



**Occurrence Analysis for Potential Source Waters  
for the Second Six-Year Review of  
National Primary Drinking Water Regulations**

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## Abbreviations and Acronyms

ATSDR	Agency for Toxic Substances & Disease Registry
BAT	Best Available Technology
CF	Coagulation/Filtration
CWS	Community Water System
DBP	Disinfection Byproduct
EDR	Electrodialysis
EPA	U.S. Environmental Protection Agency
GAC	Granular Activated Carbon
GIS	Geographical Information System
GW	ground water
IX	Ion Exchange
LDC	Legacy Data Center
LS	Lime Softening
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MSBA	Multi-Stage Bubbling Aeration
NAICS	North American Industry Classification System
NAWQA	National Water Quality Assessment
NCFAP	National Center for Food and Agricultural Policy
NCOD	National Contaminant Occurrence Database
ND	no data reported
NPDWR	National Primary Drinking Water Regulation
OPP	U.S. Environmental Protection Agency, Office of Pesticide Programs
OX	Oxidation
PAC	Powdered Activated Carbon
PDP	U.S. Department of Agriculture Pesticide Data Program
POTW	Publicly Owned Treatment Works
POU	Point-of-Use
PTA	Packed Tower Aeration
PUR	California Pesticide Use Reporting Database
PWS	Public Water System
RCRA	Resource Conservation and Recovery Act
RO	Reverse Osmosis
SDWA	Safe Drinking Water Act
SDWIS/FED	Federal Safe Drinking Water Information System
SW	surface water
TRI	Toxics Release Inventory
UI	Underground injection
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

## Executive Summary

The U.S. Environmental Protection Agency (EPA) has completed its second Six-Year Review (Six-Year Review 2) of national primary drinking water regulations (NPDWRs). The 1996 Safe Drinking Water Act (SDWA) Amendments require the U.S. Environmental Protection Agency (EPA or the Agency) to periodically review existing NPDWRs. Section 1412(b)(9) of SDWA reads:

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

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

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

For Six-Year Review 2, EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2009e), analytical feasibility (USEPA, 2009b), treatment feasibility (USEPA, 2009f), and finished water occurrence (USEPA, 2009a). EPA identified new health effects assessments that indicate the possibility to raise maximum contaminant level goal (MCLG) values for a number of regulated contaminants. Consequently, EPA reviewed data on contaminant occurrence in source water to determine if there is a meaningful opportunity to achieve cost savings while maintaining or improving the level of public health protection. This document describes this review.

**Exhibit ES-1** shows the current MCLG values for contaminants for which new health effects assessments indicate a possible MCLG that is higher than the MCLG in the NPDWR. The new health effects information results in a wide range of possible MCLG increases. The lowest relative increase is 2 times the current MCLG for both diquat and picloram. The highest relative increase is 150 times the current MCLG for the upper bound possible MCLG for lindane.

The exhibit also shows the current maximum contaminant level (MCL) values, most of which equal the MCLG values. The possible MCLG value for each contaminant is higher than the corresponding current MCL value. Thus, a revision to the MCLG for a contaminant would affect its MCL, which could reduce costs for drinking water systems that control the contaminant to meet the MCL.

**Exhibit ES-1. Current MCLG/MCL Values and Possible MCLG Values**

Contaminant	Current MCLG/MCL (mg/L)	Possible MCLG (mg/L)
Alachlor <sup>1</sup>	zero (MCLG) 0.002 (MCL)	0.04
Barium <sup>1</sup>	2	6
1,1-Dichloroethylene <sup>2</sup>	0.007	0.35
Diquat <sup>1</sup>	0.02	0.04
Glyphosate <sup>1</sup>	0.7	14
Lindane (gamma-Hexachlorocyclohexane) <sup>2</sup>	0.0002	0.001 – 0.03 (depending on risk factors used for uncertainty)
Picloram <sup>2</sup>	0.5	1
1,1,1-Trichloroethane <sup>1</sup>	0.2	14
1. New health effects information during Round 2 indicates a possibility to increase MCLG. 2. New health effects information during Round 1 indicated a possibility to increase MCLG. EPA made a decision in Round 1 not to revise the NPDWR because the revision was a low priority.		

The potential for and magnitude of cost savings related to MCL changes depend on four factors:

- The magnitude of increase in the MCL
- The concentration of the contaminant in the source water, relative to the current MCL and the possible MCLG
- The presence of co-occurring contaminants treated with the same technology and their relative importance to the design and operation of the treatment technology
- The specific treatment technology currently employed.

EPA's analysis of the potential for cost savings was constrained to readily available data. The data available to characterize contaminant occurrence was especially limited because there is no comprehensive dataset that characterizes source water quality for drinking water systems. Data from the National Water Quality Assessment (NAWQA) program conducted by the U.S. Geological Survey (USGS); EPA's STORET (short for STORage and RETrieval) data system, which are part of EPA's Office of Ground Water and Drinking Water's National Contaminant Occurrence Database (NCOD); and U.S. Department of Agriculture (USDA) Pesticide Data Program (PDP) water monitoring survey provide useful insights into potential contaminant occurrence in source water. However, these data are not based on random or representative sampling events and, therefore, cannot be used directly to derive quantitative estimates of national occurrence in drinking water sources.

Nevertheless, the available data indicate relatively infrequent contaminant occurrence in potential source waters at the levels of interest. The NAWQA data, which provide the most extensive coverage of potential source waters, indicate that only alachlor is found in concentrations that exceed the possible MCLG. In particular, two contaminants – glyphosate and picloram – are not found at levels above either the current MCLG or the possible MCLG in any of the three datasets. Diquat, which is not included in any of these datasets, has the potential to occur infrequently in source water given its less frequent use compared to the other pesticides in the table (alachlor, glyphosate, lindane, and picloram) and its tendency to dissipate quickly from surface water and be immobile in soils.



Without national estimates of contaminant occurrence in drinking water sources, EPA cannot determine how many systems currently treat for the contaminants listed in Exhibit ES-1. EPA also does not have national data regarding the treatment technologies being utilized to control these contaminants. Some technologies have higher potential for operational cost savings; however, co-occurrence considerations for all of the Best Available Technologies could diminish the potentially affected system's ability to alter treatment for possible higher MCLGs.

Despite the possibility for changes in MCLG values that range from 2 to 150 times higher than current MCLs, the available occurrence data for potential drinking water sources indicate relatively low contaminant occurrence in the concentration ranges of interest. As a consequence, EPA cannot conclude that there is a meaningful opportunity for system cost savings.

## 1. Introduction

The U.S. Environmental Protection Agency (EPA or the Agency) has completed its second Six-Year Review (Six-Year Review 2) of national primary drinking water regulations (NPDWRs). The 1996 Safe Drinking Water Act (SDWA) Amendments require the Agency to 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 NPDWRs for possible regulatory revision. Although the statute does not define when a revision is “appropriate,” as a general benchmark, EPA considered a possible revision to be “appropriate” if, at a minimum, it presents a meaningful opportunity to:

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

For Six-Year Review 2, EPA implemented the protocol that it developed for the first Six-Year Review (USEPA, 2003), including minor revisions developed during the current review process (USEPA, 2009d). EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2009e), analytical feasibility (USEPA, 2009b), treatment feasibility (USEPA, 2009f), and finished water occurrence (USEPA, 2009a). EPA identified new health effects assessments that indicate the possibility to raise maximum contaminant level goal (MCLG) values for a number of regulated contaminants. Consequently, EPA reviewed data on contaminant occurrence in source water to determine if there is a meaningful opportunity to achieve cost savings while maintaining or improving the level of public health protection. This document describes this review.

**Exhibit 1-1** shows the current MCLG values for contaminants for which new health effects assessments indicate a possible MCLG that is higher than the MCLG in the NPDWR. The new health effects information results in a wide range of possible MCLG increases. The lowest relative increase is 2 times the current MCLG for both diquat and picloram. The highest relative increase is 150 times the current MCLG for the upper bound possible MCLG for lindane.

Exhibit 1-1 also shows the current maximum contaminant level (MCL) values, most of which equal current MCLG values (the MCL for alachlor is higher because it is limited by analytical feasibility). The possible MCLG value for each contaminant is higher than the corresponding current MCL value. Thus, a revision to the MCLG for the contaminant would affect its MCL, which could reduce costs for drinking water systems that control the contaminant to meet the MCL.

**Exhibit 1-1. Current MCLG/MCL Values and Possible MCLG Values**

Contaminant	Current MCLG/MCL (mg/L)	Possible MCLG (mg/L)
Alachlor <sup>1</sup>	zero (MCLG) 0.002 (MCL)	0.04
Barium <sup>1</sup>	2	6
1,1-Dichloroethylene <sup>2</sup>	0.007	0.35
Diquat <sup>1</sup>	0.02	0.04
Glyphosate <sup>1</sup>	0.7	14
Lindane (gamma-Hexachlorocyclohexane) <sup>2</sup>	0.0002	0.001 – 0.03 (depending on risk factors used for uncertainty)
Picloram <sup>2</sup>	0.5	1
1,1,1-Trichloroethane <sup>1</sup>	0.2	14
1. New health effects information during Round 2 indicates a possibility to increase MCLG. 2. New health effects information during Round 1 indicated a possibility to increase MCLG. EPA made a decision in Round 1 not to revise the NPDWR because the revision was a low priority.		

In making its recommendation to revise or take no action regarding an MCLG, EPA needs to determine whether there is a meaningful opportunity for cost savings while maintaining the same level of protection. This report provides the information EPA reviewed for this evaluation and the basis for the Agency's decisions. This report provides the information EPA reviewed for this evaluation and the basis for the Agency's decisions.

During the First Six-Year Review, EPA made a recommendation not to revise several NPDWRs for which an increase in MCLG was possible, including several under consideration during the current review: 1,1-dichloroethylene, lindane, and picloram. EPA's recommendation was based on its determination that there was a low potential for cost savings. This meant that a revision was a low priority activity for the Agency because of competing workload priorities, administrative costs associated with rulemaking, and the burden on States and the regulated community to implement any regulatory change that resulted.

This technical support document addresses the potential for cost savings, which depends on the potential cost savings impact at the system level and the number of systems affected. Section 2 provides a discussion of the factors affecting the potential for cost savings for each contaminant of interest. Section 3 discusses the sources of these contaminants and current usage of some of the contaminants. Section 4 summarizes water quality data that is readily available to characterize contaminant occurrence. Section 5 concludes the paper with a summary of information regarding whether possible changes to the MCLGs constitute a meaningful opportunity to reduce costs while maintaining health protection. USEPA (2009a) provides occurrence analysis information for other contaminants included in the Six-Year Review 2.

## 2. Cost Savings

The potential for and magnitude of cost savings related to MCL changes depend on four factors:

- The magnitude of increase in the MCL
- The concentration of the contaminant in the source water, relative to the current MCL and the possible MCLG
- The presence of co-occurring contaminants treated with the same technology and their relative importance to the design and operation of the treatment technology
- The specific treatment technology currently employed.

The potential cost savings is generally limited by the most constrained factor for a specific treatment facility. The following sections address each of these factors.

### 2.1 Magnitude of Possible MCL Increase

In general, the potential for cost savings is positively correlated with the magnitude of the MCL increase. A larger MCL increase can mean a greater number of systems affected and more significant changes in treatment operations. This factor can be limited, however, in the case of co-treatment. If co-occurring contaminants are present, even a large increase in the MCL for one contaminant may not permit a dramatic change in treatment operations, because the treatment system must continue operations sufficient to meet the MCLs for the other contaminants.

