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Environmental Protection
Agency

Development of Estimated Quantitation Levels for the Second Six-Year Review of National Primary Drinking Water Regulations

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Abbreviations and Acronyms

2,4-D	2,4-dichlorophenoxyacetic acid
BAT	best available technology
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
PE	performance evaluation
PT	proficiency testing
SDWA	Safe Drinking Water Act
SOC	synthetic organic compound
VOC	volatile organic compounds
WS	water supply

Executive Summary

The U.S. Environmental Protection Agency (EPA) has completed its second Six-Year Review (Six-Year Review 2) 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 National Primary Drinking Water Regulations (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 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 2, EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2009e), analytical feasibility (USEPA, 2009b), treatment feasibility (USEPA, 2009f), and occurrence (USEPA, 2009a and 2009d). 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 method EPA used to establish the threshold values that it used for the occurrence analyses.

For most contaminants, EPA established an estimated quantitation level (EQL), which is an estimate of the possible lower bound for a practical quantitation level (PQL). Current PQLs are based on historical analytical capabilities, generally the quantitation capabilities at the time EPA promulgated the existing NPDWRs. Current MCLs may be limited by historical PQLs. Thus, improvements in analytical detection could present an opportunity to lower the MCL closer to MCLG. For a few contaminants, EPA established new threshold values based on new health effects information that indicates adverse health effects might occur at concentrations below the current MCLG, and evaluated whether these levels would also be feasible with respect to quantitation capabilities.

The EQLs do not represent the Agency's intent to promulgate new PQLs at this time. Any revisions to PQLs will be made as part of future rule making efforts. For Six-Year Review 2, EPA derived the new thresholds and conducted occurrence and exposure analyses only if an MCL revision would be feasible: the current MCL is limited by analytical capability (i.e., the MCL equals a PQL), and there is new information indicating improved analytical capability; or the current MCL is set equal to the MCLG, and a new health effects assessment indicates it is possible to revise the MCLG.

As a lower bound estimate of analytical capability for a given contaminant, ideally an EQL would be based on the same type of data used to drive PQLs. Current PQLs are based on two approaches: the lowest value for which 75% of laboratories can quantitate within prescribed accuracy limits based on actual performance data, and an MDL-based method that involves multiplying an MDL by five or ten to compute a PQL. EPA prefers laboratory performance data over the MDL multiplier method.

However, the PT data available during Six-Year Review 2 were not sufficient to derive PQLs. For example, there are no laboratory performance studies for several contaminants at concentrations below the current PQL. For other contaminants, the range of concentrations is not sufficient to determine what a lower bound on analytical capability might be (i.e., where at least 75% of laboratories can reliably and consistently quantitate).

Because of insufficient PT data, EPA used two other sources to derive EQLs: MRLs from the Six-Year 2 ICR dataset, and MDLs associated with approved analytical methods developed by EPA. The MRL data are the primary data source for most of the EQL estimates because these data represent laboratory analytical limits nationwide. EPA used MDL data to estimate EQLs when MRL data were inconclusive, and to confirm the analytical feasibility of the MRL-based estimates.

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.

For most contaminants, the MRL and MDL data supported EPA's conclusion based on PT data. EPA relied primarily on the MRL data to calculate EQLs. The MRLs provide information on the analytical capabilities of a large pool of laboratories. The MRL data also provide a threshold for estimating occurrence. Setting an EQL below a substantial number of MRL values will limit the monitoring data available for the occurrence analysis.

For all of the volatile organic compounds (VOCs) (except for 1,1,2-trichloroethane, for which the threshold is based on health effects), more than 90% of MRL values are equal to or less than the feasible EQL, with a clear majority equal to the modal MRL. Proportions at the modal MRL range from a low of 75.6% (vinyl chloride) to a high of 87.8% (dichloromethane). Proportions that equal or are less than the modal MRL exceed 94%. The modal MRL is 0.5 µg/L in each case.

EQLs for the synthetic organic compounds (SOCs) hexachlorobenzene and toxaphene are based on modal MRLs. EQLs for DBCP, chlordane, heptachlor, and heptachlor epoxide are based on the MDL multiplier method. This method involves taking the median MDL from the EPA approved methods for analysis of a given contaminant (or average if there are only two MDL values) and multiplying it by a factor of ten. Thresholds for endothall and oxamyl are based on new health effects information.

There are several contaminants for which the MCLs are limited by analytical capability, and EPA determined that there was no potential for PQL revision. In each case, the PQL assessment did not identify potential to revise the PQL, the modal MRL – although sometimes lower than the PQL – did not account for a large majority of MRL values, and the MDL multiplier result generally concurred with the current PQL. One exception is dioxin, for which slightly more than 90% of the MRL values are equal to or less than the modal MRL. The MRL result, however, is based on relatively few samples. Furthermore, EPA does not have PT data for dioxin, and the MDL multiplier approach generates a result that is higher than the current PQL. Therefore, EPA categorized dioxin as not having potential for a PQL revision. **Exhibit ES-1** provides a summary of results.

Exhibit ES-1. Summary of Threshold Determination

Contaminant	Type	Current PQL	Threshold (EQL or health-based)	Basis for Threshold	MRL Distribution	
					% = mode	% ≤ mode
Ongoing health effects assessment, MCL limited by PQL						
Benzo[a]pyrene	SOC	0.2 μg/L	na	na	53.7	55.4
Carbon tetrachloride	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.1	97.7
DEHP	SOC	6 μg/L	na	na	45.5	76.9
1,2-Dichloroethane	VOC	5 μg/L	0.5 μg/L	Modal MRL	83.8	96.9
Dichloromethane	VOC	5 μg/L	0.5 μg/L	Modal MRL	87.8	96.0
Pentachlorophenol	SOC	1 μg/L	na	na	44.7	48.7
PCBs	SOC	0.5 μg/L	na	na	67.6	74.3
Dioxin	SOC	3×10^{-5} μg/L	na	na	75.4	90.3
Tetrachloroethylene	VOC	5 μg/L	0.5 μg/L	Modal MRL	84.6	96.1
Thallium	IOC	2 μg/L	na	na	63.0	78.0
Trichloroethylene	VOC	5 μg/L	0.5 μg/L	Modal MRL	85.4	97.7
No new health effects assessment or new health effects assessment indicates no MCLG change, MCL is limited by PQL						
Benzene	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.4	99.3
Chlordane	SOC	2 μg/L	1 μg/L	10×MDL	46.8	63.8
DBCP	SOC	0.2 μg/L	0.1 μg/L	10×MDL	35.6	84.7
1,2-Dichloropropane	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.1	99.3
EDB	SOC	0.05 μg/L	na	na	32.4	32.9
Heptachlor	SOC	0.4 μg/L	0.1 μg/L	10×MDL	42.4	56.0
Heptachlor epoxide	SOC	0.2 μg/L	0.1 μg/L	10×MDL	45.0	55.2
Hexachlorobenzene	SOC	1 μg/L	0.1 μg/L	Modal MRL	69.5	82.1
Toxaphene	SOC	3 μg/L	1 μg/L	Modal MRL	67.4	83.0
1,1,2-Trichloroethane	VOC	5 μg/L	3 μg/L[1]	Current MCLG	99.9% below current MCLG	
Vinyl chloride	VOC	2 μg/L	0.5 μg/L	Modal MRL	75.6	94.0
New health effects assessment indicates possible MCLG below PQL						
Endothall	SOC	90 μg/L	50 μg/L[1]	Possible MCLG	98.4% below possible MCLG	
Oxamyl	SOC	50 μg/L	2 μg/L[1]	Possible MCLG	96.7% below possible MCLG	

na = not applicable (PQL assessment does not support PQL revision, and MDL range and MRL data do not indicate potential for PQL revision).

1. This threshold is based on health effects information instead of an EQL. The MRL results show the percent of MRL values below the health-based threshold.

1 Introduction

The U.S. Environmental Protection Agency (EPA or the Agency) has conducted its second Six-Year Review ("Six-Year Review 2") 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 2, EPA implemented the protocol that it developed for the first Six-Year Review (USEPA, 2003a), including minor revisions developed during the current review process (USEPA, 2009c). EPA obtained and evaluated new information including information on health effects (USEPA, 2009e), analytical feasibility (USEPA, 2009b), treatment feasibility (USEPA, 2009f), and occurrence (USEPA, 2009a and 2009d). Some of the 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.[1] This document describes the method EPA used to establish the threshold values that it used for the occurrence analyses.

For most contaminants, EPA established an estimated quantitation level (EQL), which is an estimate of the possible lower bound for a practical quantitation level (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 maximum contaminant level goal (MCLG), the MCL cannot be lower than the PQL. Thus, improvements in analytical feasibility identified in USEPA (2009b) indicate potential opportunity to lower the PQL for some contaminants that

[1] EPA used these thresholds when it estimated possible system and population impacts in the occurrence and exposure analysis conducted for the Six-Year Review 2 (USEPA, 2009a). 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 incremental exposure and human health risks. EPA based its determinations about whether a potential reduction in the MCL for a contaminant would provide a meaningful opportunity to improve the level of public health protection on the incremental occurrence and exposure estimates for that contaminant.

have MCLs limited by PQLs, and, therefore, lower the MCL closer to MCLG. The EQLs do not represent the Agency's intent to promulgate new PQLs at this time. Any revisions to PQLs will be made as part of future rule making efforts.

For two contaminants, EPA established new threshold values based on new health effects information that indicates adverse health effects might occur at concentrations below the current MCLG. These contaminants are included in this report because they have PQLs that are higher than the new possible MCLG values, prompting EPA to evaluate the potential to estimate a quantitation level below the PQL and perhaps as low as the possible MCLG.

Exhibit 1-1 shows the contaminants for both groups. In the first case, which applies to the 22 contaminants in Exhibit 1-1 with PQLs limiting their MCLs, any MCL revision depends on whether the PQL can be lower. In the second case, which applies to the final two contaminants in the exhibit, the new estimate of a possible MCLG is below the current PQL and it is necessary to examine whether the PQL can be lowered to the possible MCLG.

Analyzing the feasibility of reducing a contaminant's current PQL was one of the review tasks of the Six-Year Review 2. 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 laboratory performance evaluation (PE) data obtained during the first Six-Year Review. The PT and PE studies involve the use of spiked samples to evaluate laboratory quantitation capabilities. USEPA (2009b) describes the review method, PT and PE data, and findings for the PQL analysis. For Six-Year Review 2, EPA did not 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 and PE 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 and PE data support a reduction in the PQL. Exhibit 1-1 provides summary information for whether the data indicate there is potential to revise the PQL.

Because the PT and PE 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 Information Collection 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, 2009a). The MRL values provide direct evidence from actual monitoring results about whether quantitation below the PQL using current analytical methods is feasible.

Exhibit 1-1. Contaminants Requiring Methods or Occurrence Analyses

Contaminant	Current MCLG[1]	Current PQL[1]	Current MCL	Possible MCLG	Do PT Data Support PQL Revision?[2]
Ongoing health effects assessment, MCL limited by PQL					
Benzo[a]pyrene	0	**0.2 µg/L**	0.2 µg/L	0[3]	No
Carbon Tetrachloride	0	**5 µg/L**	5 µg/L	0[3]	Yes
Di (2-ethylhexyl)phthalate (DEHP)	0	**6 µg/L**	6 µg/L	0[3]	No
1,2-Dichloroethane	0	**5 µg/L**	5 µg/L	0[3]	Yes
Dichloromethane	0	**5 µg/L**	5 µg/L	0[3]	No
Pentachlorophenol	0	**1 µg/L**	1 µg/L	0[3]	No
Polychlorinated biphenyls (PCBs)	0	**0.5 µg/L**	0.5 µg/L	0[3]	No
2,3,7,8-TCDD (Dioxin)	0	**3×10^{-5} µg/L**	3×10^{-5} µg/L	0[3]	No
Tetrachloroethylene	0	**5 µg/L**	5 µg/L	0[3]	Yes
Thallium	0.5 µg/L	**2 µg/L**	2 µg/L	Not determined[4]	No
Trichloroethylene	0	**5 µg/L**	5 µg/L	0[3]	Yes
No new health effects assessment or new health effects assessment indicates no MCLG change, MCL is limited by PQL					
Benzene	0	**5 µg/L**	5 µg/L	No new HEA	Yes
Chlordane	0	**2 µg/L**	2 µg/L	No new HEA	Yes
1,2-Dibromo-3-Chloropropane (DBCP)	0	**0.2 µg/L**	0.2 µg/L	No new HEA	Possibly
1,2-Dichloropropane	0	**5 µg/L**	5 µg/L	No new HEA	Yes
Ethylene Dibromide (EDB)	0	**0.05 µg/L**	0.05 µg/L	No MCLG change	No
Heptachlor	0	**0.4 µg/L**	0.4 µg/L	No new HEA	Possibly
Heptachlor Epoxide	0	**0.2 µg/L**	0.2 µg/L	No new HEA	Possibly
Hexachlorobenzene	0	**1 µg/L**	1 µg/L	No new HEA	Yes
Toxaphene	0	**3 µg/L**	3 µg/L	No new HEA	Possibly
1,1,2-Trichloroethane	3 µg/L	**5 µg/L**	5 µg/L	No new HEA	Yes
Vinyl Chloride	0	**2 µg/L**	2 µg/L	No new HEA	Possibly
New health effects assessment indicates possible MCLG below PQL					
Endothall	**100 µg/L**	90 µg/L	100 µg/L	50 µg/L[5]	No
Oxamyl	**200 µg/L**	20 µg/L	200 µg/L	2 µg/L[5]	No

1. Boldface in the Current MCLG or Current PQL column indicates that the MCL is based on the MCLG or PQL, respectively.
2. Results of PQL assessment based on analysis of PT and PE data.
3. Although a health effects assessment is in progress, the current MCLG is zero. When the MCLG < MCL, the protocol includes a review of whether the MCL can be lowered even when a health effects assessment is ongoing.
4. There is a health effects assessment in progress that may change the reference dose, which is the basis for the current MCLG. Because the MCL is based on the PQL, EPA reviewed the potential to revise the PQL.
5. Possible MCLG based on a recently completed health effects assessment.

An MDL is a measure of analytical method sensitivity (USEPA, 2009b). 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 and PE data review. For most contaminants, the MRL and MDL data supported EPA's conclusion based on PT and PE data.

Section 2 provides a description of the MRL and MDL data that EPA used to derive the EQLs or evaluate analytical feasibility or the health-based thresholds. The method EPA used to derive the EQLs is in Section 3 along with an overview of the results. Section 4 contains contaminant-specific information and results.

2 Data Sources

As a lower bound estimate of analytical capability for a given contaminant, ideally an EQL would be based on the same type of data used to drive PQLs. Current PQLs are based on two approaches. The first comprises laboratory performance data; a PQL based on laboratory performance data is the lowest value for which 75% of laboratories can quantitate within prescribed accuracy limits. The second is an MDL-based method that involves multiplying an MDL by five or ten to compute a PQL. EPA prefers laboratory performance data over the MDL multiplier method. USEPA (2009b) provides detailed descriptions of these two PQL derivation methods.

The PT and PE study results available during Six-Year Review 2 are not sufficient to derive PQLs, however. For example, several contaminants have no laboratory performance studies for concentrations below the contaminant's current PQL. For other contaminants that have some performance results below the PQL, generally the range of concentrations are not sufficient to determine where a lower bound on analytical capability might be (i.e., where at least 75% of laboratories can reliably and consistently quantitate).

Because of insufficient PT or PE data, EPA used two other sources to derive EQLs: MRLs from the Six-Year 2 ICR dataset (Section 2.1), and MDLs associated with approved analytical methods developed by EPA (Section 2.2). The MRL data are the primary data source for most of the EQL estimates because these data represent laboratory analytical limits nationwide. EPA used MDL data to estimate EQLs when MRL data were inconclusive, and to confirm the analytical feasibility of the MRL-based estimates.

