BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO GROUNDWATER QUALITY (35 ILL. ADM. CODE 620)	)	**R 2022-018 (Rulemaking - Public Water Supply)**
	)	

NOTICE OF FILING

To: ALL PARTIES ON THE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today electronically filed with the Office of the Clerk of the Illinois Pollution Control Board the attached **Dynegy's Post-Hearing Comment**, copies of which are hereby served upon you.

/s/ Sarah Lode
Sarah Lode

Dated: March 3, 2023

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<u>Dynegy's Post-Hearing Comment</u>

NOW COMES Dynegy Midwest Generation, LLC; Electric Energy Inc.; Illinois Power Generating Company; Illinois Power Resources Generating, LLC; and Kincaid Generation, LLC (collectively, "Dynegy") by their attorneys, pursuant to 35 Ill. Admin. Code § 102.108, the Hearing Officer's December 8, 2022 Order, and the Hearing Officer's February 16, 2023 Order, and submits this Post-Hearing Comment.

I. Introduction

Dynegy is appreciative of the Illinois Environmental Protection Agency ("IEPA" or the "Agency") and the Illinois Pollution Control Board's ("Board's") efforts in this rulemaking to amend 35 Ill. Admin. Code Part 620 (the "Part 620 regulations" or "Part 620"). While Dynegy supports or has no opinion on much of the Agency's proposal for revisions to the Part 620 regulations, IEPA has proposed standards for certain metals that do not conform to established requirements for Illinois rulemakings, are not reflective of the evidence in the record, and are unnecessary for the protection of Illinois groundwater. Dynegy presented testimony from two witnesses, Dr. Melinda Hahn and Ms. Lisa Yost, in support of its positions in this proceeding. This Comment discusses the key deficiencies in IEPA's proposal and Dynegy's proposed revisions to account for those deficiencies for the following metals.

- **Cobalt and Vanadium**: Existing physical conditions in Illinois show that background levels of cobalt in much of the State are above IEPA's proposed Class I standard of 0.0012 milligrams per liter ("mg/L") and background levels of vanadium in much of the State are above IEPA's proposed Class I standard of 0.00027 mg/L. IEPA has failed to consider or analyze the potential investigative, enforcement, or other costs that may be associated with setting these standards below background. Additionally, evidence shows that achieving reporting levels to analyze cobalt and vanadium at IEPA's proposed standards is not technically feasible in groundwater samples. A more appropriate cobalt and vanadium standard would be one based on their background threshold values, which is approximately 0.02 to 0.03 mg/L for both constituents. Whether or not the Board promulgates IEPA's proposed cobalt and vanadium standards, Dynegy also proposes an amendment to the prefatory language in Sections 620.410 and 620.420 to allow Part 620, which contains independently enforceable standards, to better address background.
- **Selenium**: The Board should maintain the current Class I and Class II standard of 0.05 mg/L for selenium. The Agency's proposed Class I and Class II standard of 0.02 mg/L for selenium is based on irrigation of forage consumed by livestock. However, evidence demonstrates that this standard is not appropriate for the type of irrigation that occurs in Illinois or the type of soils located in Illinois. On the contrary, evidence suggests livestock in Illinois require selenium as a supplement in feed to prevent selenium deficiency. A standard of 0.02 mg/L is unnecessary and will result in no benefit to Illinois. The current standard, meanwhile, is consistent with the United States Environmental Protection Agency ("USEPA") Maximum Contamination Level ("MCL") and is protective of livestock drinking groundwater.

- **Fluoride**: The Board should maintain the current Class I and Class II fluoride standard of 4.0 mg/L. The Agency's proposed fluoride standard of 2.0 mg/L is based on an aesthetic potential dental impact on livestock, with evidence showing any other harmful effect would not be expected until concentrations were multiple times higher than 2.0 mg/L. A standard of 2.0 mg/L will therefore have no practical benefit while the current standard is consistent with the MCL and sufficiently protective against harmful impacts to livestock.

- **Molybdenum**: The Agency's Class I proposal for molybdenum is based on outdated and flawed USEPA Integrated Risk Information System ("IRIS") toxicity information. The Board should either wait until IRIS data for molybdenum is updated to account for more recent and representative information to set a Class I standard for molybdenum or it should set a Class I standard using the currently superior Agency of Toxic Substances and Disease Registry ("ATSDR") toxicity information, which would result in a standard of 0.2 mg/L. The Agency's Class II proposal for molybdenum is based on irrigation of forage consumed by livestock. The Agency has provided no evidence that its proposed Class II standard of 0.05 mg/L is representative of irrigation and soil conditions in Illinois. Meanwhile, evidence suggests the value is more representative of conditions in certain areas of the Western United States. Accordingly, the Class II standard for molybdenum is unnecessary in Illinois and should not be promulgated. In the alternative, the Board should make the Class I and II standards for molybdenum 0.1 mg/L, consistent with groundwater protection standards for molybdenum in 35 Ill. Admin. Code Part 845.

II. Standard for Rulemaking

The regulations proposed by IEPA are modifications to Illinois's existing groundwater quality standards, which were promulgated pursuant to Section 55/8 of the Illinois Groundwater Protection Act ("IGPA"). 415 Ill. Comp. Stat 55/8. Section 55/8(b) requires that the Board, when promulgating such groundwater quality standards, "in addition to the factors set forth in Title VII of the [Illinois] Environmental Protection Act,"[1] consider the following:

> (1) recognition that groundwaters differ in many important respects from surface waters, including water quality, rate of movement, direction of flow, accessibility, susceptibility to pollution, and use;
> (2) classification of groundwaters on an appropriate basis, such as their utility as a resource or susceptibility to contamination;
> (3) preference for numerical water quality standards, where possible, over narrative standards, especially where specific contaminants have been commonly detected in groundwaters or where federal drinking water levels or advisories are available;
> (4) application of nondegradation provisions for appropriate groundwaters, including notification limitations to trigger preventive response activities;
> (5) relevant experiences from other states where groundwater protection programs have been implemented; and
> (6) existing methods of detecting and quantifying contaminants with reasonable analytical certainty.

415 Ill. Comp. Stat. 55/8(b).[2]

In preparing proposed groundwater regulations, the IGPA directs IEPA to "address, to the extent feasible, those contaminants which have been found in the groundwaters of the State and which are known to cause, or are suspected of causing, cancer, birth defects, or any other adverse effect on human health according to nationally accepted guidelines." 415 Ill. Comp. Stat. 55/8(a).

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[1] Title VII of the Illinois Environmental Protection Act is titled "Regulations" and includes Section 5/27. *See* 415 Ill. Comp. Stat. 5/26 *et seq.*

[2] Section 55/8(c) exempts the promulgation of groundwater quality standards from "the requirements of subsection (b) of Section 27 of the [Illinois] Environmental Protection Act . . ." to "expedite promulgation of such standards." 415 Ill. Comp. Stat. 55/8(c). Section 5/27(b) requires the Board to (1) request that the Department of Commerce and Economic Opportunity conduct an economic impact study of the proposed rules, and (2) conduct at least one hearing. 415 Ill. Comp. Stat. 5/27(b).

It further requires "a study of the economic impact of the regulations developed pursuant to [415 Ill. Comp. Stat. 55/8]." 415 Ill. Comp. Stat. 55/8(d).

Title VII of the Illinois Environmental Protection Act (the "Act"), specifically Section 5/27(a), requires that the Board, when promulgating a rule, "take into account the existing physical conditions, the character of the area involved, including the character of surrounding land uses, zoning classifications, the nature of the existing air quality, or receiving body of water, as the case may be, and the technical feasibility and economic reasonableness of measuring or reducing the particular type of pollution." 415 Ill. Comp. Stat. 5/27(a).

Particularly relevant for this rulemaking, the Act requires the Board to specifically "take into account" the technical feasibility and economic reasonableness of all regulatory proposals before it. 415 Ill Comp. Stat. 5/27(a). A proposal for a regulation of general applicability in front of the Board must include "[a] statement of the reasons supporting the proposal, including a statement of . . . the purpose and effect of the proposal, *including environmental, technical, and economic justification.*" 35 Ill. Admin. Code § 102.202(b) (emphasis added). Further, the proposal "must include, to the extent reasonably practicable, all affected sources and facilities and the economic impact of the proposed rule." *Id.*; *see also* 415 Ill. Comp. Stat. 5/27(a) ("To aid the Board and to assist the public in determining which facilities will be affected, the person filing a proposal shall describe, to the extent reasonably practicable, the universe of affected sources and facilities and the economic impact of the proposed rule.").

When analyzing economic and technical justifications, the Board has historically "employed a cost-benefit analysis in its proceedings, which generally has involved measuring the cost of implementing pollution control technology against the benefit to the public in reducing pollution." *IEPA v. IPCB*, 721 N.E.2d 723, 730 (Ill. App. Ct., 2d Dist. 1999). In conducting cost-benefit analysis, however, the Board has generally refused to consider benefits that are purely speculative in nature. *Id.* at 731 ("We agree in theory with the Agency that the Board should take into consideration tangible benefits that have been established with some certainty. In practice, however, the benefits the Agency claimed Swenson would derive were purely speculative. Thus, the Board did not err in declining to consider the alleged benefits.").

Finally, all rules promulgated by the Board must be based on the evidence that is presented to it. The Illinois Supreme Court has explained that an administrative body exceeds its authority when it "(1) relies on factors which the legislature did not intend for the agency to consider; (2) entirely fails to consider an important aspect of the problem; or (3) offers an explanation for its decision which runs counter to the evidence before the agency, or which is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Greer v. Illinois Hous. Dev. Auth.*, 524 N.E.2d 561, 581 (Ill. 1988). Illinois appellate courts have specifically applied this standard to the Board. *See, e.g.*, *IEPA v. IPCB*, 721 N.E.2d at 730.

III. Standards for Cobalt and Vanadium

IEPA has proposed a Class I standard of 0.0012 mg/L for cobalt and a Class I standard of 0.00027 mg/L for vanadium. Both proposed standards are based on the Human Threshold Toxicant Advisory Concentration ("HTTAC") calculation procedure in Appendix A of IEPA's proposed regulations. IEPA's Motion for Acceptance, Appearances, Certificate of Origination; Statement of Reasons; and Proposed Amendments to 35 Ill. Adm. Code 620, Groundwater Quality Standards (hereinafter "Statement of Reasons") at 5013[3] (Dec. 7, 2021), Hrg. Ex. 1,[4] *In the Matter*

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[3] Due to the length of the Statement of Reasons filing and its inclusion of multiple documents, some of which do not contain page numbers, citations to the Statement of Reasons reference the PDF page of the filing rather than the page number listed on each individual document within the filing.

[4] When referencing Hearing Exhibit 1 (labelled as "Illinois Environmental Protection Agency (IEPA) Statement of Reasons (filed December 8, 2021)" on the Final Hearing Exhibit List), Dynegy is referencing the entirety of IEPA's initial filing, titled "IEPA's Motion for Acceptance, Appearances, Certificate of

of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620), R2022-018. Both standards are significantly lower than the current Class I standards for cobalt and vanadium, which are 1.0 mg/L and 0.049 mg/L, respectively.

IEPA proposed these new standards without providing information regarding or engaging in proper consideration of existing physical conditions, economic reasonableness, or technical justification, (all important factors that the Board must "take into account" in any rulemaking) and without providing a sufficient economic or technical justification in its Statement of Reasons as required under the Board's rules. 415 Ill. Comp. Stat. 5/27(a); 35 Ill. Admin. Code § 102.202(b); *see generally* Statement of Reasons (Dec. 7, 2021), Hrg. Ex. 1. IEPA has also failed to consider "existing methods for detecting and quantifying contaminants with reasonable analytical certainty" or the economic impact of the rule as required under the IGPA. 415 Ill. Comp. Stat. 55/8(b)(6); *id.* 55/8(d).

As Dynegy witness Dr. Melinda Hahn explained in her testimony, existing physical conditions in Illinois are such that background levels of cobalt and vanadium are above IEPA's proposed standards throughout much of state. Dynegy's Pre-filed Testimony of Melinda Hahn at 2–4 (Sept. 15, 2022), Hrg. Ex. 23, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620),* R2022-018. IEPA's proposal fails to take into account the costs upon owners or operators of property with background levels of cobalt and vanadium above IEPA's proposed standards, such as impact on property value and efforts to prove exceedances are due to background. *Id.* at 2. IEPA's proposal also fails to consider the ability to practically detect and quantify cobalt and vanadium. *Id.* at 4–6. As Dr. Hahn points out, Illinois labs that routinely analyze samples for stakeholders who will be subject to the new Part 620 have indicated that it is

Origination; Statement of Reasons; and Proposed Amendments to 35 Ill. Adm. Code 620, Groundwater Quality Standards," which was filed on December 8, 2021.

not feasible to detect cobalt and vanadium at or below IEPA's proposed limits in groundwater samples. *Id.*

Below, this Section discusses (a) how the Agency's proposal does not adequately address the economic impact of its proposed cobalt and vanadium standards, (b) why IEPA's proposed cobalt and vanadium standards are not technically feasible, and (c) Dynegy's proposal for revisions to the language in Section 620.410 and 620.420 to ensure Part 620, which is independently enforceable, sufficiently accounts for background.

a. IEPA has not adequately considered economic impact of the proposed cobalt and vanadium standards.

The IGPA, Section 27(a) of the Act, and 35 Ill. Admin. Code § 102.202(b) explicitly require the consideration of costs and technical feasibility in this rulemaking. 415 Ill. Comp. Stat. 55/8(b)(8); *id.* 55/8(d); 415 Ill. Comp. Stat 5/27(a); 35 Ill. Admin. Code § 102.202(b). IEPA has done no independent evaluation of the economic impact and has done only a cursory evaluation of technical feasibility of its rulemaking proposal. Instead, it has relied upon findings that *previous* Part 620 rulemakings were technically feasible and economically reasonable to conclude that *this* proposal is technically feasible and economically reasonable. Statement of Reasons at 29–33 (Dec. 7, 2021), Hrg. Ex. 1. In doing so, IEPA ignores that lowering standards for certain constituents may result in new costs and technical issues that may not have existed in those prior rulemakings.[5]

With respect to economic reasonableness, IEPA further contends that the groundwater standards are implemented through other regulations and programs and that economic burdens will be reviewed in connection with the incorporation of Part 620 standards into those other regulations

[5] In contrast, every time USEPA develops a new MCL (the basis for several Illinois Class I groundwater standards), it will review the technical feasibility and cost of the new standard. USEPA, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/sdwa/how-epa-regulates-drinking-water-contaminants#develop.

and programs. *Id.* at 32–33. Dynegy acknowledges the Board's statement in the original rulemaking for Part 620—R1989-014(B)—that "these are groundwater quality standards, not cleanup standards or requirements." Final Opinion and Order of the Board at 24–25 (Nov. 7, 1991), *In re Groundwater Quality Standards: 35 Ill. Adm. Code 620,* R1989-014(B) (further stating that it was inappropriate to attribute to that rulemaking the cost of corrective actions not prompted by the regulations in that rulemaking). While in that rulemaking the Board held that *all* of the costs associated with cleaning up to the groundwater standards could not be attributed to the rulemaking given the existence of various regulations and programs that might drive groundwater remediation, it did not hold that no costs should be attributed to and/or considered in conjunction with a Part 620 rulemaking. *Id.*

Part 620 includes independently enforceable standards that place burdens upon property owners and operators outside of the context of any other regulatory program. 35 Ill. Admin. § Code 620.115 (prohibiting a person from causing, threatening, or allowing a violation of the Part 620 regulations); 35 Ill Admin. Code § 620.405 (prohibiting a person from causing a groundwater quality standards in Part 620 to be exceeded); 415 Ill. Comp. Stat. 5/12(a) (prohibiting a person from causing, threatening, or allowing "the discharge of any contaminants into the environment in any State so as to cause or tend to cause water pollution in Illinois . . . ."); *In the Matter of: Sierra Club et. al. v. Midwest Generation, LLC*, PCB 2013-015 (an example of an enforcement action brought for violations of Part 620 groundwater quality standards). IEPA has acknowledged that this is the case, admitting at hearing that "outside the remediation programs, violations have been brought for exceedance of Part 620 standards." Transcript of the March 9, 2022 Hearing at 125:20–22 (March 14, 2022), *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620),* R2022-018. Accordingly, costs associated with investigation, delineation, remediation, or other corrective actions may be required based on the enforceable standards in Part 620, independent of any other regulatory program. *See, e.g.*, Dynegy's Index of Exhibits and Third Hearing Exhibits (hereinafter "Dynegy's Third Hearing Exhibits"), Ex. A at 6 (Dec. 5, 2022), *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*, R2022-018 (explaining that costs associated with groundwater samples above groundwater quality standards may include demonstration of consistency with background (e.g. well installation, sampling, analysis), remediation, deed restriction/lost valuation of property, or a local ordinance).

Evidence demonstrates background levels of cobalt and vanadium in much of Illinois are above IEPA's proposed standards, creating unaccounted for costs. Recently downloaded data from United States Geological Survey's ("USGS's") National Water Quality Assessment Program ("NWQAP")–analyzed by Dr. Hahn—show that 24% of samples in Illinois exceeded IEPA's proposed Class I standard of 0.0012 mg/L for cobalt and that 55% of samples collected in Illinois exceeded IEPA's proposed Class I standard of 0.00027 mg/L for vanadium. Dynegy's Pre-filed Testimony of Melinda Hahn at 2–5 (Sept. 15, 2022), Hrg. Ex. 23. Thus, based on background values, large portions of Illinois are in danger of exceeding IEPA's proposed cobalt and vanadium concentrations.[6]

Notably, the USGS samples were analyzed using filtered samples, while the standards in Part 620 are typically compared to unfiltered samples. Transcript of the December 7, 2022 Hearing

[6] In pre-filed questions and at hearing, IEPA and the Board asked questions about spacial distribution of the USGS samples Dr. Hahn analyzed. *See, e.g.*, Pre-filed Responses of Dr. Melinda Hahn (Nov. 23, 2022), Hrg. Ex. 29, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*, R2022-018; Transcript of December 7, 2022 Hearing at 31:4–23 (Dec. 15, 2022). As she noted, she was limited by publicly available data, which in this instance was available through the USGS. IEPA has additional data available regarding levels of constituents in groundwater around the State and could conduct a review of groundwater in Illinois to determine whether background concentrations vary in the State, based for example on area geology or aquifer, similar to what the Agency did for soil in Part 742. Pre-filed Responses of Dr. Melinda Hahn at 9 (Nov. 23, 2022), Hrg. Ex. 29. Not having the same access to information and capabilities as IEPA, Dr. Hahn was unable to conduct a similar analysis.

at 21:3–8 (Dec. 15, 2022), *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*, R2022-018; IEPA's Pre-filed Answers to Follow-up Questions at 15 (May 6, 2022), Hrg. Ex. 21, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*, R2022-018 ("Part 620 identifies standards for Class I and Class II groundwater, which [for inorganics] are measured as total (unfiltered) concentrations."). "[T]otal metals [i.e. unfiltered samples] can often have higher concentrations than a filtered metal sample." Transcript of December 7, 2022 Hearing at 21:6–8 (Dec. 15, 2022). *None* of the unfiltered samples in the USGS database had reporting limits for cobalt or vanadium below IEPA's proposed Class I groundwater standards for those constituents. Dynegy's Pre-filed Testimony of Melinda Hahn at 6 (Sept. 15, 2022), Hrg. Ex. 23 (noting reporting limits for cobalt and vanadium in unfiltered samples were consistently above IEPA's proposed standards). Accordingly, Dr. Hahn's determination regarding the percentage of USGS samples in Illinois above IEPA's proposed cobalt and vanadium standards is conservatively low, and the percentage of samples above those values would likely be even higher if there were unfiltered sample data that could be analyzed.

There are costs associated with setting a standard at or below background levels. Property owners and operators are stuck with the burden of proving that an exceedance at their property is due to background to avoid or respond to a violation notice or enforcement action or to demonstrate that liability does not exist in connection with a property transaction. *See* Dynegy's Pre-filed Testimony of Melinda Hahn at 1–2 (Sept. 15, 2022), Hrg. Ex. 23; Pre-filed Responses of Dr. Melinda Hahn at 2–3 (Nov. 23, 2022), Hrg. Ex. 29. As Dr. Hahn explained, Phase I and Phase II environmental site assessments ("ESAs") are often conducted prior to or during real estate transactions. Dynegy's Pre-filed Testimony of Melinda Hahn at 1–2 (Sept. 15, 2022), Hrg. Ex. 23. In Illinois, Phase II ESAs include the collection of groundwater samples and comparison of those samples to the Part 620 standards. *Id*. at 1. Sampling of properties may occur for other reasons as well. Any samples above the Part 620 standards will result in costs in the form of lowered property value, remediation costs, or costs to show the contamination above standards is due to background. *Id.* at 1–2.

The Board should not set standards that ignore existing physical conditions in much of the State and fail to take into account the costs associated with setting levels below background. Failure to do so is squarely in violation of the rulemaking requirements of the State.

b. The cobalt and vanadium standards are not technically feasible.

The Board is required to consider technical feasibility, including "existing methods of detecting and quantifying contaminants with reasonable analytical certainty." 425 Ill. Comp. Stat. 5/27(a); 415 Ill. Comp. Stat. 55/8(b)(b). IEPA's Statement of Reasons has failed to consider *practical* analytical achievability of its proposed cobalt and vanadium standards.

IEPA has done some basic analysis of achievability, comparing its proposed HTTAC-based standards with lower limits of quantitation ("LLOQs") and lowest concentration minimum reporting levels ("LCMRLs") and adopting the LLOQ/LCMRL when it is higher than the HTTAC value. Statement of Reasons at 52–54 (Dec. 7, 2021), Hrg. Ex. 1. However, ending the analysis of technical feasibility there stops short of appropriately considering the technical feasibility of the proposed standards. IEPA does not explain or cite to an origin for its LLOQ/LCMRL values and, for cobalt and vanadium, they are not consistent with practically achievable laboratory reporting limits. As Dr. Hahn explains, LLOQ and LCMRL values are based on idealized conditions for sample collection and analysis, are not based on achievable real-world conditions for groundwater samples, and therefore, do not adequately consider the technical achievability of detecting and quantifying constituents.

> The LLOQ is defined in the proposal as the minimum concentration that can be measured or reported pursuant to USEPA's Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (SW-846). The LLOQ is verified by spiking clean control water (e.g., reagent water or method blanks) that does not have issues with matrix interference. The LCRML is used by USEPA to support drinking water analysis to ensure compliance with regulation. The Technical Basis for the LCMRL describes the calculation of this value as a statistic generated from multiple laboratories estimating the minimum detectable spiking concentration of an analyte within certain statistical confidence using laboratory reagents, rather than actual field groundwater samples with significant turbidity . . . The LLOQ/LCMRLs are simply not relevant to or achievable in real world groundwater samples with a turbidity greater than 1 [nephelometric turbidity unit ("NTU")].

Dynegy's Pre-filed Testimony of Melinda Hahn at 5 (Sept. 15, 2022), Hrg. Ex. 23.[7] Accordingly, while LLOQ/LCMRLs may be appropriate to use in certain contexts, they are not appropriate to determine the achievability of detection using real world groundwater samples. *Id.*

Looking at real world achievability, existing methods cannot adequately detect and quantify cobalt and vanadium at IEPA's proposed standards. As Dr. Hahn explained, a lab must be able to achieve reporting limits lower than the standard to demonstrate compliance; however laboratories operating in Illinois have indicated they will have difficulty achieving reporting limits below the proposed cobalt and vanadium standards. Dynegy's Pre-filed Testimony of Melinda Hahn at 5 (Sept. 15, 2022), Hrg. Ex. 23. When asked about laboratories' ability to achieve

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[7] In its proposed revisions to Part 620, IEPA is replacing the concept of PQL—practical quantitation level—with LLOQ/LCMRL, which define the lowest possible level of detection in matrix-spiked samples. IEPA's values for LLOQ/LCMRL are very low, and IEPA does not provide a basis for their calculation or estimation. While SW-846 was revised to include LLOQ/LCMRL, USEPA has not deviated from the PQL concept in setting MCLs. In prior and the most recent six-year review of MCLs limited by analytical feasibility (2016), USEPA relied upon actual compliance data from the regulated community (water supplies) to ensure that 80% of laboratories could achieve reporting limits below any potential new MCL. *See* USEPA, *Development of Estimated Quantitation Levels for the Third Six-Year Review of National Primary Drinking Water Regulations (Chemical Phase Rules)* (October 2016), attached as **Exhibit F**; Office of Ground Water and Drinking Water, *EPA Protocol for the Review of Existing National Primary Drinking Water Regulations*, USEPA (June 2003), attached as **Exhibit G**. Given that the Board relies on MCLs as the first priority in selecting proposed groundwater quality standards, but also regulates certain constituents that do not have a USEPA MCL, it stands to reason in promulgating standards for constituents without MCLs the Board should use a process consistent with the one used to establish MCLs to ensure that the regulated community can reliably detect analytes below proposed groundwater standards.

reporting limits below its proposed standards, IEPA admitted that commercial laboratories may not be able to achieve reporting limits below its proposed standards. IEPA's Prefiled Answers to Follow-up Questions at 36 (May 5, 2022), Hrg. Ex. 21. Rather than conduct its own assessment of laboratory capability, IEPA responded that labs should "keep up with analytical techniques and new methodologies," meanwhile providing no evidence that new analytical techniques or methodologies *would* allow labs to achieve the necessary reporting limits to quantify cobalt and vanadium at their proposed limits. *Id*. In contrast, Dr. Hahn contacted two major laboratories that operate in Illinois and that are certified by IEPA to analyze samples collected in Illinois: Pace Analytical and Teklab, Inc. Dynegy's Pre-filed Testimony of Melinda Hahn at 5 (Sept. 15, 2022), Hrg. Ex. 23; Pre-filed Responses of Dr. Melinda Hahn at 8 (Nov. 23, 2022), Hrg. Ex. 29. As she explained,

> [b]oth laboratories were asked if they could achieve reporting limits below the proposed Class I standards for cobalt and vanadium for typical Illinois groundwater samples seen in their practice. Teklab reported that they expect difficulty in meeting the proposed vanadium standard and noted that when the groundwater standard approaches the reporting limit, the statistical confidence in the compliance determination decreases. Pace indicated that their labs are currently unable to achieve reporting limits below the proposed standards for both cobalt and vanadium based on their experience with Illinois groundwater samples.

Pre-filed Responses of Dr. Melinda Hahn at 8 (Nov. 23, 2022), Hrg. Ex. 29.

In addition to getting practical feedback from laboratories, Dr. Hahn presented additional evidence of the difficulties likely to be encountered in quantifying cobalt and vanadium at the low limits proposed by the Agency. For example, under Method 200.8, an accepted method used for analyzing cobalt, a table of typical method detection limits provided by USEPA includes a value of 0.004 mg/L for cobalt in aqueous samples (significantly higher than IEPA's proposed standard). Dynegy's Pre-filed Testimony of Melinda Hahn at 5–6 (Sept. 15, 2022), Hrg. Ex. 23. Additionally, as explained above, Dr. Hahn's analysis of background data in Illinois relied upon filtered sample results (even though unfiltered or "total" samples are generally used to determine compliance with the Part 620 standards) because relying upon unfiltered results was impossible given the high reporting limits for cobalt and vanadium in unfiltered samples. *Id.* at 6. She found that *none* of the more than 3000 unfiltered samples in the USGS database analyzed for cobalt achieved a reporting limit of less than 0.0012 mg/L, 84% of unfiltered samples were reported as undetected for cobalt at the much higher reporting limit of 0.005 mg/L, and the lowest reporting limit for cobalt was 0.03 mg/L (three times IEPA's proposed standard). *Id*. The reporting limit for vanadium from the unfiltered USGS data was 0.005 mg/L, more than 18 times the Agency's proposed Class I standard, and 92% of the over 3000 unfiltered samples analyzed for vanadium were undetected even at that higher reporting limit. *Id.*

The Board should not set limits for cobalt and vanadium that are too low to analyze under real world conditions (taking into account issues like turbidity). If it does, it runs the risk of stakeholders and the State not knowing whether groundwater is in compliance with the Class I standards. Standards that are too low to analyze under real world conditions further limit the ability to delineate and understand the source and extent of any exceedances that may exist.

c. Dynegy's Proposed Revisions to Sections 620.410(a) and 620.420(b)

IEPA's proposed standards for cobalt and vanadium are too low. More appropriate standards would take into account background levels and reporting limits for cobalt and vanadium. Dynegy witness Dr. Hahn suggested this limit could be 0.02–0.03 mg/L for both cobalt and vanadium, based on background threshold values for these constituents. Dynegy's Pre-filed Testimony of Melinda Hahn at 4, 6 (Sept. 15, 2022), Hrg. Ex. 23. A standard somewhere between 0.02 mg/L and 0.03 mg/L will not suffer from the detection issues that the Agency's proposed standards will.

Dynegy is appreciative of statements made by the Agency and questions from the Board that suggest background issues can be addressed through alternative source demonstration provisions under other Board regulations such as the Underground Storage Tank ("UST") program, the Site Remediation Program ("SRP"), and Illinois coal combustion residual ("CCR") rules. *See, e.g.*, Pre-filed Responses of Melinda Hahn at 8–9 (November 23, 2022), Hrg. Ex. 29. Dynegy's concern, however, is that the standards in Part 620 apply independent of and can be enforced independent of these other Illinois regulatory programs. Thus, the standards should be economically reasonable and technically feasible.

Whether or not the Board adopts the Agency's proposal for cobalt and vanadium standards—or Dynegy's proposal or no proposal at all—Dynegy believes it would be helpful to incorporate language into Part 620 that would explicitly account for background. Doing so will more fully align the Part 620 rules with rules under various other regulatory programs such as the Illinois UST program, the SRP, and CCR rules. Dynegy proposes the following revisions to Sections 620.410 and 620.420 (in blackline on top of IEPA's proposed revisions of the same language):

Section 620.410

a) Inorganic Chemical Constituents

Except due to natural causes or background (determined in accordance with 35 Ill. Adm. Code Section 742.410) or as provided in Section 620.450, concentrations of the following chemical constituents ~~must~~ shall not be exceeded in Class I groundwater:

Section 620.410(b)

b) Organic Chemical Constituents

Except due to natural causes or background (determined in accordance with 35 Ill. Adm. Code Section 742.410) or as provided in Section 620.450 or subsection (d), concentrations of the following organic chemical constituents ~~must~~ shall not be exceeded in Class I groundwater:

Section 620.420(a)

a) Inorganic Chemical Constituents

1) Except due to natural causes or background (determined in accordance with 35 Ill. Adm. Code Section 742.410) or as provided in Section 620.450 or subsection (a)(3) or ~~(c)~~ (d) of this Section, concentrations of the following chemical constituents ~~must~~ shall not be exceeded in Class II groundwater:

Section 620.420(b)

b) Organic Chemical Constituents

1) Except due to natural causes or background (determined in accordance with 35 Ill. Adm. Code Section 742.410) or as provided in Section 620.450 or subsection (b)(2) or ~~(c)~~ (d) of this Section, concentrations of the following chemical constituents ~~must~~ shall not be exceeded in Class II groundwater:

These revisions will help make Part 620 more clearly consistent with other regulatory programs in Illinois and help avoid unnecessary enforcement and remediation costs.

IV. Standards for Selenium and Fluoride

Below, this Section discusses (a) how the Agency has arbitrarily proposed more stringent Class I and Class II standards for fluoride and selenium based on no new supporting information, (b) that the Agency's proposed revisions to the selenium Class I and Class II standards are inappropriate and unnecessary given Illinois-specific conditions and considerations, and (c) that the Agency's proposed Class I and Class II standards for fluoride are unnecessary and will provide little to no benefit.

a. The Agency is Proposing New Standards for Selenium and Fluoride Based on No New Information.

IEPA is proposing new Class I and Class II standards for selenium and fluoride based on <u>no new information</u> compared to the information that existed when the current standards for these constituents were set. The Board would be acting in an arbitrary manner by promulgating different standards now than it previously promulgated, based on the same information and circumstances that existed during its previous promulgation.

The current Class I and Class II standard for selenium is 0.05 mg/L. The current Class I standard is consistent with the MCL for selenium. The current Class II standard was derived relying upon the 1972 Water Quality Criteria Document prepared by the National Academy of Science for USEPA ("*1972 Water Quality Criteria*"), the same document IEPA now relies on to propose a completely different standard. *See* Statement of Reasons at 3239 (Dec. 7, 2021), Hrg. Ex. 1. In the 1989 rulemaking for the current selenium standards, IEPA initially proposed setting the Class II selenium standard at 0.02 mg/L based on the forage of irrigated crops by livestock, similar to what it is proposing in this rulemaking. IEPA's Mot. To File Comments Instanter at 10–11 (July 9, 1991), *In the Matter of: Groundwater Quality Standards: 35 Ill. Adm. Code 620*, R1989-014(B), attached as **<u>Exhibit A</u>**. However, IEPA then re-evaluated its recommendation in the course of the rulemaking and ultimately determined a livestock watering based standard of 0.05 mg/L was more appropriate.

> [S]ince the date of the hearing, the Agency has re-evaluated both Class I and II standards for copper, lead and selenium and proposes new standards for the constituents below. . . . The Agency [] recommends that the Class II: General Resource Groundwater Quality Standard [for copper] should be amended from 0.5 mg/l to 0.65 mg/1. The 0.5 mg/1 Class II standard which was derived from livestock watering, was selected primarily because the 1972 water Quality Criteria recommendation specified that very few waters would exceed this level. This standard was chosen rather than the irrigation number of 0.2 mg/1 because the latter is based on continuous irrigation which is not utilized in Illinois, either within a

> year or from year-to-year. In the Agency's opinion, a 0.65 mg/1 standard will still be sufficiently protective for the vast majority, if not all, livestock uses. [] The Agency has performed a similar evaluation of the Class II: General Resource Standard established for selenium and has determined that the standard, as proposed, was also based on continuous irrigation. Thus, the Agency recommends that the Class II standard for selenium should be amended to 0.05 mg/1 which is the number established for livestock watering.

Id.; *see also*, Pre-filed Testimony of Lisa Yost at 7–8 (Sept. 15, 2022), Hrg. Ex. 24.

The current Class I and Class II standard for fluoride—4.0 mg/L—was promulgated in the same rulemaking as the current selenium standards. In the 1989 rulemaking, IEPA initially proposed a Class II fluoride standard of 2.0 mg/L based on "limits for livestock water supply," again based on *1972 Water Quality Criteria*. IEPA Statement of Reasons at 17 (Sept. 1989), *In the Matter of: Groundwater Quality Standards: 35 Ill. Adm. Code 620*, R1989-014(B), attached as **Exhibit B**. By the Board's First Notice Opinion and Order, however, IEPA had issued an amended proposal with a 4.0 mg/L Class I and Class II groundwater standard for fluoride.[8] First Notice Order of the Board at 22–24 (Feb. 28, 1991), *In the Matter of: Groundwater Quality Standards: 35 Ill. Adm. Code 620*, R1989-014(B).

Thus, in that 1989 rulemaking, IEPA not only had access to, but it actually used, *1972 Water Quality Criteria* when it proposed the current 0.05 mg/L selenium and 4.0 mg/L fluoride standards in Illinois. A conscious decision was made in that previous rulemaking to reject the 0.02 mg/L selenium standard and 2.0 mg/L fluoride standards IEPA is now proposing based on the same underlying information IEPA is relying upon today, yet IEPA has provided no basis for why the outcome of this proceeding should be any different than the outcome of R1989-014 (and its subdockets).

[8] Dynegy attempted to locate the reasoning for the Agency's amended proposal in the prior rulemaking. However, it was unable to locate any such discussion through its search of the available rulemaking record.

b. The Board Should Maintain the Current Class I and Class II Selenium Standard of 0.05 mg/L.

IEPA's proposed Class I and II selenium standard of 0.02 mg/L is unnecessary given the physical conditions of soil and character of irrigation in Illinois. As discussed above, IEPA based its current proposed selenium standard on *1972 Water Quality Criteria* that concluded the following:

> With the low levels of selenium required to produce toxic levels in forages, the recommended maximum concentration in irrigation waters is 0.02 mg/l for continuous use on all soils. At a rate of 3 acre feet of water per year this concentration represents 3.2 pounds per acre in 20 years. The same recommended maximum concentration should be used on neutral and alkaline fine textured soils until greater information is obtained on soil reactions.

National Academy of Sciences & National Academy of Engineers, *Water Quality Criteria 1972: A Report of the Committee on Water Quality Criteria* at 345 (1972), excerpted and attached as **Exhibit C**. Given the basis for this standard, it would be inappropriate to apply it in Illinois now as it was inappropriate to apply it in Illinois back in 1989. First, as IEPA has admitted, continuous irrigation does not occur in Illinois. Transcript of the March 9, 2022 Hearing at 154:16–19 (Mar. 14, 2022) ("I do not believe continuous irrigation is a practice that is used in Illinois simply because we do not have a necessity for it. We do get regular rainfall."); *id.* at 148:13–14 ("We have, yeah, I would say intermittent irrigation here.").

Second, while *1972 Water Quality Criteria* recommends the same maximum concentration for intermittent irrigation on "neutral and alkaline fine textured soils until greater information is obtained on soil reactions," the level of irrigation assumed to form the basis of the 0.02 mg/L maximum concentration is water use at 3-acre feet of water, per acre, per year. *Water Quality Criteria 1972* at 345, **Ex. C**. This rate of irrigation is much higher than the typical irrigation rate in Illinois, which is more around 0.5 acre foot of water, per acre, per year. Dynegy's Pre-filed Testimony of Lisa Yost at 7 (Sept. 15, 2022), Hrg. Ex. 24. The uncertainly surrounding the appropriateness of a 0.02 mg/L selenium standard for intermittent irrigation on neutral and alkaline fine textured soils is made clear through the *1972 Water Quality Criteria's* recommendation that the value be used only as a placeholder "until greater information is obtained." *Water Quality Criteria 1972* at 345, **Ex. C**. Tellingly, in almost every instance in that document where greater information on a metal's soil reactions was available, the recommended maximum concentrations for intermittent use on neutral and alkaline soil were *several fold higher* than the values provided for continuous irrigation. *See Water Quality Criteria 1972* at 339, **Ex. C**.

Third, while soils in Illinois tend to be fine textured, they are predominantly not neutral or alkaline. Pre-filed Testimony of Lisa Yost at (Sept. 15, 2022), Hrg. Ex. 24. As Dynegy witness Lisa Yost explained, the Illinois State Water Survey indicates that soil in Illinois tends to range from mildly alkaline to strongly acid in extreme southern Illinois. *Id*. IEPA has provided no evidence that areas used for agriculture in Illinois, or areas where livestock may forage on crops in Illinois, contain neutral and alkaline fine textured soils. Thus, even if irrigation rates in Illinois are "intermittent," the soil conditions do not support the proposed limit.

Fourth, the studies that form the basis for the 0.02 mg/L selenium standard were conducted in areas that do not reflect Illinois agriculture. Ms. Yost looked at the studies cited in support of the standard and found that they were conducted in Oregon, Wyoming, New Zealand, and Denmark, areas with agricultural conditions that vary from Illinois, and focused on "range plants," which typically do not serve as forage for livestock in Illinois. *Id*. at 9. As she explained, higher levels of irrigation would be expected in areas like Oregon and Wyoming compared to Illinois. *Id.*; *see also* Pre-filed Responses of Lisa Yost at 3–4 (Nov. 23, 2022), Hrg. Ex. 30, *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620),* R2022-018.

Fifth, not only is there is no evidence that livestock in Illinois are suffering adverse effects from elevated selenium in forage, evidence indicates livestock in Illinois in fact need selenium supplementation to avoid deficiencies. Ms. Yost's testimony provided examples of agricultural extension office publications explaining the need to supplement selenium in livestock diet in Illinois to protect against deficiency.

> In many areas of the Midwest, Selenium is deficient in the soil. As a result, pasture, hay, and grains that are grown from Midwestern soils will share the deficiency. As a herd manager, one option to consider is providing higher levels of Selenium in your mineral supplementation program to alleviate deficiency problems. Injectable products, such as Mu-Se, provide supplemental Selenium along with vitamin E. It is recommended that Selenium and vitamin E both be supplemented to guard against Selenium deficiency.

Pre-filed Testimony of Lisa Yost at 9–10 (Sept. 15, 2022), Hrg. Ex. 24 (citing Travis Meteer, *Preparing for Calving Season*, Orr Agric. R&D Ctr.: Univ. of Ill. at Urbana-Champaign (Jan. 23, 2017), attached as **Exhibit D**). "Selenium deficiency is a problem in Illinois. Selenium and Vitamin E are generally used in conjunction to supplement against Se deficiency." *Id.* (citing Travis Meteer, *Minding your Minerals*, Orr Agric. R&D Ctr.: Univ. of Ill. at Urbana-Champaign (Mar. 22, 2016), attached as **Exhibit E**). Thus, not only is it unnecessary to reduce selenium standards for groundwater to be protective of livestock in Illinois, doing so may actually adversely impact livestock by further contributing to selenium deficiency.

Finally, the IGPA specifically provides for consideration of "relevant experiences from other states where groundwater protection programs have been implemented." 4 Ill. Comp. Stat. 55/8(b)(5). Other states in the region consistently apply an enforceable standard of 0.05 mg/L for selenium. Dynegy's Pre-filed Testimony of Lisa Yost at 5 (Sept. 15, 2022), Hrg. Ex. 24, In *the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620)*, R2022-018.

Accordingly, the Board should maintain the current Class I and Class II selenium standards of 0.05mg/L. This value is consistent with the MCL for selenium, and thus protective of human health. It is also consistent with standards applied by other states and the livestock watering limit for selenium in *1972 Water Quality Criteria* (which served as the basis for the current Class II selenium standard established by the Board).

c. The Board Should Maintain the Current Fluoride Standard of 4.0 mg/L.

The IEPA's proposed Class I and Class II fluoride standards of 2.0 mg/L are unnecessary and overreaching. The sole basis IEPA has provided for its proposed fluoride standard is the upper limit for livestock drinking water recommended in *1972 Water Quality Criteria*. That upper limit for livestock drinking water is intended to be protective of the *cosmetic* dental endpoint of preventing tooth mottling in livestock. Pre-filed Testimony of Lisa Yost at 11–12 (Sept. 15, 2022), Hrg. Ex. 24. Notably, *1972 Water Quality Criteria* suggests actual health effects in livestock would not be expected until fluoride levels reached much higher concentrations, explaining that injurious effect from fluoride other than tooth mottling would not be expected until there was "[a]t least a several fold increase in its concentration." *Id.*; *see also Water Quality Criteria 1972* at 312, **Ex. C**.

IEPA has provided no basis for its proposed 2.0 mg/L standard for fluoride other than to provide an aesthetic benefit to livestock. Meanwhile, states neighboring Illinois have enforceable fluoride standards that are consistent with the current Class I and Class II standard of 4.0 mg/L. *See* Dynegy's Pre-filed Testimony of Lisa Yost at 5 (Sept. 15, 2022), Hrg. Ex. 24. The 4.0 mg/L standard is also consistent with the MCL for fluoride. If promulgated, the costs of this unnecessarily lowered standard will outweigh any speculative cosmetic dental benefit that may result in livestock. Accordingly, the Board should maintain the current Class I and Class II standards of 4.0 mg/L for fluoride.

V. Molybdenum Standard

Below, this section explains (a) that the Board should not promulgate IEPA's proposed Class I molybdenum standard because it is based on outdated and flawed toxicity information, while more current, reliable, and robust toxicity information exists through the ASTDR, and (b) that a Class II Molybdenum is unnecessary and inappropriate for conditions in Illinois.

a. The Board Should Not Promulgate IEPA's Proposed Class I Molybdenum Standard.

IEPA's proposed Class I molybdenum standard of 0.019 mg/L, derived using the HTTAC formula in the Agency's proposed Appendix A, was developed using outdated and flawed toxicity information. IEPA derived its proposed Class I molybdenum standard using 1992 toxicity information from IRIS. IEPA has admitted that the IRIS molybdenum reference dose ("RfD") used to derive the molybdenum HTTAC is outdated. Transcript of June 21, 2022 Hearing at 59:13–61:21 (June 27, 2022), *In the Matter of: Proposed Amendments to Groundwater Quality (35 Ill. Adm. Code 620),* R2022-018; *see also id.* at 83:23–84:02 Ms. Yost explains that the IRIS RfD was derived from a flawed study that included issues with controls and potential issues with analytical measurements in specimens. Dynegy's Third Hearing Exhibits, Ex. B at 16; Dynegy's Pre-filed Testimony of Lisa Yost at 14–15 (Sept. 15, 2022), Hrg. Ex. 24. The ATSDR commented on the flaws in the study used to derive the IRIS RfD explaining

> The study has a number of deficiencies that limit the interpretation of the results: (1) the control group consisted of 5 individuals compared to 52 subjects in the exposed group; (2) no information was provided on the controls to assess whether they were matched to the exposed group; (3) it does not appear that the study controlled for potential confounders, such as diet and alcohol, which can increase uric acid levels; and (4) NAS (2001) noted that there were potential analytical problems with the measurement of serum and urine copper levels (ATSDR 2020).

U.S. Dept. Health and Human Servs., ATSDR, *Toxicological Profile for Molybdenum* at A-22 (May 2020), www.atsdr.cdc.gov/toxprofiles/tp212.pdf.

More current, reliable, and robust toxicity information is available from the ATSDR:

> ATSDR (2020) reviewed the available data including the study relied upon by USEPA for the IRIS RfD and derived an intermediate duration oral [minimum risk level (MRL)] of 0.06 mg/kg/day based on a NOAEL of 17 mg/kg/day identified in a 13-week study in Sprague-Dawley rats (Murray *et al.* 2014). This study also identified a LOAEL, including reduced body weights and kidney effects in rats treated, at 60 mg/kg-day. ATSDR derived the MRL by dividing the NOAEL of 17 mg/kg-day by an UF of 100 and a modifying factor (MF) of 3 including the following: an UF of 10 for extrapolation from animals to humans; a UF of 10 for human variability; and a MF of 3 for concern that reproductive and/or developmental effects may be a more sensitive endpoint than kidney effects in populations with marginal copper intakes. ATSDR (2020) indicates that the MRL has already accounted for dietary intake stating that the MRL was derived assuming "healthy dietary levels of molybdenum and copper and represents the level of exposure above and beyond the normal diet".

Dynegy's Pre-filed Testimony of Lisa Yost at 14–15 (Sept. 15, 2022), Hrg. Ex. 24.

IEPA has noted, in the record of this proceeding, its preference and past practice of relying upon the USEPA's toxicity hierarchy in the Office of Solid Waste and Emergency Response ("OWSER") Directive 9285.7-53 (Human Health Toxicity Value in Superfund Risk Assessments) to derive toxicity values for HTTAC calculations. Statement of Reasons, Attachment 1 at 509–11 (Dec. 7, 2021), Hrg. Ex. 1. IRIS is considered the "Tier I" source under this hierarchy. However, in this instance, relying upon ATSDR toxicity values is consistent with the OSWER Directive.[9] As USEPA explained in the Directive

> IRIS is not the only source of toxicology information, and in some cases more recent, credible and relevant data may come to the Agency's attention. In particular, toxicological information other than that in IRIS may be brought to the agency by outside parties. Such information should be considered along with the data in IRIS in selecting toxicological values; ultimately the Agency should evaluate risk upon its best scientific judgement and consider all credible and relevant information available to it.

[9] As IEPA noted, the use of this hierarchy to derive toxicity values for HTTAC calculations is not codified anywhere and is, therefore, not required by law, allowing for additional flexibility to use better sources for toxicity values when they are available. Transcript of the June 21, 2022 Hearing at 53:13–17 (June 27, 2022).

Dynegy's Pre-filed Testimony of Lisa Yost at 14 (Sept. 15, 2022), Hrg. Ex. 24 (citing USEPA, *Memorandum re: Human Health Toxicity Values in Superfund Risk Assessment* at 2 (Dec. 5, 2003), https://www.epa.gov/sites/default/files/2015-11/documents/hhmemo.pdf). As explained above, the ATSDR data is "more recent, credible and relevant" than the IRIS data for molybdenum in this case. It is, accordingly, entirely consistent with the hierarchy upon which IEPA relies to use toxicity data from ATSDR instead of IRIS. If the ATSDR intermediate oral MRL of 0.06 milligrams per kilograms per day ("mg/kg-day") is used[10] instead of the IRIS RfD to calculate an HTTAC for molybdenum it results in a value of 0.2 mg/L.

As Ms. Yost explains, molybdenum is also an essential nutrient required for growth in most plants and animals. Dynegy's Pre-filed Testimony of Lisa Yost at 16 (Sept. 15, 2022), Hrg. Ex. 24. The recommended daily intake of molybdenum is 17 micrograms per day for children ages 1 to 3 and 22 micrograms per day for children ages 4 to 8. The proposed molybdenum standard would actually result in a daily intake of molybdenum through water that is less than the recommended daily intake for children. *Id.* This further supports the unnecessary conservatism of IEPA's propose value, including that it is not needed to protect public health.

Dynegy proposes the following in connection with the proposed Class I standard for molybdenum, so that the Board avoids setting an unsupported and unnecessarily low standard:

[10] Although the ATSDR oral MRL is derived to be protective of intermediate exposure, Ms. Yost explained that no further uncertainty factors are needed to use the ATSDR immediate oral MRL to calculate an HTTAC for molybdenum, consistent with the European Chemical Agency ("ECHA") analysis for molybdenum where no adjustment factor was used for sub-chronic to chronic exposure in the study because other investigations (e.g. National Toxicology Program (NTP) 1997 inhalation study34) demonstrated no increase in systemic toxicity for 13 weeks or two years. Dynegy's Pre-filed Testimony of Lisa Yost at 15 (Sept. 15, 2022), Hrg. Ex. 24 (citing Nat'l Toxicol. Program, *NTP Technical Report on the Toxicology and Carcinogenesis Studies of Molybdenum Trioxide in F344/N Rats and B6C3F1 Mice (Inhalation Studies)*, U.S. Dep't of Health & Human Servs. (April 1997), https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr462.pdf).

- Dynegy is supportive of the International Molybdenum Association's suggestion that the Board wait until the IRIS data for molybdenum is adopted before promulgating a Class I standard for molybdenum.
- If the Board wants to promulgate a standard for molybdenum now, Dynegy proposes that the Board set the Class I standard at 0.2 mg/L, consistent with a health-based standard derived using ATSDR data.

b. A Class II Standard for Molybdenum is Unnecessary.

IEPA's proposed Class II standard for molybdenum of 0.05 mg/L, based on protection of livestock that forage on irrigated crops, is unnecessary and not representative of Illinois agriculture. Dynegy's Pre-filed testimony of Lisa Yost at 17 (Sept. 15, 2022), Hrg. Ex. 24.

First, the 0.05 mg/L value is an irrigation advisory for short term use on soils that react with molybdenum. *Id.* IEPA has provided no evidence that soils in Illinois would be expected to "react with" molybdenum.

Second, Ms. Yost reviewed the studies in *1972 Water Quality Criteria* used to support the 0.05 mg/L advisory value. The studies suggest that elevated molybdenum levels are not an issue in Illinois agriculture. Rather, these studies indicate that molybdenum toxicity for grazing animals is an issue in the Western United States as opposed to the Midwest.

> Forages that contain high levels of· Mo are found in areas (a) where soils are alkaline, (b) adjoining rivers, lakes, and sinks, and where drainage is poor and water tables are high, and (c) where drainage usually covers granite rather than volcanic mountain areas." Molybdenum toxicity occurs primarily in the Western US, due to naturally occurring levels in soil and soil characteristics. Molybdenum is more readily absorbed in alkaline soils (Kaiser *et al.* (2005)) and as described above for selenium, Illinois soils tend to be mildly acidic or neutral, while high salinity soils, mineralized soils and soils with a higher pH are more common in the Western US.

Id. at 18.

Finally, Ms. Yost reviewed Illinois agricultural extension publications for information regarding elevated molybdenum in forage crops resulting in toxic effects in livestock in Illinois. She did not find any information presenting this as an issue in Illinois. On the contrary, she found evidence that certain plants in Illinois may have molybdenum deficiencies. *Id.* As she notes, molybdenum is also an essential nutrient that helps livestock with metabolism and growth. *Id.*

Given these considerations, a Class II standard of 0.05 mg/L for molybdenum is not necessary to protect Illinois livestock that forage on irrigated crops. Without evidence that soils in Illinois "react with" molybdenum and without evidence of any present or potential harm to livestock in Illinois, the promulgation of this standard will result in considerable burdens without any clear benefit.

VI. CONCLUSION

Dynegy appreciates the Board's careful review of the record submitted in this rulemaking. For the reasons stated in this Post-Hearing Comment and testimony, Dynegy requests that the Board adopt Dynegy's proposed modifications to IEPA's Part 620 rule proposal.

Respectfully submitted,

/s/ Bina Joshi
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CERTIFICATE OF SERVICE

I, the undersigned, certify that on this 3rd day of March, 2023, I have served electronically the attached **Dynegy's Post-Hearing Comment**, upon the individuals on the attached service list. I further certify that my email address is Sarah.Lode@afslaw.com; the number of pages in the email transmission is 371; and the email transmission took place today before 5:00 p.m.

Respectfully submitted,

/s/ Sarah Lode
Sarah Lode

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
PROPOSED AMENDMENTS TO GROUNDWATER QUALITY (35 ILL. ADM. CODE 620)	)	**R 2022-018 (Rulemaking - Public Water Supply)**

Dynegy's Post-Hearing Comment Exhibit List

EXHIBIT A	IEPA's Mot. To File Comments Instanter at 10–11 (July 9, 1991), *In the Matter of: Groundwater Quality Standards: 35 Ill. Adm. Code 620*, R1989-014(B)
EXHIBIT B	IEPA Statement of Reasons at 17 (Sept. 1989), *In the Matter of: Groundwater Quality Standards: 35 Ill. Adm. Code 620*, R1989-014(B)
EXHIBIT C	National Academy of Sciences & National Academy of Engineers, *Water Quality Criteria 1972: A Report of the Committee on Water Quality Criteria* at 345 (1972) **(excerpted)**
EXHIBIT D	Travis Meeter, *Preparing for Calving Season*, Orr Agric. R&D Ctr.: Univ. of Ill. at Urbana-Champaign (Jan. 23, 2017)
EXHIBIT E	Travis Meteer, Minding your Minerals, Orr Agric. R&D Ctr.: Univ. of Ill. at Urbana-Champaign (Mar. 22, 2016)
EXHIBIT F	USEPA, *Development of Estimated Quantitation Levels for the Third Six-Year Review of National Primary Drinking Water Regulations (Chemical Phase Rules)* (October 2016)
EXHIBIT G	Office of Ground Water and Drinking Water, *EPA Protocol for the Review of Existing National Primary Drinking Water Regulations*, USEPA (June 2003)

EXHIBIT A

RECEIVED
JUL - 9 1991
STATE OF ILLINOIS
POLLUTION CONTROL BOARD

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)
	)
Groundwater Quality Standards	) PCB R89-14(B)
(35 Ill. Adm. Code)	)

P.C. #58

NOTICE

TO: Dorothy Gunn, Clerk
Illinois Pollution Control Board
SOIC, Suite 11-500
100 W. Randolph
Chicago, IL 60601

Michelle Dresdow
Hearing Officer
Illinois Pollution Control Board
PO Box 505
DeKalb, IL 60115

SEE ATTACHED LIST

PLEASE TAKE NOTICE that I have filed with the Clerk of the Illinois Pollution Control Board the Illinois Environmental Protection Agency's Motion to File Comments Instanter and the Comments, a copy of which is served upon you.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By: Stephen C. Ewart
Stephen C. Ewart
Deputy Counsel
Division of Legal Counsel

DATE: July 8, 1991

2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

217/782-5544

RECEIVED
JUL - 9 1991
STATE OF ILLINOIS
POLLUTION CONTROL BOARD

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
Groundwater Quality Standards	)	PCB R89-14(B)
(35 Ill. Adm. Code)	)	
	)	

MOTION TO FILE COMMENTS INSTANTER

NOW COMES the Illinois Environmental Protection Agency ("Agency") by its attorney, Stephen C. Ewart, and pursuant to the Procedural Rules of the Illinois Pollution Control Board ("Board") moves for leave to file these COMMENTS Instanter. In support of this Motion, the Affidavit of Stephen C. Ewart is attached.

WHEREFORE, the Agency respectfully requests that the Board accept the filing of the COMMENTS Instanter.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By: Stephen C. Ewart
Stephen C. Ewart
Deputy Counsel
Division of Legal Counsel

DATE: July 8, 1991

2200 Churchill Road
P.O. Box 19276
Springfield, Illinois 62794-9276

217/782-5544

STATE OF ILLINOIS)
)
COUNTY OF SANGAMON)

AFFIDAVIT

I, STEPHEN C. EWART, being duly sworn upon oath, deposes and states as follows:

1. I am Deputy Counsel who has recently assumed the responsibilities to prepare and present the Agency's COMMENTS in the regulatory proceeding R89-14(B).

2. Per the order of Hearing Officer Michelle Dresdow in this proceeding, the COMMENTS were due on June 28, 1991.

3. The Agency was unable to complete the technical and legal analysis of issues presented in this proceeding before and since the May 30, 1991 hearing because Agency was not able to complete the review of the transcript which was received on June 21, 1991.

4. The COMMENTS document is therefore, with leave of the Board being filed seven (7) days late.

FURTHER AFFIANT SAYETH NOT.

Stephen C. Ewart

Stephen C. Ewart

SUBSCRIBED AND SWORN TO BEFORE ME

this 8th day of July, 1991.

Notary Public

OFFICIAL SEAL
RICHARD C. WARRINGTON
NOTARY PUBLIC - STATE OF ILLINOIS
My Commission Expires January 5, 1992

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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

STATE OF ILLINOIS)
) SS
COUNTY OF SANGAMON)

PROOF OF SERVICE

I, the undersigned, on oath state that I have served the attached upon the person to whom it is addressed, by placing a copy in an envelope addressed to:

Dorothy Gunn, Clerk **(AIR EXPRESS)**
Illinois Pollution Control Board
SOIC, Suite 11-500
100 W. Randolph
Chicago, IL 60601

Michelle Dresdow **(AIR EXPRESS)**
Hearing Officer
Illinois Pollution Control Board
P.O. Box 505
148 North Third St.
Dekalb, IL 60115

SEE ATTACHED LIST

and sending it by first class mail from Springfield, Illinois, on July 8, 1991, with sufficient postage affixed.

By: Richelle K. Tucker

SUBSCRIBED AND SWORN BEFORE ME

this 8 day of July, 1991.

Notary Public

OFFICIAL SEAL
RICHARD C. WARRINGTON
NOTARY PUBLIC STATE OF ILLINOIS
My Commission Expires January 5, 1992

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
Groundwater Quality Standards	)	PCB R89-14(B)
(35 Ill. Adm. Code 620)	)	
	)	

COMMENTS

The Illinois Environmental Protection Agency ("Agency") hereby files comments in the above-referenced proceeding. The Agency's COMMENTS respond to certain issues that were brought forth or left outstanding at and before and before the May 30, 1991 hearing. In addition, these comments also address several other matters.

The Agency strongly urges the Board to move forward with Docket B to Second Notice.

SUBPART A

1. The Agency was asked how "finally" should be interpreted in the definition of "carcinogen." In this context the Agency has amended this definition to clarify that "finally" means when a carcinogen is listed or classified in the Integrated Risk Information System ("IRIS") data base or is adopted by USEPA as a final rule. This final determination would be suspended if the U.S. Courts of Appeal would stay a carcinogen determination.

2. The Agency was requested to submit copies of the following: the "Annual Book of ASTM Standards, Section 8 Plastics," Volume 08.04 (PCN):01-080484-19; NCRP Report 22; 54

Fed. Reg. 22062-22160 (May 22, 1989); and 56 Fed. Reg. 3526-3597 (January 30, 1991). In addition, the Agency has included a copy of 56 Fed. Reg. 26460-26564 (June 7, 1991). This incorporation by reference includes the final lead and copper rule. A copy of these documents will be forwarded to the Board under separate cover as an exhibit. NCRP Report 22 was ordered and the Agency will provide a copy to the Board as soon as it becomes available. The Agency has also added the incorporation by reference for NCRP Report 22 to Section 620.125.

3. The Agency notes that incorporation by reference, 54 Fed. Reg. 3526-3597 (January 30, 1991), should be amended to read 56 Fed. Reg. 3526-3597 (January 30, 1991).

SUBPART B

4. The Agency was asked whether a portion of the thickness associated with the geologic materials described in Subsections 620.210(a)(2) and (a)(3) would be Class I if it were below the 10-foot interface. The Agency intends that any portion of the geologic materials described in Subsections 620.210(a)(2), (a)(3) and (a)(4) should be designated as Class I if located below the 10-foot interface and this clarification should be described in a Board note.

5. The Agency was asked why the Board's determination of "potable use" or other "non-potable beneficial uses" under Section 620.260 is not linked with the determination in Sections

620.210(b) and 620.220(b) to classify the groundwater. The Agency's proposal is not intended to limit the Board's authority to make determinations pursuant to Section 620.260. This provision is intended to address groundwater which might have potential as a drinking water source.

6. The Agency was asked to consider whether Section 620.240~~(d)~~(e) should be applied to sources where there is a potential for a release, but a release has not occurred. The Agency intends that this provision be available for potential primary and secondary sources where a release has actually occurred. The criteria in this subsection are written to evaluate the consequences of contaminants released from a source so that application of this subsection to potential release situations or conditions would make little sense. To further clarify this limitation, the Agency recommends that the phrase "from a release" be added to Section 620.240~~(d)~~(e).

Having read all comments on the appropriateness of the Section 620.240~~(d)~~(e) provisions, the Agency believes that Section 620.240~~(d)~~(e) as well as the coal mining provisions of Section 620.240~~(e)~~(f) are necessary and important provisions which address realistic conditions. The establishment of these small areas in Section 620.240~~(d)~~(e) recognizes that releases to groundwater do occur from contamination sources and that monitoring and cleanup cannot always be performed directly under sources of contamination. Remediation is sometimes not done at or under the source to avoid further damage to the integrity of the source and to the integrity of the monitoring wells. The dimensions of this area beyond the edge of a source of contamination is dependent upon site specific conditions within the limitations of this proposed rule. Under certain conditions where a release occurs at the up-gradient end of a source of contamination, a zone could be established at the downgradient edge of the source. Where the release has migrated beyond the downgradient edge of the source, the zone could be established at the end of the contaminant plume. This area in combination with the criteria provided in Subsections 620.240~~(d)~~(e)(2) through ~~(d)~~(e)(5) and for coal mining, Subsection 620.240~~(e)~~(f)(2) through ~~(e)~~(f)(5), will recognize these practical limitations while still protecting groundwater resources. The Board has recognized similar provisions in the Board's solid and hazardous waste regulations. The Agency urges the Board to retain this approach as currently drafted by the Agency.

7. The Agency was also asked what is meant by the "closest practicable distance" as it is used in Subsection 620.240~~(d)~~(e)(1). The "closest practicable distance" is the distance that is established on a site-by-site basis according to the criteria specified in Subsections 620.240~~(d)~~(e)(1)(A), ~~(d)~~(e)(1)(B), ~~(d)~~(e)(2), ~~(d)~~(e)(3) and ~~(d)~~(e)(4). This distance may be established up to but not to exceed 25 feet laterally or 15 feet vertically from a source as specified in this section. In addition, the Agency was also asked if this provision would be applicable if a potable water well was located within this area.

If a potable water supply well is located within this area, this provision is not available. This is the intent of Subsection 620.240~~(d)~~(e)(5).

8. The Agency was asked to clarify what is meant by the phrase "in such groundwater" in Subsections 620.240~~(d)~~(e)(5) and 620.240~~(e)~~(f)(5). This phrase should be interpreted as a potable water supply well which is utilizing groundwater within and underlying an area that is established according to Subsections 620.240~~(d)~~(e)(1) or 620.240~~(e)~~(f)(1). The Agency recommends the amendments which are reflected in Exhibit 1 to clarify this matter.