**Exhibit 2-1** presents the magnitude of possible change for the contaminants of interest.

**Exhibit 2-1. Magnitude of Possible Change**

Contaminant	Magnitude of Possible MCLG/MCL Increase
Alachlor	20 times higher (based on MCL)
Barium	3 times higher
1,1-Dichloroethylene	50 times higher
Diquat	2 times higher
Glyphosate	20 times higher
Lindane (gamma-Hexachlorocyclohexane)	5 to 150 times higher (depending on risk factors for uncertainty)
Picloram	2 times higher
1,1,1-Trichloroethane	70 times higher

One potential operational change that is highly dependent on the magnitude of the MCL increase is the degree of blending used by a treatment system. Some systems treat only a portion of the source water to a level well below the MCL and then blend the treated water with untreated water, resulting in blended water with contaminant concentrations below the MCL. An MCL increase could result in a system reducing the quantity of water being treated and increasing the quantity of untreated water in its blending operation. This change could result in reduced operating costs such as labor costs for operating the treatment system and, potentially, reduced energy costs for pumping water through the treatment process.

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## 2.2 Relative Source Water Concentration

If an MCL increases, there are two potential scenarios for a treatment system that could result in cost savings:

- The source water concentration is greater than the current MCL, but less than the possible higher MCL
- The source water concentration is greater than both the current and possible higher MCLs.

The potential cost savings under the first scenario are greater than under the second, because a system could cease treatment for the contaminant altogether. The potential for ceasing treatment, however, may be limited by the presence of co-occurring contaminants. A system may need to continue treatment for the other contaminants. The number of systems that face each scenario depends, in part, on the magnitude of the MCL increase as well as the distribution of the contaminant in source waters.

Under the SDWA, public water systems (PWSs) are required to conduct compliance monitoring, and EPA is collecting monitoring data from a sample of systems. These data, however, reflect post-treatment water quality. Comprehensive data for source water quality (i.e., prior to treatment) is not readily available. EPA has identified three sources of data that characterize contaminant occurrence in potential source waters: the National Water Quality Assessment (NAWQA) program conducted by the U.S. Geological Survey (USGS), and EPA's STORET (short for STOrage and RETrieval) data system, which are part of EPA's Office of Ground Water and Drinking Water's National Contaminant Occurrence Database (NCOD), and the U.S. Department of Agriculture (USDA) Pesticide Data Program (PDP) water monitoring survey. Section 4 addresses data from these sources.

## 2.3 Co-Occurring Contaminants

As discussed above, the presence of co-occurring contaminants is an important limiting factor affecting the cost savings that can be achieved for an MCL increase. Co-occurring contaminants, however, are significant only when the same treatment process that is used to remove the target contaminant also removes the co-occurring contaminant(s). For example, a system with coagulation/filtration to remove turbidity, followed by granular activated carbon (GAC) to remove lindane, could realize a cost savings as a result of an increase in the lindane MCL if the GAC system can be adjusted without a significant effect on turbidity removal. If, however, the GAC process also removed other regulated organic contaminants, the system may not be able to adjust its GAC operation despite a change in the lindane MCL.

When the same treatment process removes multiple contaminants, potential cost savings depend on the relative importance of each contaminant to the design and operation of the process. If the contaminant with the MCL increase controls operation, and removal of other contaminants is less sensitive to operational changes, there may be a greater opportunity for cost savings, at least to the point where changes begin to affect co-occurring contaminant removal. On the other hand, if a co-occurring contaminant controls operations, and the contaminant with the MCL increase is removed as an additional benefit, a system may not be able to adjust operations.

## 2.4 Treatment Technology

**Exhibit 2-2** summarizes the Best Available Technologies (BATs) for each of the seven contaminants.

**Exhibit 2-2. Summary of Treatment Technologies**

Contaminant	Best Available Treatment Technologies	Small System Compliance Technologies
Alachlor	GAC	GAC, POU GAC, PAC
Barium	IX, LS, RO, EDR	CF, IX, LS, RO, EDR, POU IX, POU RO
Diquat	GAC	GAC, POU GAC, PAC
Glyphosate	OX	OX
1,1-Dichloroethylene	PTA, GAC	PTA, GAC, MSBA, Aeration (diffused, tray, shallow tray)
Lindane (gamma-Hexachlorocyclohexane)	GAC	GAC, POU GAC, PAC
Picloram	GAC	GAC, POU GAC, PAC
1,1,1-Trichloroethane	PTA, GAC	PTA, GAC, MSBA, Aeration (diffused, tray, shallow tray, spray)
GAC = Granular Activated Carbon; IX = Ion Exchange; LS = Lime Softening; POU = point-of-use; RO = Reverse Osmosis; EDR = Electrodialysis; OX = Oxidation (Chlorine or Ozone); CF = Coagulation/Filtration; PTA = Packed Tower Aeration. Sources: 40 CFR 141.61 and 141.62, USEPA 1998.		

The potential for cost savings (e.g., chemical use, energy, media replacement) vary by treatment technology (i.e., some technologies, once in place, are more amenable to operational changes than others). The following sections provide discussions of the factors affecting the potential cost savings for each technology in Exhibit 2-2.

### 2.4.1 Ion Exchange (Barium)

Increasing the MCL for a target contaminant in an ion exchange system could allow for greater run times before regeneration or replacement of the ion exchange resin. This longer run length would mean a reduction in regeneration chemical use, with associated cost savings, or a reduction in the cost of replacement resin/media. Alternatively, by changing bed depth, a system can reduce the quantity of resin or media present, with similar cost savings. Therefore, these cost savings could be large relative to the total operating cost of the technology, particularly if the magnitude of the MCL change is large.

Also, ion exchange systems are more likely than other systems to be operated for the removal of a single contaminant. This is particularly true of systems with contaminant-specific resins. Thus, co-occurring contaminants may be less of a concern for some systems using this technology. Even when operated to remove multiple contaminants, this technology is amenable to changes in the resin used. If one contaminant's MCL increases such that it is no longer a concern, the system can switch to a contaminant-specific resin (e.g., resin designed for arsenic removal) that is more efficient for removal of co-occurring contaminants, with potential cost savings.

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#### **2.4.2 Granular Activated Carbon (Alachlor, Diquat, 1,1-Dichloroethylene, Lindane, Picloram, 1,1,1-Trichloroethane)**

Similar to ion exchange, granular activated carbon (GAC) systems treating for a contaminant with an increased MCL may be able to extend their run length before regeneration or replacement of the GAC media or decrease the bed depth to reduce the GAC quantity. Cost savings could be large relative to the total operating cost of the technology, particularly if the magnitude of the MCL change is large.

Unlike ion exchange, however, GAC removes a wide spectrum of organic and inorganic compounds including disinfection byproduct (DBP) precursors, and is more likely to be used for the removal of multiple contaminants. Thus, co-occurring contaminants may limit or eliminate the potential for cost savings, depending on which contaminant(s) have the greatest influence on GAC operation. Also, although all GAC media are not the same, there is less potential for a change in GAC media to result in significant cost savings.

#### **2.4.3 Packed Tower Aeration (1,1-Dichloroethylene, 1,1,1-Trichloroethane)**

An increased MCL could allow packed tower aeration (PTA) systems treating for 1,1-dichloroethylene or 1,1,1-trichloroethane to reduce the air-to-water ratio, resulting in reduced energy cost for blowers. Blower energy costs, however, make up a small portion of total operating costs. Thus, the cost savings could be small relative to the total operating cost of the technology.

Also like GAC, PTA can remove a wide range of contaminants, specifically volatile contaminants, and is more likely to be used for the removal of multiple contaminants. Thus, co-occurring contaminants may eliminate the potential for cost savings or limit the savings to the extent 1,1-dichloroethylene or 1,1,1-trichloroethane treatment controls the PTA system's air-to-water ratio.

#### **2.4.4 Oxidation (Glyphosate)**

With an increased MCL, systems using oxidation to treat for glyphosate could reduce the dose of chlorine or ozone, resulting in reduced chemical cost. Chlorination and ozonation, however, typically are installed for the primary purpose of disinfecting drinking water. In other words, there would almost always be a co-occurring contaminant (i.e., bacteria, viruses, and parasites) in these systems, and glyphosate treatment would be a secondary benefit of the system. Cost savings in these systems would be limited to the extent glyphosate treatment controls the chemical dose. Although chemical costs make up a large portion of operating cost for these technologies, the ability to reduce these costs significantly would likely be small because of disinfection needs. It is unlikely that systems would be able to cease their oxidation treatment because of an increase in the glyphosate MCL, given the need for disinfection.

#### **2.4.5 Lime Softening (Barium)**

An increased MCL may allow lime softening systems to reduce the dose of treatment chemicals (coagulant or lime), resulting in reduced cost. Similar to oxidation, however, lime softening systems also are typically installed for another primary purpose (e.g., solids and/or hardness removal). The treatment of the contaminant with the increasing MCL would likely be a

secondary benefit of the system. Cost savings would be limited to the extent the contaminant with the MCL increase controls the coagulant or lime dose. Although chemical costs make up a moderate portion of operating cost for this technology, the ability to reduce these costs significantly would likely be small because of treatment needs for other contaminants. It is unlikely systems would be able to cease lime softening treatment, given the need to continue removal of solids and/or hardness.

#### **2.4.6 Reverse Osmosis and Electrodialysis (Barium)**

These two technologies generally achieve a very high removal rate for a wide variety of contaminants. Although some operational adjustments may be possible (e.g., changes in blending ratios), these changes would not have a dramatic effect on operating costs unless there are no co-occurring contaminants. These technologies are very likely to be used for removal of multiple contaminants, thereby limiting the potential for cost savings due to an MCL change for one contaminant.



### 3. Contaminant Characteristics and Sources

Toxic pollutants can be introduced to surface water through natural sources as well as human activities. **Exhibit 3-1** provides a brief summary of the uses and potential sources for the pollutants of interest.

**Exhibit 3-1. Potential Sources of the Contaminants**

Contaminant	Sources of Potential Release to the Environment	Description/Uses	Environmental Fate and Transport
Alachlor	Agricultural runoff	Herbicide used for weed control: corn, soybeans, sorghum, peanuts, and beans.	Low absorption to soil; soluble and highly mobile in water; leaches to groundwater.
Barium	Industrial waste; drilling waste ground application, offshore drilling waste water; copper smelting; erosion of natural deposits.	Naturally occurring metal; used in oil and gas drilling mud, jet fuel, pesticides, paint, bricks, ceramics, glass, and rubber.	Leaching and erosion of natural deposits into groundwater; atmospheric deposition; precipitate out of aquatic media as insoluble salt; adsorb to suspended solids in surface water; not mobile in soil systems.
1,1-Dichloroethylene	Atmospheric emissions or wastewater discharge from manufacturing plants.	Industrial chemical used in making adhesives, synthetic fibers, refrigerants, food packaging, and coating resins.	Hydrophobic; highly volatile; if spilled on land, may leach to groundwater.
Diquat	Agricultural runoff; manufacturing wastewater discharges.	Herbicide used to control plant growth in aquatic environments and as agricultural and residential herbicide.	Permanently adsorbs to soil; rapidly adheres to sediments when released to water; immobile.
Glyphosate	Direct discharge during application; manufacturing wastewater discharges.	Herbicide used on food and non-food field crops as well as a plant growth regulator.	Strongly adsorbs to soil, immobile; unlikely to leach to groundwater; likely to adhere to sediments when released to surface water by aquatic use and erosion.
Lindane (gamma-Hexachlorocyclohexane)	Agricultural runoff; atmospheric emissions; rain and snow deposition.	Insecticide used to treat a variety of crop seeds; all agricultural application of this chemical will cease by October 2009.	Volatile; sorbs to soil, leaching to groundwater (soluble in water at 7 mg/L).
Picloram	Runoff from agricultural, forest, and rights-of-way application.	Herbicide used to control feed crop pastures, nonfood crops (rights-of-way), and in forestry.	Highly soluble and mobile in water; leaches to groundwater, no degradation.
1,1,1-Trichloroethane	Atmospheric emissions or wastewater discharge from manufacturing plants, discharge or leaching from landfills.	Industrial chemical used as a solvent and in production of hydrofluorocarbons.	Highly volatile; sorbs to soil, leaching to groundwater; atmospheric deposition; moderate solubility.

