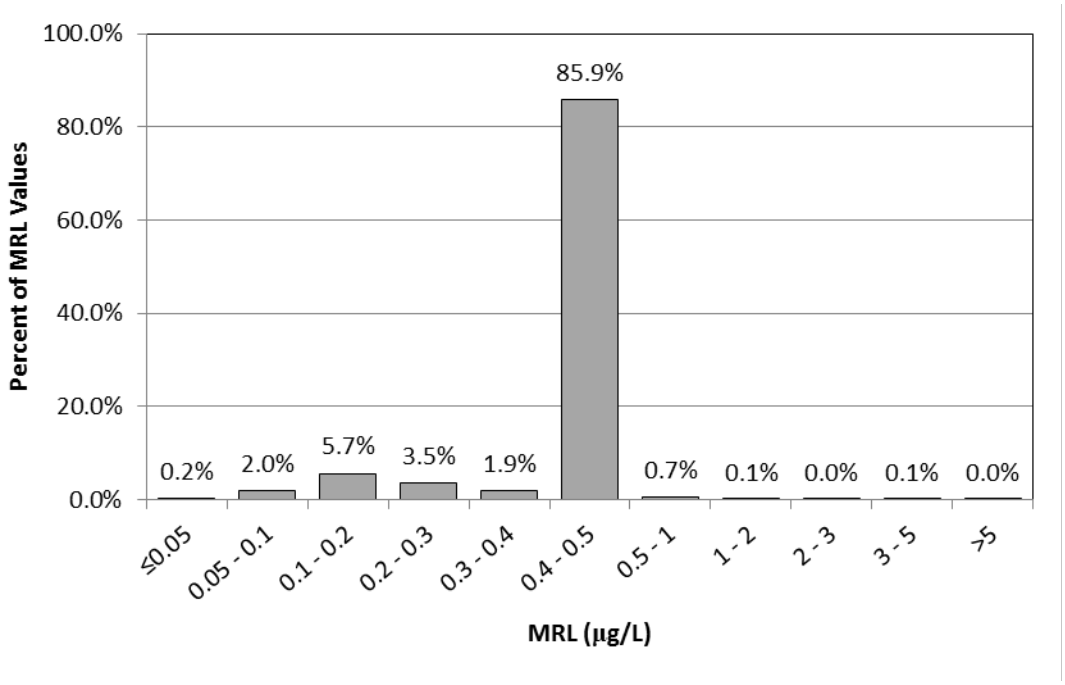
As shown in **Exhibit 4-41**, the modal MRL is 0.5 µg/L, which is less than the MCLG. More than 99 percent of MRL values are less than the mode. **Exhibit 4-42** shows that more than 99.9 percent of MRL values are less than or equal to the MCLG. Although the MRL mode meets criteria to be an EQL, the mode is less than the MCLG. Consequently, the MCLG is the appropriate threshold for the occurrence analysis.

Exhibit 4-41. Summary of MRL Data for 1,1,2-Trichloroethane

MRL Value Category	Number of Records	Percentage of Records
All	137,544	100%
Less than mode	18,378	13.4%
Equal to mode (0.5 µg/L)	117,947	85.8%
Greater than mode	1,219	0.9%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-42. MRL Distribution for 1,1,2-Trichloroethane



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-43 shows EPA's approved methods for the detection of 1,1,2-trichloroethane, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.17 to 1 µg/L. This range is below the current MCLG, which further supports use of the MCLG as the threshold in the occurrence analysis.

Exhibit 4-43. Analytical Methods for 1,1,2-Trichloroethane

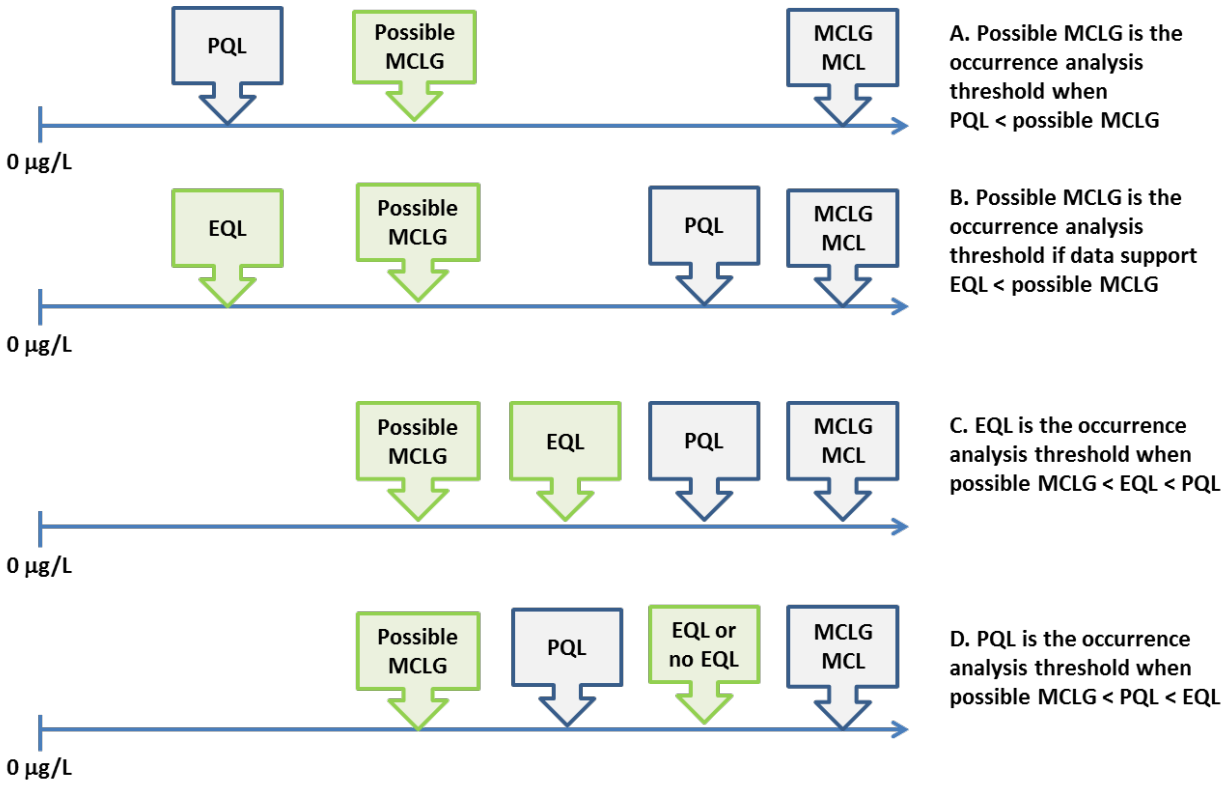
Method	MDL (µg/L)	MDL x 10 (µg/L)
502.2	0.04	0.4
524.2	0.10	1
551.1	0.017	0.17