9. The Agency notes that Subsection 620.240~~(d)~~(e) should be amended to read the owners or operators of such source.

10. Waste Management, Inc. ("WMI") made a recommendation at the May 30, 1991 hearing to incorporate within Section 620.240 a new subsection which would include groundwater within an area permitted under an existing detection monitoring system in accordance with 35 Ill. Adm. Code 724. The Agency recommends that a new subsection be established at Section 620.240(b) to address this concern. As proposed this new subsection would recognize groundwater within a point of compliance as provided in 35 Ill. Adm. Code 724 as Class IV: Other Groundwater. 35 Ill. Adm. Code 724.195 provides that the point of compliance is a vertical surface located at the hydraulically downgradient limit

of the waste management area that extends down into the uppermost aquifer underlying the regulated units. However, this area established in relation to the point of compliance shall not exceed a distance of 200 feet. This 200-foot limitation is derived from the minimum setback established for potential primary and secondary sources of contamination under Section 14.2 of the Act. The Agency has included information about the permitted RCRA, Subpart B facilities which require a point of compliance in Exhibit 2. The amendment to Subsection 620.240(b) is included in Exhibit 1.

11. The Agency was presented with a hypothetical in which a party requesting a groundwater management zone under Section 620.250 for a particular contaminant with a standard of "10" and the party was able to achieve only "15." In addition, the inquiry requested the Agency's opinion on the party's exposure to citizens' suits when corrective action falls short of the standards.

In application of the groundwater management zone under the proposed rules, the existing concentration will be the standard for the released contaminants during the corrective action. (Section 620.450(a)(4)(B))

In accordance with Section 620.250(b), the Agency may concur with the corrective action plan to mitigate impairment caused by the release of contaminants. However, as the corrective action continues and if groundwater monitoring indicates that the standards will not be achieved, the following considerations pursuant to Subsection 620.450(a)(4)(B) become applicable:

a. To the extent practicable, the exceedance has been minimized and the beneficial use, as appropriate for the class of groundwater, has been returned; and,

b. Any threat to public health or the environment has been minimized.

Based upon these considerations, a determination would be made to continue the corrective action to achieve the standard or to recognize alternative conditions. Corrective action would be discontinued where the standards are not achieved and the party demonstrates that all practicable action has been taken. In such a circumstance, the existing condition becomes the standard for the site. A party could remain vulnerable to citizens' actions and third-party appeals only to the extent that corrective action would not be timely and appropriate or the results achieved were not commensurate with the narrative provisions of Section 620.450(a)(4)(B).

SUBPART C

12. The Agency was asked if Section 620.301 allows for increases of contaminant concentrations up to its standard listed in Subpart D. Section 620.301 does not allow for increases of contaminant concentrations up to its standard listed in Subpart D. This provision sets forth a use impairment standard and technical treatment criteria. It does not establish numerical standards. Instead, Section 620.301 provides a narrative nondegradation standard for Resource Groundwater of Classes I, II

and III. It should also be noted that this provision is particularly relevant for Class II since such groundwaters are not covered under Section 620.302.

13. The Agency was asked if the State or Federal laws or regulations referred to in Subsection 620.302(b)(1) could be listed. The text of Section 620.302(b)(1) includes those facilities which are currently required by state mandate to perform groundwater monitoring. This includes existing monitoring programs under the Agency, Illinois Department of Agriculture and Illinois Department of Mines and Minerals and any new programs that may be emerging for any and all of these agencies. (e.g. R88-8, State Pesticide Plan). The Agency urges the Board to leave this provision open so that it will provide this protective flexibility.

14. In relation to Subsection 620.310(a)(2), the Agency was asked how many sanitary surveys are performed by the Illinois Department of Public Health ("IDPH") and how many monitoring wells are sampled at potential primary and secondary sources of contamination during the survey. The Agency has conferred with IDPH and found that IDPH will be completed with all 7,000 non-community water supply well surveys in January 1993. In addition, once the baseline surveys are completed, the IDPH will conduct surveys for all of these wells every two years. The IDPH will also be sampling these wells during this two-year cycle for

organic chemicals in addition to the monitoring required pursuant to the Safe Drinking Water Act. ("SDWA")

The sanitary surveys are being used to make vulnerability assessments relative to compliance monitoring requirements pursuant to the SDWA. The IDPH has made these assessments for 652 non-transient non-community wells. The statistical results of the assessments have been provided by the IDPH and the Agency has included them in Exhibit 3.

SUBPART D

15. The Agency was asked to consider a situation where a Class II use of a Class I water takes place, and for a particular constituent, the Class II standard is more stringent. Copper and selenium are the only constituents which have a Class II standard which is more stringent than its Class I standard. Since the date of the hearing, the Agency has re-evaluated both Class I and II standards for copper, lead and selenium and proposes new standards for the constituents below.

The Agency proposes a Class I and II standard for copper of 0.65 mg/l. USEPA has recently established a final "action level" of 1.3 mg/l for copper in 56 Fed. Reg. 26460-26564 (June 7, 1991). This level applies at the source in addition to the home plumbing system and represents a different approach than the typical finished water standard. (e.g., MCLs) If the "action level" is exceeded at the source, it requires that best available treatment ("BAT") be applied at the wellhead. There are four BAT techniques identified for lead and copper:

a. coagulation and filtration;
b. ion exchange;
c. lime softening; and,
d. reverse osmosis.

Of these treatment techniques, ion exchange would be the most practical. It is the Agency's professional opinion that 50 percent of the water would typically undergo ion exchange treatment and be blended with the remaining untreated water if a compliance problem were encountered.

Therefore, the 1.3 mg/l "action level" for copper should be reduced by 50 percent based upon its removal efficiency to provide a reasonable safety margin. Such an approach is necessary because treatment at the wellhead would be required if 1.3 mg/l is exceeded. In addition, the resulting concentration is still significantly above the ambient concentration or the 95 percentile level of 0.034 mg/l for copper which has been found in community water supplies. The Agency recommends that the level of 5 mg/l should be amended to 0.65 mg/l. The Agency also recommends that the Class II: General Resource Groundwater Quality Standard should be amended from 0.5 mg/l to 0.65 mg/l. The 0.5 mg/l Class II standard which was derived from livestock watering, was selected primarily because the 1972 Water Quality Criteria recommendation specified that very few waters would exceed this level. This standard was chosen rather than the irrigation number of 0.2 mg/l because the latter is based on continuous irrigation which is not utilized in Illinois, either within a year or from year-to-year. In the Agency's opinion, a 0.65 mg/l standard will still be sufficiently protective for the vast majority, if not all, livestock uses.

16. The Agency has performed a similar evaluation of the Class II: General Resource Standard established for selenium and has determined that the standard, as proposed, was also based on continuous irrigation. Thus, the Agency recommends that the Class II standard for selenium should be amended to 0.05 mg/l which is the number established for livestock watering.

17. USEPA also established an "action level" for lead at 0.015 mg/l. In evaluating this lead level in the same manner as copper was reviewed in the preceding discussion, the Agency recommends that the Class I: Potable Resource Standard for lead be established at one-half the "action level," or 0.0075 mg/l. Review of the 95 percent confidence levels for lead indicates a level of 0.006 mg/l.

Thus, the Agency urges the Board to adopt the Class I and II standards for copper of 0.65 mg/l, the Class I standard for lead of 0.0075 mg/l and the Class II standard for selenium of 0.05 mg/l.

18. Since the May 30, 1991 hearing it has come to the Agency's attention that there is a proposed maximum contaminant level ("PMCL") for nickel. The United States Environmental Protection Agency ("USEPA") has proposed in 55 Fed. Reg. 30409

(July 25, 1990) a MCL of 0.1 mg/l for nickel. The Agency recommends a Class I: Potable Resource Standard of 0.1 mg/l for nickel.

19. Since the May 30, 1991 hearing the Agency has determined that the incorrect treatment factor was used to derive the Class II standards for heptachlor epoxide and lindane. Therefore, the Class II standards for both heptachlor epoxide and lindane should be 0.001 mg/l.

20. The Agency was asked about the relationship between the proposed standards of this Part to the Board standards in 35 Ill. Adm. Code 811 and whether the proposed standards apply at or beyond the zone of attenuation ("ZOA"). In addition, the Agency was asked whether the Class I or II standards supersede the background groundwater quality standards established by the Board under the solid waste landfill regulations. (R88-7)

As stated in the R88-7 proceeding, the Agency maintains that the standards which apply at or beyond the ZOA are those specified in Section 811.320(a), the background concentration or the Board established standard as adjusted by the Board. Therefore, the applicable groundwater standard is the background concentration or the Board adjusted standard. Where background exceeds the Board adjusted standard, Board adjusted standard becomes the standard.

In response to the question about the groundwater standards superseding the background standards, the Agency states that the groundwater standards as proposed in this proceeding do not supersede the background standards established under 35 Ill. Adm. Code 811.320(a)(1). As currently drafted, the groundwater standards will be the Board established standard under 35 Ill. Adm. Code 811.320(a)(3)(B) if the groundwater standards are lower than the water quality standards of 35 Ill. Adm. Code 302.

The Agency recommends that once the groundwater standards are adopted the Board should consider deleting the adjusted standards procedure of 35 Ill. Adm. Code 811.320(b) since it is superfluous in light of the established adjusted standards procedures of Section 28.1 of the Act.

Furthermore, the Board should consider the groundwater standards of this Part to be the exclusive standard for groundwater regulation in other programs and thus replace all groundwater regulation references to 35 Ill. Adm. Code 302 with references from this Part. For Subtitle G: Waste Disposal, this includes, the Part 302 references for Board established standards (35 Ill. Adm. Code 811.320(a)(3)(B)); the adjusted standards procedures (35 Ill. Adm. Code 811.320(b)(2) and (b)(3)); and Part 302 references for groundwater standards on compliance boundaries in 35 Ill. Adm. Code 814.402(b)(3).

21. The Agency notes that Subsection 620.420(a)(2) should be amended. The phrase "which is 10 feet or more from the land surface" should be deleted. In addition, within Subsection 620.420(e) the phrase, "groundwater of 5 feet from" should be amended to "groundwater within 5 feet **from** of".

22. The Agency has considered whether Subsection 620.440(b) should be amended to include standards specified for constituents in Sections 620.410 or 620.420. After further consideration, the Agency recommends that such revisions are unnecessary. The Agency believes that within zones of attenuation, Class II protection should be adequate and suitable for the groundwaters, except for the leachate constituents where the confirmation of monitored increase requirements of Subsection 811.319(a)(4) apply.

23. At the May 30, 1991 hearing, the Agency proposed a Class I Potable Resource groundwater standard for beta particle and photon radioactivity. The Board requested the Agency to prepare proposed language for this provision. In response, the Agency has prepared proposed language that should be included as Subsection 620.420(e). This proposal is included with other amendments in the Agency's Exhibit 1.

<u>SUBPART E</u>

24. WMI made a recommendation at the May 30, 1991 hearing to delete either Subsection 620.601(d) or Section 620.615. The Agency objects to the deletion of either of these provisions. Section 620.601 applies to Class I groundwaters and Subsection 620.601(d) establishes a provision to evaluate the mixtures of chemical substances in Class I groundwater. Section 620.615 sets forth the procedures for evaluating mixtures in such groundwater.

WMI also suggested that the phrase, "lowest appropriate PQL" in Section 620.605 should be amended by deleting the word "lowest." The solid waste testing procedures ("SW-846") contain multiple analytical methods for the majority of constituents analyzed by this procedure. For example, SW-846 includes groundwater PQLs for para-dichlorobenzene. These PQLs range from 2.4-10 parts per billion. Each of these methods has its own associated PQL. Therefore, the Agency recommends that if there is more than one PQL associated with a constituent that the "lowest appropriate PQL" should be used. The Agency further recommends that the term "appropriate" be included in the phrase, "the guidance level is the lowest appropriate PQL" in Subsection 620.605(b)(1).

In addition, WMI recommended that the phrase, "which do not have standards in Subpart D" be inserted in Section 620.615 after the phrase "chemical substances." The Agency disagrees with this recommendation because if the contaminant with the standard is one of two or more chemical substances which are similar in their toxic or harmful physiological effect on the same specific organ or organ system, it should be considered in the mixture. Therefore, the Agency recommends that the combination of the concentrations of these chemical contaminants should be considered.

However, the Agency does recommend that the phrase, "the level for" in Subsection 620.615(b) be amended to:

> the ~~level-for~~procedure for evaluating the mixture of such substances ~~shall-be-determined~~is specified in accordance with Appendices A, B, and C.

In addition, the Agency requests that the phrase in Section 620.Appendix B(a) be amended as follows:

> This appendix describes procedures for ~~determining-the-maximum-amount~~evaluating mixtures of similar-acting substances which may be present~~-as-a-mixture~~ in Class I: Potable Resource Groundwaters~~-for-the-protection-of human-health~~.

This amendment is necessary to articulate that these procedures are for evaluation of "mixtures."

25. On June 28, 1991, WMI submitted comments of the Board which stated that preventive notification concentration limits for para-dichlorobenzene, ethylbenzene and phenol are below USEPA'a estimates of SW-846 PQLs. The SW-846 PQLs for these constituents and the associated preventive response levels are, as follows:

Constituent	Preventive Response Levels	SW-846 PQL/ Method (ppb)
para-dichlorobenzene	5	2.4(8010)
ethylbenzene	30	2 (8020)
phenol	1	1 (8040)

A review of this table of constituents indicates that WMI's assessment of these PQLs is not accurate.

Furthermore, WMI commented that Section 620.310(c) may not be achievable for the compounds listed in Subpart D that have standards at the PQL. The Agency has provided extensive testimony in this proceeding that the constituents which have standards listed at a PQL are carcinogens. The Agency has not listed these constituents in Subsection 620.310(a)(3)(A) because of these technical limitations. Subsection 620.310(c) also limits the application of preventive response to the Subsection 620.310(a)(3)(A) constituents. Thus, WMI's concern about verifying levels at one-half of the PQL is without foundation.

WMI also recommended that this provision should allow for exceedance of the standard in Subpart D. WMI must have misunderstood that preventive notification and response procedures specifically exclude any contaminant which exceeds Class I or III groundwater standards. (Section 620.302(c)). Releases of contaminants which exceed the standards become the subject of a corrective action under Section 620.250(a).

Additionally, WMI commented that the preventive response levels and concentration established under Subsection 620.310(c) are applicable, relevant and appropriate requirements. ("ARARs") In previous testimony the Agency testified that the USEPA Task Force had developed a draft groundwater protection strategy for the 1990's which has been finalized and has since been released. In the document entitled, <u>Protecting the Nation's Ground Water: EPA's Strategy for the 1990's, The Final Report of the EPA Ground-Water Task Force</u>, (May 8, 1991) ("Task Force Report"), USEPA discusses its policy on the use of quality standards in groundwater protection and remediation activities. The Task Force Report, USEPA states as follows:

> In certain cases, maximum contaminant level goals(MCLGs) under the Safe Drinking Water Act, or background levels may be used in order to comply with Federal statutory requirements. Reference points are to be applied differently for prevention and cleanup purposes.
>
> **Prevention:** Best technologies and management practices should be relied on to protect ground water to the maximum extent practicable. Detection of a percentage of the reference point at an appropriate monitoring location would then be used to trigger consideration of additional action (e.g., additional monitoring; restricting, limiting use or banning the use of a pesticide). Reaching the MCL or other appropriate reference point would be considered a failure of prevention.
>
> **Cleanup:** Remediation will generally attempt to achieve a total lifetime cancer risk levels in the range of 10^{-4} to 10^{-6}, and exposures to non-carcinogens below appropriate reference doses. Most stringent measures may be selected based on such factors as the cumulative effect of multiple contaminants, exposure from other pathways, and usual population sensitivities. Less stringent measures than the reference point may be selected where authorized by law, based on such factors as technological practicality, adverse environmental impacts of remediation measures, cost and low likelihood of potential use.

Protecting the Nation's Groundwater: EPA's Strategy for the 1990's, The Final Report of the EPA Ground-water Task Force Report, May 8, 1991, p 33.

The Subpart D groundwater standards of Part 620 are generally based on potential drinking water concerns which serve as a basis for ARARs consistent with USEPA's Final Task force Report. In contrast, the essence of the proposed prevention policy of this proceeding is the percentage of the reference point (e.g., MCLs), not the reference point, and are thus distinct and distinguishable from ARARs. The Agency has provided a copy of the final Task Force Report as Exhibit 4.

Respectfully submitted,

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

By: Stephen C. Ewart
Stephen C. Ewart
Deputy Counsel
Division of Public Water Supplies

Dated: July 8, 1991

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INITIALSSCE:rmi/1952q/sp

EXHIBIT 1

TITLE 35: ENVIRONMENTAL PROTECTION
SUBTITLE F: PUBLIC WATER SUPPLIES
CHAPTER I: POLLUTION CONTROL BOARD

PART 620
GROUNDWATER QUALITY

SUBPART A: GENERAL

Section

SUBPART B: GROUNDWATER CLASSIFICATION

Section

SUBPART C: NONDEGRADATION PROVISIONS FOR APPROPRIATE GROUNDWATERS

Section

SUBPART D: GROUNDWATER QUALITY STANDARDS

Section

AUTHORITY: Implementing and authorized by Section 8 of the Illinois Groundwater Protection Act (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 7458).

SOURCE: Adopted at ____ Ill. Reg., ___________, effective ________________________.

NOTE: Capitalization denotes statutory language.

SUBPART A: GENERAL

Section 620.105 Purpose

This Part prescribes various aspects of groundwater quality, including method of classification of groundwaters, nondegradation provisions, standards for quality of groundwaters, and various procedures and protocols for the management and protection of groundwaters.

Section 620.110 Definitions

The definitions of the Environmental Protection Act (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1001 et seq.) and the Groundwater Protection Act (Ill. Rev. Stat. 1989, ch. 111 1/2, pars. 7451 et seq.) apply to this Part unless otherwise provided. The following definitions also apply to this Part.

"Act" means the Environmental Protection Act (Ill. Rev. Stat. 1989, ch. 111 1/2, pars. 1001 et seq.).

"Agency" means the Illinois Environmental Protection Agency.

"AQUIFER" MEANS SATURATED (WITH GROUNDWATER) SOILS AND GEOLOGIC MATERIALS WHICH ARE SUFFICIENTLY PERMEABLE TO READILY YIELD ECONOMICALLY USEFUL QUANTITIES OF WATER TO WELLS, SPRINGS, OR STREAMS UNDER ORDINARY HYDRAULIC GRADIENTS. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 7453(b))

"BETX" means the sum of the concentrations of benzene, ethylbenzene, toluene, and xylenes.

"Board" means the Illinois Pollution Control Board.

"Carcinogen" means a chemical, or complex mixture of closely related chemicals, which has been ~~finally determined~~listed or classified in the Integrated Risk Information System or as speicified in a final rule adopted by USEPA in accordance with USEPA Guidelines for Carcinogenic Risk Assessment, incorporated by reference at Section 620.125, to be a group A, B_1, or B_2 carcinogen.

"COMMUNITY WATER SUPPLY" MEANS A PUBLIC SUPPLY WHICH SERVES OR IS INTENDED TO SERVE AT LEAST 15 SERVICE CONNECTIONS USED BY RESIDENTS OR REGULARLY SERVES AT LEAST 25 RESIDENTS. (Ill. Rev. Stat. 1989, ch. 111 1/2 par. 1003.05)

"CONTAMINANT" MEANS ANY SOLID, LIQUID, OR GASEOUS MATTER, ANY ODOR, OR ANY FORM OF ENERGY, FROM WHATEVER

SOURCE. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.06)

"Corrective action process" means those procedures and practices that may be imposed by a regulatory agency when a determination has been made that contamination of groundwater has taken place, and are necessary to address a potential or existing violation of the standards set forth in Subpart D.

"Cumulative impact area" means the area, including the coal mine area permitted under the Surface Coal Mining Land Conservation Act (Ill. Rev. Stat. 1989, ch. 96 1/2, pars. 7901.01 et seq., as amended) and 62 Ill. Adm. Code 1700 through 1850, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface water and groundwater systems.

"Detect" or "detection" are defined as follows:

> "Method Detection Limit" or "MDL" means the minimum concentration of a substance that can be measured as reported with 99 percent confidence that the true value is greater than zero. (54 Fed. Reg. 22100); or
>
> "Method Quantitation Limit" or "MQL" means the minimum concentration of a substance that can be measured and reported. ("Test Methods for Evaluating Solid Wastes, Physical/ Chemical Methods," EPA Publication No. SW-846 (Third Edition, 1986, as amended by Revision I (December 1987))

"Department" means the Illinois Department of Energy and Natural Resources.

"GROUNDWATER" MEANS UNDERGROUND WATER WHICH OCCURS WITHIN THE SATURATED ZONE AND GEOLOGIC MATERIALS WHERE THE FLUID PRESSURE IN THE PORE SPACE IS EQUAL TO OR GREATER THAN ATMOSPHERIC PRESSURE. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.64)

"Hydrologic balance" means the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake, or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage.

"IGPA" Mmeans the Illinois Groundwater Protection Act. (Ill. Rev. Stat. 1989, ch. 111 1/2, pars. 7451 et seq.)

"LOAEL" or "Lowest observable adverse effect level" means the lowest tested concentration of a chemical or substance which produces a statistically significant increase in frequency or severity of non-overt adverse effects between the exposed population and its appropriate control. LOAEL may be determined for a human population (LOAEL-H) or an animal population. (LOAEL-A)

"NOAEL" or "No observable adverse effect level" means the highest tested concentration of a chemical or substance which does not produce a statistically significant increase in frequency or severity of non-overt adverse effects between the exposed population and its appropriate control. NOAEL may be determined for a human population (NOAEL-H) or an animal population (NOAEL-A)

"NON-COMMUNITY WATER SUPPLY" MEANS A PUBLIC WATER SUPPLY THAT IS NOT A COMMUNITY WATER SUPPLY. (Ill. Rev. Stat. 1989, ch. 111 1/2 par. 1003.05)

"Off-site" means any site that is not on-site.

"On-site" means the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between properties is at a crossroads intersection and access is by crossing as opposed to going along the right-of-way. Noncontiguous properties owned by the same person but connected by a right-of-way which he controls and to which the public does not have access is also considered on-site property.

"Operator" means the person responsible for the operation of a facility or unit.

"Owner" means the person who owns a site or part of a site, or who owns the land on which the site is located.

"POTABLE" MEANS GENERALLY FIT FOR HUMAN CONSUMPTION IN ACCORDANCE WITH ACCEPTED WATER SUPPLY PRINCIPLES AND PRACTICES. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 7453(h))

"POTENTIAL PRIMARY SOURCE" MEANS ANY UNIT AT A FACILITY OR SITE NOT CURRENTLY SUBJECT TO A REMOVAL OR REMEDIAL ACTION WHICH: IS UTILIZED FOR THE TREATMENT, STORAGE, OR DISPOSAL OF ANY HAZARDOUS OR SPECIAL WASTE NOT GENERATED AT THE SITE; OR IS UTILIZED FOR THE DISPOSAL OF MUNICIPAL WASTE NOT GENERATED AT THE SITE, OTHER THAN LANDSCAPE WASTE AND CONSTRUCTION AND DEMOLITION DEBRIS; OR IS UTILIZED FOR THE LANDFILLING, LAND

TREATING, SURFACE IMPOUNDING OR PILING OF ANY HAZARDOUS OR SPECIAL WASTE THAT IS GENERATED ON THE SITE OR AT OTHER SITES OWNED, CONTROLLED OR OPERATED BY THE SAME PERSON; OR STORES OR ACCUMULATES AT ANY TIME MORE THAN 75,000 POUNDS ABOVE GROUND, OR MORE THAN 7,500 POUNDS BELOW GROUND, OF ANY HAZARDOUS SUBSTANCES. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.59)

"POTENTIAL ROUTE" MEANS ABANDONED AND IMPROPERLY PLUGGED WELLS OF ALL KINDS, DRAINAGE WELLS, ALL INJECTION WELLS, INCLUDING CLOSED LOOP HEAT PUMP WELLS, AND ANY EXCAVATION FOR THE DISCOVERY, DEVELOPMENT OR PRODUCTION OF STONE, SAND OR GRAVEL. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.58)

"POTENTIAL SECONDARY SOURCE" MEANS ANY UNIT AT A FACILITY OR A SITE NOT CURRENTLY SUBJECT TO A REMOVAL OR REMEDIAL ACTION, OTHER THAN A POTENTIAL PRIMARY SOURCE, WHICH: IS UTILIZED FOR THE LANDFILLING, LAND TREATING, OR SURFACE IMPOUNDING OF WASTE THAT IS GENERATED ON THE SITE OR AT OTHER SITES OWNED, CONTROLLED OR OPERATED BY THE SAME PERSON, OTHER THAN LIVESTOCK AND LANDSCAPE WASTE, AND CONSTRUCTION AND DEMOLITION DEBRIS; OR STORES OR ACCUMULATES AT ANY TIME MORE THAN 25,000 BUT NOT MORE THAN 75,000 POUNDS ABOVE GROUND, OR MORE THAN 2,500 BUT NOT MORE THAN 7,500 POUNDS BELOW GROUND, OF ANY HAZARDOUS SUBSTANCES; OR STORES OR ACCUMULATES AT ANY TIME MORE THAN 25,000 GALLONS ABOVE GROUND, OR MORE THAN 500 GALLONS BELOW GROUND, OF PETROLEUM, INCLUDING CRUDE OIL OR ANY FRACTION THEREOF WHICH IS NOT OTHERWISE SPECIFICALLY LISTED OR DESIGNATED AS A HAZARDOUS SUBSTANCE; OR STORES OR ACCUMULATES PESTICIDES, FERTILIZERS, OR ROAD OILS FOR PURPOSES OF COMMERCIAL APPLICATION OR FOR DISTRIBUTION TO RETAIL SALES OUTLETS; OR STORES OR ACCUMULATES AT ANY TIME MORE THAN 50,000 POUNDS OF ANY DE-ICING AGENT; OR IS UTILIZED FOR HANDLING LIVESTOCK WASTE OR FOR TREATING DOMESTIC WASTEWATERS OTHER THAN PRIVATE SEWAGE DISPOSAL SYSTEMS AS DEFINED IN THE "PRIVATE SEWAGE DISPOSAL LICENSING ACT". (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.60)

"Practical Quantitation Limit" or "PQL" means the lowest concentration or level that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions as set forth in Section 620.125.

"Previously mined area" means land disturbed or affected by coal mining operations prior to February 1, 1983.

(Board Note: February 1, 1983, is the effective date of the Illinois permanent program regulations implementing the Surface Coal Mining Land Conservation and Reclamation Act (Ill. Rev. Stat. 1989, ch. 96 1/2, pars. 7901.1 et seq., as amended) as codified in 62 Ill. Adm. Code 1700 through 1850.)

"Property class" means the class assigned by a tax assessor to real property for purposes of real estate taxes.

(Board Note: The property class [rural property, residential vacant land, residential with dwelling, commercial residence, commercial business, commercial office, or industrial] is identified on the property record card maintained by the tax assessor in accordance with the Illinois Real Property Appraisal Manual [February 1987], published by the Illinois Department of Revenue, Property Tax Administration Bureau.)

"PUBLIC WATER SUPPLY" MEANS ALL MAINS, PIPES AND STRUCTURES THROUGH WHICH WATER IS OBTAINED AND DISTRIBUTED TO THE PUBLIC, INCLUDING WELLS AND WELL STRUCTURES, INTAKES AND CRIBS, PUMPING STATIONS, TREATMENT PLANTS, RESERVOIRS, STORAGE TANKS AND APPURTENANCES, COLLECTIVELY OR SEVERALLY, ACTUALLY USED OR INTENDED FOR USE FOR THE PURPOSE OF FURNISHING WATER FOR DRINKING OR GENERAL DOMESTIC USE AND WHICH SERVE AT LEAST 15 SERVICE CONNECTIONS OR WHICH REGULARLY SERVE AT LEAST 25 PERSONS AT LEAST 60 DAYS PER YEAR. A PUBLIC WATER SUPPLY IS EITHER A "COMMUNITY WATER SUPPLY" OR A "NON-COMMUNITY WATER SUPPLY". (Ill. Rev. Stat. 1989, ch. 111 1/2 par. 1003.28).

"Regulated entity" means a facility or unit regulated for groundwater protection by any State or federal agency.

"Regulatory agency" means the Illinois Environmental Protection Agency, Department of Public Health, Department of Agriculture, Department of Mines and Minerals, and the Office of State Fire Marshall.

"REGULATED RECHARGE AREA" MEANS A COMPACT GEOGRAPHIC AREA, AS DETERMINED BY THE BOARD pursuant to Section 17.4 of the Act, THE GEOLOGY OF WHICH RENDERS A POTABLE RESOURCE GROUNDWATER PARTICULARLY SUSCEPTIBLE TO CONTAMINATION. (Ill. Rev. Stat. 1989, ch. 111 1/2 par. 1003.67)

"RESOURCE GROUNDWATER" MEANS GROUNDWATER THAT IS PRESENTLY BEING OR IN THE FUTURE CAPABLE OF BEING PUT TO BENEFICIAL USE BY REASON OF BEING OF SUITABLE QUALITY. (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 7453(j))

"SETBACK ZONE" MEANS A GEOGRAPHIC AREA, DESIGNATED PURSUANT TO THIS ACT, CONTAINING A POTABLE WATER SUPPLY WELL OR A POTENTIAL SOURCE OR POTENTIAL ROUTE HAVING A CONTINUOUS BOUNDARY, AND WITHIN WHICH CERTAIN PROHIBITIONS OR REGULATIONS ARE APPLICABLE IN ORDER TO PROTECT GROUNDWATERS. (Ill. Rev. Stat. 1989, ch. 111 1/2 par. 1003.61)

"Site" means any location, place, tract of land and facilities, including but not limited to buildings and improvements.

"Spring" means a natural surface discharge of an aquifer from rock or soil.

"Threshold" means the lowest dose of a chemical at which a specified measurable effect is observed and below which it is not observed.

"Treatment" means the technology, treatment techniques, or other procedures for compliance with 35 Ill. Adm. Code: Subtitle F.

"UNIT" MEANS ANY DEVICE, MECHANISM, EQUIPMENT, OR AREA (EXCLUSIVE OF LAND UTILIZED ONLY FOR AGRICULTURAL PRODUCTION). (Ill. Rev. Stat. 1989, ch. 111 1/2, par. 1003.62)

"USEPA" or "U.S. EPA" means the United States Environmental Protection Agency.

Section 620.115 Prohibition

No person shall cause, threaten or allow a violation of the Act, the IGPA or regulations adopted by the Board thereunder, including but not limited to this Part.

Section 620.125 Incorporations by Reference

a) The Board incorporates the following material by reference:

ASTM. Available from: ASTM, 1916 Race Street, Philadelphia, Pa. 19103:

"Annual Book of ASTM Standards, Section 8 Plastics," Volume 08.04 (PCN): 01-080484-19.

EMSL. Available from Environmental Monitoring Systems Laboratory, Office of Research and Development, USEPA, Cincinnati, Ohio 45268, (513-569-7562):

"Methods for Chemical Analysis of Water and Wastes," EPA Publication No. EPA-600/4-79-020, (March 1983).

"Methods for the Determination of Organic Compounds in Drinking Water," EPA, EMSL, EPA-600/4-88/039 (Dec. 1988).

GPO. Available from: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20401, (202-783-3238):

"Practical Guide for Ground-Water Sampling," EPA Publication No. EPA/600/2-85/104 (September 1985).

"RCRA Groundwater Monitoring Technical Enforcement Guidance Document," EPA Publication No. OSWER-9950.1 (September 1986).

"Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," EPA Publication No. SW-846 (Third Edition, 1986, as amended by Revision I (December 1987).

USEPA Guidelines for Carcinogenic Risk Assessment, 51 Fed. Reg 33992-34003 (September 24, 1986).

40 CFR 141, 142 and 143 (1990)

40 CFR 300 (1990)

54 Fed. Reg. 22062-22160 (May 22, 1989).

5456 Fed. Reg. 3526-3597 (January 30, 1991).

NCRP National Council on Radiation Protection, 7910 Woodmont Ave., Bethesda, MD (301-657-6252).

"Maximum Permissible Body Burdens and Maximum Permissible Concentrations of Radionuclides in Air and in Water for Occupatonal Exposure", NCRP Report Number 22, June 5, 1959.

USGS. Available from: Distribution Branch, United States Geological Survey, 604 South Pickett Street, Alexandria, VA 22304, (703-648-7411):

"Techniques of Water Resources Investigations of the United States Geological Survey, Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents," Book I, Chapter D2 (1981).

b) This Section incorporates no later editions or amendments.

Section 620.130 Exemption from General Use Standards and Public and Food Processing Water Supply Standards

Groundwater is not required to meet the general use standards and public and food processing water supply standards of 35 Ill. Adm. Code 302.Subparts B and C.

Section 620.135 Exclusion for Waters in Certain Man-Made Conduits

This does not apply to waters contained in man-made subsurface drains, tunnels, reservoirs, storm sewers, tiles or sewers.

SUBPART B: GROUNDWATER CLASSIFICATION

Section 620.201 Groundwater Designations

All groundwaters of the State are designated as:

a) One of the following four classes of groundwater in accordance with Sections 620.210 through 620.240:

1) Class I: Potable Resource Groundwater

2) Class II: General Resource Groundwater;

3) Class III: Special Resource Groundwater;

4) Class IV: Other Groundwater; or

b) A groundwater management zone in accordance with Section 620.250.

Section 620.210 Class I: Potable Resource Groundwater

Except as provided in Sections 620.230, 620.240, or 620.250, Potable Resource Groundwater is:

a) Groundwater located 10 feet or more below the land surface and within:

1) The minimum setback zone of a well which serves as a potable water supply and to the bottom of such well;

2) Unconsolidated sand, gravel or sand and gravel which is 5 feet or more in thickness and that contains 12 percent or less of fines (i.e. fines which pass through a No. 200 sieve tested according to ASTM Standard Test Method D2487-83);

3) Sandstone which is 10 feet or more in thickness, or fractured carbonate which is 15 feet of more in thickness; or

4) Any geologic material which is capable of a:

A) Sustained groundwater yield, from up to a 12 inch borehole, of 150 gallons per day or more from a thickness of 15 feet or less; or

B) Hydraulic conductivity of 1×10^{-4} cm/sec or greater using one of the following test methods or its equivalent:

i) Permeameter;

ii) Slug test; or

iii) Pump test.

b) Any groundwater which is determined by the Board pursuant to petition procedures set forth in Section 620.260, to be capable of potable use.

(Board Note: Any portion of the thickness associated with the geologic materials as described in subsections 620.210(a)(2), (a)(3) or (a)(4) should be designated as Class I: Potable Resource Groundwater if located 10 feet or more below the land surface.)

Section 620.220 Class II: General Resource Groundwater

Except as provided in Section 620.250, General Resource Groundwater is:

a) Groundwater which does not meet the provisions of Section 620.210 (Class I), Section 620.230 (Class III), or Section 620.240 (Class IV).

b) Groundwater which is found by the Board, pursuant to the petition procedures set forth in Section 620.260, to be capable of agricultural, industrial, recreational or other beneficial uses.

Section 620.230 Class III: Special Resource Groundwater

Except as provided in Section 620.250, Special Resource Groundwater is:

a) Groundwater of high value that is determined by the Board, pursuant to the procedures set forth in Section 620.260, to be:

1) Demonstrably unique (e.g., irreplaceable sources of groundwater), vulnerable to contamination and suitable for application of a water quality standard more stringent than the otherwise applicable water quality standard specified in Subpart D; or

2) Vital for a particularly sensitive ecological system.

b) Groundwater that contributes to a dedicated nature preserve that is listed by the Agency as set forth below:

1) A written request to list a dedicated nature preserve under this subsection shall contain, at a minimum, the following information:

A) A general description of the site and the surrounding land use;

B) A topographic map or other map of suitable scale denoting the location of the dedicated nature preserve;

C) A general description of the existing groundwater quality at and surrounding the dedicated nature preserve;

D) A general geologic profile of the dedicated nature preserve based upon the most reasonably available information, including but not limited to geologic maps and subsurface groundwater flow directions; and

E) A description of the interrelationship between groundwater and the nature of the site.

2) Upon confirmation by the Agency of the technical adequacy of a written request, the Agency shall publish the proposed listing of the dedicated nature preserve in the Environmental Register for a 45 day public comment period. Within 60 days after the close of the public comment period, the Agency shall either publish a final listing of the dedicated nature preserve in the Environmental Register or provide a written response to the requestor specifying the reasons for not listing the dedicated nature preserve.

3) At least once annually, the Agency shall publish in the Environmental Register a complete listing of all dedicated nature preserves listed under this subsection.

4) For purposes of this Section the term "dedicated nature preserve" means a nature preserve that is dedicated pursuant to the Illinois Natural Areas Preservation Act (Ill. Rev. Stat. 1989, ch. 105, pars. 701 et seq.).

Section 620.240 Class IV: Other Groundwater

Except as provided in Section 620.250, Other Groundwater is:

a) Groundwater within a zone of attenuation as provided in 35 Ill. Adm. Code 811 and 814;

b) Groundwater within a point of compliance as provided in 35 Ill. Adm. Code 724, but not to exceed a distance of 200 feet from a potential primary or secondary source.

~~b)~~c) Groundwater that naturally contains more than 10,000 mg/L of total dissolved solids;

~~c)~~d) Groundwater which has been designated by the Board as an exempt aquifer pursuant to 35 Ill. Adm. Code 730.104; or

~~d)~~e) Groundwater which underlies a potential primary or secondary source, in which contaminants may be present from a release, if the owner ~~and~~or operator of such source notifies the Agency in writing and the following conditions are met:

1) The outermost edge is the closest practicable distance from such source, but does not exceed:

   A) A lateral distance of 25 feet from the edge of such potential source or the property boundary, whichever is less; and

   B) A depth of 15 feet from the bottom of such potential source or the land surface, whichever is greater;

2) The source of any release of contaminants to groundwater has been controlled;

3) Migration of contaminants within the site resulting from a release to groundwater has been minimized;

4) Any on-site release of contaminants to groundwater has been managed to prevent migration off-site; and

5) No potable water well exists ~~in such groundwater~~within the outermost edge as provided in subsection (e)(1).

~~e)~~f) Groundwater which underlies a coal mine refuse disposal area not contained within an area from which overburden has been removed, a coal combustion waste disposal area at a surface coal mine authorized under Section 21(s) of the Illinois Environmental Protection Act (Ill. Rev. Stat. 1989, ch.111 1/2, paragraph 1021(s)(3)), or an impoundment that contains sludge, slurry, or precipitated process material at a coal preparation plant, in which contaminants may be present, if such area or impoundment was placed into operation after February 1, 1983, if the owner and operator notifies the Agency in writing, and if the following conditions are met:

1) The outermost edge is the closest practicable distance, but does not exceed:

   A) A lateral distance of 25 feet from the edge of such area or impoundment, or the property boundary, whichever is less; and

   B) A depth of 15 feet from the bottom of such area or impoundment, or the land surface, whichever is greater;

2) The source of any release of contaminants to groundwater has been controlled;

3) Migration of contaminants within the site resulting from a release to groundwater has been minimized;

4) Any on-site release of contaminants to groundwater has been managed to prevent migration off-site; and

5) No potable water well exists ~~in such groundwater~~within the outermost edge as provided in subsection (f)(1)..

g)~~f)~~ Groundwater within a previously mined area, unless monitoring demonstrates that the groundwater is capable of being consistent with the standards as provided in Sections 620.410 or 620.420. In the event that such capability is determined, groundwater within the previously mined area shall not be Class IV.

Section 620.250 Groundwater Management Zone

a) Within any class of groundwater, a groundwater management zone may be established as a three dimensional region containing groundwater being managed to mitigate impairment caused by the release of contaminants from a site:

1) That is subject to a corrective action process approved by the Agency; or

2) For which the owner or operator undertakes an adequate corrective action in a timely and appropriate manner and provides a written confirmation to the Agency. Such confirmation shall be provided in a form as prescribed by the Agency.

b) A groundwater management zone is established upon concurrence by the Agency that the conditions as specified in subsection (a) are met and continues for a period of time consistent with the action described in that subsection.

c) A groundwater management zone shall expire upon the Agency's receipt of appropriate documentation which confirms the completion of the action taken pursuant to subsection (a) and which confirms the attainment of applicable standards as set forth in Subpart D. The Agency shall review the on-going adequacy of controls and continued management at the site if concentrations of chemical constituents, as specified in Section 620.450(a)(4)(B), remain in groundwater at the site following completion of such action. The review shall take place no less often than every 5 years and the results shall be presented in a written report.

Section 620.260 Reclassification of Groundwater by Adjusted Standard

Any person may petition the Board to reclassify a groundwater in accordance with the procedures for adjusted standards specified in Section 28.1 of the Act and 35 Ill. Adm. Code 106.Subpart G. In any proceeding to reclassify specific groundwater by adjusted standard, in addition to the requirements of 35 Ill. Adm. Code 106.Subpart G, and Section 28.1(c) of the Act, the petition shall, at a minimum, contain information to allow the Board to determine:

a) The specific groundwater for which reclassification is requested, including but not limited to geographical extent of any aquifers, depth of groundwater, and rate and direction of groundwater flow and that the specific groundwater exhibits the characteristics of the requested class as set forth in Sections 620.210(b), 620.220(b), 620.230, or 620.240(b);

b) Whether the proposed change or use restriction is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social benefits such as loss of jobs or closing of facilities, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards would be beneficial or necessary;

c) Existing and anticipated uses of the specific groundwater;

d) Existing and anticipated quality of the specific groundwater;

e) Existing and anticipated contamination, if any, of the specific groundwater;

f) Technical feasibility and economic reasonableness of eliminating or reducing contamination of the specific groundwater or of maintaining existing water quality;

g) The anticipated time period over which contaminants will continue to affect the specific groundwater;

h) Existing and anticipated impact on any potable water supplies due to contamination;

i) Availability and cost of alternate water sources or of treatment for those users adversely affected;

j) Negative or positive effect on property values; and

k) For special resource groundwater, negative or positive effect on:

1) The quality of surface waters; and

2) Wetlands, natural areas, and the life contained therein, including endangered or threatened species of plant, fish or wildlife listed pursuant to the Endangered Species Act 16 U.S.C. 1531 et seq., or the Illinois Endangered Species Protection Act (Ill. Rev. Stat. 1989, ch. 8, par. 331 et seq.).

SUBPART C: NONDEGRADATION PROVISIONS FOR APPROPRIATE GROUNDWATERS

Section 620.301 General Prohibition Against Use Impairment of Resource Groundwater

a) No person shall cause, threaten or allow the release of any contaminant to a resource groundwater such that:

1) Treatment or additional treatment is necessary to continue an existing use or to assure a potential use of such groundwater; or

2) An existing or potential use of such groundwater is precluded.

b) Nothing in this Section shall prevent the establishment of a groundwater management zone pursuant to Section 620.250 or a cumulative impact area within a permitted site.

c) Nothing in this Section shall limit underground injection pursuant to a permit issued by the Agency under the Act or issued by the Department of Mines and Minerals under "An Act in relation to oil, gas, coal and other surface and underground resources and to repeal an Act herein named" (Ill. Rev Stat. 1989, ch. 96 1/2, pars. 5401 et seq., as amended).

Section 620.302 Applicability of Preventive Notification and Preventive Response Activities

a) Preventive notification and preventive response as specified in Sections 620.305 through 620.310 shall apply to:

1) Class I groundwater under Section 620.210(a)(1), (a)(2), or (a)(3) which is monitored by the persons listed in subsection (b); or

2) Class III groundwater which is monitored by the persons listed in subsection (b).

b) For purposes of subsection (a), the persons that conduct groundwater monitoring are:

1) An owner or operator of a regulated entity for which groundwater quality monitoring must be performed pursuant to State or Federal law or regulation;

2) An owner or operator of a public water supply well who conducts groundwater quality monitoring; or

3) A state agency which is authorized to conduct or is the recipient of groundwater quality monitoring data (e.g., Illinois Environmental Protection Agency, Department of Public Health, Department of Conservation, Department of Mines and Minerals, Department of Agriculture, Office of State Fire Marshall or Department of Energy and Natural Resources).

c c) Sections 620.305 and 620.310 shall not appl contaminant that exceeds a standard set forth in Section 620.410 or Section 620.430, or that is the subject of a corrective action as described in Section 620.250(a)(1) or (a)(2).

Section 620.305 Preventive Notification Procedures

a) Pursuant to groundwater quality monitoring as described in Section 620.302, a preventive notification shall occur whenever a contaminant:

1) Listed under Section 620.310(a)(3)(A) is detected (except due to natural causes) in Class I groundwater;

2) Denoted as a carcinogen under Section 620.410(b) is detected in Class I groundwater; or

3) Subject to a standard under Section 620.430 is detected (except due to natural causes) in Class III groundwater.

b) When a preventive notification is required for groundwater which is monitored by a regulated entity for the subject contaminant, the owner or operator of the site shall confirm the detection by resampling the monitoring well. This resampling shall be made within 30 days of the date on which the first sample analyses are received. The owner or operator shall provide a preventive notification to the appropriate regulatory agency of the results of the resampling analysis within 30 days of the date on which the sample analyses are received, but no later than 90 days after the results of the first samples were received.

c) When a preventive notification is required for groundwater which is monitored by a regulatory agency, such agency shall notify the owner or operator of the site where the detection has occurred. The owner or operator shall confirm the detection by resampling within 30 days of the date of the notice by the regulatory agency. The owner or operator shall provide preventive notification to the regulatory agency of the results of the resampling analysis within 30 days of the date on which the sample analyses are received, but no later than 90 days after the results of the first samples were received.

d) When a preventive notification of a confirmed detection has been provided by an owner or operator pursuant to this Section, additional detections of the same contaminant do not require further notice, provided that the groundwater quality conditions are substantially unchanged or that preventive response is underway for such contaminant.

Section 620.310 Preventive Response Activities

a) The following preventive assessment shall be undertaken:

1) If a preventive notification under Section 620.305(c) is provided by a community water supply:

A) The Agency shall notify the owner or operator of any identified potential primary source, potential secondary source, potential route, or community water supply well that is located within 2,500 feet of the wellhead.

B) The owner or operator notified under subsection (a)(1)(A) shall, within 30 days of the date of issuance of such notice, sample each water well or monitoring well for the contaminant identified in the notice if the contaminant or material containing such contaminant is or has been stored, disposed, or otherwise handled at the site. If a contaminant identified under Section 620.305(a) is detected, then the well shall be resampled within 30 days of the date on which the first sample analyses are received. If a contaminant identified under Section 620.305(a) is detected by the resampling, preventive notification shall be given as set forth in Section 620.305.

C) If the Agency receives analytical results under subsection (a)(1)(B) that show a contaminant identified under Section 620.305(a) has been detected, the Agency shall:

i) Conduct a well site survey pursuant to Section 17.1(d) of the Act, if such a survey has not been previously conducted within the last 5 years; and

ii) Identify those sites or activities which represent a hazard to the continued availability of groundwaters for public use unless a groundwater protection needs assessment has been prepared pursuant to Section 17.1 of the Act.

2) If a preventive notification is provided under Section 620.305(c) by a non-community water supply or for multiple private water supply wells, the Department of Public Health shall conduct a sanitary survey within 1,000 feet of the wellhead of a non-community water supply or within 500 feet of the wellheads for multiple private water supply wells.

3) If a preventive notification under Section 620.305(b) is provided by the owner or operator of a regulated entity and the applicable standard in Subpart D has not been exceeded:

A) The appropriate regulatory agency shall determine if any of the following occurs for Class I: Potable Resource Groundwater:

i) The levels set forth below are exceeded or are changed for pH:

Constituent	Criteria (mg/l)
para-Dichlorobenzene	0.005
ortho-Dichlorobenzene	0.01
Ethylbenzene	0.03
Phenols	0.001
Styrene	0.01
Toluene	0.04
Xylenes	0.02

ii) A statistically significant increase occurs above background (as determined pursuant to other regulatory procedures (e.g., 35 Ill. Adm. Code 616, 724, 725 or 811)) for arsenic, cadmium, chromium, cyanide, lead or mercury (except due to natural causes); or for aldicarb, atrazine, carbofuran, endrin, lindane (gamma-hexachlor cyclohexane), 2,4-D, 1,1-dichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, methoxychlor, monochlorobenzene, 2,4,5-TP (Silvex) and 1,1,1-trichloroethane.

iii) For a chemical constituent of gasoline, diesel fuel, or heating fuel, the constituent exceeds the following:

Constituent	Criteria (mg/l)
BETX	0.095

iv) For pH, a statistically significant change occurs from background.

(Board Note: Constituents that are carcinogens have not been listed in subsection (a)(3)(A) because the standard is set at the PQL and any exceedance thereof is a violation subject to corrective action.)

B) The appropriate agency shall determine if, for Class III: Special Resource Groundwater, the levels as determined by the Board are exceeded.

C) The appropriate regulatory agency shall consider whether the owner or operator reasonably demonstrates that:

i) The contamination is as a result of contaminants remaining in groundwater from a prior release for which appropriate action was taken in accordance with laws and regulations in existence at the time of the release;

ii) The source of contamination is not due to the on-site release of contaminants; or

iii) The detection resulted from error in sampling, analysis, or evaluation.

D) The appropriate regulatory agency shall consider actions necessary to minimize the degree and extent of contamination.

b) Based on the considerations in subsection (a)(3) as well as other relevant factors, the appropriate regulatory agency shall determine whether a preventive response shall be undertaken at a site.

c) After completion of preventive response pursuant to authority of an appropriate regulatory agency, the concentration of a contaminant listed in subsection (a)(3)(A) in groundwater may exceed 50 percent of the applicable numerical standard in Subpart D only if the following conditions are met:

1) The exceedance has been minimized to the extent practicable;

2) Beneficial use, as appropriate for the class of groundwater, has been assured; and

3) Any threat to public health or the environment has been minimized.

d) Nothing in this Section shall in any way limit the authority of the State or of the United States to require or perform any corrective action process.

SUBPART D: GROUNDWATER QUALITY STANDARDS

Section 620.401 Applicability

Groundwaters shall meet the standards appropriate to the groundwater's class as specified in this Subpart and the nondegradation provisions of Subpart C.

Section 620.405 General Prohibition Against Violations of Groundwater Quality Standards

No person shall cause, threaten or allow the release of any contaminant to groundwater so as to cause a groundwater quality standard set forth in this Subpart to be exceeded.

Section 620.410 Groundwater Quality Standards for Class I: Potable Resource Groundwater

a) Inorganic Chemical Constituents

Except due to natural causes or as provided in Section 620.450, concentrations of the following chemical constituents shall not be exceeded in Class I groundwater:

Constituent	Units	Standards
Arsenic	mg/l	0.05
Barium	mg/l	2
Boron	mg/l	2
Cadmium	mg/l	0.005
Chloride	mg/l	200
Chromium	mg/l	0.1
Cobalt	mg/l	1
Copper	mg/l	50.65
Cyanide	mg/l	0.2
Fluoride	mg/l	4.0
Iron	mg/l	5
Lead	mg/l	~~0.05~~0.0075
Manganese	mg/l	0.15
Mercury	mg/l	0.002
Nickel	mg/l	~~2~~0.1
Nitrate as N	mg/l	10
Radium-226	pCi/l	20
Radium-228	pCi/l	20
Selenium	mg/l	0.05
Silver	mg/l	0.05
Sulfate	mg/l	400
Total Dissolved Solids (TDS)	mg/l	1,200
Zinc	mg/l	5

b) Organic Chemical Constituents

Except due to natural causes or as provided in Section 620.450 or subsection (c), concentrations of the following organic chemical constituents shall not be exceeded in Class I groundwater:

Constituent	Standards (mg/l)
Alachlor*	0.002
Aldicarb	0.003
Atrazine	0.003
Benzene*	0.005
Carbofuran	0.04
Carbon Tetrachloride*	0.005
Chlordane*	0.002
Endrin	0.002
Heptachlor*	0.0004
Heptachlor Epoxide*	0.0002
Lindane (Gamma-Hexachlor cyclohexane)	0.0002
2,4-D	0.07
ortho-Dichlorobenzene	0.6
para-Dichlorobenzene	0.075
1,2-Dichloroethane*	0.005
1,1-Dichloroethylene	0.007
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
1,2-Dichloropropane*	0.005
Ethylbenzene	0.7
Methoxychlor	0.04
Monochlorobenzene	0.1
Pentachlorophenol*	0.001
Phenols	0.1
Polychlorinated Biphenyls (PCB's)(as decachloro-biphenyl)*	0.0005
Styrene	0.1
2,4,5-TP (Silvex)	0.05
Tetrachloroethylene*	0.005
Toluene	1
Toxaphene*	0.003
1,1,1-Trichloroethane	0.2
Trichloroethylene*	0.005
Vinyl Chloride*	0.002
Xylenes	10

*Denotes a carcinogen.

c) Complex Organic Chemical Mixtures

Concentrations of the following chemical constituents of gasoline, diesel fuel, or heating fuel shall not be exceeded in Class I groundwater:

Constituent	Standards (mg/l)
Benzene*	0.005
BETX	11.705

*Denotes a carcinogen.

d) pH

Except due to natural causes, a pH range of 6.5 - 9.0 units shall not be exceeded in Class I groundwater.

e) Beta Particle and Photon Radioactivity

1) Except due to natural causes, the average annual concentration of beta particle and photon radioactivity from man-made radionuclides shall not exceed an annual dose equivalent to the total body organ greater than 4 mrem/year in Class I groundwater.

2) Except for the radionuclides listed in subsection (e)(3), the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalent must be calculated on the basis of a 2 liter per day drinking water intake using the 168-hour data in accordance with the procedure set forth in the document listed in Section 620.125(a). If two or more radionuclides are present, the sum of their annual dose equivalent to the total body, or to any internal organ shall not exceed 4 mrem/year in Class I groundwater except due to natural causes.

3) Except due to natural causes, the average annual concentration assumed to produce a total body or organ dose of 4 mrem/year of the following chemical constituents shall not be exceeded in Class I groundwater:

Constituent	Critical Organ	Standards (pCi/l)
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

Section 620.420 Groundwater Quality Standards for Class II: General Resource Groundwater

a) Inorganic Chemical Constituents

1) Except due to natural causes or as provided in Section 620.450 or subsection (a)(3) or (d), concentrations of the following chemical constituents shall not be exceeded in Class II groundwater:

Constituent	Standards (mg/l)
Arsenic	0.2
Barium	2
Cadmium	0.05
Chromium	1
Cobalt	1
Cyanide	0.6
Fluoride	4.0
Lead	0.1
Mercury	0.01
Nitrate as N	100

2) Except as provided in Section 620.450 or subsection (a)(3) or (d), concentrations of the following chemical constituents shall not be exceeded in Class II groundwater~~-which-is-10-feet or-more-from-the-land-surface~~:

Constituent	Standards (mg/l)
Boron	2.0
Chloride	200
Copper	~~0.5~~0.65
Iron	5
Manganese	10
Nickel	2
Selenium	~~0.02~~0.05
Total Dissolved Solids (TDS)	1,200
Sulfate	400
Zinc	10

3) The standard for any inorganic chemical constituent listed in subsection (a)(2), for barium, or for pH shall not apply to groundwater within fill material or within the upper 10 feet of parent material under such fill material on a site not within the rural property class for which:

A) Prior to the effective date of this Part, surficial characteristics have been altered by the placement of such fill material so as to impact the concentration of the parameters listed in subsection (a)(3), and any on-site groundwater monitoring of such parameters is available for review by the Agency.

B) On the effective date of this Part, surficial characteristics are in the process of being altered by the placement of such fill material, which proceeds in reasonably continuous manner to completion, so as to impact the concentration of the parameters listed in subsection (a)(3), and any on-site groundwater monitoring of such parameters is available for review by the Agency.

4) For purposes of subsection (a)(3), the term "fill material" means clean earthen materials, slag, ash, clean demolition debris, or other similar materials.

b) Organic Chemical Constituents

1) Except due to natural causes or as provided in Section 620.450 or subsection (b)(2) or (d), concentrations of the following organic chemical constituents shall not be exceeded in Class II groundwater:

Constituent	Standards (mg/l)
Alachlor*	0.010
Aldicarb	0.015
Atrazine	0.015
Benzene*	0.025
Carbofuran	0.2
Carbon Tetrachloride*	0.025
Chlordane*	0.01
Endrin	0.01
Heptachlor*	0.002
Heptachlor Epoxide*	~~0.01~~0.001
Lindane (Gamma-Hexachlor cyclohexane)	~~0.0002~~0.001
2,4-D	0.35
ortho-Dichlorobenzene	1.5
para-Dichlorobenzene	0.375
1,2-Dichloroethane*	0.025
1,1-Dichloroethylene	0.035
cis-1,2-Dichloroethylene	0.2
trans-1,2-Dichloroethylene	0.5
1,2-Dichloropropane*	0.025

Ethylbenzene	1.0
Methoxychlor	0.2
Monochlorobenzene	0.5
Pentachlorophenol*	0.005
Phenols	0.1
Polychlorinated Biphenyls (PCB's)(as decachloro-biphenyl)*	0.0025
Styrene	0.5
2,4,5-TP	0.25
Tetrachloroethylene*	0.025
Toluene	2.5
Toxaphene*	0.015
1,1,1-Trichloroethane	1.0
Trichloroethylene*	0.025
Vinyl Chloride*	0.01
Xylenes	10

*Denotes a carcinogen.

2) The standards for pesticide chemical constituents listed in subsection (b)(1) shall not apply to groundwater within 10 feet of the land surface, provided that the concentrations of such constituents result from the application of pesticides in a manner consistent with the requirements of the Federal Insecticide, Fungicide and Rodenticide Act (7 U. S. C. 136 et seq.) and the Illinois Pesticide Act (Ill. Rev. Stat. 1989, ch. 5, pars. 801 et seq.).

d) Complex Organic Chemical Mixtures

Concentrations of the following organic chemical constituents of gasoline, diesel fuel, or heating fuel shall not be exceeded in Class II groundwater:

Constituent	Standards (mg/l)
Benzene*	0.025
BETX	13.525

*Denotes a carcinogen.

e) pH

Except due to natural causes, a pH range of 6.5 - 9.0 units shall not be exceeded in Class II groundwater of which is within 5 feet fromof the land surface.

Section 620.430 Groundwater Quality Standards for Class III: Special Resource Groundwater

Concentrations of inorganic and organic chemical constituents shall not exceed the standards set forth in Section 620.410, except for those chemical constituents for which the Board has adopted a standard pursuant to Section 620.260.

Section 620.440 Groundwater Quality Standards for Class IV: Other Groundwater

a) Except as provided in subsections (b) or (c), Class IV: Other Groundwater standards are equal to the existing concentrations of constituents in groundwater.

b) For groundwater within a zone of attenuation as provided in 35 Ill. Adm. Code 811 and 814, the standards specified in Section 620.420 shall not be exceeded, except for concentrations of contaminants within leachate ~~discharged~~released from a permitted unit.

c) For groundwater within a previously mined area, the standards set forth in Section 620.420 shall not be exceeded, except for concentrations of TDS, chloride, iron, manganese, sulfates, or pH. For concentrations of TDS, chloride, iron, manganese, sulfates, or pH, the standards are the existing concentrations.

Section 620.450 Alternative Groundwater Quality Standards

a) Groundwater Quality Restoration Standards

1) Any chemical constituent in groundwater within a groundwater management zone is subject to this Section.

2) Except as provided in subsections (a)(3) or (a)(4), the standards as specified in Sections 620.410, 620.420, 620.430, and 620.440 shall apply to any chemical constituent in groundwater within a groundwater management zone.

3) Prior to completion of a corrective action described in Section 620.250(a), the standards as specified in Sections 620.410, 620.420, 620.430, and 620.440 are not applicable to such released chemical constituent, provided that the initiated action proceeds in a timely and appropriate manner.

4) After completion of a corrective action as described in Section 620.250(a), the standard for such released chemical constituent is:

A) The standard as set forth in Section 620.410, 620.420, 620.430, or 620.440, if the concentration as determined by groundwater monitoring of such constituent is less than or equal to the standard for the appropriate class set forth in those sections; or

B) The concentration as determined by groundwater monitoring, if such concentration exceeds the standard for the appropriate class set forth in Section 620.410, 620.420, 620.430, or 620.440 for such constituent, and:

i) To the extent practicable, the exceedance has been minimized and beneficial use, as appropriate for the class of groundwater, has been returned; and

ii) Any threat to public health or the environment has been minimized.

5) The Agency shall develop and maintain a listing of concentrations derived pursuant to subsection (a)(4)(B). This list shall be made available to the public and be updated periodically, but no less frequently than semi-annually. This listing shall be published in the Environmental Register.

b) Coal Reclamation Groundwater Quality Standards

1) Any inorganic chemical constituent or pH in groundwater, within an underground coal mine, or within the cumulative impact area of groundwater for which the hydrologic balance has been disturbed from a permitted coal mine area pursuant to the Surface Coal Mining Land Conservation and Reclamation Act (Ill. Rev. Stat. 1989, ch. 96 1/2, pars. 7901.1 et seq., as amended) and 62 Ill. Adm. Code 1700 through 1850, is subject to this Section.

2) Prior to completion of reclamation at a coal mine, the standards as specified in Sections 620.410(a) and (d), 620.420(a) and (e), 620.430 and 620.440 are not applicable to inorganic constituents and pH.

3) After completion of reclamation at a coal mine, the standards as specified in Section 620.410(a) and (d), 620.420(a), 620.430, and 620.440 are applicable to inorganic constituents and pH, except:

A) The concentration of total dissolved solids (TDS) shall not exceed:

i) The post-reclamation concentration or 3000 mg/l, whichever is less, for groundwater within the permitted area; or

ii) The post-reclamation concentration of TDS shall not exceed the post-reclamation concentration or 5000 mg/l, whichever is less, for groundwater in underground coal mines and in permitted areas reclaimed after surface coal mining if the Illinois Department of Mines and Minerals and the Agency have determined that no significant resource groundwater existed prior to mining; and

B) For chloride, iron, manganese and sulfate, the post-reclamation concentration within the permitted area shall not be exceeded.

C) For pH, the post-reclamation concentration within the permitted area shall not be exceeded within Class I: Potable Resource Groundwater as specified in Section 620.210(a)(4).

4) A refuse disposal area (not contained within the area from which overburden has been removed) shall be subject to the inorganic chemical constituent and pH requirements of:

A) 35 Ill. Adm. Code 303.203 for such area that was placed into operation after February 1, 1983 and before the effective date of this Part, provided that the groundwater is a present or a potential source of water for public or food processing;

B) Section 620.440(c) for such area that was placed into operation prior to February 1, 1983, and has remained in continuous operation since that date; or

C) Subpart D for such area that is placed into operation on or after the effective date of this Part.

5) For a refuse disposal area (not contained within the area from which overburden has been removed) that was placed into operation prior to February 1, 1983, and is modified after that date to

include additional area, this Section shall apply to the area that meets the requirements of subsection (b)(4)(C) and the following shall apply to the additional area:

A) 35 Ill. Adm. Code 303.203 for such additional refuse disposal area that was placed into operation after February 1, 1983, and before the effective date of this Part, provided that the groundwater is a present or a potential source of water for public or food processing; and

B) Subpart D for such additional area that was placed into operation on or after the effective date of this Part.

6) A coal preparation plant (not located in an area from which overburden has been removed) which contains slurry material, sludge or other precipitated process material, shall be subject to the inorganic chemical constituent and pH requirements of:

A) 35 Ill. Adm. Code 303.203 for such plant that was placed into operation after February 1, 1983 and before the effective date of this Part, provided that the groundwater is a present or a potential source of water for public or food processing;

B) Section 620.440(c) for such plant that was placed into operation prior to February 1, 1983, and has remained in continuous operation since that date; or

C) Subpart D for such plant that is placed into operation on or after the effective date of this Part.

7) For a coal preparation plant (not located in an area from which overburden has been removed) which contains slurry material, sludge or other precipitated process material, that was placed into operation prior to February 1, 1983, and is modified after that date to include additional area, this Section shall apply to the area that meets the requirements of subsection (b)(6)(C) and the following shall apply to the additional area:

A) 35 Ill. Adm. Code 303.203 for such additional area that was placed into operation after February 1, 1983, and before the effective date of this Part, provided that the groundwater is a present or a potential source of water for public or food processing; and

B) Subpart D for such additional area that was placed into operation on or after the effective date of this Part.