Sources: USEPA OPP 2006; ATSDR 2005; ATSDR 2007; ATSDR 2002; USEPA 2002; USEPA 1995a; USEPA 1993; USEPA 2006c; USEPA 1995b; USEPA 2007; ATSDR 2006.

EPA collected the most recently reported state level releases and disposal data for the pollutants of concern from EPA's Toxic Release Inventory (TRI). This data identifies states that are most likely to have anthropogenic sources of the contaminants of interest that are reported to the TRI, which excludes agricultural applications of pesticides. No release or disposal were reported for 1,1-dichloroethane, diquat, or glyphosate. The following table and map exhibits show the total number of pounds of each pollutant of interest reportedly released or disposed of on-site to different media, the total off-site disposal/releases, and a graphical representation of the total releases/disposal.

Alachlor releases occurred only in Iowa in 2006 (see **Exhibit 3-2** and **Exhibit 3-3**). Most of the 274 pounds were released to air; 12 pounds were discharged to water.

**Exhibit 3-2. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Alachlor for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+(d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Iowa	262	12	0	0	0	274	0	274
Total	262	12	0	0	0	274	0	274

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.

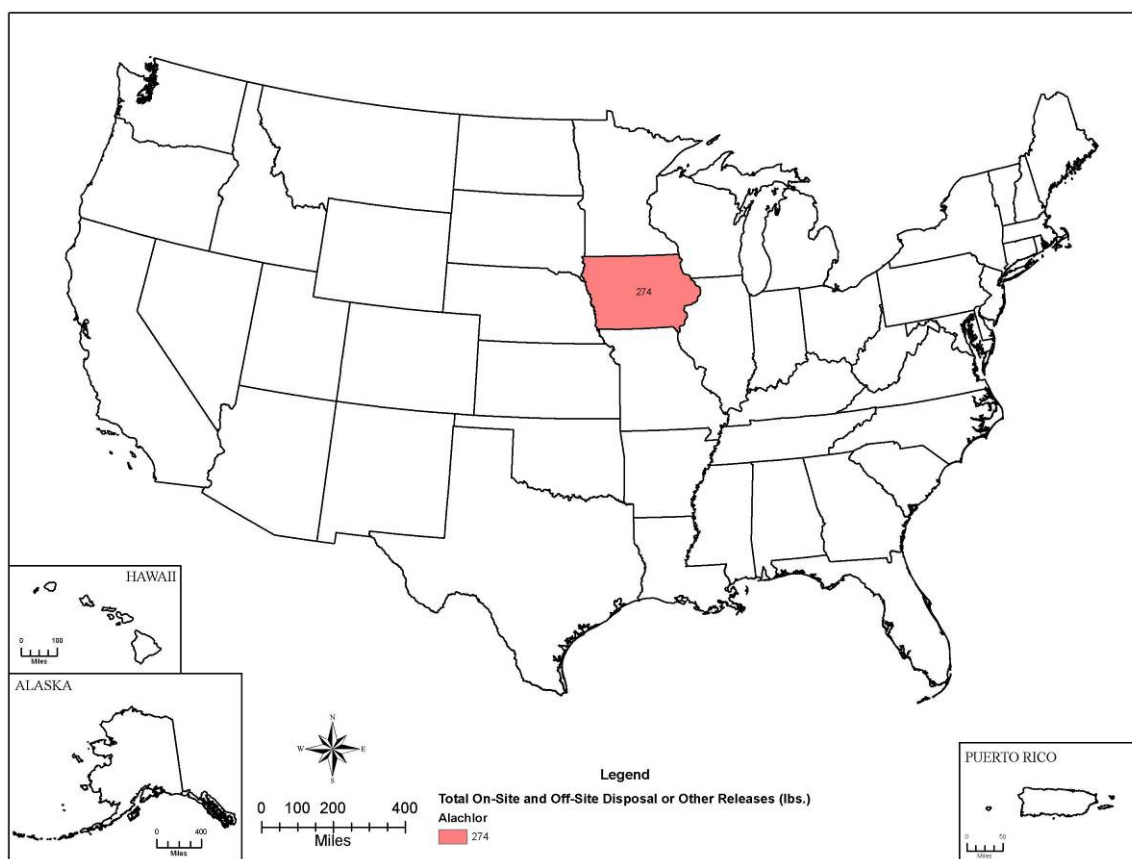
2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.

3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.

4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.

5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.

6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

**Exhibit 3-3. TRI State Total Reported Disposal of or Otherwise Released Pounds  
of Alachlor for facilities in All Industries (2006)**

National releases and disposal of barium were reported to be approximately 6.8 million pounds in 2006. **Exhibit 3-4** and **Exhibit 3-5** show that Arizona reported the greatest release and disposal of 2.5 million pounds (36.3%) followed by Kansas (0.65 million pounds), Oregon (0.63 million pounds), and Pennsylvania (0.55 million pounds). In Arizona all releases and disposal came from the electric utilities sector (NAICS 2211) and most was disposed of in on-site landfills. The total release directly to surface water in 2006 was 6,640 pounds. Nebraska reported the highest release to surface water of 3,913 pounds.

**Exhibit 3-4. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Barium for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Underground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+(d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Alabama	4	313	0	0	0	317	2,927	3,244
Alaska	4,808	ND	0	0	0	4,808	177,652	182,460
Arizona	4,529	ND	0	2,273,949	235	2,278,713	173,489	2,452,202
California	1,607	ND	0	622,433	18	624,058	112	624,170
Colorado	28,643	0	0	0	9,547	38,190	0	38,190
Connecticut	3	ND	0	0	0	3	2,565	2,568
Delaware	35	11	0	0	0	46	0	46
Georgia	98	ND	0	0	0	98.1	10,350	10,448
Idaho	29	ND	0	164,671	0	164,700	0	164,700
Illinois	56	0	0	0	0	56	46,878	46,934
Indiana	6	ND	0	0	0	6	28,353	28,359
Iowa	715	0	0	0	0	715	32,395	33,110
Kansas	7,533	0	0	131,690	0	139,223	507,055	646,278
Kentucky	79,829	250	0	0	0	80,079	0	80,079
Louisiana	0	ND	0	16,000	0	16,000	1,980	17,980
Michigan	2	0	0	0	0	2	88,487	88,489
Minnesota	8.8	ND	0	0	0	8.8	1,005	1,014
Nebraska	55,056	3,913	0	0	22,524	81,493	379,261	460,754
New Jersey	130	ND	0	0	0	130	6,387	6,517
New York	0	314	0	6,072	0	6,386	8,700	15,086
North Carolina	31.4	501	0	0	0	532	3,110	3,642
Ohio	10,230	1,089	18,086	82,086	0	93,405	81,556	174,961
Oregon	0	7	0	631,136	90	631,233	12	631,244
Pennsylvania	1,556	0	0	335,647	0	337,203	213,707	550,910
Puerto Rico	0	ND	0	0	0	0	5	5
South Carolina	274	ND	0	0	0	274	48	322
South Dakota	1,000	ND	0	47,646	0	48,646	0	48,646
Tennessee	0	ND	0	0	0	0	33,629	33,629
Texas	2,511	242	0	44,385	0	47,138	57,339	104,477
Utah	503	0	0	107,604	0	108,107	30,017	138,124
Virginia	0	ND	0	0	0	0	40,470	40,470
Washington	49	ND	0	0	0	49	14	63
West Virginia	0	ND	0	0	90,000	90,000	0	90,000
Wisconsin	0	ND	0	0	0	0	31,850	31,850
Total	199,246	6,640	18,086	4,463,319	122,414	4,791,619	1,959,353	6,750,972

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.

2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from

**Exhibit 3-4. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Barium for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+(d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
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contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.

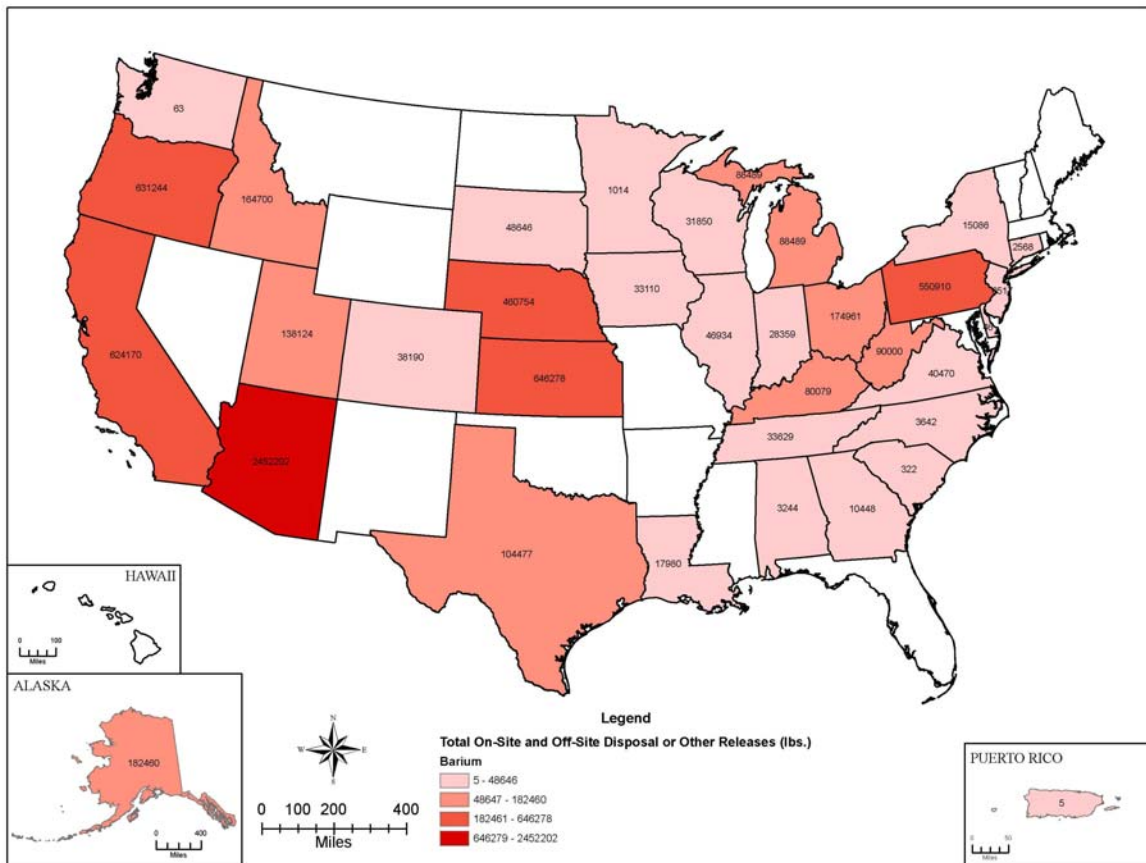
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.

4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.

5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.