2.1 MRL Data

For the Six-Year Review 2 occurrence analysis, EPA obtained compliance monitoring data for 1998 through 2005. USEPA (2009a) 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 47 States/Primacy Entities. This dataset – the Second Six-Year Review National Compliance Monitoring Information Collection Rule dataset (Six-Year Review 2 ICR dataset) – is the largest and most comprehensive drinking water compliance monitoring dataset ever compiled and analyzed by EPA. It contains over 17 million records.

The Six-Year Review 2 ICR dataset 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, 2009a). In other words, the MRL is the lowest contaminant concentration that can be reliably quantified in the laboratory and reported with the contaminant occurrence data to primacy agencies (e.g., States).

The MRL values provide EPA with valuable insights into current 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.

When compliance monitoring data are recorded for a contaminant concentration that does not exceed the MRL for that contaminant at a laboratory using an applicable analytical method, then the compliance record should specify "<MRL" (i.e., less than the MRL) in the result field of the dataset and a numeric MRL value in the MRL field of the dataset. 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 (2009a) describes the data management process, including measures taken to address data quality concerns that affect the occurrence and exposure analysis; the Appendix provides summary information from this process.

2.2 MDL Data

The MDL multiplier approach for estimating an EQL applies a multiplier of five or ten to an MDL. An MDL is a measure of analytical method sensitivity (USEPA, 2009b), defined in 40 CFR Part 136 Appendix B as "the minimum concentration of a substance that can be reported with 99% 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 2. Instead, EPA is using the MDL approach to help identify EQLs below current PQLs for the occurrence and exposure analysis.

MDLs can vary by analytical method and contaminant. USEPA (2009b) provides complete information for MDLs by contaminant and analytical method. The MDL values or ranges of values in USEPA (2009b) 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 (2009b).[2] EPA used only upper bound values when there was an MDL range for a particular method and contaminant in an effort to derive an EQL value that would represent a level where most laboratories should be able to quantitate; the lower bound value for each method's MDL range is likely to result in an EQL that would represent analytical capabilities of fewer laboratories.

2.3 Data Summary

Exhibit 2-1 provides a summary of the information used to develop EQL values: the modal MRL values from the Six-Year Review 2 MRL data and a range of upper bound MDL values across the analytical methods developed by EPA. The exhibit also reports the current PQL for comparisons purposes. The modal MRL values for Six-Year Review 2 are generally lower than the PQL values. The MDL ranges for several contaminants, however, are not low enough to

[2] For some methods in USEPA (2009b), the reported MDL is range; for others the MDL is a single value. For example, the MDL range for analysis of carbon tetrachloride using EPA Method 502.2 is 0.01 – 0.02 µg/L. In the EQL analysis, EPA used only the upper bound values whenever USEPA (2009b) reported an MDL range; i.e., 0.02 µg/L for EPA Method 502.2 for carbon tetrachloride.

indicate potential for a PQL reduction (i.e., lower than the current PQL by more than a factor of ten). Section 4 addresses each contaminant in detail.

Exhibit 2-1. U.S. EPA Drinking Water MDLs, MRLs and Related Information for Contaminants in the EQL Report

Contaminant	PQL (µg/L)	Six Year 2 Modal MRL (µg/L)	MDL Range for EPA Methods (µg/L)
Ongoing health effects assessment, MCL limited by PQL			
Benzo[a]pyrene	0.2	0.02	0.016 - 0.23
Carbon Tetrachloride	5	0.5	0.02 - 0.21
DEHP	6	1.0	1.3 - 2.25
1,2-Dichloroethane	5	0.5	0.03 - 0.06
Dichloromethane	5	0.5	0.02 - 0.09
Pentachlorophenol	1	0.04	0.032 - 1.6
PCBs	0.5	0.1	0.08
Dioxin	0.00003	0.000005	0.00001 (ML)
Tetrachloroethylene	5	0.5	0.008 - 0.14
Thallium	2	1	0.3 - 0.7
Trichloroethylene	5	0.5	0.042 - 0.19
No new health effects assessment or new health effects assessment indicates no MCLG change, MCL is limited by PQL			
Benzene	5	0.5	0.01 - 0.04
Chlordane	2	0.2	0.004 - 0.22
DBCP	0.2	0.5	0.009 - 0.01
1,2-Dichloropropane	5	0.5	0.03 - 0.04
EDB	0.05	0.01	0.01 - 0.032
Heptachlor	0.4	0.04	0.0015 - 0.15
Heptachlor Epoxide	0.2	0.02	0.001 - 0.202
Hexachlorobenzene	1	0.1	0.001 - 0.13
Toxaphene	3	1	0.13 - 1.7
1,1,2-Trichloroethane	5	0.5	0.017 - 0.1
Vinyl chloride	2	0.5	0.17 - 0.18
New health effects assessment indicates possible MCLG below PQL			
Endothall	90	9	1.79
Oxamyl	50	2	0.065 - 0.86

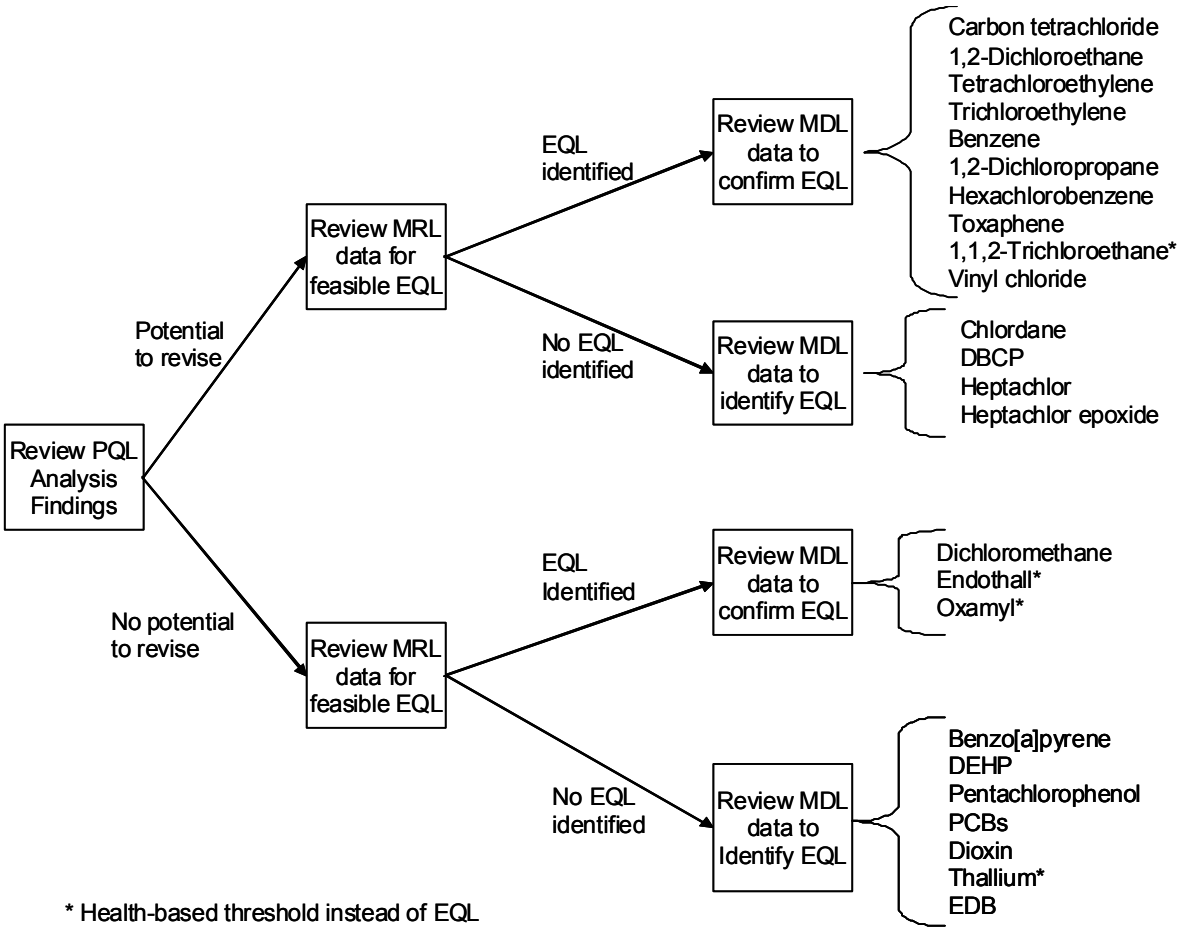
Sources: USEPA (2009a and 2009b)
ML=minimum level

For DBCP, the modal MRL for Six-Year Review 2 is 0.5 µg/L, which is higher than the PQL of 0.2 µg/L, which is also the MCL. Given the range of upper bound MDL values for EPA methods shown in Exhibit 2-1 (0.009 to 0.01 µg/L), MRL values greater than the MCL are generally not expected. The MRL data for this contaminant indicate a data quality issue. As the discussion in Section 4 indicates, EPA disregarded MRL data in setting an EQL for DBCP.

3 Threshold Development Method

EPA's method for developing an EQL has essentially three steps – one for each of the three information sources (PT and PE data, MRL data, and MDL values). The first step is to review the conclusion of the PQL analysis (**Exhibit 3-1**). The next two steps depend somewhat on whether the PT and PE data indicate potential to revise the PQL. If they do, then the objective of the next two 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 EPA determines in the second step that the modal MRL is not a feasible EQL, then EPA uses the MDL multiplier approach to establish an EQL in the third step. If the PT data do not indicate potential to revise, then EPA determines whether the MRL and MDL data concur with this finding or indicate an EQL value. As Exhibit 3-1 shows, there were two types of outcomes for this case. For the first type, the MRL and MDL data contradict the PQL analysis finding, and EPA used these secondary data sources to derive an EQL (or verify the use of a health-based threshold) for the occurrence analysis. For the second type, the MRL and MDL data confirm the PQL analysis finding and there is no basis for an EQL that is less than the PQL. Exhibit 3-1 provides an overview of the three steps and outcomes; **Exhibit 3-2** provides a summary of the EQL results.

Exhibit 3-1. EQL Development Steps



As Exhibit 3-2. Summary of Threshold DeterminationExhibit 3-2 indicates, EPA relied primarily on the MRL data to calculate EQLs. The MRLs provide information on the analytical capabilities of a large pool of laboratories. The MRL data also provide a threshold for estimating occurrence. Setting an EQL below a substantial number of MRL values will limit the monitoring data available for the occurrence analysis.

EPA set the EQL equal to the modal MRL when at least 80% of the MRL values were equal to or less than the modal MRL. EPA determined that the contaminants with more than 80% of MRL values equal to or less than the modal MRL also have MDL values that support an EQL below the current PQL and often as low as the modal MRL. Thus, an MRL distribution threshold of 80% enables EPA to derive EQLs that tend to be supported by multiple data sources.

For all of the volatile organic compounds (VOCs) in Exhibit 3-2 (except for 1,1,2-trichloroethane, which has a health-based threshold) more than 90% of each contaminant's MRL values are equal to or less than the modal MRL, with a clear majority equal to the modal MRL. Proportions at the modal MRL range from a low of 75.6% (vinyl chloride) to a high of 87.8% (dichloromethane). Proportions that equal or are less than the modal MRL exceed 94%. In each case, the modal MRL is 0.5 µg/L. Therefore, EQLs for the VOCs are based on modal MRL values.

The synthetic organic compounds (SOCs) have EQLs based on different methods. Two have with EQLs based on modal MRLs – hexachlorobenzene and toxaphene. Four SOCs have EQLs based on the MDL multiplier method – DBCP, chlordane, heptachlor, and heptachlor epoxide. This method takes the median MDL from the EPA approved methods for analysis of a given contaminant (or average if there are only two MDL values), and multiplies it by a factor of ten. Two have health-based thresholds – endothall and oxamyl.

As Exhibit 3-2 indicates, there are several contaminants with MCLs that are limited by analytical capability, for which EPA determined there was no potential for PQL revision. In each case, the PT analysis did not identify potential to revise the PQL, the modal MRL – although sometimes lower than the PQL – did not meet the 80% distribution threshold, and the MDL multiplier result generally concurred with the current PQL. One exception is dioxin, which has slightly more than 90% of the MRL values equal to or less than the modal MRL. The MRL result, however, is based on relatively few samples. Furthermore, EPA does not have PT data for dioxin and the MDL multiplier approach generates a result that is higher than the current PQL. Therefore, EPA categorized dioxin as not having potential for a PQL revision.

Exhibit 3-2. Summary of Threshold Determination

Contaminant	Type	Current PQL	Threshold (EQL or health-based)	Basis for Threshold	MRL Distribution[1]	
					% = mode	% ≤ mode
Ongoing health effects assessment, MCL limited by PQL						
Benzo[a]pyrene	SOC	0.2 μg/L	na	na	53.7	55.4
Carbon tetrachloride	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.1	97.7
DEHP	SOC	6 μg/L	na	na	45.5	76.9
1,2-Dichloroethane	VOC	5 μg/L	0.5 μg/L	Modal MRL	83.8	96.9
Dichloromethane	VOC	5 μg/L	0.5 μg/L	Modal MRL	87.8	96.0
Pentachlorophenol	SOC	1 μg/L	na	na	44.7	48.7
PCBs	SOC	0.5 μg/L	na	na	67.6	74.3
Dioxin	SOC	3×10^{-5} μg/L	na	na	75.4	90.3
Tetrachloroethylene	VOC	5 μg/L	0.5 μg/L	Modal MRL	84.6	96.1
Thallium	IOC	2 μg/L	na	na	63.0	78.0
Trichloroethylene	VOC	5 μg/L	0.5 μg/L	Modal MRL	85.4	97.7
No new health effects assessment or new health effects assessment indicates no MCLG change, MCL is limited by PQL						
Benzene	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.4	99.3
Chlordane	SOC	2 μg/L	1 μg/L	10×MDL	46.8	63.8
DBCP	SOC	0.2 μg/L	0.1 μg/L	10×MDL	35.6	84.7
1,2-Dichloropropane	VOC	5 μg/L	0.5 μg/L	Modal MRL	86.1	99.3
EDB	SOC	0.05 μg/L	na	na	32.4	32.9
Heptachlor	SOC	0.4 μg/L	0.1 μg/L	10×MDL	42.4	56.0
Heptachlor epoxide	SOC	0.2 μg/L	0.1 μg/L	10×MDL	45.0	65.2
Hexachlorobenzene	SOC	1 μg/L	0.1 μg/L	Modal MRL	69.5	82.1
Toxaphene	SOC	3 μg/L	1 μg/L	Modal MRL	67.4	83.0
1,1,2-Trichloroethane	VOC	5 μg/L	3 μg/L[1]	Current MCLG	99.9% below current MCLG	
Vinyl chloride	VOC	2 μg/L	0.5 μg/L	Modal MRL	75.6	94.0
New health effects assessment indicates possible MCLG below PQL						
Endothall	SOC	90 μg/L	50 μg/L[1]	Possible MCLG	98.4% below possible MCLG	
Oxamyl	SOC	50 μg/L	2 μg/L[1]	Possible MCLG	96.7% below possible MCLG	

na = not applicable (PQL assessment does not support PQL revision, and MDL range and MRL data do not indicate potential for PQL revision).

1. This threshold is based on health effects information instead of an EQL. The MRL results show the percent of MRL values below the health-based threshold.

4 Development of Individual EQLs

This section provides a discussion of the EQL or health-based threshold determination for each contaminant addressed in this report. The discussion for each contaminant contains an overview of the PQL review in USEPA (2009b), followed by MRL summary data and MDLs. There are three subsections – one for each of the three contaminant groups shown in previous exhibits.

4.1 Contaminants with Ongoing Health Effects Review and MCL Limited by PQL

4.1.1 Benzo[a]pyrene

The MCL for benzo[a]pyrene is based on a PQL of 0.2 μg/L. Its 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 will be based on analytical feasibility. There are no PT or PE study results at spiked concentrations below the current PQL. Several passing rates for the available PT studies are below 75%, although none of the PE data passing rates are below 75%. Because of the variability in passing rates and lack of data below the PQL, EPA determined that a PQL revision is not appropriate at this time (USEPA, 2009b).