SUBPART E: GROUNDWATER MONITORING AND ANALYTICAL PROCEDURES

Section 620.505 Compliance Procedures

a) Compliance with standards at a site shall be determined as follows:

1) For a structure (e.g., buildings), at the closest practical distance beyond the outermost edge for the structure.

2) For groundwater that underlies a potential primary or secondary source, the outermost edge as specified in Section 620.240~~(d)~~(e)(1).

3) For groundwater that underlies a coal mine refuse disposal area, a coal combustion waste disposal area, or an impoundment that contains sludge, slurry, or precipitated process material at a coal preparation plant, the outermost edge as specified in Section 620.240~~(e)~~(f)(1) or the location of monitoring wells in existence as of the effective date of this Part on a permitted site.

4) For a groundwater management zone, as specified in a corrective action process.

5) At any point at which groundwater monitoring is conducted using any water well or monitoring well that meets the following conditions:

A) For a potable well other than a community water supply well, a construction report has been filed with the Department of Public Health for such potable well, or such well has been located and constructed (or reconstructed) to meet the Illinois Water Well Construction Code (Ill. Rev. Stat. 1989, ch. 111 1/2, pars. 116.111 et seq., as amended) and 35 Ill. Adm. Code 920.

B) For a community water supply well, such well has been permitted by the Agency, or has been constructed in accordance 35 Ill. Adm. Code 602.115.

C) For a water well other than a potable water well (e.g., a livestock watering well or an irrigation well), a construction report has been filed with the Department of Public Health or the Department of Mines and Minerals for such well, or such well has been located and constructed (or reconstructed) to meet the Illinois Water Well Construction

Code (Ill. Rev. Stat. 1989, ch. 111 1/2, pars. 116.111 et seq., as amended) and 35 Ill. Adm. Code 920.

D) For a monitoring well, such well meets the following requirements:

i) Construction must be done in a manner that will enable the collection of groundwater samples;

ii) Casings and screens must be made from durable material resistant to expected chemical or physical degradation that do not interfere with the quality of groundwater samples being collected; and

iii) The annular space opposite the screened section of the well (i.e., the space between the bore hole and well screen) must be filled with gravel or sand if necessary to collect groundwater samples. The annular space above and below the well screen must be sealed to prevent migration of water from adjacent formations and the surface to the sampled depth.

b) For a spring, compliance with this Subpart shall be determined at the point of emergence.

Section 620.510 Monitoring and Analytical Requirements

a) Representative Samples

A representative sample shall be taken from locations as specified in Section 620.505.

b) Sampling and Analytical Procedures

1) Samples shall be collected in accordance with the procedures set forth in the documents listed in Section 620.125(a) or other procedures adopted by the appropriate agency.

2) Groundwater elevation in a groundwater monitoring well must be determined and recorded when necessary to determine the gradient.

3) The analytical methodology used for the analysis of constituents in Subparts C and D must be consistent with both of the following:

A) The methodology must have a PQL at or below the preventive response levels of Subpart C or the groundwater standard set forth in Subpart D, whichever is applicable; and

B) The methodology must be consistent with methodologies contained in the documents listed in Section 620.125(a).

c) Reporting Requirements

At a minimum, groundwater monitoring analytical results must include information, procedures and techniques for:

1) Sample collection (including but not limited to name of sample collector, time and date of the sample, method of collection, and identification of the monitoring location);

2) Sample preservation and shipment (including but not limited to field quality control);

3) Analytical procedures (including but not limited to the method detection limits and the PQLs); and

4) Chain of custody control.

SUBPART F: HEALTH ADVISORIES

Section 620.601 Purpose of a Health Advisory

This Subpart establishes procedures for the issuance of a Health Advisory that sets forth guidance levels that, in the absence of standards under Section 620.410, must be considered by the Agency in:

a) Establishing groundwater cleanup or action levels whenever there is a release or substantial threat of a release of:

1) A hazardous substance or pesticide; or

2) Other contaminant that represents a significant hazard to public health or the environment.

b) Determining whether the community water supply is taking its raw water from the "best available source which is economically reasonable and technologically possible" as mandated under 35 Ill. Adm. Code 604.501(a).

c) Developing Board rulemaking proposals for new or revised numerical standards.

d) Evaluating mixtures of chemical substances.

Section 620.605 Issuance of a Health Advisory

a) The Agency shall issue a Health Advisory for a chemical substance if all of the following conditions are met:

1) A community water supply well is sampled and a substance is detected and confirmed by resampling;

2) There is no standard under Section 620.410 for such chemical substance; and

3) The chemical substance is toxic or harmful to human health according to nationally accepted guidelines.

b) The Health Advisory shall contain a general description of the characteristics of the chemical substance, the potential adverse health effects, and a guidance level to be determined as follows:

1) If disease or functional impairment is caused due to a physiological mechanism for which there is a threshold dose below which no damage occurs, the guidance level for any such substance shall be the Maximum Contaminant Level Goal ("MCLG") adopted by

USEPA for such substance. If there is no MCLG for the substance, the guidance level shall be the Human Threshold Toxicant Advisory Concentration for such substance as determined in accordance with Appendix A, unless the concentration for such substance is less than the lowest appropriate PQL specified in Section 620.125 for the substance. If the concentration for such substance is less than the lowest appropriate PQL specified in Section 620.125 for the substance, the guidance level is the lowest appropriate PQL.

2) If the chemical substance is a carcinogen, the guidance level for any such chemical substance shall be the lowest appropriate PQL specified in Section 620.125 for such substance.

Section 620.610 Publishing Health Advisories

a) The Agency shall publish the full text of each Health Advisory upon issuance and make the document available to the public.

b) The Agency shall publish and make available to the public, at intervals of not more than 6 months, a comprehensive and up-to-date summary list of all Health Advisories.

Section 620.615 Additional Health Advice for Mixtures of Similar-Acting Substances

a) The need for additional health advice appropriate to site-specific conditions shall be determined by the Agency when mixtures of chemical substances are detected, where two or more of the chemical substances are similar-acting in their toxic or harmful physiological effect on the same specific organ or organ system.

b) If mixtures of similar-acting chemical substances are present, the ~~level for~~procedure for evaluating the mixture of such substances ~~shall be determined~~is specified in accordance with Appendices A, B, and C.

Section 620.Appendix A Procedures for Determining Human Threshold Toxicant Advisory Concentration for Class I: Potable Resource Groundwater

a) Calculating the Human Threshold Toxicant Advisory Concentration

For those substances for which USEPA has not adopted a Maximum Contaminant Level Goal ("MCLG"), the Human Threshold Toxicant Advisory Concentration shall be calculated as follows:

$$HTTAC = \frac{ADE}{WH} \times RSC$$

Where:

HTTAC = Human Threshold Toxicant Advisory Concentration in milligrams per liter

ADE = Acceptable Daily Exposure of substance in milligrams per day (mg/d) as determined pursuant to subsection (b).

WH = Per capita daily water consumption equal to 2 liters per day (l/d)

RSC = Relative contribution of the amount of the exposure to a chemical via drinking water when compared to the total exposure to that chemical from all sources. Valid chemical-specific data shall be used if available. If valid chemical-specific data are not available, a value of 20% (=0.20) shall be used.

b) Procedures for Determining Acceptable Daily Exposures for Class I: Potable Resource Groundwater

1) The Acceptable Daily Exposure (ADE) represents the maximum amount of a threshold toxicant in milligrams per day (mg/d) which if ingested daily for a lifetime results in no adverse effects to humans. Subsections (b)(2) through (b)(6) list, in prescribed order, methods for determining the ADE in Class I: Potable Resource Groundwater.

2) For those substances for which the USEPA has derived a Verified Oral Reference Dose for humans, USEPA's Reference Dose given in milligrams per kilogram per day (mg/kg/d) shall be used. The ADE equals the product of multiplying the Reference

Dose by 70 kilograms (kg), which is the assumed average weight of an adult human.

3) For those substances for which a no observed adverse effect level for humans (NOAEL-H) exposed to the substance has been derived, the ADE equals the product of multiplying one-tenth of the NOAEL-H given in milligrams of toxicant per kilogram of body weight per day (mg/kg/d) by the average weight of an adult human of 70 kilograms (kg). If two or more studies are available, the lowest NOAEL-H shall be used in the calculation of the ADE.

4) For those substances for which only a lowest observed adverse effect level for humans (LOAEL-H) exposed to the substance has been derived, one-tenth the LOAEL-H shall be substituted for the NOAEL-H in subsection (b)(3).

5) For those substances for which a no observed adverse effect level has been derived from studies of mammalian test species (NOAEL-A) exposed to the substance, the ADE equals the product of multiplying 1/100 of the NOAEL-A given in milligrams toxicant per kilogram of test species weight per day (mg/kg/d) by the average weight of an adult human of 70 kilograms (kg). Preference will be given to animal studies having High Validity, as defined in subsection (c), in the order listed in that subsection. Studies having a Medium Validity shall be considered if no studies having High Validity are available. If studies of Low Validity must be used, the ADE shall be calculated using 1/1000 of the NOAEL-A having Low Validity instead of 1/100 of the NOAEL-A of High or Medium Validity, except as described in subsection (b)(6). If two or more studies among different animal species are equally valid, the lowest NOAEL-A among animal species shall be used in the calculation of the ADE. Additional considerations in selecting the NOAEL-A include:

A) If the NOAEL-A is given in milligrams of toxicant per liter of water consumed (mg/l), prior to calculating the ADE the NOAEL-A must be multiplied by the average daily volume of water consumed by the mammalian test species in liters per day (l/d) and divided by the average weight of the mammalian test species in kilograms (kg).

B) If the NOAEL-A is given in milligrams of toxicant per kilogram of food consumed (mg/kg), prior to calculating the ADE, the NOAEL-A must be multiplied by the average amount in kilograms of food consumed daily by the mammalian test species (kg/d) and divided by the average weight of the mammalian test species in kilograms (kg).

C) If the mammalian test species was not exposed to the toxicant each day of the test period, the NOAEL-A must be multiplied by the ratio of days of exposure to the total days of the test period.

D) If more than one equally valid NOAEL-A is available for the same mammalian test species, the best available data shall be used.

6) For those substances for which a NOAEL-A is not available but the lowest observed adverse effect level (LOAEL-A) has been derived from studies of mammalian test species exposed to the substance, one-tenth of the LOAEL-A may be substituted for the NOAEL-A in subsection (b)(5). The LOAEL-A shall be selected in the same manner as that specified in subsection (b)(5). One-tenth the LOAEL-A from a study determined to have Medium Validity may be substituted for a NOAEL-A in subsection (b)(3) if the NOAEL-A is from a study determined to have Low Validity, or if the toxicity endpoint measured in the study having the LOAEL-A of Medium Validity is determined to be more biologically relevant than the toxicity endpoint measured in the study having the NOAEL-A of Low Validity.

c) Procedures for Establishing Validity of Data from Animal Studies

1) High Validity Studies

A) High validity studies use a route of exposure by ingestion or gavage, and are based upon:

i) Data from animal carcinogenicity studies with a minimum of 2 dose levels and a control group, 2 species, both sexes, with 50 animals per dose per sex, and at least 50 percent survival at 15 months in mice and 18 months in rats and at least 25 percent survival at 18 months in mice and 24 months in rats;

ii) Data from animal chronic studies with a minimum of 3 dose levels and a control group, 2 species, both sexes, with 40 animals per dose per sex, and at least 50 percent survival at 15 months in mice and 18 months in rats and at least 25 percent survival at 18 months in mice and 24 months in rats, and a well-defined NOAEL; or

iii) Data from animal subchronic studies with a minimum of 3 dose levels and control, 2 species, both sexes, 4 animals per dose per sex for non-rodent species or 10 animals per dose per sex for rodent species, a duration of approximately 10 percent of the test species' lifespan, and a well-defined NOAEL.

B) Supporting studies which reinforce the conclusions of a study of Medium Validity may be considered to raise such a study to High Validity.

2) Medium Validity Studies

Medium validity studies are based upon:

A) Data from animal carcinogenicity, chronic, or subchronic studies in which minor deviations from the study design elements required for a High Validity Study are found, but which otherwise satisfy the standards for a High Validity Study;

B) Data from animal carcinogenicity and chronic studies in which at least 25 percent survival is reported at 15 months in mice and 18 months in rats (a lesser survival is permitted at the conclusion of a longer duration study, but the number of surviving animals should not fall below 20 percent per dose per sex at 18 months for mice and 24 months for rats), but which otherwise satisfy the standards for a High Validity Study;

C) Data from animal subchronic or chronic studies in which a Lowest Observable Adverse Effect Level (LOAEL) is determined, but which otherwise satisfy the standards for a High Validity Study; or

D) Data from animal subchronic or chronic studies which have an inappropriate route of exposure (for example, intraperitoneal injection or inhalation) but which otherwise satisfy the standards for a High Validity Study, with correction factors for conversion to the oral route.

3) Low Validity Studies

Low validity studies are studies not meeting the standards set forth in subsection (c)(1) or (c)(2).

Section 620.Appendix B Procedures for Determining Hazard Indices for Class I: Potable Resource Groundwater for Mixtures of Similar-Acting Substances

a) This appendix describes procedures for ~~determining the maximum amount~~ evaluating mixtures of similar-acting substances which may be present ~~as a mixture~~ in Class I: Potable Resource Groundwater~~s for the protection of human health~~. Except as provided otherwise in subsection (c), subsections (d) through (h) describe the procedure for determining the Hazard Index for mixtures of similar-acting substances.

b) For the purposes of this appendix, a "mixture" means two or more substances which are present in Class I: Potable Resource Groundwater which may or may not be related either chemically or commercially, but which are not complex mixtures of related isomers and congeners which are produced as commercial products (for example, PCBs or technical grade chlordane).

c) The following substances listed in Section 620.410 are mixtures of similar acting substances:

1) Mixtures of ortho-Dichlorobenzene and para-Dichlorobenzene. The Hazard Index ("HI") for such mixtures shall be determined as follows:

$$HI = \frac{[\text{ortho-Dichlorobenzene}]}{0.6} + \frac{[\text{para-Dichlorobenzene}]}{0.075}$$

2) Mixtures of 1,1-Dichloroethylene and 1,1,1-trichloroethane. The Hazard Index ("HI") for such mixtures shall be determined as follows:

$$HI = \frac{[\text{1,1-Dichloroethylene}]}{0.007} + \frac{[\text{1,1,1-trichloroethane}]}{0.2}$$

d) When two or more substances occur together in a mixture, the additivity of the toxicities of some or all of the substances will be considered when determining health based standards for Class I: Potable Resource Groundwater. This is done by the use of a dose addition model with the development of a Hazard Index for the mixture of substances with similar-acting toxicities. This method does not address synergism or antagonism. Guidelines for determining when the dose addition of similar-acting substances is appropriate are presented in Appendix C.

The Hazard Index shall be calculated as follows:

$$HI = \left(\frac{[A]}{ALA} + \frac{[B]}{ALB} + \ldots \frac{[I]}{ALI}\right)$$

Where: HI = Hazard Index, unitless.

[A], [B], [I] = Concentration of each similar-acting substance in groundwater in milligrams per liter (mg/l).

ALA, ALB, ALI = The acceptable level of each similar-acting substance in the mixture in milligrams per liter (mg/l).

e) For substances which are considered to have a threshold mechanism of toxicity, the acceptable level is:

1) The standards listed in Section 620.410; or

2) For those substances for which standards have not been established in Section 620.410, the Human Threshold Toxicant Advisory Concentration (HTTAC) as determined in Appendix A.

f) For substances which are carcinogens, the acceptable level is:

1) The standards listed in Section 620.410; or

2) For those substances for which standards have not been established under Section 620.410, the lowest appropriate PQL of USEPA-approved analytical methods for each substance.

g) Since the assumption of dose addition is most properly applied to substances that induce the same effect by similar modes of action, a separate HI shall be generated for each toxicity endpoint of concern.

h) In addition to meeting the individual substance objectives, a Hazard Index shall be less than or equal to 1 for a mixture of similar-acting substances.

Section 620.Appendix C Guidelines for Determining When Dose Addition of Similar-Acting Substances in Class I: Potable Resource Groundwaters is Appropriate

a) Substances shall be considered similar-acting if:

1) The substances have the same target in an organism (for example, the same organ, organ system, receptor, or enzyme).

2) The substances have the same mode of toxic action. These actions may include, for example, central nervous system depression, liver toxicity, or cholinesterase inhibition.

b) Substances that have fundamentally different mechanisms of toxicity (threshold toxicants vs. carcinogens) shall not be considered similar-acting. However, carcinogens which also cause a threshold toxic effect should be considered in a mixture with other similar-acting substances having the same threshold toxic effect. In such a case, an Acceptable Level for the carcinogen must be derived for its threshold effect, using the procedures described in Appendix A.

c) Substances which are components of a complex mixture of related compounds which are produced as commercial products (for example, PCBs or technical grade chlordane) shall not be considered mixtures, as defined in Appendix B. Such complex mixtures shall be considered to be equivalent to a single substance. In such a case, the Human Threshold Toxicant Advisory Concentration may be derived for threshold effects of the complex mixture, using the procedures described in Appendix A, if valid toxicological or epidemiological data are available for the complex mixture. If the complex mixture is a carcinogen, the Health Advisory Concentration shall be the lowest appropriate PQL of USEPA-approved analytical methods.

SOP/SCE: 620D38.DOC

EXHIBIT 2

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
RCRA, PART B FACILITIES
POINTS OF COMPLIANCE
UNDER 35 ILL. ADM. CODE 724

Point of Compliance	Distance (feet)	
Allied Chemical	< 200	
Amoco Main Plant	< 200	(Permit Pending)
Amoco Riverfront Property	< 200	(Permit Pending)
CID #1	< 200	
CID #2	< 200	
BFI - Winthrop Harbor	< 200	
Marathon	< 200	
ESL	< 200	
Northwestern Steel & Wire	< 200	
Shell	< 200	
BFI (Rockford)	< 200	

(Note: With the point of compliance wells located at approximately a maximum distance of 200 feet at any of the above facilities, most have an average point of compliance at 100 feet or less.)

EXHIBIT 3

May 6, 1991

NON-TRANSIENT, NON-COMMUNITY SUPPLIES
VULNERABLE TO CHEMICAL CONTAMINATION

Not Vulnerable to Any Chemical -	531
Vulnerable to VOC Contamination -	76
Vulnerable to Pesticide and Herbicide Contamination Only -	29
Vulnerable to Asbestos Contamination Only -	0
Vulnerable to Both VOC and Pesticide Contamination -	15
Vulnerable to Contamination by VOCs, Pesticides and Asbestos -	1
	652

skz/6648Z

EXHIBIT 4

NOTE: REPLACE PREVIOUS DRAFTS W/ THIS VERSION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAY 3 1991

Make Copies

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MEMORANDUM TO: Assistant Administrators
Regional Administrators
General Counsel
Inspector General
Associate Administrators

SUBJECT : Final Report of the EPA Ground-Water Task Force

As you know, one of the most important issues facing the Environmental Protection Agency (EPA) is ground-water protection. Therefore, in 1989, we established an EPA Ground-Water Task Force to develop an Agency-wide ground-water strategy. We are pleased to announce our release today of the final report of the Task Force titled, Protecting the Nation's Ground Water: EPA's Strategy for the 1990s. A copy of the report is attached.

Each of you has a critical role to play in the successful implementation of this new policy, and we will provide you with further direction soon. We know that you share our commitment to protect the nation's ground water and will join us in meeting this challenge.

Bill
William K. Reilly
Administrator

Hank
F. Henry Habicht II
Deputy Administrator

Attachment

PROTECTING THE NATION'S GROUND WATER:

EPA'S STRATEGY FOR THE 1990s

The Final Report of the EPA Ground-Water Task Force

*** EARLY RELEASE COPY ***
May 8, 1991

NOTE TO THE READER:

This Ground-Water Task Force Report is a statement of Agency policy and principles. It does not establish or affect legal rights or obligations. This guidance document does not establish a binding norm and is not finally determinative of the issues addressed. Agency decisions in any particular case will be made by applying the law and regulations to the specific facts of the case.

EPA GROUND-WATER TASK FORCE

REPORT

TABLE OF CONTENTS

EPA GROUND-WATER TASK FORCE REPORT

Executive Summary

BACKGROUND:

A number of Federal statutes provide EPA with the authority to prevent and control sources of ground-water contamination, as well as to clean up existing contamination. During the early 1980s, EPA recognized that these authorities to protect ground water were fragmented among many different statutes, and were largely undefined. As a result, in 1984 the Agency adopted a Ground-Water Protection Strategy to articulate the problem and EPA's role in a national ground-water protection program. Under this Strategy, the Agency has focused its efforts on four major objectives:

- Building State capacity;
- Addressing sources of contamination;
- Establishing ground-water policy direction and program consistency; and
- Coordinating EPA programs.

While this strategy was effective in creating momentum for States to develop and implement ground-water programs, the passage of time and growing body of experience indicated that gaps remained in protection efforts across the country. It became clear that there was a need to assess our progress and adjust our approach to take into account recent changes in statutory authorities and our increased knowledge of the issue by promoting comprehensive protection on the State and local level.[1]

In July 1989, EPA Administrator William Reilly established a Ground-Water Task Force chaired by Deputy Administrator F. Henry Habicht II to review the Agency's ground-water protection program and to develop concrete principles and objectives to ensure effective and consistent decision-making in all Agency decisions affecting the resource. The Task Force included membership from all Headquarters offices with ground-water protection responsibilities and selected Regional representation. Several work groups were created to develop recommendations on issues of special interest, and a substantial outreach effort succeeded in obtaining input on two key issues - Agency principles and the character of the Federal/State relationship - from major Federal, State, local, public interest, industry and agricultural leadership groups and the Governors and agency officials of all States.

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1 *Under Federal statutes and EPA policy, Indian Tribes may be recognized as States for the purpose of operating national environmental programs. Throughout this report, references to States also refer to Tribal governments as well as the U.S. Territories.*

The outcome of this effort is a policy and implementation principles that are intended to set forth an aggressive approach to protecting the Nation's ground-water resources and direct the course of the Agency's efforts over the coming years. It will be reflected in EPA policies, programs, and resource allocations, which will guide EPA, States and local governments, and other parties with whom we work in carrying out the Agency's ground-water responsibilities. This approach is characterized by:

- **Clear Statement of Policy**: This document sets forth a clear statement of Agency policy, which will serve as a decision-making framework for all Agency programs relating to the ground-water resource.

- **Focus on Comprehensive Resource Management**: This policy builds on current State activities by providing financial incentives for filling in gaps in protection efforts and building comprehensive protection programs on the State level. Under this resource-based approach to protection, States are to take into account the total impact of all sources of contamination as well as the unique hydrogeologic features of their resource. A critical first step in developing and implementing protection programs and arraying priorities, is to ensure that currently used and reasonably expected sources of drinking water do not present adverse health risks.

- **Emphasis on Prevention of Ground-Water Contamination**: Under this policy the Agency will place an increased emphasis on prevention of ground-water contamination, and strive to achieve a greater balance between prevention and remediation activities.

- **Clear Federal and State Roles**: EPA's policy clearly articulates the principles defining the EPA/State relationship in ground-water protection, and provides for developing the framework on the State level for integrating Federal and State actions relating to the resource.

- **Adequacy of State Programs:** The Agency's new policy describes EPA's intention to refine over the next year the definition of the elements of a State ground water protection program, and how each of the elements must be addressed to develop a program that is "adequate" to comprehensively protect a State's resource. It also describes how EPA will work to provide greater flexibility to a State in implementing Agency programs when that State has achieved an "adequate" ground-water protection program which affords comprehensive protection of the resource.

- **EPA Oversight:** In keeping with the recognition that States will develop and implement their own unique but adequate State programs, EPA oversight in the Agency's ground-water related programs will shift from a program-specific basis to a cross-program, resource-based approach to be further defined over the coming year.

- **Coordinated Funding:** In contrast with Agency tradition, EPA will shift from a traditional grants mode into one characterized by coordinated management of current ground-water related grants and the incentive of increased funding for States showing progress with comprehensive protection of the resource.

DOCUMENTS TO GUIDE THE AGENCY'S FUTURE AGENDA:

A. EPA's Ground-Water Protection Principles - This document establishes that the "overall goal of EPA's Ground-Water Policy is to prevent adverse effects to human health and the environment, and to protect the environmental integrity of the nation's ground-water resources." It also states that, "In determining appropriate prevention and protection strategies, EPA will also consider the use value and vulnerability of the resource, as well as social and economic values." Additionally, the document establishes principles related to prevention, remediation, and Federal, State and local responsibilities.

B. The Federal/State Relationship in Ground-Water Protection - This document contains an initial section that outlines the broadly applicable principles of the Federal/State relationship, e.g., the role of the States and EPA, and the importance of resource-based prevention efforts. This document also includes a second section that describes EPA's new approach for promoting comprehensive protection of the resource; provides a preliminary list of the elements of a State ground-water protection program, which will be further refined through discussions with the States. An appendix contains a draft document that describes the preliminary elements of a state program in greater detail. This document will serve as the framework for future work in this area. In 1991, EPA will hold workshops around the country to provide the Agency with State input on further refining the elements and their descriptions and on defining an "adequate" State program. In 1992, EPA will work with each State to complete a profile of its ground-water protection programs based on the final elements and criteria for adequacy. These profiles will identify gaps in State programs and will serve as the basis for grant workplan agreements for the States' FY 1993 program efforts.

C. EPA's Approach to Implementation - This section describes the specific roles and responsibilities of EPA program offices, both in Headquarters and the Regional Offices, in implementing the Ground-Water Protection Principles and ensuring the development and implementation of State ground-water programs which will provide comprehensive protection (Parts A and B of the report). It also describes the initial implementation actions the Agency will take over the next few years.

D. Agency Policy on EPA's Use of Quality Standards in Ground-Water Prevention and Remediation Activities - This policy statement describes how EPA will use maximum contaminant levels (MCLs) under the Safe Drinking Water Act, and water quality standards (WQSs) under the Clean Water Act, as "reference points" in carrying out ground-water programs. It also describes how these reference points will be applied differently in prevention and remediation activities.

E. Data Management Recommendations - This document discusses the status of EPA's ground-water data availability, accessibility, and utilizations. It discusses how data collected by EPA and others is used in ground-water planning and decision-making at the Federal, State, and local levels. Several specific recommendations for improvement developed by the Task Force follow. Also, an extensive computer and data system modernization effort now being undertaken by EPA's Office of Information Resources Management, should result in a substantial improvement in the availability and utility of ground-water data over the coming years. In FY 1991 the Agency will be moving ahead with this initiative as well as recommendations relating to data consistency, quality and automation; accessibility; and data utilization.

F. Office of Research and Development (ORD) Ground-Water Research Plan - This document describes the research EPA plans to undertake over the coming years in response to the needs of Agency programs. It discusses research activities needed to provide the scientific knowledge base for successfully preventing and remediating ground-water contamination. In FY 1991, ORD will conduct new research and technology transfer relating to three key areas of the Agency's ground-water protection efforts: the Wellhead Protection Program, State information systems for preventing ground-water contamination from pesticides; and subsurface cleanup and mobilization processes.

PART A:

EPA'S GROUND-WATER PROTECTION PRINCIPLES

EPA GROUND-WATER PROTECTION PRINCIPLES

The overall goal of EPA's Ground-Water Policy is to prevent adverse effects to human health and the environment and to protect the environmental integrity of the nation's ground-water resources; in determining appropriate prevention and protection strategies, EPA will also consider the use, value, and vulnerability of the resource, as well as social and economic values.

- In all events, EPA will execute this goal and the principles below in accordance with Federal law.
- Adverse effects means those risks that are significant to affected population and determined to be unreasonable where appropriate under relevant statue.
- EPA's fundamental premise is that the attainment of this goal is necessary to achieve the sustainability of the resource and closely hydrologically connected surface water systems, not just for the near term but for the future as well.
- In addition, because ground-water cleanup is extremely costly, and usually difficult and in some cases impossible to achieve and demonstrate, EPA's goal is to emphasize prevention of pollution where appropriate.

In order to achieve this goal, the Agency's principles are that:

<u>With respect to prevention:</u>

- ♦ **Ground water should be protected to ensure that the nation's currently used and reasonably expected drinking water supplies, both public and private, do not present adverse health risks and are preserved for present and future generations.**
- ♦ **Ground water should also be protected to ensure that ground water that is closely hydrologically connected to surface waters does not interfere with the attainment of surface water quality standards, which is necessary to protect the integrity of associated ecosystems.**
- ♦ **Ground-water protection can be achieved through a variety of means including: pollution prevention programs; source controls; siting controls; the designation of wellhead protection areas and future public water supply areas; and the protection of aquifer recharge areas. Efforts to protect ground water must also consider the use, value, and vulnerability of the resource, as well as social and**

economic values.

- Ground water is a uniquely local resource due to the ease with which small sources can affect it, and the impact that use and hydrologic characteristics (e.g. vulnerability) can have on its quality. As such, ground-water programs will require an appropriate blend of several protection methods.

<u>With respect to remediation:</u>

♦ **Ground-water remediation activities must be prioritized to limit the risk of adverse effects to human health first and then to restore currently used and reasonably expected sources of drinking water and ground water closely hydrologically connected to surface waters, whenever such restorations are practicable and attainable.**

- Given the costs and technical limitations associated with ground-water cleanup, a framework should be established that ensures the environmental and public health benefit of each dollar spent is maximized. Thus, in making remediation decisions, EPA must take a realistic approach to restoration based upon actual and reasonably expected uses of the resource as well as social and economic values.

- In an ideal world of unlimited funds, prioritization would be unnecessary. However, because resources do not permit all contamination to be addressed at once, the need for prioritization must be recognized.

- Moreover, given the expense and technical difficulties associated with ground-water remediation, EPA is emphasizing early detection and monitoring so that it can address the appropriate steps to control and remediate the risk of adverse effects to human health and the environment.

<u>With respect to Federal, State, and Local Responsibilities:</u>

♦ **The primary responsibility for coordinating and implementing ground-water protection programs has always been and should continue to be vested with the States. An effective ground-water protection program should link Federal, State, and local activities into a coherent and coordinated plan of action.**

♦ **EPA should continue to improve coordination of ground-water protection efforts within the Agency and with other Federal agencies with ground-water responsibilities.**

- Since ground water in any given area may be subject to contamination from a wide variety of point and non-point source activities, coherence and coordination in any plan of action are vitally important. EPA must ensure that the ground-water protection programs it implements under the Clean Water Act (CWA), the Resource Conservation and Recovery

Act (RCRA), the Safe Drinking Water Act (SDWA), the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the research programs that it funds under these Acts, are directed toward achieving the principles outlined above. In the design and timing of regulatory initiatives, EPA will address the highest risks. In addition, the authority of each State to allocate water within its jurisdiction should not be abrogated.

- Given the uniquely local nature of ground-water pollution and use, the States and localities must have primary responsibility for assessing and prioritizing risks to the resource and for implementing programs to protect the resource within each state so that it is available for various uses. However, where specific Federal responsibilities are provided for under the law, the requirements of the law must prevail.

- Not only must Federal, State, and local activities be linked to form a coherent plan of action; but air, water, and land practices, to the extent practicable, must also be examined in an integrated fashion to ensure protection of the ground-water resource.

PART B:

THE FEDERAL/STATE RELATIONSHIP IN GROUND-WATER PROTECTION

THE FEDERAL/STATE RELATIONSHIP IN GROUND-WATER PROTECTION

BACKGROUND:

Since the adoption of the Agency's 1984 Ground-Water Protection Strategy, EPA has been providing technical and financial assistance under the Clean Water Act to build State capacity to protect ground water in a comprehensive manner. Further, EPA has been implementing several source-specific statutes that protect and cleanup ground water.

Over the last few years, States have made significant strides in developing and implementing ground-water protection strategies. Yet, both the States and EPA recognize, that much remains to be done to ensure comprehensive protection of the nation's ground-water resource. State ground-water programs vary considerably from one State to another, and are often a patchwork of Federal, State and local source control efforts, focusing on individual sources of contamination rather than the resource as a whole. Source control programs tend to focus on sources that present significant risks on a national basis, but may not represent the most important threats to drinking water supplies (and therefore human health) at the local level. Many nonpoint and small, dispersed sources remain unaddressed, and commercial, residential, and industrial development often occurs with no recognition of long-term impacts on the quality of ground water.

As a result of the work of the recent Agency Task Force, beginning in FY 1992, EPA will take a more strategic approach to actively assisting States in comprehensively protecting their ground-water resources. The Task Force identified the need for EPA to step up its efforts to coordinate more fully Agency programs and authorities at the EPA Regional and Headquarters levels, to help States build comprehensive, integrated programs that protect the ground-water resource, to provide a framework for coordinating multiple Federal programs and activities at the State and local level, and to make optimum use of EPA grant authorities to promote Federal and State program coordination.

The purpose of this report is to set in motion a more fully coordinated EPA effort based on existing Agency authorities. EPA recognizes that, because of the timing of this document, the Regions and States have already completed much of the planning and negotiations for ground-water activities to be carried out in FY 1992. To the maximum extent possible, however, EPA will work with the States to promote aggressive implementation in FY 1992 through vehicles such as Regional grant amendments and technical assistance.

This document consists of three main sections: the first section describes the broadly applicable principles of the Federal/State relationship; the second describes EPA's support of a new comprehensive approach by State Ground-Water Protection Programs and lists possible elements of such State programs, which are based in large part on the consensus developed in discussions held with members of the Administrator's State/EPA Operations Committee; and the third section describes EPA's approach to implementation through a coordinated grant program that relies on multiple, ground-water related grant authorities. An appendix contains a preliminary narrative description of the elements of a State program, which will be further refined in collaboration with the States over the coming year.

PRINCIPLES DEFINING THE FEDERAL/STATE RELATIONSHIP:

In preparing this report, the Agency used "EPA's Ground-Water Protection Principles" as a starting point for defining the Federal/State relationship in ground-water protection (see Part A). The Agency believes, however, that there are several additional broadly applicable principles of this relationship that need to be laid out as well. They include:

- State Role is Critical: The Agency believes that while EPA will continue its role in controlling major sources of contamination, the States (and Indian Tribes) should retain the primary responsibility for the management and protection of the ground-water resource and in addressing diffuse sources of pollution. Such management may require decisions about ground-water allocation and land use which are appropriately the province of state and local government. EPA should support States in developing ground-water protection programs that adequately protect the resource as well as the framework for State/EPA relations.

- Resource-Based Efforts: States and EPA should emphasize a resource-based approach to protection, in addition to the current source control programs. Under this approach, the total impact of all sources of contamination, as well as the unique hydrogeologic features of the resource, should be taken into account in developing and implementing protection programs. Further, in addition to protecting current drinking water supplies, States should designate ground waters for protection that are reasonably expected to be drinking water supplies, taking into account such factors as: remoteness, quality, cost of protection, future growth and population patterns, and the availability and cost of alternative water supplies.

- Emphasis on Prevention and Sustainability: In general, the Federal/State relationship should be structured so that ground-water protection efforts are enhanced and coordinated.

- Scientific and Economic Research: EPA should continue to conduct scientific and economic research on various aspects of ground-water protection, and provide standard setting information to the States. This includes developing Maximum Contaminant Levels/Maximum Contaminant Level Goals which relate to health concerns, Water Quality Criteria which relate to ecological concerns, risk assessment information, fate and transport data, and information on the economic values and tradeoffs involved in protection activities.

- Federal Consistency: EPA should strive for consistency among Federal agencies and programs with ground-water protection responsibilities. For example, the Agency intends to work with the U.S. Department of Agriculture (USDA) to develop a joint strategy for addressing issues affecting the agriculture community through the ongoing USDA/EPA Work Group on Water Quality. Further, mechanisms should be established or better utilized for coordinating with DOI, DOE, NOAA, DOD, and other Federal agencies with ground-water responsibilities.

- The Roles of Federal and State Government in Regulating Specific Sources of Contamination Should be Based on the Following Factors:

  1. In general, State and local governments should play the prominent regulatory role. This is especially appropriate when: a) the activities of concern are numerous (e.g., 23 million septic tanks) or highly localized (e.g., vary in impact and number from State to State) and nationally present a low to medium risk potential; b) when land use management is a principal protection approach; and c) when technologies currently exist or are easily developed to address the problem. Further, State and local governments should play the primary role in the implementation of federally-mandated ground-water protection regulations.

  2. EPA should take a prominent regulatory role as currently authorized by law when: a) there is a need to establish regulatory consistency (e.g. to limit adverse impacts on interstate commerce); b) when the scope of the effort requires national resources (e.g., research, regulations addressing technically complex environmental problems); c) when State-by-State efforts would create unwarranted and inefficient duplication (e.g., bans, research); and d) when national security is involved (e.g., the disposal of radioactive waste).

- Differential Protection: In implementing EPA programs, the Agency should continue its policy of taking the use, value, and vulnerability as well as social and economic values of the resource into account in decisions affecting ground water. This is necessary to achieve EPA's overall ground-water policy goal of preventing adverse effects to human health and the environment, and protecting the environmental integrity of the nation's ground-water resources.

- Voluntary Approaches: EPA should encourage States to pursue voluntary nonregulatory approaches to protecting the resource. For example, the Agency is currently working with USDA under the President's Water Quality Initiative to involve States in fostering effective prevention approaches with the agriculture sector.

STATE GROUND-WATER PROTECTION PROGRAMS:

EPA intends to promote the development and implementation of State ground-water protection programs designed to provide comprehensive protection of the resource and the framework to coordinate programs and activities under Federal, State and local statutes and ordinances. A core premise is recognition of the primary State role in designing and implementing programs to protect the resource consistent with distinctive local needs and conditions. (References to States include Indian Tribes where recognized as States in the operation of environmental programs, as well as the U.S. Territories). This generally means that EPA will provide broad national guidance and use financial incentives to promote action. The Agency recognizes that protecting the ground water is a unique and complex environmental issue that requires a new, non-traditional approach. Clearly, a nationally prescriptive program is not appropriate; risk taking and innovation should be rewarded.

EPA's New Approach:

- Over the next six months, the Agency will hold Regional roundtables discussions with State Directors of Environmental Agencies as well as State ground-water program directors to reach agreement on the elements of a State program which would provide comprehensive protection, a definition of the range of "adequate" State programs, and an EPA review process.

- Over the next year EPA will continue ongoing work with the States to profile and assess current State ground-water protection activities to obtain a baseline of information and help States identify gaps in their current ground-water protection programs. This two stage profile process includes developing an objective description of current State activities and then working with the State in conducting a self-assessment of its activities to identify areas in need of further work. A State's current efforts will be compared with the elements of, and adequacy criteria for, a comprehensive program developed, in part, through the Regional roundtables process described above. This baseline information will be used by the EPA Regional offices in supporting State efforts to develop and implement programs that provide comprehensive ground-water protection. Regional priorities, milestones, and commitments for the Agency's ground-water related programs will be set in a way that are consistent with the individual State's needs and circumstances.

- As States move toward designing and achieving a comprehensive approach to protection of the resource, EPA will review and concur in State ground-water quality protection programs submitted by the States. The review will focus on "adequacy" instead of "consistency" – the threshold question will not be whether a State's program is consistent with EPA criteria, but whether a program falls within a range deemed "adequate" to protect a State's ground-water resource. The Agency, in collaboration with the States, will define a range of ways to achieve "adequacy" rather than one prescriptive definition.

- EPA's review of State programs will be flexible and take into account the unique characteristics of each State, as well as the different stages of development of each State program. The process will be interactive and iterative, with the States and EPA working together. It will focus on assessing programs to identify gaps, and providing EPA technical and financial assistance to States to address the gaps.

- The purpose of the process of determining adequacy is not to judge or evaluate a State program in a "pass/fail" manner, or determine that a State's program is "inadequate" if it does not meet the criteria EPA has developed in conjunction with the States. Rather it is meant to be a process in which EPA works with States to help them fill in gaps in State ground-water protection efforts and bring their programs to a point where the States are fully capable of comprehensively protecting the ground-water resource, given an individual State's particular needs and circumstances. Where EPA can determine that a State has reached this point, EPA will seek to defer to State standards, priorities, and programs to the extent authorized under Federal statutes (see below).

- EPA's non-concurrence of a State's Ground-Water Protection Program will not imply inadequacy of other ground-water protection programs within the State either being conducted or approved by EPA or other Federal agencies. However, non-concurrence of a State's Program could result from a State not taking responsibility for an expected role in the implementation of these other ground-water protection programs.

- Using current ground-water related grants, EPA will support the development and implementation of State ground-water protection programs. While all States will initially be eligible for funds, the Agency, working with the States, will define a range of program characteristics that will be used to assess State progress toward achieving an "adequate" comprehensive program. Exemplary State programs will receive an increasing share of the grants, while States showing little or no progress will receive reduced grant amounts. Further, for States with an "adequate" program, the Agency oversight process will focus less on defining and overseeing individual State actions and more on the overall effect of the program in protecting ground water. States which elect not to participate in the process will not be able to avail themselves of certain EPA-provided financial and oversight benefits.

- To the extent authorized by EPA statute and consistent with Agency program implementation objectives, EPA will defer to State policies, priorities, and standards once a State has developed an "adequate" program. For States that develop adequate State ground-water protection programs, EPA's policy will be to look to or "defer to" State policies, priorities, and standards. Under this policy of deference, EPA will study and identify ways in which the Agency can defer to State decisions in implementing Agency programs. Implementation of this policy for States with an adequate ground-water protection program will take several forms.

    - First, EPA will identify ways to provide States with greater flexibility to target enforcement and permitting activities consistent with the States' own policies and priorities.

    - Second, EPA will establish policies for reducing routine Agency oversight of State programs affecting ground water.

    - Third, in its development of regulations and guidance, EPA will explore ways in which they could provide for deference to State ground-water standards, regulations or policies. To the extent authorized by EPA statutes and consistent with Agency program implementation objectives EPA will provide for consideration of or deference to State standards, regulations and policies. EPA statutes generally provide that Federally promulgated standards or regulations serve as minimum levels of protection. These statutes, however, generally reserve to the States the authority to adopt more stringent standards or regulations. Therefore, States already have a significant role in establishing applicable standards for EPA programs. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) is an excellent example of a statute that provides an important role for States in decision-making.[2]

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2 *With some limitations, CERCLA provides significant opportunities for EPA to adopt State requirements as part of CERCLA cleanup actions. Whether or not CERCLA cleanups would be based on provisions of a State ground-water protection program depends first on whether the plan includes "ARARs." As defined in section 121(d)(2) of CERCLA, ARARs are "applicable or relevant and appropriate requirements" of other Federal or State environmental laws. For a State law requirement to be ARAR,*

- Finally, where State regulations, standards or policies would provide for less stringent protection than EPA regulations, standards or policies, there may be statutory or regulatory prohibitions to deferring to the State. EPA, however, is committed to exploring opportunities for providing for deference to State regulations, standards or policies as authorized by EPA statutes and consistent with Agency program implementation objectives.

ELEMENTS OF A STATE GROUND-WATER PROTECTION PROGRAM

As part of its role in promoting development of State programs which will provide comprehensive ground water protection, the Agency, in collaboration with the States, will determine over the next year the key elements of a State program. A preliminary list of elements of a comprehensive protection program is below (see Part B: Appendix for a preliminary narrative description):

Setting Goals and Documenting Progress:

- Ground-water protection goal which accounts for present and future uses of the resource;

- Yearly action plan for achieving the goal, which includes a mechanism for evaluating progress toward accomplishing the goal and provides for EPA review.

Characterizing the Resource and Setting Priorities for Actions:

- Comprehensive assessment of aquifer systems and their associated recharge and discharge areas;

- Procedure for inventorying and ranking potential sources of contamination that may cause an adverse effect on human health; or ecological systems; and

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it must be promulgated (i.e., of general applicability and legally enforceable, see section 300.400(g)(4) (1990) of the National Contingency Plan), substantive rather than administrative (see 55 Fed. Reg. 8756-57, March 8, 1990), identified in a timely manner, and more stringent than the Federal standard (section 300.400(g)(4) (1990)). Where a State requirement is not directly applicable, EPA has discretion to find the requirement to be ARAR because it is "relevant and appropriate" to circumstances at the site. Where State standards include substantive requirements that are ARARs, the CERCLA remedy would be required to meet or waive them. ARARs may be waived in six limited circumstances, such as where it is impracticable to attain them, or for State standards, where the standard has not been consistently applied (see CERCLA section 121(d)(4)). Under CERCLA, where State plans, policies or guidelines do not qualify as ARARs, EPA may nevertheless treat them as provisions "to be considered" ("TBCs") with respect to the cleanup plan. TBCs would be evaluated and justified on a site-specific basis. The recently revised NCP, in implementing CERCLA's cleanup program, demonstrates EPA's commitment to providing a significant role for States in decision-making.

- Process used for setting priorities for actions taken to protect or remediate the resource, such as a use designation/classification scheme that considers use, value, vulnerability, yield, current quality, etc.; including wellhead protection and cost benefit analyses.

Developing and Implementing Prevention and Control Programs:

- A coordinated pollution prevention and source reduction program aimed at eliminating and reducing the amount of pollution that could potentially affect ground water; including wellhead and recharge area protection programs, siting criteria, improved management practices and technology standards, etc.

- Enforceable quality standards that are health based for drinking water supplies and ecologically based in areas where ground water is closely hydrologically connected to surface water (Note: For actions under State law that are independent of any Federally authorized program, it is the State's prerogative to determine whether to establish its own standards or to use EPA's standards);

- Regulatory and nonregulatory authorities to control sources of contamination currently under State or local jurisdictions; e.g. permitting, siting and zoning authorities on the State and local level;

- Remediation program that dovetails with RCRA and Superfund and sets priorities for action according to risk;

- Monitoring, data collection, and data analysis activities to determine the extent of contamination, update control strategies, and assess any needed changes in order to meet the ground-water protection goal;

- Compliance and enforcement authorities given to the appropriate State and local officials through legislative or administrative processes;

- Water well programs, including private drinking water wells, covering areas such as well testing, driller certification, well construction, and plugging abandoned wells;

- Statement of how Federal, State and local resources will be used to adequately fund the program; and

- Public participation activities to involve the public in the development and implementation of the program.

Defining Roles Within the State and the Relationship to Federal Programs:

- Delineation of State agencies' responsibilities in the ground-water program covering areas such as planning, implementation, enforcement and coordination;

- Statement indicating how the State will or does provide local governments with authorities to address local ground-water protection issues;

- Statement of the State's role under ground-water related EPA statutes including RCRA, CERCLA, SDWA, CWA, and FIFRA; e.g., EPA-approved programs such as a RCRA authorization should be listed and integrated as part of the State's overall ground-water protection strategy yet continue operating as free-standing programs;

- Mechanisms for dealing with other Federal agencies that affect State ground-water programs (e.g., MOUs or other arrangements with USDA, DOI, DOD);

- Statement indicating how the State intends to integrate water quantity and quality management; and

- Coordination of ground-water programs with other relevant natural resource protection programs, including surface water management.

GROUND-WATER RELATED GRANTS

Statutory Authority	Match	ELIGIBLE ACTIVITIES	LIMITATIONS*	FY 91 $ APPROPRIATION
CLEAN WATER ACT				
106	None	General: Prevention & abatement of surface & ground-water pollution. Specific: Permitting, pollution control studies, planning, surveillance & enforcement, assistance to locals, training, & public information.	Allotment based on extent of pollution problem, not the quality of the State program. No authorization ceiling in FY91.	$81.7 million (Ground-water portion: $12.2m)
104(b) (3)	None	General: Pollution prevention, reduction, & elimination programs. Specific: Research, experiments, training, demonstrations, surveys, studies, investigations.	Not for program operation.	$16.5 million
205(g)	None	Delegated administration of construction grants program, 402 or 404 permit program, 208(b)(4) planning program, & construction grants management for small communities.		0 (Congress cut off funding)
205(j)(1) / 604(b)	None	Develop water quality management plans.	Not for implementation; 40% to regional comprehensive planning agencies.	0 / $16 million
205(j)(5) 201(g) (1)(b)	None	Develop & implement nonpoint source management programs.	201(g)(1)(b): Construction grant deobligations and reallotment funds available.	0 (Congress cut off funding)
319(h)	40%	Implement nonpoint source management programs.	No more than 15% of total available to any one State. Financial assistance for demonstrations only (cannot be used for cost sharing programs). Limits on administrative costs.	$51 million
319(i)	50%	Carry out ground-water protection activities.	$150K per State.	See 319(h)

Statutory Authority	Match	ELIGIBLE ACTIVITIES	LIMITATIONS*	FY 91 $ APPROPRIATION
FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT				
23(a)(1)	15%	General: Implement pesticide enforcement programs.		$26.8 million (Ground-water portion: $5m)
TOXIC SUBSTANCES CONTROL ACT				
28	25%	General: Establish & operate toxics control programs. Specific: Monitoring, analysis, surveillance & general program activities (currently used for asbestos & SARA Title III activities).	Authorization expired in 1982. Appropriations committees should be notified before funds are used for new ground-water program.	$8.1 million
RESOURCE CONSERVATION AND RECOVERY ACT				
3011	25%	General: State hazardous waste management programs. Specific: Planning for hazardous waste treatment, storage & disposal facilities.		$83 million
SAFE DRINKING WATER ACT				
1443(a)	25%	Public water system supervision; State drinking water programs.	Funds available only to States with primacy.	$47.5 million
1443(b)	25%	General: Underground injection control programs. Specific: Program costs, inventories, data management, technical assistance, etc.	Funds available only to States with primacy.	$10.5 million
COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION & LIABILITY ACT				
104(b)	10%	General: Superfund activities under core program cooperative agreements. Specific: Implementation, coordination, enforcement, training, community relations, site inventory and assessment, administration of remedial activities, legal assistance relating to CERCLA implementation.	Not for site-specific activities.	$14 million

*Authorities in this matrix may be used to fund ground-water activities either in separate categorical grants or consolidated grants. Further, the scope of eligible ground-water activities varies among authorities. Regions should consult their Grants Management Office and Regional Counsel regarding these issues.

Part B: Appendix

Descriptions of Common Elements of Comprehensive State Ground-Water Protection Programs

DESCRIPTIONS OF COMMON ELEMENTS OF COMPREHENSIVE STATE GROUND-WATER PROTECTION PROGRAMS

Because of each State's unique hydrogeological characteristics and conditions, the character of a Comprehensive Program will not be identical in all States. EPA will provide States with great flexibility in addressing the elements of a Comprehensive Program. A list of elements commonly found in mature ground-water programs is provided below, including a narrative description of each element. Using this universe of potential elements, EPA in collaboration with the States over the coming year, will develop a final set of elements and adequacy criteria for element of a comprehensive State program.

Setting Goals and Documenting Progress

- Ground-Water Protection Goal which Accounts for Present and Future Uses of the Resource. The ground-water protection goal is in harmony with the national ground-water protection goal, and the goal is founded in State statute. The ground-water protection goal accounts for present and reasonably expected future ground-water uses.

- Yearly Action Plan for Achieving the Goal, which Includes a Mechanism for Evaluating Progress Toward the Goal and Provides for EPA Review. The State has an action plan which describes how the State will achieve its Comprehensive Program goal. The action plan outlines outcomes that are needed to assure that the resource protection goal is achieved; a process for reaching those outcomes; short- and long-term timetables, milestones, and measures of progress; and parties responsible for achieving desired outcomes. Usually, the plan reflects the diverse authorities available to the State to achieve its goal, including land use authorities, public health authorities, and enforcement authorities.

Characterizing the Resource and Setting Priorities for Actions

- Comprehensive Assessment of Aquifer Systems for Ground-Water Protection Purposes. The State has an ongoing, effective program which provides basic information on the occurrence, movement, and quality of ground-water resources within its borders. This program utilizes and integrates the information available from State geological surveys, as well as ongoing Federal assessment and mapping programs, such as those available from the USGS and Soil Conservation Service.

- Procedure for Inventorying and Ranking Potential Sources of Contamination that May Cause an Adverse Effect on Human Health or Ecological Systems. The State has a program for identifying the existence, location, and relative magnitude/risk of anthropogenic and natural threats to ground-water quality. The program is capable of (1) identifying specific categories of activities which pose threats to the quality of the resource, (2) locating geographic areas where such threats/sources are concentrated, and (3) identifying specific source locations, facilities, plumes, etc., deemed to pose a threat to public health and or the environment.

- Process Used for Setting Priorities for Actions Taken to Protect or Remediate the Resource, Such as a Use Designation/Classification Scheme that Considers Use, Value, Vulnerability, Yield, and Current Quality, Including Wellhead Protection and Cost Benefit Analysis. The State balances the timing, ordering, and extent of protection activity development and implementation based on a scheme which reflects the risk to ground-water quality, human health, and ecosystem maintenance. Prioritization schemes reflect resource characterization and source inventory efforts. The State is encouraged to adopt prioritization schemes which considers such factors as resource use and potential use for drinking water and other purposes, resource sensitivity to contamination, and the tradeoffs in cost and/or effectiveness between protection and remediation options. Prioritization schemes incorporate priorities established in Federal environmental statutes.

Developing and Implementing Prevention and Control Programs

- A Coordinated Pollution Prevention and Source Reduction Program Aimed at Reducing and Eliminating the Amount of Pollution that Could Affect Ground Water. A program to reduce and eliminate the amount of pollution that could potentially affect ground water with techniques such as wellhead and recharge area protection programs, siting criteria, improved management practices and technology standards, etc.

- Enforceable Quality Standards that Are Health Based for Drinking Water Supplies and Ecologically Based in Areas Where Ground Water is Closely Hydrologically Connected to Surface Water. Legally defensible and enforceable quality standards that could be based on MCLs (or EPA Health Advisory levels) for drinking water, and on surface water quality criteria established under the Clean Water Act for ground water closely hydrologically connected to surface water are a part of a Comprehensive Plan. In applying standards, States should distinguish between prevention and remediation activities -- EPA's policy on the use of quality standards in ground-water prevention and remediation activities is one approach the States can refer to. (Note: It is the State's prerogative to determine whether to establish its own standards or to use EPA's for actions under State law.)

- Regulatory and Nonregulatory Authorities to Control Sources of Contamination Under State or Local Jurisdiction; e.g., Permitting, Siting, and Zoning Authorities. The State has authorities necessary to manage the contaminant sources characterized in Element Two. The State has received or is making progress toward receiving delegation of EPA's contaminant control programs. Regulatory and nonregulatory authorities are sufficient to control additional sources of contamination under State or local jurisdiction. These authorities include, but are not limited to, permitting authorities; controls on activities such as transport regulations and facility design standards; and land use regulations (e.g., zoning) that limit where, when, how, and if certain activities may occur. Implementation and enforcement authorities are vested in local governments where appropriate.

- Remediation Program which Dovetails With RCRA and Superfund and Sets Priorities for Action According to Risk. The State has or is developing a remediation program that adequately addresses those potential polluting activities and sites not already covered by EPA's remediation programs (e.g., hazardous waste treatment, storage, and disposal facilities -- including solid waste management units at such facilities) and sites not on the National Priorities List.

- Monitoring, Data Collection, and Data Analysis Activities to Determine the Extent of Contamination, Update Control Strategies and Assess Any Needed Changes in Order to Achieve the State's own Ground-Water Protection Goal. The State's information management activities include the collection, laboratory analysis, storage, retrieval, and analysis of ground-water data. The State has a program to ensure that the data collected within the State is consistent, of known and reliable quality, and is efficiently stored for retrieval and use. This data is readily accessible to State and local agencies for use in analysis and decision making such as ground-water protection planning, enforcement, trend analysis, permitting and other activities.

- Compliance and Enforcement Authorities Given to the Appropriate State and Local Officials Through Legislative or Administrative Processes. Compliance monitoring and enforcement authorities are adequately delegated to the appropriate State and local officials.

- Water Well Program, Including Private Drinking Water Wells, Covering Areas Such as Well Testing, Driller Certification, Well Construction, and Plugging Abandoned Wells. The State has standards for water well construction, testing, and driller certification to ensure that wells are drilled and finished in a manner that is protective of public health. These standards include both public and private drinking water wells. Additionally, the State provides well closure standards to ensure that abandoned wells will not act as conduits into drinking water aquifers for contaminants.

- Statement of How Federal, State, and Local Resources will be used to Adequately Fund the Program. The State adequately funds and staffs the Comprehensive Program. There is a good match between available revenues and proposed expenditures.

- Public Participation Activities to Involve the Public in the Development and Implementation of the Program. The public is involved in the development, review, and implementation of the Comprehensive Program.

Defining Roles Within the State, and the Relationship to Federal Programs

- Delineation of State Agencies' Responsibilities in the Ground-Water Program Covering Areas Such as Planning, Implementation, Enforcement, and Coordination. The State delineates the responsibilities of State agencies in planning, implementing, enforcing, and coordinating the Comprehensive Program. The designation of a lead agency, or formally established institutional structure, with responsibility for coordinating program implementation is recommended. The State addresses these issues with respect to interstate and regional organizations, if applicable.

- Statement Indicating How the State Will or Does Provide Local Governments With Authorities to Address Local Ground-Water Protection Issues. The State provides local governments with the authorities to address local ground-water protection issues. The State encourages local agency involvement in all aspects of ground-water protection, including technical assistance, training, and financial assistance.

- Statement of the State's Role Under Ground-Water Related Federal Statutes Including RCRA, CERCLA, SDWA, CWA, and FIFRA -- e.g. EPA-approved programs such as RCRA authorization should be listed and integrated as part of the State's overall ground-water protection strategy yet continue operating as free-standing programs. The State carries out its responsibilities in delegated and authorized Federal programs. For any program for which the State has not been delegated implementation authority, the State is striving to get such delegation.

- Mechanisms for Dealing with Other Federal Agencies that Affect State Ground-Water Programs Including MOUs and Other Formal Agreements. The State's Comprehensive Program provides for coordination with other Federal Agencies that affect State ground-water programs (e.g., USDA, DOI, DOD).

- Statement Indicating how the State Intends to Integrate Water Quantity and Quality Management. The State addresses methods that it will use to minimize the impacts of ground-water withdrawals on ground water quality. The approach includes coordination between the State agencies responsible for quantity management and quality management.

- Coordination of Ground-Water Programs with other Relevant Natural Resource Protection Programs, Including Surface Water Management. The State has a mechanism for coordinating and integrating the planning and implementation of all State, local, and Federal activities affecting the ground water. The mechanism might include commissions or task forces that use inter-departmental staff from all State and Federal regulatory agencies, including staff from agencies not usually associated with ground-water protection such as community development and public works.

PART C:

EPA'S APPROACH TO IMPLEMENTATION

EPA'S APPROACH TO IMPLEMENTATION

HEADQUARTERS ROLES AND RESPONSIBILITIES:

An ongoing Ground-Water Policy Committee will be established to oversee the implementation of the Agency "Ground-Water Principles" and the Comprehensive State Ground-Water Protection Program. It will develop overall program policy direction and integration and work to improve coordination with other Federal agencies. It will be co-chaired by the Deputy Assistant Administrator (DAA) for Water and the lead Deputy Regional Administrator (DRA) for Pesticides, RCRA, or Superfund. Further, a mechanism for providing ongoing State input into this effort will be established. The Policy Committee will function in the following way:

Co-chair: DAA for Water and Lead Regional DRA for Pesticides, RCRA or Superfund.

Membership: DAAs, selected DRAs, key office directors, and selected regional division directors.

Responsibilities: to develop overall program policy direction and oversee implementation of both the integration effort within EPA and the work with the States and other Federal agencies. This will include carrying out an ongoing active outreach effort to seek the views and concerns of both the States and Federal agencies in implementing this report, and developing a coordination plan for working with Federal agencies. The Policy Committee will report semi-annually to the Deputy Administrator (DA) and/or the Assistant Administrators and Regional Administrators.

Implementation Workgroups will be formed as necessary with supplemental membership of other Office Directors and Regional Division Directors to develop policy and program operations proposals and to work with the national program manager in the overall direction of the effort. These implementaion workgroups will be chaired by selected representatives of the DAAs as well as key office director and regional division directors or their representatives. The implementation workgroups will include:

- A ground-water "regulatory cluster" implementation workgroup to coordinate upcoming ground-water related decisions made across regulations, offices, and media. The cluster approach will help ensure that the Ground-Water Principles guide all Agency regulatory actions relating to the resource and help provide for integration and consistency in the development of EPA regulations required under Federal statutes. The workgroup will develop a work plan for the cluster covering such topics as: the coverage and timing for each action; cross-cutting issues that should be addressed or resolved; effects of decisions on one action for others in the cluster. The key focus of the cluster activity will be to determine the appropriateness of deferring to a State comprehensive programs under each regulation, etc.

A schedule will be set for the DAA to deliver a coordination plan and briefing to the DA.

- A State Adequacy/Oversight Implementation Workgroup to implement the comprehensive State protection program. This workgroup will focus on finalizing the list and definitions of the elements of a comprehensive State ground-water protection program and the adequacy criteria for each element. The subcommittee will also recommend the procedures for EPA review and concurrence of State programs as well as the Agency's continuing oversight role. This subcommittee will have primary responsibility for ensuring State input into all activities of the Ground-Water Policy Committee.

- A Ground-Water Resources and Program Implementation Workgroup to address cross-Agency ground-water related resource, grants, and program operating guidance issues. This workgroup will work to ensure that the Agency's ground-water related programs are supporting the development of comprehensive State ground-water protection programs through annual operating guidances and grant guidances. It will also focus on developing a budget strategy for supporting State ground-water related needs and priorities across Agency programs.

REGIONAL OFFICE ROLES AND RESPONSIBILITIES:

Regional Offices will place the authority for annual planning and evaluation of the EPA Ground-Water Protection Program at the DRA level. A ground-water coordinating committee, chaired by the DRA and composed of key regional division directors should be established in each Regional Office. The Regions will be responsible for ensuring that State officials are actively involved in the implementation of EPA's Comprehensive Ground-Water Protection Program. The responsibility for carrying out integrated planning on a day-to-day basis should be placed at the Division Director level. Regional responsibilities include:

Reviewing all activities of the various programs with respect to their impact on or contribution to, the development of Comprehensive State Ground Water Protection Programs (CSGWPPs). Such activities would include assessing the use of available program funding sources to implement CSGWPPs.

Establishing specific priorities, milestones, and commitments for all programs. The objective to support and acknowledge CSGWPPs that meet certain adequacy criteria redefines the basic relationship between EPA and the States with respect to ground water. This relationship requires a change in the process through which priorities are set and flexibility by EPA regarding each program's requirements and performance measures. This shift, from a predominantly source control emphasis to a more resource-focussed viewpoint, will first require identification of the institutional barriers to change such as the Agency's Strategic Targeted Activities for Results System (STARS) and other management controls. It is expected that this shift will be fully reflected in STARS by 1993.

STRATEGIC TARGETED ACTIVITIES FOR RESULTS SYSTEM (STARS)

Utilizing available resources in each program in a creative and integrated manner to build comprehensive State programs, through the development of Agency operating guidance and the identification of specific initiatives which support implementation of CSGWPPs. The CSGWPPs would be used to guide implementation of Federal programs in that State. For example, a special Regional/State initiative could be developed which would allow relief from a certain percentage of STARS commitments for that program.

Establishing an integrated State/EPA planning process in order to reach agreement on specific milestones and joint commitments for action. The first step in this new planning process is the ongoing development of State profiles and self-assessments, including State/EPA workshops on how to define "adequacy" as a basis for approving State programs and directing additional Federal support to each State for development of a CSGWPP.

Conducting regular annual evaluations of State, Regional, and Headquarters progress in implementing CSGWPPs with a process for revision and planning. This should be embarked upon as a process of continual improvement where every aspect of each program seeks to improve "delivery", i.e. support of and responsiveness to joint State/EPA milestones and agreements. Initially, all programs should be directed to look at how they may do things differently in response to this effort. Specifically, each program should determine the value added; i.e. how can development of CSGWPPs help each program in what they do. Some examples are:

- A coordinated Regional/State data management effort to allow more effective reporting under State 305(b) and other environmental indicator reports.

- A comprehensive State mapping effort to locate all water wells, especially public water supply wells, using the same geolocator data element (latitude/longitude) to ease assessments of the proximity to sources of contamination. Aggressive implementation of the Agency's minimum data element set must take place in order to assure contaminant source locations are consistently provided.