6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

**Exhibit 3-5. TRI State Total Reported Disposal of or Otherwise Released Pounds of Barium for facilities in All Industries (2006)**



National releases and disposal of barium compounds were reported to be approximately 224.7 million pounds in 2006. **Exhibit 3-6** and **Exhibit 3-7** show that Texas reported the greatest release and disposal of 16.5 million pounds (7.4%) followed by North Dakota (13.9 million pounds) and Michigan (12.6 million pounds). In Texas, 94% of the reported releases and disposal came from the electric utilities sector (NAICS 2211) and 2% came from the chemical sector (NAICS 325). The total release directly to surface waters in 2006 was approximately one million pounds. Illinois reported the highest release to surface water of 123,897 pounds followed by Tennessee (119,997 pounds) and South Carolina (75,055 pounds).

**Exhibit 3-6. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Barium Compounds for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+(d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Alabama	39,293	68,042	0	1,819,037	8,852,004	10,778,376	53,416	10,831,793
Alaska	26,894	ND	0	149,061	1,243	177,198	1,243	178,441
Arizona	19,259	ND	0	1,618,845	5,576,154	7,214,258	19,112	7,233,370
Arkansas	53,429	75,026	0	3,243,243	344,456	3,716,153	37,327	3,753,480
California	12,052	260	0	7,838	0	20,150	14,516	34,666
Colorado	14,733	930	0	4,810,972	415	4,827,050	3,911,998	8,739,048
Connecticut	2,545	7	0	0	0	2,553	99,338	101,891
Delaware	10,601	10,593	0	280,000	0	301,194	149,119	450,313
Florida	27,228	10,727	0	1,789,344	2,411,543	4,238,842	342,315	4,581,157
Georgia	66,339	62,809	0	817,488	7,801,677	8,748,313	62,617	8,810,930
Hawaii	64	ND	0	0	0	64	50,896	50,960
Idaho	7,456	ND	0	10,634	48,573	66,663	47,000	113,663
Illinois	154,529	123,897	0	476,000	4,822,273	5,576,699	3,562,257	9,138,956
Indiana	95,425	34,454	0	4,983,355	3,765,383	8,878,617	819,017	9,697,633
Iowa	186,258	5,515	0	1,341,054	1,894,000	3,426,827	1,451,238	4,878,065
Kansas	93,805	747	0	3,461,575	1,995,885	5,552,012	0	5,552,012
Kentucky	58,941	67,955	0	2,671,201	2,648,100	5,446,197	1,891,428	7,337,625
Louisiana	49,943	30,962	541	2,012,600	1,012,871	3,106,376	1,338,912	4,445,289
Maine	1,448	4,600	0	82,130	0	88,178	18,197	106,375
Maryland	8,048	896	3	38,246	197,754	244,947	954,092	1,199,039
Massachusetts	3,684	1,061	0	9,572	228,932	243,249	103,068	346,317
Michigan	64,032	39,122	0	5,807,055	4,307,884	10,218,093	2,364,276	12,582,369
Minnesota	52,501	2,860	0	2,942,269	5,575,059	8,572,689	782,215	9,354,903
Mississippi	4,106	20,656	51,600	1,043,777	91,925	1,160,464	93,627	1,254,090
Missouri	161,647	16,584	0	1,673,048	5,398,947	7,250,226	103,723	7,353,948
Montana	114,897	795	0	8,398,812	165,155	8,679,659	440,377	9,120,036
Nebraska	59,038	5	0	1,828,368	10	1,887,421	336,671	2,224,092
Nevada	898	0	0	841,677	53,390	895,965	35	896,000
New Hampshire	1,267	ND	0	0	13,000	14,267	3,558	17,825
New Jersey	8,128	39	0	0	0	8,167	289,375	297,542

**Exhibit 3-6. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Barium Compounds for facilities in All Industries by State (2006)**

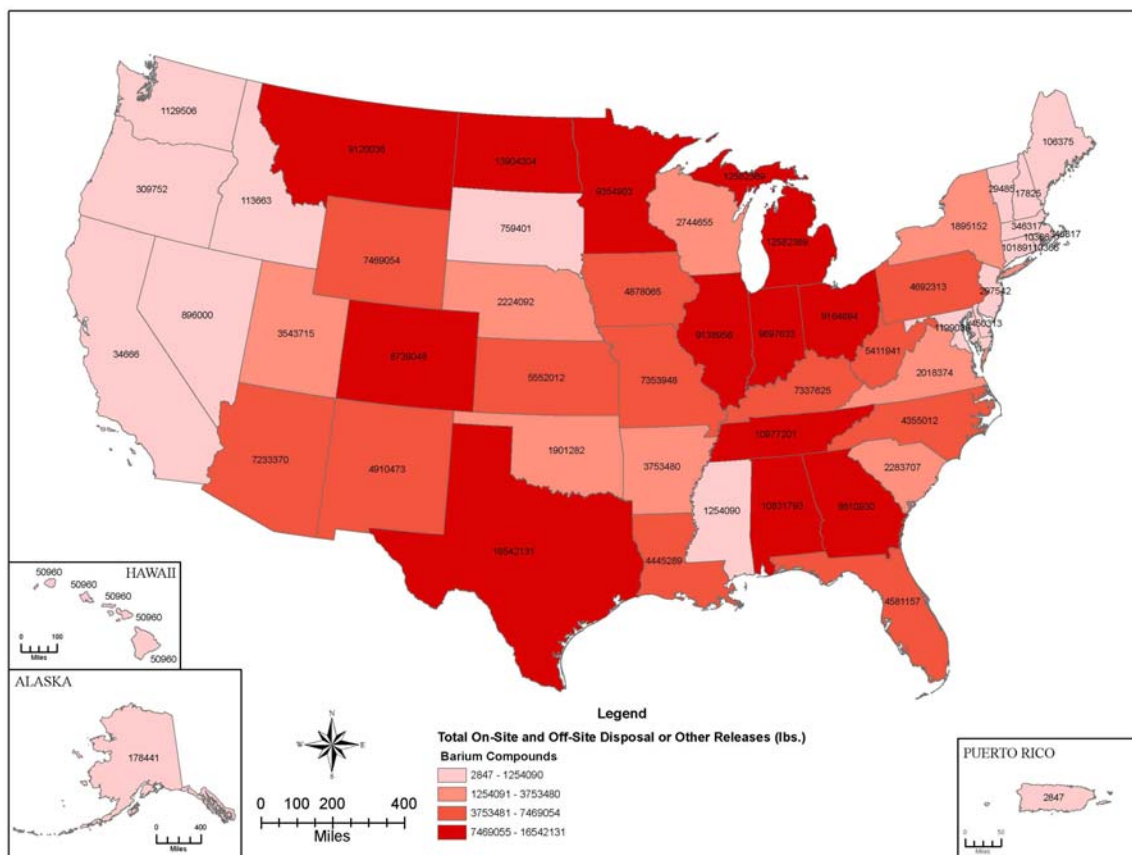
State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+(d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
New Mexico	13,880	2,100	0	3,683,605	1,210,133	4,909,718	755	4,910,473
New York	23,342	13,186	0	607,765	25	644,317	1,250,835	1,895,152
North Carolina	24,666	58,290	0	299,831	3,545,025	3,927,812	427,201	4,355,012
North Dakota	41,053	20,722	0	1,645,308	5,347,505	7,054,588	6,849,716	13,904,304
Ohio	70,988	34,283	0	1,671,929	3,663,861	5,441,061	3,723,633	9,164,694
Oklahoma	23,899	15,920	0	1,069,250	396,268	1,505,337	395,945	1,901,282
Oregon	15,617	3,939	0	250,000	0	269,556	40,196	309,752
Pennsylvania	42,320	29,942	0	1,229,599	193,816	1,495,677	3,196,635	4,692,313
Puerto Rico	2,847	0	0	0	0	2,847	0	2,847
Rhode Island	5	18	0	0	0	23	10,343	10,366
South Carolina	25,317	75,055	0	674,795	912,137	1,687,303	596,404	2,283,707
South Dakota	1,120	120	0	588,856	0	590,095	169,306	759,401
Tennessee	20,231	119,997	0	1,310,070	4,012,858	5,463,156	5,514,045	10,977,201
Texas	143,884	43,683	0	10,620,521	2,444,136	13,252,225	3,289,907	16,542,131
Utah	4,498	80	0	3,314,131	180,397	3,499,106	44,609	3,543,715
Vermont	0	ND	0	0	0	0	29,485	29,485
Virginia	5,159	37,270	0	1,027,000	516,161	1,585,590	432,784	2,018,374
Washington	1,048	3,105	0	26,143	1,010,646	1,040,942	88,564	1,129,506
West Virginia	6,418	15,186	0	3,141,468	1,089,119	4,252,191	1,159,751	5,411,941
Wisconsin	51,094	8,283	0	285,180	656,674	1,001,231	1,743,425	2,744,655
Wyoming	41,688	4,987	0	6,068,618	675,635	6,790,928	678,126	7,469,054
Total	1,957,560	1,064,708	52,144	89,671,269	83,061,028	175,754,568	48,982,625	224,737,194

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.
2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.
4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.
5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.
6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

### Exhibit 3-7. TRI State Total Reported Disposal of or Otherwise Released Pounds of Barium Compounds for facilities in All Industries (2006)



As shown in **Exhibit 3-8** and **Exhibit 3-9**, nationally only 10 pounds of lindane were reportedly released and disposed of in 2006 from three states including Arkansas, Ohio, and Utah. Half of the 10 pounds were released into the air, while the other 5 pounds were disposed of at off-site facilities.



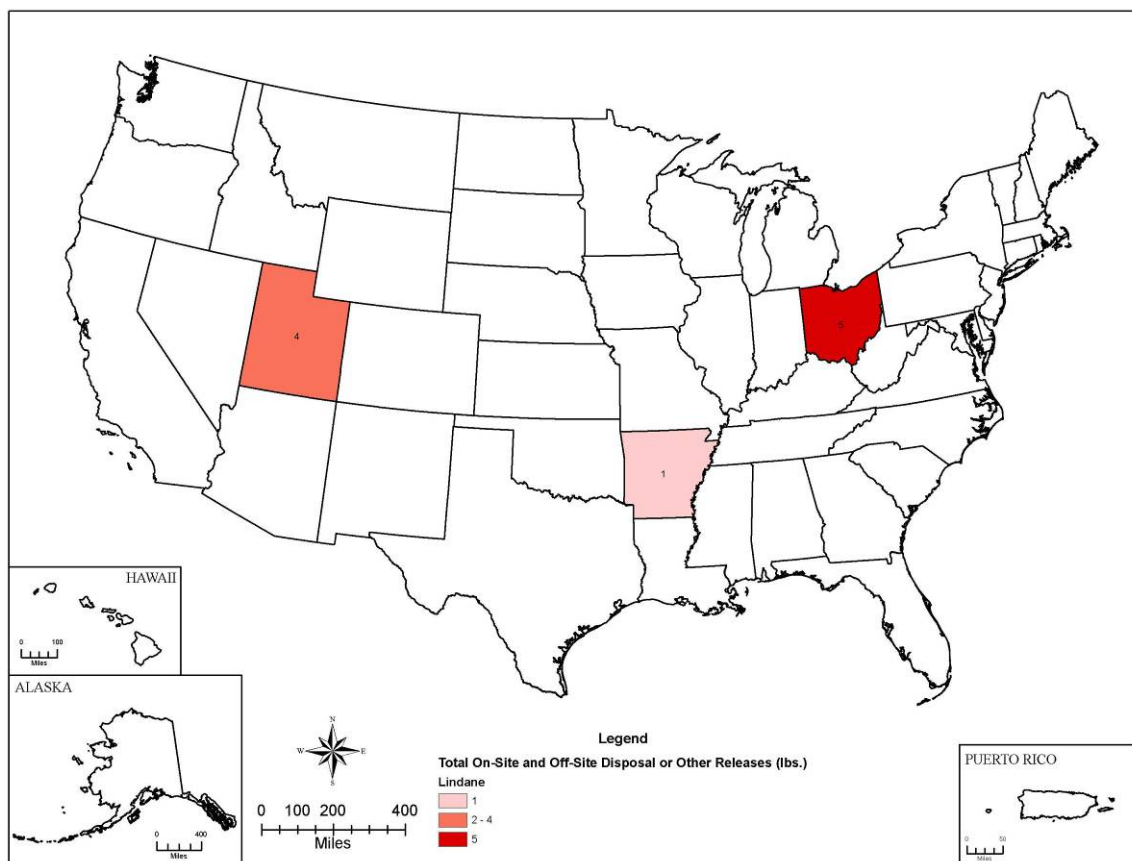
**Exhibit 3-8. TRI On-site and Off-site Reported Disposal of or Otherwise Release of (in pounds) Lindane for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+ (d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Arkansas	1	ND	0	0	0	1	0	1
Ohio	0	0	0	0	0	0	5	5
Utah	4	ND	0	0	0	4	0	4
Total	5	0	0	0	0	5	5	10

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.
2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.
4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.
5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.
6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

**Exhibit 3-9. TRI State Total Reported Disposal of or Otherwise Released Pounds  
of Lindane Compounds for facilities in All Industries (2006)**

National releases and disposal of picloram were reported to be approximately 51.8 thousand pounds in 2006. As shown in **Exhibit 3-10** and **Exhibit 3-11**, while three states reported releases (Michigan, Missouri, and Texas), 99% of the releases and disposal were in Texas. All of the reported releases and disposal came from the chemical sector (NAICS 325) and most was disposed of in on-site landfills. The total release directly to surface water in 2006 was only 350 pounds, all of which was reported in Michigan.