As shown in **Exhibit 4-1** and **Exhibit 4-2**, the modal MRL for benzo[a]pyrene is 0.02 μg/L. Summary data show that 53.7% of the MRLs are equal to this value, and 55.4% of the MRL values are equal to or less than it. There is, however, a second cluster of MRLs at or just below the current PQL. Unlike the PT data, the MRL data indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. Less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-1. Summary of MRL Data for Benzo[a]pyrene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	55,487	100%
Value < Modal MRL	970	1.7%
Value = Modal MRL (0.02 μg/L)	29,769	53.7%
Value > Modal MRL and ≤ 0.1 μg/L	21,198	38.2%
Value > 0.1 μg/L	3,550	6.4%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-2. MRL Distribution for Benzo[a]pyrene

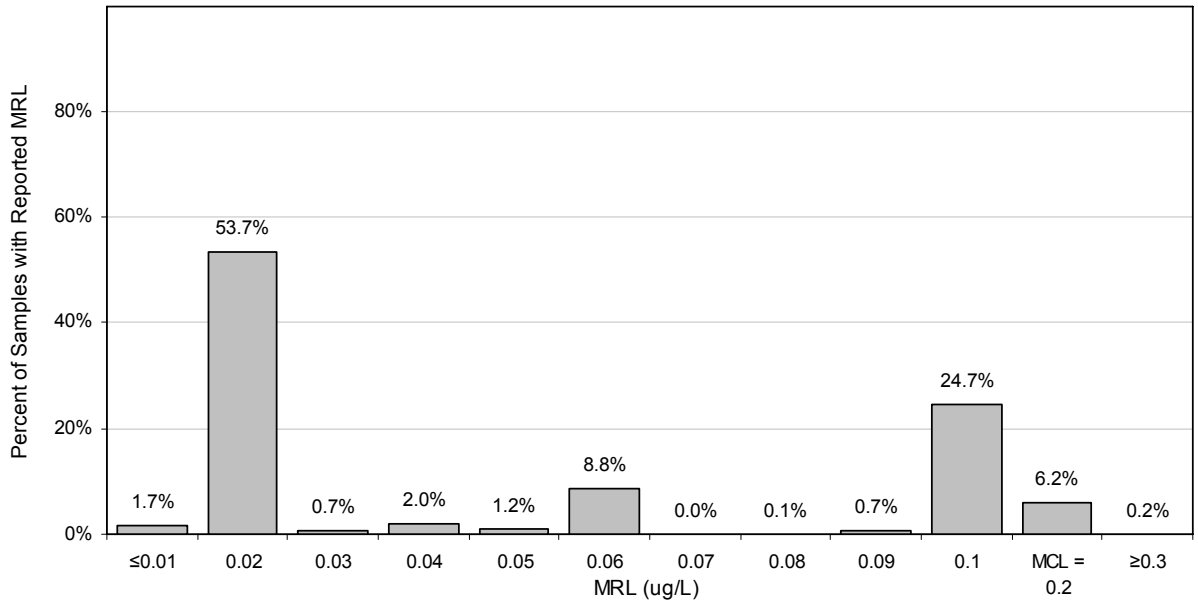


Exhibit 4-3 shows the EPA approved methods for the detection of benzo[a]pyrene, and their MDLs. Multiplying the median MDL by ten would give a value of 0.29 µg/L, which is higher than the current PQL of 0.2 µg/L. The MDL data do not support an EQL below the PQL.

Exhibit 4-3. Analytical Methods for Benzo[a]pyrene

Method	MDL (µg/L)
525.2	0.23
550	0.029
550.1	0.016

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

EPA concluded that although MRL values are generally below the current 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 Carbon Tetrachloride

The MCL for carbon tetrachloride is based on a PQL of 5 µg/L. Its MCLG is zero. It has an ongoing health effects assessment, but there is no new health information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis will be based on analytical feasibility. The PT and PE studies show greater than 90% passing rates for most of the studies around the PQL, which include ten studies with spiked concentrations below the current PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-4** and **Exhibit 4-5**, 86.1% of the MRL values in the ICR dataset are equal to the modal value of 0.5 µg/L, and 97.7% of the MRL values are equal to or less than the modal

value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-4. Summary of MRL Data for Carbon Tetrachloride

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,221	100%
Value < Modal MRL	16,195	11.6%
Value = Modal MRL (0.5 µg/L)	119,849	86.1%
Value > Modal MRL	3,177	2.3%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-5. MRL Distribution for Carbon Tetrachloride

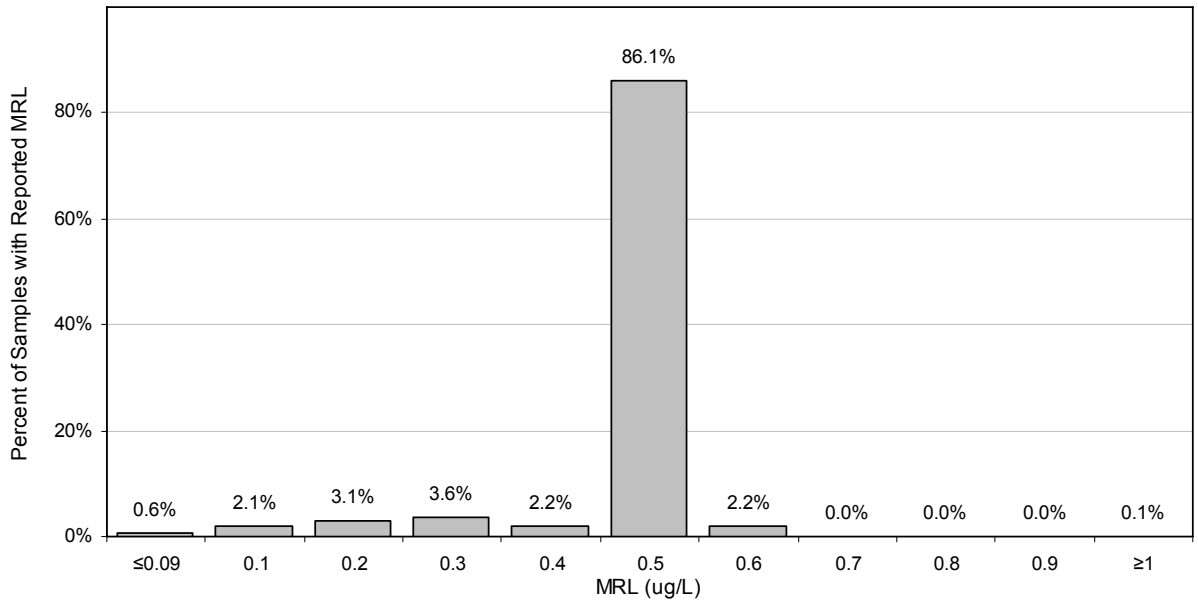


Exhibit 4-6 shows the EPA approved methods for the detection of carbon tetrachloride, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.2 to 2.1 µg/L. This range contains the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-6. Analytical Methods for Carbon Tetrachloride

Method	MDL (µg/L)
502.2	0.02
524.2	0.21
551.1	0.050

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.1.3 Di(2-ethylhexyl)phthalate (DEHP)

The MCL for DEHP is based on a PQL of 6 µg/L. Its 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 will be based on analytical feasibility. Several PT and PE studies had passing rates below 75%, including two studies with spiked concentrations below the PQL. Because of the low passing rates, EPA determined that the PT and PE results do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-7** and **Exhibit 4-8**, the modal MRL for DEHP is 1 µg/L. Summary data show that 45.5% of the MRLs are equal to this value, and 76.9% of the MRL values are equal to or less than it. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. Less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-7. Summary of MRL Data for DEHP

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	50,490	100%
Value < Modal MRL	15,842	31.4%
Value = Modal MRL (1 µg/L)	22,980	45.5%
Value > Modal MRL	11,668	23.1%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-8. MRL Distribution for DEHP

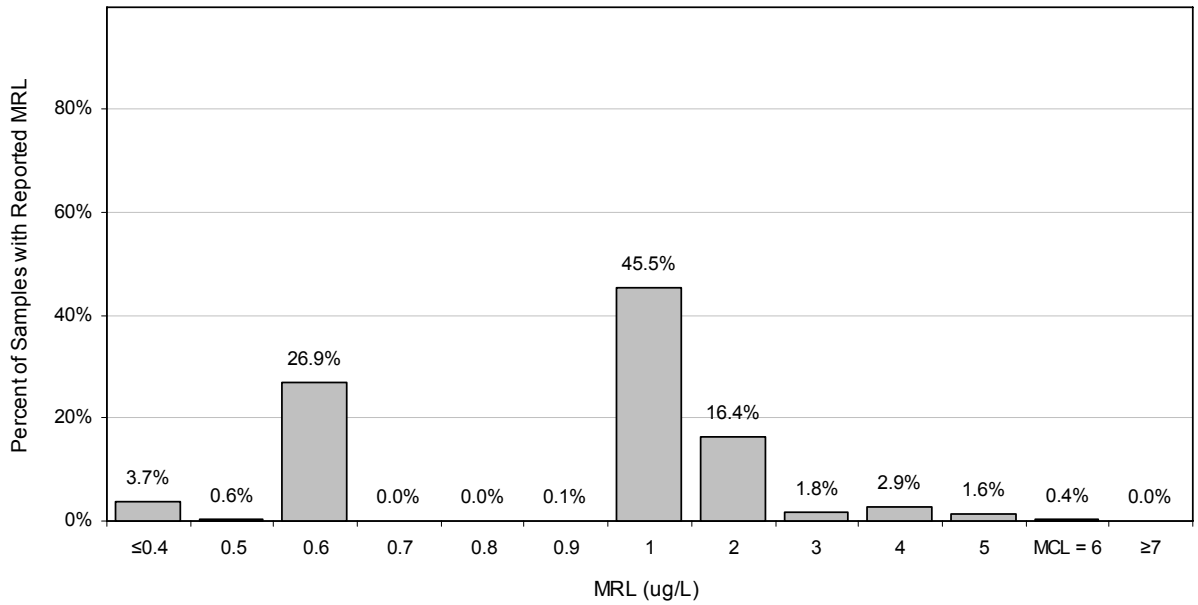


Exhibit 4-9 shows the EPA approved methods for the detection of DEHP, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 13.0 to 22.5 μg/L. This range is greater than the current PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-9. Analytical Methods for DEHP

Method	MDL (μg/L)
506	2.25
525.2	1.3

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

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

4.1.4 1,2-Dichloroethane

The MCL for 1,2-dichloroethane is based on a PQL of 5 μg/L. Its 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 will be based on analytical feasibility. The PT and PE studies show greater than 90% passing rates for most of the spiked concentrations around the PQL, which include eight studies with concentrations below the current PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-10** and **Exhibit 4-11**, 83.8% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 μg/L, and 96.9% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 μg/L, EPA based the EQL on the modal MRL.

Exhibit 4-10. Summary of MRL Data for 1,2-Dichloroethane

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,085	100%
Value < Modal MRL	18,160	13.1%
Value = Modal MRL (0.5 μg/L)	116,533	83.8%
Value > Modal MRL	4,392	3.2%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-11. MRL Distribution for 1,2-Dichloroethane

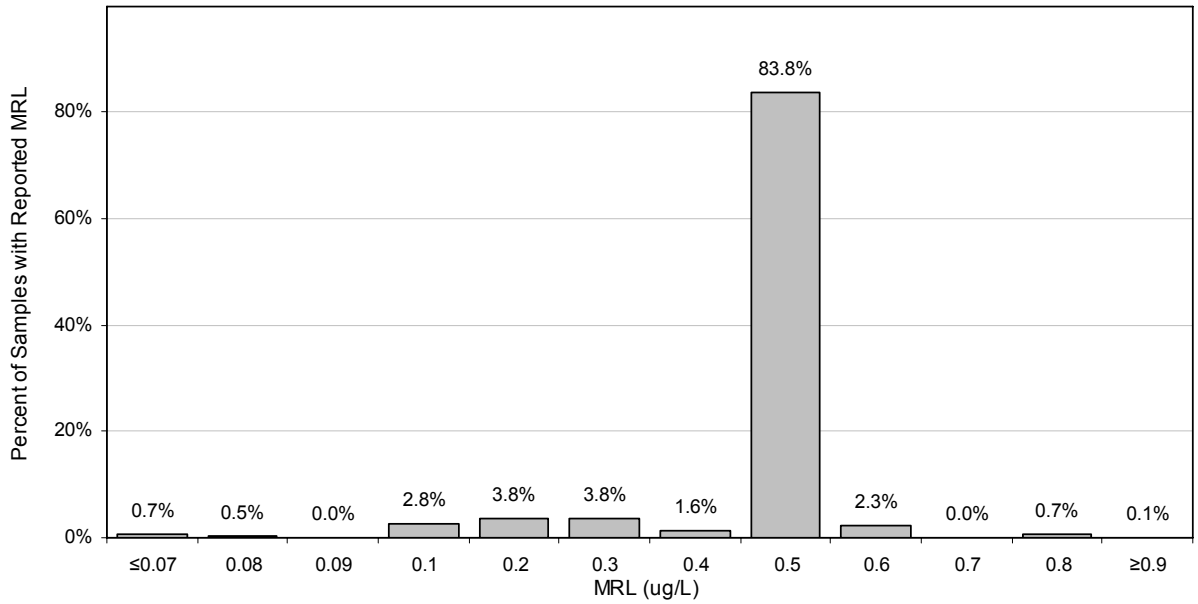


Exhibit 4-12 shows the EPA approved methods for the detection of 1,2-dichloroethane, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.3 to 0.6 µg/L. This range contains the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-12. Analytical Methods for 1,2-Dichloroethane

Method	MDL (µg/L)
502.2	0.03
524.2	0.06

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.1.5 Dichloromethane

The MCL for dichloromethane is based on a PQL of 5 µg/L. Its MCLG is zero. It has an ongoing health effects assessment, but there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis will be based on analytical feasibility. Although passing rates for the PT and PE studies are generally above 85%, there are no studies with spiked concentrations below the current PQL. Therefore, EPA determined that the PT and PE results do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-13** and **Exhibit 4-14**, 87.8% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 µg/L, and 96.0% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-13. Summary of MRL Data for Dichloromethane

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	138,625	100%
Value < Modal MRL	11,294	8.2%
Value = Modal MRL (0.5 µg/L)	121,532	87.8%
Value > Modal MRL	5.619	4.1%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-14. MRL Distribution for Dichloromethane