- A comprehensive State vulnerability assessment effort that can assist development of State pesticide management plans and that is also useful in prioritizing ground-water areas for geographically targeted enforcement and clean up efforts.

- A Geographic Enforcement Initiative, integrating all programs and selected through a joint State/EPA planning process which seeks to address a high priority ground-water area.

EPA/STATE IMPLEMENTATION -- FIRST PHASE FISCAL YEARS (FYs) 1991-1993:

EPA intends to strengthen the impressive progress the States have made over the last few years, by helping them to build on their current programs and providing them with the financial, technical, and management tools to do so. The cornerstone of this approach is an increased EPA focus on assisting States in identifying and filling in the gaps in their current programs and developing a mechanism for integrating separate programs and setting priorities. This approach will rely on coordinating multiple ground-water related grant authorities to help States develop and implement comprehensive, resource-based programs. This approach signals that we are moving toward a truly integrated program.

As a demonstration that EPA is pulling together all its programs and authorities to achieve substantial progress under existing legislative authorities, the Agency will promote EPA and State program coordination in FY 1992. Based on an inventory of potential funding sources (see attached), Regions will be asked to look creatively at the inventory and to fully explore ways to tie these sources of Agency grant funding together and/or work out mutual work plans. Potential options for awarding grants to States include one or more of the following:

- Encourage each EPA regional program with ground-water responsibilities, under the leadership of the Deputy Regional Administrators (DRAs), to participate in and contribute resources for the purpose of creating a formal ground-water coordinating mechanism in each State, which will be responsible for addressing the issues of comprehensive state program development, program integration and priority setting.

- Profile current State programs based on a list of elements of a comprehensive State protection program, to establish a more detailed baseline of information on State programs and to determine where EPA and State priorities intersect in order to help direct EPA funding.

- While all of the elements of a comprehensive State protection program are important to an adequate State program that comprehensively protects the ground-water resource, three elements are of special importance for States to effectively implement existing EPA requirements. These particular elements are also of particular interest and concern to Congress and other interest groups. Consequently, EPA is encouraging Regions and States to give special attention to the following three critical State program elements in FY 1992:

(1) Establishing a formal mechanism for coordinating authorities and programs under various EPA statutes;

(2) Identifying the most valuable, vulnerable aquifers; and

(3) Evaluating or ranking the highest priority sources of contamination.

Many State programs may already adequately address these three elements, while others may need improvement in one or more of the areas.

- As an example of creative grantsmanship, OPP and OGWP issued FY 1991 grant guidance under the CWA Section 106 and FIFRA grants to encourage States to develop pesticide management plans, clearly integrating the activities under each grant to promote a coordinated approach among State agencies. While most other EPA/State grant negotiations are well underway and it is difficult to make changes at this point in time, Regions and States are encouraged to use mid-year grant amendments to implement this model and/or pursue other creative grant mechanisms in FY 1992, with special emphasis on accomplishing one or more of the objectives outlined above.

During FY 1991 and 1992, the Agency's current ground-water related grants will be awarded to States based on existing allocation formulas -- starting in FY 1993, however, States showing exemplary progress toward achieving the objectives of their comprehensive programs will receive increased amounts, while States showing little or no progress will receive lower grant amounts. Once the "elements of a comprehensive State protection program" are fully defined and EPA and the States reach closure on how to determine adequacy, they will serve as the basis for determining whether a State program is adequate to protect its ground-water resource and for making adjustments to grant amounts accordingly.

By the end of 1991, regional workshops will be held across the country to provide the Agency with State input on several key issues: (1) how to fully define the list of comprehensive program elements; (2) how to determine "adequacy" for concurring with and funding comprehensive State protection programs; and (3) how to oversee State programs.

In FYs 1992 and 1993, the Agency will work to institute enhanced and integrated management of the Comprehensive State Program effort -- including greater integration of the management of grant resources.

PART D:

AGENCY POLICY ON EPA'S USE OF QUALITY STANDARDS IN GROUND-WATER PROTECTION PREVENTION AND REMEDIATION ACTIVITIES

AGENCY POLICY ON EPA'S USE OF QUALITY STANDARDS IN GROUND-WATER PREVENTION AND REMEDIATION ACTIVITIES

[*The purpose of this policy statement is to describe the approach the Agency will use in making specific decisions with quality standards when carrying out EPA's ground-water related statutory responsibilities.*]

When EPA is carrying out its programs, the Agency will use Maximum Contaminant Levels (MCLs) under the Safe Drinking Water Act, as "reference points" for water resource protection efforts when the ground-water in question is a potential source of drinking water. Water Quality Standards under the Clean Water Act, will be used as reference points when ground water is closely hydrologically connected to surface water ecological systems. Where MCLs are not available, EPA Health Advisory numbers or other approved health-based levels are recommended as the point of reference. If such numbers are not available, reference points may be derived from the health-effects literature where appropriate. In certain cases, maximum contaminant level goals (MCLGs) under the Safe Drinking Water Act, or background levels may be used in order to comply with Federal statutory requirements. Reference points are to be applied differently for prevention and cleanup purposes.

- *Prevention*: Best technologies and management practices should be relied on to protect ground water to the maximum extent practicable. Detection of a percentage of the reference point at an appropriate monitoring location would then be used to trigger consideration of additional action (e.g., additional monitoring; restricting, limiting use or banning the use of a pesticide). Reaching the MCL or other appropriate reference point would be considered a failure of prevention.

- *Cleanup*: Remediation will generally attempt to achieve a total lifetime cancer risk levels in the range of 10-4 to 10-6, and exposures to non-carcinogens below appropriate reference doses. More stringent measures may be selected based on such factors as the cumulative effect of multiple contaminants, exposure from other pathways, and unusual population sensitivities. Less stringent measures than the reference point may be selected where authorized by law, based on such factors as technological practicality, adverse environmental impacts of remediation measures, cost and low likelihood of potential use.

PART E:

GROUND-WATER DATA MANAGEMENT RECOMMENDATIONS

GROUND-WATER DATA COLLECTION, ACCESSIBILITY, AND UTILIZATION

Report to the EPA Ground-Water Task Force
by the Data Management Workgroup

October 1989

Preface

The Data Management Committee of the EPA Ground-Water Task Force was charged with examining ground-water data collection, accessibility, and utilization throughout the Agency, and developing recommendations. This report addresses the first stage of the process by summarizing the status of these activities, describing improvements and changes underway, and presenting options for the future.

Ground-Water Data Collection, Accessibility, and Utilization

Contents

Executive Summary

Ground-water data is collected using different methods and formats, according to the needs of individual EPA programs, States, and other agencies. Different data quality objectives result in a range of data collection elements, dataset structures, sophistication, and quality. Data collection for EPA decision-making includes locating sources of contamination, performing risk assessments, and initiating remedial actions. Data collection for identifying spatial and temporal trends attempts to discover ground-water quality patterns, plan national and regional programs, and perform research on ground-water behavior. Advances in data quality and quantity are evident in Agency activities such as RCRA facility monitoring, the National Pesticide Survey, and identification of ground-water quality indicators. More baseline data could be used to isolate certain sources of contamination, investigate local and site-specific problems, and advance research. Options are presented for improving information capture, data quality, management, and dissemination.

Uneven data accessibility reflects differences in data collection among programs and States. Data is often scattered or cumbersome to access. While recognizing limitations in current data accessibility, a significant investment of resources and multi-office agreement would be necessary to affect a major change. Specific user benefits of any new, standardized system should be defined. Advances have been made in data retrieval systems, electronic bulletin board systems, and standardizing some aspects of data entry. Options are presented for using Agency resources and leveraging other agencies to improve automation, and establish or upgrade information clearinghouses.

Data utilization tends to follow the purpose for which the data was collected, however EPA could do more to utilize available data. Patterns of data utilization are closely linked to ease of accessibility, user knowledge, time available, and proximity to appropriate computer hardware and software. Advances in data utilization include use of geographic information systems (GIS), use of ground-water models, and numerical screening and ranking systems for targeting environmental priorities. Options are presented for encouraging data utilization through improving data retrieval systems, preparing guidance, and performing demonstrations.

DATA COLLECTION, ACCESSIBILITY, AND UTILIZATION

I. Background

A. What EPA does in ground-water data collection, accessibility and utilization

EPA programs have a variety of approaches to managing ground-water data. Activities within the four major EPA programs that collect ground-water data are summarized below.

1. Office of Solid Waste and Emergency Response (OSWER)

Ground-water data collection under the CERCLA, RCRA, and LUST programs is conducted to determine if a release of hazardous constituents has occurred and the nature and extent of ground-water contamination from a hazardous waste site, facility, or underground storage tank. ground-water detection or assessment monitoring is required of owners or operators of both LUST and RCRA facilities. The purpose of these monitoring activities is to identify and remove a source of ground-water contamination and/or prevent the introduction of hazardous constituents or petroleum products to the ground-water environment.

Understanding site hydrogeology is essential to characterizing the distribution and movement of contaminants in the subsurface environment. In undertaking hydrogeologic evaluations, therefore, the following related data is collected; 1) pertinent information relating to chemical or physical properties of saturated geologic units, 2) the ground-water potentiometric surface and, 3) the hydraulic properties of the aquifer (e.g., hydraulic conductivity, transmissivity, storativity, and velocity).

Data is typically submitted in hardcopy report format, however, for EPA-lead Superfund sites, chemical data generated through the Contract Laboratory Program (CLP) is available electronically. Generally, site-specific data can then be accessed from the Superfund RPM or RCRA permit writer in the EPA Regions, or their State counterparts.

Both RCRA and LUST track the status of ground-water monitoring through permitting in RCRA, and by registering tanks in LUST. Specific regulations which have been issued to govern this process are primarily implemented by the States through authorized programs. In the Superfund program, EPA responds to and tracks releases or threatened releases of hazardous substances, pollutants or contaminants, requires responsible parties to respond to releases or threatened releases and conducts oversight of their response.

2. Office of Pesticides and Toxics Substances (OPTS)

OPTS, in carrying out its responsibilities, can request and receive data relating to a chemical's impact on ground water. These data may cover physical and chemical characteristics, fate of the chemical in the environment studies, information on the amount of material released onto land or injected into the soil, and ground-water monitoring studies. Much of the data obtained is utilized in the assessment of risk associated with the chemical from its release into the environment. The Office also carries out specific projects and research to obtain data that supports the improvement of its regulatory decision process and evaluates the impact of its regulatory decisions on the environment.

The Pesticides in Ground-Water Data Base contains information derived from monitoring studies conducted by pesticide registrants, universities, and government agencies. The data base identifies the pesticides that have been looked for in ground water, the areas that have been monitored, and the pesticides that have been detected. The data base will be used by the Agency to supplement the regulatory process for pesticides. It is being used to target pesticides that are contaminating ground water and establish priority candidates for regulation to mitigate such problems. It will also be used to highlight vulnerable areas for which reduced applications or other restrictions may be warranted, and to depict data gaps where additional monitoring should be conducted. The ground-water data base is presently printed and distributed to the Regions, States, and other interested parties. Consideration is being given to making the data base available via electronic transfer through OPP's Pesticide Information Network.

A significant data collection effort underway is the National Pesticide Survey (NPS). The primary purpose of the NPS is to characterize, for the first time, the occurrence and levels of pesticide residues in rural domestic wells and community system wells across the nation using a statistical design. A second major purpose of the NPS is to assess any major associations among patterns of agricultural pesticide use, hydrogeologic characteristics indicative of ground-water vulnerability to pollution and pesticide residues in wells.

Information gained from the planning stages of the NPS is already being used by EPA and pesticide registrants in designing other required studies. Health Advisory Levels generated by the survey have been used in other efforts by OPP such as the Agricultural Chemicals in Ground-Water Strategy and vulnerability measures generated for US counties. Multiresidue analytical methods developed for the NPS are currently being evaluated for uses by EPA and non-EPA parties. The results of this study are expected to be completed by the end of 1990 or beginning of 1991. Interim findings have been printed for distribution to the Regions, States, and other interested parties.

Data collection also occurs through chemical-specific studies by registrants. The data required to support the registration of a pesticide attempt to predict its degradation, terrestrial and aquatic metabolism, mobility, dissipation and accumulation in the environment. Additional retrospective or prospective ground-water monitoring studies may be required if a pesticide or its degradates demonstrate those characteristics of persistence and mobility generally associated with chemicals that have a high potential for contaminating ground water. These data are utilized in OPP's exposure assessment and in model simulations on the pesticide. The results of these data are currently held in the Environmental Fate and Ground Water Branch and are not readily available to other parties. Consideration is being given to making the data base available via electronic transfer through OPP's Pesticide Information Network.

In the Office of Toxic Substances, ground-water monitoring is a required permit condition for TSCA landfills. Regulations in 40 CFR section 761.75(b)(6) address ground-water monitoring for PCBs and other parameters at TSCA chemical landfills.

3. Office of Research and Development (ORD)

ORD ground-water research serves two functions: providing support for program office regulatory and technical assistance needs, and building a longer term scientific understanding of the subsurface as a basis for EPA's current and future activities regarding ground water. As part of this research program, ORD collects and utilizes ground-water data in certain laboratory and field research efforts. Most of this is project-specific data generation, such as collection, storage, and analysis of ground-water quality data from field experiments. An example would be ground-water sample data from a multi-year field experiment. Some, however, entail analysis of trends in large sets of data, such as identifying indicator parameters among VOCs from examination of hazardous constituents commonly found in ground-water at hazardous waste sites nationally.

For research purposes, data is collected and utilized to fit the purposes of particular research efforts. For example, a research project can be designed with unique combinations of sampling equipment, sampling frequency, statistical analyses, computer data entry, and data reporting format. These can vary considerably, depending upon the nature of the project, judgment of the researcher, and intended product. Thus, considerable variability is inherent in research data collection and utilization, despite general aims of standardizing laboratory and field methods.

Accessibility to ground-water that ORD collects and utilizes is also variable. Most data can be accessed by request from the laboratory performing or sponsoring individual projects, or can be gleaned from published reports or journal articles.

There are also several information clearinghouse projects underway, as explained in section IV.C.8. of this Report. These sources provide access to project descriptions, articles, reports, and models rather than numerical ground-water data.

An advancement is underway to provide access to large ground-water datasets. The International Ground-Water Modeling Center (IGWMC) has begun to collect and automate ground-water data from several well-studied locations in order to enhance the use of these datasets for model validation. This effort will enable developers and users of various ground-water models to compare their modeling results with field data generated from well characterized sites such as the Cape Cod aquifer, which have undergone long-term monitoring by various agencies with extensive QA/QC procedures.

4. Office of Water (OW)

The SDWA and CWA programs are largely delegated to the States, leaving OW itself in a policy and oversight role. As such, OW performs very little data collection and utilization. Office of Ground Water Protection (OGWP) and its Regional Ground-Water Offices do take an active role in facilitating the sharing and use of ground-water related data sets.

OW maintains STORET, EPA's computerized national database system for environmental monitoring data related to the quality of surface and ground-water within the United States. The system serves as a data repository and analysis tool for EPA, other Federal agencies, State and local governments, U.S. Territories, interstate commissions, universities, and Canadian agencies. The Water Quality System (WQS), the largest of the STORET components, contains data for over 700,000 ground and surface water sampling sites scattered across the nation. Data loaded into STORET are not of consistent quality.

The SDWA does not specifically require the collection of ground-water data. However, some State drinking water programs do require that public water supplies (PWSs) collect and report on the ground-water quality where ground-water wells are the source of drinking water. The most important users of ground-water data in the Drinking Water Program are the State governments who are often delegated responsibility for program operation. EPA Regions are responsible for the oversight of the delegated programs. OW uses ground-water data to help designate MCLs. Data to support the creation of new MCLs are obtained from literature searches, feedback from delegated program, special studies, and stratified random surveys.

Office of Drinking Water (ODW) maintains the Federal Reporting Data System (FRDS) to support the Drinking Water Program. FRDS tracks enforcement and violation actions for PWSs and does not contain routine nonviolation site-specific information such as water quality of samples. Regions and State-delegated programs enter data directly into FRDS.

ODW and OGWP have long recognized the need for data on the location of public supply wells. In an effort to provide this information, EPA and the USGS have assembled information on the location of water-supply wells in the southeast and northeast regions of the U.S. The information is currently available for use in databases and GIS.

The key decision-makers using ground-water data in the Underground Injection Control (UIC) Program are EPA Regions and delegated States. The UIC program functions which are supported by various types of ground-water data are: injection authorization (by permit or rule) and program enforcement. Ground-water quality data are not routinely collected by permittees for an injection well, but may be made available for review by program authorities through State Public Health Departments.

ODW maintains the Federal Underground Injection Reporting System (FURS) to support the UIC Program. Data are supplied by the Regions and State-delegated programs. FURS represents a national inventory of underground injection well facilities; however, it does not routinely have information on individual wells.

B. What States and Local Governments Do

States are responsible for implementing and enforcing many Federal policies and standards. With the assistance of Clean Water Act grants, most States are now developing and implementing ground-water protection strategies addressing various sources of contamination. States collect ground-water data in response to these Federally-generated as well as State-generated programs. A few states have delegated data collection responsibility to local governments, which also conduct some monitoring for their own purposes. Also, self-monitoring by permitted businesses (e.g., public water supplies, RCRA facilities) is a common practice in ground-water protection programs. There is a great deal of variety in the extent and quality of State and local monitoring programs.

Monitoring is conducted to address a variety of needs depending upon the program requirements. Community public supply wells are monitored quarterly for chemical and radiological parameters as required in the SDWA. Ground-water monitoring is also required as a permit specification for sanitary landfills, sludge disposal sites, RCRA facilities, and TSCA landfills. Results of the monitoring are usually submitted on a quarterly, semi-annual and annual basis. Investigative monitoring determines the nature of contamination at UST and CERCLA sites. Research monitoring is conducted on specific problems or directed at a defined project area. Each of the programs has a different regulatory authority, program objective, and requirements for conducting the monitoring program. In addition, each program has a unique form of storing, accessing and releasing information. This may range from hard copy filing systems to computerized databases.

Hydrogeologic and related geographic evaluations are performed to identify activities and/or areas where ground water is contaminated or threatened and to allow evaluation and interpretation by managers. Usually, this is performed through research monitoring and investigative monitoring. Research monitoring is directed at specific projects to enhance understanding of geologic and hydrologic regimes. Investigative monitoring, on the other hand, is used to examine various potential sources of contamination which may enter the ground-water system.

Remediation of ground-water contamination is considered a high priority in the States and many have adopted guidelines and policies which are more stringent than EPA's health-based and risk-based requirements. These requirements also extend to solid waste management facilities, and sensitive watersheds/drinking water sources. In many instances, the owner/operator, or responsible party's requirement for remediation is to clean-up to background concentrations, i.e., complete restoration of the damaged aquifer to its previous condition.

Status tracking is required through several regulatory and water quality programs. In most cases, it is the States that implement and operate the EPA's environmental programs that address ground water. For programs such as RCRA, UIC, UST, and PWSs, States are required to enter permitting and compliance status information into national databases such as HWDMS or RCRIS for RCRA. In addition to the national environmental programs, many States have developed their own programs to protect local ground-water resources, and have developed their own tracking systems.

Laboratory and field research in State and local agencies varies, but is generally conducted on a limited scale. When conducted it is most often related to site investigations. Typically, these government agencies rely on EPA, USGS, other Federal agencies, private sources, and universities to provide information related to research advances in the field of ground-water management.

In the area of pesticides, many States have initiated ground-water monitoring programs and have identified areas where pesticide contamination of water resources is a problem. In OPP's Agricultural Chemicals in Ground Water Strategy (draft), monitoring of pesticides in ground water is emphasized as a feedback mechanism for determining the success or failure of contamination prevention efforts.

C. What Other Federal Agencies Do

The USGS routinely collects large amounts of ground-water and surface water data, and therefore developed automated systems for information storage and retrieval. The USGS operates WATSTORE (Water Data Storage and Retrieval System), which includes GWSI (Ground-Water Site Inventory), an inventory of wells, springs, and other sources of ground-water and relational information such as hydrogeologic characteristics, well construction history, and water quality measurements. Data are loaded into STORET monthly. NAWDEX (National Water Data Exchange) indexes available water research data for user access.

Other related information retrieval systems at the USGS, although not specifically for numerical ground-water data are WRSIC (Water Resources Scientific Information Center), which maintains abstracts and bibliographic citations on the scientific literature and research in progress, and various clearinghouses. Related mapping efforts includes GIRAS (Geographic Information Retrieval Analysis System), and standard hard copy geologic and topographic maps. These maps, which support ground-water investigations, are not consistently automated.

Various research efforts in ground water are underway at the USGS. Two large and significant data-generating projects are NAWQAP, (National Water Quality Assessment Program), where selected areas of the nation will be monitored extensively for surface and ground-water quality, and the interagency Midwest Water Quality Initiative, which is investigating various factors and processes governing the effects of agricultural chemicals on surface and ground water. EPA coordinates with USGS on planning these two efforts. Many other, smaller and more specific research projects generate ground-water data which, like EPA's, are not uniform in specifications, frequency, or format, and are not routinely entered into large, accessible databases.

USDA's data collection is essentially on soil types and localities, however a bibliographic database including water management information is maintained. USDA supports a national ground-water quality directory of Federal, State, and private sector research projects, and records data on the results of their clean-water program. Significant increases in ground-water research, data development, and automation are planned under the Midwest Water Quality Initiative and Water Quality Plan. EPA is coordinating with USDA on these activities.

DOE and DOD collect and utilize ground-water data in order to comply with CERCLA, RCRA, and NRC requirements. Compliance entails intensive ground-water monitoring, hydrogeologic evaluations, and ground-water program tracking, as well as research on fate and transport processes, monitoring instrumentation, and remedial techniques.

Other agencies with ground-water data collection and utilization functions, primarily connected with research, are NASA, NSF, NRC, BOM, and BLM.

II. DECISIONS MADE WITH GROUND-WATER DATA

A. Permitting and Compliance Under Federal and State Programs

In the UIC program, States have primacy for implementation and the decisions affecting permitting, compliance, and enforcement activities. This includes decisions on the operation of underground injection well systems and preventing their impacts on ground-water resources.

In RCRA, both the States and EPA utilize ground-water monitoring data for permitting and compliance decisions for detection monitoring to determine if a release has occurred, and assessment monitoring to determine extent and characteristic of contamination. Results from assessment monitoring can lead to lengthy and costly clean-ups. Also, RCRA hazardous waste listing and delisting decisions are increasingly based on national and site-specific ground-water data. Superfund National Priority List sites are ranked in part through evaluation of the ground-water pathway, which utilizes site-specific ground-water data.

In the UST program, if ground-water monitoring indicates presence of free petroleum product, the owner/operator is required to immediately notify the State or local implementing agency. The agency may follow up with release confirmation and corrective action.

Under TSCA, OTS also utilizes ground-water monitoring data for permitting and compliance decisions. Such data are used to determine if a release has occurred from a TSCA landfill, a remediation project, or a PCB spill.

B. Risk Assessments

Ground-water contamination is an issue at most hazardous waste sites. Thus, risk assessments based on ground-water data are critical to the remedial process. The risk assessment process uses ground-water data as part of the exposure assessment step to predict the extent of exposure and the number of people exposed to released contaminants, and the chronic exposure concentrations. These data are used to document contaminant sources, pathways, exposure points and routes.

Using the ground-water concentration data and site-specific exposure scenarios, the risk assessor calculates daily intake of contaminants from ground-water by ingestion and inhalation. Chemical-specific carcinogenic risks and systemic hazard indexes are calculated, then summed across compounds and exposure routes. Usually, two separate sets of risk estimates are prepared, the first based on average ground-water concentrations and the second based on maxima or 95% upper confidence limits.

OTS assesses potential for ground-water contamination as part of its screening of chemical suspects or as input to fate and transport modeling for releases. Fate and transport models for contaminant movement in soil and ground water are used for both generic and site-specific assessments.

C. Remedial Actions

Ground-water data generated during the investigatory phase of a CERCLA, LUST, RCRA, or TSCA study are used for a sequence of decisions. Initially, the data is reviewed as a means of providing a three-dimensional picture of a contaminant plume, or the immiscible petroleum "pancake," in the aquifer. At

LUST sites, owners/operators are required to begin the removal of free product upon detection. The plume extent, the velocity with which it moves, and the environmental fate of these contaminants are determined in order to estimate risk to potential receptors.

This information is also used to notify potential receptors of such risk. Once a risk assessment is conducted to predict any impacts to these receptors, target clean-up goals are feasible. The number of contaminants, their chemical and physical characteristics, concentration gradients within the plume, and tendency of the aquifer matrix to interact with the contaminants may all preclude the use of current remedial technologies. Hence, reliable ground-water data is not only critical in determining the nature of remedial activities, but also may provide the basis for deciding that certain techniques are technically infeasible.

D. Targeting of Oversight Activities

In the RCRA corrective action area, there are thousands of solid waste management units which are candidates for permit or enforcement action. Many have ground-water releases. Careful oversight of this program will be necessary to meet statutory deadlines. Another area where oversight activities are targeted with ground-water data is Preliminary Assessment/Site Investigations (PA/SIs) in CERCLA.

In some Regions, data bases with ground-water data used by EPA programs are downloaded into a Geographic Information System (GIS) which is then used to target priority attention of oversight activities. The GIS can be used to develop a ranking system for corrective action candidates using available data and GIS mapping techniques. Using GIS technology, priorities for the scheduling of future PA/SIs can be established.

GIS is an emerging method for targeting activities, and is assuming a greater role. GIS is essentially a tool for storing and manipulating geographic information in a computer. It is an information system in which both spatial and non-spatial data are stored, analyzed and displayed. GIS technology is unique in that it integrates computer graphic capabilities with an automated database management system, although it is not necessarily limited to the confines of a single, well-defined software system. A unique aspect of GIS is that the maps created can be organized into various thematic layers, which can be displayed in any combination desired. By using presently available data bases from the USGS and EPA (DLG, GIRAS, CERCLIS, WHDMS, PWSS, UIC, etc.), thematic coverages can be created to display ground-water quality and assist managers in making planning decisions.

Other methods for targeting oversight activities include environmental or public emergencies, risk assessments, informal comparisons of risk, analysis of cost effective options, and a prevention-focused approach using an aquifer classification system.

E. Protection of Wellheads and Vulnerable Aquifers

The Wellhead Protection (WHP) Program, established in 1986 by the Amendments to the SDWA, is designed to protect the recharge area to public water supply wells from sources of contamination. Unlike most EPA Programs which are regulatory in nature and address specific sources of contamination, the WHP Program is designed to assist State and local governments in focusing on the resource itself through a comprehensive analysis of the land uses, geology, hydrology, and institutional arrangements impacting a public water supply well rather than on controlling a limited set of contamination sources via State or Federal regulations.

Protection of aquifers presents a myriad of problems for the Federal, State and local decision-makers, which are often hinged on the lack of information. The vulnerability of an aquifer to contamination mainly depends upon the extent and location of recharge areas in relation to contamination sources, depth to the ground-water body, the composition of the soil and rocks overlying the aquifer, the recharge rate, the nature of the ground-water flow system, and the potential for biodegradation of contaminants. Much of the information to support such a vulnerability assessment is not readily available. Research on methods for performing these assessments is in progress.

F. Ground-Water Status and Trends (indicators of water quality)

Uniform "indicators" are useful for the characterization of ground-water quality across local, State, Regional and National areas. Ground-water indicators provide consistent models for the presentation of ground-water quality data and trends over time. They can provide a decision-maker with a better grasp of the risks posed by ground-water contamination and help to improve his/her ability to focus efforts on the greatest risks.

G. Assessment of Pesticide Impacts

Ground-water data are used by OPTS as a basis for regulatory decisions, measure of the effectiveness of regulatory decisions, a basis for additional regulatory actions, and as an indicator of potential environmental problems. When residues of a particular pesticide are detected in ground water at a level of concern, OPTS has a range of options available to prevent or minimize the contamination. Several of the available regulatory options are:

a) Require additional labeling that informs the user of the pesticides's leaching potential under certain situations and steps the user can take to reduce the likelihood of the pesticide to contaminate ground water;

b) Classify the pesticide for "restricted use" to be applied only by an applicator that has been trained and certified on the use of the pesticide;

c) Take steps to cancel some or all uses of the pesticide. The proposed Agricultural Chemicals in Ground-Water Strategy would provide a framework for States to develop a State management plan for preventing or minimizing ground-water contamination in lieu of cancellation.

III. Data Collection

A. Needs for Additional or Different Data

1. Additional baseline data

A vast amount of data exists within the ground-water community, often at broad Regional or national scales, and collected by a multitude of programs and organizations. Much of this data has not been automated by the data holders. The data were frequently collected under inconsistent standards, protocols and quality assurance programs, and often focused on the narrow needs of the collector. The quality of much of the data is not known and may potentially be unreliable for use in decision-making. Site-specific, sub-county and county data are often lacking.

There is also a strong need for more complete health effects data and drinking water standards for comparison to ground-water concentrations and subsequent decision-making on remediations.

2. Data for water quality trend analyses

In addition to the need for certain kinds of additional baseline information, there has been a growing awareness of the need to collect information to support ground-water indicators in an effort to characterize ground-water quality across local, State, Regional and National areas and over time. In FY89, OGWP compiled a series of ground-water indicators for public water supplies, hazardous waste sites, waste and industrial sites, area-wide sources of nitrate contamination, and area-wide sources of pesticide contamination. Region III completed a pilot study with Pennsylvania on the use of ground-water indicators, with mixed results on the ability of indicators to predict other aspects of water quality. Additional work is needed to refine the existing indicators and to develop other program and location specific indicators to be used in more fully characterizing the quality of the Nation's ground water. Inherent in the process of using indicators is the existence of uniform data to support the indicators. Currently, the ground-water community lacks such a program and focus for uniform data collection.

3. Data collection in automated format

Currently, very little of the ground-water data collected by or requested by Federal, State and local governments are available in a readily usable form. Ground-water data submitted to government agencies are commonly in the form of voluminous paper reports. This format precludes the ability of staff to perform rapid analyses of spatial and temporal trends and constitutes a significant records management problem. The specific data types that are missing or not readily available in automated format include:

- monitoring data - most of the existing data are in hardcopy format; data were collected under inconsistent protocols and are sometimes of unknown quality;
- inventories of sources of contamination at State and local levels - information to support the inventories is scattered or unavailable;
- hydrogeologic, land use and natural resources data information to support ground-water site analyses, ground-water modeling, vulnerability assessments, etc. are scattered and often only in hardcopy or map format;
- zoning, tax, real estate maps - most remain in hardcopy format;
- demographic data - some demographic data are available in machine-readable format; however, significant technical resources are needed to load and use the data on local systems;
- well construction documentation and well logs at State, county, and local levels - most is in hardcopy format.
- locations of public water supplies - most is in hardcopy only.

It is also important to note that numerous data-collection methodologies are available; however, to obtain comparable ground-water monitoring data, consistent data collection and analytical methods must be used. This list of methods must be readily available to Federal, State and local agencies as well as the regulated community and academia.

4. Research needs

Additional data collection and analysis would improve EPA's understanding of sources of ground-water contamination. For example, the data generated from intensive ground-water monitoring under USGS' NAWQAP survey could help EPA understand the significance of various point and non-point sources of ground-water contamination, if the results can be clearly related to specific sources. In addition, the Midwest Water Quality Initiative will provide data for EPA's purposes in understanding transport and fate of agricultural chemicals in water. In both efforts, EPA is coordinating with other Federal agencies in order to ensure that these data are collected and analyzed so that the results are useful to EPA. In the latter case, ORD has presented a research proposal to establish a cooperating research role with USGS and USDA. ORD would participate by analyzing subsurface processes and ecological effects of particular interest to EPA research and program offices.

EPA also has a need to collect and have better access to ground-water data from closed or remediated hazardous waste sites in order to systematically evaluate the effects of these closures and remedies on ground-water quality. A research proposal to collect and analyze such data has been considered.

5. Resource implications of additional data collection

Although several of EPA's major programs gather ground-water data for their own purposes, the level of funding for these programs and the intended use of the data vary. Similar data gathering diversity also occurs in the States. In any data collection effort, the cost is a function of the number of samples, the number of compounds for which each sample is analyzed, and the level of quality assurance. As EPA has become increasingly involved in gathering ground-water data, levels of quality assurance have increased, minimum data sets have been established and the number of samples and compounds analyzed has increased. With these increases have come increases in costs.

In order to control these costs, programs such as Superfund, which historically have generated large amounts of site-specific data, are now looking to manage the volume of analytical data gathered by using on-site mobile labs, new screening systems and methods of analysis, and more efficient quality assurance. All of these activities are consistent with the program's data quality objectives. In other programs, resource constraints have already resulted in careful choices among activities related to data acquisition, handling and storage. For these reasons, careful cost benefit analysis must be included in any proposals for additional data gathering and changes in data handling or storage.

B. Data Quality

All data used in the management of the ground-water resource must be of known and documented quality. In order to evaluate the "usefulness" of data, a determination must be made as to how the data will be applied, e.g., health and safety decisions, site characterization, risk assessment, etc. In many instances, data collected at a site may be suitable for several categories of decision-making. However, the accuracy and precision of the data must be specified in order to determine if data use for each decision is appropriate. In the past, there was little effort made to define data requirements prior to data collection. In addition, much existing data is of unknown quality because most of it was submitted by the regulated community to comply with the regulatory program governing their activities, and verification of it's quality was not fully assessed.

In addition to the problem faced with unknown data quality, data quality objectives vary across all the agency programs. DQOs are the qualitative and quantitative statements that specify the quality of data required to support Agency decision-making. They provide the substantive basis for the detailed technical design of procedures to be used in data collection, quality assurance and quality control (QA/QC). DQOs were established by each program office to meet the objectives of their decision-making. Therefore, use of one program's data may not be applicable to another because DQOs embody an understanding of what applications of the data will be made and what limitations of the data are expected. For example, DQOs under the Public Water Supply program are designed to meet established regulatory standards, while under the CERCLA program, DQOs are designed to meet lower health based and/or risk based standards.

C. Improvements and Changes Underway

EPA is currently working to improve data collection through a number of activities, including:

- Ground-Water Indicators - OGWP compiled a set of indicators that the Agency and the States can use to track progress and set priorities in ground-water protection efforts. The ground-water indicators cover the following areas of concern: public drinking water supplies; hazardous waste sites; waste sites and industrial sites; area-wide sources of nitrate and pesticide contamination. OGWP is currently sponsoring State pilot projects with New Jersey, Minnesota, and Idaho to further refine the current indicators. The focus of the pilots is on implementing the indicators in the States' SDWA 305(b) water quality reports;

- Data Management Standards - EPA is currently working on a number of Agency-wide data and data management standards which will improve the collection of ground-water and related data. OIRM is completing policy analyses which will guide decisions concerning Agency practices in the management of facility and spatial data. The proposed facility data standard will provide a much-needed link for sharing data on facilities across Programs, and will improve EPA's capability to maintain a central inventory of basic information on regulated facilities. The spatial data standard will establish a consistent definition of spatial data parameters for the Agency. This standard is critical to the successful implementation of GIS technology.

- OPPE has established an Agency-wide workgroup on electronic reporting standards (ERS). ERS would facilitate the electronic transfer of reporting data (e.g., from the regulated community, analytical labs) to EPA and eliminate many labor-intensive, paperbased, routine data entry efforts. The OPPE Workgroup is drafting an Agency policy on ERS and serves to coordinate ERS activities within EPA.

- QAMS Program - For each category of information used by EPA, there are appropriate procedures and systems to enhance the information's utility and safeguard against errors. The system which fulfills this function for environmental data is the mandatory Agency-wide quality assurance program, which was officially established in 1979 and formally documented in 1984 by means of EPA Order 5360.1 ("Policy and Program Requirements to Implement the Mandatory Quality Assurance Program"). The QAM Staff is charged with overseeing the QA activities of the Agency. QAMS has focused its attention on the development of conceptual tools, such as Data Quality Objectives, as well as on implementation support and education.

D. Options

1. In order for EPA to have ground-water trend information to establish environmental goals for the Agency, to evaluate the quality of the environment, and to evaluate the performance of EPA Programs, options for EPA to assess the quality of our nation's ground-water include:

- use the results of the USGS National Water Quality Assessment Program (NAWQAP) (results due in the mid 1990's);

- use State efforts to provide the data through the CWA Section 305(b) reports to Congress;

- use OGWP's guidance for ground-water indicators, also included in the 305(b) report;

- conduct a national assessment on a routine basis using existing data bases;

2. Options for how EPA can improve ground-water data quality include:

- develop and use consistent ground-water data quality objectives across all EPA Programs;

- develop and use Program-specific ground-water data quality objectives;
- require the inclusion of information on data quality in all databases containing ground-water data.

3. Options for ways EPA can develop and disseminate more health effects information on a faster basis:

- Increase resources to ODW to expedite the development of MCLs (ODW is under a Congressional timetable for developing MCLs after the initial 83 MCLs are in place. The timetable requires the development of 25 MCLs every three years.);
- Increase resources to EPA's peer review process associated with the entry of summary health risk assessment and regulatory information on chemical substances into the Integrated Risk Information System (IRIS).

IV. DATA ACCESSIBILITY

A. What Kinds of Ground-Water Data are Being Requested from EPA Programs?

1. Hazardous waste programs

Information is frequently requested from EPA's hazardous waste programs. Requests are usually linked to particular sites, and originate from Congress, the regulated community, environmental organizations, the media, academia, and other public agencies. Much of the ground-water information which the hazardous waste programs use is available for public inspection, however it often is stored in filing cabinets. Enforcement-confidential files, containing data from sites or facilities in litigation is not easily accessible. Similar limitations apply to ground-water data that is considered confidential business information (CBI).

2. Pesticides and Toxic Substances

OPTS responds to a variety of requests from a multitude of different constituents. Requests for ground-water information/data are received from Congress, the regulated industry,environmental organizations, academia, other Federal, State and local agencies, public media, and other interested parties. The more focused and sophisticated information/data requestor, such as the regulated industry or other agencies, generally asks for more scientific data whereas public media and other interested parties ask for summary information. OPTS' data is accessible to the public after a CBI clearance is performed. The following is a list of some of the more typical data requests:

- A list of chemicals/pesticides that demonstrate a high potential to contaminate ground-water;
- Information/data on chemical/physical characteristics, the environmental fate, and toxicity to mammalian, avian, or aquatic organisms on a specific chemical or a group of chemicals;
- A copy of all the data developed during a particular monitoring project or contained within a given dataset;
- Acceptable analytical methodology for a chemical or a group of chemicals;
- What monitoring studies have been carried out for a chemical or a group of chemicals? Who were the principal investigators? Where can they be contacted?

frequency, statistical analyses, computer data entry, and data reporting format. These can vary considerably, depending upon the nature of the project, judgment of the researcher, and intended product. Thus, considerable variability is inherent in research data collection and utilization, despite general aims of standardizing laboratory and field methods.

Accessibility to ground-water that ORD collects and utilizes is also variable. Most data can be accessed by request from the laboratory performing or sponsoring individual projects, or can be gleaned from published reports or journal articles.

There are also several information clearinghouse projects underway, as explained in section IV.C.8. of this Report. These sources provide access to project descriptions, articles, reports, and models rather than numerical ground-water data.

An advancement is underway to provide access to large ground-water datasets. The International Ground-Water Modeling Center (IGWMC) has begun to collect and automate ground-water data from several well-studied locations in order to enhance the use of these datasets for model validation. This effort will enable developers and users of various ground-water models to compare their modeling results with field data generated from well characterized sites such as the Cape Cod aquifer, which have undergone long-term monitoring by various agencies with extensive QA/QC procedures.

4. Office of Water (OW)

The SDWA and CWA programs are largely delegated to the States, leaving OW itself in a policy and oversight role. As such, OW performs very little data collection and utilization. Office of Ground Water Protection (OGWP) and its Regional Ground-Water Offices do take an active role in facilitating the sharing and use of ground-water related data sets.

OW maintains STORET, EPA's computerized national database system for environmental monitoring data related to the quality of surface and ground-water within the United States. The system serves as a data repository and analysis tool for EPA, other Federal agencies, State and local governments, U.S. Territories, interstate commissions, universities, and Canadian agencies. The Water Quality System (WQS), the largest of the STORET components, contains data for over 700,000 ground and surface water sampling sites scattered across the nation. Data loaded into STORET are not of consistent quality.

The SDWA does not specifically require the collection of ground-water data. However, some State drinking water programs do require that public water supplies (PWSs) collect and report on the ground-water quality where ground-water wells are the source of drinking water. The most important users of ground-water data in the Drinking Water Program are the State governments who are often delegated responsibility for program operation. EPA Regions are responsible for the oversight of the delegated programs. OW uses ground-water data to help designate MCLs. Data to support the creation of new MCLs are obtained from literature searches, feedback from delegated program, special studies, and stratified random surveys.

Office of Drinking Water (ODW) maintains the Federal Reporting Data System (FRDS) to support the Drinking Water Program. FRDS tracks enforcement and violation actions for PWSs and does not contain routine nonviolation site-specific information such as water quality of samples. Regions and State-delegated programs enter data directly into FRDS.

ODW and OGWP have long recognized the need for data on the location of public supply wells. In an effort to provide this information, EPA and the USGS have assembled information on the location of water-supply wells in the southeast and northeast regions of the U.S. The information is currently available programs such as RCRA, UIC, UST, and PWSs, States are required to enter permitting and compliance status information into national databases such as HWDMS or RCRIS for RCRA. In addition to the national environmental programs, many States have developed their own programs to protect local ground-water resources, and have developed their own tracking systems.

Laboratory and field research in State and local agencies varies, but is generally conducted on a limited scale. When conducted it is most often related to site investigations. Typically, these government agencies rely on EPA, USGS, other Federal agencies, private sources, and universities to provide information related to research advances in the field of ground-water management.

In the area of pesticides, many States have initiated ground-water monitoring programs and have identified areas where pesticide contamination of water resources is a problem. In OPP's Agricultural Chemicals in Ground Water Strategy (draft), monitoring of pesticides in ground water is emphasized as a feedback mechanism for determining the success or failure of contamination prevention efforts.

C. What Other Federal Agencies Do

The USGS routinely collects large amounts of ground-water and surface water data, and therefore developed automated systems for information storage and retrieval. The USGS operates WATSTORE (Water Data Storage and Retrieval System), which includes GWSI (Ground-Water Site Inventory), an inventory of wells, springs, and other sources of ground-water and relational information such as hydrogeologic characteristics, well construction history, and water quality measurements. Data are loaded into STORET monthly. NAWDEX (National Water Data Exchange) indexes available water research data for user access.

Other related information retrieval systems at the USGS, although not specifically for numerical ground-water data are WRSIC (Water Resources Scientific Information Center), which maintains abstracts and bibliographic citations on the scientific literature and research in progress, and various clearinghouses. Related mapping efforts includes GIRAS (Geographic Information Retrieval Analysis System), and standard hard copy geologic and topographic maps. These maps, which support ground-water investigations, are not consistently automated.

Various research efforts in ground water are underway at the USGS. Two large and significant data-generating projects are NAWQAP, (National Water Quality Assessment Program), where selected areas of the nation will be monitored extensively for surface and ground-water quality, and the interagency Midwest Water Quality Initiative, which is investigating various factors and processes governing the effects of agricultural chemicals on surface and ground water. EPA coordinates with USGS on planning these two efforts. Many other, smaller and more specific research projects generate ground-water data which, like EPA's, are not uniform in specifications, frequency, or format, and are not routinely entered into large, accessible databases.

USDA's data collection is essentially on soil types and localities, however a bibliographic database including water management information is maintained. USDA supports a national ground-water quality directory of Federal, State, and private sector research projects, and records data on the results of their clean-water program. Significant increases in ground-water research, data development, and automation are planned under the Midwest Water Quality Initiative and Water Quality Plan. EPA is coordinating with USDA on these activities.

DOE and DOD collect and utilize ground-water data in order to comply with CERCLA, RCRA, and NRC requirements. Compliance entails intensive ground-water monitoring, hydrogeologic evaluations, and ground-water program tracking, as well as research on fate and transport processes, monitoring

LUST sites, owners/operators are required to begin the removal of free product upon detection. The plume extent, the velocity with which it moves, and the environmental fate of these contaminants are determined in order to estimate risk to potential receptors.

This information is also used to notify potential receptors of such risk. Once a risk assessment is conducted to predict any impacts to these receptors, target clean-up goals are feasible. The number of contaminants, their chemical and physical characteristics, concentration gradients within the plume, and tendency of the aquifer matrix to interact with the contaminants may all preclude the use of current remedial technologies. Hence, reliable ground-water data is not only critical in determining the nature of remedial activities, but also may provide the basis for deciding that certain techniques are technically infeasible.

D. Targeting of Oversight Activities

In the RCRA corrective action area, there are thousands of solid waste management units which are candidates for permit or enforcement action. Many have ground-water releases. Careful oversight of this program will be necessary to meet statutory deadlines. Another area where oversight activities are targeted with ground-water data is Preliminary Assessment/Site Investigations (PA/SIs) in CERCLA.

In some Regions, data bases with ground-water data used by EPA programs are downloaded into a Geographic Information System (GIS) which is then used to target priority attention of oversight activities. The GIS can be used to develop a ranking system for corrective action candidates using available data and GIS mapping techniques. Using GIS technology, priorities for the scheduling of future PA/SIs can be established.

GIS is an emerging method for targeting activities, and is assuming a greater role. GIS is essentially a tool for storing and manipulating geographic information in a computer. It is an information system in which both spatial and non-spatial data are stored, analyzed and displayed. GIS technology is unique in that it integrates computer graphic capabilities with an automated database management system, although it is not necessarily limited to the confines of a single, well-defined software system. A unique aspect of GIS is that the maps created can be organized into various thematic layers, which can be displayed in any combination desired. By using presently available data bases from the USGS and EPA (DLG, GIRAS, CERCLIS, WHDMS, PWSS, UIC, etc.), thematic coverages can be created to display ground-water quality and assist managers in making planning decisions.

Other methods for targeting oversight activities include environmental or public emergencies, risk assessments, informal comparisons of risk, analysis of cost effective options, and a prevention-focused approach using an aquifer classification system.

E. Protection of Wellheads and Vulnerable Aquifers

The Wellhead Protection (WHP) Program, established in 1986 by the Amendments to the SDWA, is designed to protect the recharge area to public water supply wells from sources of contamination. Unlike most EPA Programs which are regulatory in nature and address specific sources of contamination, the WHP Program is designed to assist State and local governments in focusing on the resource itself through a comprehensive analysis of the land uses, geology, hydrology, and institutional arrangements impacting a public water supply well rather than on controlling a limited set of contamination sources via State or Federal regulations.

Protection of aquifers presents a myriad of problems for the Federal, State and local decision-makers, which are often hinged on the lack of information. The vulnerability of an aquifer to contamination mainly depends upon the extent and location of recharge areas in relation to contamination sources, depth to ground-water quality across local, State, Regional and National areas and over time. In FY89, OGWP compiled a series of ground-water indicators for public water supplies, hazardous waste sites, waste and industrial sites, area-wide sources of nitrate contamination, and area-wide sources of pesticide contamination. Region III completed a pilot study with Pennsylvania on the use of ground-water indicators, with mixed results on the ability of indicators to predict other aspects of water quality. Additional work is needed to refine the existing indicators and to develop other program and location specific indicators to be used in more fully characterizing the quality of the Nation's ground water. Inherent in the process of using indicators is the existence of uniform data to support the indicators. Currently, the ground-water community lacks such a program and focus for uniform data collection.

3. Data collection in automated format

Currently, very little of the ground-water data collected by or requested by Federal, State and local governments are available in a readily usable form. Ground-water data submitted to government agencies are commonly in the form of voluminous paper reports. This format precludes the ability of staff to perform rapid analyses of spatial and temporal trends and constitutes a significant records management problem. The specific data types that are missing or not readily available in automated format include:

- monitoring data - most of the existing data are in hardcopy format; data were collected under inconsistent protocols and are sometimes of unknown quality;
- inventories of sources of contamination at State and local levels - information to support the inventories is scattered or unavailable;
- hydrogeologic, land use and natural resources data information to support ground-water site analyses, ground-water modeling, vulnerability assessments, etc. are scattered and often only in hardcopy or map format;
- zoning, tax, real estate maps - most remain in hardcopy format;
- demographic data - some demographic data are available in machine-readable format; however, significant technical resources are needed to load and use the data on local systems;
- well construction documentation and well logs at State, county, and local levels - most is in hardcopy format.
- locations of public water supplies - most is in hardcopy only.

It is also important to note that numerous data collection methodologies are available; however, to obtain comparable ground-water monitoring data, consistent data collection and analytical methods must be used. This list of methods must be readily available to Federal, State and local agencies as well as the regulated community and academia.

4. Research needs

Additional data collection and analysis would improve EPA's understanding of sources of ground-water contamination. For example, the data generated from intensive ground-water monitoring under USGS' NAWQAP survey could help EPA understand the significance of various point and non-point sources of ground-water contamination, if the results can be clearly related to specific sources. In addition, the Midwest Water Quality Initiative will provide data for EPA's purposes in understanding transport and fate of agricultural chemicals in water. In both efforts, EPA is coordinating with other Federal agencies in order to

- Ground-Water Indicators OGWP compiled a set of indicators that the Agency and the States can use to track progress and set priorities in ground-water protection efforts. The ground-water indicators cover the following areas of concern: public drinking water supplies; hazardous waste sites; waste sites and industrial sites; area-wide sources of nitrate and pesticide contamination. OGWP is currently sponsoring State pilot projects with New Jersey, Minnesota, and Idaho to further refine the current indicators. The focus of the pilots is on implementing the indicators in the States' SDWA 305(b) water quality reports;

- Data Management Standards - EPA is currently working on a number of Agency-wide data and data management standards which will improve the collection of ground-water and related data. OIRM is completing policy analyses which will guide decisions concerning Agency practices in the management of facility and spatial data. The proposed facility data standard will provide a much-needed link for sharing data on facilities across Programs, and will improve EPA's capability to maintain a central inventory of basic information on regulated facilities. The spatial data standard will establish a consistent definition of spatial data parameters for the Agency. This standard is critical to the successful implementation of GIS technology.

- OPPE has established an Agency-wide workgroup on electronic reporting standards (ERS). ERS would facilitate the electronic transfer of reporting data (e.g., from the regulated community, analytical labs) to EPA and eliminate many labor-intensive, paperbased, routine data entry efforts. The OPPE Workgroup is drafting an Agency policy on ERS and serves to coordinate ERS activities within EPA.

- QAMS Program - For each category of information used by EPA, there are appropriate procedures and systems to enhance the information's utility and safeguard against errors. The system which fulfills this function for environmental data is the mandatory Agency-wide quality assurance program, which was officially established in 1979 and formally documented in 1984 by means of EPA Order 5360.1 ("Policy and Program Requirements to Implement the Mandatory Quality Assurance Program"). The QAM Staff is charged with overseeing the QA activities of the Agency. QAMS has focused its attention on the development of conceptual tools, such as Data Quality Objectives, as well as on implementation support and education.

D. Options

1. In order for EPA to have ground-water trend information to establish environmental goals for the Agency, to evaluate the quality of the environment, and to evaluate the performance of EPA Programs, options for EPA to assess the quality of our nation's ground-water include:

- use the results of the USGS National Water Quality Assessment Program (NAWQAP) (results due in the mid 1990's);

- use State efforts to provide the data through the CWA Section 305(b) reports to Congress;

- use OGWP's guidance for ground-water indicators, also included in the 305(b) report;

- conduct a national assessment on a routine basis using existing data bases;

2. Options for how EPA can improve ground-water data quality include:

- develop and use consistent ground-water data quality objectives across all EPA Programs;

- Sources of other existing datasets relating to hydrology, hydrogeology, soil profiles/characteristics for a given geographical location, chemical/pesticide use sites, etc..

- Where and what chemicals/pesticides and their levels, have been detected in ground water;

- Information on the site and the amount of a chemical or chemical released on the land or injected into the soil;

- The concentrations and locations of PCBs that have been detected in ground water.

3. Research

Research data are being requested particularly on remedial actions and technologies. Hazardous waste site investigators are interested in which remedies have been successful in various scenarios, including what concentrations of hazardous constituents were obtained from various methods.

4. Other

Additional kinds of data that are being requested as part of ground-water analyses include:

- hydrogeologic, land use and natural resources data;
- zoning, tax, real estate maps;
- demographic data;
- well construction and well logs at State, county, and local scales.

C. Improvements and Changes Underway

EPA is working to improve the accessibility of ground-water data and related information through a number of activities including:

- Minimum set of data elements for ground water - OGWP, supported by a workgroup, developed a minimum set of data elements for ground-water. This set includes 22 data elements, including geographic, well/spring, and sample/analysis descriptors. These elements form the core use, on which ground-water data users can build their own data base by adding additional elements to meet their specific needs. EPA has adopted an Agency Order which requires the collection of the minimum set by EPA and its contractors whenever ground-water data collection activities occur. OGWP is also working with other Federal agencies, State and local governments, the regulated community, etc. to encourage them to voluntarily adopt the minimum set. OGWP has also initiated an effort to develop final definitions and formats for the minimum data set through a workgroup process.

- Region 10 Data Management Order - Region 10 adopted a Regional Order for Ground-Water Data Management which establishes consistent procedures for organizing, reporting, transmitting, storing and retrieving ground-water data in the Region. The major provisions of the Order include: ground-water data must be submitted to the Region in electronic format; the minimum set of data elements must be collected and stored; and all ground-water data must be stored in a centralized Regional ground-water data system. The Order applies to all ground-water data collection activities directly carried out by EPA staff or EPA contractors, including research and development, enforcement, and permit issuance.

- STORET enhancements - STORET is currently being modernized by OW and OIRM. Ground-water data can now be retrieved using the new user-friendly menu-driven retrieval system as well as the STORET command language. Once retrieved, the data can be manipulated using SAS, or presented in reports, tables, graphs, plots and maps. Data can also be downloaded to floppy diskettes. Provisions have been made in STORET for storing information on the minimum set of data elements for ground-water. In an ongoing effort to improve STORET's utility and user friendliness, EPA is now working on the development of user-friendly menu-driven data entry software as well as an electronic data transfer mechanism to facilitate entry of monitoring data into STORET. Data entry is still voluntary, however, so STORET provides the user with a limited data set.

• EPA/State Data Management Program - EPA initiated the EPA/State Data Management Program in 1985. The goal of the Program is to build and maintain the infrastructure needed (1) for effective State/EPA data management and sharing; (2) to integrate data across media and programs so EPA and State managers can target their efforts on environmental results.

There are currently two phases of the Program in progress: (1) data sharing by providing direct communication links to the States for access to EPA's national information systems; (2) data integration across programs and media. Most States now have direct communication links to EPA's computers. Many are using the national systems for storage and retrieval of data. EPA has initiated Phase 2 efforts through some State pilot studies.

• Steering Committee for Water Quality Data Systems - OW established this Steering Committee in 1987 to guide the continued development and management of STORET and other water quality systems. The Steering Committee activities are carried out by EPA staff representatives from OW's program offices, OIRM, the Regions, and two States. In FY89, the Committee sponsored Regional Forums on Water Information Systems for Regional and State staff. The Forums provided a setting for managers to exchange ideas about EPA and State activities related to ground and surface water information. The Steering Committee is currently working on a data sharing and system integration and compatibility study to evaluate OW's major systems as well as a system modernization study.

• Interagency Advisory Committee on Water Data/Ground-Water Subcommittee - The Advisory Committee on Water Data, established by the Secretary of the Interior, is chaired by USGS and is composed of representatives of Federal agencies, including EPA, that acquire or use water data. The Ground-Water Subcommittee provides a forum for interagency coordination and exchange of ideas on ground-water data management issues.

• Clearinghouses and bulletin boards - Clearinghouses and bulletin boards related to ground-water information include:

- OGWP Ground-Water Bulletin Board - OGWP has developed an electronic ground-water bulletin board for State and local governments on the LOCAL EXCHANGE which is focused on ground-water and wellhead protection issues.

- OSWER Bulletin Board - a PC-based electronic bulletin board for communications, dissemination of computer programs and databases related to solid and hazardous waste regulation, permitting and enforcement, including ground water.

- USGS Water Resources Scientific Information Center (WRSIC) - provides abstracts and computerized bibliographic information on water-related scientific information, and maintains an information base on water research in progress.

- USGS National Water Data Exchange - assists users of water data with the identification, location, and acquisition of needed data.

- National Water Well Association's National Ground-Water Information Center - provides access to bibliographic database containing references on the occurrence and utilization of surface and ground-water, and on water well technology. EPA/ORD previously supported "Ground-Water On-Line" development, but now it is wholly user supported.

- ORD's R.S. Kerr Environmental Research Laboratory has begun a Superfund site remediation technology clearinghouse, as a service to technical EPA and State staff in hazardous waste programs.

- ORD sponsors a ground-water model clearinghouse at the International Ground-Water Modeling Center (IGWMC), located at the Holcomb Institute.

- ORD's Center for Exposure Assessment Modeling (CEAM) operates an electronic bulletin board system for distribution and technical assistance on exposure models from ERL-Athens.

- A new, general ORD bulletin board system enhances communications and public access to many ORD publications, including those on ground-water research.

● The Office of Information Resources Management has published the Agency's Information Resources Directory (IRD) in response to ever-increasing demand for better awareness of information resources and greater information sharing throughout EPA and its partners in environmental protection. The IRD is a guide to a variety of widely used information resources, including information services and centers, information systems, and datasets that are compiled and utilized by OPTS.

In addition, the Office of Pesticide Program maintains the Pesticide Information Network (PIN) which presently is not listed in IRD. The PIN contains a compilation of monitoring projects being performed by Federal, State and local governments and private institutions. The database contains a short synopsis of each project, including chemicals, substrates and location. It also lists the name, address, and phone number of a person to contact to gain additional information on a specific project. The PIN is a free, PC-based network by which all interested parties may communicate and share monitoring information.

● Region III MERITs/ Temple Study (Regional Assessment Study) - This project employed GIS and various databases to conduct an integrated analysis to identify and rank counties in the Region with the most endangered ground water. The results of the study have supported decision-making on Regional program priorities and resource expenditures. A second phase is underway for the state of Pennsylvania, refining the database usage at a more detailed scale.

D. Options

1. Options for improving the automation of monitoring data obtained from the regulated community, EPA contractors, and EPA Program Offices' projects are:

- promulgate regulations requiring that all new data collected be automated and transferred to EPA in electronic format;
- publish EPA guidance directing the automation of data for carrying out and reporting monitoring data;
- promote voluntary use of electronic reporting by the regulated community and others to automate the data;

2. Options for EPA's role in automating national hydrogeologic, soils, and aquifer characterization data

include:

- involvement of USGS and the Soil Conservation Service (SCS) in more EPA projects which have side benefits of data automation;

- encouragement of USGS to institute a national program;

- funding USGS to automate data for EPA on a case-by-case basis;

- working with USGS upper management to restructure their program to more closely meet EPA's needs;

- establishing an internal information system at EPA which would identify where more in-depth information can be located, and what types of data are available.

The option of loading all ground-water data into one large, centrally accessible electronic data base has some appeal, but may not be feasible. While a large data base could provide almost immediate access to data, and could be used for trend analysis or responding to Congressional inquiries on a national scale, the cost of loading, quality assuring, and maintaining such a data base may not be justified by the benefits. These data are accessible already through various sources, although not easily or immediately. EPA could alternatively improve coordination and access to information available from internal files, State and other Federal agencies, in conjunction with GIS, to highlight areas of concern. (Areas of concern may include sensitive aquifers or areas of high ground-water use for drinking water which are potentially threatened by a large number of underground storage tanks, hazardous waste sites, or agricultural chemical use.)

3. Options of the Federal government for improving ground-water data access to States and local governments:

- national clearinghouse of pollution sources / contamination;
- national directory of ground-water information;
- national database of ground-water quality and related data;
- modernization and expansion of EPA's STORET system;
- improved State/Federal partnerships;
- funding State systems.

4. Options for EPA to ensure consistency among the ground-water data that are collected by EPA, the States and others include:

- regulations requiring EPA and the States to collect data using a specified format;

- EPA and States develop a consistent format but participation is voluntary;

- implement EPA policy on the minimum set of data elements which must be collected by EPA and its contractors; State participation is voluntary but strongly encouraged.

V . DATA UTILIZATION

A. How Should EPA Improve Utilization of Ground-Water Data?

Individual program offices utilize data they collect, but EPA could do more to utilize available data for broader purposes. For example, EPA needs to have ground-water trend information in order to establish environmental goals for the Agency, plan future emphasis for programs and to evaluate program effectiveness, evaluate the quality of the environment, target protection efforts and perform gross level screening, and to respond to Congressional inquiries.

Assessing the ground-water quality over large areas of the nation is a very difficult task. Geographic Information Systems (GIS) offers a comprehensive means for managing and assessing the quality of ground-water over a large geographic area. Also, it is an excellent tool for assisting managers in making planning decisions.

Utilizing ground-water data can augment the Agency's ability to perform ecological assessments in aquatic ecosystems. Broadening the use of ground-water data in our ecological assessments would improve our ability to better define ground-water remediation goals. There is also potential for expanding utilization of ground-water data for analysis of other environmental areas, such as global warming effects.

Manipulation of ground-water data through predictive models also has the potential to assist the data user in making better hydrogeologic decisions. Although there are limitations (see V.B.2), the use of models is growing and their optimum use should be supported. Further statistical comparisons of ground-water data are possible, e.g., through STORET and SAS, and other datasets and statistical packages.

2. Targeting environmental problems

In addition to the databases described earlier, ground-water data entered into GIS can be used to determine areas that are undergoing environmental stress by adding other thematic layers such as DRASTIC, pesticide usage and population using ground-water for their drinking water supply. A ranking system can then be developed that takes into account a range of risk-related factors including potential sources and known incidents of contamination. Based on this evaluation, environmental problems can be targeted for priority attention, both geographically and by specific EPA program.

Ground-water data is also an essential component of other methods for targeting environmental problems, including the Superfund Hazard Ranking System, which determines the grouping of sites on the National Priorities List and which sites are eligible for funding, and the RCRA location standards (draft), which determines types of locations environmentally unsuitable for hazardous waste facilities.

3. Research

EPA and State ground-water data could be utilized more fully and systematically to interpret subsurface contaminant behavior, and methods for prevention and remediation of ground-water contamination. If the range of EPA and State ground-water data were more readily accessible and of known quality, there would be a greater potential for research analysis and interpretation on a national or regional scale. This would ultimately provide better scientific understanding of ground-water characteristics and behavior.

B. Problems and Issues in Data Utilization

1. Limited resources to manage and use data

In enacting legislation designed to address specific environmental concerns in several media, Congress included ground water as an area where attention should be focused. As a result, each media program established its own unique set of programmatic data elements to assist in managing ground water and report their results to Congress. Although these individual data collection activities have served the programs well, their use in making effective and consistent planning decisions across all Agency programs is inefficient.

Data sets generated by individual agencies or programs are often ignored by other agencies or programs. Recognizing and improving our ability to utilize data generated by other "media" programs is a challenge facing the Agency. At the same time, data users must communicate their needs to others who may be willing to modify their approach to collect or manage data so that it is more universally useful.

2. Tools for utilizing data are sometimes unknown or difficult to use

Utilizing statistical and modeling tools in evaluating ground-water data enables staff to determine if contamination exists, estimate plume movement, and evaluate its response to various remedies. The statistical methods of establishing the presence or absence of contamination and the underlying need to begin or end remediation are important and currently controversial issues. Many ground-water flow and transport models are well documented and sophisticated tools for processing large amounts of data. However, in real applications, input data is limited and many assumptions must be made. Further, skilled staff and significant time input is necessary to utilize ground-water models properly.

Data utilization via models, statistical comparisons, and GIS are all hampered to some extent by the same user-related problems discussed in terms of data accessibility. These include user knowledge, available time, and proximity to appropriate hardware and software.

3. Interpreting significance of relational data

The technical procedures involved in installing a well, sampling the ground water, and analyzing the samples are all critical in determining the value of ground-water monitoring data. Therefore, it is necessary that information pertaining to these procedures is included in the data review. Although some level of uncertainty is associated with every data point, professional experience and judgment is critical to identifying when and how this relational information is used.