**Exhibit 3-10. TRI On-site and Off-site Reported Disposal of or Otherwise Release of  
(in pounds) Picloram for facilities in All Industries by State (2006)**

State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+ (d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Michigan	14	350	0	0	0	364	0	364
Missouri	46	ND	0	0	0	46	8	54
Texas	201	0	0	51,133	0	51,334	0	51,334
Total	261	350	0	51,133	0	51,744	8	51,752

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.

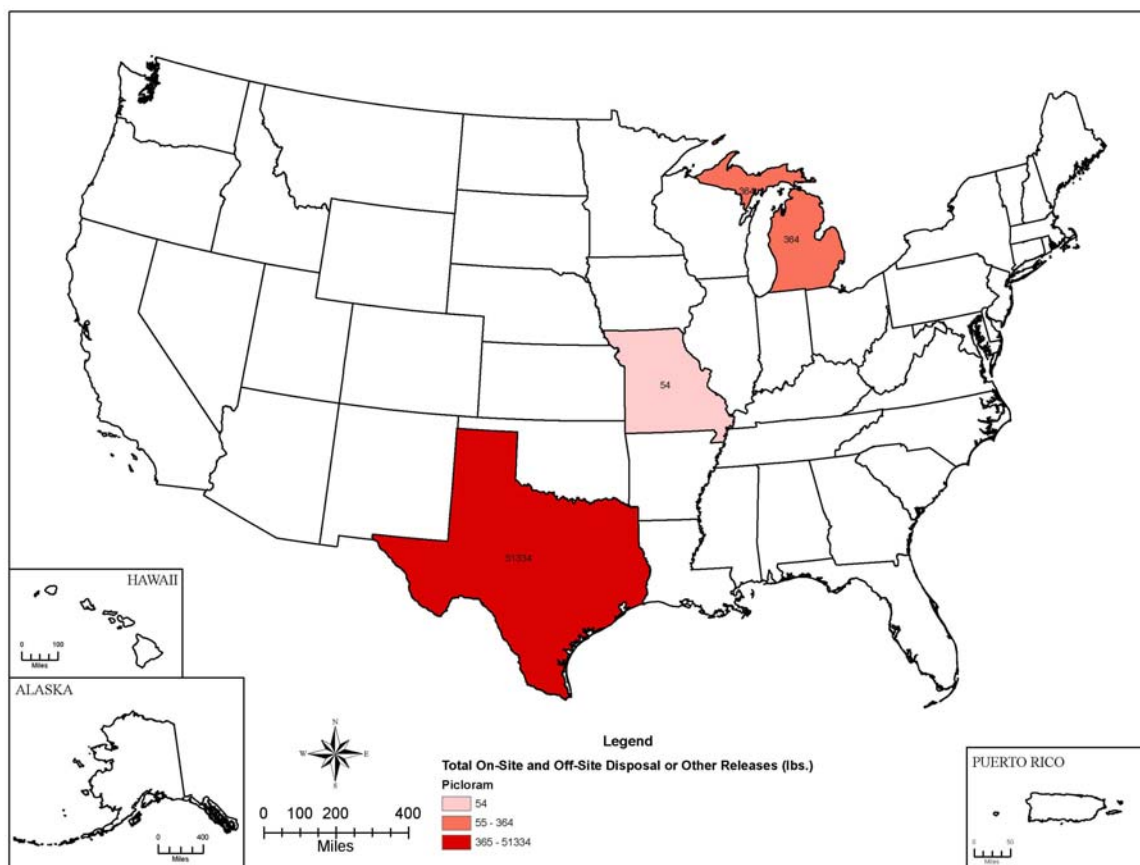
2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.

3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.

4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.

5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.

6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

**Exhibit 3-11. TRI State Total Reported Disposal of or Otherwise Released Pounds of Picloram Compounds for facilities in All Industries (2006)**

National releases and disposal of 1,1,1-trichloroethane were reported to be approximately 119.8 thousand pounds in 2006. **Exhibit 3-12** and **Exhibit 3-13** show that Louisiana reported the greatest release and disposal of 57.0 thousand pounds (47.6%) followed by Minnesota (36.3 thousand pounds) and New Mexico (10.8 thousand pounds). In Louisiana all releases and disposal came from the chemical sector (NAICS 325) and most was released into the air. The total release directly to surface water in 2006 was only 53 pounds. Louisiana also reported the highest release to surface water of 47 pounds.

**Exhibit 3-12. TRI On-site and Off-site Reported Disposal of or Otherwise Release of  
(in pounds) 1,1,1-Trichloroethane for facilities in All Industries by State (2006)**

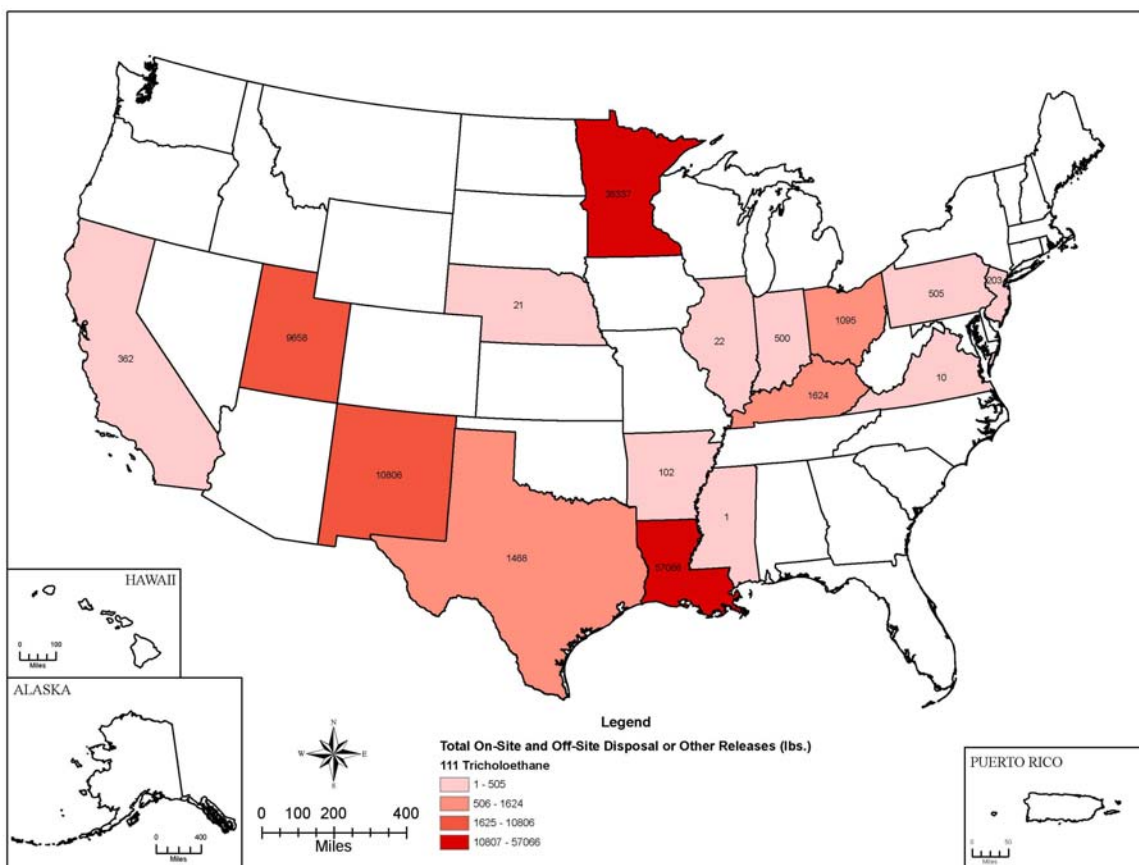
State	Air <sup>1</sup> (a)	Surface Water Discharges <sup>2</sup> (b)	Under-ground Injection <sup>3</sup> (c)	On-site Landfill Disposal <sup>4</sup> (d)	Other On-site Releases <sup>5</sup> (e)	Total On-site Disposal or Other Releases (f)=(a)+(b)+(c)+ (d)+(e)	Total Off-site Disposal or Other Releases <sup>6</sup> (h)	Total On- and Off-site Disposal or Other Releases (i)=(f)+(h)
Arkansas	102	ND	0	0	0	102	0	102
California	272	ND	0	0	0	272	90	362
Illinois	1	0	0	0	0	1	21	22
Indiana	500	ND	0	0	0	500	0	500
Kentucky	1,620	4	0	0	0	1,624	0	1,624
Louisiana	57,018	47	0	0	0	57,065	1	57,066
Minnesota	36,337	ND	0	0	0	36,337	0	36,337
Mississippi	1	0	0	0	0	1	0	1
Missouri	ND	ND	ND	ND	ND	ND	0	0
Nebraska	10	0	0	11	0	21	0	21
New Jersey	1	2	0	0	0	3	200	203
New Mexico	0	ND	0	0	10,806	10,806	0	10,806
Ohio	840	0	0	0	0	840	255	1,095
Pennsylvania	500	0	0	0	0	500	5	505
Texas	1,468	0	0	0	0	1,468	0	1,468
Utah	9,654	ND	0	0	0	9,654	4	9,658
Virginia	10	ND	0	0	0	10	0	10
Total	108,334	53	0	11	10,806	119,204	576	119,780

Source: USEPA, 2008

ND: no data reported

1. Includes fugitive and point source air releases. Fugitive emissions are all releases to air that are not released through a confined air stream. Fugitive emissions include equipment leaks, evaporative losses from surface impoundments and spills, and releases from building ventilation systems. Point source air emissions occur through confined air streams such as stacks, vents, ducts, or pipes.
2. Releases to water include discharges to streams, rivers, lakes, oceans, and other bodies of water. This includes releases from contained sources, such as industrial process outflow pipes or open trenches. Releases due to runoff, including storm water runoff are also reportable to TRI.
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.
4. Total On-Site Disposal to Class I UI RCRA Landfills and other Landfills.
5. Includes land treatment, surface impoundments, and other land disposal. Other disposal is the disposal of the toxic chemical to land at the facility that does not fall into one of the other on-site land releases listed. Other disposal includes such activities as placement in waste piles and spills or leaks.
6. Disposal of toxic chemicals in waste to off-site locations include discharges to Publicly Owned Treatment Works (POTWs) or disposal at other off-site facilities. Other off-site disposal facilities may include underground injection, landfills, solidification/stabilization (metals), water treatment (metals), surface impoundments, land treatment, waste broker, or other unknown off-site facilities.