Source: USEPA, 2009a (upper bound values when ranges are reported)

4.2 MCL Currently Limited by MCLG

For each contaminant addressed in this section, new health effects information indicates potential to lower the MCLG (USEPA, 2016c). Therefore, EPA's objective was to determine whether this possible MCLG could be used as the threshold for the occurrence analysis. When it could not be used, EPA identified an alternative threshold. **Exhibit 4-44** illustrates four possible outcomes. In each case, the blue boxes show that the current MCL equals the current MCLG and the current PQL is a lower value. The green boxes show new information – the possible MCLG and an EQL.

Exhibit 4-44. Occurrence Analysis Threshold Selection Scenarios for Contaminants with New Possible MCLGs



The top case (A) shows that the PQL is less than the possible MCLG. In this case, current analytical feasibility does not limit setting an MCL equal the possible MCLG. Therefore, the possible MCLG can be the threshold for the occurrence analysis.

The possible MCLG can still be the threshold for the occurrence analysis when it is less than the PQL. This is possible if EPA can identify an EQL that is less than the possible MCLG (case B).

If, however, data analysis results in an EQL that is greater than possible MCLG, then EPA used the EQL as the threshold for the occurrence analysis when it was less than the PQL (case C). If available data did not support deriving an EQL less than the current PQL, then EPA used the PQL as the occurrence threshold (case D).

As Exhibit 1-2 shows, case A (PQL < possible MCLG) applies to the following contaminants: cis-1,2-dichloroethylene, fluoride, hexachlorocyclopentadiene, selenium, toluene, and xylene. For these contaminants, EPA can use the possible MCLG values as occurrence thresholds without analyzing PT, MRL, or MDL data.

The six remaining contaminants – carbofuran, cyanide, endothall, methoxychlor, oxamyl, and styrene – require further analysis. To establish an occurrence threshold, EPA used the available PT, MRL, and MDL data and an analysis method similar to the one in section 4.1.

4.2.1 Carbofuran

The MCL for carbofuran equals the MCLG of 40 µg/L. EPA based the promulgated MCLG on a reference dose (RfD) of 0.005 mg/kg-day. New health effects information indicates a revised RfD of 0.0003 mg/kg-day. The corresponding possible MCLG is 0.6 µg/L (2016c), which is less than the PQL of 7 µg/L. Because the PQL would not allow setting the MCL equal to the possible MCLG, EPA evaluated how low an occurrence threshold could be.

There are no PT results at spiked concentrations below the PQL. In fact, none of the spiked concentrations are below 15 µg/L, which is two times the PQL. Most of the passing rates are above 75 percent; only one is less than 75 percent (USEPA, 2016b). Because of a lack of PT data below the PQL, EPA determined that the PT data do not support reduction of the PQL.

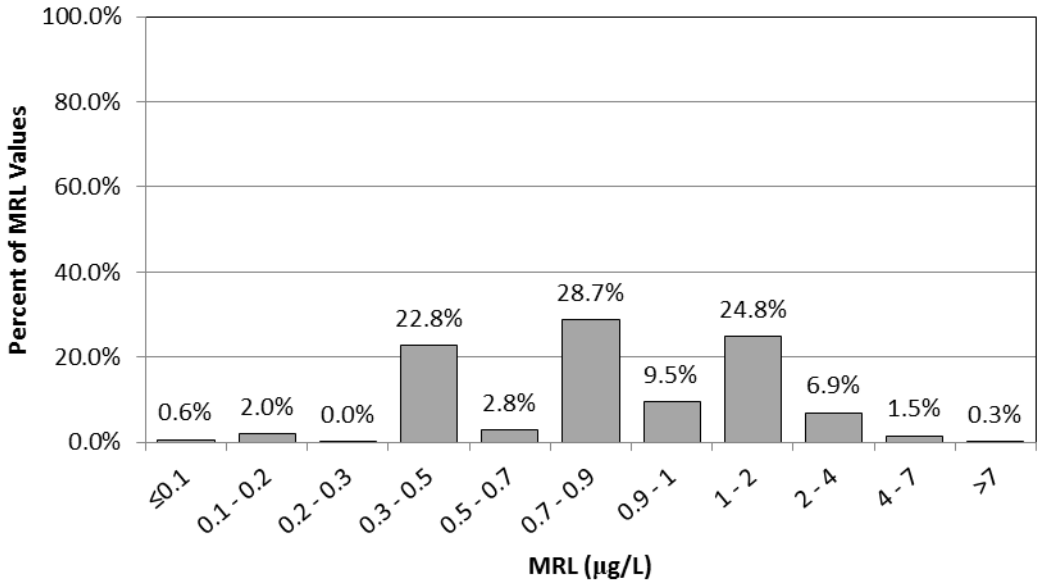
As shown in **Exhibit 4-45,** the modal MRL for carbofuran is 0.9 µg/L, which is less than the PQL of 7 µg/L, but greater than the possible MCLG. **Exhibit 4-46** shows that a majority of MRL values exceed 0.6 µg/L, which means the possible MCLG cannot be used for the occurrence analysis without substantial upward bias in the occurrence estimates. Summary data show that 28.4 percent of the MRLs are equal to the mode, and 56.9 percent of the MRL values are equal to or less than it. Therefore, a threshold cannot be based on the mode. EPA reviewed MDL values to determine whether they support a threshold between the possible MCLG and the PQL.