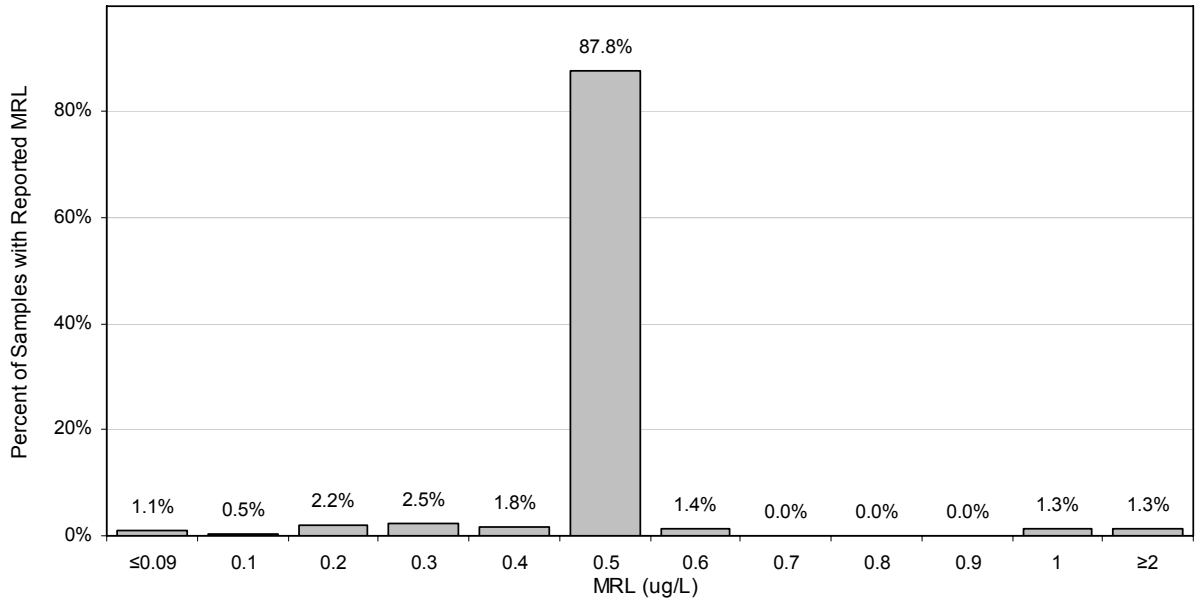


Exhibit 4-15 shows the EPA approved methods for the detection of dichloromethane, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.2 to 0.9 µg/L. This range contains the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-15. Analytical Methods for Dichloromethane

Method	MDL (µg/L)
502.2	0.02
524.2	0.09

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.1.6 Pentachlorophenol

The MCL for pentachlorophenol is based on a PQL of 1 μg/L. Its 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 will be based on analytical feasibility. Several PT and PE studies had passing rates below 75%, and only one PE study had a spiked concentration below the current PQL. Therefore, EPA determined that the PT and PE results do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-16** and **Exhibit 4-17**, the modal MRL for pentachlorophenol is 0.4 μg/L. Summary data show that 44.7% of the MRLs are equal to this value, and 48.7% of the MRL values are equal to or less than it. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. Less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-16. Summary of MRL Data for Pentachlorophenol

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	59,594	100%
Value < Modal MRL	2,399	4.0%
Value = Modal MRL (0.04 μg/L)	26,666	44.7%
Value > Modal MRL	30,529	51.2%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-17. MRL Distribution for Pentachlorophenol

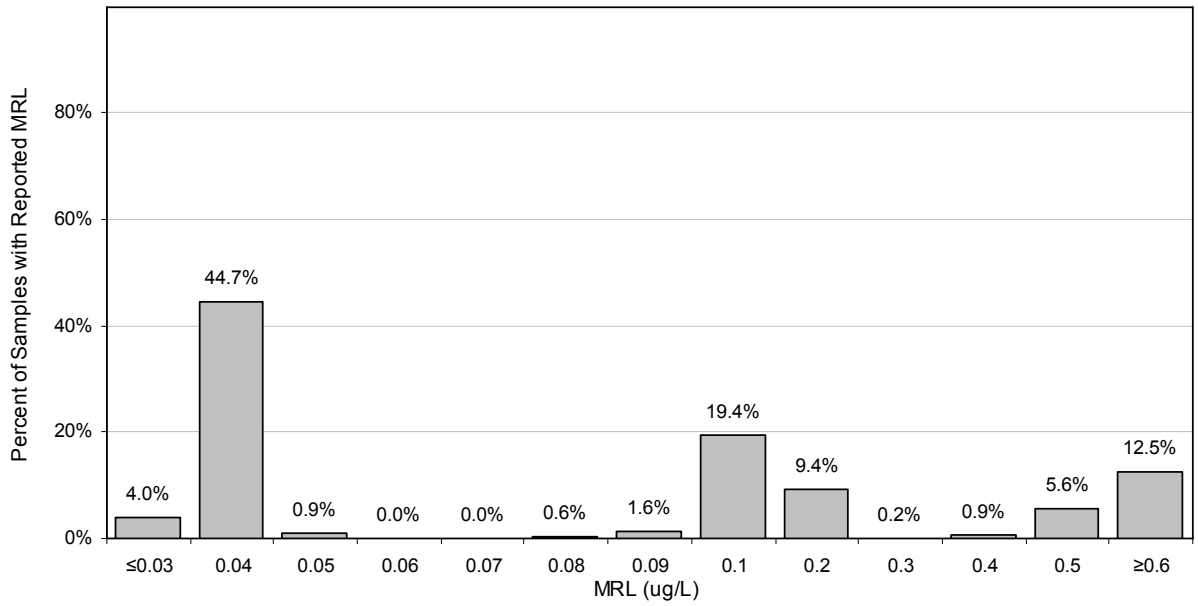


Exhibit 4-18 shows the EPA approved methods for the detection of pentachlorophenol, and their MDLs. Applying a multiplier of 10 would give a range from 0.32 to 16.0 µg/L with a median of 1.225 µg/L. This range does not contain the modal MRL and most of the 10 × MDL values exceed or nearly equal the current PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-18. Analytical Methods for Pentachlorophenol

Method	MDL (µg/L)
515.1	0.032
515.2	0.16
515.3	0.085
515.4	0.084
525.2	1.0
555	1.6

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

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

4.1.7 Polychlorinated Biphenyls (PCBs)

The MCL for PCBs is based on a 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 will be based on analytical feasibility. The only PE study with a spiked concentration below the current PQL had a passing rate below 75%. The PT data had few data points with spiked concentrations near the PQL and none below it. Therefore, EPA determined that the PT data do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-19** and **Exhibit 4-20**, the modal MRL for PCBs is 0.1 µg/L. Summary data show that 67.6% of the MRLs are equal to this value, and 74.3% of the MRL values are equal to or less than it. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. Less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-19. Summary of MRL Data for PCBs

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	35,178	100%
Value < Modal MRL	2,355	6.7%
Value = Modal MRL (0.1 µg/L)	23,785	67.6%
Value > Modal MRL	9,038	25.7%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-20. MRL Distribution for PCBs

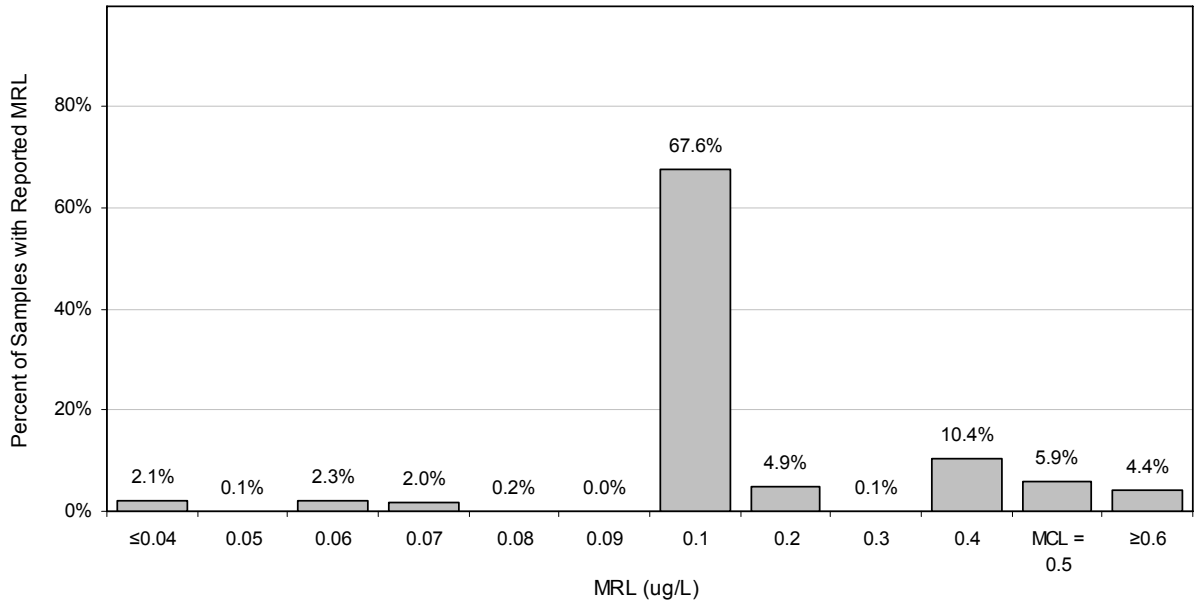


Exhibit 4-21 shows the EPA approved method for the detection of PCBs (as decachlorobiphenyl), and its MDL. Applying a multiplier of 10 would give a possible PQL of 0.8 µg/L, which is greater than the current PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-21. Analytical Methods for PCBs

Method	MDL (µg/L)
508A	0.08

Source: USEPA, 2009b

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

4.1.8 2,3,7,8-TCDD (Dioxin)

The MCL for dioxin is based on a PQL of 3×10^{-5} µg/L. Its 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 will be based on analytical feasibility. There is only one PT study result available, and its spiked value is above the PQL; there are no PE studies. Therefore, EPA determined that the PT data do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-22** and **Exhibit 4-23**, the modal MRL for dioxin is 5×10^{-6} µg/L. Summary data show that 75.4% of the MRLs are equal to this value, and 90.3% of the MRL

values are equal to or less than it. Because the majority of MRLs equal 5×10^{-6} µg/L, the MRL data suggest that value as the EQL. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. The small sample size, however, limits its usefulness for EQL development. Therefore, EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-22. Summary of MRL Data for Dioxin

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	1,278	100%
Value < Modal MRL	191	14.9%
Value = Modal MRL (0.000005 µg/L)	964	75.4%
Value > Modal MRL	123	9.6%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-23. MRL Distribution for Dioxin

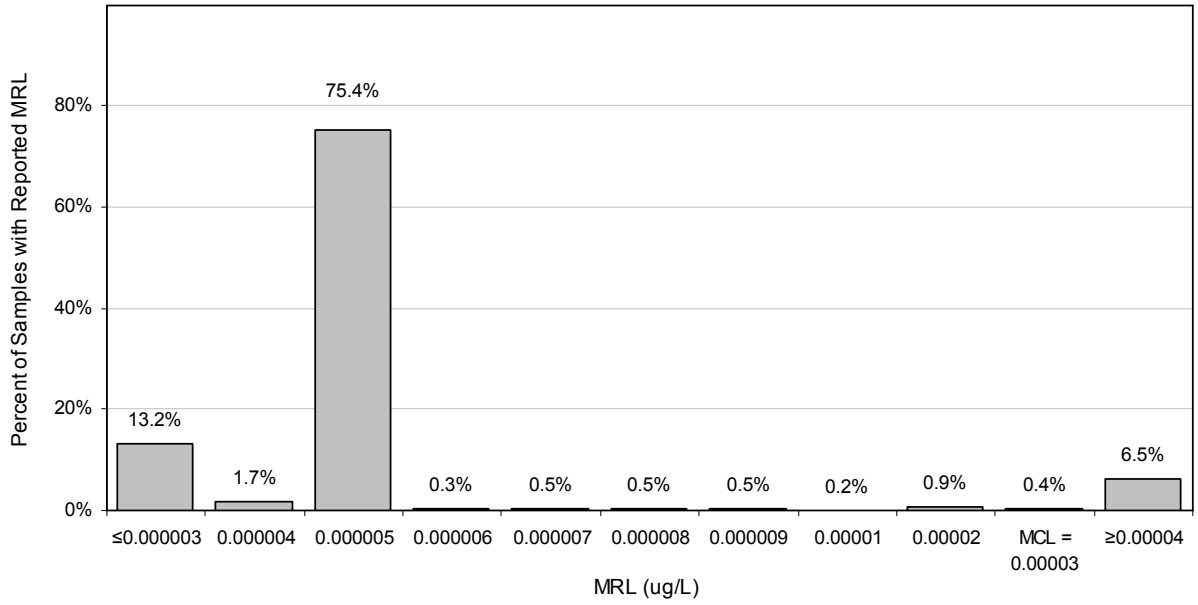


Exhibit 4-24 shows the EPA approved method for the detection of dioxin, and its minimum level (ML). Applying a multiplier of 5 would give a possible PQL of 5×10^{-5} µg/L, which is higher than the current PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-24. Analytical Methods for Dioxin

Method	MDL (µg/L)
1613	1×10^{-5} (ML)

ML = minimum level
Source: USEPA, 2009b and 40 CFR 141.24 (Organic chemicals, sampling and analytical requirements).

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

4.1.9 Tetrachloroethylene

The MCL for tetrachloroethylene is based on a PQL of 5 µg/L. Its MCLG is zero. It has an ongoing health effects assessment, but there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis will be based on analytical feasibility. The passing rates for the PT and PE studies with spiked concentrations near the PQL are above 90%, including 13 studies with spiked concentrations below the current PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-25** and **Exhibit 4-26**, 84.6% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 µg/L, and 96.1% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-25. Summary of MRL Data for Tetrachloroethylene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	138,348	100%
Value < Modal MRL	15,848	11.5%
Value = Modal MRL (0.5 µg/L)	117,033	84.6%
Value > Modal MRL	5,467	4.0%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-26. MRL Distribution for Tetrachloroethylene

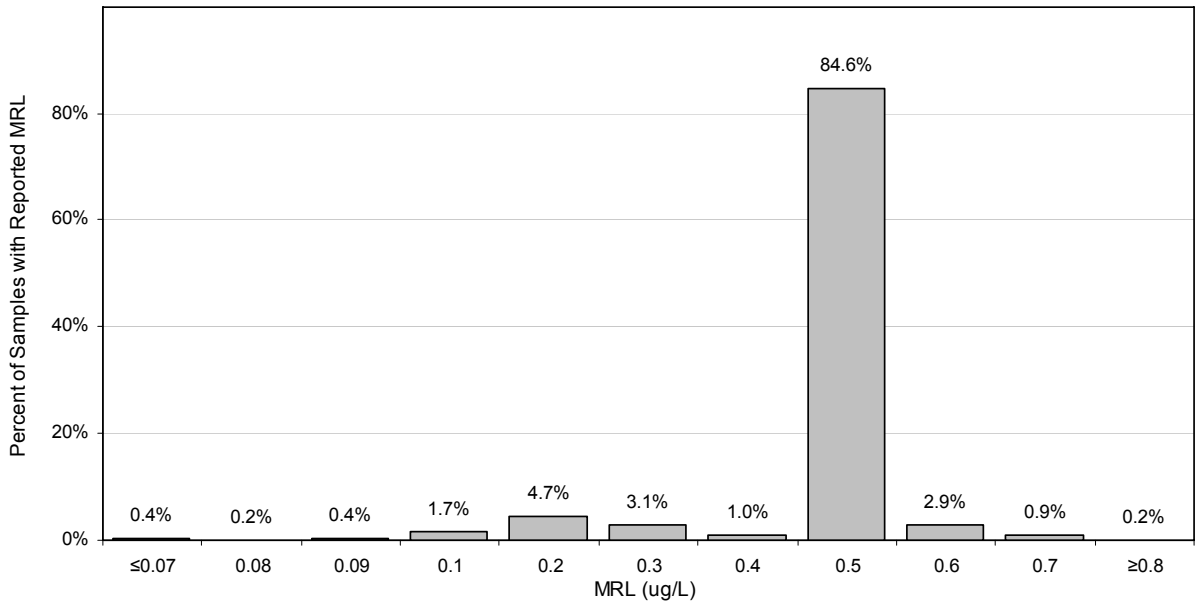


Exhibit 4-27 shows the EPA approved methods for the detection of tetrachloroethylene, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.08 to 1.4 µg/L. This range contains the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-27. Analytical Methods for Tetrachloroethylene