**Exhibit 3-13. TRI State Total Reported Disposal of or Otherwise Released Pounds of 1,1,1-Trichloroethane Compounds for facilities in All Industries (2006)**



## 4. Contaminant Occurrence Data Sources

EPA has identified three sources of data that provide information on contaminant occurrence in source water: USGS' NAWQA Program, EPA's STORET data system, and USDA's Pesticide Data Program (PDP) water monitoring survey. This section provides background information on these three sources as well as occurrence summary data for the seven contaminants of interest.

### 4.1 NAWQA

In 1991, USGS implemented the NAWQA Program, in part, to characterize the condition of streams, rivers, and ground water in the U.S.

From 1991-2001, the NAWQA Program conducted interdisciplinary assessments, including water chemistry, hydrology, land use, stream habitat, and aquatic life, and established a baseline understanding of water-quality conditions in 51 of the Nation's river basins and aquifers, referred to as Study Units (USGS, 2006a). **Exhibit 4-1** depicts these study units.

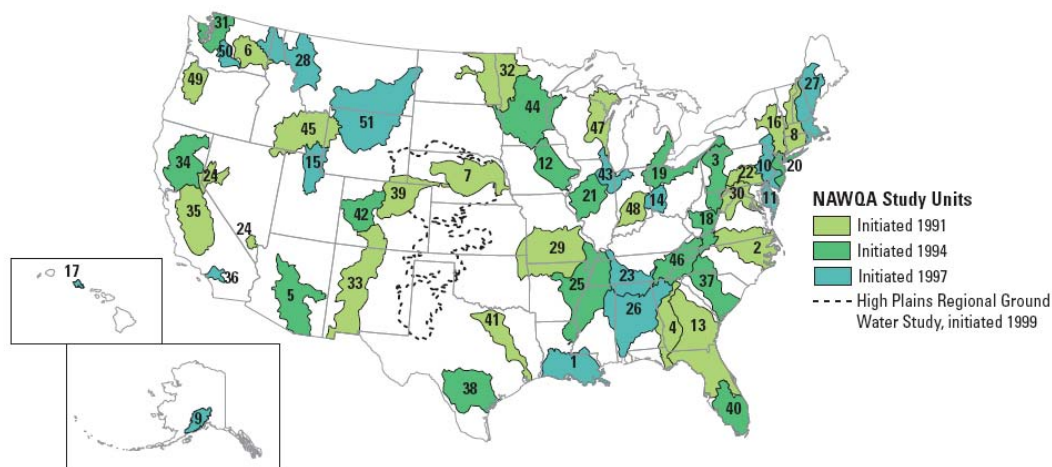
USGS selected these Study Units to reflect important hydrologic and ecological resources; critical sources of contaminants, including agricultural, urban, and natural sources; and a high percentage of population served by municipal water supply and irrigated agriculture. These areas account for more than 70 percent of total water use (excluding thermoelectric and hydropower) and more than 50 percent of the population's supply of drinking water (Gilliom, 2006).

The Study-Unit design used a rotational sampling scheme; therefore, sampling intensity varied year to year at the different sites. During the first decade, 20 investigations began in 1991; 16 in 1994; and 15 in 1997. During the time period 2001-2012, rotational monitoring will continue in 42 of the 51 Study Units.

USGS has made most of this data available through the NAWQA Warehouse. EPA collected and analyzed all available water quality sampling data for the seven contaminants of interest. EPA selected the maximum reported concentration for each contaminant analyzed at each location. The results shown below are based on these maximum concentrations and, therefore, represent upper bounds on contaminant occurrence in the NAWQA database.

The NAWQA data include latitude and longitude fields for the water quality sampling stations. EPA used these data along with latitude and longitude data in the Federal Safe Drinking Water Information System (SDWIS/FED) for community water system (CWS) facilities (e.g., intake well or treatment plant) to characterize the proximity of NAWQA sampling stations to these systems. EPA used a 2007 data extract of system, facility, and location information from SDWIS/FED for the analysis. EPA developed an initial dataset that contained 108,243 facility location records for 40,875 active CWSs that did not purchase water. EPA selected the records for facilities associated with water sources: infiltration gallery, intake, reservoir, roof catchment, spring, well, and well head. Treatment plant location records were also retained if a PWS had none of the facilities associated with source water. Because there are no NAWQA monitoring stations outside the contiguous 48 States, EPA removed records for Alaska (AK), Hawaii (HI), Puerto Rico (PR), and the Northern Mariana Islands (NMI), resulting in a final dataset of 106,351 facility records for 40,013 CWS. **Exhibit 4-2** provides a breakdown of the CWS by system size and **Exhibit 4-3** provides a breakdown by source water type.

## Exhibit 4-1. NAWQA Study Units



## NAWQA Study Units

- |                                                                  |                                             |
|------------------------------------------------------------------|---------------------------------------------|
| 1 Acadian–Pontchartrain Drainages                                | 27 New England Coastal Basins               |
| 2 Albemarle–Pamlico Drainage Basin                               | 28 Northern Rockies Intermontane Basins     |
| 3 Allegheny and Monongahela River Basins                         | 29 Ozark Plateaus                           |
| 4 Apalachicola–Chattahoochee–Flint River Basin                   | 30 Potomac River Basin                      |
| 5 Central Arizona Basins                                         | 31 Puget Sound Basin                        |
| 6 Central Columbia Plateau                                       | 32 Red River of the North Basin             |
| 7 Central Nebraska Basins                                        | 33 Rio Grande Valley                        |
| 8 Connecticut, Housatonic, and Thames River Basins               | 34 Sacramento River Basin                   |
| 9 Cook Inlet Basin                                               | 35 San Joaquin–Tulare Basins                |
| 10 Delaware River Basin                                          | 36 Santa Ana Basin                          |
| 11 Delmarva Peninsula                                            | 37 Santee River Basin and Coastal Drainages |
| 12 Eastern Iowa Basins                                           | 38 South-Central Texas                      |
| 13 Georgia–Florida Coastal Plain                                 | 39 South Platte River Basin                 |
| 14 Great and Little Miami River Basins                           | 40 Southern Florida                         |
| 15 Great Salt Lake Basins                                        | 41 Trinity River Basin                      |
| 16 Hudson River Basin                                            | 42 Upper Colorado River Basin               |
| 17 Island of Oahu                                                | 43 Upper Illinois River Basin               |
| 18 Kanawha–New River Basins                                      | 44 Upper Mississippi River Basin            |
| 19 Lake Erie–Lake Saint Clair Drainages                          | 45 Upper Snake River Basin                  |
| 20 Long Island–New Jersey Coastal Drainages                      | 46 Upper Tennessee River Basin              |
| 21 Lower Illinois River Basin                                    | 47 Western Lake Michigan Drainages          |
| 22 Lower Susquehanna River Basin                                 | 48 White River Basin                        |
| 23 Lower Tennessee River Basin                                   | 49 Willamette Basin                         |
| 24 Las Vegas Valley Area and the Carson and Truckee River Basins | 50 Yakima River Basin                       |
| 25 Mississippi Embayment                                         | 51 Yellowstone River Basin                  |
| 26 Mobile River Basin                                            |                                             |

Source: Gilliom, 2006a.



**Exhibit 4-2. CWS Dataset Summary by System Size**

Dataset	25 - 500	501 – 3,300	3,301 – 10,000	10,001 – 100,000	>100,000	Total
Total CWS with facility location (%)	24,131 (59%)	10,382 (25%)	3,492 (9%)	2,566 (6%)	304 (1%)	40,875 (100%)
CWS excluding AK, HI, PR, NMI (%)	23,660 (59%)	10,162 (25%)	3,414 (9%)	2,484 (6%)	293 (1%)	40,017 (100%)

Source: SDWIS/FED 2007 data extract

**Exhibit 4-3. CWS Summary by Water Source**

Dataset	GW	SW	Total
Total CWS with facility location (%)	36,251 (89%)	4,624 (11%)	40,875 (100%)
CWS excluding AK, HI, PR, NMI (%)	35,666 (89%)	4,347 (11%)	40,013 (100%)

Source: SDWIS/FED 2007 data extract

GW: ground water, SW: surface water (includes 454 CWS with ground water under the influence of surface water)

Using a geographical information system (GIS), EPA estimated the distance between each CWS facility and the nearest NAWQA sampling site. **Exhibit 4-4** shows results for 11 distance categories, including the number, cumulative number, and cumulative percent of NAWQA stations in each category. For example, 1,179 or 12.3% of the NAWQA sites are located within 0.5 miles of a CWS facility. Almost half of the NAWQA stations are within three miles of a CWS facility, and over 65% are within five miles. This location analysis does not, however, demonstrate that the water sources monitored by the NAWQA sampling sites are the drinking water sources for the nearest CWS facility; it only demonstrates relative proximity.

**Exhibit 4-4. Distance from NAWQA Sampling Stations to Nearest CWS Facility**

Distance in Miles	NAWQA Total	Cumulative	Cumulative %
<0.5	1,179	1,179	12.3%
0.5-1	834	2,013	21.1%
1-2	1,456	3,469	36.3%
2-3	1,183	4,652	48.7%
3-5	1,592	6,244	65.4%
5-10	1,642	7,886	82.6%
10-15	587	8,473	88.7%
15-20	267	8,740	91.5%
20-25	172	8,912	93.3%
25-50	434	9,346	97.8%
>50	206	9,552	100.0%

Although many of the NAWQA sampling sites are located within 5 to 10 miles of a CWS facility, the same cannot be said of the CWS facilities. There are approximately 4 times more CWS systems and 10 times more facilities than there are NAWQA sampling sites.

## 4.2 STORET

EPA manages two databases that contain water quality data for waterways in the United States (<http://www.epa.gov/storet/>). The Legacy Data Center (LDC) contains archived data through the end of 1998, while STORET is an active database updated each month with new water quality data beginning in 1999. It also includes all LDC data. STORET is a repository for data collected by local, state and federal agencies, Indian tribes, universities, and volunteers. Data downloads for a location vary over time as contributors revise their data. It contains raw biological, chemical, and physical data on surface and ground water for all 50 states and U.S. territories and jurisdictions. EPA collected and analyzed all available water quality data for the seven contaminants of interest.

## 4.3 PDP

The USDA established the PDP in 1991 to collect data pertaining to pesticide residues in food consumed by infants and children. In 1996, Congress expanded the program to include pesticide residues in drinking water. Implementation of this portion of the program was initiated in 2001.

The databases are produced annually and contain the following data collected through December 2006:

- pesticide residual concentrations in drinking water, bottled water, vegetables, grains, grain products, nuts, dairy products, fruits, poultry, beef, and pork for approximately 372 pesticides
- results from consumables originating in 43 countries, 50 states, Washington D.C., and Puerto Rico

The drinking water data are used to support the Food Quality Protection Act authorized in 1996 by Congress. Sampling occurs in regions of interest for a minimum of two years to track variations throughout different growing seasons. When the study began in 2001, it was limited to treated water at community water systems in New York and California. In 2002, monitoring efforts expanded to include five additional systems in Colorado, Kansas, and Texas; these locations were eliminated after 2003. The study expanded in 2004 to include Michigan, North Carolina, Ohio, Oregon, Pennsylvania, and Washington, as well as add source or raw water samples. Treatment plant personnel collect PDP samples from the raw and treated water flows, attempting to synchronize the collection of samples so that the sample collected after treatment is theoretically from the same aliquot of water sampled at the intake.