4. Scales of data vary

The utilization of data for program use and decision-making is very scale-dependent. For instance, careful consideration should be given when selecting the scale at which spatial data is entered into the GIS. Scale is important in grid spacing since large scale studies require higher levels of accuracy and finer grid spacing. Regional data exists at the 1:1,000,000 scale. EPA also has maps for most of the country at the larger 1:250,000 scale but unfortunately the level of accuracy is dramatically decreased due to errors in the GIRAS (land use) database file. At the 1:100,000 scale, data exists but sometimes in quantities too great for a Regional computer's current capabilities. Therefore, EPA should utilize large scale maps only when a detailed study is being performed or for any high priority counties as needed.

GIS and other mapping scales are often smaller than needed for hazardous waste site evaluations. Other examples of this phenomenon of scale difference are common when using various databases, and therefore hinder their utilization.

C. Improvements and Changes Underway

Computerized Geographic Information Systems (GIS) are being established to varying degrees in the Regions. GIS is a practical tool that can qualitatively manipulate large data sets of environmentally sensitive data. A GIS can vastly improve on traditional methods for capturing, storing, updating, analyzing, and displaying mapped natural resources data. The system allows the Regions to integrate efforts in ground water with other concerns for water quality. Landfills, Superfund sites, and industrial facilities could all be located in the database and compared with the location of water wells, wetlands, or other environmentally sensitive areas. Applications of GIS highlight program interrelationships which may not be recognized at this time. Further, GIS can enable us to focus management decisions more efficiently, and communicate those decisions more effectively to other offices and the public.

• GIS in wellhead protection program (WHP) demonstration projects - In an effort to encourage the use of GIS in WHP and ground-water protection efforts, OGWP is sponsoring a series of pilot projects at the county, State, and Regional levels. These projects are intended to demonstrate unique and/or transferable applications that support the decision-making process. Currently, OGWP is funding three WHP GIS projects at the local level: Carroll County, MD (development of ground-water management performance standards and county ordinances on land use to be used in a WHP Program); St. Charles County, MO (development of interpretive maps to used in the development of a WHP Program); and Santa Clara Valley Water District, CA (development of a model ground-water management strategy for a pilot recharge area).

• ORD-Environmental Monitoring Systems Laboratory (EMSL) support to WHP GIS projects - EMSL is providing technical support to OGWP's GIS projects. They are also producing a guidance document on the implementation and use of GIS for WHP that is focused on the needs of local governments. The document is scheduled for completion in FY91.

• WHP Data Management Demonstration Projects - OGWP is initiating a series of WHP data management demonstration projects based on a national competition.

• In FY90, Congress appropriated $500,000 to EPA for grants to local communities to show how data management efforts of local communities can assist in better decision-making in the implementation of WHP Programs.

• OIRM System Modernization Project - EPA recognizes that there is a need to modernize its information systems. The traditional single media approach to systems development no longer meets the Agency's information needs. In an effort to meet these changing needs, OIRM started a "System Modernization Program". The elements of the initiative include: a Systems Development Center (to provide a central focus for system development activities and emerging technologies); a modernization fund (to fund priority projects and create incentives for modernization); an OIRM support team (to facilitate information and technology transfer as well as the development of integrated systems); and an Agency-wide IRM Steering Committee (to provide guidance and set priorities for the modernization effort).

• Technology transfer programs which include ground-water are operated by several EPA Headquarters offices: the Office of the Administrator, Office of Research and Development, Office of Solid Waste and Emergency Response, and the Office of Water. ORD operates the Center for Research Information (CERI), which distributes research publications and sponsors training on ground-water science and engineering subjects. Office of Water's ground-water Protection office also distributes documents and provides training, mostly tailored for State and local governments and their needs in setting up ground-water protection programs.

• Hazardous waste ground-water work stations in Regions: OSWER's Office of Program Technology Support (currently the Technology Innovation Office) installed ground-water work stations in each regional office for use by RCRA and CERCLA personnel. The work stations provide the means to store and manipulate site-specific ground-water data from hazardous waste sites. The work stations are a collection of PC- based hardware and software, including CAD (Computer Assisted Design) based graphics and ground-water flow and transport models. Work station users can communicate via the OSWER electronic bulletin board system. The work stations can improve ground-water decision making, however, they are not designed to foster agency-wide access to ground-water data.

The ground-water work station has been used primarily for graphical representation of surface and subsurface conditions and the contouring of chemical, as well as ground-water elevation, data. The system has been used on an uneven basis partly due to the labor-intensive exercise required to input chemical data and information regarding aquifer properties. Also, the limited number of models loaded into the workstation and their inherent assumptions limited it's use at a significant number of sites. Some Regions have, however, "customized" their work stations by adding models and other software, and have thereby made the systems more useful.

Regional staff have found the system valuable for map preparation in anticipation of briefings, meetings, enforcement conferences, etc. Most of the maps are of large scale and are very legible. It's use in permitting and enforcement decisionmaking is somewhat limited to date partly because of time constraints, workload, changing priorities and other factors. Some staff would like to use the system on a more frequent basis but find it difficult to allocate the time necessary to become familiar with it. Personnel assigned to the system on at least a part-time basis to enter site or project information into the system would improve utilization. This would allow technical staff to use their time on the work station more productively.

D. Options

1. Options for improving the utilization of ground-water data include:

- modernize STORET to make it more "user friendly," as a mechanism to encourage the use of the system as a central groundwater data repository;
- foster more data coordination at the Regional level through the use of GIS as a tool for integrated environmental management;
- devote more resources to pilot and demonstration projects in ground-water data management which have transferable applications to EPA, State and local decision-makers;
- issue generic guidance for carrying out and reporting monitoring studies to be used by academia, industry, Federal, and State officials.

not all of the research needs expressed by programs. To respond to a range of needs, both on the generic and site-specific scale, on-going research and new initiatives must be better supported.

An increase in the ground water research budget could potentially support within five years a significant improvement in the development and evaluation of databases, codes, and field methodologies to respond to many of the outstanding needs of EPA programs. For example, an increase of funds in transport and transformation (currently funded at approximately $9M/yr.) could advance current research efforts to the stage where we might understand and begin to predict with some accuracy: a) the behavior of major classes of organic compounds in major hydrogeologic settings, b) the transport of contaminants in certain complex environments, such as fractured rock, c) abiotic transformations of certain common compounds, and d) biotransformation in the subsurface, particularly under anaerobic conditions.

With an increase in the monitoring budget (currently at approximately $7M/yr.) we could move forward in developing advanced, low cost screening and monitoring techniques for major contaminants. In aquifer remediation (currently at approximately 5M/yr.) we could be much farther along in developing, evaluating, and predicting the time and cost involved with a number of subsurface remedies. In underground source control (currently at approximately 1M/yr.) we could significantly advance our knowledge of the impact of injection wells on the subsurface and consequent effects on ground water.

In technology transfer and technical assistance (currently at approximately 1M/yr.) we could provide much needed support for information clearinghouses, technology transfer to States, and greater support for EPA enforcement cases and other site-specific ground water activities. We could make major progress toward improving data management systems for storing and accessing the vast amount of information available for site characterization.

A larger budget in general would also improve our ability to provide seed money for promising external projects, and leverage other agencies and organizations for cooperative research efforts.

Congress has considered new legislation for ground water research over the past several years, including authorization for additional appropriations. The potential impact on current research activities is not clear, however significant new funds might be appropriated to carry out the legislative provisions, such as research demonstrations, environmental profiles of significant ground water contaminants, and State grants.

The potential results of not advancing ground water research through some mechanism (legislative or otherwise) are, (1) early contaminant detection and ground water protection limited by untested monitoring approaches, (2) uneven predictability of contaminant transport and subsequent human and ecological exposure, (3) poor source control planning where based on crude predictions of contaminant fate and transport, and (4) inefficient or ineffective remedial actions at hazardous waste sites and other ground water corrective actions.

Aside from these impacts on implementation of EPA and State programs, there are potential impacts of a lagging knowledge base for future rulemaking and national policy development. A strong, current knowledge base in ground water has benefits for many aspects of environmental programs.

- Enhancement of technology transfer to State and local users. New and innovative means ofr transmitting researtch results can be developed.

- Further development of in situ, real-time monitoring devices, to provide faster, less costly results for planning, regulatory compliance, and remedial actions.

- Characterization of subsurface heterogeneity, and quantifying the dispersion term in different settings. This impacts the results of virtually all of the transport models EPA uses.

- Abiotic transformations of contaminants. Nonbiological transformations in the subsurface are not well understood for may compounds, and have significant effects on mobility and toxicity.

- Methods for measuring redox potential in ground water samples. This property is essential for understanding certain reactions and modeling the subsurface, yet current methods may be inadequate for measuring it.

- Develop chemical-specific reference documents, or environmental profiles, containing physical/chemical properties, environmental transport and fate information, remedial methods and treatability information for significant ground water contaminants.

- Analysis of water quality trends in ground-water used for drinking water supplies. There are various approaches to analyzing the growing body of information on ground water quality to better understand national and regional trends.

- Subsurface transport of pathogens. Much remains to be known about the public health risk of viruses and bacteria transported via ground water to water supplies.

- Potential effects of alternative fuels use and storage on ground water quality. While the use of certain fuels may improve ambient air quality, potential leakage of highly mobile fuel products from storage tanks may endanger ground water quality.

- Effects of global warming on groun water. Global warming may have significant impacts on ground water quantity, for example through water table lowering of major aquifers and changes in recharge patterns.

C. Future Funding of ORD Ground Water Research

At the current funding level of approximately $23 million/year (total R&D plus S&E), ORD can respond to some but advisory body. However, EPA's concerns with environmental impacts of pesticides, wellhead protection, and non-point source pollution suggest that basic knowledge in this area is of primary importance. The interagency initiative presents an excellent opportunity to share and contribute to an important research effort. An interagency work group has met and agreed on several proposed research areas for EPA, should funding become available.

Of particular benefit to EPA would be the addition of research components to this interagency effort for studying subsurface degradation processes of agricultural chemicals, behavior of nitrates in surface and ground waters, macropore flow in the subsurface, testing and improving EPA-developed pesticide leaching models, real time monitoring methods, non-point source monitoring strategies, interaction of pesticide runoff with wetlands and potential recharge to ground water, and ecosystem effects.

This initiative would address the prevention theme of this Plan, and the emerging topics of monitoring strategies for non-point sources, subsurface behavior of agricultural chemicals, and model validation. MASTER is not entirely a ground- water initiative, however much of the investigation is within the scope of this Plan. Several recommendations of the SAB would be addressed by this research, as discussed in Chapter 2. The goals of this initiative are also consistent with the President's Water Quality Initiative, EPA's Agricultural Chemicals in Ground Water Strategy, and the Agency's support for interagency coordination in research.

2. Other Initiatives to Consider for the 1990s

Other research initiatives to consider for the future, in line with the themes, emerging topics, and appoaches discussed earlier include:

- Further development of bioremediation methods, including continuation of such essential efforts as characterizing subvsurface controls on implementing bioremediation in situ for contaminated ground water, and developing methods for evaluating and augmenting bioremediation processes in the subsurface.
- Enhancement of wellhead protection research, such as assessing the relative impacts of multiple sources of contamination to undergroun water supplies, as well as identifying and preventing "unaddressed" sources of contaminatin, e.g., from Class V injection wells.
- RCRA Technical Support Centers. Expand the existing infrastructure for Superfund technical support at ORD laboratories to address similar problems at RCRA sites.

treat methods; 5) research on contaminant sorption to geologic materials, and its effect on pump and treat methods; 6) research and development of accelerated remediation methods, such as combination of pump and treat with use of surfactants or micro-organisms; and 7) technical assistance and technology transfer to Superfund personnel.

The SCAMP research is a fundamental part of the ground-water remediation theme of this Plan, and several emerging topics including site characterization, behavior of immiscible substances, sorption, bioremediation, effects of heterogeneous media, and model refinement. It also strongly supports the CERCLA and RCRA programs in site remedy decisions, and responds to several Regional research priorites expressed in a recent survey of Regional Superfund offices. In addition, it addresses several research activities recommended by the SAB, as noted in Chapter 2 of this Plan.

B. Proposed Initiative for FY 1992 and Beyond

Of the many remaining research needs in ground water, a high-priority research area has been identified for special consideration in FY 1992 planning and beyond. With consideration of limited funding availability, the following two initiatives address many, although not all, of the emerging topics discussed earlier in this Plan.

1. Mid-West Agrichemical Subsurface/Surface Transport and Effects Research (MASTER)

EPA, USGS, and especially USDA have various research projects in progress studying the effects of agriculture on the quality of ground water and surface water. Although each agency has its unique responsibilities and areas of expertise and concentration, there is mutual concern about the fate of agricultural chemicals as they move through the environment that could best be addressed through a coordinated plan of study. Such a plan was drafted in February, 1989, and selected the mid-continent soybean and corn-growing region to determine the regional factors affecting the distribution of atrazine, an herbicide of long-standing use, through the environment.

It is expected that methodologies developed through this interagency research could be used by the agricultural community and others to predict the effects of various soil, hydrogeological, and climatic factors and management practices on the distribution of agricultural chemicals on ground and surface waters in other parts of the U.S. This interagency effort will, among other things, generate basic and applied research into the transport and transformation of agricultural chemicals in midwest farmland. The information afforded from this research will provide a better basis for predicting and controlling the leaching of agricultural chemicals into drinking water aquifers. Currently, ORD's role in the ineragency effort is mainly as an

These tools include models which have been developed to predict the leaching of pesticides to ground water, data which has been collected on soil properties and other relevant environmental factors, and geographic information systems (GIS) for displaying and analyzing spatial information. To date, these types of tools have not been systematically integrated into a workstation framework for State and local risk management.

The main purpose of this initiative is to provide such a framework for States upon which they can develop locally meaningful pesticide management plans. The work will also include field evaluation of monitoring and modeling schemes. The project will be carefully coordinated with related research on the effects of agricultural chemicals on water quality at the USGS and USDA, in order to ensure integration of information and dissemination of results.

3. Subsurface Characterization and Mobilization Processes (SCAMP)

The potential effectiveness of "pump and treat" technology to remediate contaminated ground water and soils is largely unknown, but widely practiced. Further, the technology sometimes fails to accomplish the mandates of the Superfund Amendments and Reauthorization Act of 1986 (SARA) which states that cost-effective technologies be utilized for the permanent remediation of contaminated sites. The successful application of this technology in site remediation requires an understanding of site characterization methods and the processes controlling contaminant transport and mobilization in the subsurface. Poor understanding of these processes and inadequate site characterization are the most common reasons that pump and treat does not perform as a cost-effective, permanent remedy. This does not mean that pump and treat should be abandoned, but that a research program should be carried out to significantly improve its efficacy, and current guidelines for the implementation of this technology should be reexamined with new recommendations for its use.

The overall objective of the research is to acquire process and characterization information that will allow development of a decision-making framework for predicting the appropriateness and potential efficacy of "pump and treat" for site remediation. This research will support the goals of the Superfund and RCRA programs by providing information necessary to improve remedial actions at hazardous waste sites.

The effort will consist of seven phases or activities: 1) consolidation of existing information, and development of a 5-year plan for research and development projects and outputs; 2) development of improved methods for site characterization; 3) research on immiscible fluid flow and residual saturation, and their effects on pump and treat methods; 4) research on mass transport in heterogeneous media, and its effect on pump and

VII. New and Proposed Research

A. New research for FY 1990 and 1991

Three research initiatives have been approved within the last two fiscal years which will address some of the emerging topics presented in this Plan.

1. Wellhead Protection

In September, 1988, ORD and EPA's Office of Water entered into a 5-year research and technology transfer agreement to support State Wellhead Protection (WHP) Progams. States are currently implementing WHP programs in accordance with the 1986 Amendments to the SDWA. The purpose of the research is to advance fundamental understanding and transfer information regarding how to protect ground-water supplies which flow to drinking water wells in various physical and institutional settings across the nation. ORD begins research and development activities for WHP in FY 1990.

Four research priorities are envisioned. First, field testing and verification for WHP area delineation methods will be undertaken, including the refinement of current modeling approaches. Second, ORD will evaluate the ability of the subsurface to assimilate certain amounts of contamination without impact to drinking water supplies, and apply this information to the delineation of WHP areas. Third, ORD will evaluate and apply knowledge of agricultural chemical behavior, including use of the RUSTIC model, for delineating WHP areas. Fourth, ORD will develop WHP area ground-water monitoring strategies, including definition of optimal sampling and monitoring designs.

The WHP research is consistent with the prevention theme for ground water research, as well as ORD's approaches to long-term basic research, service to EPA client offices, and technology transfer to the States. It also will use results from several emerging topics identified in this Plan, such as sorption, model validation, transport of agricultural chemicals, and monitoring strategies.

2. Preventing Ground-Water Contamination from Pesticides: Information Systems for State Use

The problem of pesticides in ground water is national in scope, but locally variable, therefore accurate predictions of pesticide transport and transformation requires specific information at the local level. Evaluation of all likely combinations of pesticides, environmental settings, and management practices is virtually impossible using random, large-scale monitoring studies or limited site-specific investigations. However, tools are available to locate problem areas, and develop strategies for regulation and use of pesticides on a local level.

biological transformation processes. Some of this research is incorporated in ORD's Biosystems research program.

In the future, EPA may be able to estimate and enhance the rate and extent of natural degradation processes of many contaminants of concern in soils and ground water. A major emphasis should be to approximate the extent of contaminant reduction that can be attained with bioremediation to determine whether the technology can be used to meet EPA's regulatory standards for remediation and closure.

Abiotic remediation is another topic that has an unexplored potential. EPA investigators are in the process of isolating the natural compounds responsible for the observed abiotic reduction of several classes of pollutants. These compounds may be useful in enhancement of degradation processes.

VI. Future Needs and Support of ORD Ground-Water Research

While significant strides have been made in understanding various aspects of ground-water science and technology, ground-water research is still in its infancy in many respects. Unlike surface water, ground water is very difficult to observe and measure in the field, it moves slowly, and is strongly influenced by the medium through which it flows. Further, contamination results in different flow characteristics as well as a range of chemical interactions and transformations, most of which cannot be quantitatively predicted at this time.

The scope of research needs has been broadened by greater concern for ground-water quality, new legislation and regulations, better problem identification, and a tendency for investigations to uncover ever greater variability in the chemistry, physics, and biology of the subsurface. Research must strive for but may never attain solutions to every contamination problem in every hydrogeologic setting.

EPA programs require increasingly sophisticated knowledge on which to base complex, costly contamination prevention and remediation decisions. The importance of continued and expanded supporting research is paramount. The value to EPA programs in supporting ORD research has been demonstrated by such advances as in ground water monitoring practices, site characterizations, tools for risk assessments, remedy selections at hazardous waste sites, and pesticide leaching models. Continued sustenance of these and other program office activities will depend in part on future research in the high priority areas identified below.

continue to be explored, in order to maximize the success of costly and time-consuming remedial efforts.

Enhanced in situ methods for biotic and abiotic contaminant degradation is an active research area that merits greater attention. The permanent solutions possible through this approach (as opposed to moving contaminants to treatment systems, concentrating them, and moving the residuals to still other locations), and the important alternatives these methods provide to unproven extraction methods, render in situ methods one of the most important growth areas for research. Processes for transforming contaminants in the subsurface to simpler, less toxic compounds are being explored for application to remediation of hazardous waste sites and pesticide use.

Topics include in situ bioremediation, where microbes are stimulated to degrade organic contaminants in place. Use of naturally occuring, indigenous species is showing promise for some contaminants and settings, while engineered microbes are being developed for others. It has been shown in the laboratory and field that certain organic wastes can be converted into biomass and harmless byproducts of microbial metabolism. This has begun to be demonstrated in the field for indigenous species with hydrocarbon components of gasoline and for chlorinated compounds such as vinyl chloride and DCE, which can be cometabolized with methane. More highly chlorinated compounds tend to be more recalcitrant to these methods, and may require addition of microbes with special biodegradative functions. White rot fungus has also shown to be effective on a number of contaminants including DDT, PCBs, PAHs, chlorinated phenols and chlorinated dioxins.

The major limiting factor in successful field application of bioremediation, however, appears to be transporting oxygen or other electron acceptor and nutrients to the microbial populations so that they may flourish and metabolize the contaminants rapidly. This transport factor is a function of the heterogeneity and hydraulic conductivity of the site's geologic media and distance from the remedial application to the contaminant plume. In addition, in certain anaerobic conditions, reductive dechlorination can be an effective bioremediation method. In all circumstances, the importance of reliable site investigations, monitoring systems, and predictive tools are evident.

Ahead in bioremediation research is identification of breakdown mechanisms for a range of contaminants, identification of alternative electron acceptors (other than oxygen), aerobic degradation of solvents, and the feasibility of adding micro-organisms with special metabolic capabilities. Of equal importance is overcoming hydrogeological obstacles to employing bioremediation in the field, and developing methods for enhancing transport of nutrients to microbial populations. This research must be built upon methods development and controlled studies of organic pollutants. Recent discoveries, for example, show that certain halogenated hydrocarbon solvents may be hydrolyzed or reduced over a period of days or months to other compounds having different properites.

The mobility and bioavailability of toxic metals and metalloids depend on the species of the metal, which in turn is a function of metal/metalloid chemical properties and the characteristics of the subsurface. Improving our understanding in these areas is providing a better basis for predicting exposures to these toxic substances.

Little is known about the fate of pollutants disposed of in underground injection wells. The conditions of temperature and pressure in this environment may greatly accelerate the transformation and transport of pollutants.

Ground-Water Modeling

The National Research Council, Water Science and Technology Board, Committee on Ground-Water Modeling Assessment's report "Ground- Water Models: Scientific and Regulatory Applications" (September, 1989) contained a number of recommendations applicable to EPA ground- water research. In summary, the report recommends: (1) continued validation and refinement of ground-water models, particularly those for flow through the unsaturated zone, fractured rock, multiphase flow, and codes linking mass transport and chemical reactions; (2) the role of bacteria in transport and removal of contaminants; (3) improving the presentation of uncertainty in model predictions, and improving our ability to estimate the reliability of model results; (5) continued efforts at characterizing subsurface processes through field and laboratory studies; and (6) developing approaches for parameter estimation and measurement techniques.

The Science Advisory Board gave similar recommendations in their July, 1985 report, "Review of the EPA Ground Water Research Program" and their January, 1989 report, "Resolution on Use of Mathematical Models for EPA for Regulatory Assessment and Decision-Making", particularly points (1) and (3) above. Clearly, future research in transport and transformation should address improvements in the development, application, and validation (i.e., laboratory or field evaluation) of predictive models that EPA uses.

C. Subsurface Remediation

Identification of information requirements for remedy selection, and methods for subsurface remediation continue to be crucial areas for research. Low and variable permeability influence the transport of contaminants, as well as the dispersion of surfactants used in clean up, and pumping rates in ump-and-treat operations. Other important relationships between bsurface conditions and application of remedial technology must techniques, monitoring strategies for karst terrain, and new applications for problem solving with GIS.

B. Transport and Transformation

The roles of organic carbon, redox potential (eH), pH, and solubility in aqueous phase transport need better understanding in order to develop and rely upon predictions of contaminant transport. Facilitated transport, a phenomenon that refers to various mechanisms whereby contaminants move through the subsurface at velocities greater than expected by considering solubility and primary permeability alone, merits greater understanding. For example, sorption of contaminants on colloidal particles, and flow through macropores facilitate transport, and must be accounted for in our predictions of time of travel and exposure. Although anecdotal evidence exists that this phenomenon occurs, it is not fully understood and is not accounted for in operational transport models.

Another research topic in the area of contaminant transport is complex wastes, or wastes with several components, densities, or behavioral characteristics. The separation of leachates into water-soluble and immiscible fractions can result in plume stratification, with light non-aqueous phase liquids (LNAPLS) floating above dense non-aqueous phase liquids (DNAPLS). A portion of the former sometimes can be removed from the subsurface, while the latter settle in residual masses which are not currently amenable to conventional removal methods. Another complexity to this situation is the chemical alterations which take place in the subsurface, sometimes producing plumes of degradation products more toxic than the original waste.

The kinetics of adsorption and desorption, collectively referred to as sorption, must be better understood to predict transport reliably and design remedies. This is particularly applicable to understanding the slow desorption of residual contaminants in the deep subsurface. Remedies that enhance desorption may be necessary in some settings.

Most transport models assume homogeneous hydrogeology, while in fact this is more the exception rather than the rule. Accelerated flow through fractured media is one important example of the effects of heterogeneity on transport. This phenomenon needs to be better understood and integrated into transport models.

Transport, transformation, and environmental fate of non-point sources, particularly agricultural chemicals is of special interest to EPA. For example, much remains to be learned in the areas of nitrate and pesticide behavior in the subsurface in order to predict fate and effects with confidence.

Abiotic transformation processes have been studied for some time, but much remains to be done, given the large number of remediation may be governed by mutiphase behavior of contaminants, partitioning among solid and fluid media, biotic and abiotic transformations, and transport in fractured media. In order to remediate ground water at a waste site, knowledge of these processes and how they are likely to operate under given site-specific environmental conditions is essential.

Predictive tools such as models are also part of designing and tracking remedial actions. For example, the BIOPLUME model predicts contaminant migration affected by oxygen-limited biodegradation, and can be used to help plan a bioremediation project. Monitoring is also integral to remedial actions, both for detecting contaminants and monitoring the progress of ground-water cleanup. For example, assessing whether health-based concentrations have been reached at a site depends heavily on the monitoring techniques and strategy utilized.

Knowledge of subsurface conditions also interfaces with the design of engineering methods and technologies for remediation. For example, ground-water pumping systems and practices must be compatible with the local hydrogeology and contaminant properties. Because subsurface remediation is relatively new and much remains unknown about the subsurface proceeses and long-term results of various remedies, development and evaluation of remedies must continue to be a focus for research.

V. Emerging Research Topics

Within the prevention and remediation themes, ORD has identified a number of emerging topics and research needs in ground water.

A. Monitoring

Advanced monitoring techniques that rely upon non-intrusive, in situ, or microelectronic techniques hold promise for the future, and may supplement or possibly replace conventional laboratory "wet chemistry" for ground-water monitoring. Development of fiber optics and x-ray fluorescence (XRF) have been successful for in-situ, real time monitoring of some organics and metal compounds, respectively. For example, in XRF, an x-ray is directed at a sample, and in response the sample emits induced fluorescence in the x-ray spectrum. A detector analyzes the fluorescence for both type and concentration of inorganics. With further refinement, it may be possible to do at least preliminary screenings for a range of specific contaminants at waste sites or USTs with these methods. The advantages in time and cost savings, holding times, chain of custody, and laboratory requirements are significant.

Other emerging topics include monitoring strategies for non-point sources of contamination, long-term monitoring strategies for closed hazardous waste sites, problems monitoring in wet nvironments, remote sensing methods for fracture aracterization, unsaturated zone processes and monitoring and reinforces the need for additional research to serve the needs of the Nation.

IV. Growth Themes for ORD Ground-Water Research

Subject areas where ground- water research should seek to expand can be broadly characterized by two themes: prevention and remediation.

A. Prevention

Prevention encompasses the identification of threats to ground water from point and non-point sources, and mitigating these threats through a combination of source control, management practices, land use changes, and institutional measures. Prevention requires an understanding of fate and transport processes, use of predictive techniques, and monitoring to delineate the threats to ground water.

One aspect of prevention is wellhead protection, which involves focused land and source management practices aimed at preventing contamination of aquifers which supply drinking water wells. By characterizing the vulnerability of aquifer systems, local sources of contamination, and likely pathways and rates of transport and transformation to such wells, State and local governments can develop plans for protecting their drinking water supplies. Wellhead protection research includes methods for delineating wellhead protection areas, and managing point-source/non-point source contamination threats.

Other aspects of the prevention theme are predictive tools, such as models for flow, fate and transport. Predictive models can be used to support management decisions to prevent the introduction of contaminants to the subsurface or to prevent exposure above a health-based concentration at a specified location. The correct use of these models depends upon the underlying field and contaminant data and assumptions that are incorporated in the models. Research into rate constants and physical properties such as hydraulic conductivity and effective porosity can therefore all be looked upon as part of the prevention goal.

Monitoring the subsurface for early detection of leaks from underground storage tanks or waste impoundments, or seepage from pesticide applications, can also be considered an integral part of prevention. By employing various sampling and remote sensing methodologies near the source of contamination, actions can be taken to prevent the spread of contamination to ground water.

B. Remediation

The success of ground-water remediation efforts depends largely upon understanding subsurface processes in order to design effective remedies. For example, the success of

F. Science Advisory Board Recommendations

The Science Advisory Board's "Review of the EPA Ground Water Research Program" (1985) identified a number of needed refinements, including the need for increased resources and the need for increased technology transfer and training. They indicated 16 specific recommendations for filling research gaps among monitoring, source control, fate and transport, and remediation. Some of those recommendations have been partially implemented, such as CERCLA funding for ground-water research, increased funding for monitoring, source control, source minimization research, and technology transfer. Many, however, have not been fully implemented due to resource limitations and competing priorities for research funding. This includes research on contaminant sources not addressed by specific Congressional mandates, field validation of predictive techniques, assessment of field applications of containment techniques (caps, liners, walls, hydrodynamic controls), remedial actions in fractured formations and in karst topography.

The SAB also emphasized the general need for sustained, long-term research and emphasis on environmental protection at EPA in "Future Risk: Research Strategies for the 1990's" (1988). The SAB's "Resolution on Use of Mathematical Models for EPA for Regulatory Assessment and Decision-Making" (1989) recommended, among other things, that EPA increase its model validation program. To the extent practicable, EPA should incorporate these recommendations into plans for future research.

G. Ground-Water Research Legislation

Several bills have been introduced in Congress over the past several years calling for additional ground water research and related activities in the Federal government. This legislation would give EPA specific authority and direction to perform ground water research. Currently, EPA derives this authority from a number of different statutes, such as the Safe Drinking Water Act.

Major provisions of these bills that affect EPA include a new interagency research oversight committee and an education committee, a research demonstration program, environmental profiles and research on significant ground-water contaminants, technical assistance, training, and technology transfer, establishment of a ground- water information clearinghouse, establishment of research institutes, and grants to States to develop and implement ground-water strategies. Most of these provisions are consistent with parts of the existing program; however, the research demonstrations, environmental profiles, and clearinghouse would entail significant added emphasis in EPA's research program.

The attention that Congress has given to new legislation in is area underscores the importance of existing work at EPA,

D. External Coordination

Coordination plays a major role in prevention and remediation research. ORD coordinates with other federal agencies as well as State governments and private and public institutions to promote information exchange and produce better research products. Some examples are: current coordination on the preparation of an interagency research plan with the USGS and USDA on agricultural chemicals and their effects on water resources; ongoing coordination with these agencies at field test sites for validating pesticide leaching models and performing site investigations; participation in the EPA/USGS Coordinating Committee; recently co-sponsoring a conference on hazardous waste ground-water research with the Electric Power Research Institute; and participation in the Federal Coordinating Council for Science, Engineering and Technology (FCCSET), which has recently published a synopsis of all ground-water research supported by Federal agencies. These types of alliances, and coordinated research plans and projects will continue to be fostered in the future.

Particular attention should be paid to the special expertise and perspective various organizations can bring to a research problem. EPA's needs and expertise are somewhat unique in the research community due to our regulatory missions and timetables. Subsurface processes that attenuate, transport, or transform synthetic chemicals and metals, and sampling strategies for point and non-point sources, are examples of areas where EPA specializes. Our Agency's mandates to protect and remediate ground water quality have generated research into areas other organizations have not explored. We must continue to work with other agencies to identify areas of common and separate interest, so that important research is conducted but not duplicated.

E. Dissemination of Research Results

Technology transfer and technical assistance are important applications of ground-water research. This mechanism provides a direct link between the researchers' expertise and EPA's program implementation at the Headquarters, Regional, and State levels. Various efforts are underway, including seminars and publications disseminated from ORD's Center for Environmental Research Information (CERI). These efforts also support EPA's Ground-Water Protection Strategy (1984), which calls for strengthening State ground-water programs through technical assistance and a strong research program.

ORD's major technical assistance activities in ground water are supported by and directed at Superfund programs. However, other programs such as RCRA are equally in need of hazardous waste remediation expertise, and an institutional mechanism for accessing all appropriate laboratories for short-term, intensive, site-specific project support should be considered.

research. For instance, the Office of Solid Waste, the major supporting office for ground-water research funding, uses research results from fate and transport modeling to formulate hazardous waste characteristic criteria.

A second primary category of users is the Regional, State, local government staff, and consulting community who implement environmental regulations, guidance, and strategies. Technical field manuals and technical assistance activities are generally geared to this group. They represent the largest segment of the user community, and are increasingly receiving more of the research focus through technology transfer, technical assistance, and training. Some examples are technical assistance on developing remediation plans at Superfund sites, or providing training on sampling procedures. This user group is also a valuable source of information on the application of ground-water methods and techniques, and can provide essential feedback to research.

Third, basic research projects feed into other, more advanced research projects which can eventually lead to products or predictions. For instance, basic research in methods development is necessary in order to conduct quantitative field or laboratory studies. Research to develop scientific principles of sorption, transformation, and migration provides the basis for much of the research on technological controls for specific sources of ground-water contamination. Therefore, one of the primary users of research is researchers, who work through iterative, experimental processes to develop products of use to environmental programs.

Fourth, EPA contributes to extramural knowledge and applications in ground- water science. Through interagency agreements, publications, participation in conferences, and membership in professional organizations, EPA ground-water research is shared among users in the scientific community for the betterment of all. Clearly, the research plan should emphasize environmental program support, while seeking the best balance among the various user groups.

The future trend will be toward greater and more innovative technology transfer and technical assistance to Regions and their contractors, as well as delegated States because these groups are increasingly responsible for carrying out environmental programs and are in need of technical knowledge. This effort cannot occur in the absence of continued basic research and development. Basic research to maintain and build our knowledge base must be sustained so that there will continue to be technology to transfer.

RREL operates the largest of the technical support centers in ORD. Support is provided on engineering problems related to but not specific to ground water, such as soil and above-ground-water treatment alternatives, remedial construction processes and materials, source control, and geotechnical methods.

Technical assistance and technical support continue to be a highly important part of the ground water research program. In the future, the services described above could be further expanded to others in need of scientific and engineering expertise for technical decision-making.

III. General Approaches for Future Ground-Water Research

A. Staying at the Forefront of an Emerging Scientific Field

Hydrogeology and contaminant behavior is an emerging field, and EPA's scientific research is at the forefront. EPA's contribution to the state of knowledge is evidenced by our contributions to the literature, our sponsorship of cutting-edge research by universities such as Stanford, Yale, Louisiana State, Carnegie-Mellon, and the consortium of Rice, Oklahoma, and Oklahoma State Universities, and our participation in international conferences (such as the International Geological Congress, and others). Implementation of EPA's environmental programs need the best available technologies and methods. These needs demand that supporting research be innovative, state-of-the-science, and timely. It is essential therefore that ground-water research be supported so that it may remain at the forefront.

B. Preserving Continuity

Another essential aspect of the research program is continuity. Research projects studying flow, sorption, transformation, or model development often require years of steady effort. Field studies in particular require multiple years of observation. A successful ground-water research program must maintain stability over time in order to generate useful, tested products. Ground-water research should therefore be part of the Agency's long-term research agenda. Two examples of on-going research areas related to ground water which have successfully adopted 5-year plans are the Biosystems Technology Development Program and the Wellhead Protection Research Program.

C. Meeting Users' Needs

There are several categories of users of EPA's ground-water research. A primary user of research is EPA Headquarters program offices, that develop regulations, guidance, and strategies for national implementation. The scientific underpinnings of these documents are based on ground-water

D. Underground Source Control

EPA's Underground Injection Control program regulates the injection of hazardous wastes into the subsurface. ORD has a research effort to develop protocols for injection well practices, injection well integrity testing methods, and to understand the interaction of injected material with subsurface materials.

E. Technical Assistance and Technology Transfer

Technical assistance generally refers to one-on-one assistance by ORD on site-specific or problem-specific Regional, State, or National regulatory matters. Technology transfer generally refers to printed documents, software packages, and focused training that are initiated and budgeted by ORD. Both are carried out by ORD laboratories primarily for Superfund staff in the Regional Offices. This effort is largely funded by OSWER through the Superfund Technical Support Project, which provides support on ground water as well as other aspects of Superfund site investigations and remedies.

For example, the RSKERL provides assistance on subsurface remediation problems through the Subsurface Remediation Technology Support Core Team, operates an information clearinghouse on this subject, and transfers technology from the National Center for Ground Water Research, a consortium of Rice, Oklahoma, and Oklahoma State Universities. Areas of expertise include hydrogeological aspects of pump-and-treat aquifer remediation, in situ bioremediation of soils and ground water, geochemistry, fluid and contaminant transport, transformation, and mathematical modeling.

EMSL-LV provides assistance in detecting, monitoring, site characterization, data interpretation, and geophysical techniques.This includes saturated and unsaturated zone monitoring, remote sensing, mapping, geostatistics, anaytical methods and quality assurance, borehole and surface geophysics, and x-ray fluorescence field survey methods. A hotline and on-site field training facility are important features of the technology support program at EMSL-LV.

At ERL-Athens, the emphasis is on multimedia (i.e., ground water, surface water, and soil) exposure and risk assessment modeling of remedial action alternatives. Through the Agency's Center for Exposure Assessment Modeling (CEAM), support is provided on applying models to assist in risk-based decisions. This includes information on models and databases that link ground-water transport and transformation to human and ecological exposure scenarios. Workshops and an electronic bulletin board serve to enhance technology transfer and assistance.

Recent advances in integrating process level information into predictive tools include:

- the development and dissemination of the metal speciation model MINTEQA2;
- the pesticide soils leaching model PRZM;
- the pesticide ground water leaching model RUSTIC;
- the screening model for vulnerable soils DBAPE, and development of databases for access through DBAPE;
- development of the multimedia model MULTIMED for predicting the exposure from landfilled solid and hazardous wastes; and
- development and application of the CEEPES comprehensive environmental management model to agricultural chemicals.

Most of the transport and transformation research in ORD is performed in support of the hazardous waste programs, and their needs in predicting the off-site effects of ground- water contamination from waste disposal sites. Some is also done to support the Office of Pesticide Programs to predict the leaching behavior of agricultural chemicals. A new effort is underway to support the Office of Water in determining the sorptive properties of soils as a factor in protecting wellheads from contaminant migration.

C. In situ Subsurface Remediation

ORD's ground-water research in the area of subsurface remediation is developing effective, reliable methods for restoring contaminated soils and ground water as close as possible to their original quality. This includes methods for recovering contaminants from aquifers for further treatment, reducing the volume or toxicity of contaminants in situ, monitoring and modeling remediation projects, and examining past remediation and source control efforts to identify subsurface factors contributing to their success or failure.

Significant research advances have included the initiation of applied bioremediation to the subsurface, the development of design tools for remediation (i.e., the BIOPLUME model), and methods for performance evaluation of pump-and-treat technology. Other areas of investigation include steam stripping and soil vacuum extraction of contaminants, with an emphasis on understanding the subsurface processes governing the results of remedial measures.

ORD's research in the subsurface remediation area has been performed in support of EPA's drinking water and hazardous waste programs.

B. Transport and Transformation

In order to predict the movement of contaminants in the subsurface, and thereby predict potential human and ecological exposure, ORD maintains a research program in transport and transformation of contaminants. Predicting contaminant behavior in the subsurface requires understanding the mechanisms and rates of transport, and chemical, physical, and biological transformations of contaminants. Transport is often assumed to occur in the dissolved, aqueous phase, but may also occur in separate, dissolved phases such as in immiscible oils, or sorbed to fine, colloidal particles. The subsurface environment affects the oxidation state, and the rates and types of chemical transformations. These transformations in turn affect the solubility and mobility of the contaminants. Transformation and transport are therefore intimately related processes. ORD's research studies these processes for various contaminants in different settings, and develops models for predicting time of travel and exposure concentrations.

Recent developments in transport and transformation research include advances in understanding the processes that control these phenomena, and integrating these processes into mathematical models for describing and predicting the behavior of contaminants in the subsurface.

At the process level, there have been recent advances in:

- understanding the kinetics of the partitioning of contaminants between ground water and aquifer solids;
- the behavior of multiphase fluid systems of water, oil, and air;
- the movement of metal ions in response to chemical conditions;
- abiotic transformation pathways and rates;
- vapor phase transport phenomena important in the vadose zone;
- facilitated transport resulting from the presence of colloidal materials, or cosolvents such as alchohols;
- the movement of contaminants through fractured rocks;
- aerobic and anaerobic biotransformation;
- re-examination of the capacity of pollution-degrading bacteria to move through soils and geological material, which has improved our understanding of the partitioning of organic compounds between ground water and residual oily material;
- understanding higher order transformation reactions;
- understanding hydrodynamic dispersion in relation to heterogeneity in the hydrodynamic domain;
- a more definitive description of the metals sorption processes; and
- mathematical descriptions of the reduction of organic pollutants in ground water.

A. Subsurface Monitoring

The goal of this research program is to produce techniques and methodologies for detecting and quantifying changes in hydrogeology, and in subsurface water quality. Both direct sampling and remote sensing approaches are generated. This program includes research on locating and installing monitoring wells; sample collection and preservation; quality assurance and quality control; geophysical and geochemical detection and mapping of shallow contaminant plumes with both surface and downhole methods; mapping deeply buried plumes associated with injection wells, determining chemical indicators of ground water contamination; developing monitoring methodologies for the unsaturated zone; advanced monitoring techniques such as real-time, in situ monitoring of ground water with fiber optic sensor and flourescence spectroscopy; and external leak detection devices for underground storage tanks.

Most of ORD's subsurface monitoring research has been undertaken in response to the needs of the CERCLA and RCRA hazardous waste programs, where immediate needs to accurately sample and analyze ground water have challenged the state of the science to develop appropriate laboratory and field techniques. ORD's monitoring research and development has advanced EPA's ability to meet environmental needs and statutory requirements.

Some of ORD's most significant contributions have been in:

- fiber optic and x-ray fluorescence remote sensing;
- unsaturated zone monitoring for hazardous waste facilities and underground storage tanks;
- well construction techniques to minimize sample contamination;
- identification of indicator parameters for ground- water contaminants;
- methods for collection of uncontaminated aquifer core material;
- quality assurance of field investigations;
- application of standard geophysical techniques to hazardous waste site investigations;
- development of geographical information systems (GIS); and
- methods for statistical comparisons of ground- water monitoring data.

As these methods and technologies are developed, they are transferred to EPA Regions, States, and the public through guidance manuals, training, reports, and professional journals. Case-by-case technical support to program offices in these areas is also a major effort.

I. Introduction

The Science Advisory Board's, "Review of the EPA Ground Water Research Program" (July, 1985) concluded, among other things, that ORD should establish centralized direction and management for its ground-water research program through a Ground-Water Research Manager. They recommended that this Manager develop an integrated, comprehensive ground-water research plan. The plan would address research needs and activities spanning thu various EPA programs having ground-water components.

ORD has responded to these recommendations by appointing a Ground- Water Matrix Manager, who coordinates with other ORD Offices to analyze ground-water needs and promote new initiatives. This Ground-Water Research Plan summarizes the status of ground-water research at EPA, and proposes areas for growth for fiscal year 1991 and beyond.

II. Background

ORD supports an active, diverse ground-water research program dedicated to provide the scientific basis for protecting current and potential drinking water aquifers, and interconnected surface water resources, from contamination. The interrelated scientific fields of hydrogeology, hydrology, geochemistry, geophysics, biochemistry, microbiology, statistics, soil science, and physical chemistry are components of ground-water research. Each field provides a perspective on what can collectively be called ground-water science. Research areas span source control, detection, monitoring, prediction, and remediation of ground-water contamination. Five EPA programs and their statutory missions are served: CERCLA, RCRA, CWA, SDWA, and FIFRA.

EPA's role is somewhat unique in the Federal ground-water research community, due to our regulatory missions and timetables. For example, EPA's need to monitor ground-water quality and remediate contamination to drinking water concentrations has generated research into areas sometimes untested by other organizations. Technology transfer and technical assistance to those implementing environmental programs depends upon a strong in-house knowledge base, responsive research agenda, and assertive outreach program. EPA's research effort in support of environmental programs is therefore distinctive in purpose, direction, and timing. Other agencies cannot be expected to fulfill this role. Our challenge in working with other agencies and organizations is to identify areas of common and separate interest, so that research is complementary but not duplicative or lacking.

To carry out its functions in supporting ground-water activities at EPA, ORD conducts research in five broad areas. These areas, and some of ORD's significant contributions, are summarized below:

Executive Summary

Ground-water research at EPA encompasses several different ORD programs which are contributing to the body of knowledge in this emerging science. Efforts are focused on serving EPA programs which are requiring an increasingly sophisticated knowledge base and greater technical assistance in order to develop and implement environmental programs. A major theme or objective for future research are prevention and remediation of ground-water contamination. These objectives can continue to be met through focused research products for EPA program clients, supported by basic research on subsurface processes, monitoring and remediation methods, while evaluating and refining research results based on field experience. Of primary importance are coordination with other research agencies and organizations, and dissemination of research expertise through technology transfer and technical assistance. Several ground-water research initiatives are highlighted in this Plan which would serve these goals. A significant research initiative proposed for consideration for FY 1992 concerns basic process research on the behavior and effects of agricultural chemicals in ground-water and surface water. Enhanced funding for ground water research should be considered in order to sustain its ability to serve the Agency's needs.

Foreword

Ground water is a vital natural resource in the United States. Its quality is of foremost concern for the future of human health and the environment. The importance of ground water for consumption and other uses, as well as the interaction of ground water with the rest of the hydrologic cycle and other aspects of the environment has become increasingly apparent in a number of EPA programs. The Agency has therefore established standards and undertaken various activities to protect and remediate this resource. To underscore the importance of these activities, the Deputy Administrator convened an EPA-wide Ground Water Task Force to coordinate and direct future efforts.

There are three essential and inter-related requirements for EPA's ground water efforts: legislative authority, administrative framework, and scientific and technological know-how. This document addresses the third requirement, particularly the role of research in building a scientific understanding of how to prevent, predict, and remediate ground water contamination. This Plan presents the Office of Research and Development's strategy for conducting subsurface and related research in support of EPA's programs.

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EPA

ORD Ground Water Research Plan: Strategy for FY 1991 and Beyond

PART F:

ORD GROUND-WATER RESEARCH PLAN

GROUND-WATER DATA MANAGEMENT IMPLEMENTATION RECOMMENDATIONS

BACKGROUND:

Over the last few years, the management of ground-water data in support of the nation's ground-water protection efforts has become increasingly more complex. Agency programs addressing ground-water protection have grown, cross-program integration has increased, and the sheer volume of data that is required and collected and has to be managed, has expanded significantly.

The Ground Water Task Force Subcommittee on Data Management's Report titled "Ground-Water Data Collection, Accessibility, and Utilization: was transmitted to the Ground-Water Task Force on October 25, 1990 (Attachment). It discusses the many issues that programs are facing as they manage ground-water data for decision making. This document represents a consensus of the programs involved in data management

As a result of the issues identified in the Report, and in the context of a Ground-Water Task Force Subcommittee meeting held on May 25, 1990, the Task Force is making several recommendations to address Agency needs with respect to ground-water data consistency, quality, and automation; ground-water data accessibility; and ground-water data utilization: geographic information systems (GIS) and other applications.

RECOMMENDATIONS:

Over the last several years there have been many successes in ground water data management by the program Offices and OIRM. In addition, each of these Offices have additional data management activities under development. However, most of these efforts are focused on programs specific needs and not on the integration across the programs to develop a comprehensive approach to data management. Therefore, the following recommendations are proposed to build upon what has already been accomplished and to fill in the gaps created by the need for cross program integration.

Resources must be provided for implementation of these recommendations because at the present time there are no Regional data management resources similar to those available for air or surface water data management to implement a ground-water data management effort. A corresponding budget initiative is being developed by Headquarters for the Regions and Headquarters.

Ground-Water Data Consistency, Quality, and Automation

Recommendation: Each Region should develop a cross-program policy on integrating and improving the management and use of ground-water data within the Region.

Each Regional policy would address but not be limited to program needs, data quality, automation, and usage of the data for decision making. This Regional policy would be consistent with EPA policy on minimum set of data elements for ground-water and data standards. The value of implementing this policy at the Regional level is the programs directly involved in each Region can determine what data to automate, how to use information already in EPA Regional files, the cost of making the data available electronically, the link to GIS and other issues. The Regional policy would also consider the needs and capabilities of the States, local governments, and the regulated community as key players and users of ground-water data. Region X which has already implemented this policy should provide the other Regions the benefits of their experience.

Ground-Water Accessibility

Recommendation: Develop a Directory for use by the Regions, States, local governments, other Federal Agencies, and the ground-water community to locate ground-water data.

The Directory would establish a central pointer system or "one stop shopping" to identify the many EPA, State, and other Federal ground-water and related data bases in existence. The Directory would have two tiers. The first tier would contain national information which would be useful nationally. The second tier would only contain information only useful to each Region such as their State and Regional data bases. This Directory would begin to document and build an institutional memory of the existence and the location of the data collected by the Regions and States.

Ground-Water Data Utilization: GIS and other Applications

Recommendation: Incorporate more fully the regional GIS capabilities developed from pilot projects into Regional ground-water decision making.

GIS is an emerging tool for cross-media planning and integrated environmental management, and base program activities such as permitting, inspection, and enforcement. In addition, it is particularly useful in risk-based priority setting of Regional program commitments and resource requirements. GIS has been found to be increasingly useful in program planning and priority setting activities, once the investment in area-specific mapping has been accomplished. As EPA begins using GIS in its decision making, it is also important to begin promoting the use of GIS by the State's in their decision making process.

EXHIBIT B

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:) PCB R89-
GROUNDWATER QUALITY STANDARDS (35 ILL. ADM. CODE 620))

STATEMENT OF REASONS

Pursuant to 35 Ill. Adm. Code 102.120(b), the Illinois Environmental Protection Agency ("Agency") hereby submits to the Illinois Pollution Control Board ("Board") a statement of reasons in support of the attached proposal of regulations.

I. STATUTORY AUTHORITY

Section 2(b) of the Illinois Groundwater Protection Act ("IGPA") (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7452(b)) sets forth that:

> . . . it is the policy of the State of Illinois to restore, protect, and enhance the groundwaters of the State, as a natural and public resource. The State recognizes the essential and pervasive role of groundwater in the social and economic well-being of the people of Illinois, and its vital importance to the general health, safety, and welfare. It is further recognized as consistent with this policy that the groundwater resources of the State be utilized for beneficial and legitimate purposes; that waste and degradation of the resources be prevented; and that the underground water resource be managed to allow for maximum benefit of the people of the State of Illinois.

To further this statutory purpose, Section 4 of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7454) establishes within State government the Interagency Coordinating Committee on Groundwater. The Committee consists of ten agencies[1] and is required to review and evaluate State groundwater activities.

In addition, Section 5 of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7455) creates the Groundwater Advisory Council. The Council consists of 9 public members appointed by the Governor and provides an independent review and evaluation of State groundwater activities.

Section 8(a) of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7458(a)) requires the Agency (after consultation with the Interagency Coordinating Committee on Groundwater and the Groundwater Advisory Council) to propose, and the Board to adopt within two years:

> . . . *comprehensive water quality standards for the protection of groundwater. In preparing such* regulations, the Agency shall address, to the extent feasible, those contaminants which have been found in groundwaters of the State and which are known to cause, or suspected of causing cancer, birth defects, or any other adverse effect

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[1] The Illinois Environmental Protection Agency, Illinois Department of Energy and Natural Resources, Illinois Department of Public Health, Department of Mines and Minerals, Office of the State Fire Marshall, Division of Water Resources of the Illinois Department of Transportation, Illinois Department of Agriculture, Illinois Emergency Services and Disaster Agency, Illinois Department of Nuclear Safety, and Illinois Department of Commerce and Community Affairs.

on human health according to nationally accepted guidelines . . .

Based upon the broad statutory mandate contained in the IGPA and the extraordinary measures provided in that law for interagency communication and cooperation, it is clear that the IGPA requires the Board to adopt "comprehensive water quality standards for the protection of groundwater" that apply even to such activities that may have in the past been primarily regulated by another State agency, department, or office. To be truly "comprehensive," the groundwater standards must be a body of regulations that form a regulatory "umbrella" under which these other State programs must operate. This point is further supported by the fact that the Board mandate to adopt the "comprehensive water quality standards for the protection of groundwater" was not merely added as an amendment to the Environmental Protection Act ("Act") (Ill. Rev. Stat. 1987, ch. 111 1/2, pars. 1001 et seq.), but rather was set forth in the IGPA, a free-standing body of statute containing its own stated policies and purposes.

While the IGPA does not directly specify the subject matter to be contained in the proposed regulations, Section 8(b) of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7458(b)) does list the factors that the Board must consider when adopting these regulations:

1. recognition that groundwaters differ in many important respects from surface waters, including water quality, rate of movement,

direction of flow, accessibility, susceptibility to pollution, and use;

2. classification of groundwaters on an appropriate basis, such as their utility as a resource or susceptibility to contamination;

3. preference for numerical water quality standards, where possible, over narrative standards, especially where specific contaminants have been commonly detected in groundwaters or where Federal drinking water levels or advisories are available;

4. application of nondegradation provisions for appropriate groundwaters, including notification limitations to trigger preventive response activities;

5. relevant experiences from other states where groundwater programs have been implemented; and

6. existing methods of detecting and quantifying contaminants with reasonable analytical certainty.

Using this list as a guide, the Agency developed the regulations set forth in 35 Ill. Adm. Code 620.

II. REGULATORY DEVELOPMENT

In the development of 35 Ill. Adm. Code 620, the Agency actively invited comments and suggestions regarding the proposal from other State agencies, public interest groups, and the general public.

On February 2, 1988, the Interagency Coordinating Committee on Groundwater met in Springfield. At that meeting the Agency distributed a draft of the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater. The Agency provided a detailed explanation of the paper and solicited comments from the Committee (see Exhibit 1).

On May 9, 1988, the Agency met with the Groundwater Advisory Council in Springfield. At that meeting the Agency distributed a draft of the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater. The Agency provided a detailed explanation of the paper and solicited comments from the Council (see Exhibit 2).

On July 7, 1988, the Interagency Coordinating Committee on Groundwater met in Springfield. At that meeting the Agency discussed the comments received from the Groundwater Advisory Council and from the Illinois Regulatory Group on the draft Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater. Also the Agency solicited additional comments from the Committee (see Exhibit 3).

On September 12, 1988, the Interagency Coordinating Committee on Groundwater and the Groundwater Advisory Council met in Springfield. At that meeting the Agency discussed a draft of the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater (see Exhibit 4).

On November 14, 1988, the Interagency Coordinating Committee on Groundwater met in Springfield and the Agency discussed the comments received on the draft Issues/Options

Paper for Comprehensive Water Quality Standards for Groundwater (see Exhibit 5).

On December 1, 1988, the Groundwater Advisory Council sponsored a groundwater protection policy forum in Naperville. At this meeting the Agency participated in an overview of the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater that was presented by a panel of Groundwater Advisory Council members. In addition, implementation of groundwater quality standards in other States was discussed by representatives from several other states (see Exhibits 6 and 7).

On December 2, 1988, the Groundwater Advisory Council met with the Agency in Naperville and discussed the Council's response to the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater (see Exhibit 8).

On January 10, 1989, the Interagency Coordinating Committee on Groundwater met in Springfield. The Agency announced the establishment of an Interagency Groundwater Standards Technical Team to be comprised of members from other State agencies to assist in the development of 35 Ill. Adm. Code 620, and discussed the development of a Discussion Document for Comprehensive Groundwater Quality Standards (see Exhibits 9 and 10).

On January 11, 1989, the Interagency Groundwater Standards Technical Team met in Springfield. The Agency prepared a table of over 400 compounds that were known or suspected to occur in Illinois groundwater, and the Team discussed the table extensively. In addition, the Agency and the Team discussed the development of a Discussion Document for Comprehensive Groundwater Quality Standards and the basis for developing groundwater standards (see Exhibits 11 and 12).

On January 24, 1989, the Agency met with the Groundwater Advisory Council in Naperville. The Agency discussed the development of a Discussion Document for Comprehensive Groundwater Quality Standards, and responded to questions concerning the Issues/Options Paper for Comprehensive Water Quality Standards for Groundwater (see Exhibit 13).

On February 10, 1989, the Interagency Groundwater Standards Technical Team met in Springfield. The Agency described the statutory authority under the IGPA and the rationale behind the proposed groundwater classification system.

On February 21, 1989, the Interagency Groundwater Standards Technical Team met in Springfield. The Team provided comments on the compounds and criteria that should be addressed in a draft Discussion Document for Comprehensive Groundwater Quality Standards.

On March 7, 1989, the Interagency Coordinating Committee on Groundwater met in Springfield. The Agency distributed a copy of the draft Discussion Document for Comprehensive Groundwater Quality Standards to the Committee, and provided a detailed explanation of the document (see Exhibit 14).

On March 8 and 16, 1989, the Interagency Groundwater Standards Technical Team met in Springfield. At these meetings the Agency explained the draft Discussion Document for Comprehensive Groundwater Quality Standards and solicited comments from the Team.

On April 21, 1989 the Agency met with the Groundwater Advisory Council in Springfield. At the meeting the Agency provided a detailed explanation of the final draft of the Discussion Document on Comprehensive Groundwater Quality Standards and solicited comments from the Council (see Exhibits 15 and 16).

On April 24, 1989, the Agency conducted a public rulemaking development session in Springfield. At this session the Agency described the content of the Discussion Document on Comprehensive Groundwater Quality Standards and solicited comments.

On May 3, 9, and 11, 1989, the Agency conducted open public workshops in Elgin, Springfield, and Collinsville respectively. At those workshops the Agency described the Discussion Document For Comprehensive Groundwater Quality Standards and solicited comments.

On May 8, 1989, the Interagency Coordinating Committee on Groundwater met in Springfield. At that meeting the Agency described the comments received from the Groundwater Advisory Council and the rulemaking development session, and solicited comments from the Committee (see Exhibit 17).

On May 30, 1989, the Interagency Groundwater Standards Technical Team met in Springfield. At that meeting the Agency discussed the comments received from the Interagency Coordinating Committee on Groundwater, Groundwater Advisory Council, rulemaking development session, and public workshops. In addition, the Department of Public Health and the Agency's Office of Chemical Safety discussed the research they had done on the groundwater quality criteria.

On July 12, 1989, the Agency met with the McHenry County Defenders and Citizens for A Better Environment in Springfield. At that meeting the Agency described options under consideration and solicited comments.

On July 17, 1989, the Interagency Coordinating Committee on Groundwater met in Springfield. At that meeting the Agency provided a detailed description of a draft of 35 Ill. Adm. Code 620 and solicited comments from the Committee.

On August 8, 1989, the Agency met with the Illinois Environmental Regulatory Group in Springfield. At that meeting the Agency described a draft of 35 Ill. Adm. Code 620 and solicited comments.

On August 9, 1989, the Agency conducted a public rulemaking development session in Springfield. At that meeting the Agency described a draft of 35 Ill. Adm. Code 620 and solicited comments.

On August 15, 1989, the Agency met with the Illinois Coal Association and the Illinois Department of Mines and Minerals in Springfield. At that meeting the Agency described a draft of 35 Ill. Adm. Code 620 and solicited comments.

The Agency made numerous revisions to 35 Ill. Adm. Code 620 in response to the comments and suggestions received as a result of these public participation efforts.

III. DESCRIPTION OF THE PROPOSAL

A. Subpart A

Subpart A sets forth the general provisions applicable to the entire part.

Section 620.101 sets forth the purpose of Part 620. This expressed purpose is consistent with the mandate contained in Section 8 of the IGPA.

Section 620.102 contains the definitions that are applicable to Part 620.

Section 620.103 requires persons to comply with the Act and Board regulations.

Section 620.104 describes the documents that are incorporated by reference into Part 620.

Section 620.105 provides that groundwater is not required to meet the general use standards and public and food processing standards contained in Subparts B and C of 35 Ill. Adm. Code 302. This section clarifies the relationship between 35 Ill. Adm. Code 302 and 35 Ill. Adm. Code 620.

Section 620.106 excludes the listed activities from Subparts C and D of Part 620. These excluded activities include certain types of man-made conduits and certain types of dewatering operations. The discharge to surface waters from such activities are regulated under 35 Ill. Adm. Code: Subtitle C.

B. Subpart B

Subpart B establishes the groundwater classification system and sets forth procedures for reclassification of groundwater.

Section 620.201 describes the four classes of groundwater:

1. Class I: Potable Resource Groundwater
2. Class II: General Resource Groundwater
3. Class III: Remedial Groundwater
4. Class IV: Naturally Limited Groundwater

All groundwater within the State falls into one of these four classes.

Class I: Potable Resource Groundwater is groundwater within a certain specified distance from a community water supply well or other potable water supply well. As set forth in Section 620.201(b), this distance may vary depending on the type of well and the hydrogeology of the area around the well.

Class II: General Resource Groundwater is all groundwater that is not otherwise contained in one of the other three classes.

Class III: Remedial Groundwater is groundwater that due to contamination cannot meet the groundwater criteria set forth in Subpart C for an extended period of time. This class includes groundwater contaminated by National Priorities List sites, State Remedial Action Priorities List sites, leaking underground storage tank sites, sites subject to corrective action approved by the Agency under 35 Ill. Adm. Code: Subtitle G, sites undergoing corrective action under 35 Ill. Adm. Code 615 or 616, permitted coal mining sites, or coal mining sites that were mined prior to current State land reclamation regulations.

It should be noted that under Section 620.303 remediation or reclamation efforts on Class III: Remedial Groundwater must result in such groundwater meeting Class II: General Resource Groundwater criteria on-site and meeting whatever criteria that is appropriate to the class of groundwater located off-site (i.e., Class I: Potable Resource Groundwater or Class II: General Resource Groundwater). It should also be noted that the status of groundwater as Class III: Remedial Groundwater ends when remediation or reclamation is completed.

Class IV: Naturally Limited Groundwater is groundwater that contains more than 10,000 mg/l of total dissolved solids due to natural conditions, or groundwater that the Board has designated as an exempted aquifer pursuant to 35 Ill. Adm. Code 730.104.

Section 620.202 sets forth the procedures by which the Board may reclassify groundwater by a site-specific rule.

For example, groundwater classified under this proposal as Class II: General Resource Groundwater may be reclassified by site-specific rule as Class I: Potable Resource Groundwater if the petitioner can demonstrate that the groundwater meets the standard set forth in Section 620.201(b)(5).

Section 620.203 sets forth the procedures by which the Board may reclassify certain groundwater by an adjusted standard. Under Section 620.201(b)(3) and (b)(4), within a specified period of time the area that is designated as Class I: Potable Resource Groundwater around certain community water supply wells will automatically increase to 3000 feet from the wellhead. Under Section 620.203, the Board must grant an adjusted standard resulting in an extension of Class I: Potable Resource Groundwater beyond 3000 feet from the wellhead if the petitioner demonstrates that the requested extension is within a "proximate aquifer" as defined in Section 620.203(e).

Section 620.204 authorizes the owner of a potable water supply well (other that a community water supply well) to obtain from an adjacent landowner a waiver of a Class I: Potable Resource Groundwater designation for groundwater contained on the adjacent site under certain specified conditions. This waiver process is similar in concept to the waiver provisions set forth in Section 14.2(b) of Act.

C. Subpart C

Subpart C sets forth the groundwater quality criteria for Class I: Potable Resource Groundwaters, Class II: General Resource Groundwater, Class III: Remedial Groundwater, and Class IV: Naturally Limited Groundwater.

The Agency based the health-related groundwater quality criteria in Subpart C on the Maximum Contaminant Levels ("MCLs") developed by the United States Environmental Protection Agency ("USEPA"). Where USEPA has proposed an MCL for a contaminant for which there is no existing MCL or where USEPA has proposed to modify an existing MCL, the Agency based its groundwater criteria on the proposed MCL. If USEPA adopts the proposed MCL as a final rule prior to the Board's adoption of this proposal, the Agency recommends that the Board adopt the MCL contained in USEPA's final rule, even if the MCL contained in the final rule differs from USEPA's proposed MCL.