Exhibit 4-45. Summary of MRL Data for Carbofuran

MRL Value Category	Number of Records	Percentage of Records
All	50,018	100%
Less than mode	14,273	28.5%
Equal to mode (0.9 µg/L)	14,219	28.4%
Greater than mode	21,526	43.0%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-46. MRL Distribution for Carbofuran



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-47 shows EPA's approved methods for the detection of carbofuran, and the MDLs. Applying a multiplier of 10 would result in possible EQL values of 0.58 and 5.2 µg/L. Both values approximate or exceed the possible MCLG. Thus, EPA determined that the possible MCLG cannot be the occurrence threshold. EPA used the highest value below the PQL (5.2 µg/L) and rounded down to 5.0 µg/L to obtain an EQL. Exhibit 4-46 shows that almost 98 percent of the MRL values are less than or equal to this value.

Exhibit 4-47. Analytical Methods for Carbofuran

Method	MDL (µg/L)	MDL x 10 (µg/L)
531.1	0.52	5.2
531.2	0.058	0.58

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.2.2 Cyanide

The MCL for cyanide equals the MCLG of 200 µg/L. EPA promulgated the MCLG based on an RfD of 0.02 mg/kg-day. New health effects information indicates a lower RfD of 0.0006 mg/kg-day (USEPA, 2016c). The corresponding possible MCLG is 4 µg/L, which is less than the PQL of 100 µg/L. Because the PQL would limit setting the MCL equal to the possible MCLG, EPA evaluated whether the EQL can be as low as 4 µg/L.

There are no PT studies with spiked values below the PQL and the passing rates above the PQL range from 75 percent to 100 percent (USEPA, 2016b). Given the the lack of data below the PQL, EPA determined that the PT data do not support reduction of the PQL.

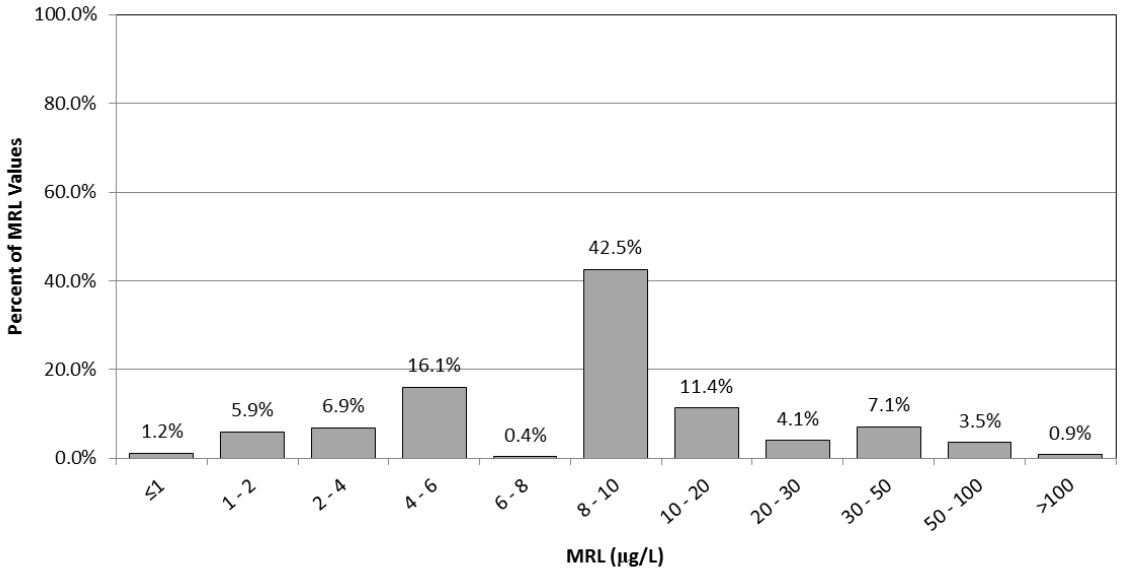
As shown in **Exhibit 4-48**, the modal MRL for cyanide is 10 µg/L, which is greater than the potential MCLG of 4 µg/L, but less than the PQL of 100 µg/L. **Exhibit 4-49** shows that approximately 14 percent of the MRL values are less than 4 µg/L, which means the possible MCLG cannot be used for the occurrence analysis. Summary data show that 42.5 percent of the MRLs are equal to this value, and 73.1 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-49** shows that more than 99 percent of MRL values are less than the PQL. Therefore, EPA reviewed MDL values to determine whether they indicate an EQL value that is less than the PQL.

Exhibit 4-48. Summary of MRL Data for Cyanide

MRL Value Category	Number of Records	Percentage of Records
All	56,219	100%
Less than mode	17,213	30.6%
Equal to mode (10 µg/L)	23,865	42.5%
Greater than mode	15,141	26.9%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-49. MRL Distribution for Cyanide



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-50 shows EPA's method for the detection of cyanide and the corresponding MDL. USEPA (2016b) identifies additional methods including several newer, proprietary methods that have lower MDL values. Applying a multiplier of 10 gives a possible EQL of 50 µg/L, which is greater than the potential MCLG, but less than the PQL.