## 4.4 Contaminant Occurrence

The following sections discuss the occurrence of six of the seven contaminants of interest, and present summary data (maximum concentration values) from the NAWQA, STORET, and PDP databases. Each summary table juxtaposes the occurrence data with the current MCLG value (or MCL value when it is greater than the MCLG) and one or more possible MCLG values that are based on new health risk information. EPA also plotted the NAWQA data to demonstrate the spatial extent of the sampling locations and occurrence of the contaminants.

EPA did not identify any readily available water quality data for diquat. The Agency, therefore, obtained available information on diquat use and environmental fate and transport to characterize potential source water occurrence.

#### 4.4.1 Alachlor

**Exhibit 4-5** and **Exhibit 4-6** provide comparisons of the maximum alachlor concentrations found at locations in the NAWQA and STORET databases, respectively, with the current MCL (which is greater than the MCLG) and the possible MCLG value. **Exhibit 4-7** presents a spatial representation of the NAWQA data. Less than 0.4% of NAWQA sampling locations have a maximum concentration that exceeds the current MCL and only one has a concentration that exceeds the possible MCLG. STORET data show that less than 1.4% of sampling locations have maximum concentrations above the MCL and none have samples exceeding the possible MCLG.

**Exhibit 4-8** and **Exhibit 4-9** show alachlor raw water concentrations and finished water concentrations, respectively, from the PDP database. None of the samples contained alachlor concentrations that exceeded the current MCL or possible MCLG.

#### Exhibit 4-5. Summary of Alachlor Occurrence Based on Maximum Sample Values for Locations in NAWQA

Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	2,125 (100.0%)	6,785 (100.0%)	326 (100.0%)	9,236 (100.0%)
All samples are nondetect	1,601 (75.3%)	6,665 (98.2%)	305 (93.6%)	8,571 (92.8%)
At least one detection	524 (24.7%)	120 (1.8%)	21 (6.4%)	665 (7.2%)
Maximum concentration exceeds current MCL <sup>1</sup> (0.002 mg/L)	32 (1.5%)	2 (0.03%)	1 (0.31%)	35 (0.38%)
Maximum concentration exceeds possible MCLG (0.04 mg/L)	1 (0.05 %)	0 (0.0%)	0 (0.0%)	1 (0.01%)

Source: USGS 2006b (national data from 1992 to 1/1/2008).

1. The current MCLG is zero. Because of analytical limitations, EPA cannot determine the number of samples that do not exceed the current MCLG. Consequently, EPA reports the number exceeding the current MCL, instead of the MCLG.

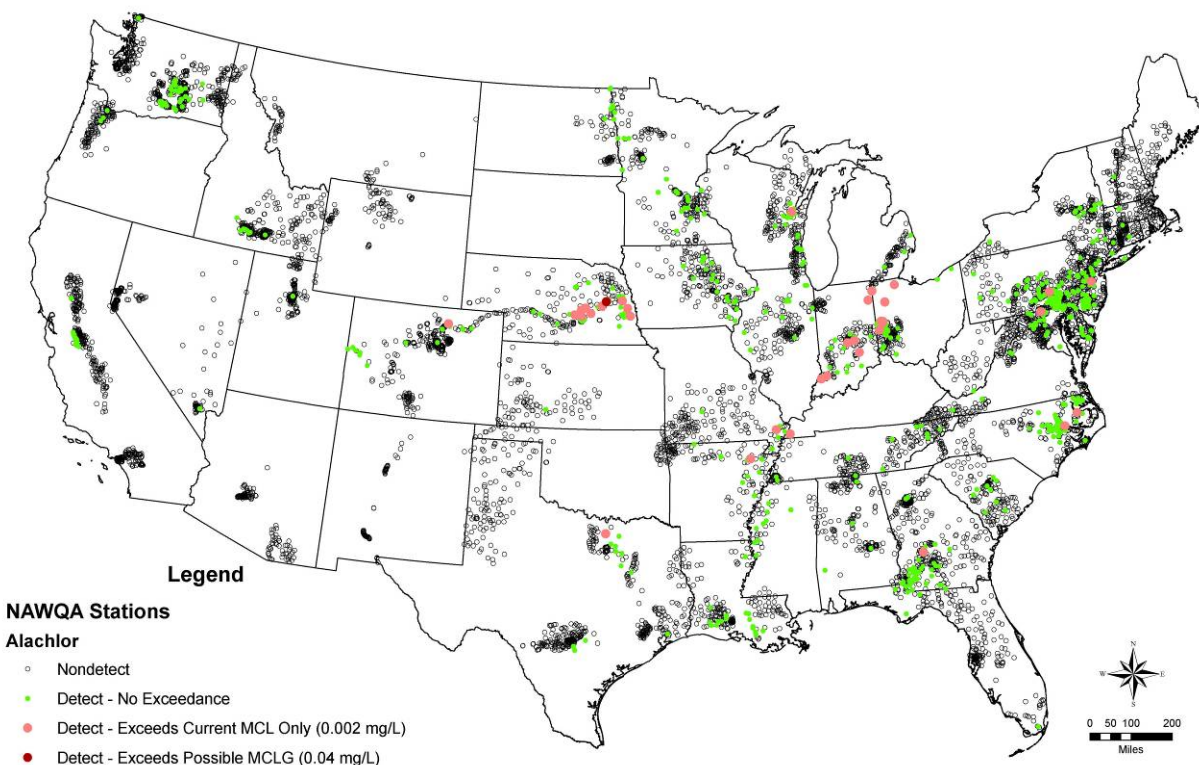
#### Exhibit 4-6. Summary of Alachlor Occurrence Based on Maximum Sample Values for Locations in STORET

Occurrence Result	Number of Locations (% locations)
Total locations	2,252 (100.0%)
All samples are nondetects	1,669 (74.1%)
At least one detection	583 (25.9%)
Exceeds current MCL <sup>1</sup> (0.002 mg/L)	40 (1.8%)
Exceeds possible MCLG (0.04 mg/L)	0 (0.0%)

Source: USEPA 2006b (national data 1/1/2002 to 9/20/2006).

1. The current MCLG is zero. Because of analytical limitations, EPA reports the number exceeding the current MCL, instead of the MCLG.

### Exhibit 4-7. NAWQA Occurrence Data for Alachlor Based on Maximum Sample Values



### Exhibit 4-8. Summary of Alachlor Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program

Occurrence Result	Number of Samples (% total samples)
Total Samples	1,121 (100%)
Nondetect	1,118 (99.73%)
Detected quantity <sup>1</sup>	3 (0.27%)
Exceeds current MCL (0.002 mg/L)	0 (0%)
Exceeds possible MCLG (0.04 mg/L)	0 (0%)

Source: USDA (2004, 2005, and 2006). Detection limits range from  $7.8 \times 10^{-6}$  mg/L to  $45 \times 10^{-6}$  mg/L.

1. Detected quantities range from  $16.3 \times 10^{-6}$  mg/L to  $44 \times 10^{-6}$  mg/L.

### Exhibit 4-9. Summary of Alachlor Occurrence for Finished Water Samples in USDA Agricultural Marketing Service Pesticide Data Program

Occurrence Result	Number of Samples (% total samples)
Total Samples	2,511 (100%)
Nondetect	2,492 (99.24%)
Detected quantity <sup>1</sup>	19 (0.76%)
Exceeds current MCL (0.002 mg/L)	0 (0%)
Exceeds possible MCLG (0.04 mg/L)	0 (0%)

Source: USDA (2001, 2002, 2003, 2004, 2005, and 2006). Detection limits range from  $5 \times 10^{-6}$  mg/L to  $49.5 \times 10^{-6}$  mg/L.

1. Detected quantities range from  $16.3 \times 10^{-6}$  mg/L to  $145 \times 10^{-6}$  mg/L.

#### 4.4.2 Barium

**Exhibit 4-10** and **Exhibit 4-11** provide comparisons of maximum barium concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values. **Exhibit 4-12** presents a spatial representation of the NAWQA data.

These data indicate that less than 1% of the total sampling locations for this contaminant have maximum concentrations between the current MCLG and the possible MCLG value. Although barium occurs in detected quantities at most of the NAWQA sampling locations, less than 0.1% of ground water sampling locations and no surface water sampling locations in NAWQA report maximum concentrations above the current MCLG. Likewise, the STORET data indicate less than 0.5% of detections exceed the current MCLG value.

##### **Exhibit 4-10. Summary of Barium Occurrence Based on Maximum Sample Values for Locations in NAWQA**

Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	417 (100.0%)	4,326 (100.0%)	121 (100.0%)	4,864 (100.0%)
All samples are nondetects	1 (0.2%)	42 (1.0%)	0 (0.0%)	43 (0.9%)
At least one detection	416 (99.8%)	4,284 (99.0%)	121 (100%)	4,821 (99.1%)
Exceeds current MCLG (2.0 mg/L)	0 (0.0%)	3 (0.07%)	0 (0.0%)	3 (0.06%)
Exceeds possible MCLG (6.0 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

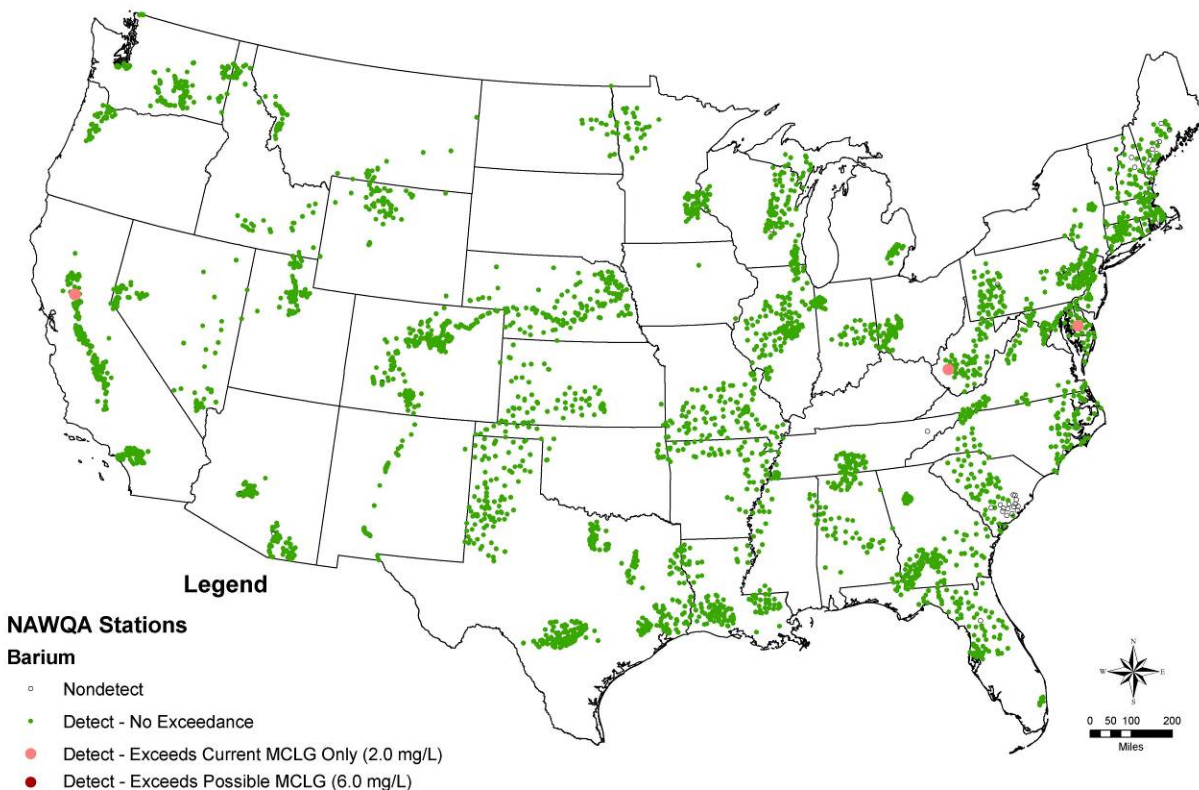
Source: USGS 2006b (national data from 1992 to 1/1/2008).