Section 620.301 contains the inorganic and organic chemical constituents that are applicable to Class I: Potable Resource Groundwater. The inorganic constituent criteria for gross alpha and lead are based on USEPA's MCLs. Arsenic, barium, cadmium, chromium, copper, mercury, nitrate-nitrogen, and selenium are based on USEPA's proposed MCLs. The criteria for cyanide, manganese, and silver are based on the Maximum Allowable Concentration ("MAC") set forth in 35 Ill. Adm. Code 604.202. USEPA is proposing to delete the MCL for silver and in its place adopt a Secondary Maximum Contaminant Level ("SMCL"). The criteria for chloride, iron, sulfate, and total dissolved solids are based on the 95 percent confidence concentration level from all of the groundwater monitoring conducted by the Agency from community water supply wells.

The organic chemical constituent criteria for benzene, carbon tetrachloride, endrin, para-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethylene, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride are based on USEPA's MCLs. The organic chemical constituent criteria for alachlor, alidicarb, atrazine, carbofuran, chlordane, heptachlor, heptachlor epoxide, lindane, 2,4-D, ortho-dichlorobenzene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, ethylbenzene, methoxychlor, monochlorobenzene, pentachlorophenol, polychlorinated biphenyls, styrene, 2,4,5-TP, tetrachloroethylene, toluene, toxaphene, and xylenes are based on USEPA's proposed MCLs.

USEPA proposed dual criteria for styrene because of the uncertainty of its carcinogenicity classification. The Agency utilized the less stringent criteria since USEPA's discussion of the uncertainty factors appears to support the less stringent criteria.

The complex organic chemical mixture criteria for gasoline, diesel fuel or heating fuel were selected consistent with USEPA model procedures for effluent limitations. Benzene is used as a main pollutant of concern because of its solubility and because it is a carcinogen. Benzene can also be used as an indicator parameter for the removal of other related chemicals (e.g., propylene and naphthalene). The aggregate parameter of benzene, ethylbenzene, toluene, and the xylenes ("BETX") was also selected as an indicator since BETX is often used as the petroleum industry standard. The criteria for benzene was based on a USEPA MCL. The complex organic chemical mixture criteria for BETX was based on the summation of the USEPA's MCLs and proposed MCLs for benzene, ethylbenzene, toluene, and xylenes.

Section 620.302 contains the inorganic and organic criteria that are applicable to Class II: General Resource Groundwater. The general basis for the inorganic criteria in this section are the levels recommended to USEPA in "Water Quality Criteria: 1972, by the National Academy of Sciences - National Academy of Engineering.

The inorganic chemical constituent criteria for arsenic, cobalt, copper, cyanide, fluoride, lead, and mercury are based on recommended limits for livestock water supply. The inorganic chemical constituent criteria for cadmium and chromium are based on recommended water quality criteria for both livestock and irrigation concerns. The inorganic criteria for boron, selenium, and zinc are based on recommended water quality criteria for intermittent irrigation on tolerant crops. These are similar to the conditions under which irrigation is used in Illinois. The inorganic constituent criteria for total dissolved solids are based on the 95 percent confidence concentration level from all of the groundwater monitoring conducted by the Agency at community water supply wells.

The organic chemical constituent criteria are based on a calculation that takes USEPA's MCLs or proposed MCLs and increases that level by a factor derived from either an 80% removal efficiency or USEPA's most cost-effective best available treatment ("BAT") removal percentage levels, with the exception of phenols[2] and xylenes[3]. Therefore, the upper limit for Class II: General Resource Groundwater would never exceed a treatable level for any organic constituent having a health-based Class I: Potable Resource Groundwater criteria.

The organic criteria for alachlor, aldicarb, atrazine, benzene, carbofuran, carbon tetrachloride, chlordane, endrin, heptachlor, heptachlor epoxide, lindane, 2,4-D, para-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, methoxychlor monochlorobenzene, pentachlorophenol, polychlorinated

[2] The criteria established for phenols is based on 35 Ill. Adm. Code 302.208.

[3] The criteria for all three of the xylenes is based on USEPA's proposed MCL for any single xylene.

biphenyls, styrene, 2,4,5-TP, tetrachloroethylene, toxaphene, 1,1,1-trichloroethane, trichloroethylene, and vinyl chloride is derived from a 80 percent removal efficiency rate. The criteria established for ortho-dichlorobenzene is derived from a 40 percent removal efficiency rate. The criteria established for cis-1,2-dichloroethylene is derived from a 65 percent removal efficiency rate. The criteria established for ethylbenzene is derived from a 30 percent removal efficiency rate. The criteria established for toluene is derived from a 60 percent removal efficiency rate.

The complex organic chemical mixture criteria of gasoline and fuels is derived from the criteria established for each individual chemical. The criteria for BETX is based on adding the criteria for benzene, ethylbenzene, toluene, and xylenes as described above.

The alternate total dissolved solids ("TDS") criteria is based upon the maximum concentration of the ambient TDS concentration level resulting from past surface coal mining, but not to exceed 3000 mg/l. Such a TDS level will still allow the water to be used for irrigation, livestock watering, and other beneficial general uses. In addition, this level also corresponds to the lower limit established by USEPA as an exempt aquifer pursuant to 35 Ill. Adm. Code 730.104. Also, where coal mining activity creates groundwater where no significant resource groundwater existed prior to mining, the TDS criteria for such groundwater is based upon the maximum concentration of the ambient TDS concentration level resulting from past surface coal mining, but not to exceed 5000 mg/l.

Section 620.303 establishes the groundwater quality criteria for Class III: Remedial Groundwater. This criteria is based on the existing concentration of contaminants in the groundwater underlying a site. The criteria that apply on-site after remediation or closure are the criteria for Class II: General Resource Groundwater. The criteria that applies off-site are the criteria appropriate to the class of groundwater off-site.

Section 620.304 establishes the procedures for determining compliance with the groundwater criteria. Section 620.304 describes where each criteria apply and describes the points where monitoring data can be obtained to determine compliance.

In general, criteria for a particular class of groundwater applies to that groundwater unless the groundwater is located on-site. All groundwater on-site must meet the criteria for Class II: General Resource Groundwater.

Groundwater criteria shall only apply down gradient of a contamination source or at the boundary of other structures (e.g., buildings). This exclusion recognizes that monitoring and removal of contaminants under certain structures may not be feasible. In addition, appropriate criteria always apply off-site unless a waiver is provided under Section 620.204.

The criteria applies at appropriate wells or springs. An appropriate well is one permitted by a State regulatory agency or constructed (or reconstructed) in accordance with applicable codes or rules. In addition, monitoring wells must meet the specified technical criteria. These requirements are consistent with the Department of Public Health standards. The Department of Public Health is developing a monitoring well code. When the Department of Public Health codifies a monitoring well code, it is the Agency's intent to be consistent with those rules.

In addition, a spring discharging groundwater from an aquifer is a permissible monitoring point to determine compliance. This is not intended to allow seeps or other minor groundwater discharges as a monitoring point.

The technical requirements proposed in this section for wells and springs helps assure representative groundwater samples. The procedures standardize the monitoring locations, and better define the specific criteria applicable to those groundwaters.

Section 620.305 details groundwater monitoring, analytical, and reporting requirements. This section establishes standards for a representative sample collection point for drinking water wells, wells other than drinking water wells, monitoring wells, and springs. Groundwater samples must be collected from drinking water wells and wells other than drinking water wells prior to any treatment. This section also requires that groundwater collected from a monitoring well or spring be filtered for inorganic chemical constituent analyses.

Section 620.305 also details sample collection procedures, water level collection requirements, and analytical laboratory methods. For organic compounds that are listed as carcinogens, the analytical standard requires the use of a methodology which has a practical quantification level ("PQL") at or below the groundwater criteria. In addition, all analytical methodology must be consistent with the methodologies incorporated by reference under Section 620.104.

Further, Section 620.305 sets forth specific groundwater monitoring information reporting requirements. The reporting requirements contained in this section do not apply to activities subject to Subpart B of 35 Ill. Adm. Code 615 or 616, or units subject to Subpart F of 35 Ill. Adm. Code 724.

D. Subpart D

Subpart D details groundwater non-degradation and preventive management procedures.

Section 620.401 describes the general regulation prohibiting the downgrading of a groundwater class. Thus, for example, Class I: Potable Resource Groundwater must not be degraded to non-potable use, while Class II: General Resource Groundwater must not be degraded to Class III: Remedial Groundwater.

Section 620.402 requires that preventative management procedures apply to new sites within Class I: Potable Resource Groundwater and Class II: General Resource Groundwater, and to existing sites within a setback zone. This section differentiates between new and existing sites. The requirements for new sites are more stringent than the requirements for existing sites. This approach is consistent with the application of nondegradation to "appropriate groundwaters" as described in Section 8(b)(4) of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7458(b)(4)). By distinguishing between new and existing sites in the application of nondegradation requirements, Subpart D results in a gradual and manageable phase-in of these more rigorous requirements. This regulation is also consistent with 35 Ill. Adm. Code 615 and 616, and the IGPA which prescribe more stringent provisions for those activities or sources that are not already in existence.

Section 620.402 describes when a preventative management response must be initiated for Class I: Potable Resource Groundwater and Class II: General Resource Groundwater. If a constituent listed in this section is detected by a regulated entity or regulatory agency or department, a preventative management response must be undertaken. This generally requires that the detection of a constituent be confirmed by additional monitoring.

In addition, Section 620.402 describes the person or entity that may determine a detection. A detection may be determined by a State regulatory agency or department, or by the owner and operator of a regulated entity for which groundwater monitoring is required pursuant to State or Federal law. Also, definitions are provided for terms used in this section.

Section 620.403 sets forth the preventative management response procedure responsibilities of regulated entities, the Agency, and the Department of Public Health. This section requires that a detection at a monitoring well or drinking water well must be resampled by a regulated entity or State agency or department and, if confirmed, the appropriate agency must be notified.

In addition under Section 620.403, the owner and operator of a regulated entity that has been notified must sample each of their own monitoring wells or drinking water wells if the site stores, disposes, or otherwise handles material containing the constituent that was detected. If the same constituent is detected again, the monitoring or drinking water well must be resampled and the results must be reported to the Agency. The results of monitoring under Section 620.403 is used to determine the nature, extent, and source of any contamination.

Section 620.403 also requires the Agency to conduct a well site survey if it receives notice that a contaminant has been detected, unless a well site survey has been conducted within the last 3 years or a groundwater protection needs assessment has been conducted. This information will help determine if sources, routes, or activities might be a possible cause of the contamination.

Section 620.404 specifies the conditions and criteria which trigger applicable corrective action at sites that are subject to the preventive management procedures of Section 620.402. This section is a specific response to Section 8(b)(4) of the IGPA (Ill. Rev. Stat. 1987, ch. 111 1/2, par. 7458(b)(4)). The applicable corrective action is that which is required by other law or regulations governing the regulated entity that is a source of the contamination. In other words, this section establishes a groundwater "trigger" for corrective action under other State or Federal programs.

Section 620.404(a) describes the corrective action trigger for Class I: Potable Resource Groundwater. Applicable corrective action must be undertaken in Class I: Potable Resource Groundwater if (1) the Secondary Maximum Contaminant Level ("SMCL") are exceeded for the seven listed constituents which have organoleptic thresholds less than the health-based threshold of the Class I: Potable Resource Groundwater criteria, (2) a carcinogen denoted in Section 620.301(c) or (d) is exceeded, (3) benzene exceeds 0.005 mg/l or BETX exceeds 0.095 mg/l[4] for fuels, or (4) a statistically significant increase above background for any other constituent listed in the Class I: Potable Resource Groundwater criteria (i.e, Section 620.301).

Exceeding an SMCL will trigger potable groundwater protection at the first indication of taste or odor impacts upon the groundwater. Triggering corrective action whenever a PQL is exceeded for constituents denoted as carcinogens in Section 620.301(c) or (d) essentially requires corrective action whenever one of these constituents can be quantified. The statistically significant increase trigger is consistent with the requirements set forth in 35 Ill. Adm. Code 616 and 724.

[4] Note that the value of 0.095 mg/l for BETX was derived from the sum of the SMCLs for ethylbenzene, toluene, and xylenes.

Section 620.404(b) describes the corrective action trigger for Class II: General Resource Groundwater. Applicable corrective action must be undertaken in Class II: General Resource Groundwater if the Class I: Potable Resource Groundwater criteria (Section 620.301) for organics, complex organic chemical mixtures and selected inorganics are exceeded. This trigger for Class II: General Resource Groundwater is intended to help assure that groundwaters of this class which already comply with Class I: Potable Resource Groundwater criteria are maintained at this better water quality level. Detection of constituents exceeding this criteria would cause preventative management procedures and corrective action to be initiated.

The exceptions set forth in Section 620.404(c) provide regulatory relief if the regulated entity can demonstrate that the source of the contamination is due to background or due to sampling error. In addition, this subsection grandfathers all levels established by appropriate prior corrective action, thus assuring that final determinations that were previously made regarding prior closure actions will be recognized. This subsection requires that the demonstration thereunder must be made to the Agency.

Section 620.405 provides for an adjusted standard from applicable corrective action. If a regulated entity is subject to applicable corrective action the owner or operator can file a petition with the Board and the State regulatory agency or department that issued the notice of corrective action. The Board must issue an adjusted standard if the owner and operator of a regulated entity demonstrates that significant adverse economic and social impacts will result from implementation of the corrective action, and that the residual environmental or health risks posed by the contaminants are not a significant hazard. This section does not allow an adjusted standard option for any regulated entity that is the subject of corrective action under 35 Ill. Adm. Code 724 or 725, or under the Resource Conservation and Recovery Act of 1976 (P.L. 94-580, 42 USCS §6901 et seq., as amended).

E. Subpart E

Subpart E establishes procedures for developing and issuing a Health Advisory. A Health Advisory is a means for the Agency to establish a guidance level for a chemical substance or a mixture of chemical substances for which criteria have not yet been set under Section 620.301. This advisory process is intended to mirror the procedure used by USEPA to account for substances detected in groundwater that do not have promulgated criteria. Also, it should be noted that this Subpart codifies existing practice by the Agency.

The Health Advisory procedure will begin when such a chemical substance or mixture of chemical substances is detected in a community water supply. The Agency will then develop a guidance level for this chemical substance or mixture of chemical substances using the procedures described in Appendices A, B, and C. These procedures are derived from USEPA's guidelines for assessing risk to human health, including guidelines on developing Maximum Contaminant Level Goals ("MCLGs") and Oral Reference Doses (RfD_O), and National Academy of Sciences' guidelines for assessing adverse effects to human health from drinking water contaminants. The Agency will publish the Health Advisories in documents which will be available to the public.

Section 620.501 states that the guidance level developed from the Health Advisory process will be used by the Agency in setting groundwater cleanup or action levels and proposing new or revised groundwater quality criteria to the Board. The Health Advisory guidance level will also be used by the Agency to determine whether the community water supply is being taken from the best available raw water source as required by 35 Ill. Adm. Code 604.501(a).

Section 620.502 states that a Health Advisory will be issued if a chemical substance or mixture of chemical substances is found in a community water supply well as no criteria under Section 620.301, and is harmful to human health.

The Health Advisory guidance level will be equal to the MCLG, if it exists, for noncarcinogens or the PQL for carcinogens. If the chemical substance does not have an established MCLG or a mixture of chemical substances is present, the guidance level is determined using the procedures specified in Appendices A, B, and C.

Section 620.503 states that the full text of the Health Advisory will be published and made available to the public.

F. Appendices

Appendix A sets forth specific procedures for calculating Human Threshold Toxicant Advisory Concentrations for a chemical substance for which the Board has not adopted a groundwater standard for Class I: Potable Resource Groundwater and for which USEPA has not adopted an MCLG. These procedures reflect the preference stated in the IGPA for the use of "rationally accepted guidelines" in implementing that act.

Subsection (a) of Appendix A describes the calculation of the Human Threshold Toxicant Advisory Concentration. The methodology is identical to the procedures used by USEPA to calculate Lifetime Health Advisories for drinking water. The Human Threshold Toxicant Advisory Concentration is calculated from an estimation of the Acceptable Daily Exposure (determined in subsection (b)), which is then distributed into the normal amount of drinking water consumed by humans. There is an adjustment made to this acceptable concentration for the relative contribution of the amount of a person's exposure to a chemical from drinking water when compared to their exposure to that chemical from all other sources. Chemical-specific information on the relative contribution of drinking water and all other sources of exposure to a chemical must be used, if available. If such data are not available, the default value specified is the default value used by USEPA to develop its drinking water Health Advisories.

Subsection (b) of Appendix A lists procedures for determining the Acceptable Daily Exposure to be used in calculating the Human Threshold Toxicant Advisory Concentration in subsection (a). Subsection (b)(1) describes the Acceptable Daily Exposure as the maximum amount of a threshold toxicant, in units of milligrams per day, which if ingested daily for a lifetime is expected to result in no adverse effects to humans. Subsections (b)(2) through (b)(6) describe methods for deriving the Acceptable Daily Exposure. Preference is given to the use of USEPA's Verified Oral Reference Dose where available. This value is a peer-reviewed estimate of the human no-effect "dose", developed by USEPA for chemicals which cause toxic effects for which there are identifiable thresholds for the toxic effects. For chemicals which lack a Verified Oral Reference Dose, preference is given in descending order to health effects data from: investigations of human exposures in which a No Adverse Effect Level is identified; investigations of human exposures in which a Lowest Adverse Effect Level is identified; animal studies in which a No Adverse Effect Level is identified; and animal studies in which a Lowest Adverse Effect Level is identified. Guidance is also provided for animal studies to convert study results into the form (i.e., in units of milligrams per kilogram per day) required to be used in subsection (a), if necessary, and to correct for less-than-full time exposure. When animal studies must be used, preference is given to studies determined to have High Validity, as specified in subsection (c).

Subsection (c) of Appendix A outlines procedures for establishing the validity of data from animal studies. A rating of High Validity is given to animal studies in which the animals are exposed to the chemical for their lifetime, or, if the study design calls for less-than-lifetime exposure, in which a No Observable Adverse Effect Level may be identified for the chemical. Minimum requirements for various aspects of the study designs are also specified for a study of High Validity. Studies in which minor deviations from the requirements of a High Validity study are found, but which satisfy all other requirements for a study of High Validity, are considered to have Medium Validity. Low

Validity studies are those not meeting the requirements for High or Medium Validity studies.

Appendix B describes procedures for calculating the Hazard Index for mixtures of similar-acting substances in Class I: Potable Resource Groundwater. The Hazard Index calculations rely on procedures very similar to those used by USEPA to assess the potential health hazards from mixtures of chemical substances. The Hazard Index is an estimator of the combined effect of two or more similar acting substances in a mixture on human health.

In subsection (b) of Appendix B, "mixture" is defined as two or more substances which may or may not be related chemically or commercially, but which are not complex mixtures of closely related chemicals which are intentionally produced as a commercial product, such as PCBs or technical grade chlordane.

Subsection (c) of Appendix B specifically identifies the Hazard Index calculation for two mixtures of similar acting substances for which both members of the mixture have had groundwater standards for Class I: Potable Resource Groundwater proposed in Section 620.301. For any other mixtures in which one or more of the members do not have groundwater standards proposed in Section 620.301, the procedures outlined in subsections (d) through (g) of

Appendix B identify the Hazard Index calculations for such mixtures for similar acting substances in the mixtures.

Subsection (d) of Appendix B sets forth the method of calculating the Hazard Index, using a dose addition model[5]. The Hazard Index is calculated by summing two or more fractions, which are calculated by dividing the measured concentration of each similar acting substance in the mixture by its respective acceptable level.

Subsection (e) of Appendix B identifies the acceptable levels to be used in subsection (d) for substances which have a mechanism of toxicity for which there is a threshold for the toxic effect.

Subsection (f) of Appendix B identifies the acceptable levels to be used in subsection (d) for carcinogens.

Subsection (g) of Appendix B requires that a separate Hazard Index be calculated for each toxicity endpoint of concern for the chemical substances in a mixture. This follows from the use of a dose addition model, which is most properly applied to cases in which two or more substances induce the same toxic effect by the same or similar mode of action.

Subsection (h) of Appendix B lists the health-based goals for the individual substances in a mixture and the

[5] This model does not take into account possible synergistic or antagonistic effects of chemicals in a mixture.

goal for those chemicals in a mixture which are similar acting substances.

Appendix C sets forth guidance for determining when two or more chemical substances in a mixture shall be considered to be similar acting. This guidance is provided since the use of the dose addition model in Appendix B to address the combined toxicities of two or more chemicals in a mixture is most appropriate when the chemicals cause the same toxic effect by the same or similar mode of action.

Subsection (a) of Appendix C describes instances in which substances will be considered to be similar acting. This will occur when it can be shown that the substances have the same target in an organism or when the substances have the same mechanism of toxicity.

Subsection (b) of Appendix C cautions against including substances in a mixture which are fundamentally different in their mechanism of toxicity. Specifically, substances which cause toxic effects for which there is a threshold for the toxic effect shall not be included in mixtures of chemicals which exert their effects through a nonthreshold mechanism (i.e., carcinogens), and vice-versa. This subsection, however, does provide for the inclusion of a carcinogen in a mixture with "threshold" substances if it can be shown that the carcinogen also causes the same threshold effect as the other substances in the mixture. In this case, the acceptable level for the threshold effect of the carcinogen is calculated the same as the Human Threshold Toxicant Advisory Concentration in Appendix A.

Subsection (c) of Appendix C directs that certain complex mixtures, which are composed of closely related compounds and which are produced commercially as specific products, be treated as if they are a single chemical substance. In such cases, the Health Advisory for these complex mixtures shall be derived using the procedures of Appendix A for mixtures which cause threshold effects, and shall be equal to the lowest PQL for those mixtures which are carcinogens.

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EXHIBIT C

Water Quality Criteria 1972

A Report of the
Committee on Water Quality Criteria

Environmental Studies Board

National Academy of Sciences
National Academy of Engineering

Washington, D.C., 1972

At the request of
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lactating ewes and their lambs (NRC 1968b[203]). A level of 6 ppm in the diet is considered adequate for swine (NRC 1968a).[202]

Swine are apparently very tolerant of high levels of copper, and 250 ppm or more in the diet have been used to improve liveweight gains and feed efficiency (Nutrition Reviews 1966a[210]; NRC 1968a).[202] On the other hand, sheep were very susceptible to copper poisoning (Underwood 1971),[254] and for these animals a diet containing 25 ppm was considered toxic. About 9 mg per animal per day was considered the safe tolerance level (NRC 1968b).[203]

Several reviews of copper requirements and toxicity have been presented (McKee and Wolf 1963,[193] Nutrition Reviews 1966a,[210] Underwood 1971).[254] There is very little experimental data on the effects of copper in the water supply on animals, and its toxicity must be judged largely from the results of trials where copper was fed. The element does not appear to accumulate at excessive levels in muscle tissues, and it is very readily eliminated once its administration is stopped. While most livestock tolerate rather high levels, sheep do not (NRC 1968b).[203]

Recommendation

It is recommended that the upper limit for copper in livestock waters be 0.5 mg/l. Very few natural waters should fail to meet this.

Fluorine

The role of fluorine as a nutrient and as a toxin has been thoroughly reviewed by Underwood (1971).[254] (Unless otherwise indicated, the following discussion, exclusive of the recommendation, is based upon this review.) While there is no doubt that dietary fluoride in appropriate amounts improved the caries resistance of teeth, the element has not yet been found essential to animals. If it is a dietary essential, its requirement must be very low. Its ubiquity probably insures a continuously adequate intake by animals.

Chronic fluoride poisoning of livestock has, on the other hand, been observed in several areas of the world, resulting in some cases from the consumption of waters of high fluoride content. These waters come from wells in rock from which the element has been leached, and they often contain 10–15 mg/l. Surface waters, on the other hand, usually contain considerably less than 1 mg/l.

Concentrations of 30–50 ppm of fluoride in the total ration of dairy cows is considered the upper safe limit, higher values being suggested for other animals (NRC 1971a).[205] Maximum levels of the element in waters that are tolerated by livestock are difficult to define from available experimental work. The species, volume, and continuity of water consumption, other dietary fluoride, and age of the animals, all have an effect. It appears, however, that as little as 2 mg/l may cause tooth mottling under some circumstances. At least a several-fold increase in its concentratio[n] seems, however, required to produce other injurious effect[s].

Fluoride from waters apparently does not accumulate i[n] soft tissues to a significant degree. It is transferred to a ver[y] small extent into the milk and to a somewhat greater degre[e] into eggs.

McKee and Wolf (1963)[193] have also reviewed the matte[r] of livestock poisoning by fluoride, concluding that 1.0 mg/[l] of the element in their drinking water did not harm thes[e] animals. Other more recent reports presented data suggesting that even considerably higher concentrations of fluorid[e] in the water may, with the exception of tooth mottling caused no animal health problems (Harris et al. 1963,[16..] Shupe et al. 1964,[246] Nutrition Reviews 1966b,[211] Savill[e] 1967,[231] Schroeder et al. 1968a[237]).

Recommendation

An upper limit for fluorides in livestock drinking waters of 2.0 mg/l is recommended. Although thi[s] level may result in some tooth mottling it shoul[d] not be excessive from the standpoint of anima[l] health or the deposition of the element in meat milk, or eggs.

Iron

It is well known that iron (Fe) is essential to animal life Further, it has a low order of toxicity. Deobald and Elvehjem (1935)[138] found that iron salts added at a level o[f] 9,000 mg Fe/kg of diet caused a phosphorus deficiency i[n] chicks. This could be overcome by adding phosphate to th[e] diet. Campbell (1961)[124] found that soluble iron salt administered to baby pigs by stomach tube at a level of 600 m[g] Fe/kg of body weight caused death within six hours. O'Donovan et al. (1963)[212] found very high levels of iron in th[e] diet (4,000 and 5,000 mg/kg) to cause phosphorus deficienc[y] and to be toxic to weanling pigs Lower levels (3,000 mg/kg) apparently were not toxic. The intake of water by livestoc[k] may be inhibited by high levels of this element (Taylo[r] 1935).[250] However, this should not be a common or a seriou[s] problem. While iron occurs in natural waters as ferrou[s] salts which are very soluble, on contact with air it is oxidized and it precipitates as ferric oxide, rendering it essentially harmless to animal health.

It is not considered necessary to set an upper limit of acceptability for iron in water. It should be noted, however, that even a few parts per million of iron can cause clogging of lines to stock watering equipment or an undesirable staining and deposit on the equipment itself.

Lead

Lake and river waters of the United States usually contain less than 0.05 mg/l of lead (Pb), although concentrations in excess of this have been reported (Durum et al. 1971,[141] Kopp and Kroner 1970).[182] Some natural waters in areas where galena is found have had as much as 0.8 mg/l of the

Comprehensive reviews of literature dealing with trace element effects on plants are provided by McKee and Wolf (1963),[436] Bolland and Butler (1966),[378] and Chapman (1966).[386] Hodgson (1963)[417] presented a review dealing with reactions of trace elements in soils.

In developing a workable program to determine acceptable limits for trace elements in irrigation waters, three considerations should be recognized:

- Many factors affect the uptake of and tolerance to trace elements. The most important of these are the natural variability in tolerances of plants and of animals that consume plants, in reactions within the soil, and in nutrient interactions, particularly in the plant.
- A system of tolerance limits should provide sufficient flexibility to cope with the more serious factors listed above.
- At the same time, restrictions must be defined as precisely as possible using presently available, but limited, research information.

Both the concentration of the element in the soil solution, assuming that steady state may be approached, and the total amount of the element added in relation to quantities that have been shown to produce toxicities were used in arriving at recommended maximum concentrations. A water application rate of 3 acre feet/acre/year was used to calculate the yearly rate of trace elements added in irrigation water.

The suggested maximum trace element concentrations for irrigation waters are shown in Table V-13.

The suggested maximum concentrations for continuous use on all soils are set for those sandy soils that have low capacities to react with the element in question. They are generally set at levels less than the concentrations that produce toxicities when the most sensitive plants are grown in nutrient solutions or sand cultures. This level is set, recognizing that concentration increases in the soil as water is evapotranspired, and that the effective concentration in the soil solution, at near steady state, is higher than in the irrigation water. The criteria for short-term use are suggested for soils that have high capacitites to remove from solution the element or elements being considered.

The work of Hodgson (1963)[417] showed that the general tolerance of the soil-plant system to manganese, cobalt, zinc, copper, and boron increased as the pH increased, primarily because of the positive correlation between the capacity of the soil to inactivate these ions and the pH. This same relationship exists with aluminum and probably exists with other elements such as nickel (Pratt et al. 1964)[449] and boron (Sims and Bingham 1968).[465] However, the ability of the soil to inactivate molybdenum decreases with increase in pH, such that the amount of this element that could be added without producing excesses was higher in acid soils.

TABLE V-13—Recommended Maximum Concentrations of Trace Elements in Irrigation Waters[a]

Element	For waters used continuously on all soil	For use up to 20 years on fine textured soils of pH 6.0 to 8.5
	mg/l	mg/l
Aluminum	5.0	20.0
Arsenic	0 10	2.0
Beryllium	0.10	0.50
Boron	0.75	2.0
Cadmium	0.010	0.050
Chromium	0.10	1.0
Cobalt	0.050	5.0
Copper	0.20	5 0
Fluoride	1.0	15.0
Iron	5.0	20.0
Lead	5.0	10.0
Lithium	2.5[b]	2.5[b]
Manganese	0.20	10.0
Molybdenum	0.010	0.050[d]
Nickel	0.20	2.0
Selenium	0.020	0.020
Tin[c]		
Titanium[c]		
Tungsten[c]		
Vanadium	0.10	1.0
Zinc	2.0	10.0

[a] These levels will normally not adversely affect plants or soils.
[b] Recommended maximum concentration for irrigating citrus is 0.075 mg/l.
[c] See text for a discussion of these elements.
[d] For only acid fine textured soils or acid soils with relatively high iron oxide contents.

In addition to pH control (i.e., liming acid soils), another important management factor that has a large effect on the capacity of soils to adsorb some trace elements without development of plant toxicities is the available phosphorus level. Large applications of phosphate are known to induce deficiencies of such elements as copper and zinc and greatly reduce aluminum toxicity (Chapman 1966).[386]

The concentrations given in Table V-13 are for ionic and soluble forms of the elements. If insoluble forms are present as particulate matter, these should be removed by filtration before the water is analyzed.

Aluminum

The toxicity of this ion is considered to be one of the main causes of nonproductivity in acid soils (Coleman and Thomas 1967,[392] Reeve and Sumner 1970,[453] Hoyt and Nyborg 1971a[419]).

At pH values from about 5.5 to 8.0, soils have great capacities to precipitate soluble aluminum and to eliminate its toxicity. Most irrigated soils are naturally alkaline, and many are highly buffered with calcium carbonate. In these situations aluminum toxicity is effectively prevented.

With only a few exceptions, as soils become more acid ($pH < 5.5$), exchangeable and soluble aluminum develop by dissolution of oxides and hydroxides or by decomposition of clay minerals. Thus, without the introduction of aluminum, a toxicity of this element usually develops as soils are acidified, and limestone must be added to keep the soil productive.

Selenium

Selenium is toxic at low concentrations in nutrient solutions, and only small amounts added to soils increase the selenium content of forages to a level toxic to livestock. Broyer et al. (1966)[384] found that selenium at 0.025 mg/l in nutrient solutions decreased the yields of alfalfa.

The best evidence for use in setting water quality criteria for this element is application rates in relation to toxicity in forages. Amounts of selenium in forages required to prevent selenium deficiencies in cattle (Allaway et al. 1967)[366] ranged between 0.03 and 0.10 mg/kg (depending on other factors), whereas concentrations above 3 or 4 mg/kg were considered toxic (Underwood 1966).[171] A number of investigators (Hamilton and Beath 1963,[410] Grant 1965,[107] Allaway et al. 1966)[367] have shown that small applications of selenium to soils at a rate of a few kilograms per hectare produced plant concentrations of selenium that were toxic to animals. Gissel-Nielson and Bisbjerg (1970)[406] found that applications of approximately 0.2 kg/hectare of selenium produced from 1.0 to 10.5 mg/kg in tissues of forage and vegetable crops.

Recommendation

With the low levels of selenium required to produce toxic levels in forages, the recommended maximum concentration in irrigation waters is 0.02 mg/l for continuous use on all soils. At a rate of 3 acre feet of water per acre per year this concentration represents 3.2 pounds per acre in 20 years. The same recommended maximum concentration should be used on neutral and alkaline fine textured soils until greater information is obtained on soil reactions. The relative mobility of this element in soils in comparison to other trace elements and slow removal in harvested crops provide a sufficient safety margin.

Tin, Tungsten, and Titanium

Tin, tungsten, and titantium are effectively excluded by plants. The first two can undoubtedly be introduced to plants under conditions that can produce specific toxicities. However, not enough is known at this time about any of the three to prescribe tolerance limits. (This is true with other trace elements such as silver.) Titantium is very insoluble, at present it is not of great concern.

Vanadium

Gericke and Rennenkampff (1939)[405] found that vanadium at 0.1, 1.0, and 2.0 mg/l added to nutrient solutions as calcium vanadate slightly increased the growth of barley, whereas at 10 mg/l vanadium was toxic to both tops and roots and that vanadium chloride at 1.0 mg/l of vanadium was toxic. Warington (1954,[476] 1956[477]) found that flax, soybeans, and peas showed toxicity to vanadium in the concentration range of 0.5 to 2.5 mg/l. Chiu (1953)[389] found that 560 pounds per acre of vanadium added as ammonium metavanadate to rice paddy soils produced toxicity to rice.

Recommendations

Considering the toxicity of vanadium in nutrient solutions and in soils and the lack of information on the reaction of this element with soils, a maximum concentration of 0.10 mg/l for continued use on all soils is recommended. For a 20-year period on neutral and alkaline fine textured the recommended maximum concentration is 1.0 mg/l.

Zinc

Toxicities of zinc in nutrient solutions have been demonstrated for a number of plants. Hewitt (1948)[413] found that zinc at 16 to 32 mg/l produced iron deficiencies in sugar beets. Hunter and Vergnano (1953)[421] found toxicity to oats at 25 mg/l. Millikan (1947)[438] found that 2.5 mg/l produced iron deficiency in oats. Earley (1943)[399] found that the Peking variety of soybeans was killed at 0.4 mg/l, whereas the Manchu variety was killed at 1.6 mg/l.

The toxicity of zinc in soils is related to soil pH, and liming acid soil has a large effect in reducing toxicity (Barnette 1936,[371] Gall and Barnette 1940,[404] Peech 1941,[146] Staker and Cummings 1941,[468] Staker 1942,[467] Lee and Page 1967[428]). Amounts of added zinc that produce toxicity are highest in clay and peat soils and smallest in sands.

On acid sandy soils the amounts required for toxicity would suggest a recommended maximum concentration of zinc of 1 mg/l for continuous use. This concentration at a water application rate of 3 acre feet/acre/year would add 813 pounds per acre in 100 years. However, if acid sandy soils are limed to pH values of six or above, the tolerance level is increased by at least a factor of two (Gall and Barnette 1940).[404]

Recommendations

Assuming adequate use of liming materials to keep pH values high (six or above), the recommended maximum concentration for continuous use on all soils is 2.0 mg/l. For a 20-year period on neutral and alkaline soils the recommended maximum is 10 mg/l. On fine textured calcareous soils and on organic soils, the concentrations can exceed this limit by a factor of two or three with low probability of toxicities in a 20-year period.

PESTICIDES (IN WATER FOR IRRIGATION)

Pesticies are used widely in water for irrigation on commercial crops in the United States (Sheets 1967).[502] Figures on production, acreage treated, and use patterns indicate insecticides and herbicides comprise the major agricultural pesticides. There are over 320 insecticides and 127 herbicides registered for agricultural use (Fowler 1972).[498]

EXHIBIT D

Preparing for Calving Season

Posted by
Travis Meteer (/staff/travis-meteer)
January 23, 2017

There is nothing like a healthy new born calf to make your day. However, it is important to remember there are several factors that can influence the health and vigor of new born calves. Here are some things you may want to consider.

In many areas of the Midwest, Selenium is deficient in the soil. As a result, pasture, hay, and grains that are grown from Midwestern soils will share the deficiency. As a herd manager, one option to consider is providing higher levels of Selenium in your mineral supplementation program to alleviate deficiency problems. Injectable products, such as Mu-Se, provide supplemental Selenium along with vitamin E. It is recommended that Selenium and vitamin E both be supplemented to guard against Selenium deficiency.

Body condition of cows at calving has been shown to influence several factors. First, cows in heavier body condition are better equipped to handle the nutritional demands of lactation. This results in faster breed back in the spring. Also, cows with a higher Body Condition Score (BCS) supply more IgG in their colostrum which generally leads to healthier calves and less scour issues. Take a look at your cow BCS and provide supplemental feed to bring thin cows up to more ideal scores.

Planning a calving flow chart can be very beneficial to maintaining health and performance. Many producers will have one area for close-up cows, one area for calving, and one area for lactating cows. This is a good layout until disease occurs. When a disease occurs, the remainder of cows yet to flow through the layout will be exposed to the pathogens. Thus, you may want to formulate a plan B area to allow better disease control.

Order calving season supplies ahead of time to ensure they are on site when you need them. Artificial colostrum or bagged, dry colostrum replacer is one of the supplies you will want to have. Make sure when buying colostrum replacer it is in fact a replacer and not just a supplement. The easiest way to know is the price. The replacer will be roughly 3 times the cost. Trust me it is worth the extra money. Obtaining colostrum from a cow that lost her calf or a neighboring farm can work too. Just make sure the herd is Johne's free and on a good herd health standing. Calves will need colostrum in the first 2-4 hours, thus having some on site is crucial. Don't forget OB lube, OB chains, palpation sleeves and other materials that may be needed to assist calves.
Live calves are the best calves. Being prepared for calving season could return several dollars to your operation.

The Cattle Connection (/blogs/cattle-connection)

(https://extension.illinois.edu/blogs/cattle-connection/rss)

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EXHIBIT E

Minding your Minerals

Posted by
Travis Meteer (/staff/travis-meteer)
March 22, 2016

Have you ever watched a person walk a tight rope? The balance and precision that it takes to make it from one side to the other is incredible. Focus and attention must be combined with talent and practice. If any small thing goes wrong… balance can be lost and the goal of making it across is gone.

Mineral nutrition is a balancing act too. It is very delicate and much more fragile than other nutrition tasks, such as meeting protein and energy requirements. Minerals must be provided to the animal in a BALANCE. When minerals are not balanced, problems can arise. Low levels can lead to deficiency. High levels can lead to toxicity. Matter of fact, high levels of one mineral can cause a deficiency in another.

Sources of Minerals in the Diet

Minerals enter the animal primarily through feed, water, and supplementation. While it is easy to understand that your mineral feeder full of mineral supplement is a source of mineral, many times cattlemen ignore the minerals that are available to an animal in the feed and water.

In order to better understand what minerals you cattle are ingesting you should test your feedstuffs and even your water source. If you are certain mineral imbalances are affecting you herd, you can discuss this with your local veterinarian and they can draw blood or take liver biopsy samples to identify mineral deficiencies.

Mineral Interactions

I personally believe this is a problem in many cattle rations and many times is holding cow performance back. Producers that are trying to push performance higher need to take a look at what may be causing mineral interactions in their cattle diets.

Mineral interactions can result in one mineral restricting the bioavailability of another. Thus, reducing the amount of that mineral absorbed by the animal. This can lead to deficiency. Another way to put this is an excess can cause a deficiency.

One of the most common mineral interactions in beef cattle is the interaction between calcium and phosphorus. Generally, calcium and phosphorus levels are recommended in a ratio (Ca:P). Ideally, a ratio of 2:1 is targeted. Cattle can handle slightly lower Ca:P ratios, however when the ratio becomes inverted, or more phosphorus is provided than calcium, steer cattle can be at risk of urinary calculi (also known as water belly). A prolonged period with a Ca:P imbalance in young cattle can interfere with bone growth and decrease overall performance.

Certainly the Ca:P ratio is important to monitor. Many corn co-product feeds are high in P. In cases of high levels of Ca and P in the diet, other mineral requirements for magnesium, manganese, iodine, sulfur, iron, and zinc will all increase. Remember the key to proper mineral nutrition… balance.

The relationship between copper, iron, molybdenum, sulfur, and zinc is another crucial mineral interaction. These minerals can all influence the bioavailability of each other. High levels of zinc, iron, molybdenum, or sulfur can all interfere with copper availability. Copper deficiency is one of the most common mineral problems across the country.

Do you have hard water? Are your cornstalk bales dirty? Did your hay field get flooded before you cut and baled it? These are all likely suspects for more iron in your cattle rations. Iron is really good at reducing the availability of crucial trace minerals.

Are you feeding distillers grains or CCDS? These feedstuffs are higher in sulfur. High sulfur levels in the ration will bind trace minerals, especially copper. Cows that suddenly have red tinged hair coats are likely experiencing copper deficiency.

EXHIBIT F

United States
Environmental Protection
Agency

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

Office of Water (4607M)
EPA 810-R-16-002
October 2016
www.epa.gov/safewater

Table of Contents

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Abbreviations and Acronyms

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

Executive Summary

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

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

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

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

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

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

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

MCL Currently Limited by PQL

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

Exhibit ES-1. EQL Threshold Results

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

MCL Greater than Possible MCLG

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

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

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

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

Exhibit ES-2. Occurrence Threshold Results

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

1 Introduction

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

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

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

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

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

1.1 Background

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

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

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

1.2 Estimated Quantitation Level Development

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

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

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

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

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

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

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

1.3 Contaminants

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

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

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

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

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

Source: USEPA, 2016b and 2009a.

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

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

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

Source: USEPA, 2016b and 2009a.

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

2 Data Sources

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

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

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

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

2.1 MRL Data

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

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

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

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

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

2.2 MDL Data

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

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

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

[2] The modal MRL used in the EQL analysis is the mode across all reported MRL values for a contaminant in the SYR3 ICR dataset. This mode may differ from the mode reported in *The Analysis of Regulated Contaminant Occurrence Data from Public Water Systems in Support of the Third Six-Year Review of National Primary Drinking Water Regulations: Chemical Phase Rules and Radionuclides Rules* (USEPA, 2016a), which reports the mode of the state-level modes instead of the mode of all MRL value.

3 Threshold Development Method

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

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

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

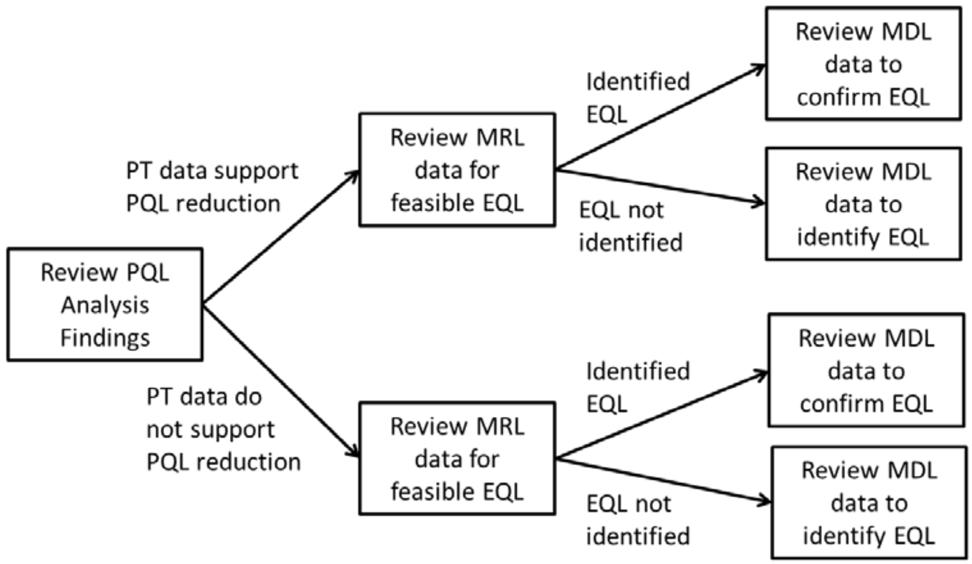
First, EPA evaluated whether the PT data indicated potential to revise the PQL. However, the PT studies were rarely conducted at spiked concentrations lower than current PQLs and thus the data are limited for identifying an EQL. Nevertheless, indications of potential to revise would add credibility to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

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

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

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

Exhibit 3-1. EQL Development Steps



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

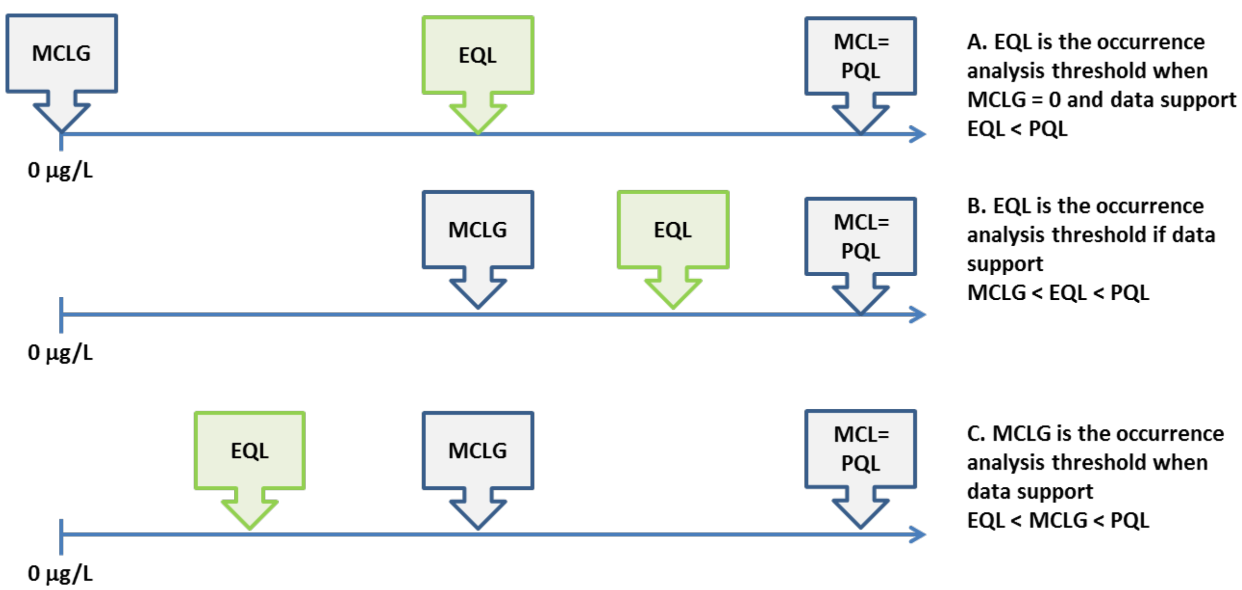
4 Development of Individual EQLs

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

4.1 MCL Currently Limited by PQL

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

Exhibit 4-1. Occurrence Analysis Threshold Selection Scenarios



4.1.1 Benzo[a]pyrene

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

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

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

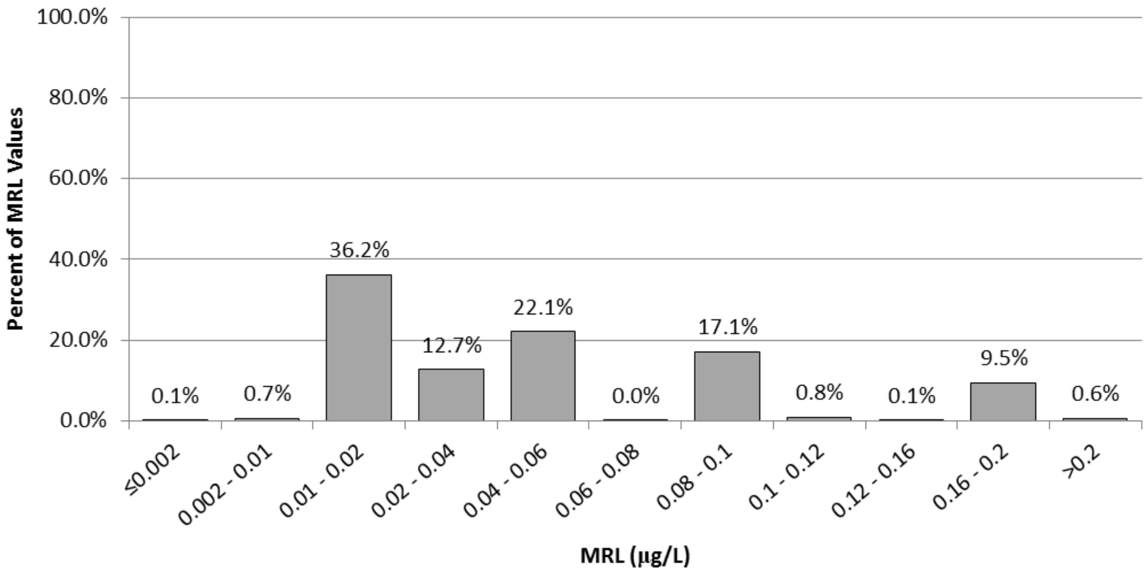
As shown in **Exhibit 4-2**, the modal MRL for benzo[a]pyrene is 0.02 µg/L. Summary data show that 35.6 percent of the MRLs are equal to this value and 37 percent are equal to or less than it. **Exhibit 4-3** shows that there are multiple clusters of MRLs between the mode and the PQL of 0.2 µg/L. Unlike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

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

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

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

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



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

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

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

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

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

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

4.1.2 Chlordane

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

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

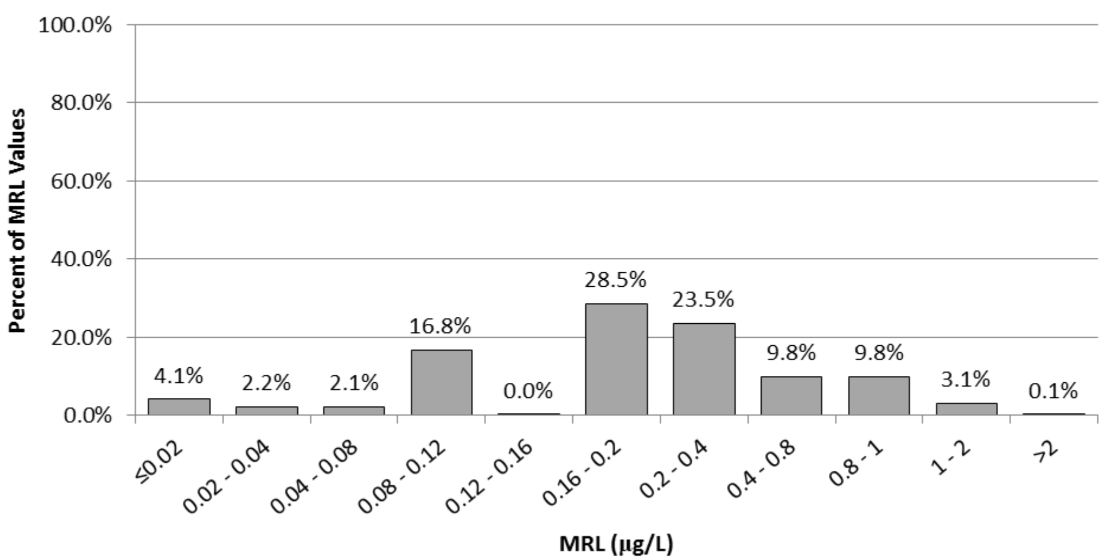
As shown in **Exhibit 4-5**, the modal MRL for chlordane is 0.2 µg/L. Almost 54 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on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

Exhibit 4-5. Summary of MRL Data for Chlordane

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

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

Exhibit 4-6. MRL Distribution for Chlordane



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

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

Exhibit 4-7. Analytical Methods for Chlordane

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

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

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

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

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

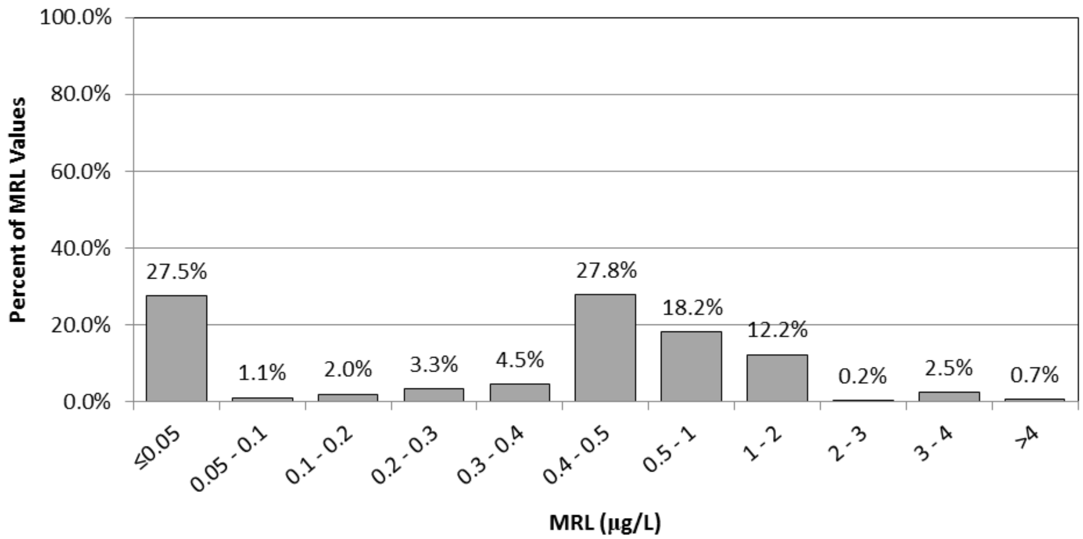
As shown in **Exhibit 4-8**, the modal MRL for DBCP is 0.5 µg/L, which is greater than the PQL of 0.2 µg/L. Therefore, EPA did not base the EQL on the modal MRL regardless of the large proportion of MRL values below the mode. **Exhibit 4-9** shows that almost 70 percent of the MRL values are greater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

Exhibit 4-8. Summary of MRL Data for DBCP

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

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

Exhibit 4-9. MRL Distribution for DBCP



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

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

Exhibit 4-10. Analytical Methods for DBCP

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

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

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

4.1.4 Di(2-ethylhexyl)phthalate (DEHP)

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

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

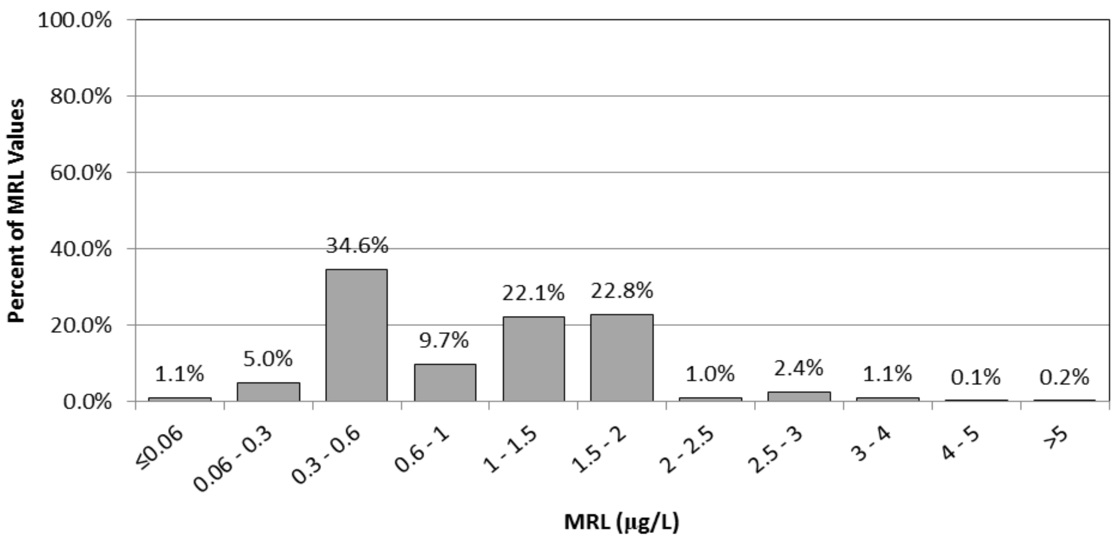
As shown in **Exhibit 4-11** and, the modal MRL for DEHP is 0.6 µg/L. Summary data show that 31.8 percent of the MRLs are equal to this value, and 40.7 percent of the MRL values are equal to or less than it. **Exhibit 4-12** shows multiple clusters of MRLs between the mode and the PQL of 6 µg/L. Unlike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

Exhibit 4-11. Summary of MRL Data for DEHP

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

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

Exhibit 4-12. MRL Distribution for DEHP



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

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

Exhibit 4-13. Analytical Methods for DEHP

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

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

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

4.1.5 Ethylene Dibromide (EDB)

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

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

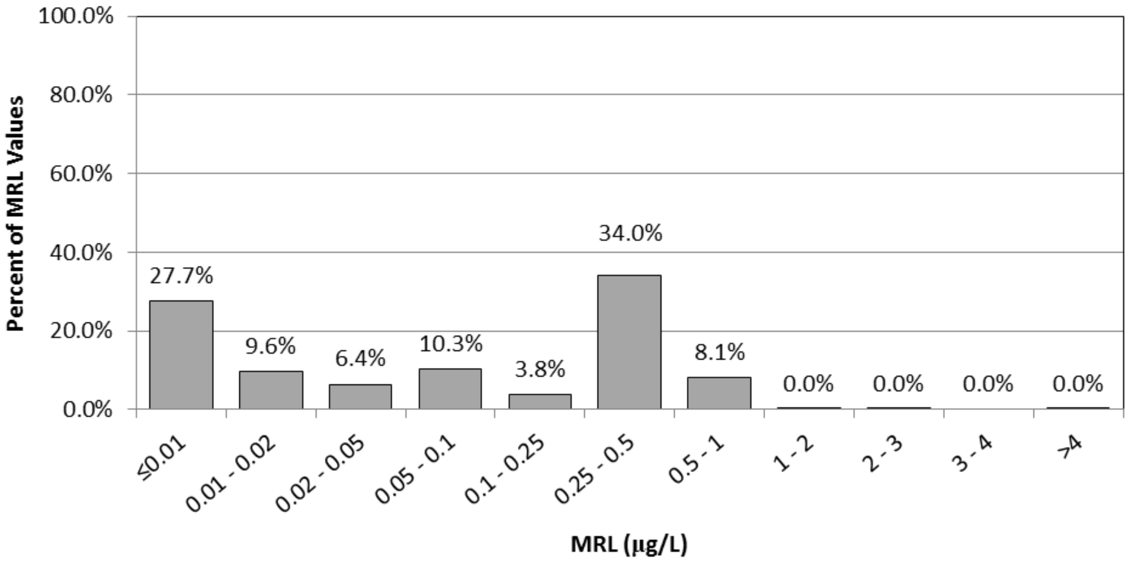
As shown in **Exhibit 4-14**, the modal MRL for EDB is 0.5 µg/L which is greater than the PQL of 0.05 µg/L. Therefore, EPA did not base the EQL on the modal MRL regardless of the large proportion of MRL values below the mode. **Exhibit 4-15** shows that about 56 percent of the MRL values are greater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

Exhibit 4-14. Summary of MRL Data for EDB

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

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

Exhibit 4-15. MRL Distribution for EDB



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

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

Exhibit 4-16. Analytical Methods for EDB

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

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

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

4.1.6 Heptachlor

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

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

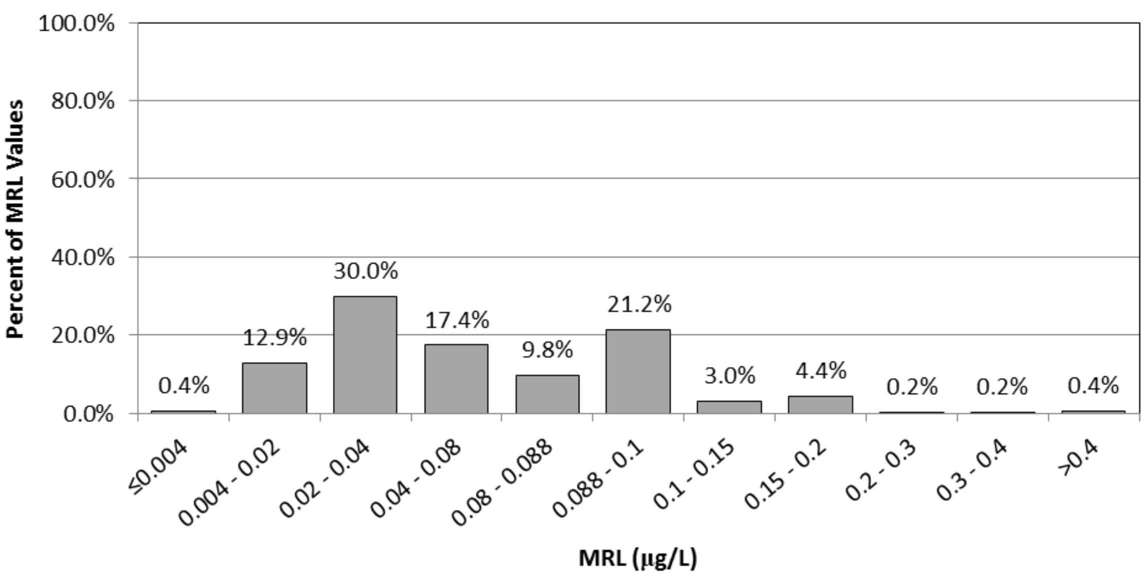
As shown in **Exhibit 4-17,** the modal MRL for heptachlor is 0.04 µg/L. Summary data show that 27.9 percent of the MRLs are equal to this value, and 43.4 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the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

Exhibit 4-17. Summary of MRL Data for Heptachlor

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

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

Exhibit 4-18. MRL Distribution for Heptachlor



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

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

Exhibit 4-19. Analytical Methods for Heptachlor

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

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

4.1.7 Heptachlor Epoxide

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

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

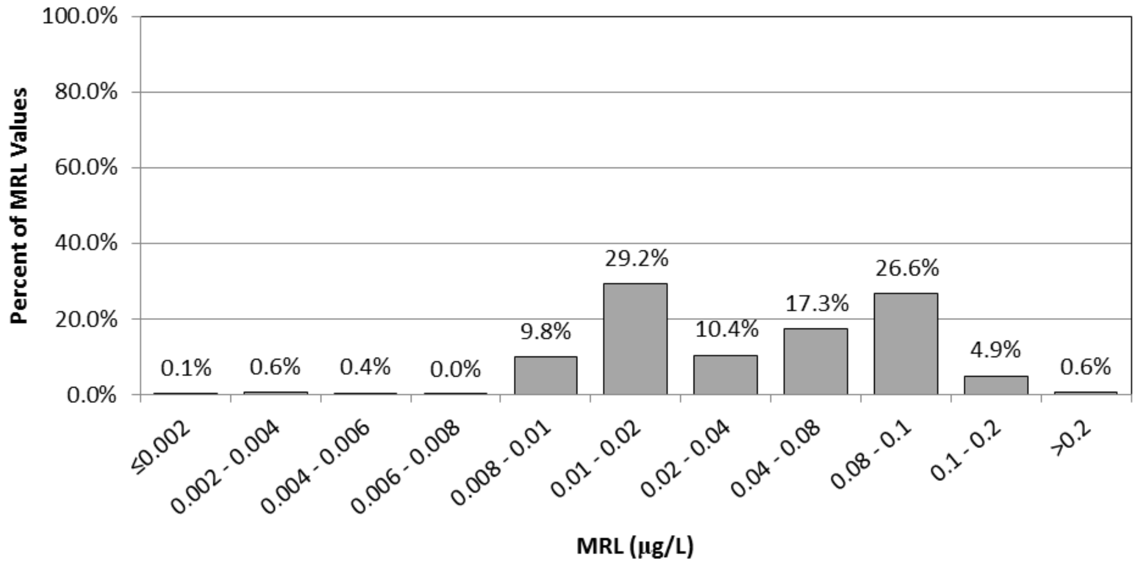
As shown in **Exhibit 4-20**, the modal MRL for heptachlor epoxide is 0.02 µg/L. Summary data show that 28.9 percent of the MRLs are equal to this value, and 40.2 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not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