Exhibit 4-50. Analytical Methods for Cyanide

Method	MDL (µg/L)	MDL x 10 (µg/L)
335.4	5.0	50

Source: USEPA, 2016b and NEMI, 2015.

The distribution in Exhibit 4-49 shows that more than 95 percent of the MRL values are less than or equal to 50 µg/L. Thus, an occurrence analysis at an EQL of 50 µg/L will have a relatively small degree of bias introduced by the MRL values that are greater than the EQL.

4.2.3 Endothall

The MCL for endothall equals the MCLG of 100 µg/L. EPA promulgated the MCLG based on an RfD of 0.02 mg/kg-day. New health effects information indicates a revised RfD of 0.007 mg/kg-day. The corresponding possible MCLG is 50 µg/L (USEPA, 2016c), which is less than the PQL of 90 µg/L. Because the PQL would limit setting the MCL equal to the possible MCLG, EPA evaluated whether the EQL can be as low as 50 µg/L.

There are no PT study results with spiked values below the PQL. Furthermore, some passing rates for PT studies at spiked concentrations greater than the PQL are below 75 percent (USEPA, 2009a). Because of the lack of data below the PQL, EPA determined that the available PT data do not support PQL reduction.

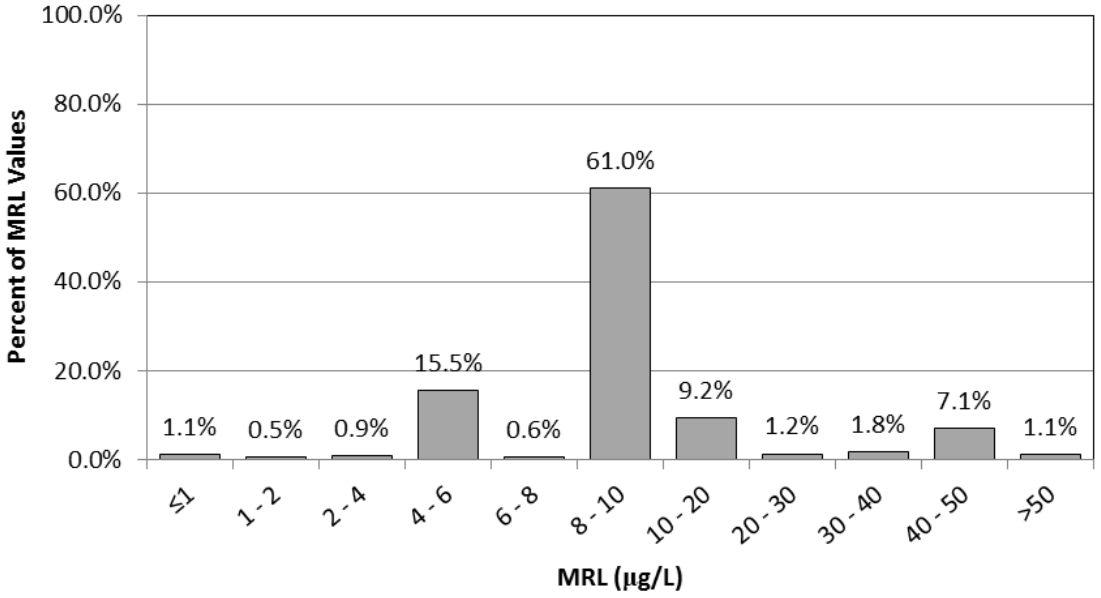
As shown in **Exhibit 4-51,** the modal MRL for endothall is 10 µg/L, which is less than the PQL. Summary data show that 34.3 percent of the MRLs are equal to this value, and 79.6 percent of the MRL values are equal to or less than it. The mode is also less than the possible MCLG of 50 µg/L. **Exhibit 4-52** shows that more than 98 percent of the MRL values are less than or equal to 50 µg/L. Thus, the MRL data support use of the possible MCLG for the occurrence analysis.

Exhibit 4-51. Summary of MRL Data for Endothall

MRL Value Category	Number of Records	Percentage of Records
All	19,895	100%
Less than mode	9,004	45.3%
Equal to mode (10 µg/L)	6,833	34.3%
Greater than mode	4,058	20.4%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-52. MRL Distribution for Endothall



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-53 shows EPA's approved method for the detection of endothall, and the MDL. Applying a multiplier of 10 gives a possible EQL 17.9 µg/L, which is less than 50 µg/L. Thus, the MDL data support the use of the possible MCLG as a threshold in the occurrence analysis.

Exhibit 4-53. Analytical Methods for Endothall

Method	MDL (µg/L)	MDL x 10 (µg/L)
548.1	1.79	17.9

Source: USEPA, 2016b (upper bound value when a range is reported)

Although the PT data do not support a reduction of the PQL, the MRL and MDL data do support the use of the possible MCLG value of 50 µg/L as a threshold for the occurrence analysis.

4.2.4 Methoxychlor

The MCL for methoxychlor equals the MCLG of 40 µg/L. The promulgated MCLG was based on an RfD of 0.005 mg/kg-day. New health effects information indicates a revised RfD of 0.00002 mg/kg-day. The corresponding possible MCLG is 0.1 µg/L (USEPA, 2016c), which is less than the PQL of 10 µg/L. Because the PQL would limit setting the MCL equal to the possible MCLG, EPA evaluated whether the EQL can be as low as 0.1 µg/L.

Four PT studies with spiked concentrations less than the PQL had passing rates above 75 percent. There are, however, studies with values greater than the PQL with passing rates at or below 75 percent (USEPA, 2009a). Nevertheless, because of high passing rates for

concentrations less than the PQL, EPA concluded that the available PT data may support PQL revision.