Method	MDL (µg/L)
502.2	0.05
524.2	0.14
551.1	0.008

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.1.10 Thallium

The MCL for thallium is based on a PQL of 2 µg/L. Its MCLG is 0.5 µg/L, and a health effects assessment is ongoing. Since it is not presently known how the health effects assessment may change the MCLG, the threshold for an occurrence analysis would be based on a potential change in analytical feasibility. A few PE studies with spiked concentrations slightly below the PQL have passing rates close to 80%. Two PT studies with concentrations slightly above the PQL have passing rates of 75% and there is a downward trend in the passing rate as the spiked value approaches the PQL. Therefore, EPA determined that the PT and PE studies do not support revision of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-28** and **Exhibit 4-29**, the modal MRL for thallium is 1 µg/L. Summary data show that 63.0% of the MRLs are equal to this value, and 78.0% of the MRL values are equal to or less than it. Unlike the PT data, the MRL data appear to indicate that there is potential to lower the PQL because most of the MRL values are below the current PQL. The data do not, however, support an EQL as low as the current MCLG of 0.5 µg/L. Furthermore, less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-28. Summary of MRL Data for Thallium

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	73,409	100%
Value < Modal MRL	11,032	15.0%
Value = Modal MRL (1 µg/L)	46,273	63.0%
Value > Modal MRL	16,104	21.9%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-29. MRL Distribution for Thallium

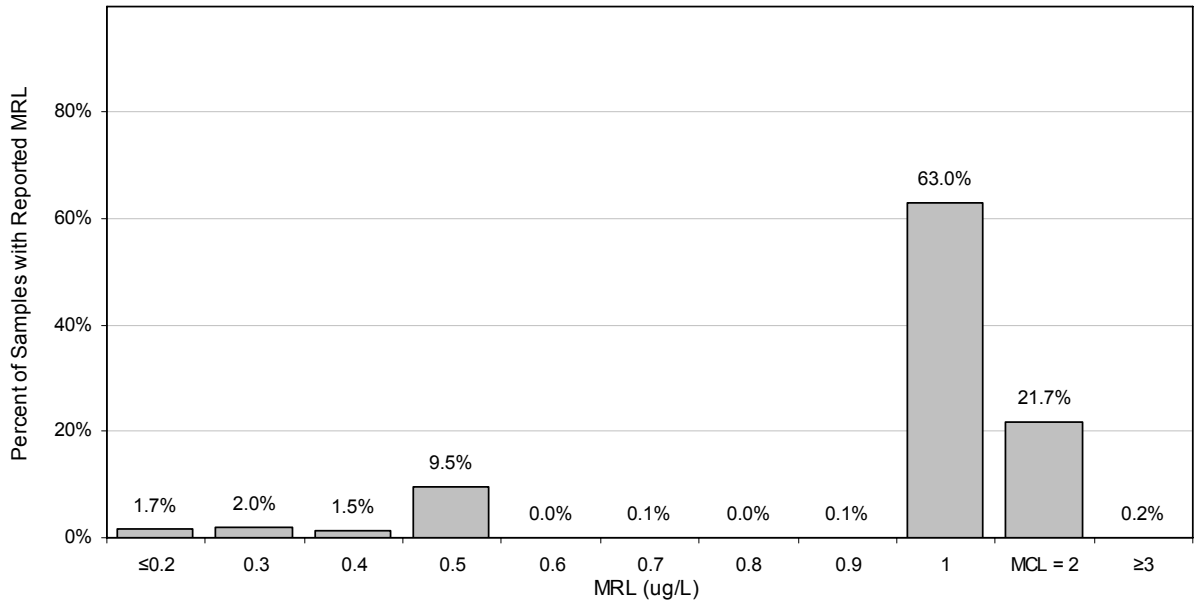


Exhibit 4-30 shows the EPA approved methods for the detection of thallium, and their MDLs. Applying a multiplier of 10 would give a possible PQL rage of 3.0 to 7.0 µg/L. The current PQL is below this range. The MDL data do not support an EQL below the PQL.

Exhibit 4-30. Analytical Methods for Thallium

Method	MDL (µg/L)
200.8	0.3
200.9	0.7

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

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

4.1.11 Trichloroethylene

The MCL for trichloroethylene is based on a PQL of 5 µg/L. Its MCLG is zero. It has an ongoing health effects assessment, but there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis will be based on analytical feasibility. The PT studies show greater than 95% passing rates for most of the studies around the PQL, including six studies with spiked concentrations below the current PQL. Passing rates for PE studies are also high near the PQL, but there are no studies with concentrations below the PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-31** and **Exhibit 4-32**, 85.4% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 µg/L, and 97.7% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-31. Summary of MRL Data for Trichloroethylene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	138,439	100%
Value < Modal MRL	17,057	12.3%
Value = Modal MRL (0.5 μg/L)	118,193	85.4%
Value > Modal MRL	3,189	2.3%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-32. MRL Distribution for Trichloroethylene

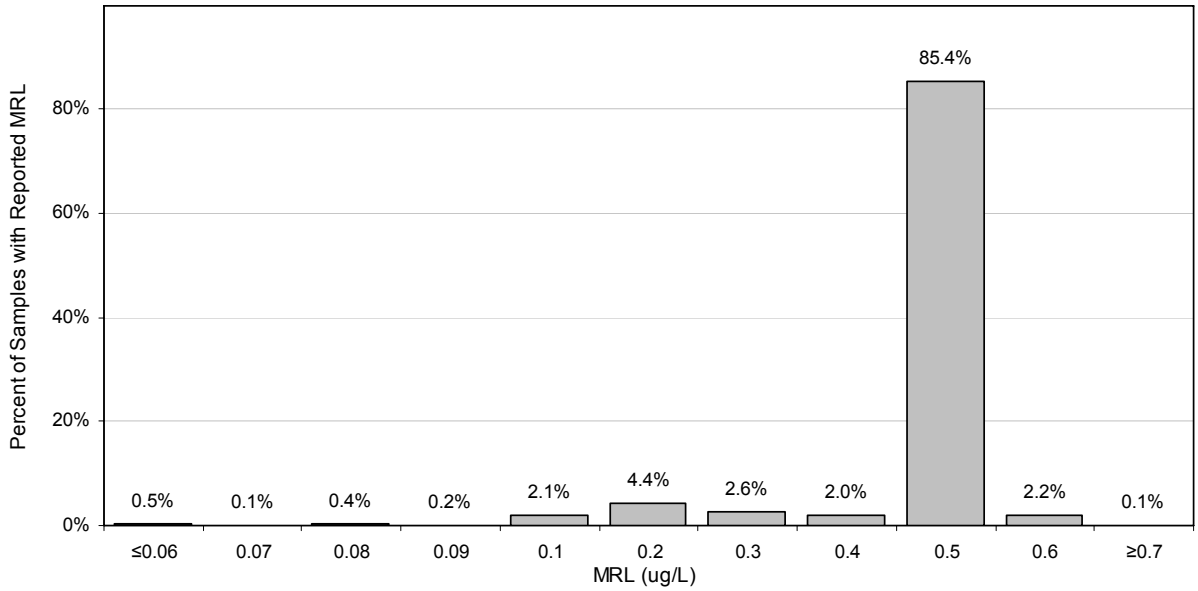


Exhibit 4-33 shows the EPA approved methods for the detection of trichloroethylene, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.42 to 1.9 μg/L. This range contains the modal MRL. Therefore, EPA retained 0.5 μg/L as the EQL value.

Exhibit 4-33. Analytical Methods for Trichloroethylene

Method	MDL (μg/L)
502.2	0.06
524.2	0.19
551.1	0.042

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

The EQL of 0.5 μg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 μg/L (2 x EQL) and 2.5 μg/L (1/2 MCL).

4.2 Contaminants with MCL Limited by PQL and No Health-Based Changes

4.2.1 Benzene

The MCL for benzene is based on a PQL of 5 µg/L. Its MCLG is zero. It has a new health effects assessment, but there is no new health effects information that suggests a change in the MCLG. Consequently, the threshold for the occurrence analysis will be based on analytical feasibility. The PT studies show greater than 90% passing rates for most of the spiked concentrations around the PQL, which include eight studies with concentrations below the current PQL. PE studies with spiked concentrations near the PQL also have passing rates above 90% including two studies with spiked concentrations below the PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-34** and **Exhibit 4-35**, 86.4% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 µg/L, and 99.3% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-34. Summary of MRL Data for Benzene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,190	100%
Value < Modal MRL	17,964	12.9%
Value = Modal MRL (0.5 µg/L)	120,328	86.4%
Value > Modal MRL	898	0.6%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-35. MRL Distribution for Benzene

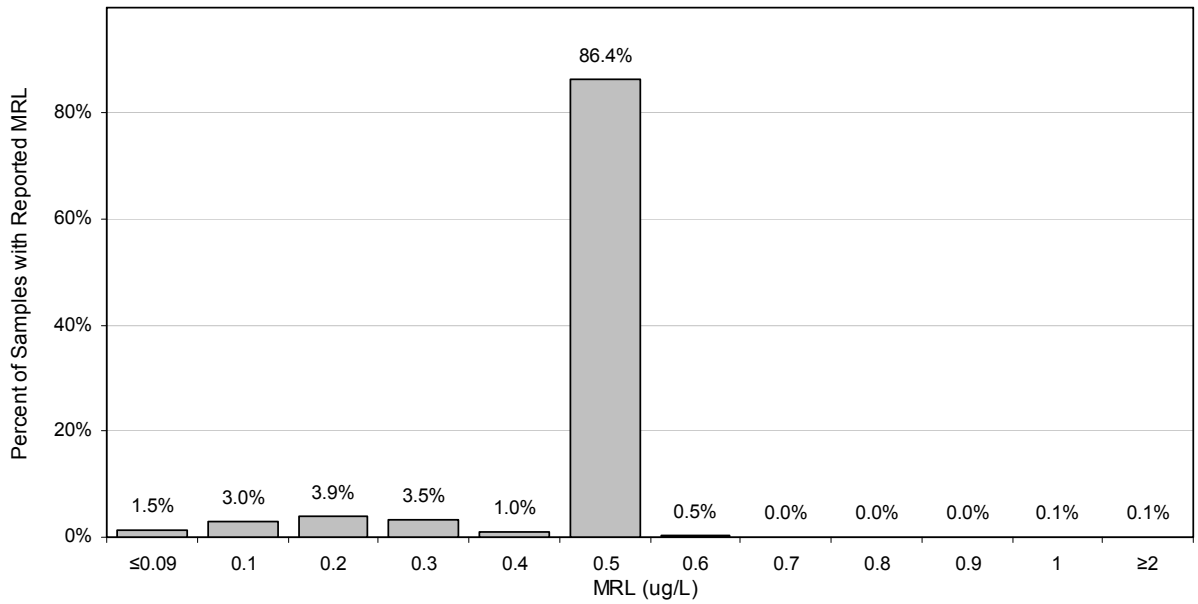


Exhibit 4-36 shows the EPA approved methods for the detection of benzene, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.1 to 0.4 µg/L. This range is lower than the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-36. Analytical Methods for Benzene

Method	MDL (µg/L)
502.2	0.01
524.2	0.04

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.2.2 Chlordane

The MCL for chlordane is based on a PQL of 2 µg/L. Its 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 will be based on analytical feasibility. The PT data show greater than 80% passing rates for most of the studies including all studies near the PQL. There are no PT studies with spiked values below the current PQL, but three PE studies have spiked values below the PQL and passing rates above 85%. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-37** and **Exhibit 4-38**, 46.8% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.2 µg/L, and 63.8% of the MRL values are equal to or less than the modal value. Less than 80% of the MRL values are equal to or less than the modal MRL and, 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 4-37. Summary of MRL Data for Chlordane

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	57,506	100%
Value < Modal MRL	9,764	17.0%
Value = Modal MRL	26,893	46.8%
Value > Modal MRL (0.2 µg/L) and ≤ 1.0 µg/L	15,453	26.9%
Value > 1.0 µg/L	5,396	9.4%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-38. MRL Distribution for Chlordane

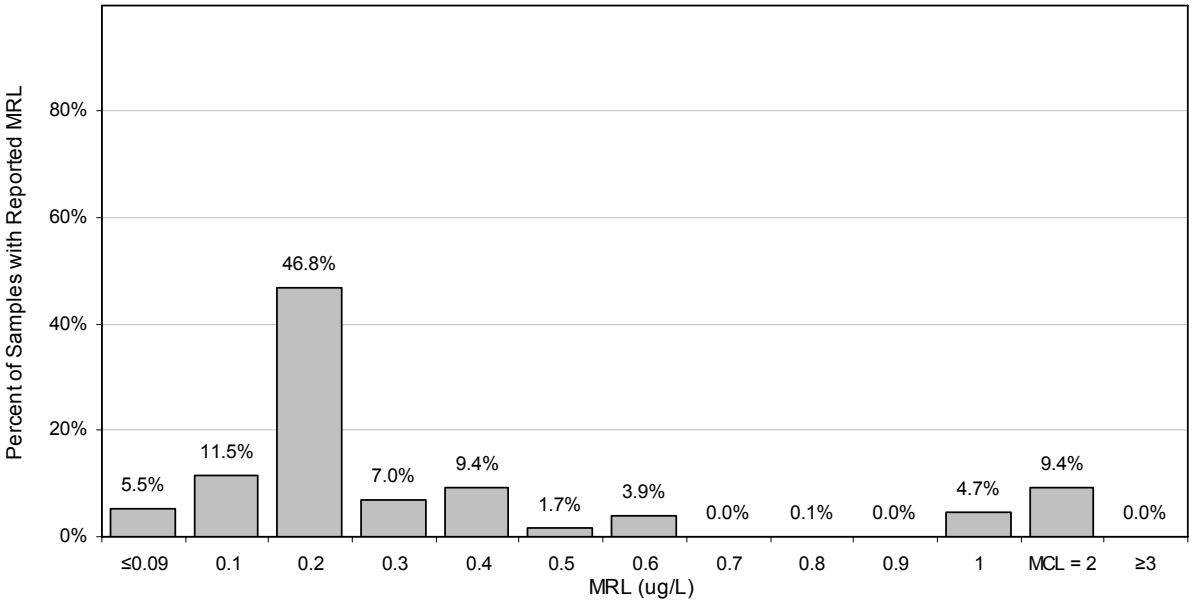


Exhibit 4-39 shows the EPA approved methods for the detection of chlordane, and their MDLs. Applying a multiplier of 10 would give a range of 0.04 to 2.2 µg/L. For an EQL, EPA multiplied the median of the MDLs by ten and rounded to one significant digit, for a value of 1.0 µg/L. Approximately 90% of the MRLs in the Six-Year Review 2 ICR dataset are less than or equal to this value.

Exhibit 4-39. Analytical Methods for Chlordane

Method	MDL (µg/L)
505	0.14
508	0.0041
508.1	0.004
525.2	0.22

Source: USEPA, 2009b

The EQL of 1.0 µg/L is half of the current PQL. Therefore, EPA performed the occurrence analysis only with this EQL value and the current MCL (which is equal to the PQL).