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

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

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

Exhibit 4-21. MRL Distribution for Heptachlor Epoxide



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

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

Exhibit 4-22. Analytical Methods for Heptachlor Epoxide

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

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

4.1.8 Hexachlorobenzene

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

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

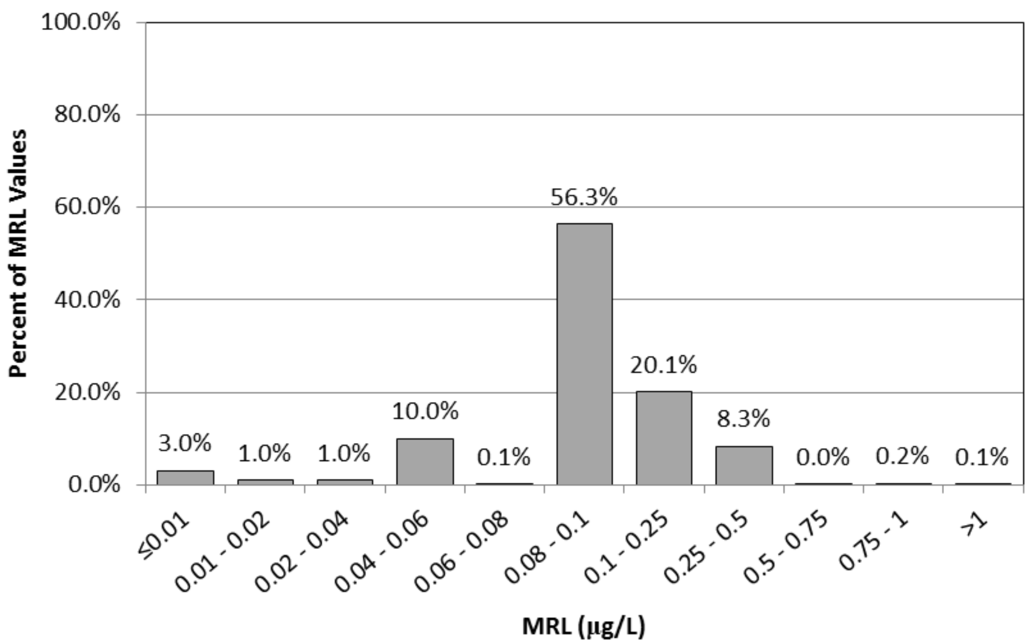
As shown in **Exhibit 4-23**, the modal MRL for hexachlorobenzene is 0.1 µg/L. Approximately 71 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not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

Exhibit 4-23. Summary of MRL Data for Hexachlorobenzene

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

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

Exhibit 4-24. MRL Distribution for Hexachlorobenzene



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

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

Exhibit 4-25. Analytical Methods for Hexachlorobenzene

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

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

4.1.9 Pentachlorophenol

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

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

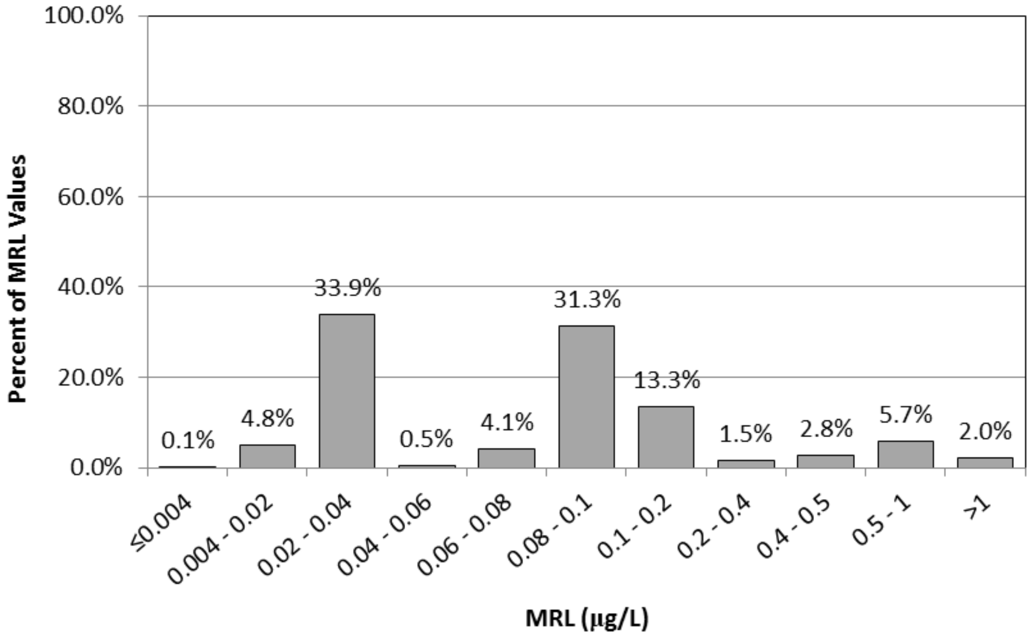
As shown in **Exhibit 4-26** the modal MRL for pentachlorophenol is 0.04 µg/L. Summary data show that 33.1 percent of the MRLs are equal to this value, and 38.8 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet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

Exhibit 4-26. Summary of MRL Data for Pentachlorophenol

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

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

Exhibit 4-27. MRL Distribution for Pentachlorophenol



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

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

Exhibit 4-28. Analytical Methods for Pentachlorophenol

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

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

4.1.10 Polychlorinated Biphenyls (PCBs)

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

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

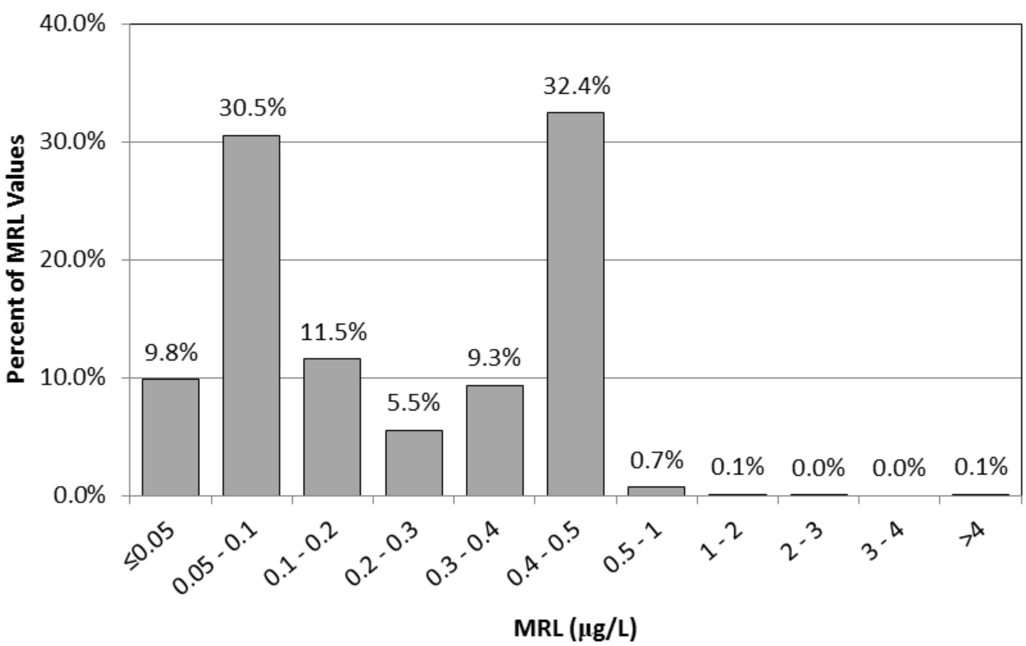
As shown in **Exhibit 4-29**, the modal MRL for PCBs is 0.5 µg/L, which equals the PQL. Summary data show that 32 percent of the MRLs are equal to this value, and 99.2 percent of the MRL values are equal to or less than it. As shown in **Exhibit 4-30,** the MRL data appear to indicate that there is potential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

Exhibit 4-29. Summary of MRL Data for PCBs

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

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

Exhibit 4-30. MRL Distribution for PCBs



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

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

Exhibit 4-31. Analytical Methods for PCBs

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

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

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

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

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

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

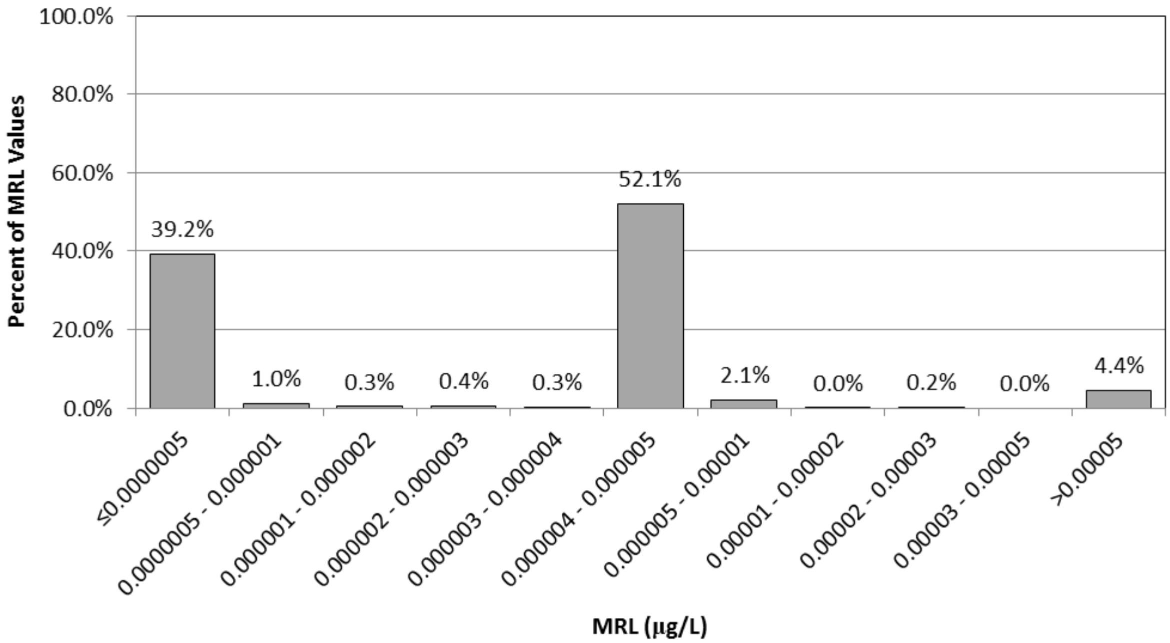
As shown in **Exhibit 4-32** the modal MRL for dioxin is 5×10^{-6} µg/L. Summary data show that 52 percent of the MRLs are equal to this value, and 93.3 percent of the MRL values are equal to or less than it. Because more than 80 percent of the MRL values are less than or equal to 5×10^{-6} µg/L, EPA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

Exhibit 4-32. Summary of MRL Data for Dioxin

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

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

Exhibit 4-33. MRL Distribution for Dioxin



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

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

Exhibit 4-34. Analytical Methods for Dioxin

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

Source: USEPA, 2016b

4.1.12 Thallium

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

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

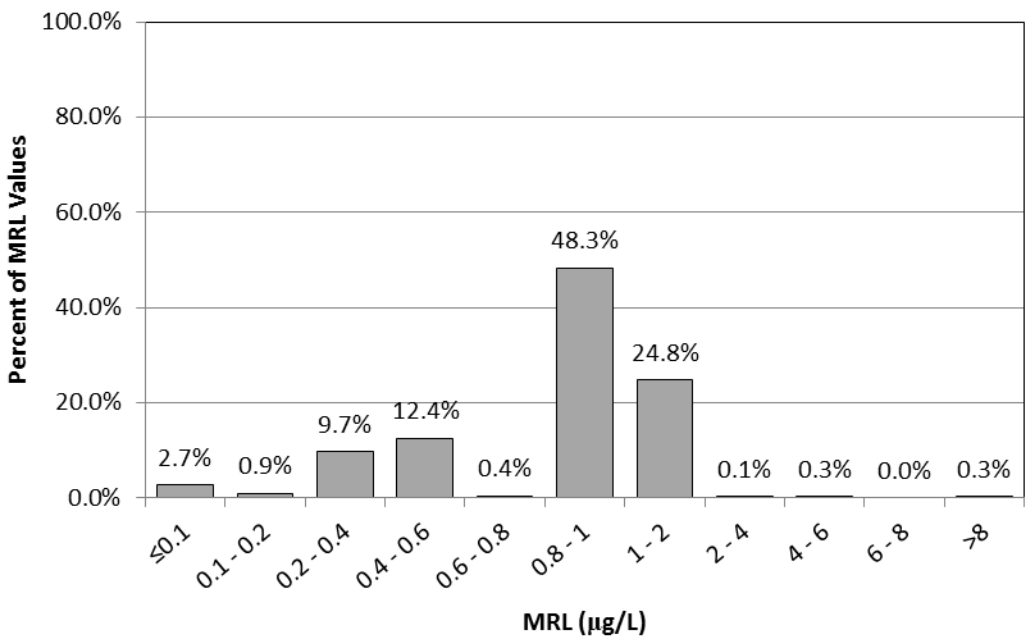
As shown in **Exhibit 4-35,** the modal MRL for thallium is 1 µg/L. Summary data show that 48.3 percent of the MRLs are equal to this value, and 74.5 percent of the MRL values are equal to or less than it. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal MRL. **Exhibit 4-36** shows that more than 99 percent of the MRL values are less than or equal to the PQL. Consequently, EPA reviewed MDL values to determine whether they support an EQL less than the PQL.

Exhibit 4-35. Summary of MRL Data for Thallium

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

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

Exhibit 4-36. MRL Distribution for Thallium



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

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

Exhibit 4-37. Analytical Methods for Thallium

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

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

4.1.13 Toxaphene

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

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

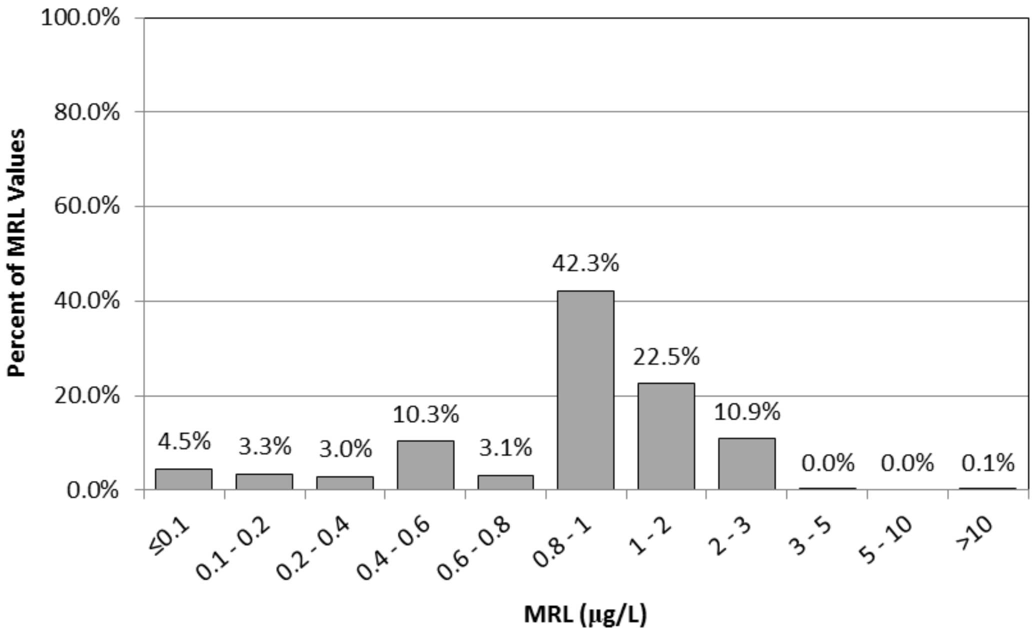
As shown in **Exhibit 4-38**, the modal MRL is 1 µg/L. Approximately 66.5 percent of the MRL values are equal to or less than the modal value. The percentage of the MRL values that are less than or equal to the mode does not meet the 80 percent threshold. Therefore, EPA did not base the EQL on the modal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

Exhibit 4-38. Summary of MRL Data for Toxaphene

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

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

Exhibit 4-39. MRL Distribution for Toxaphene



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

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

Exhibit 4-40. Analytical Methods for Toxaphene

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

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

4.1.14 1,1,2-Trichloroethane

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

There are several studies with spiked concentrations less than the PQL that have passing rates greater than 90%. The PT results above the PQL also have passing rates in the 90 to 100 percent range (USEPA, 2009a). Given the high passing rates below the PQL, EPA determined that the PT data support reduction of the PQL.

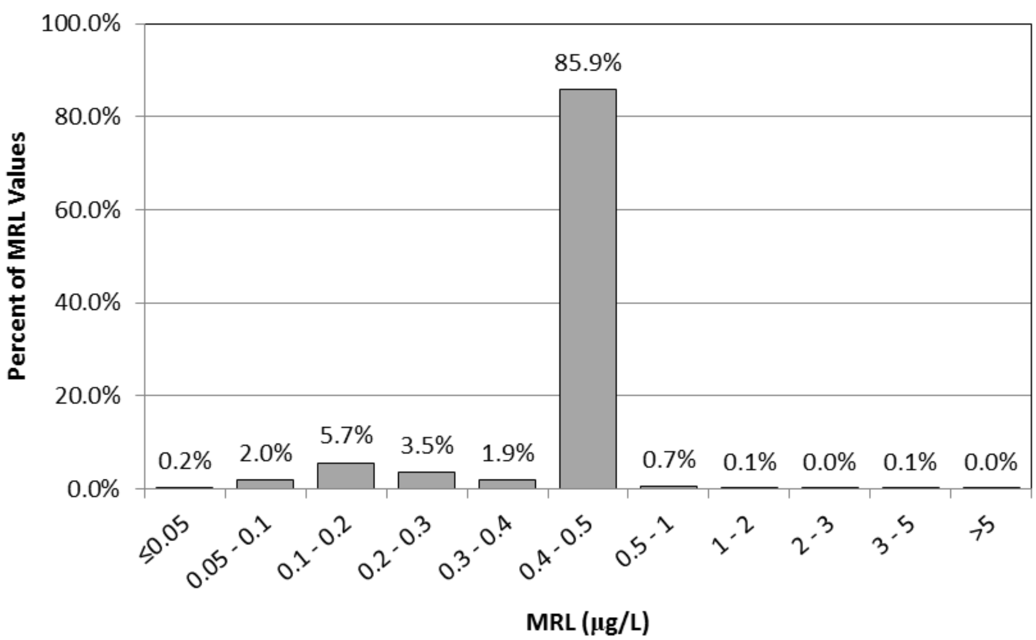
As shown in **Exhibit 4-41**, the modal MRL is 0.5 µg/L, which is less than the MCLG. More than 99 percent of MRL values are less than the mode. **Exhibit 4-42** shows that more than 99.9 percent of MRL values are less than or equal to the MCLG. Although the MRL mode meets criteria to be an EQL, the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

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

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

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

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



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

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

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

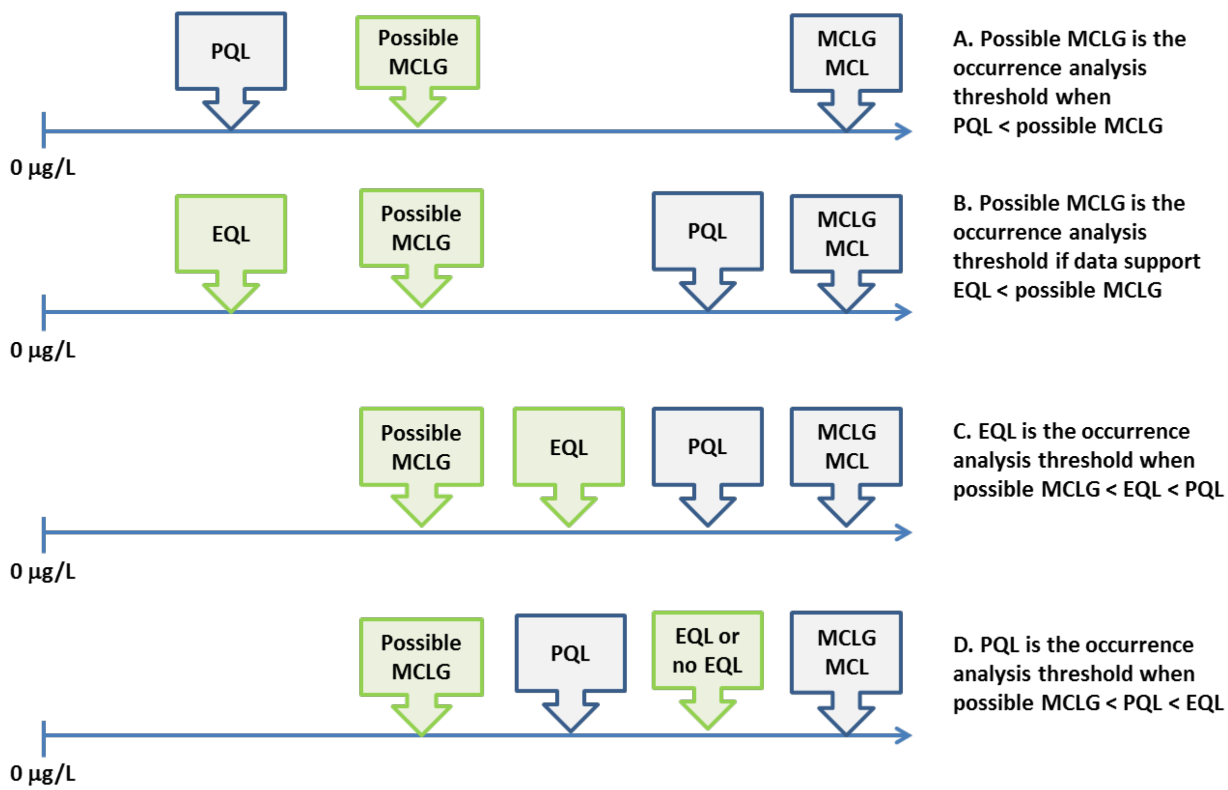
Method	MDL (µg/L)	MDL x 10 (µg/L)
502.2	0.04	0.4
524.2	0.10	1
551.1	0.017	0.17

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

4.2 MCL Currently Limited by MCLG

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

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



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

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

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

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

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

4.2.1 Carbofuran

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

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

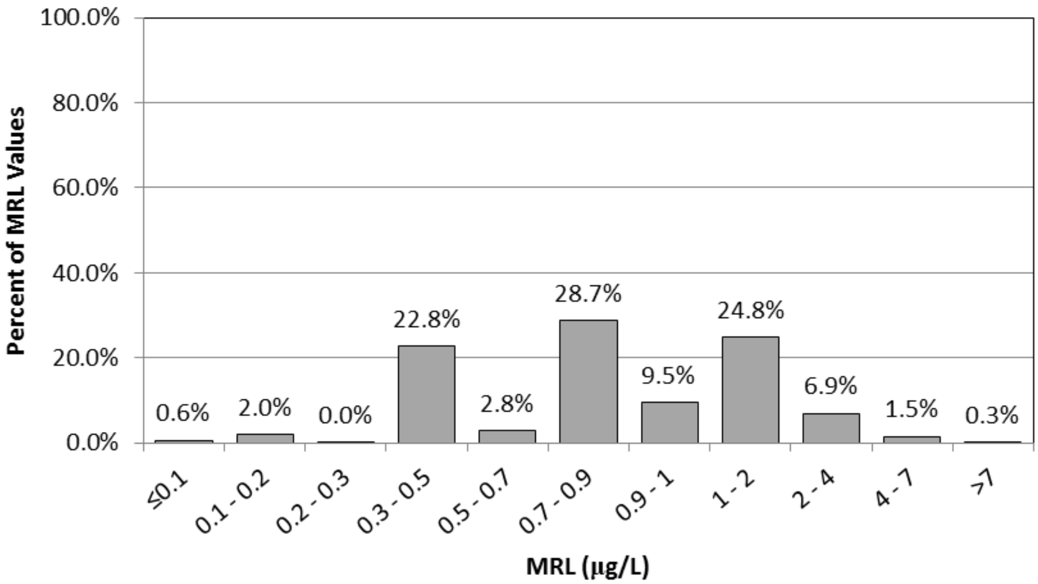
As shown in **Exhibit 4-45,** the modal MRL for carbofuran is 0.9 µg/L, which is less than the PQL of 7 µg/L, but greater than the possible MCLG. **Exhibit 4-46** shows that a majority of MRL values exceed 0.6 µg/L, which means the possible MCLG cannot be used for the occurrence analysis without substantial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

Exhibit 4-45. Summary of MRL Data for Carbofuran

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

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

Exhibit 4-46. MRL Distribution for Carbofuran



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

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

Exhibit 4-47. Analytical Methods for Carbofuran

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

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

4.2.2 Cyanide

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

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

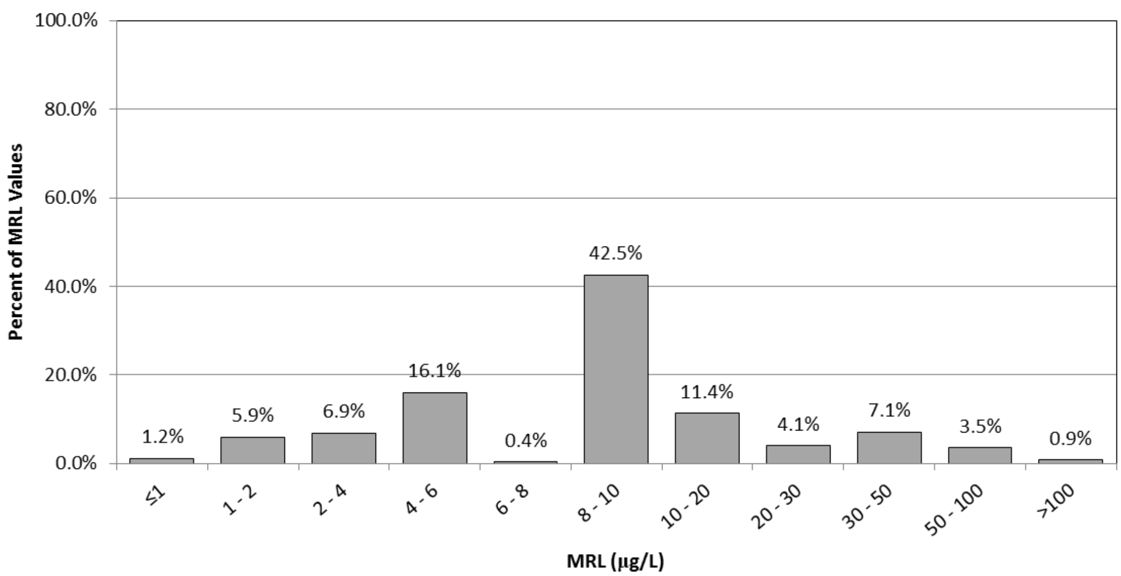
As shown in **Exhibit 4-48**, the modal MRL for cyanide is 10 µg/L, which is greater than the potential MCLG of 4 µg/L, but less than the PQL of 100 µg/L. **Exhibit 4-49** shows that approximately 14 percent of the MRL values are less than 4 µg/L, which means the possible MCLG cannot be used for the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

Exhibit 4-48. Summary of MRL Data for Cyanide

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

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

Exhibit 4-49. MRL Distribution for Cyanide



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

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

Exhibit 4-50. Analytical Methods for Cyanide

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

Source: USEPA, 2016b and NEMI, 2015.

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

4.2.3 Endothall

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

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

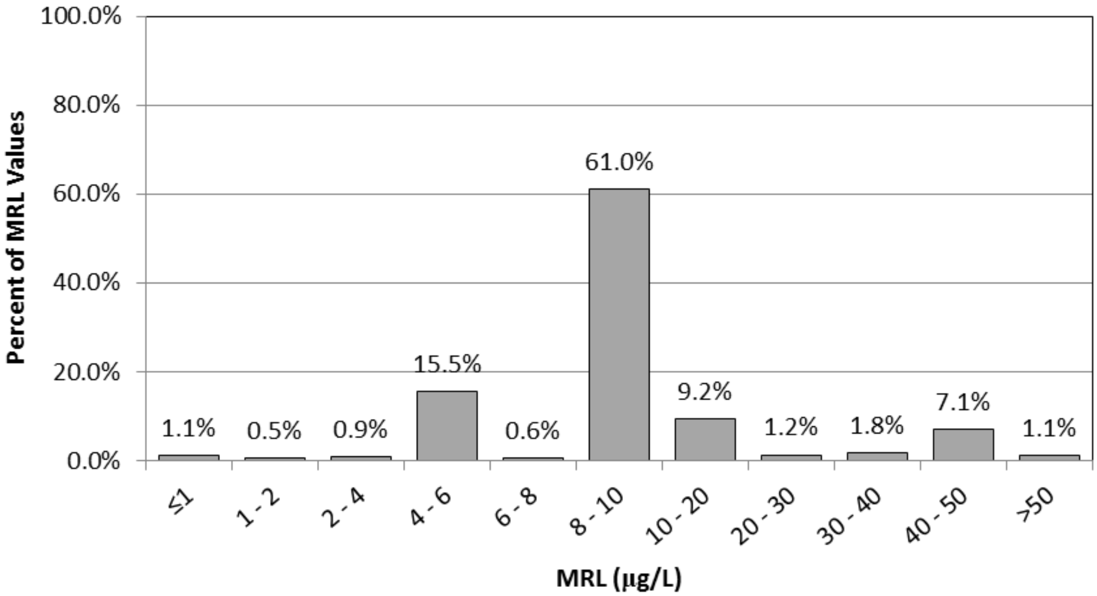
As shown in **Exhibit 4-51,** the modal MRL for endothall is 10 µg/L, which is less than the PQL. Summary data show that 34.3 percent of the MRLs are equal to this value, and 79.6 percent of the MRL values are equal to or less than it. The mode is also less than the possible MCLG of 50 µg/L. **Exhibit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

Exhibit 4-51. Summary of MRL Data for Endothall

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

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

Exhibit 4-52. MRL Distribution for Endothall



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

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

Exhibit 4-53. Analytical Methods for Endothall

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

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

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

4.2.4 Methoxychlor

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

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

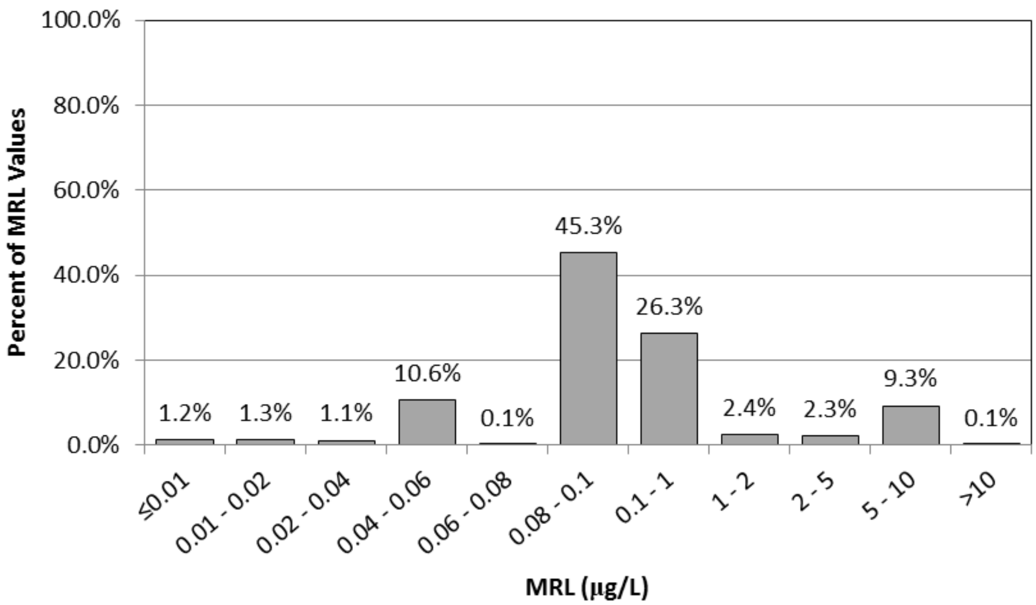
As shown in **Exhibit 4-54**, the modal MRL for methoxychlor is 0.1 µg/L, which equals the possible MCLG. Summary data show that 44.3 percent of the MRLs are equal to this value, and 59.7 percent of the MRL values are equal to or less than it. The percentage of MRL values less than or equal to the mode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

Exhibit 4-54. Summary of MRL Data for Methoxychlor

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

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

Exhibit 4-55. MRL Distribution for Methoxychlor



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

Exhibit 4-56 shows EPA's approved methods for the detection of methoxychlor, and the MDLs. Applying a multiplier of 10 would give a possible EQL range from 0.03 to 9.6 µg/L. This range is below the PQL. The highest value, 9.6 µg/L, rounds to the PQL. The next highest value rounds to 1.0 µg/L, which is less than the current PQL. Although this value is greater than the possible MCLG, EPA established an EQL of 1.0 µg/L as the threshold for the occurrence analysis.

Exhibit 4-56. Analytical Methods for Methoxychlor

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

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

4.2.5 Oxamyl

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

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

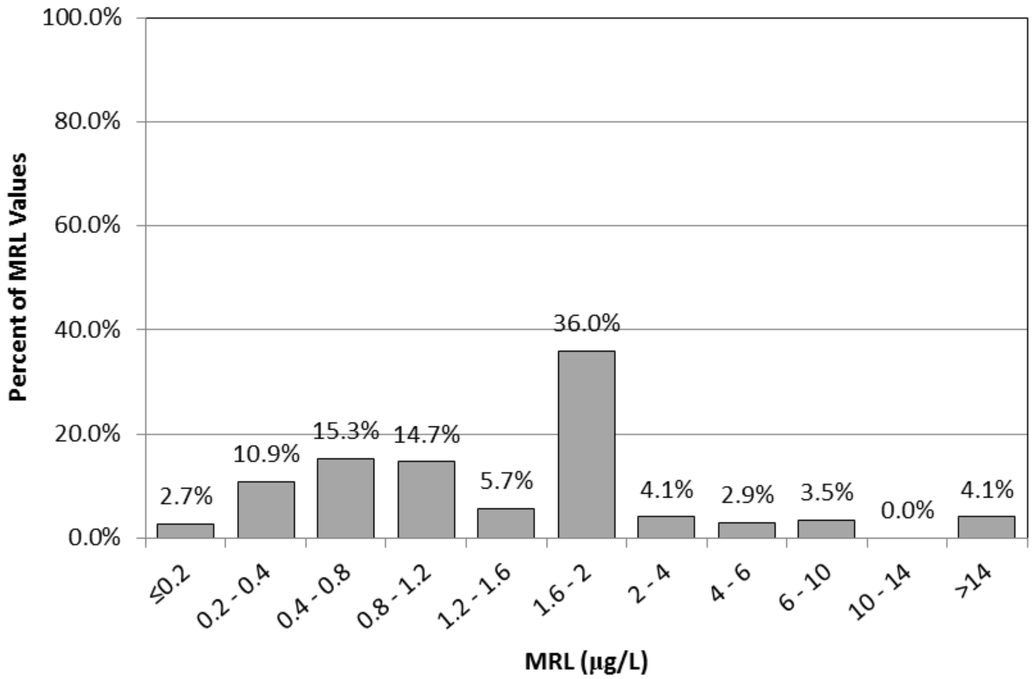
As shown in **Exhibit 4-57**, the modal MRL for oxamyl is 2 µg/L, which is less than the possible MCLG. Summary data show that 36 percent of the MRLs are equal to this value, and 85.4 percent of the MRL values are equal to or less than it. The fraction of MRL values less than or equal to the mode meets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

Exhibit 4-57. Summary of MRL Data for Oxamyl

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

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

Exhibit 4-58. MRL Distribution for Oxamyl



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

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

Exhibit 4-59. Analytical Methods for Oxamyl

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

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

4.2.6 Styrene

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

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

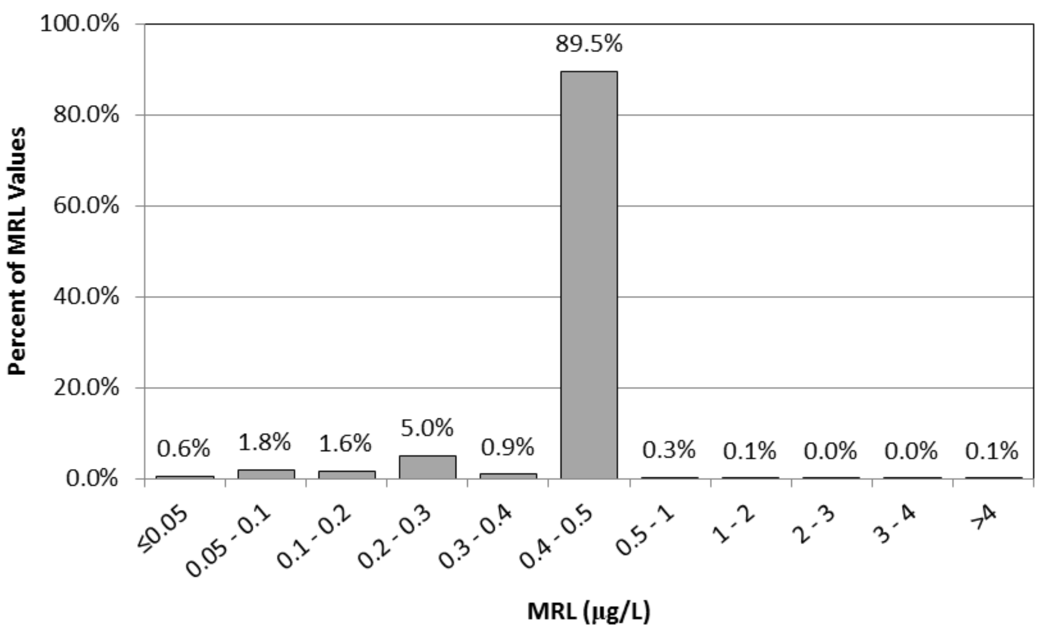
As shown in **Exhibit 4-60**, the modal MRL for styrene is 0.5 µg/L. Summary data show that 89.5 percent of the MRLs are equal to this value, and 99.5 percent of the MRL values are equal to or less than it. The fraction of MRL values less than or equal to the mode meets the 80 percent threshold. Therefore,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

Exhibit 4-60. Summary of MRL Data for Styrene

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

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

Exhibit 4-61. MRL Distribution for Styrene



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

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

Exhibit 4-62. Analytical Methods for Styrene

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

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

5 Summary

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

5.1 MCL Currently Limited by PQL

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

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

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

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

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

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

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

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

Exhibit 5-2. EQL Threshold Results

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

5.2 MCL Greater than Possible Lower MCLG

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

For the other contaminants, the PQL is lower than the possible MCLG. The MRL information for these contaminants indicates the percent of MRL values that are less than the possible MCLG value (instead of an MRL mode). In all instances, almost all of the MRL values are less than the possible MCLG. The 10 × MDL ranges are generally less than the possible MCLG. Thus, the possible MCLGs can be used as occurrence thresholds.

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

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

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

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

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

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

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

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

Exhibit 5-4. Occurrence Threshold Results

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

6 References

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

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

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

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

USEPA. 2016a. The Analysis of Regulated Contaminant Occurrence Data from Public Water Systems in Support of the Third Six-Year Review of National Primary Drinking Water Regulations: Chemical Phase Rules and Radionuclides Rules. EPA 810-R-16-014.

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

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

EXHIBIT G

EPA Protocol for the Review of Existing National Primary Drinking Water Regulations

Office of Water
Office of Ground Water and Drinking Water (4607M)
EPA 815-R-03-002
www.epa.gov/safewater
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EPA Protocol for the Review of Existing National Primary Drinking Water Regulations

June 2003

United States Environmental Protection Agency
Office of Water
Office of Ground Water and Drinking Water
Standards and Risk Management Division
Targeting and Analysis Branch
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ASTM	American Society for Testing and Materials
ATP	Alternate test procedure
ASDWA	Association of State Drinking Water Administrators
ATSDR	Agency for Toxic Substances and Disease Registry
AWWA	American Water Works Association
BAT	Best available technology
BMP	Best management practice
CFR	Code of Federal Regulations
CMR	Chemical Monitoring Reform
EPA	U.S. Environmental Protection Agency
FACA	Federal Advisory Committees Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FQPA	Food Quality Protection Act
FR	*Federal Register*
IRED	Interim reregistration eligibility decision
IRIS	Integrated Risk Information System
LOAEL	Lowest-observed-adverse-effect level
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal
MDL	Method detection limit
mL	milliliters
MOE	Margin of exposure
NAS	National Academy of Sciences
NDWAC	National Drinking Water Advisory Council
NERL	National Exposure Research Laboratory

List of Acronyms and Abbreviations

NIST	National Institute of Standards and Technology
NOAEL	No-observed-adverse-effect level
NPDWR	National Primary Drinking Water Regulation
OGWDW	Office of Ground Water and Drinking Water
OPP	Office of Pesticide Programs
OW	Office of Water
PAD	Population adjusted dose (aPAD – acute; cPAD – chronic)
PE	Performance evaluation
PQL	Practical quantitation level
PT	Proficiency testing
PWS	Public water system
RED	Reregistration eligibility decision
RfD	Reference dose (aRfD – acute RfD; cRfD – chronic RfD)
RSC	Relative source contribution
SAB	Science Advisory Board
SDWA	Safe Drinking Water Act
SM	Standard methods
TCR	Total Coliform Rule
TT	Treatment technique
WS	Water supply

EPA Protocol for the Review of Existing National Primary Drinking Water Regulations

EXECUTIVE SUMMARY

The Safe Drinking Water Act (SDWA), as amended in 1996, requires that the U.S. Environmental Protection Agency (EPA) review existing National Primary Drinking Water Regulations (NPDWRs) no less often than every six years and, if appropriate, revise them. This document describes the systematic approach that EPA used to review 68 chemical NPDWRs and the Total Coliform Rule (TCR) which were promulgated prior to the 1996 Amendments. The statutory deadline for completing this review was August 2002. EPA developed this document based on recommendations of the National Drinking Water Advisory Council (NDWAC), through internal Agency deliberations, and discussions with the diverse stakeholders involved in drinking water and its protection.

As long as an NPDWR revision maintains or provides for the same or greater protection of public health, the SDWA 1996 Amendments give the Administrator discretion to determine if revision is appropriate. In order to determine that a revision is appropriate, EPA believes the revision must continue to meet the basic statutory requirements of the SDWA and present meaningful opportunities to improve the level of public health protection and/or to achieve cost-savings while maintaining, or improving, the level of public health protection.

EPA applied the following basic principles to the review process:

- The Agency assumed health effects, analytical feasibility, treatment data, and analyses underlying existing regulations remain adequate and relevant, except in those instances where reliable, peer-reviewed, new data were available that indicated a need to re-evaluate an NPDWR (e.g., where a change in health risk assessment has occurred).

- If new data were available, EPA determined whether changes in existing standards were warranted. For example, in determining whether there was a change in analytical feasibility, the Agency applied the current policy and procedures for calculating the practical quantitation level for drinking water contaminants.

- EPA was unable to complete evaluation of certain new data within the time available for the review. For example, if a new health risk assessment for a contaminant was not completed during the review cycle, EPA generally made a "not revise" decision on the rationale that it was not appropriate to revise the regulation while the assessment was ongoing. When an updated assessment is completed, EPA will review the update and any new conclusions or additional information associated with the contaminant during the next review cycle. The Agency may make a determination to review a particular NPDWR before August 2008 where a compelling reason exists to revisit the "not revise" decision sooner.

- During the review, EPA identified areas where information was inadequate or unavailable ("data gaps") and is needed before an NPDWR may be considered as a candidate for revision. If EPA was unable to fill such gaps during the review process, the Agency provided information about the data gaps to the appropriate Agency group(s) for consideration and prioritization. The results of further research or data gathering, if any, will be considered as part of a subsequent review.

- During the review process, the Agency did not consider potential regulatory revisions that were already the subject of other rulemaking activities.

- EPA applied the Agency's peer review policy (USEPA, 2000e), where appropriate, to any new analyses.

To most efficiently utilize limited resources and assure continued public health protection, the Agency conducted the review in two phases: (1) an initial technical review of all 69 NPDWRs (see Appendix A for a list); and (2) an in-depth technical evaluation of those NPDWRs identified during the initial review as potential candidates for revision. The key elements of the review included: health effects, technology assessment (*i.e.*, analytical and treatment feasibility), and consideration of other regulatory requirements (e.g., monitoring). If the Agency identified a potential health or technological basis for a revision during the initial screening, EPA also conducted occurrence and exposure analyses and evaluated available economic information as a part of the in-depth review.

Based on the results of comprehensive analyses, EPA identified those NPDWRs that remained appropriate at the completion of the 1996-2002 review cycle, and those NPDWRs that may be appropriate for revision. The Agency published its preliminary determinations and its protocol for the review in the April 17, 2002, *Federal Register* to seek comment from the public (67 FR 19030 (USEPA, 2002d)). EPA received comments from 44 commenters on these preliminary determinations. These comments, along with other new information received since April 2002, have been considered as a part of the current revise/not revise decisions.

EPA Protocol for the Review of Existing National Primary Drinking Water Regulations

SECTION I: INTRODUCTION

A. What Is the Purpose of the Six-Year Review?

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

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

Prior to the 1996 Amendments, the SDWA required EPA to review NPDWRs at least every three years to determine whether any changes in technology, treatment techniques (TTs) or other means might provide better health protection. EPA was required to publish its findings in the *Federal Register* and provide an explanation, after opportunity for public comment, of any finding that such new technology, TT, or other means would not be feasible. Although the Agency did revise existing NPDWRs on occasion when new data became available, EPA did not have a systematic process for reviewing NPDWRs on a regular basis.

B. What Is the Purpose of This Protocol?

This protocol defines the systematic process EPA used to review most of the NPDWRs[1] promulgated prior to the 1996 Amendments during the 1996-2002 review cycle. Although this document is specific to the initial review under the 1996 SDWA Amendments, the Agency plans to adopt a similar approach, modified as appropriate and with stakeholder involvement, for subsequent review cycles.

EPA presented its initial ideas for the regulatory review protocol at a stakeholder meeting in November 1999. Based on the comments made at that meeting, EPA revised the draft protocol. Among other changes, the revised draft clarified the role of research in the process and expanded the discussion of the potential need to review/revise an NPDWR. The Agency provided its

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[1] Several NPDWRs promulgated prior to 1997 have been the subject of recent rulemaking or are the subject of ongoing rulemaking activity. The review of these NPDWRs has been incorporated into those rulemaking activities. Appendix A identifies each of the pre-1997 NPDWRs and indicates whether it is being reviewed in accordance with this protocol or whether it has been or will be reviewed as a part of a separate rulemaking activity.

revised draft to a National Drinking Water Advisory Council (NDWAC) Working Group[2] that met during the Summer of 2000 to develop recommendations regarding the protocol process. The NDWAC Working Group submitted their recommendations to the full NDWAC in November 2000, which approved the recommended guidance and presented it to the Agency (NDWAC, 2000). EPA incorporated the majority of the NDWAC's recommendations into this document. In a few cases, however, EPA either decided not to incorporate a NDWAC recommendation, or to revise it, because of practical considerations and/or resource constraints. Appendix B contains a summary of those NDWAC recommendations that were not incorporated or that were substantially revised.

The systematic planning process used to develop this protocol satisfies the Agency's quality assurance requirements (USEPA, 2002b). The process described in this protocol addresses critical aspects of health protection and the setting of standards under the SDWA. In addition, this protocol allows for the fact that numerous types of regulatory changes may be considered and therefore, contains an element of flexibility to allow EPA the opportunity to consider a range of possible issues. The review process described in this protocol document culminated with decisions of whether or not to revise each of the reviewed NPDWRs.

EPA requested public comments on its protocol in the April 17, 2002, *Federal Register*. In response to these protocol-related comments, the Agency has revised this document to better explain how occurrence and exposure, and economic considerations have been factored into the decision process.

The publication of a decision to revise pursuant to a section 1412(b)(9) review is not the end of the regulatory process, but is the beginning of one. A decision to revise starts a regulatory process for a contaminant that involves more detailed analyses concerning health effects, costs, benefits, occurrence, and other matters relevant to deciding whether and how an NPDWR should be revised. At any point in this process, EPA may find that regulatory revisions are no longer appropriate and may discontinue regulatory revision efforts at that time. Review of that NPDWR would continue in future Six-Year Reviews.

Similarly, a decision "not to revise at this time" means only that EPA does not believe that regulatory changes to a particular NPDWR are appropriate due to: a lack of new data, ongoing scientific reviews, low priority, or other reasons discussed in this document. Reviews of these contaminants continue and future Six-Year Reviews may lead to a decision that regulatory changes are appropriate.

C. What Information Will I Find In This Document?

This protocol is divided into three remaining sections as follows:

- **Section II: Overview of the Six-Year Review Process** provides a summary of the review process. It discusses how potential candidates for regulatory revision were

[2] The NDWAC Working Group and the full NDWAC operate in accordance with the provisions of the Federal Advisory Committees Act (FACA). All meetings are announced in the *Federal Register* and members of the public are welcome to attend as observers.

identified; how this list was refined to nominate NPDWR(s) for revision; and the potential types of regulatory decisions that EPA considered.

- **Section III: Detailed Discussion of the Review Process** provides an in-depth discussion of each of the analyses that were conducted (*i.e.*, health effects, analytical and technology assessments, consideration of other regulatory revisions, occurrence and exposure, and evaluation of available economic information), and how these analyses interrelate.

- **Section IV: Stakeholder Involvement** discusses how EPA involved the public during the Six-Year Review process.

This protocol also contains five appendices as described below:

- **Appendix A: List of pre-1997 National Primary Drinking Water Regulations (NPDWRs)** identifies each of pre-1997 NPDWRs and indicates whether it was being reviewed in accordance with this protocol or whether it has been/will be reviewed as a part of a separate rulemaking activity.

- **Appendix B: Differences between the National Drinking Water Advisory Council's (NDWAC's) Recommendations and this Protocol** summarizes the NDWAC recommendations that EPA either modified or did not include in this protocol.

- **Appendix C: Overview of the IRIS Assessments** provides a discussion of how EPA conducts its Integrated Risk Information System (IRIS) health assessments.

- **Appendix D: Overview of the OPP Process for Toxicity Assessments** contains a discussion of the Office of Pesticide Programs (OPP) process for conducting toxicity assessments.

- **Appendix E: Overview of the Analytical Methods Review Process** describes EPA's process for approving new analytical methods for chemical drinking water contaminants and how the Agency has derived practical quantitation levels in the past.

SECTION II: OVERVIEW OF THE SIX-YEAR REVIEW PROCESS

This section provides an overview of the review process. It contains a discussion of the basic principles that EPA followed during the review, the types of analyses that EPA conducted, and the types of regulatory revisions that EPA considered. Figure 1 in this section provides a graphical overview of the review process. A more detailed discussion of each of the analyses, that were conducted under the review, is provided in section III.

A. What Basic Principles Did EPA Follow During this Review?

EPA's primary goal was to identify and prioritize candidates for regulatory revision in order to target those revisions that are most likely to result in a meaningful opportunity for health risk reduction and/or result in a meaningful opportunity for cost-savings while maintaining the level of public health protection. In conducting the review, EPA applied the following basic principles:

- The Agency assumed that health effects, occurrence, analytical feasibility, treatment data, and analyses underlying existing regulations remain adequate and relevant, except in those instances where reliable, peer-reviewed[3], new data were available that indicated a need to re-evaluate an NPDWR (e.g., where a change in health risk assessment has occurred).

- If new data were available, EPA determined whether changes in existing standards were warranted. For example, in determining whether there was a change in analytical feasibility, the Agency applied the current policy and procedures for calculating the practical quantitation level for drinking water contaminants.[4]

- EPA generally made a "not revise at this time" decision for those NPDWRs whenever evaluation of certain new data could not be completed within the time available for the review. For example, if a new health risk assessment for a contaminant was not completed during the review cycle, EPA made a "not revise at this time" decision on the rationale that it was not appropriate to revise the regulation while the assessment was ongoing. When an updated assessment is completed, EPA will review the update and

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[3] "Peer review" is a documented critical review of a specific major scientific and/or technical work product. The peer review is conducted by qualified individuals (or organizations) who are independent of those who performed the work, but who are collectively equivalent in technical expertise (*i.e.*, peers) to those who performed the original work. The peer review is conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established quality requirements. The peer review is an in-depth assessment of the assumptions, calculation, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to the specific major scientific and/or technical work product and of the documentation that supports them.

[4] EPA establishes a practical quantitation level to estimate the level at which laboratories can routinely measure a chemical contaminant in drinking water. See: 50 FR 46902, November 13, 1985 (USEPA, 1985); 52 FR 25690, July 8, 1987 (USEPA, 1987); 54 FR 22062, May 22, 1989 (USEPA, 1989a).

any new conclusions or additional information associated with the contaminant during the next review cycle. The Agency may make a determination to review a particular NPDWR before August 2008 where a compelling reason exists to revisit the "not revise" decision sooner.

- During the review, EPA identified areas where information was inadequate or unavailable ("data gaps") and is needed before an NPDWR may be considered as a candidate for revision. Where EPA was unable to fill such gaps during the review process, the Agency has provided information about the data gaps to the appropriate Agency group(s) for consideration and prioritization so that further research and data collection can be considered as part of a subsequent review cycle.

- During the review process, the Agency did not consider potential regulatory revisions that were already the subject of other periodic rulemaking activities.

- EPA applied the Agency's peer review policy, where appropriate, to any new analyses (USEPA, 2000e).

B. What Types of Analyses Did EPA Conduct?

To most efficiently utilize limited resources and assure continued public health protection, the Agency conducted the review in two phases: (1) an initial technical review of all 69 NPDWRs included in this Six-Year Review (see Appendix A for a list); and (2) an in-depth technical evaluation of those NPDWRs identified during the initial review as potential candidates for revision. Figure 1, at the end of this section, illustrates the Six-Year Review process.

1. Initial Technical Review

The initial review phase included these three screening and general evaluation steps:

- *Health effects review*. The purpose of the health effects review was to identify NPDWRs for which the Agency has revised health risk assessments that indicate possible changes to the maximum contaminant level goal (MCLG) and perhaps to the maximum contaminant level (MCL);

- *Current technology review*. The purpose of the current technology review was to identify NPDWRs where improvements in analytical or treatment feasibility might allow the MCL to be established closer to the MCLG, or where adjustments in TT requirements might be appropriate; and/or

- *Other regulatory revisions review*. The purpose of the other regulatory revisions review was to identify where adjustments to implementation aspects of NPDWRs (e.g., system monitoring and reporting requirements) might be appropriate, and where such changes were not already being addressed, or had not been addressed, through alternative mechanisms such as a recent or ongoing rulemaking.

EPA primarily performed these reviews independently. Once the results of the individual reviews were available, the Agency integrated the results to determine whether a potential health or technological basis existed to support a regulatory revision. For the purposes of the Six-Year

Review, EPA considered a potential health basis to exist if the results of the health effects review indicated that a possible basis existed for revising the MCLG and, if appropriate, the MCL. EPA considered a potential technological basis to exist if the results of the current technology review and/or the results of the other regulatory revisions review provided a possible basis for revising the MCL, TT, and/or other regulatory requirements.

EPA generally determined after the initial review that an NPDWR was not a candidate for revision at that time, if a health risk assessment was in process or had been initiated as a result of the review. The Agency made this determination because EPA does not believe it is appropriate to revise an NPDWR while a health risk assessment is underway. EPA also determined, after the initial review, that an NPDWR was not a candidate for revision at that time if none of the initial screening analyses identified a basis for a potential regulatory revision.

2. In-Depth Technical Analysis

The Agency subjected the remaining NPDWRs to more in-depth technical analyses. If the results of the initial review indicated a possible revision to the MCLG/MCL, EPA further considered health and technology factors that might affect the development of a revised standard (e.g., revisions to the MCLG, MCL, or TT requirements, and/or revisions to other regulatory revisions such as system monitoring and reporting requirements).

For the chemical NPDWRs, if the outcome of these analyses indicated that a regulatory revision might be appropriate, the Agency also estimated potential occurrence and exposure at public water systems (PWSs). The Agency used the results of the other analyses to determine the contaminant concentrations that would be used in the occurrence and exposure analyses (*i.e.*, the levels of regulatory interest). EPA also conducted a qualitative economic evaluation, which was primarily based on available occurrence and exposure data. The Agency used the results of these analyses to determine whether, in the Agency's judgement, an opportunity existed for meaningful health risk reduction and/or meaningful cost savings to PWSs and their customers without lessening the level of public health protection.

If EPA identified data gaps that could not be filled during the current review cycle, the Agency did not conduct some or all of the remaining analyses. Although, Figure 1, on page 8 shows the identification of data gaps as the final step in the review; in some instances, data gaps were identified during earlier steps in the process. If the Agency identified data gaps, EPA determined that a revision to the NPDWR was not appropriate during the current review.

Based on the results of comprehensive analyses, EPA identified those NPDWRs that remained appropriate at the completion of the 1996-2002 review cycle, and those NPDWRs that may be appropriate for revision. If the Agency decided that it was not appropriate to revise an NPDWR during the 1996-2002 review cycle, that decision was based on one of the following reasons.

- *Health risk assessment in process*: At the time the review was completed, the Agency was conducting, or had scheduled, a detailed review of current health effects information. Because the results of the assessment were not available at the time the review was completed, the Agency did not believe it was appropriate to revise the NPDWR at that time. In these cases, EPA will consider the results of the updated health risk assessment during the 2002-2008 review cycle. However, if the results of the health risk assessment indicate a compelling reason to reconsider the MCLG, EPA may decide to accelerate the review schedule for that contaminant's NPDWR.

- *NPDWR remained appropriate after data/information review*: The outcome of the review indicated that the current regulatory requirements remained appropriate and, therefore, no regulatory revisions were warranted. Any new information available to the Agency either supported the current regulatory requirements or did not justify a revision.

- *New information but no revision appropriate at the completion of the review because*:

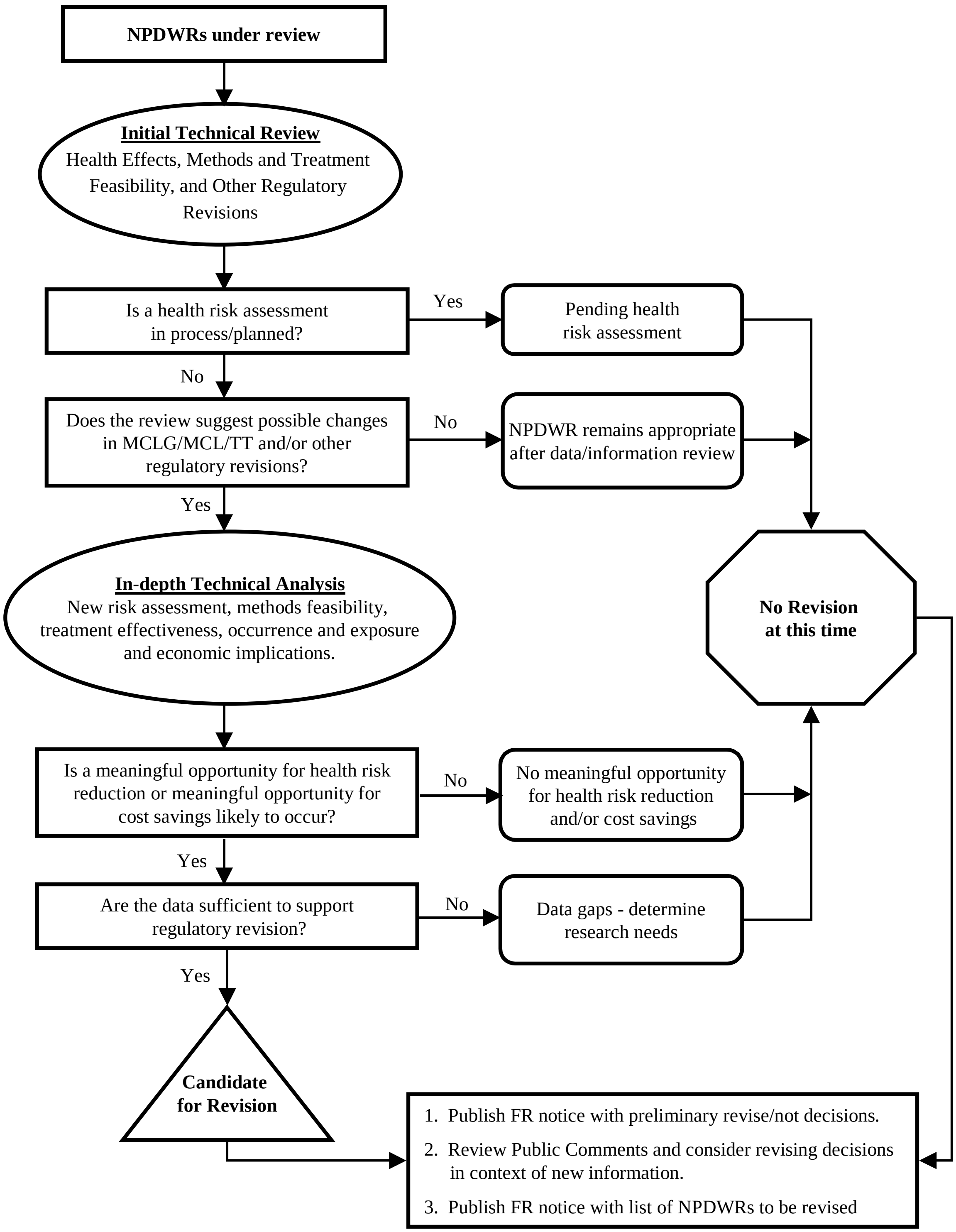
  - *Low priority*: In EPA's judgment, any resulting revisions to the NPDWR would not provide a meaningful opportunity for health risk reduction or result in meaningful cost-savings to PWSs and their customers.[5] EPA considers these revisions to be a low priority activity for the Agency and, thus, "not appropriate" for revision "at this time" because of one or more of the following considerations: competing workload priorities; the administrative costs associated with rulemaking; and the burden on States and the regulated community to implement any regulatory change that resulted.

  - *Information gaps*: Although results of the review support consideration of a possible revision, the available data were insufficient to support a definitive regulatory decision.

EPA published its preliminary determinations and its protocol for the review in the April 17, 2002, *Federal Register* in order to seek comment from the public. EPA received comments from 44 commenters on these preliminary determinations. These comments, along with other new information received since April 2002, have been considered as a part of the current revise/not revise decisions.

[5] EPA conducted occurrence and exposure analyses to help in determining whether a revision was a priority for the Agency. For example, the Agency estimated occurrence and exposure to a contaminant at concentrations between the current MCL and any possible MCL to help determine whether there was likely to be a meaningful opportunity for health risk reduction or cost-savings to PWSs and their customers, if EPA were to revise the MCL.

Figure 1: Overview of the Protocol and Making the Revise/Not Revise Decision



C. What Types of Regulatory Revisions Did EPA Consider?

As a part of the review, EPA considered regulatory revisions, with the primary goal of improving or maintaining public health protection. The types of revisions considered were based on the various components of each NPDWR. Some NPDWRs set enforceable MCLs for particular contaminants in drinking water. Others impose TTs to remove chemical contaminants or microbiological pathogens from drinking water. Most standards also include requirements for water systems to test for contaminants in the water to make sure standards are achieved. NPDWRs also specify recordkeeping and reporting requirements, define what constitutes compliance, and specify language and delivery requirements for public notification.

Some regulatory revisions that are not listed below (e.g., revisions to approved analytical methods) are already addressed through periodic rulemaking activities of SDWA, and thus, were not included in the Six-Year Review.

1. Changes to MCLGs

SDWA requires EPA to establish non-enforceable health-based MCLGs. As a part of the Six-Year Review, EPA considered MCLG changes only in those instances where a new health risk assessment had been completed since the MCLG was promulgated or last revised, and where the most current assessment resulted in a revised reference dose (RfD) and/or cancer classification which justified calculating a revised MCLG.