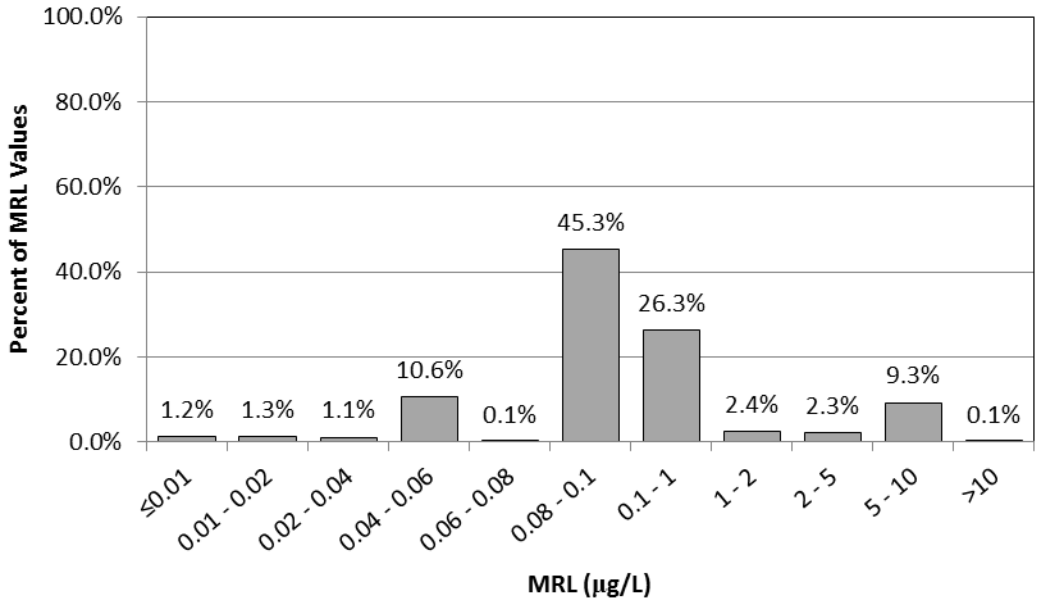
As shown in **Exhibit 4-54**, the modal MRL for methoxychlor is 0.1 µg/L, which equals the possible MCLG. Summary data show that 44.3 percent of the MRLs are equal to this value, and 59.7 percent of the MRL values are equal to or less than it. The percentage of MRL values less than or equal to the mode does not meet the 80 percent threshold. Therefore, the MRL data do not support the use of the possible MCLG for the occurrence analysis. **Exhibit 4-55** shows that less than 1 percent of the MRL values are greater than the PQL of 10 µg/L. Therefore, EPA evaluated MDL data.

Exhibit 4-54. Summary of MRL Data for Methoxychlor

MRL Value Category	Number of Records	Percentage of Records
All	70,142	100%
Less than mode	10,788	15.4%
Equal to mode (0.1 µg/L)	31,060	44.3%
Greater than mode	28,294	40.3%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-55. MRL Distribution for Methoxychlor



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-56 shows EPA's approved methods for the detection of methoxychlor, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.03 to 9.6 µg/L. This range

is below the PQL. The highest value, 9.6 µg/L, rounds to the PQL. The next highest value rounds to 1.0 µg/L, which is less than the current PQL. Although this value is greater than the possible MCLG, EPA established an EQL of 1.0 µg/L as the threshold for the occurrence analysis.

Exhibit 4-56. Analytical Methods for Methoxychlor

Method	MDL (µg/L)	MDL x 10 (µg/L)
505	0.96	9.6
508	0.022	0.22
508.1	0.003	0.03
525.2	0.13	1.3
551.1	0.026	0.26

Source: USEPA, 2009a (upper bound values when ranges are reported)

4.2.5 Oxamyl

The MCL for oxamyl equals the MCLG of 200 µg/L. The promulgated MCLG was based on an RfD of 0.025mg/kg-day. New health effects information indicates a revised RfD of 0.0069 mg/kg-day. The corresponding possible MCLG is 10 µg/L (USEPA, 2016c), which is less than the PQL of 20 µg/L. Because the PQL would limit setting the MCL equal to the possible MCLG, EPA evaluated whether the EQL can be as low as 10 µg/L.

Two PT studies with spiked concentrations less than the PQL had passing rates at 75 percent. There are also studies with values greater than the PQL with passing rates at or below 75 percent (USEPA, 2016b). Because of limited number of studies below the PQL, EPA concluded that the available PT data do not support PQL reduction.

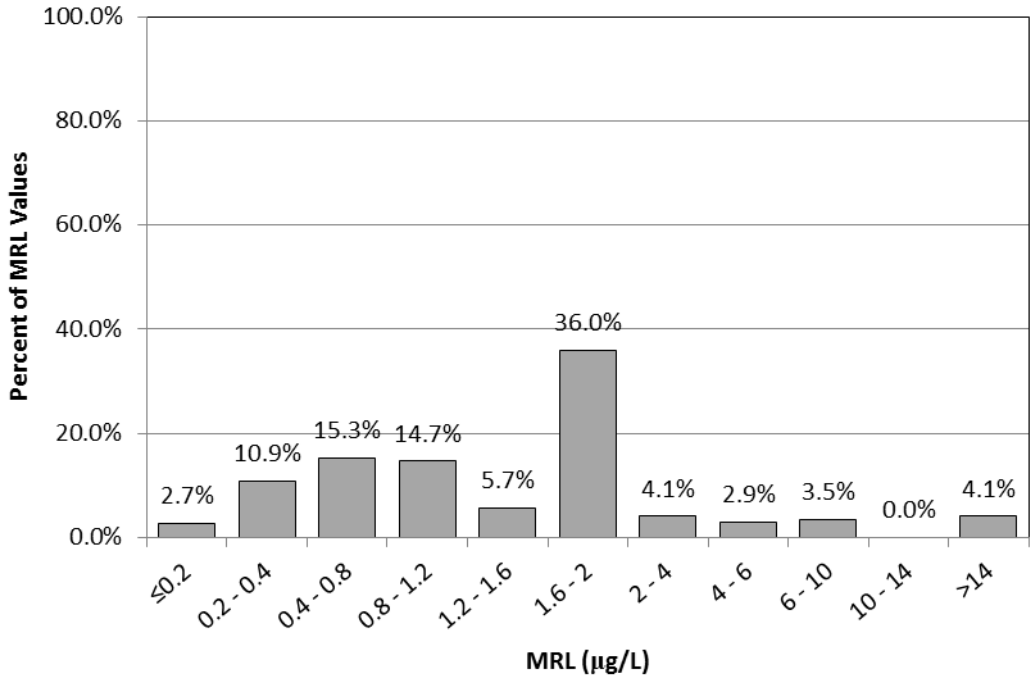
As shown in **Exhibit 4-57**, the modal MRL for oxamyl is 2 µg/L, which is less than the possible MCLG. Summary data show that 36 percent of the MRLs are equal to this value, and 85.4 percent of the MRL values are equal to or less than it. The fraction of MRL values less than or equal to the mode meets the 80 percent threshold. Therefore, the MRL data also support the use of the possible MCLG for the occurrence analysis. **Exhibit 4-58** shows that less than 5 percent of the MRL values exceed 10 µg/L.