4.2.3 1,2-Dibromo-3-Chloropropane (DBCP)

The MCL for DBCP is based on a PQL of 0.2 µg/L. Its 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 will be based on analytical feasibility. The PT data show greater than 80% passing rates for most of the studies around the PQL, which include three studies with spiked values below the current PQL. PE studies with spiked concentrations near the PQL also have passing rates above 80% including one study with a spiked concentration below the PQL EPA determined that PQL assessment may support reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-40** and **Exhibit 4-41**, only 44.1% of the MRL values in the Six-Year Review 2 ICR dataset are less than or equal to MCL of 0.2 µg/L, and the modal MRL is greater than the MCL. Because the modal MRL is greater than the PQL, EPA did not use the MRL data to derive an EQL value. EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-40. Summary of MRL Data for DBCP

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	85,801	100%
Value ≤ MCL (0.2 µg/L)	37,844	44.1%
Value > MCL (0.2 µg/L) and ≤ Modal MRL (0.5 µg/L)	34,813	40.6%
Value > Modal MRL	13,144	15.3%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-41. MRL Distribution for DBCP

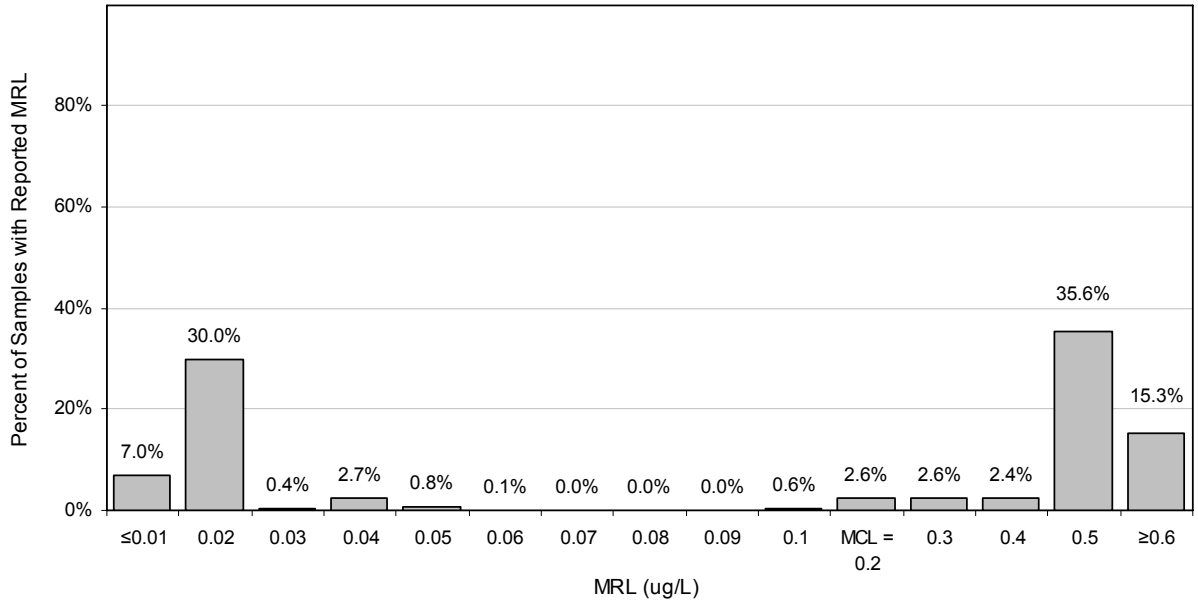


Exhibit 4-42 shows the EPA approved methods for the detection of DBCP and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.09 to 0.1 µg/L. Averaging these values and rounding to one significant figure gives an EQL of 0.1 µg/L. Almost 56% of the MRL values are equal to or greater than the current MCL (0.2 µg/L), indicating that the occurrence analysis of any EQL value below the current PQL could be biased by missing occurrence values. Most of the MRL values below the current MCL are, however, also below the EQL of 0.1 µg/L.

Exhibit 4-42. Analytical Methods for DBCP

Method	MDL (μg/L)
504.1	0.01
551.1	0.009

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

Because the PT data for DBCP suggests that there may be potential to lower the PQL, EPA disregarded the MRL data and adopted an EQL of 0.1 μg/L based on the MDLs. The EQL of 0.1 μg/L is half of the current PQL. Therefore, EPA performed the occurrence analysis only with this EQL value and the current MCL.

4.2.4 1,2-Dichloropropane

The MCL for 1,2-dichloropropane is based on a PQL of 5 μg/L. Its 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 will be based on analytical feasibility. The PT data show greater than 90% passing rates for most of the studies around the PQL, which include nine studies with spiked concentrations below the current PQL. PE studies with spiked concentrations near the PQL also have passing rates above 90%, but there are no PE studies with spiked concentrations below the PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-43** and **Exhibit 4-44**, 86.1% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 μg/L, and 99.3% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 μg/L, EPA based the EQL on the modal MRL.

Exhibit 4-43. Summary of MRL Data for 1,2-Dichloropropane

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,237	100%
Value < Modal MRL	18,311	13.2%
Value = Modal MRL (0.5 μg/L)	119,831	86.1%
Value > Modal MRL	1,095	0.8%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-44. MRL Distribution for 1,2-Dichloropropane

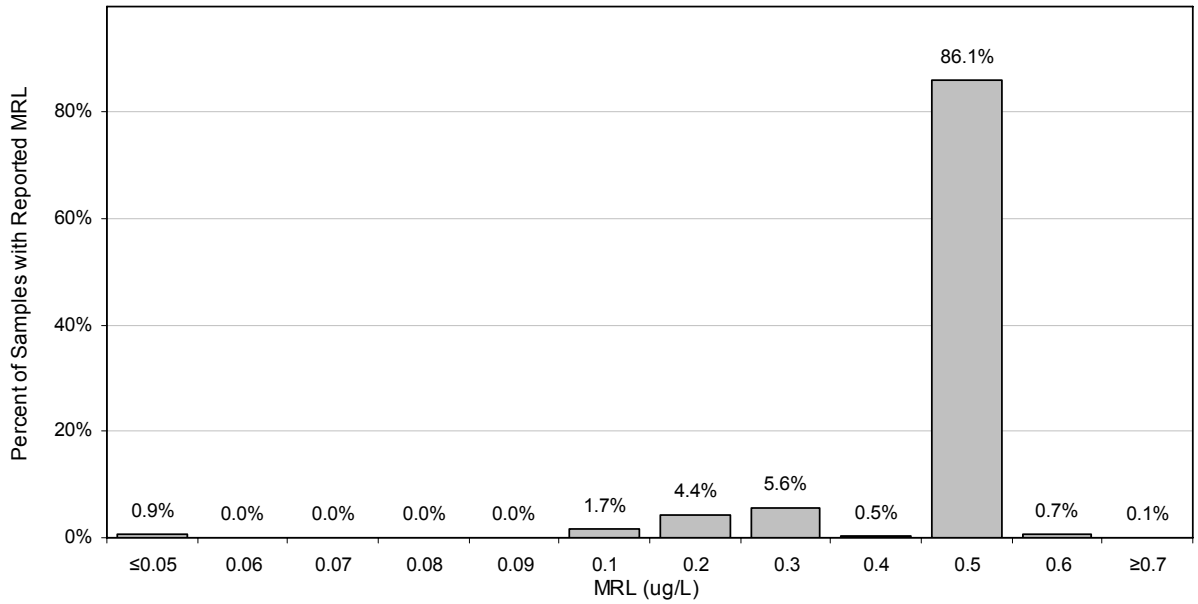


Exhibit 4-45 shows the EPA approved methods for the detection of 1,2-dichloropropane, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.3 to 0.4 µg/L. This range is lower than the modal MRL. Therefore, EPA retained 0.5 µg/L as the EQL value.

Exhibit 4-45. Analytical Methods for 1,2-Dichloropropane

Method	MDL (µg/L)
502.2	0.03
524.2	0.04

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

The EQL of 0.5 µg/L is ten times lower than the current PQL. EPA also performed the occurrence analysis with intermediate values of 1 µg/L (2 x EQL) and 2.5 µg/L (1/2 MCL).

4.2.5 Ethylene Dibromide (EDB)

The MCL for EDB is based on a PQL of 0.05 µg/L. Its MCLG is zero. A new health effects assessment completed during the Six-Year Review 2 cycle did not change the MCLG. Therefore, the threshold for an occurrence analysis would be based on analytical feasibility. There are no PT or PE study results with spiked concentrations below the current PQL. Although most passing rates are above 80%, a few studies have passing rates equal to 75%. Therefore, EPA determined that the PT and PE data do not support revision of the PQL (USEPA, 2009b).

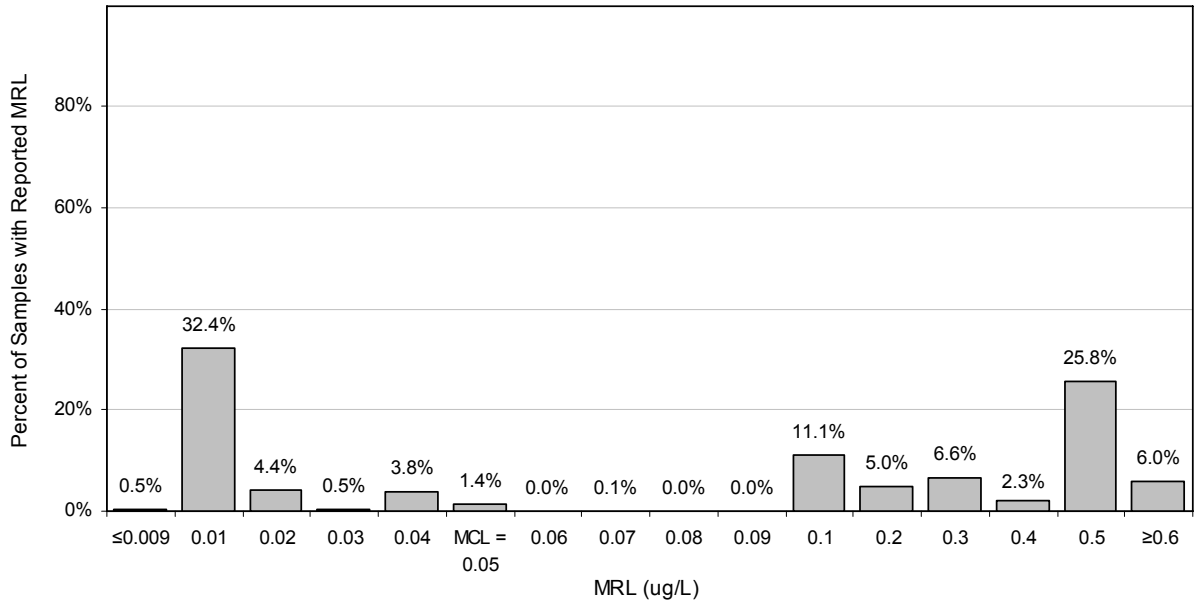
As shown in **Exhibit 4-46** and **Exhibit 4-47**, the modal MRL for EDB is 0.01 µg/L. Summary data show that 32.9% of the MRL values are equal to or less than the modal MRL; 56.9% of the MRL values are greater than the MCL. Less than 80% of the MRL values are equal to or less than the modal MRL. Therefore, EPA did not use the MRL data to derive an EQL value. EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-46. Summary of MRL Data for EDB

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	83,063	100%
Value < Modal MRL	454	0.5%
Value = Modal MRL	26,926	32.4%
Value > Modal MRL (0.01 µg/L) and ≤ MCL (0.05 µg/L)	8,416	10.1%
Value > MCL (0.05 µg/L)	47,267	56.9%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-47. MRL Distribution for EDB



EPA approved methods for the detection of EDB, and their MDLs, are summarized in **Exhibit 4-48**. Applying a multiplier of 5 would give a possible PQL range from 0.05 to 0.16 µg/L. The lower bound of this range is the current PQL. The MDL data do not support an EQL below the PQL.

Exhibit 4-48. Analytical Methods for EDB

Method	MDL (µg/L)
504.1	0.01
551.1	0.032

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

EPA concluded that the combination of PT, MRL, and MDL data do not support revision of the PQL for EDB. Therefore, EPA did not develop an EQL.

4.2.6 Heptachlor

The MCL for heptachlor is based on a PQL of 0.4 μg/L. Its 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 will be based on analytical feasibility. The PT data have passing rates above 75% for all but three of the studies with spiked values close to the PQL, but there are no PT studies with spiked values below the current PQL. Three PE studies had spiked concentrations below the PQL and passing rates above 90%. EPA determined that the PQL assessment may support reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-49** and **Exhibit 4-50**, 42.4% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.04 μg/L, and 56.0% of the MRL values are equal to or less than the modal value. Less than 80% of the MRL values are equal to or less than the modal MRL and, therefore, EPA did not base the EQL on the modal MRL. EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-49. Summary of MRL Data for Heptachlor

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	58,758	100%
Value < Modal MRL	7,966	13.6%
Value = Modal MRL	24,918	42.4%
Value > Modal MRL (0.04 μg/L) and ≤ 0.1 μg/L	24,752	42.1%
Value > 0.1 μg/L	1,122	1.9%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-50. MRL Distribution for Heptachlor

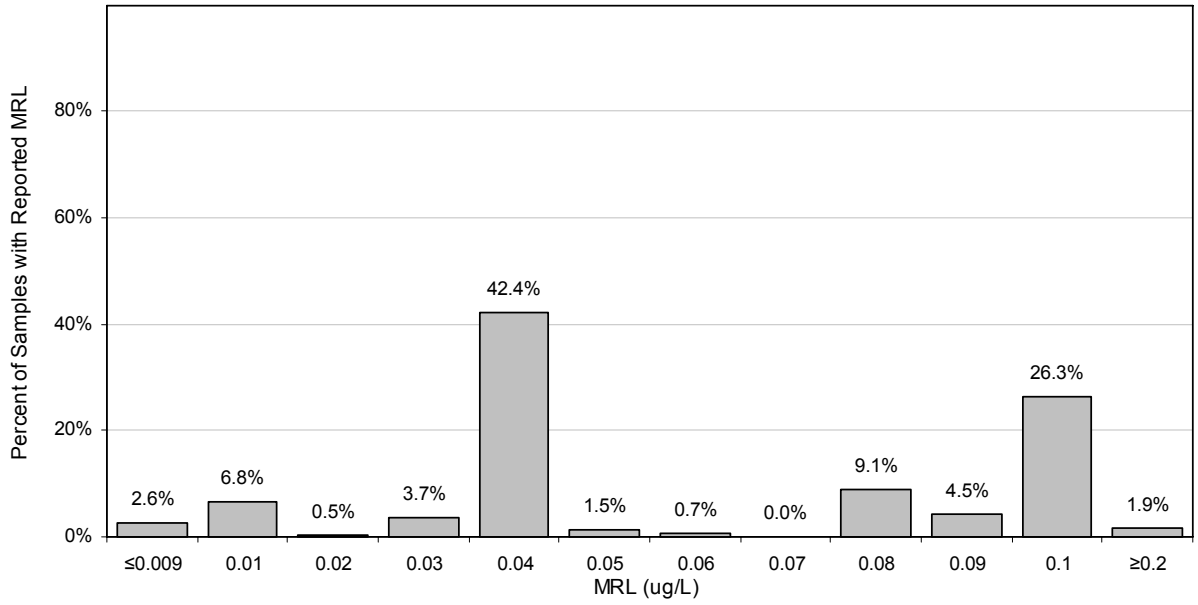


Exhibit 4-51 shows the EPA approved methods for the detection of heptachlor, and their MDLs. EPA applied a multiplier of 10 to the median value of 0.005 µg/L and rounded up to 0.1 µg/L to obtain an EQL. More than 98% of the MRLs in the Six-Year Review 2 ICR dataset are less than or equal to this value, indicating little potential for bias in occurrence estimates because of missing occurrence data above an EQL of 0.1 µg/L.

Exhibit 4-51. Analytical Methods for Heptachlor

Method	MDL (µg/L)
505	0.003
508	0.0015
508.1	0.005
525.2	0.15
551.1	0.081

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

The EQL of 0.1 µg/L is one quarter of the current PQL. Therefore, EPA also performed the occurrence analysis with an intermediate threshold value of 0.2 µg/L.

4.2.7 Heptachlor Epoxide

The MCL for heptachlor epoxide is based on a PQL of 0.2 µg/L. Its 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 will be based on analytical feasibility. The PT data show greater than 75% passing rates for all but two of the studies near the PQL, but there are no PT studies with spiked values below the current PQL. Three PE studies had spiked values below the PQL and passing rates above 85%. EPA determined that the PQL assessment may support reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-52** and **Exhibit 4-53**, 45.0% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.02 µg/L, and 55.2% of the MRL values are equal to or less than the modal value. Less than 80% of the MRL values are equal to or less than the modal MRL and, therefore, EPA did not base the EQL on the modal MRL. EPA reviewed MDL values to determine whether they support an EQL below the PQL.