A revision to an MCLG may result in a more or less stringent standard. The legislative history of the SDWA Amendments of 1996 makes clear that Congress envisioned the possibility that a relaxed standard might be appropriate under circumstances that would not result in a lessening of the level of public health protection. In its discussion of potential revisions to an existing drinking water standard, Senate Report Number 104-169 (available electronically at http://thomas.loc.gov/) states:

> *Amendments made by the bill require that any future standard issued for a contaminant already regulated must maintain or provide for greater protection of the health of persons. Generally, this will preclude the promulgation of a revised standard for a contaminant that is less stringent than the standard already in place. However, there are circumstances under which a standard may be relaxed. The maximum contaminant level goal for a contaminant is set at a level at which there is no adverse effect on the health of persons with an adequate margin of safety. New scientific information may cause the MCLG to be revised and in some cases these revisions may be to less stringent levels. This may lead to a revision of the maximum contaminant level since it need be no more stringent than the MCLG. New information may also allow for a smaller margin of safety because it narrows the range of uncertainty for estimates of health risks. Finally, some substances which have been regulated as carcinogens for ingestion in drinking water may be reclassified (as asbestos has been in the most recent revision) or assigned a threshold for the effect based on new scientific information. In each of these cases, EPA may issue a revised standard for a contaminant that is less stringent than the one it replaces.*
> (S. Rep. 104-169, 104th Cong., 1st Sess. (1995) at 38)

EPA also believes it is reasonable to consider the extent of potential cost-savings for PWSs and their customers when determining whether revisions that potentially would result in a relaxed standard (*i.e.*, where a health basis exists for a less stringent standard) or streamlined implementation are appropriate. These considerations allow the Administrator to better prioritize efforts that are most likely to result in a meaningful opportunity for health risk reduction or cost-savings to PWSs and their customers. Revisions that do not satisfy at least one of these criteria are a low priority activity for the Agency, and, thus not appropriate "at this time" because of one or more of the following considerations:

- Competing workload priorities;
- The administrative costs associated with rulemaking; and
- The burden on States and the regulated community to implement any regulatory change that resulted.

Further, because section 1412(b)(9) of SDWA requires that any revision to an existing NPDWR maintain or improve the level of public health protection, EPA believes that a clear, technically-based demonstration regarding the absence of potential risk is necessary to deregulate a contaminant.

2. Changes to MCLs

An MCL is an enforceable standard for a contaminant. SDWA generally requires the MCL to be set as close to the MCLG as is feasible. As a part of the Six-Year Review, EPA considered MCL revisions under the following circumstances[6]:

- The health effects review indicated a change to the MCLG that also indicated a change to the MCL was appropriate[7]; and/or

- The current MCL was limited by analytical or treatment feasibility and the review of these capabilities indicated it might now be feasible to set the MCL closer to the MCLG.

3. Changes to Treatment Technique Requirements

When it is not economically or technically feasible to set an MCL, or when there is no reliable or economically feasible method to detect contaminants in the water, EPA sets a TT requirement in lieu of an MCL. A TT specifies a type of treatment (e.g., filtration, disinfection, other methods of control to limit contamination in drinking water, etc.) and means for ensuring adequate treatment performance (e.g., monitoring of water quality to ensure treatment performance, etc.).

Water TTs may improve to the point where more protective drinking water standards may be considered. Before EPA would consider a revision to TT requirements, the potential methods

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[6] Although the 1996 Amendments to SDWA allow EPA to set the MCL at higher than the feasible level if the benefits do not justify the costs, SDWA also precludes the Agency from making an existing standard less stringent solely on economic considerations. Therefore, EPA does not believe it is appropriate to revise a pre-1997 MCL unless a health or technical basis exists for the revision.

[7] Potential changes to MCLs may be appropriate in circumstances where the potentially revised MCLG is more or less stringent than the current MCL (refer back to section II.C.1 for further discussion).

must be generally available and must have demonstrated consistent control of the subject contaminant in drinking water. As a part of the Six-Year Review, EPA reviewed available information on TTs for those chemical NPDWRs for which: (1) a TT is set in lieu of an MCL; and (2) no health risk assessment was in process to determine if changes to TT requirements might be warranted.

4. Changes to Other Treatment Technology

When EPA sets an MCL, the NPDWR also contains Best Available Technology (BAT) recommendations that address drinking water treatment processes. Although not required for compliance purposes, EPA sets BATs that have the capability to meet MCLs.

As part of the Six-Year Review, the Agency limited its review of BATs to those NPDWRs for which EPA was considering possible revisions to the MCL based on the health effects or analytical feasibility reviews. To revise a BAT, the treatment technology must be generally available and must have demonstrated consistent removal of the subject contaminant under field conditions.

EPA has a separate program in place to periodically review specific treatment technology issues, such as compliance and variance technology for small systems (*i.e.*, systems serving up to 10,000 people) for both the MCL-type and the TT-type rules (however, for microbiological contaminant regulations, no variances are allowed).[8] As a part of its periodic review of small system compliance and variance technology, the Agency also plans to include the identification of: (1) BATs for larger systems for future regulations, and (2) new and emerging technologies as potential compliance and variance technologies for all system sizes for existing and future regulations. EPA believes that this separate review of treatment technologies is appropriate because it maintains the focus of technology assessment within one program function (USEPA, 1998a).

5. Changes to Other Regulatory Revisions

In addition to possible revisions to MCLGs, MCLs, and TTs, EPA considered other regulatory revisions, such as monitoring and system reporting requirements, as a part of the Six-Year Review process. EPA focused this review on issues that were not already being addressed, or had not been addressed, through alternative mechanisms (e.g., as part of a recent or ongoing rulemaking). Where appropriate alternative mechanisms did not exist, EPA considered these implementation-related concerns if the potential revision met the following criteria:

[8] The 1996 SDWA Amendments identify two classes of technologies for systems serving 10,000 and fewer persons: compliance technologies and variance technologies. A compliance technology is defined in §1412(b)(4)(E)(ii) as a technology or other means that is affordable and achieves compliance with an MCL or satisfies a TT requirement. EPA listed compliance technologies in the EPA publication entitled *Small System Compliance Technology List for the Non-Microbial Contaminants Regulated Before 1996* (USEPA, 1998a). Variance technologies, defined in §1412(b)(15)(A), are specified for those system size category/source water quality combinations for which there are no listed compliance technologies. Variance technologies, where they are permitted, may not achieve compliance with a particular MCL or TT requirement; however, they must achieve the maximum reduction or inactivation efficiency that is affordable, taking into consideration system size and source water quality. Variance technologies must also achieve a level of contaminant reduction that is protective of public health.

- It indicated a potential change to an NPDWR, as defined under section 1401 of SDWA;
- It was "ready" for rulemaking – that is, the problem to be resolved has been clearly identified and specific option(s) have been formulated to address the problem; and
- It met at least one of the following conditions:
  - clearly improved the level of public health protection; and/or
  - represented a meaningful opportunity for cost savings while not lessening public health protection.

SECTION III: DETAILED DISCUSSION OF THE SIX-YEAR REVIEW PROCESS

This section provides a detailed discussion of how EPA conducted its review of health risk assessments, technology assessments, other regulatory revisions, and, where appropriate, occurrence and exposure analyses, and economic factors.

A. Health risk assessments

1. What Were the Objectives of the Health Effects Review?

The objectives for the examination of health effects under the Six-Year Review were to:

- Identify new health risk assessments for individual contaminants that could change the MCLG for the contaminant in question and affirm or change the MCL, thus, affording the same or greater protection of human health provided by the present MCLG;

- Use existing Agency health risk assessments in accomplishing the health effects data review;

- Ensure that the health effects data for each contaminant is the subject of a detailed review at least once in every two, Six-Year Review cycles (with the exception of pesticides that are still in active use, because they are subject to a detailed review that is conducted on a different schedule[9]); and

- Accomplish the review within the limitations imposed by Agency resources.

The procedure for review of health effects data differed depending on whether the substance to be controlled is a chemical contaminant or a microbiological pathogen/indicator, as discussed in detail below. The health risk assessment identified a list of NPDWRs that were possible candidates for regulatory revisions based on changes in health considerations. This list of NPDWRs was combined with those identified by other key elements of the review to develop a list of NPDWRs that were candidates for additional evaluation.

2. How Did EPA Review Health Effects Data for Chemical Contaminants?

EPA used a systematic approach in reviewing the health effects data for chemical contaminants. This approach considered the risk assessment policies that link the MCLG and MCL as well as the data that have become available since the time of regulation. The document, *Six-Year Review - Chemical Contaminants - Health Effects Technical Support Document*

[9] The health effects for these contaminants are reassessed no less frequently than every 15 years. Within EPA, health risk assessments for pesticides are conducted by the OPP under authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and the Food Quality Protection Act (FQPA) of 1996. A goal of FIFRA is that EPA reviews each pesticide's registration every 15 years. Under some circumstances, a pesticide's health effects may be reassessed more frequently.

(USEPA, 2003e), describes how EPA reviewed the chemical contaminants and provides the results of the health effects technical review.

If there is evidence that a chemical may cause cancer, and if the cancer mode of action is linear, there is no dose below which the chemical is considered safe, and thus the MCLG is set at zero. In these instances, the MCL is based on feasible technology (analytical methods/treatment). If a chemical is carcinogenic and acts by a well-documented, nonlinear mode of action, the MCLG may be set at a level above zero. As the health risks of nonlinear carcinogens undergo reassessment, this may provide regulatory options for MCLGs for carcinogens that are greater than zero.

For non-carcinogenic chemicals, the MCLG is based on an oral RfD. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious non-cancer effects during a lifetime. A change in an Agency RfD for a chemical could accordingly lead to a change in an MCLG and MCL. In deriving the MCLG for a non-carcinogen, the Agency applies a Relative Source Contribution (RSC) factor to allocate a portion of the total allowable exposure to drinking water. The RSC is one factor which will determine whether or not a change in RfD will lead to a change in the MCLG/MCL.

In the past, it was Agency policy to apply a risk management factor to the RfD for chemicals with equivocal data on carcinogenicity. This policy is a second factor that must be evaluated to determine the impact of a change in RfD on the MCLG/MCL for these chemicals.

For most of the 68 chemical NPDWRs included in the Six-Year Review, the MCLG is derived from the cancer classification and/or the RfD. Therefore, the health effects technical review focused on whether there has been a change to these values. The Agency reviewed the results of health risk assessments completed under the following programs to determine if there has been a change in critical effect or dose-response pattern that indicates the possible need for an MCLG revision.

- EPA's IRIS (see Appendix C)[10]
- OPP (see Appendix D)[11]
- Agency for Toxic Substances and Disease Registry (ATSDR)
- National Academy of Sciences (NAS).

Where possible, an oral RfD or comparable value is derived and an assessment of carcinogenicity from oral exposure is conducted under each of these programs.

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[10] For purposes of the Six-Year Review protocol, EPA considered a risk assessment final when an Interim Reregistration Eligibility Decision (IRED), Reregistration Eligibility Decision (RED), and/or IRIS assessments was complete. The IRED is an intermediate decision for an individual pesticide that does not take into account cumulative risk issues for pesticides with a common mode of action. The RED does include cumulative risk. If an IRIS assessment was also in process when the IRED or RED was signed, EPA made a case-by-case decision on whether to wait for the IRIS assessment before considering possible revisions to the NPDWR.

[11] See footnote 10.

As a result of the health effects review, EPA placed each of the 68 chemical NPDWRs into one of the following categories:

(1) *New risk assessment 1997 or later*. An IRIS, OPP, ATSDR, and/or NAS assessment has been completed in 1997 or later. These assessments have considered developmental and reproductive toxicity as a part of the assessment. The Agency considered these assessments to be recent enough that it was not necessary to conduct a literature search to identify any additional relevant studies that have become available on the toxicological effects of these contaminants. In cases where the health risk assessment resulted in a change in the critical effect, or the dose-response pattern for a regulated contaminant, and where that change could result in a change in the MCLG, EPA subjected the NPDWR to a more in-depth analysis as a part of the review process. Where recent assessments were conducted by an agency other than EPA and new developmental and reproductive data were identified, EPA initiated an update of its assessment.

(2) *New risk assessment since promulgation, but prior to 1997*. An IRIS, OPP, ATSDR, and/or NAS assessment has been completed since the NPDWR was promulgated, but prior to 1997. None of these assessments reflected a change in RfD or cancer classification. However, since these assessments may not have specifically considered developmental and reproductive health effects, EPA conducted a full literature search, including developmental and reproductive toxicity, for those NPDWRs with non-zero MCLGs to identify any relevant studies that might affect the MCLGs of these contaminants.[12] In a few instances, the results of the literature search indicated that it might be appropriate to revise the RfD and/or cancer classification. EPA initiated updates to risk assessments for these chemicals, and established a schedule for their completion. EPA did not consider these NPDWRs appropriate candidates for revision during the 1996-2002 review cycle.

(3) *Agency risk assessment in progress during the Six-Year health effects review*. The Agency was conducting a health risk assessment for the contaminant but the assessment was not completed in time for consideration during the 1996-2002 review cycle. When completed, the assessment will consider all relevant studies that have become available on the toxicology of the contaminant, including developmental and reproductive toxicity. EPA generally did not consider these NPDWRs appropriate candidates for revision during the 1996-2002 review cycle.

(4) *Original NPDWR risk assessment*. No health risk assessment has been conducted since promulgation of the NPDWR. The Agency conducted a full toxicological literature search, including developmental and reproductive toxicity, for each of these contaminants with non-zero MCLGs to identify new toxicological studies that might

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[12] For the 1996-2002 review, EPA considered a zero MCLG to be protective of public health and that new information on developmental and reproductive effects would not affect the MCLG. However, for those NPDWRs with a zero MCLG, EPA reviewed available information to inquire whether data show a non-linearity of the dose-response; EPA did not find any data to support such a mode of action (USEPA, 2003e). EPA recognizes that information on potential reproductive and developmental effects for chemicals with MCLGs of zero may have an impact on risk management strategies, such as monitoring frequency, to control peak occurrence. This aspect of the assessment will be considered during subsequent Six-Year Review cycles, in conjunction with available occurrence data, to determine whether changes in risk management strategies might provide for better public health protection.

have an impact on the MCLGs. In a few instances, the results of the literature search indicated that it might be appropriate to revise the RfD and/or cancer classification. EPA initiated updates to risk assessments for these chemicals, and established a schedule for their completion. EPA did not consider these NPDWRs appropriate candidates for revision during the 1996-2002 review cycle.

Thus, only contaminants in the first category were considered to be potential candidates for an MCLG revision during the 1996-2002 review cycle. If the revised health risk assessment indicated changes to the MCLG/MCL, the Agency conducted a detailed occurrence and exposure assessment. See section III.D for more discussion of how EPA conducted the occurrence and exposure analyses.

The document, *Six-Year Review - Chemical Contaminants - Health Effects Technical Support Document*, (USEPA, 2003e) describes the process that EPA used to address the health effects aspect of the current review for the chemical contaminants.

3. How Did EPA Review Health Effects Data for Microbiological NPDWRs?

The Total Coliform Rule (TCR) is one of several EPA regulations that protect the public from pathogens in drinking water. The TCR requires all PWSs to monitor for the presence of total coliforms in the distribution system. Total coliforms are a group of closely related bacteria that are (with few exceptions) not harmful to humans. They are natural and common inhabitants of the soil and ambient waters (e.g., lakes, rivers and estuaries), as well as in the gastrointestinal tract of animals. A few of these coliforms (fecal coliforms, including *Escherichia coli or E. coli*) only grow within the intestinal tract of humans and other warm-blooded animals. Total coliforms may be injured by environmental stresses (e.g., lack of nutrients) and water treatment (e.g., chlorine disinfection) in a manner similar to most bacterial pathogens and many virus pathogens. Therefore, EPA considers them a useful indicator of bacterial and many viral waterborne enteric pathogens. More specifically, for drinking water, total coliforms are used to determine the adequacy of water treatment and the integrity of the distribution system. The absence of total coliforms in the distribution system minimizes the likelihood that fecal pathogens are present. Thus, total coliforms are used to determine the vulnerability of a system to fecal contamination.

The 1989 TCR set an MCLG of zero for total coliforms because EPA was not aware of any data in the scientific literature supporting a particular value for the concentration of coliforms below which no known or anticipated adverse health effects occur, with an adequate margin of safety.

The memorandum, *Six-Year Review of the Total Coliform Rule - Comments Received* (USEPA, 2002c), describes the process EPA applied to the review of the TCR. Where appropriate, EPA applied the same approach to reviewing the TCR as it did to the review of the 68 chemical NPDWRs. However, because of the nature of the TCR, the pathogens it controls, the Agency focused its review on the implementation-related requirements.

B. Technology Assessments

1. What Were the Objectives of the Technology Assessments?

SDWA generally requires that MCLs be set as close to the MCLG as is feasible. When determining feasibility, the Agency considers cost and capability of the analytical and treatment methods to respectively measure and remove/reduce drinking water contaminants, and the availability of these technologies. In some cases, particularly when the Agency sets a zero MCLG, EPA establishes a higher MCL based on the limitations of analytical or treatment feasibility.

Where these constraints apply to the current MCL, the objectives of the technology assessments were to determine whether there have been improvements in analytical methods or treatment technologies that may allow EPA to lower the MCL.

2. How Did EPA Review Analytical Methods?

As described in Appendix E, EPA's Office of Ground Water and Drinking Water (OGWDW) has a process in place to approve new and/or improved analytical methods for drinking water contaminants. The review and approval of new methods, updates to §§141.23, 141.24, or 141.25, and the approval of methods through §141.27 (alternate analytical techniques - also known as alternate test procedures or ATP) is generally performed through periodic method update rules. The review and approval of new methods and/or updates to the methods is also performed through the rulemaking process to regulate a contaminant or revise the standard for a contaminant, when appropriate (e.g., the January 22, 2001 final rule for arsenic, (66 FR 6975 (USEPA, 2001b)). More recent methods update rules include 62 FR 10167, March 5, 1997 (USEPA, 1997a), 64 FR 67449, December 1, 1999 (USEPA, 1999d), and 66 FR 3526, a proposed rule published January 16, 2001 (USEPA, 2001a).

The Six-Year Review did not duplicate those efforts, but used the information from these method updates in the review process. In those instances where the MCL has been established based on the limitations of analytical method capabilities and/or where the health effects analysis suggests that the MCLG/MCL should be lowered, EPA reviewed the existing approved methods in the context of potential changes in analytical feasibility. The goal of this part of the review was for EPA to determine whether the currently approved methods provide sufficient analytical capability to reliably measure the contaminant at levels lower than the current MCL. If the currently approved method capabilities (*i.e.*, a method detection limit (MDL)) and the practical quantitation level (PQL) remain limiting factors for revising an MCL, and if the occurrence and exposure analyses suggest that a meaningful opportunity for health risk reduction could occur with a more stringent standard, then EPA may determine that the revision may be appropriate. Under these circumstance, EPA will consider including a request in the *Federal Register* for potential new and/or improved methods that are technologically and economically feasible. However, once a more sensitive method is approved for a contaminant, there may be a time lag between the time of promulgation and the ability of laboratories to begin using the new method. Any time lag in the usage of more sensitive methods may therefore result in the delay of any noticeable change in the feasible level of quantitation.

The remainder of this section generally describes how EPA determines the feasible level of measurement for chemical and microbiological contaminants for SDWA purposes. It also discusses how EPA evaluated available, new data to determine if any changes in analytical feasibility for the chemical contaminants have occurred since promulgation of the NPDWR. The document, *Analytical Feasibility Support Document for the Six-Year Review of Existing National Primary Drinking Water Regulations: Reassessment of Feasibility for Chemical Contaminants*, (USEPA, 2003a) describes the process that EPA used to address the analytical feasibility aspect of the current review for specific chemical contaminants.

Chemical Contaminants

OGWDW establishes a PQL to estimate the level at which laboratories can routinely measure a chemical contaminant in drinking water. Historically, OGWDW has typically used two main approaches to determine a PQL for SDWA analytes. The preferred approach used data from Water Supply (WS) studies (which were predominantly used to certify drinking water laboratories).[13] In most cases, OGWDW used the WS method when sufficient WS data were available to calculate a PQL. In the absence of sufficient WS data, OGWDW used a multiplier method, in which the PQL was calculated by multiplying the EPA-derived MDL by a factor of 5 or 10.

Although there are several approaches that could have been used for the reassessment or re-evaluation of the PQLs, to be consistent with the historical process, only the "WS data method" and the "MDL Multiplier method" were considered for this Six-Year Review process. Of these two approaches, the Agency preferred to use the WS data approach since it relies on actual data from a number of EPA Regional and State laboratories. In cases where the WS data were indicative of a change in the PQL, the MDL multiplier method was only used to estimate what the potentially new PQL could be.

EPA reviewed analytical capabilities for contaminants under two circumstances: (1) for those NPDWRs where the current MCL is set at the PQL and there is no indication that the MCLG would change; and (2) for those NPDWRs that have undergone a health effects review and there was a potentially more stringent MCLG. For each of these chemical NPDWRs, EPA used the following steps to evaluate whether changes in analytical feasibility have occurred:

(1) a *methods comparison* step to identify whether the ability to detect (and therefore quantify) these contaminants at lower levels has increased;

(2) a *methods usage over time* step to identify the analytical methods that appear to be the most widely used for the analysis of particular contaminants.

(3) a *WS data analysis* step to determine if a PQL could be recalculated (if sufficient WS information were available) or if there was an indication that a PQL might be lower using the available information.

The results of these three steps aided in assessing whether a PQL might change for a specific contaminant and, if so, an estimate of what the new PQL might be. Ultimately, the purpose of this analysis was to determine whether the analytical method capabilities would support a lower MCL.

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[13] Because the WS program has been externalized, the Agency is currently deciding how it should assess the multiple laboratory data that are used to determine the PQL for chemical contaminants. Appendix E briefly discusses the externalization of the Performance Evaluation program.

Microbiological Contaminants

For microbes, EPA does not have, or currently envision, a routine pathogen monitoring requirement, but rather employs indicators of water quality (e.g., total coliforms, *E. coli*). PQLs have not been used for microbial indicators because, for approval, the method must be able to detect a single cell (*i.e.*, MDL and PQL must both be one cell) in a 100 milliliter (mL) water sample (40 CFR 141.21(f)). In addition, the false-positive and false-negative (*i.e.*, recovery) rates must be reasonable. EPA is considering whether to define "reasonable" in numerical terms.

In some cases, EPA may require systems to determine the density of a particular pathogen or indicator in either their source waters or drinking waters. For example, under the future Long Term 2-Enhanced Surface Water Treatment Rule (LT2-ESWTR), EPA may require surface water systems to determine the density of *Cryptosporidium* in the source water to determine the level of water treatment the system would need. In this case, the accuracy and precision of the method at low levels of pathogen density would have to be determined using interlaboratory studies. The method would have to be sufficiently sensitive to detect a single oocyst. Therefore, the PQLs and MDLs are not meaningful. In addition, it may be appropriate to determine an MDL and PQL for some required non-microbial measurements associated with microbial water quality such as turbidity, disinfectant residual, and algal microcystins. Currently, accurate measurement of microbiological density is problematic. Moreover, regulation of most microbiological contaminants are currently treatment-technique based. Therefore, for the purposes of making a revise/not revise decision, the Agency primarily focused the review on the treatment-technique (if appropriate) and "other regulatory revisions" aspects of the NPDWRs for microbiological contaminants. The TCR is the only microbiological NPDWR reviewed under this protocol as a part of the 1996-2002 review cycle. The TCR is a monitoring rule. Rather than specify TT requirements, the TCR provides PWSs with a list of recommended best management practices (BMPs). The review of the "other regulatory revisions" for the TCR considered whether revisions to the BMPs might be appropriate.

3. How Did EPA Review Treatment Technologies?

As discussed previously, an NPDWR either identifies the BAT for meeting the MCL (even though BATs are not required for compliance purposes), or establishes enforceable TT requirements. Currently, for all the pre-1997 chemical NPDWRs reviewed in accordance with this protocol that include an MCL, the MCL is set equal to the MCLG or the PQL. None of these MCLs are currently limited by treatment feasibility. Thus, although EPA generally reviews treatment technologies through alternative mechanisms, there were a few scenarios for which EPA reviewed treatment feasibility as a part of the Six-Year Review process:

- The health effects technical review identified a potential change to the MCLG/MCL; or
- A health risk assessment was not in process for the contaminant and one of the following two conditions applied:
  (1) the analytical feasibility review identified a possible change to the MCL; or
  (2) the NPDWR is a TT-type rule.

EPA also considered revisions that clarify or modify BAT or TT requirements where existing requirements were not clear or were incorrectly specified. In addition, and where appropriate, EPA evaluated the likelihood that systems would discontinue existing treatment if EPA were to raise the MCL. See section III.E for further discussion of how EPA considered economic factors, as they relate to treatment.

Treatment capabilities of existing BATs and TTs are well documented by EPA and other organizations. Likewise, small system compliance and variance technologies are well documented and periodically reviewed by the Agency. During the development of NPDWRs, EPA provides state-of-the-science and feasibility of treatment information primarily through its technical support documents (e.g., EPA technologies and costs reports, and guidance materials published to assist in regulatory implementation). As part of the Six-Year Review process, EPA used these same resources, in addition to newer treatment and cost reports, peer-reviewed data, and other available treatment technology information including that received by EPA from stakeholders.

The evaluation of treatment technologies supported the regulatory review process by identifying any known water treatment limitations that might affect a revision of an MCL. In the case of TT-type rules, this effort supported consideration of whether changes to TT requirements were warranted. For example, consideration was given to any new treatment processes that are available and appropriate. If the Agency identified treatment technology-related research needs as a part of the Six-Year Review process, those research needs were forwarded to the appropriate Agency group(s) for consideration and prioritization as a part of the overall drinking water research strategy.

The document, *Water Treatment Technology Feasibility Support Document for Chemical Contaminants; In Support of EPA Six-Year Review of National Primary Drinking Water Regulations*, (USEPA, 2003f) describes the process that EPA used to address the treatment feasibility aspect of the current review for specific chemical contaminants.

C. Other Regulatory Revisions

1. What Was the Objective of the Review of Other Regulatory Revisions?

In addition to possible revisions to MCLGs, MCLs, and TTs, EPA considered other regulatory revisions, such as monitoring and system reporting requirements, as a part of the Six-Year Review process. The objective of the review of other regulatory revisions was to identify potential revisions related to the implementation of the rules that may result in improved public health protection, and/or present the opportunity for meaningful cost-savings while maintaining, or improving, the level of public health protection.

2. How Did EPA Consider Other Regulatory Revisions?

EPA focused its review on issues that were not already being addressed, or had not been addressed, through alternative mechanisms (e.g., as part of a recent or ongoing rulemaking). Where appropriate alternative mechanisms did not exist, EPA considered these implementation-related concerns if the potential revision met the following criteria:

- It indicated a potential change to an NPDWR, as defined under section 1401 of SDWA;
- It was "ready" for rulemaking – that is, the problem to be resolved has been clearly identified and specific option(s) have been formulated to address the problem; and
- It met at least one of the following conditions:
  - clearly improved the level of public health protection; and/or
  - represented a meaningful opportunity for cost-savings while maintaining or improving the public health protection.

The document, *Consideration of Other Regulatory Revisions for Chemical Contaminants in Support of the Six-Year Review of National Primary Drinking Water Regulations* (USEPA, 2003b) summarizes the specific issues identified during the review process. Some of these issues (e.g., the need to specifically define new system/new source monitoring requirements for chemical contaminants) have already been addressed in the recently published arsenic and radionuclides NPDWRs (66 FR 6975, January 22, 2001 (USEPA, 2001b); 65 FR 76707, December 7, 2000 (USEPA, 2000d)).

D. Occurrence and Exposure Analysis

1. What Were the Objectives of the Occurrence and Exposure Analysis?

The objectives of the occurrence and exposure analysis components of the review process were to estimate the numbers of PWSs at which contaminants occur at levels of regulatory interest in drinking water, and to evaluate the number of people exposed to these levels. This analysis was not necessary for the TCR, since national data were not available and were not needed. If an organism is known to be transmitted by the fecal-oral route, and has caused at least one waterborne disease outbreak in this country, that is sufficient reason to control the organism nationally. The number of systems affected by an organism depends on the characteristics of the waterborne organism and the type of water source. Therefore, the remaining discussion of the occurrence and exposure analysis pertains only to the chemical NPDWRs under review.

Combined with results of the other technical analyses described in section III (e.g., health effects), the results of the occurrence and exposure analysis were used to help determine which revisions are most likely to provide the greatest public benefit. In some cases, these results may also be used as a factor when recalculating RSCs.[14] EPA plans to perform further, in-depth, occurrence and exposure analysis prior to any proposed revision to an NPDWR.

2. How Did EPA Conduct the Occurrence and Exposure Analysis?

During the 1996-2002 review cycle, EPA used data voluntarily provided by eight States as a part of the Agency's occurrence analyses for its Chemical Monitoring Reform (CMR) evaluation (USEPA, 1999b). EPA augmented this information with other data that were voluntarily submitted by an additional eight States, based on the same geographic diversity and agricultural and industrial pollution potential analyses utilized in the CMR analyses.

The Agency does not believe it is appropriate to revise a pre-1997 NPDWR solely on the basis that a contaminant is low-occurring or high-occurring at PWSs. However, in assessing whether to revise the MCL and/or other regulatory revisions, EPA considered the estimated occurrence and exposure to a contaminant at PWSs at concentrations between the current MCL and any possible MCL. More specifically, this assessment helped the Agency to determine whether such revisions were likely to provide a meaningful opportunity for health risk reduction or cost-savings to PWSs and their customers. Therefore, EPA conducted a detailed occurrence

[14] While occurrence and exposure estimates factor into the derivation of an RSC, a much more important factor is exposure information for other media (air, food, etc.) relative to that for water. Exposure information for other media will be assessed as a part of the health risk assessment described in section III.A of this document, and not as a part of the occurrence and exposure assessment described in this section.

and exposure analysis if a regulated chemical contaminant was identified as a potential candidate for revision by the health effects, technology, and/or other regulatory revisions reviews.

As a part of a "Stage 1" analysis, EPA estimated the percent of PWSs (and the total population served by those PWSs) with at least one analytical result exceeding the following thresholds: the lowest level of detection reported by the States; one-half the current MCL, and the current MCL. Of the chemicals reviewed under this first regulatory review cycle, all were analyzed in this way, except for contaminants for which: (1) not enough data were available; (2) the NPDWR specifies a TT-type requirement instead of an MCL; and (3) EPA did not request data, since the Agency determined there was no health or technological basis for revising, and because these data would have required extra burden for States to transmit.

Based on the outcome of the health effects, technology, and other regulatory revision reviews, EPA determined the level(s) of regulatory interest and performed a more detailed, "Stage 2" statistical analysis. The "Stage 2" analysis estimated the numbers of systems (and the corresponding affected populations) with mean contaminant concentrations above the levels of regulatory interest. For example, where WS data in the analytical feasibility review indicated a possibly lower PQL, EPA estimated a value and used this as a threshold in the occurrence and exposure analysis. If this analysis indicated that a contaminant was unlikely to occur at concentrations above those of regulatory interest, EPA determined that a revision was not warranted during the 1996-2002 review cycle.

The document, *Occurrence Estimation Methodology and Occurrence Findings Report for the Six-Year Review of Existing National Primary Drinking Water Regulations*, (USEPA, 2003c) describes the process that EPA used to address the occurrence and exposure aspect of the current review for specific chemical contaminants

E. Consideration of Economic Factors

1. What Were the Objectives of EPA's Evaluation of Economic Impacts?

While section 1412(b)(9) of SDWA provides the Agency broad discretion to consider economic impacts in the context of the Six-Year Review, the statute precludes EPA from using economic impacts as the sole basis for a revision that would provide less health protection than the current standard (anti-backsliding). However, if new peer-reviewed scientific health effects research indicates that an MCLG could be raised while maintaining public health protection, then such a change is permitted. For NPDWRs published prior to the 1996 SDWA Amendments, consideration of economic factors was of limited use when determining whether revisions were appropriate, except in those situations where a health or technical basis existed for a potential regulatory revision. Therefore, EPA qualitatively evaluated available economic information for those NPDWRs identified as potential candidates for revision by the health and technology reviews. The purpose of this analysis was to determine whether a potential revision is likely to provide a meaningful opportunity for health risk reduction and/or cost-savings that at least maintain the current level of public health protection.

2. How Did EPA Consider Economic Impacts?

EPA did not quantify likely costs and benefits as a part of the review, since many of the factors that are needed for such calculations depend on specific regulatory options that will not be definitive until EPA begins the actual rulemaking process. EPA therefore conducted a qualitative assessment based on the extent of occurrence of a contaminant at the MCL, as well as at alternative levels, to help determine whether possible changes to an MCL offered a meaningful opportunity for health risk reduction and/or cost-savings to PWSs and their customers. For example, in those instances where the health effects and/or technology reviews indicated that a more stringent MCL might be appropriate, EPA considered the difference between the levels of occurrence and exposure at the current MCL and the occurrence and exposure at potentially revised regulatory level(s) indicated by those reviews. On the other hand, if the health effects review indicated it might be appropriate to establish a less stringent MCLG/MCL, EPA considered whether such a revision would be likely to offer a meaningful opportunity for cost-savings. In making this assessment, EPA considered the number of PWSs with concentrations above the current MCL that may avoid the need to install treatment.

For any NPDWR for which the Agency made a revise decision, the Agency will conduct detailed cost and benefit analyses, as required, prior to proposing specific regulatory revisions.

SECTION IV: STAKEHOLDER INVOLVEMENT

Section IV discusses how the Agency involved the public during the Six-Year Review process. More specifically, it lists those organizations with which EPA coordinated during the Six-Year Review process (*i.e.*, key stakeholders), describes the mechanisms EPA used to keep these stakeholders involved, and discusses the Science Advisory Board's (SAB's) role in the review process.

A. Who Were the Key Stakeholders in the Six-Year Review Process?

The key stakeholders for the 1996-2002 review cycle included members of the following:

- The general public
- Congress
- Other Federal agencies
- State, Tribal, and local officials
- Public health/health care providers
- Public interest groups
- Public water suppliers
- National trade associations
- Environmental groups
- Manufacturers
- Agricultural producers.

B. How Were Stakeholders Involved in the Six-Year Review Process?

EPA involved stakeholders by: holding periodic stakeholder meetings; participating in national meetings, workshops, and technical forums; meeting informally with associations and technical experts; posting information on the OGWDW web page (www.epa.gov/safewater/); and publishing *Federal Register* notices on the Six-Year Review.

EPA invited representatives from State and Tribal communities, PWSs, public health organizations, academia, environmental and public interest groups, engineering firms, and other stakeholders to a stakeholder meeting in Washington, DC, in November 1999 (64 FR 55711, October 14, 1999 (USEPA, 1999a)). Approximately 50 participants attended, including representatives from the invited groups. EPA discussed its preliminary strategy for the Six-Year Review and invited stakeholder comment. Stakeholders generally agreed that EPA had identified the appropriate key elements for the review; however, in some cases, stakeholders suggested that EPA needed to be more proactive in seeking out new information that might affect the regulatory decision (USEPA, 1999c). The executive meeting summary is available on EPA's drinking water web page, http://www.epa.gov/safewater/ccl/novmtg.html.

In the Spring of 2000, the NDWAC formed a working group to develop recommendations regarding the process the Agency should apply to conducting a periodic and systematic review of existing NPDWRs. The Working Group held two meetings and a conference call from June through September 2000 (USEPA, 2000a-2000c). The NDWAC approved the Working Group's recommendations in November 2000 and formally provided them to EPA in December 2000 (NDWAC, 2000). The NDWAC recommended that EPA's review include consideration of five key elements, as appropriate: health effects, analytical and treatment feasibility, implementation-related issues, occurrence and exposure, and economic impacts. The NDWAC suggested that the Agency conduct a preliminary screening review of each NPDWR to identify potential candidates for an in-depth analysis. Except where noted in Appendix B, EPA has followed the protocol recommended by the NDWAC.

In addition to the November 1999 stakeholder meeting and consultation with the NDWAC, EPA representatives delivered presentations at a variety of meetings held by other organizations, including: American Water Works Association (AWWA) Technical Advisory Workgroup meetings, held in February 2001 in Washington, DC and in February 2002 in San Diego, CA; a meeting held by the Association of State Drinking Water Administrators (ASDWA) in March 2001 in Alexandria, VA; and the annual AWWA meeting held in Washington, DC in June 2001. At each of these meetings, stakeholders were given the opportunity to comment on the protocol by which EPA was planning to perform the review of existing NPDWRs. EPA received valuable input from stakeholders on the proposed protocol to reviewing existing NPDWRs.

In December of 2000, EPA Headquarters circulated a memorandum to its Regional offices requesting feedback on issues relating to the implementation of its drinking water regulations. Although the memorandum specified a "potential set of issues" for consideration, Regions were asked to identify any other known issues related to regulatory implementation. In addition, ASDWA was asked to confer with the States regarding implementation issues that they felt needed to be reviewed or addressed. In response to the memorandum and the request to ASDWA, EPA received comments from four EPA Regions (3, 6, 7, and 8), five States (Iowa, Michigan, Minnesota, Pennsylvania, and Texas), and ASDWA.

In the April 17, 2002, *Federal Register*, EPA published its protocol and its preliminary revise/not revise decisions for the 69 NPDWRs, and requested public comment. The Agency received and reviewed comments from 44 commenters. EPA discussed the major public comments and the Agency's response to these comments in the document entitled, *Public Comment and Response Summary for the Six-Year Review of National Primary Drinking Water Regulations* (USEPA, 2003d). Based on these public comments, EPA revised this protocol document to better explain how the Agency integrated the separate analyses and where it applied judgment in the decisionmaking. EPA also revised several of its technical support documents to clarify how the Agency conducted the specific analyses that support its revise/not revise decisions.

C. How Did EPA Plan to Involve the Science Advisory Board?

In June 2002, EPA consulted with the SAB Drinking Water Committee and requested their review and comment on whether the protocol EPA developed based on the NDWAC recommendations was consistently applied and appropriately documented. The SAB provided verbal feedback regarding the transparency and clarity of EPA's decision criteria for making its revise/not revise decisions under the 1996-2002 review cycle. EPA revised this protocol document to better explain how the decision criteria were applied and will also take the SAB comments into consideration when planning for the next review cycle.

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USEPA. 2002a. National Primary Drinking Water Regulations: Long-Term 1 Enhanced Surface Water Treatment Rule; Final Rule. *Federal Register*. Vol. 67, No. 9. p. 1811, January 14, 2002.

USEPA, 2002b. *Quality Assurance for the Six-Year Review of National Primary Drinking Water Regulations.* Memo from Judy Lebowich and Wynne Miller, Targeting and Analysis Branch. Office of Ground Water and Drinking Water. March 2002.

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APPENDICES

Appendix A: **Pre-1997 National Primary Drinking Water Regulations (NPDWRs)**

Appendix B: **Differences between the National Drinking Water Advisory Council's (NDWAC's) Recommendations and the Protocol**

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Appendix A: List of Pre-1997 National Primary Drinking Water Regulations (NPDWRs)

Table A-1 identifies the NPDWRs promulgated prior to the 1996 SDWA Amendments (pre-1997 NPDWRs) and the rulemaking by which they were originally promulgated. EPA reviewed these NPDWRs by 2002 in accordance with the review protocol described in this document. Table A-2 identifies the remaining pre-1997 NPDWRs which are being or have already been reviewed in separate actions and the NPDWRs promulgated after the 1996 SDWA Amendments. The NPDWRs listed in Table A-2 will be reviewed as a part of the 2002-2008 review cycle.

Table A-1: Pre-1997 NPDWRs Reviewed in Accordance with this Protocol

Contaminant	Corresponding NPDWR	Contaminant	Corresponding NPDWR
Chemical Contaminants		**Chemical Contaminants (continued)**	
Acrylamide	Phase II Rule	cis-1,2-Dichloroethylene	Phase II Rule
Alachlor	Phase II Rule	trans-1,2-Dichloroethylene	Phase II Rule
Antimony	Phase V Rule	Dichloromethane (Methylene chloride)	Phase V Rule
Asbestos	Phase II Rule	1,2-Dichloropropane	Phase II Rule
Atrazine	Phase II Rule	Di(2-ethylhexyl)adipate (DEHA)	Phase V Rule
Barium	Phase IIB Rule	Di(2-ethylhexyl) phthalate (DEHP)	Phase V Rule
Benzene	Phase I Rule	Dinoseb	Phase V Rule
Benzo[a]pyrene	Phase V Rule	Diquat	Phase V Rule
Beryllium	Phase V Rule	Endothall	Phase V Rule
Cadmium	Phase II Rule	Endrin	Phase V Rule
Carbofuran	Phase II Rule	Epichlorohydrin	Phase II Rule
Carbon tetrachloride	Phase I Rule	Ethylbenzene	Phase II Rule
Chlordane	Phase II Rule	Ethylene dibromide (EDB)	Phase II Rule
Chromium (total)	Phase II Rule	Fluoride	Fluoride Rule; Phase II Rule revised monitoring requirements
Copper	Lead and Copper Rule (LCR)	Glyphosate	Phase V Rule
Cyanide	Phase V Rule	Heptachlor	Phase II Rule
2,4-D	Phase II Rule	Heptachlor epoxide	Phase II Rule
Dalapon	Phase V Rule	Hexachlorobenzene	Phase V Rule
1,2-Dibromo-3-chloropropane (DBCP)	Phase II Rule	Hexachlorocyclopenta-diene	Phase V Rule
1,2-Dichlorobenzene (*o*-Dichlorobenzene)	Phase II Rule	Lead	LCR
1,4-Dichlorobenzene (*p*-Dichlorobenzene)	Phase I Rule	Lindane	Phase II Rule
1,2-Dichloroethane (Ethylene dichloride)	Phase I Rule	Mercury (Inorganic)	Phase II Rule
1,1-Dichloroethylene	Phase I Rule	Methoxychlor	Phase II Rule
Monochlorobenzene (Chlorobenzene)	Phase II Rule	Thallium	Phase V Rule

Table A-1: Pre-1997 NPDWRs Reviewed in Accordance with this Protocol

Contaminant	Corresponding NPDWR	Contaminant	Corresponding NPDWR
Nitrate (as N)	Phase II Rule	Toluene	Phase II Rule
Nitrite (as N)	Phase II Rule	Toxaphene	Phase II Rule
Oxamyl (Vydate)	Phase V Rule	2,4,5-TP (Silvex)	Phase II Rule
Pentachlorophenol	Phase IIB Rule	1,2,4-Trichlorobenzene	Phase V Rule
Picloram	Phase V Rule	1,1,1-Trichloroethane	Phase I Rule
Polychlorinated biphenyls (PCBs)	Phase II Rule	1,1,2-Trichloroethane	Phase V Rule
Selenium	Phase II Rule	Trichloroethylene	Phase I Rule
Simazine	Phase V Rule	Vinyl chloride	Phase I Rule
Styrene	Phase II Rule	Xylenes (total)	Phase II Rule
2,3,7,8-TCDD (Dioxin)	Phase V Rule	**Microorganisms**	
Tetrachloroethylene	Phase II Rule	Total coliforms (including fecal coliform and *E. coli*)	Total Coliform Rule (TCR)

Dates of original promulgation are as follows:

- Phase II Rule: 56 FR 3526, January 30, 1991 (USEPA, 1991a)
- Phase V Rule: 57 FR 31776, July 17, 1992 (USEPA, 1992)
- Phase IIB Rule: 56 FR 30266, July 1, 1991 (USEPA, 1991c)
- Phase I Rule: 52 FR 25690, July 8, 1987 (USEPA, 1987)
- LCR: 56 FR 26460, June 7, 1991 (USEPA, 1991b)
- Fluoride Rule: 51 FR 11396, April 2, 1986 (USEPA, 1986)
- TCR: 54 FR 27562, June 29, 1989 (USEPA, 1989b)

Table A-2: NPDWRs Not Covered by this Protocol		
Contaminant/Indicator	**Corresponding NPDWR**[1]	**Reason Not Included**
Chemical Contaminants		
Arsenic	Pre-1986 National Interim Primary Drinking Water Regulation (NIPDWR)	Reviewed/revised under January 22, 2001 Arsenic Rule[2,3]
Radionuclides		
Beta particles and photon emitters	Pre-1986 NIPDWR	Reviewed/revised under December 7, 2000 Radionuclides Rule[2]
Gross alpha particle activity		
Radium-226/228 (combined)		
Uranium	2000 Radionuclides Rule	Promulgated after 1996. NPDWR established in the December 7, 2000 Radionuclides Rule[2]
Microorganisms		
Cryptosporidium	Interim Enhanced Surface Water Treatment Rule (IESWTR) Long-Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR)	Subject of ongoing rulemaking activity - Long-Term 2 ESWTR (LT2ESWTR) (November 2003 to mid 2004)[4]
Giardia lambia	Surface Water Treatment Rule (SWTR); IESWTR; LT1ESWTR	
Heterotrophic plate count (HPC)	SWTR	
Legionella	SWTR	
Turbidity	SWTR; IESWTR; LT1ESWTR	
Viruses	SWTR; IESWTR; LT1ESWTR	
Disinfection Byproducts		
Bromate ion	Disinfectants and Disinfection Byproducts Rule Stage 1 (DBPR)	Revised rule promulgated after 1996 and additional revisions to be considered under Stage 2 DBPR (July 2003 to mid 2004)[4]
Chlorite ion		
Haloacetic acids: Monobromoacetic acid; Dibromoacetic acid; Monochloroacetic acid; Dichloroacetic acid; and Trichloroacetic acid		
Total Trihalomethanes (TTHMs): Chloroform; Bromodichloro-methane; Dibromochloromethane; and Bromoform	TTHM Rule; Requirements revised under Stage 1 DBPR	Revised rule promulgated after 1996 and additional revisions to be considered under Stage 2 DBPR (July 2003 to mid 2004)[4]
Disinfectant Residuals		
Chlorine	Stage 1 DBPR	Revised rule promulgated after 1996
Chloramines		
Chlorine dioxide		

Table A-2: NPDWRs Not Covered by this Protocol

[1] Dates of original promulgation are as follows:

- – Arsenic Rule: 40 FR 59566, December 24, 1975 (USEPA, 1975)
- – Radionuclides Rule: 41 FR 28402, July 9, 1976 (USEPA, 1976)
- – IESWTR: 63 FR 69478, December 16, 1998 (USEPA, 1998c)
- – LT1ESWTR: 67 FR 1811, January 14, 2002 (USEPA, 2002a)
- – SWTR: 54 FR 27486, June 29, 1989 (USEPA, 1989b)
- – Stage 1 DBPR Rule: 63 FR 69389, December 16, 1998 (USEPA, 1998b)
- – TTHM Rule: 44 FR 68624, November 29, 1979 (USEPA, 1979)

[2] Indicates date of rule revision.

- – Arsenic Rule: 66 FR 6976, January 22, 2001 (USEPA, 2001b)
- – Radionuclides Rule: 65 FR 76707, December 7, 2000 (USEPA, 2000d)

[3] After promulgation of the revised arsenic NPDWR on January 22, 2001, EPA initiated a review of the new MCL, and postponed the effective date of the rule until February 22, 2002. EPA requested independent expert panel reviews of the science, cost and benefits analyses for the January 2001 rule, and in July 2001, sought additional public comment on a range of MCLs. Following receipt of the final expert panel reports in the Fall of 2001, EPA requested comment on the reports. EPA will continue to evaluate the expert panel reports, the voluminous comments received during these comment periods, and other relevant information and comments as they become available as part of the next Six-Year Review; EPA expects to make a final decision on whether to revise the January 2001 rule as part of that Six-Year Review, which is due in August 2008. In the meantime, as announced by the Administrator on October 31, 2001, EPA will not further postpone the January 2001 rule, and EPA also does not expect to take any other additional action relative to the July 2001 proposal in the interim. The revised arsenic MCL became effective on February 22, 2002. The date for compliance with the MCL remains January 23, 2006.

[4] Indicates anticipated date of promulgation.

Appendix B: Differences between the National Drinking Water Advisory Committee's (NDWAC's) Recommendations and this Protocol

This table indicates those NDWAC recommendations that EPA either did not incorporate or that EPA changed substantially in this protocol document. Overall, EPA incorporated the majority of the NDWAC's recommendations

NDWAC Recommendation	EPA Response
EPA should review the basis of all existing NPDWRs during the first review round (*i.e.*, the review round ending August 2002)	EPA does not believe that such a review is practical in light of resource constraints and has not incorporated it into the protocol. EPA will review the basis of existing regulations only if new data suggest the need for regulatory revision(s).
Effective with review rounds starting after August 2002, EPA should complete both the review and the revision within the Six-Year window.	This recommendation does not apply to the 1996-2002 review round.
EPA should fully consider "other regulatory revisions" (e.g., monitoring requirements system data reporting requirements, etc.) as a part of the Six-Year Review process.	EPA believes that many of these issues are best addressed through mechanisms other than the Six-Year Review process. Where appropriate alternative mechanisms to consider these issues are not available, EPA may consider them as a part of the Six-Year Review if they meet the following criteria: • they indicated a potential change to an NPDWR, as defined under section 1401; • they are "ready" for rulemaking – that is, the problem to be resolved has been clearly identified and specific option(s) have been formulated to address the problem; and • they represented a meaningful opportunity for cost-savings while maintaining or improving the level of public health protection.
EPA should consider non-regulatory options, in addition to regulatory changes, if the costs of other regulatory compliance are considered to be too high or interim measures are needed pending promulgation of a rule.	EPA agrees that this suggestion has merit but believes it is outside the scope of the Six-Year Review effort and should be addressed through alternative mechanisms. The recommendation has not been incorporated into the protocol document.
EPA should consider changes in State data-reporting requirements, as well as changes to system data-reporting requirements, as a part of the Six-Year Review process.	EPA believes that revisions to State data-reporting requirements are best considered through other mechanisms outside the scope of the Six-Year Review effort. The recommendation has not been incorporated into the protocol document.

NDWAC Recommendation	EPA Response
EPA should consider multi-media mitigation options as a part of the Six-Year Review process.	Efforts to pursue multi-media mitigation for contaminants are outside the scope of the Six-Year process, except in those instances where the SDWA specifically authorizes EPA to consider a multi-media approach as a part of the NPDWR. Therefore, consideration of multi-media mitigation is outside the scope of the 1996-2002 Six-Year Review.
EPA should quantify, to the maximum extent practicable, costs and benefits associated with possible regulatory revisions.	EPA does not believe it is practicable to quantify costs and benefits during the review phase. This is best done as a part of the rulemaking phase before EPA proposes actual revisions. Instead, EPA will conduct a qualitative assessment of economic considerations for those NPDWRs where a health or technical basis exists for a possible regulatory revision.

Appendix C: Overview of the IRIS Assessments

The Integrated Risk Information System (IRIS) is an EPA database containing Agency consensus scientific positions on potential adverse human health effects that may result from chronic exposure to chemical substances found in the environment.[15] Assessments by IRIS undergo internal and external peer reviews by health scientists.

The main reasons for including a chemical in the IRIS program are (1) Agency statutory, regulatory, or program implementation needs; and (2) availability of new scientific information or new methodology that might significantly change current IRIS assessment.

IRIS assessments are based solely on scientifically valid studies. Evaluations of original toxicological and epidemiological studies conducted by the National Toxicology Program, National Cancer Institute, National Institute of Environmental Health Sciences, EPA's National Center for Environmental Assessment, industry, universities, etc., are all used in risk assessment. These studies are individually evaluated for their soundness, methodological strength and weaknesses, and whether or not they have been conducted according to current quality standards.

IRIS reviews are not based on secondary sources such as reviews conducted by other national or international organizations (e.g., State of California, World Health Organization or the International Agency for Research on Cancer), although such assessments are often examined as part of the IRIS review.

A full list of chemicals assessed in IRIS and those for which assessments are planned can be found on IRIS web site (http://www.epa.gov/iris). A large number of these IRIS assessments are of direct relevance to the regulatory function of Office of Water (OW) and more specifically to the six-year review. Some of the reviews are being conducted by OW. Others were nominated for review by OW.

[15] IRIS contains chemical specific health effects information. Information on synergistic effects of chemical mixtures is scarce and is seldom available for inclusion in IRIS.

Appendix D: Overview of the OPP Process for Toxicity Assessments

Under the requirements of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), a registrant (manufacturer) is required to submit animal toxicity data on the potential human health effects that may be posed by pesticide chemicals. Toxicity data are provided during the initial registration of a pesticide as well as during the periodic re-registration review of the pesticide as required by FIFRA. The schedule priority, for when an existing pesticide enters a re-review is set in part by regulatory requirements which include provisions to give priority to certain active ingredients. The Office of Pesticides Programs (OPP) will establish the review schedule taking into account the procedures outlined in the Act. A more complete discussion of the re-registration process can be found in section 4(a)-(f) of FIFRA.

In 1998, The Office of Water's (OW's) OGWDW and the OPP established major areas of coordination on cross-cutting scientific issues. Included in the major efforts was the harmonization of the human health hazard assessments and dose-response relationships for pesticides. The two offices have agreed to share health effects data and coordinate activities on the issues such as endpoint selection, dose-response information, and quantifying risks. Therefore, the OW and OPP are working closely on establishing consistency in health effects endpoints through resource and information sharing.

The OPP receives health effects data that are generated under specific scientific guidelines established by the Agency and conducted under the requirements of Good Laboratory Practices. These guidelines are available on the EPA's Internet site at the following location: http://www.epa.gov/opptsfrs/OPPTS_Harmonized/870_Health_Effects_Test_Guidelines/indexx.html.

In addition to the required guideline studies, the OPP will obtain and review open literature data on adverse effects to test species. Although these studies are not used in establishing health end-points (RfDs) and cancer potency or threshold values, they are used in establishing the "weight of evidence" for an adverse effect. Data sources include, but are not limited to, published, peer-reviewed journal articles in the open literature and toxicity data submitted to other U.S. federal or international agencies that do not conform to the OPP's test guidelines.

Below is a brief overview of end-point selection.

Toxicity Assessment

Non-Cancer Effects:

Reference Dose. For non-cancer effects, toxicity is represented by an RfD; it may be calculated for acute effects (acute RfD (aRfD)) and chronic effects (chronic RfD (cRfD)). RfDs are calculated by determining the No-Observed-Adverse-Effect Level (NOAEL) or bench-mark dose point of departure from either acute or chronic toxicity studies (the choice of study depends on which type of RfD is being calculated - aRfD or cRfD) and dividing it by the appropriate uncertainty factors. Typically, an uncertainty factor is applied to account for: variation within the human population (*i.e.*, intraspecies); the differences between humans and animals as the animal data are extrapolated to humans (*i.e.*, interspecies); the duration of the study; the end point used in the calculation (NOAEL or Lowest-Observed-Adverse-Effect Level (LOAEL)); and the completeness of the database.

If the RfD will be used in dietary risk assessment, then it is adjusted to take into account the Food Quality Protection Act (FQPA) Safety Factor for infants and children. Such an adjusted RfD is called a Population Adjusted Dose (PAD). Like the RfD, it may be acute (aPAD) or chronic (cPAD). In making the decision regarding the FQPA Safety Factor, the Agency takes into account both information on the toxicity of the pesticide and the completeness of the toxicity and exposure databases. For more information on how the Agency applies the FQPA Factor, see the document "Standard Operating Procedures for use of FQPA Safety Factor," April 26, 1999 at http://www.epa.gov/pesticides/trac/science/. However, these standard operating procedures are currently under revision; and notification of the release of these revisions is posted at: http://www.epa.gov/oppfead1/trac/science.

Cancer Effects:

Linear Effect - *Cancer Potency Factor* (*q1**). The cancer potency factor, which is commonly known as a q1*, is the relative strength of a carcinogen. The bigger the q1*, the more potent the carcinogen. It is calculated using a computer model that assumes linearity at doses below which the effect occurred in the studies.

Non-Linear Effect - *Margin of Exposure*. For some carcinogenic pesticides, it is not considered appropriate to calculate a potency factor. In these cases, the cancer effect is assumed to have a threshold, as for non-cancer effects, and as such, a Margin of Exposure (MOE) is derived. The MOE is a ratio calculated by dividing the toxicity Point of Departure (such as a NOAEL or benchmark dose) by the estimated or calculated exposure level. EPA has not yet established a policy on the level of risk that is of no concern for non-linear cancer risk assessment.

During the review of the toxicity data and the dose-response assessment, the pesticide being evaluated undergoes review by several in-house peer review committees.

Appendix E: Overview of the Analytical Methods Review Process

A. What Section of SDWA Requires the Agency to Specify Analytical Methods?

SDWA directs EPA to promulgate NPDWRs which specify either MCLs or TTs for drinking water contaminants (SDWA section 1412; 42 U.S.C. § 300g-1). According to SDWA (section 1401(1)(D)), NPDWRs include "criteria and procedures to assure a supply of drinking water which dependably complies with such maximum contaminant levels; including accepted methods for quality control and testing procedures to insure compliance with such levels." (42 U.S.C. § 300f(1)(D)) Moreover, EPA is to set an MCL for such NPDWRs "if, in the judgement of the Administrator, it is economically and technologically feasible to ascertain the level of a contaminant in water in public water systems." (SDWA section 1401(1)(C)(i); 42 U.S.C. § 300f(1)(C)(i)). Alternatively, if it is not economically or technologically feasible to so ascertain the level of a contaminant, the Administrator may identify known TTs, which sufficiently reduce the contaminant in drinking water, in lieu of an MCL (SDWA section 1401(1)(C)(ii)).

B. What is the Typical Process for Approving Methods for SDWA Analytes?

Methods are initially approved as a part of an MCL or monitoring requirement rulemaking. Thereafter, as revisions to the approved methods are published or as new technologies are developed, the Agency, from time-to-time, will group a set of methods for proposal in a methods update rule. It generally takes 18 to 24 months to promulgate a methods update rule. This can increase significantly if there is adverse public comment on a proposed method.

The revised or new methods included in a methods update rule may be from EPA, other Federal or State agencies, or standards organizations (e.g., American Society for Testing and Materials (ASTM) or Standard Methods (SM)). These non-EPA entities have independent review and/or collaborative testing requirements. In addition, under 40 CFR 141.27 (alternate analytical techniques, also known as alternate test procedures or ATP) methods may also be developed by private laboratories, vendors or groups. Independent review and collaborative testing of these privately developed methods is accomplished by requiring submission of the method to the Agency under the alternate test procedure (ATP) program. An alternate technique is accepted "only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with the MCL." (40 CFR 141.27(a)) Initially, many ATP applications are missing data. Once a completed ATP application is recorded by the Agency, the ATP pass/fail decision generally takes three to four months. For successful ATPs, this period is followed by the formal rulemaking process, which was described above as taking 18-24 months.

C. What Factors Does the Agency Consider in Approving Analytical Methods and in Determining Feasible Limits?

In deciding whether an analytical method is economically and technologically feasible to determine the level of a contaminant in drinking water, the Agency generally considers the following (50 FR 46902, November 13, 1985 (USEPA, 1985); 52 FR 25690, July 8, 1987 (USEPA, 1987); 54 FR 22062, May 22, 1989a):

- Is the method sensitive enough to address the level of concern (*i.e.*, is quantitation sufficient to meet the MCL)?

- Does the method give reliable analytical results at the MCL? What is the precision (or reproducibility) and the bias (accuracy or recovery)?
- Is the method specific? Does the method identify the contaminant of concern in the presence of potential interferences?
- Is the availability of certified laboratories, equipment and trained personnel sufficient to conduct compliance monitoring?
- Is the method rapid enough to permit routine use in compliance monitoring?
- What is the cost of the analysis to Water Supply systems?

Regarding the first criteria (*i.e.*, sensitivity), the method detection limit (MDL) and the practical quantitation level (PQL) are two performance measures used by EPA to estimate the limits of performance of analytic chemistry methods for measuring contaminants in drinking water. For SDWA analytes, EPA defines the MDL as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero"(40 CFR Part 136 Appendix B). MDLs can be operator, method, laboratory, and matrix specific. MDLs are not necessarily reproducible within a laboratory or between laboratories on a daily basis due to the day-to-day analytical variability that can occur and the difficulty of measuring an analyte at very low concentrations. In an effort to integrate this analytical chemistry data into regulation development, the Agency uses the PQL to estimate or evaluate the minimum, reliable quantitation level that most laboratories can be expected to meet during day-to-day operations. EPA's Drinking Water program generally defines the PQL as "the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions" (50 FR 46902, November 13, 1985 (USEPA, 1985)) For several SDWA analytes, EPA has set the MCL at the PQL.

D. How Are PQLs Typically Determined for SDWA Contaminants?

Historically, EPA's OGWDW has used two main approaches to determine a PQL for SDWA analytes. The preferred approach, the WS method, uses data from WS studies to calculate the lower limit of quantitation. The WS method was used in most cases when sufficient WS data are available to calculate a PQL. In the absence of WS data, the second approach that EPA used was the MDL multiplier method. In this approach, the PQL was calculated by multiplying the EPA-derived MDL by a factor of 5 or 10. The 5 or 10 multiplier was used to account for the variability and uncertainty that can occur at the MDL.

1. How Were Water Supply Studies Conducted?

Water supply laboratory performance evaluation (PE) studies have been an integral part of EPA's certification program for drinking water laboratories for over 20 years. Historically, EPA's National Exposure Research Laboratory (NERL) in Cincinnati, Ohio conducted WS studies for all current and proposed drinking water contaminants. Although EPA conducted the WS studies semi-annually, for certification purposes, laboratories were only required to demonstrate acceptable performance once a year (141.23(k)(3) and 141.24(f)(17)).

Each WS study included WS samples (or sample concentrates) that were analyzed for both SDWA analytes and analytes being considered for regulation under the SDWA. During these WS studies, EPA-NERL sent participating laboratories a set of the stable WS sample concentrates in sealed glass ampules, a data reporting form, and appropriate instructions. EPA-NERL sent WS samples to all laboratories that conducted drinking water analyses, including utility laboratories, commercial laboratories, and State and EPA Regional laboratories. With appropriate dilution, the laboratory then analyzed the WS samples using the specified procedures. Afterwards, the laboratory sent the completed reporting form to EPA for evaluation. After evaluation, EPA returned a fully detailed report to each participating laboratory.

At this point in time, WS PE studies are no longer performed by EPA. On July 18, 1996 (61 FR 37464 (USEPA, 1996)), EPA proposed options for the externalization of the PE studies program (now referred to as the Proficiency Testing or PT program). After evaluating public comment, in the June 12, 1997 final notice EPA stated that the Agency has decided (62 FR 32113 (USEPA, 1997b)):

> *...on a program where EPA would issue standards for the operation of the program, the National Institute of Standards and Technology (NIST) would develop standards for private sector PE (PT) suppliers and would evaluate and accredit PE suppliers, and the private sector would develop and manufacture PE (PT) materials and conduct PE (PT) studies. In addition, as part of the program, the PE (PT) providers would report the results of the studies to the study participants and to those organizations that have responsibility for administering programs supported by the studies.*

2. PQL Determinations - How Are WS Studies Evaluated and What Criteria Are Used?

The derivation of the PQL involves determining the concentration of an analyte at which a set percentage of the laboratories achieve results within a specified range of the spiked value. Historically, the percentage of laboratories was set at 75 percent, while a range of acceptance limits around the spiked value were used. In many cases, EPA derived PQLs only from the data submitted by the EPA Regional and State laboratories that participate in the WS studies.

A PQL derived from WS data in such a manner is considered a stringent target for routine laboratory performance because:

- WS samples are prepared in reagent water and therefore do not contain the matrix interferences that may occur in field samples.
- Laboratories analyze only a small number of samples for the study and are aware that the samples are for the purposes of PE (*i.e.*, they are not "blind" samples).

In deriving a PQL from WS study data, the Agency typically sets a fixed percentage or 2 sigma (2 standard deviation) acceptance window around the known concentration (or spike value) of the WS samples. Then percentage of laboratories achieving results within the specified acceptance window (y-axis) is plotted against the known spike concentration of the WS study samples (x-axis). While the acceptance limits for inorganics typically range from 15 to 30 percent, the acceptance limits for organics generally range from 40 to 50 percent. Several SDWA analytes have acceptance limits of 2 sigma (2 standard deviation). Linear regression or graphical analysis is performed on the WS data to determine the concentration at which 75 percent of EPA Regional and State laboratories achieve acceptable results.

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EPA Protocol for the Review of
Existing National Primary Drinking Water Regulations