Exhibit 4-57. Summary of MRL Data for Oxamyl

MRL Value Category	Number of Records	Percentage of Records
All	49,438	100%
Less than mode	24,422	49.4%
Equal to mode (2 µg/L)	17,818	36.0%
Greater than mode	7,198	14.6%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-58. MRL Distribution for Oxamyl



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-59 shows EPA's approved methods for the detection of oxamyl, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.65 to 8.6 µg/L. This range contains the modal MRL and is less than the possible MCLG of 10 µg/L. Therefore, EPA estimated an EQL of 10 µg/L as a health-based threshold for the occurrence analysis.

Exhibit 4-59. Analytical Methods for Oxamyl

Method	MDL (µg/L)	MDL x 10 (µg/L)
531.1	0.86	8.6
531.2	0.065	0.65

Source: USEPA, 2016b (upper bound values when ranges are reported)

4.2.6 Styrene

The MCL for styrene equals the MCLG of 100 µg/L. The promulgated MCLG was based on an RfD of 0.2 mg/kg-day. New health effects information indicates potential to revise the cancer classification, resulting in a possible MCLG of zero (2016c). Because the PQL of 5 µg/L limits setting the MCL equal to the possible MCLG, EPA evaluated how low an EQL can be.

There are several PT studies with spiked concentrations below the PQL and passing rates greater than 90%. PT studies with spiked concentrations greater than the PQL consistently have passing rates above 75 percent (USEPA, 2009a). Because of high passing rates for concentrations less than the PQL, EPA concluded that the available PT data support PQL revision.

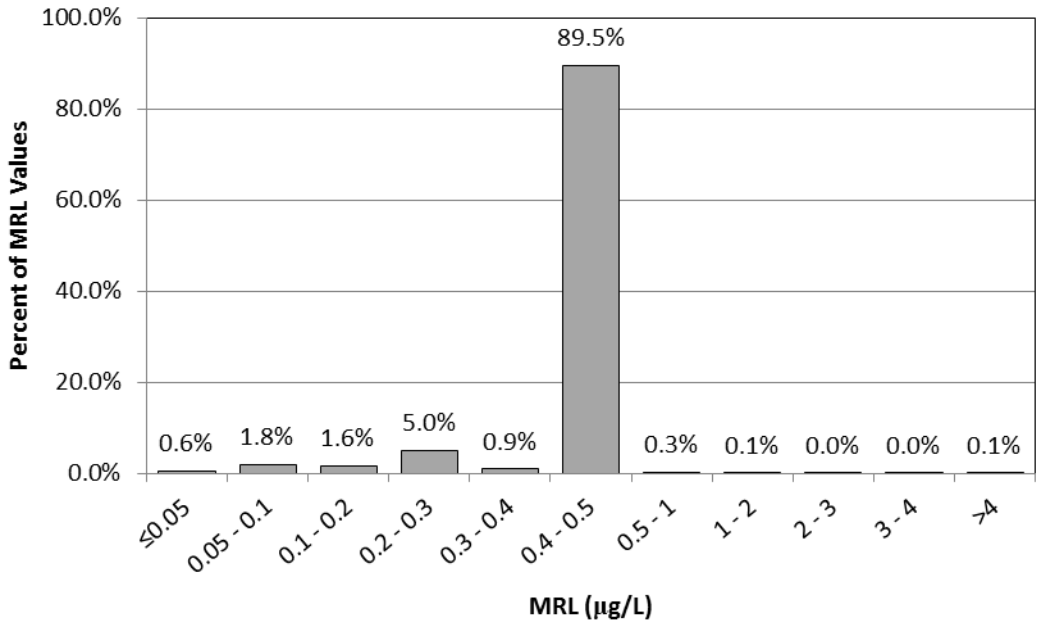
As shown in **Exhibit 4-60**, the modal MRL for styrene is 0.5 µg/L. Summary data show that 89.5 percent of the MRLs are equal to this value, and 99.5 percent of the MRL values are equal to or less than it. The fraction of MRL values less than or equal to the mode meets the 80 percent threshold. Therefore, the MRL data support the use of the modal MRL for the occurrence analysis. **Exhibit 4-61** shows that less than 1 percent of the MRL values exceed 0.5 µg/L.