Exhibit 4-52. Summary of MRL Data for Heptachlor Epoxide

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	58,731	100%
Value < Modal MRL	5,969	10.2%
Value = Modal MRL	26,424	45.0%
Value > Modal MRL (0.02 µg/L) and ≤ 0.1 µg/L	25,888	44.1%
Value > 0.1 µg/L	450	0.8%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-53. MRL Distribution for Heptachlor Epoxide

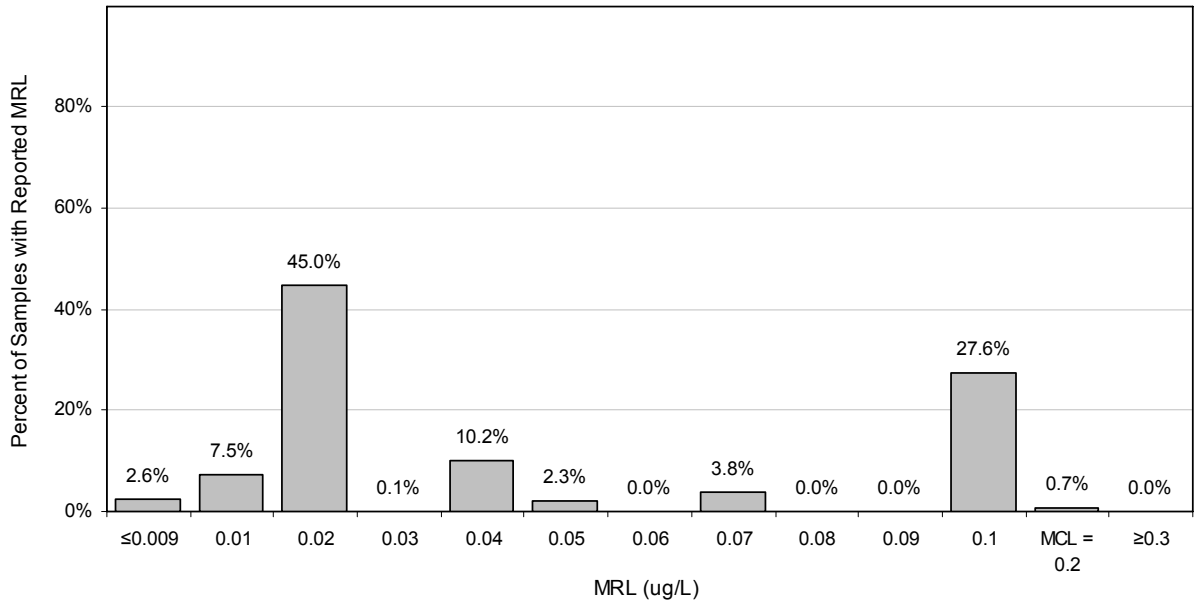


Exhibit 4-54 shows the EPA approved methods for the detection of heptachlor epoxide, and their MDLs. EPA applied a multiplier of 10 to the median value of 0.0059 µg/L and rounded up to 0.1 µg/L to obtain an EQL. More than 99% of the MRLs in the Six-Year Review 2 ICR dataset are less than or equal to this value, indicating little potential for bias in occurrence estimates because of missing occurrence data above an EQL of 0.1 µg/L..

Exhibit 4-54. Analytical Methods for Heptachlor Epoxide

Method	MDL (µg/L)
505	0.004
508	0.0059
508.1	0.001
525.2	0.13
551.1	0.202

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

The EQL of 0.1 µg/L is half of the current PQL. Therefore, EPA performed the occurrence analysis only with this EQL value and the current MCL.

4.2.8 Hexachlorobenzene

The MCL for hexachlorobenzene is based on a PQL of 1 µg/L. Its 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 will be based on analytical feasibility. The PT data show greater than 75% passing rates for most of the studies around the PQL, which include nine studies with spiked values below the current PQL. PE study results, including eight with spiked concentrations below the PQL, have passing rates above 80% Although one PT study with a

spiked value below the PQL has a passing rate below 75%, EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-55** and **Exhibit 4-56**, 69.5% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.1 µg/L, and 82.1% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.1 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-55. Summary of MRL Data for Hexachlorobenzene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	58,713	100%
Value < Modal MRL	7,380	12.6%
Value = Modal MRL (0.1 µg/L)	40,791	69.5%
Value > Modal MRL	10,542	18.0%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-56. MRL Distribution for Hexachlorobenzene

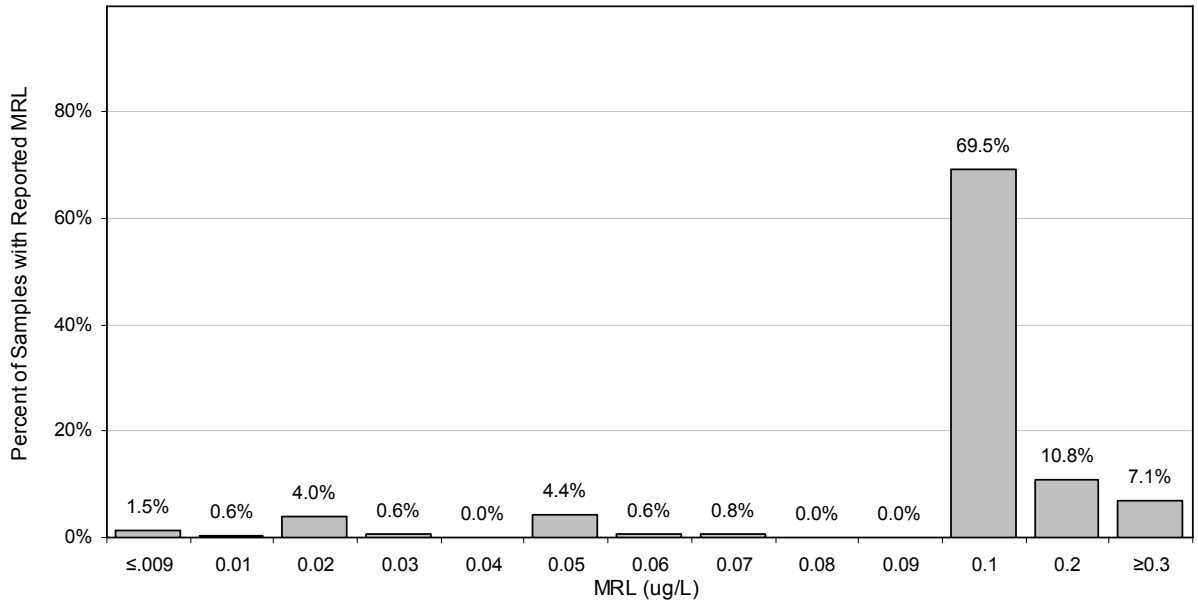


Exhibit 4-57 shows the EPA approved methods for the detection of hexachlorobenzene, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.01 to 1.3 µg/L. This range contains the modal MRL of 0.1 µg/L.

Exhibit 4-57. Analytical Methods for Hexachlorobenzene

Method	MDL (µg/L)
505	0.002
508	0.0077
508.1	0.001
525.2	0.13
551.1	0.003

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

The EQL of 0.1 µg/L is one-tenth the current PQL. Therefore, EPA also performed the occurrence analysis with an intermediate threshold value of 0.5 µg/L.

4.2.9 Toxaphene

The MCL for toxaphene is based on a PQL of 3 µg/L. Its 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 will be based on analytical feasibility. The PT studies have passing rates above 85% for most of the studies around the PQL, but there are no PT studies with spiked values below the current PQL. Two PT studies have passing rates below 75%. Three PE studies have spiked concentrations below the PQL and passing rates above 90%. EPA determined that the PQL assessment may support reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-58** and **Exhibit 4-59**, 67.4% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 1 µg/L, and 83.0% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 1 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-58. Summary of MRL Data for Toxaphene

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	54,529	100%
Value < Modal MRL	8,525	15.6%
Value = Modal MRL (1 µg/L)	36,763	67.4%
Value > Modal MRL	9,241	16.9%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-59. MRL Distribution for Toxaphene

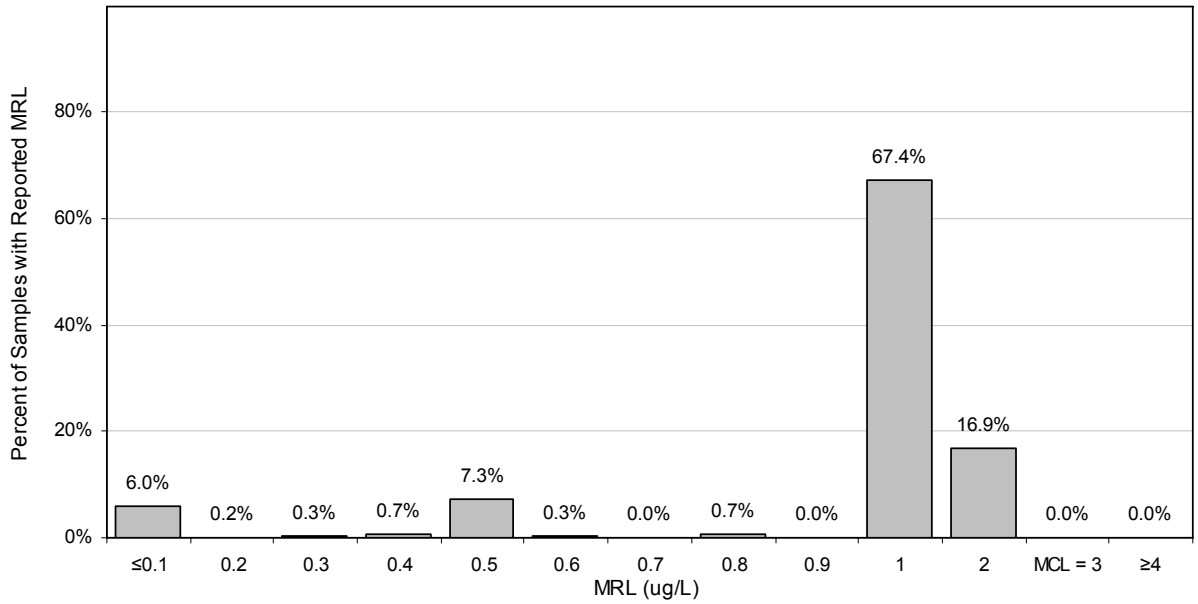


Exhibit 4-60 shows the EPA approved methods for the detection of toxaphene, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 1.3 to 17.0 µg/L. This range exceeds the modal MRL of 1.0 µg/L.

Exhibit 4-60. Analytical Methods for Toxaphene

Method	MDL (µg/L)
505	1.0
508	No MDL reported
508.1	0.13
525.2	1.7

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

The EQL of 1 µg/L is one-third the current PQL. Therefore, EPA also performed the occurrence analysis with an intermediate value of 1.5 µg/L.

4.2.10 1,1,2-Trichloroethane

The MCL for 1,1,2-trichloroethane is based on a PQL of 5 µg/L. Its MCLG is 3 µg/L, and there is no new health effects information that suggests a change in the MCLG. Because the MCLG is lower than the current PQL, the lowest threshold of interest for the occurrence analysis is the current MCLG of 3 µg/L. The PT results have passing rates above 90% for most of the studies with spiked concentrations around the PQL, which include 12 studies with spiked values below the current PQL. PE studies also have passing rates above 90% for studies with spiked conentrations close to the PQL, although none are below the PQL. EPA determined that the PQL assessment supports reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-61** and **Exhibit 4-62**, the MRL data for 1,1,2-trichloroethane share general characteristics with other VOCs, e.g., a modal MRL of 0.5 µg/L. The exhibit also shows that more than 99.9% of MRLs are at or below the MCLG. The MRL data thus indicate that it is appropriate to use the MCLG as the threshold in the occurrence analysis.

Exhibit 4-61. Summary of MRL Data for 1,1,2-Trichloroethane

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,672	100%
Value ≤ MCLG (3 µg/L)	139,616	>99.9%
Value < Modal MRL	17,142	12.3%
Value = Modal MRL (0.5 µg/L)	117,788	84.3%
Value > Modal MRL	4,742	3.4%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-62. MRL Distribution for 1,1,2-Trichloroethane

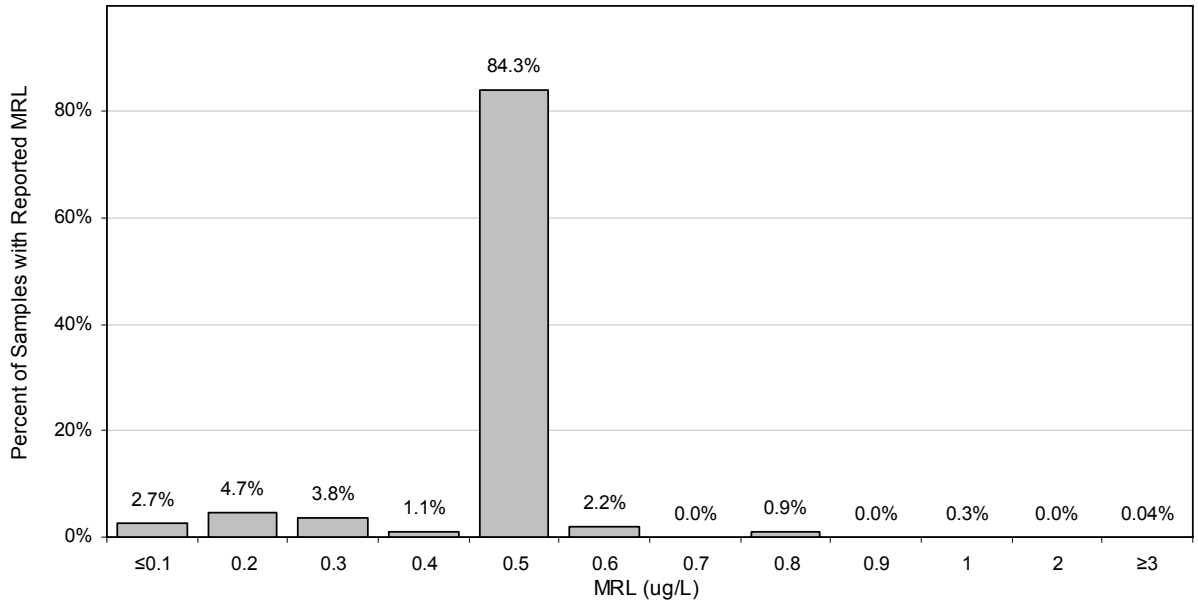


Exhibit 4-63 shows the EPA approved methods for the detection of 1,1,2-trichloroethane, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.17 to 1.0 µg/L. This range is below the current MCLG, which further supports use of the MCLG as the threshold in the occurrence analysis.

Exhibit 4-63. Analytical Methods for 1,1,2-Trichloroethane

Method	MDL (µg/L)
502.2	0.04
524.2	0.10
551.1	0.017

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

An EQL based on the MRL data would be lower than the current MCLG for 1,1,2-trichloroethane, and there is no information that suggests a potential to lower the MCLG. Therefore, EPA used the current MCLG of 3 µg/L as the threshold in the occurrence analysis. Since the current MCLG differs from the MCL by less than a factor of two, EPA did not use any intermediate thresholds in the analysis.

4.2.11 Vinyl Chloride

The MCL for vinyl chloride is based on a PQL of 2 µg/L. Its 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 will be based on analytical feasibility. The PT studies have passing rates greater than 80% for most of the studies with spiked concentrations near the PQL, including two studies with spiked values below the current PQL. PE data also have passing rates above 75% for studies with spiked concentrations near the PQL, although none are below the PQL. EPA determined that the PQL assessment may support reduction of the PQL (USEPA, 2009b).

As shown in **Exhibit 4-64** and **Exhibit 4-65**, 75.6% of the MRL values in the Six-Year Review 2 ICR dataset are equal to the modal value of 0.5 µg/L, and 94.0% of the MRL values are equal to or less than the modal value. Because more than 80% of the MRLs are equal to or less than 0.5 µg/L, EPA based the EQL on the modal MRL.