Exhibit 4-60. Summary of MRL Data for Styrene

MRL Value Category	Number of Records	Percentage of Records
All	145,902	100%
Less than mode	14,589	10.00%
Equal to mode (0.5 µg/L)	130,578	89.50%
Greater than mode	735	0.50%

Note: Percentages may not sum to 100 percent because of independent rounding. Aggregate percentages in the table may differ from detail in the accompanying chart because of independent rounding.
Source: Six-Year Review 3 ICR database

Exhibit 4-61. MRL Distribution for Styrene



Note: The horizontal axis shows the percent of MRL values in each of 11 discrete ranges. The range with the modal MRL as an upper bound includes MRL values throughout the range and, therefore, has a greater percentage than the one reported in the preceding table for the modal MRL.

Exhibit 4-62 shows EPA's approved methods for the detection of styrene, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.6 to 1.0 µg/L. This range exceeds the modal MRL. Therefore, EPA established an EQL of 0.5 µg/L based on the modal MRL as a threshold for the occurrence analysis.

Exhibit 4-62. Analytical Methods for Styrene

Method	MDL (µg/L)	MDL x 10 (µg/L)
502.2	0.1	1.0
524.2	0.06	0.6

Source: USEPA, 2009a (upper bound values when ranges are reported)

5 Summary

This section provides a summary of the thresholds that EPA derived for analysis of occurrence.

5.1 MCL Currently Limited by PQL

Exhibit 5-1 provides a summary of the information EPA used to develop EQL values in cases of potential improvements in analytical feasibility. The information includes the PQL values, which limit current MCL values. The next column indicates whether the PT data indicate potential to reduce the PQL, i.e., whether there are high passing rates for studies with spiked values below the PQL. Next is the modal MRL values and the percentage of MRL values that are less than or equal to the mode. Finally, the table contains the range of EQLs based on the MDL multiplier method (10 × MDL values; 5 × MDL for 2,3,7,8-TCDD). Bold font indicates information supporting PQL reduction and EQL development.

Exhibit 5-1. Threshold Information Summary: Potential Improvements in Analytical Feasibility

Contaminant	PQL	PT Data Support PQL Reduction	Modal MRL[1] (μg/L)	Range of 10 × MDL Values[2] (μg/L)
Benzo[a]pyrene	0.2	no	0.02 (37%)	0.16 to 2.3
Chlordane	2	no	0.2 (54%)	0.04 to 2.2
DBCP	0.2	no	0.5 (66%)	0.09 to 2.6
DEHP	6	no	0.6 (41%)	13 to 22.5
EDB	0.05	no	0.5 (92%)	0.1 to 0.32
Heptachlor	0.4	no	0.04 (43%)	0.015 to 3.4
Heptachlor Epoxide	0.2	no	0.02 (40%)	0.001 to 2.02
Hexachlorobenzene	1	yes	0.1 (71%)	0.01 to 1.3
Pentachlorophenol	1	no	0.04 (39%)	0.32 to 16
PCBs	0.5	no	0.5 (99%)	0.8
Dioxin	3.0×10^{-5}	no	5.0×10^{-6} (93%)	2.2×10^{-5}
Thallium	2	no	1 (75%)	3 to 10
Toxaphene	3	no	1 (67%)	1.3 to 17
1,1,2-Trichloroethane	5	yes	0.5 (99%)	0.17 to 1

1. Based on Six Year 3 ICR dataset. MRL mode is the most frequently reported value. Value in parenthesis is the percent of MRL values that are less than or equal to the mode.
2. For each contaminant, the range shown is 10 times the range of MDL values for the EPA–developed analytical methods. The exception is 2,3,7,8-TCDD, which reflects a multiplier of 5 instead of 10.

The PT data are not sufficient to support PQL reductions for most of the contaminants. This generally occurs because of the lack of PT studies at spiked concentrations below PQL values. The three contaminants for which PT data indicate potential to reduce the PQL are hexachlorobenzene and 1,1,2-trichloroethane.

Generally, the modal MRL values are less than the PQL values, often differing by an order of magnitude. The exceptions are MRL values that exceed the PQL values for DBCP and EDB, and

the MRL for PCBs, which equals the PQL. Nevertheless, most of these modal MRL values are not EQL candidates because less than 80 percent of MRL values are less than or equal to them. Thus, only the MRL modes for dioxin and 1,1,2-trichloroethane meet criteria for EQL development. The mode for 1,1,2-trichlorethane of 0.5 µg/L is less than the MCLG, which is 3 µg/L. Therefore, the occurrence threshold for this contaminant is the current MCLG instead of an EQL.

The MDL data indicate the greatest potential to revise PQL values. The ranges in bold font include at least one MDL that is less than the PQL. EPA used the MDL data to derive an EQL for the following contaminants: chlordane, heptachlor, heptachlor epoxide, hexachlorobenzene, and toxaphene.

The EQL summary in **Exhibit 5-2** shows that EPA did not use MDL values to develop EQL values for three contaminants despite there being an MDL lower than the PQL: benzo[a]pyrene, DBCP, and pentachlorophenol. For benzo[a]pyrene, an EQL based on the MDL would be the same as the PQL. For DBCP, an EQL based on MDL data was less than 70 percent of the MRL values in the database. For pentachlorophenol, EPA did not develop an EQL because six of the seven MDL values rounded to or exceeded the PQL.

Exhibit 5-2. EQL Threshold Results

Contaminant	PQL	EQL	Basis
Benzo[a]pyrene	0.2	none	Data do not support EQL < PQL
Chlordane	2	1	Based on 10 × MDL
DBCP	0.2	none	Data do not support EQL < PQL
DEHP	6	none	Data do not support EQL < PQL
EDB	0.05	none	Data do not support EQL < PQL
Heptachlor	0.4	0.1	Based on 10 × MDL
Heptachlor Epoxide	0.2	0.04	Based on 10 × MDL
Hexachlorobenzene	1	0.1	Based on 10 × MDL
Pentachlorophenol	1	none	Data do not support EQL < PQL
PCBs	0.5	none	Data do not support EQL < PQL
Dioxin	3.0×10^{-5}	5.0×10^{-6}	Based on MRL mode
Thallium	2	none	Data do not support EQL < PQL
Toxaphene	3	1	Based on 10 × MDL
1,1,2-Trichloroethane	5	3	Based on MCLG (EQL < MCLG)

5.2 MCL Greater than Possible Lower MCLG

Exhibit 5-3 contains summary data for the contaminants for which EPA identified a lower possible MCLG. The first two data columns contain the possible MCLG and PQL values. Bold font indicates that seven PQL values are greater than corresponding possible MCLG values.