Exhibit 4-64. Summary of MRL Data for Vinyl Chloride

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	139,494	100%
Value < Modal MRL	25,723	18.4%
Value = Modal MRL (0.5 µg/L)	105,410	75.6%
Value > Modal MRL	8,361	6.0%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-65. MRL Distribution for Vinyl Chloride

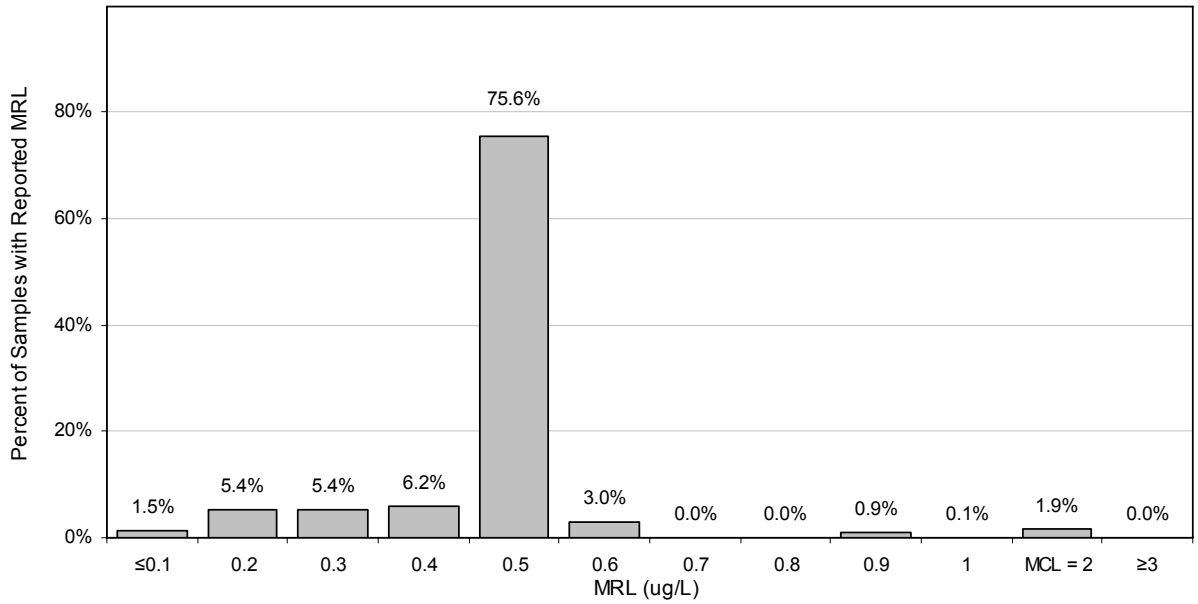


Exhibit 4-66 shows the EPA approved methods for the detection of vinyl chloride, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 1.8 to 1.7 µg/L, which is slightly below the MCL of 2.0 µg/L. This range is also higher than the EQL of 0.5 µg/L based on MRL data.

Exhibit 4-66. Analytical Methods for Vinyl Chloride

Method	MDL (µg/L)
502.2	0.18
524.2	0.17

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

The EQL of 0.5 µg/L is one-fourth the current PQL. EPA also performed the occurrence analysis with an intermediate value of 1 µg/L (2 x EQL and 1/2 MCL).

4.3 Contaminants with New Health Effects Information and Possible MCLG Decrease

4.3.1 Endothall

The MCL for endothall is based on its MCLG of 100 µg/L. A new health effects assessment indicates that there is potential to reduce the MCLG to 50 µg/L. The current PQL of 90 µg/L would limit an MCL revision. There are no PT or PE study results with spiked values below the current PQL. Furthermore, some passing rates for PT studies are below 75%. Because of the lack of data below the PQL, and variability in the PT data, EPA concluded that the available PT data do not support PQL revision (USEPA, 2009b).

In light of the new information about health effects of endothall, however, EPA needed to determine whether it could examine occurrence at levels below the current PQL. EPA used MRL and MDL data to evaluate the feasibility of a quantitation threshold equal to the possible MCLG of 50 μg/L.

As shown in **Exhibit 4-67** and **Exhibit 4-68**, 98.4% of the MRLs are at or below the possible MCLG. The MRL data thus indicate that it is appropriate to use the possible MCLG as the threshold in the occurrence analysis.

Exhibit 4-67. Summary of MRL Data for Endothall

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	21,792	100%
Value ≤ Possible MCLG (50 μg/L)	21,445	98.4%
Value < Modal MRL	5,695	26.1%
Value = Modal MRL (9 μg/L)	6,884	31.6%
Value > Modal MRL	9,213	42.3%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-68. MRL Distribution for Endothall

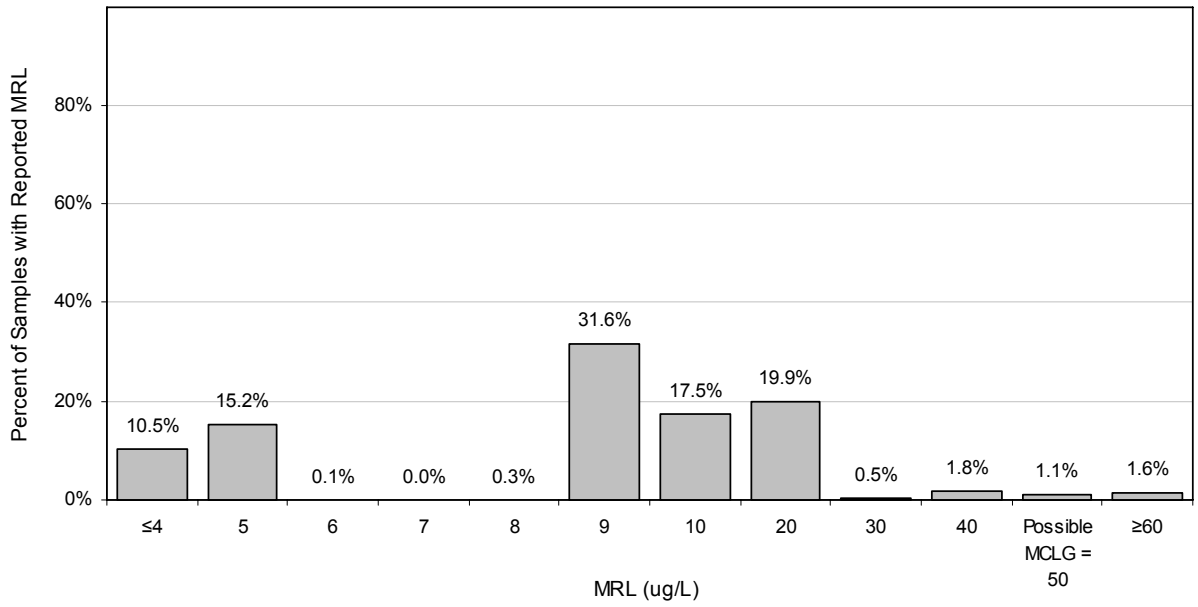


Exhibit 4-69 shows the EPA approved method for the detection of endothall, and its MDL. Because this MDL is more than a factor of ten lower than the possible MCLG, the MDL data also support use of the possible MCLG as a threshold in the occurrence analysis.

Exhibit 4-69. Analytical Methods for Endothall

Method	MDL (µg/L)
548.1	1.79

Source: USEPA, 2009b (upper bound value when a range is reported)

EPA did not use any intermediate values in the occurrence analysis because the analysis threshold is based on a possible MCLG.

4.3.2 Oxamyl

The MCL for oxamyl is based on its MCLG of 200 µg/L. A new health effects assessment indicates that there is potential to reduce the MCLG to 2 µg/L. The present PQL of 20 µg/L would limit an MCL revision. There are no PT study results below the current PQL, and some passing rates in the available data are below 75%. Seven PE studies with spiked concentrations below the PQL had passing rates at or below 75%, and none had passing rates above 75%. A new method (EPA Method 531.2) for the analysis of oxamyl in drinking water was approved in 2002, however, and it may have improved laboratory performance at low concentrations in the more recent PT data. Nevertheless, because of the lack of data below the PQL, and variability in the data that is available, EPA concluded that the available PT data do not support PQL revision (USEPA, 2009b).

In light of the new information about health effects of oxamyl, however, EPA needed to determine whether it could examine occurrence at levels below the current PQL. EPA used MRL and MDL data to evaluate the feasibility of a quantitation threshold equal to the possible MCLG of 2 µg/L.

As shown in **Exhibit 4-70** and **Exhibit 4-71**, the modal MRL for oxamyl is 2 µg/L, which is equal to the possible MCLG. Summary data show that 61.2% of the MRLs are equal to this value, and 86.7% of the MRL values are equal to or less than it. The MRL data thus indicate that it is appropriate to use the possible MCLG as the threshold in the occurrence analysis.

Exhibit 4-70. Summary of MRL Data for Oxamyl

MRL Value Category	Number of Records	Percentage of Records
All MRL Values	52,201	100%
Value < Modal MRL/Possible MCLG	13,335	25.5%
Value = Modal MRL/Possible MCLG (2 µg/L)	31,955	61.2%
Value > Modal MRL/Possible MCLG	6,911	13.2%

Percentages may not sum to 100% 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 2 ICR dataset

Exhibit 4-71. MRL Distribution for Oxamyl

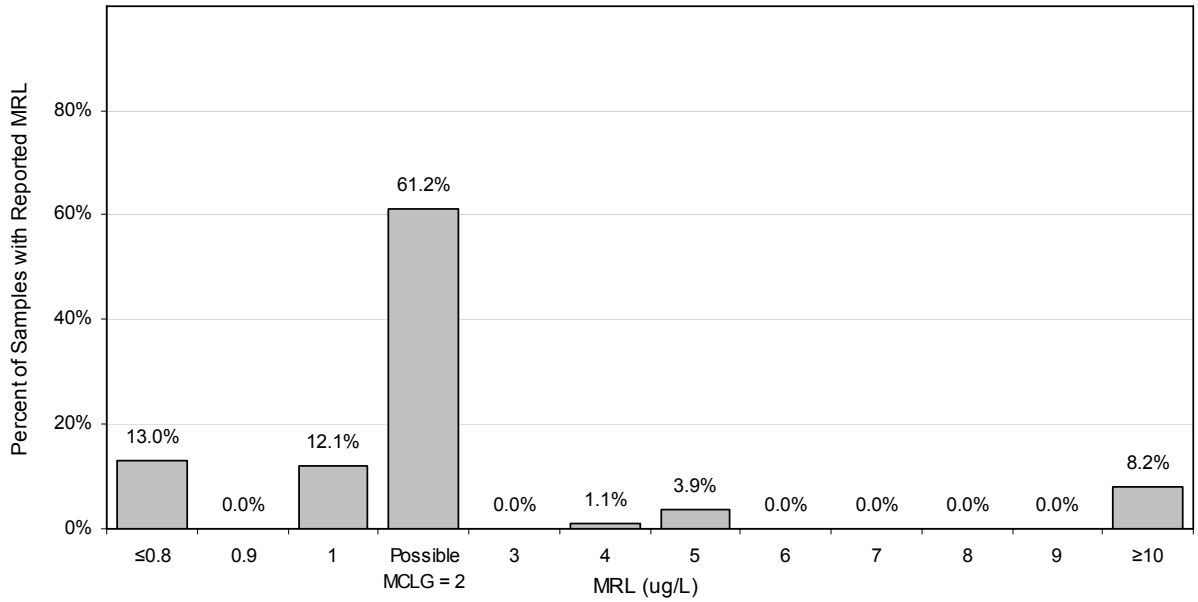


Exhibit 4-72 shows the EPA approved methods for the detection of oxamyl, and their MDLs. Applying a multiplier of 10 would give a possible PQL range from 0.65 to 8.6 µg/L. This range contains the modal MRL and possible MCLG of 2.0 µg/L. Therefore, EPA used the possible MCLG as a health-based threshold for the occurrence analysis.

Exhibit 4-72. Analytical Methods for Oxamyl

Method	MDL (µg/L)
531.1	0.86
531.2	0.065 (DL)

DL = detection limit
Source: USEPA, 2009b (upper bound values when ranges are reported)

EPA did not use any intermediate values in the occurrence analysis because the analysis threshold is based on a possible MCLG.

5 References

Glaser, J.A, et al. 1981. "Trace analyses for wastewaters." *Env. Sci. Technol*. Vol. 15(12).

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USEPA. 2003b. Occurrence Estimation Methodology and Occurrence Findings Report for the Six-Year Review of Existing National Primary Drinking Water Regulations. EPA-815-R-03-006. June 2003.

USEPA. 2009a. Analysis of Occurrence Data from the Second Six-Year Review of Existing National Primary Drinking Water Regulations. EPA 815-B-09-006.

USEPA. 2009b. Analytical Feasibility Support Document for the Second Six-Year Review of Existing 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. 2009d. Occurrence Analysis for Potential Source Waters for the Second Six-Year Review of National Primary Drinking Water Regulations. EPA 815-B-09-004.

USEPA. 2009e Six-Year Review 2 – Health Effects Assessment – Summary Report. EPA 822-R-09-006.

USEPA. 2009f. Water Treatment Technology Feasibility Support Document for Chemical Contaminants for the Second Six-Year Review of National Primary Drinking Water Regulations. EPA 815-B-09-007.

USEPA. 2009f. Consideration of Other Regulatory Revisions in Support of the Second Six-Year Review of the National Primary Drinking Water Regulations. EPA 815-B-09-008.

Appendix: MRL Data Description

The MRL data used for the EQL analysis include some edits and transformations to address the following data quality issues that directly affect EPA's efforts to derive EQL values using MRL data:

- minimum detection level (MDL) values reported instead of MRL values[3]
- value not identified as either an MRL or MDL (i.e., only "<" reported in the result field)
- MRL or MDL units not identified (i.e., unclear whether value is reported in mg/L or µg/L)
- MRL value of zero reported
- no MRL value reported (i.e., the MRL field is blank).

To address the first two issues, EPA excluded observations that did not clearly identify a nondetect value as an MRL. This led EPA to exclude data from 14 of the 47 states/territories in the Second Six-Year Review Dataset.[4] Because MDL values should be lower than MRL values, excluding MDL observations should remove the lower values from the distribution of actual MRL values used in the EQL analysis. Removing the non-identified values could, however, reduce the number or MRL values, thereby introducing uncertainty into the use of MRL data to derive EQL values. Because the EQL development process depends on the mode or most frequently occurring MRL value, deleting a substantial number of values could affect the result.

To address the next two data quality issues, EPA excluded approximately 1% of the remaining MRL values because their units of measure were not reported and another 0.7% with reported MRL values of zero.[5] Both of these revisions affect relatively few values and, therefore, they have no effect on the EQL development process.

Finally, when an MRL value was missing for a record, EPA replaced the missing value with the most common MRL (i.e., the mode of the MRL distribution) reported in the given state for that chemical. These values vary by state and contaminant.

To account for variations in reporting precision, EPA rounded all of the MRL values to one significant digit. For example, a result of 0.132 µg/L rounds to 0.1 µg/L and a result of 132 µg/L rounds to 100 µg/L. EPA used the resulting distribution for each contaminant to identify a modal MRL as well as the percentage of MRLs below and above the mode.

[3] An MDL is defined in Glaser et al. (1981) as "the minimum concentration of a substance that can be identified, measured, and reported with 99% confidence that the analyte concentration is greater than zero and is determined from replicate analyses of a sample from a given matrix containing the analyte." The lowest concentration at which one can be almost certain the contaminant is present (i.e., MDL) is below the lowest concentration that can be measured with some degree of reliability (i.e., MRL).

[4] The original Six-Year Review 2 ICR dataset did not contain data from DC, MS, LA, KS, PA, and WA. In addition, the following states did not provide usable MRL data: AR, CA, FL, HI, MA, MD, MI, MN, NH, SD, TN, TX, and WI.

[5] The ability of any instrument or method to measure contaminant levels within specific precision bounds will be exhausted above zero, so no MRL can equal zero.