For the other contaminants, the PQL is lower than the possible MCLG. The MRL information for these contaminants indicates the percent of MRL values that are less than the possible MCLG value (instead of an MRL mode). In all instances, almost all of the MRL values are less than the

possible MCLG. The 10 × MDL ranges are generally less than the possible MCLG. Thus, the possible MCLGs can be used as occurrence thresholds.

Exhibit 5-3. Threshold Information Summary: Possible Lower MCLGs

Contaminant	Possible MCLG (µg/L)	PQL (µg/L)	PT Data Support PQL Reduction	Six Year 3 MRL Data[1] (µg/L)	Range of 10 × MDL Values[2] (µg/L)
Carbofuran	0.6	7	no	mode: 0.9 (57%)	0.58 – 5.2
Cyanide	4	100	no	mode: 10 (73%)	50
cis-1,2-Dichloroethylene	10	5	yes	**	**
Endothall	50	90	no	mode: 10 (80%)	17.9
Fluoride	900	500	no	**	**
Hexachlorocyclopentadiene	40	1	no	**	**
Methoxychlor	0.1	10	yes	mode: 0.1 (60%)	0.03 – 9.6
Oxamyl	10	20	no	mode: 2 (85%)	0.65 – 8.6
Selenium	40	10	no	**	**
Styrene	0	5	yes	mode: 0.5 (99.5%)	0.6 – 1.0
Toluene	600	5	yes	**	**
Xylene	1000	5	no	**	**

1. Based on Six Year 3 ICR dataset. MRL mode is the most frequently reported value. Value in parenthesis is the percent of MRL values that are less than or equal to the mode.
2. For each contaminant, the range shown is 10 times the range of MDL values for the EPA–developed analytical methods.
**. Analysis not required because the PQL is less than the possible MCLG.

For six contaminants – carbofuran, cyanide, endothall, methoxychlor, oxamyl, and styrene – the PQL potentially limits setting an MCL equal to the possible MCLG. The MRL and MDL summary information shown in the table indicate whether an EQL could be as low as the possible MCLG.

The modal MRL values for two contaminants, endothall and oxamyl, are less than the possible MCLG values and meet EQL criteria. The MDL values are also less than the possible MCLG. Therefore, the MRL and MDL data support using the possible MCLG as an occurrence threshold for these two contaminants.

For styrene, the modal MRL meets the EQL criteria. The modal MRL is greater than the possible MCLG, however. Therefore, EPA used the EQL instead of the possible MCLG for the occurrence analysis.

For carbofuran, cyanide, and methoxychlor, the modal MRLs do not meet EQL criteria. Furthermore, the MDL values did not support use of the respective possible MCLGs as occurrence thresholds. Nevertheless, EPA could use 10 × MDL values to develop EQLs that are less than current PQLs. The EQL for carbofuran is 5 µg/L; more than 98 percent of the MRL values are less than 5 µg/L. The EQL for cyanide is 50 µg/L; 94 percent of the MRL values are less than this value. Similarly, the EQL for methoxychlor is 1 µg/L; 86 percent of the MRL values less than 1 µg/L.

Exhibit 5-4 provides a summary of the occurrence thresholds for this contaminant group. EPA's analysis indicates that most of the thresholds can be set equal to corresponding possible MCLG values, regardless of whether PQL values exceed possible MCLGs. In five cases, alternative values must be used because analytical feasibility will most likely limit setting an MCL equal to a possible MCLG.

Exhibit 5-4. Occurrence Threshold Results

Contaminant	Possible MCLG (µg/L)	Occurrence Threshold	Basis
Carbofuran	0.6	5	EQL based on 10 × MDL
Cyanide	4	50	EQL based on 10 × MDL
cis-1,2-Dichloroethylene	10	10	possible MCLG
Endothall	50	50	possible MCLG
Fluoride	900	900	Possible MCLG
Hexachlorocyclopentadiene	40	40	possible MCLG
Methoxychlor	0.1	1	EQL based on 10 × MDL
Oxamyl	10	10	possible MCLG
Selenium	40	40	possible MCLG
Styrene	0	0.5	EQL based on modal MRL
Toluene	600	600	possible MCLG
Xylene	1000	1000	possible MCLG

6 References

U.S. Environmental Protection Agency (USEPA). 2003. EPA Protocol for Review of Existing National Primary Drinking Water Regulations. EPA 815-R-03-002.

USEPA. 2009a. Analytical Feasibility Support Document for the Second Six-Year Review of Existing National Primary Drinking Water Regulations. EPA 818-B-09-003.

USEPA. 2009b. Development of Estimated Quantitation Levels for the Second Six-Year Review of National Primary Drinking Water Regulations. EPA 815-B-09-003.

USEPA. 2009c. EPA Protocol for the Second Review of Existing National Primary Drinking Water Regulations (Updated). EPA 815-B-09-002.

USEPA. 2016a. 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. EPA 810-R-16-014.

USEPA. 2016b. Analytical Feasibility Support Document for the Third Six-Year Review of National Primary Drinking Water Regulations: Chemical Phase Rules and Radionuclides Rules. EPA 810-R-16-005.

USEPA. 2016c. Six-Year Review 3 – Health Effects Assessment for Existing Chemical and Radionuclide National Primary Drinking Water Regulations – Summary Report. EPA 822-R-16-008.