##### **Exhibit 4-11. Summary of Barium Occurrence Based on Maximum Sample Values for Locations in STORET**

Occurrence Result	Number of Locations (% locations)
Total locations	16,595 (100.0%)
All samples are nondetects	2,299 (13.9 %)
At least one detection	14,296 (86.1%)
Exceeds current MCLG (2.0 mg/L)	234 (1.4%)
Exceeds possible MCLG (6.0 mg/L)	163 (1.0%)

Source: USEPA 2006b (national data 1/1/2002 to 9/20/2006).

### Exhibit 4-12. NAWQA Occurrence Data for Barium Based on Maximum Sample Values



#### 4.4.3 1,1-Dichloroethylene

**Exhibit 4-13** and **Exhibit 4-14** provide comparisons of maximum 1,1-dichloroethylene concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values. **Exhibit 4-15** presents a spatial representation of the NAWQA data. These data indicate that less than 0.1% of NAWQA locations have maximum concentrations between the current MCLG and the higher possible MCLG values. STORET results indicate higher occurrence frequencies above both the current MCLG and possible MCLG values. The STORET results are driven by the 157 sampling locations in Phoenix, Arizona, that have a maximum sample above the MCL of 0.007 mg/L. Five of these locations also account for those having a maximum sample that exceeds 0.35 mg/L.

#### Exhibit 4-13. Summary of 1,1-Dichloroethylene Occurrence Based on Maximum Sample Values for Locations in NAWQA

Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	211 (100.0%)	5,467 (100.0%)	110 (100.0%)	5,788 (100.0%)
All samples are nondetects	183 (86.7%)	5,346(97.8%)	107 (97.3 %)	5,636 (97.4%)
At least one detection	28 (13.3%)	121 (2.2%)	3 (2.7 %)	152 (2.6%)
Exceeds current MCLG (0.007 mg/L)	1 (0.5%)	0 (0.0%)	0 (0.0%)	1 (0.02%)
Exceeds possible MCLG (0.35 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: USGS 2006b (national data from 1992 to 1/1/2008).

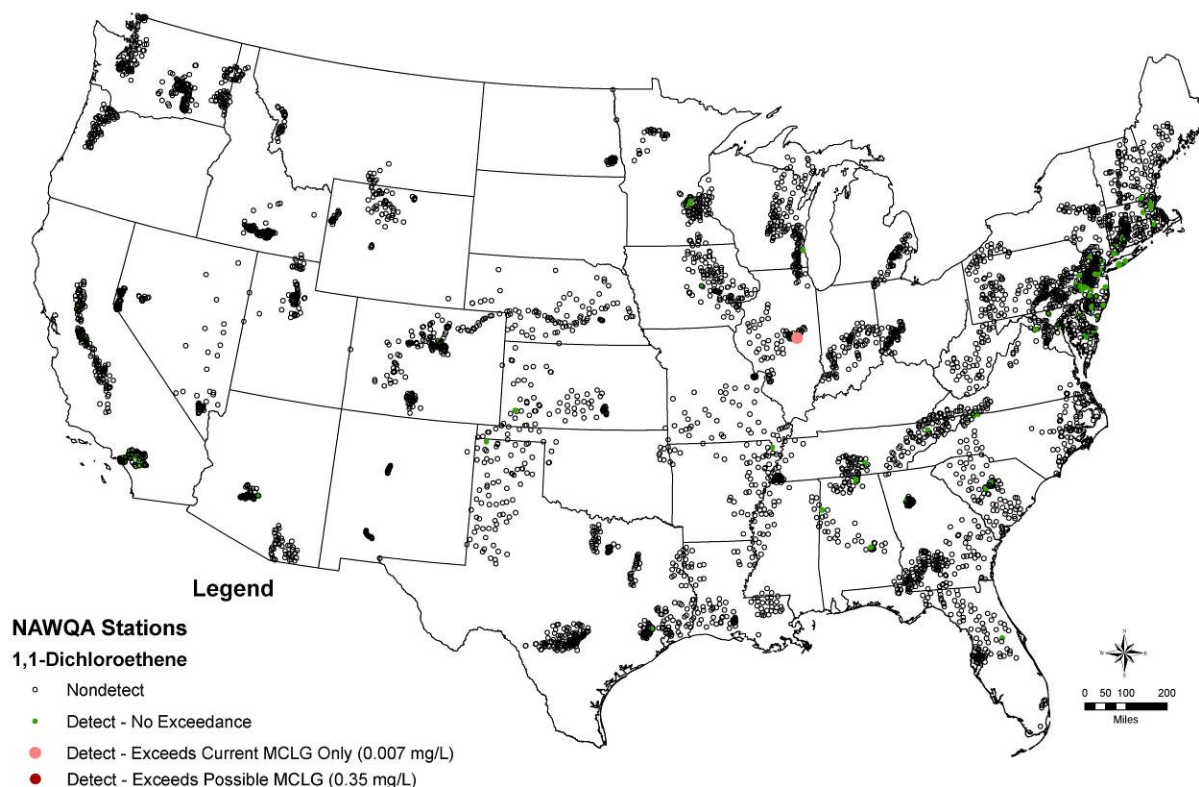
### Exhibit 4-14. Summary of 1,1-Dichloroethylene Occurrence Based on Maximum Sample Values for Locations in STORET

Occurrence Result	Number of Locations (% locations)
Total locations	2,448 (100.0%)
All samples are nondetects	1,498 (61.2%)
At least one detection	950 (38.8%)
Exceeds current MCLG (0.007mg/L)	165 (6.7%)
Exceeds possible MCLG (0.35 mg/L)	5 (0.2%)

Source: USEPA 2006b (national data from 1/1/2002 to 5/1/2007).

Note: 97.14% of reported detection limits for the nondetect samples were at or below the current MCLG of 0.007 mg/L and 99.81% were at or below the possible MCLG of 0.35 mg/L.

### Exhibit 4-15. Plot of 1,1-Dichloroethylene NAWQA Occurrence Data



#### 4.4.4 Diquat

Water quality results for diquat were not available in either NAWQA or STORET. To characterize potential source water occurrence, EPA obtained pesticide application estimates because diquat's primary uses are as an algaecide, defoliant, desiccant, and herbicide (USEPA, 1995a). There are two sources of national pesticide use:

- Pesticide Use Database developed by the National Center for Food and Agricultural Policy (NCFAP) in 1997 and CropLife Foundation in 2002
- Pesticide Use Maps developed by the USGS for the Pesticide National Synthesis Project.

NCFAP estimates indicate overall cropland application of almost 270,000 pounds in 1997, primarily on potato and alfalfa crops (NCFAP, 2000). The NCFAP based these estimates on its own estimates of State-level pesticide diquat application patterns for the period 1994-1998 and State-level crop acreage for 1997 from the USDA Census of Agriculture. The diquat application estimates – annual pounds of active ingredient applied per acre per crop per year – are based on a wide variety of agricultural pesticide survey sources. Thus, the diquat use estimates reflect several limitations: they do not include noncropland applications, the data sources vary in quality, and state-level pesticide use data gaps are filled using data for nearby states.

The CropLife Foundation updated NCFAP's analysis to use crop acreage estimates from the 2002 Census of Agriculture and State-level diquat usage patterns based on survey data collected from 1999 through 2004. The annual diquat use estimate is 217,649 pounds (Gianessi and Reigner, 2006). Because the CropLife Foundation study uses the same method as the NCFAP to derive State-level diquat use estimates, the national estimate has similar limitations.

More detailed pesticide application data from California indicates the potential for crop usage estimates to understate total diquat use. The State maintains a comprehensive Pesticide Use Reporting (PUR) database. **Exhibit 4-16** provides a summary of detailed pesticide application estimates for 2005, which indicate that total diquat use is three times higher than reported crop use. Major non-crop uses include right-of-way (24,521 pounds active ingredient or lb a.i.) and landscape (15,689 lb a.i.) applications. Both of these uses exceeded the two top crop uses: alfalfa for forage (11,138 lb a.i.) and potatoes (5,104 lb a.i.).

#### **Exhibit 4-16. Crop and Noncrop Diquat Application for California in 2005**

Use <sup>1</sup>	Pounds	Percent of Total
Crop Application	17,375	25%
Non Crop Application	51,150	75%
Total Application	68,525	100%

Source: California Pesticide Use Database available at [http://pesticideinfo.org/Detail\\_ChemUse.jsp?Rec\\_Id=PC33217#working](http://pesticideinfo.org/Detail_ChemUse.jsp?Rec_Id=PC33217#working)  
1. Crop total comprises the following use categories: alfalfa for forage, potatoes, clover for forage, wine grapes, cabbage, and almonds. Non-crop total includes all other use categories.

Of the pesticides addressed in this document, diquat has the lowest national estimate for use on crops. **Exhibit 4-17** provides national crop use estimates for diquat and the other pesticides included in this report that were developed by Gianessi and Reigner (2006) and provided on-line in an Excel file. These data suggest that even if the actual national use of diquat is several times greater than the crop use estimate indicates, diquat would have one of the lowest annual usage rates in terms of pounds applied.

#### **Exhibit 4-17. Estimates of National Annual Pesticide Use for Crops**

Pesticide	Annual Pounds	Type
Alachlor	6,269,543	Herbicide
Diquat	217,649	Herbicide
Glyphosate	102,325,419	Herbicide
Lindane	1,698,309	Insecticide
Picloram	1,915,653	Herbicide

Source: Gianessi and Reigner (2006) and on-line Excel file at [http://www.croplifefoundation.org/cpri\\_npud2002.htm](http://www.croplifefoundation.org/cpri_npud2002.htm)



The USGS estimated county-level pesticide usage for 2002 based on crop acreage estimates in the 2002 Census of Agriculture and state-level diquat application rates for the period 1999-2004 developed by the CropLife Foundation (USGS, no date), which implemented the NCFAP method for estimating pesticide usage (Gianessi and Reigner, 2006) and, therefore, has similar limitations. The USGS estimates total diquat application to crops of approximately 200,000 pounds per year, with potatoes accounting for almost 90% of these applications (USGS, no date). Diquat use on crops occurred primarily in regions of New England, the Great Lakes states, North Dakota, the Pacific Northwest, California, and Florida.

USEPA (1995a) notes that although diquat is persistent (i.e., it does not hydrolyze and is resistant to degradation), it becomes immobile when it adsorbs to soil particles and, therefore, is not expected to contaminate ground water. Furthermore, diquat dissipates quickly from surface water because it adsorbs to soil sediments, vegetation, and organic matter; the estimated half-life in surface water is 1 to 2 days, based on a study of two ponds in Florida (USEPA, 1995). These factors indicate the possibility of low occurrence in drinking water sources.

#### 4.4.5 Glyphosate

**Exhibit 4-18** and **Exhibit 4-19** provide comparisons of maximum glyphosate concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values.

**Exhibit 4-20** presents a spatial representation of the NAWQA data. Although these data are sparse, they indicate that none of the sampling locations for this contaminant have maximum concentrations between the current MCLG and the possible MCLG values.

#### **Exhibit 4-18. Summary of Glyphosate Occurrence Based on Maximum Sample Values for Locations in NAWQA**

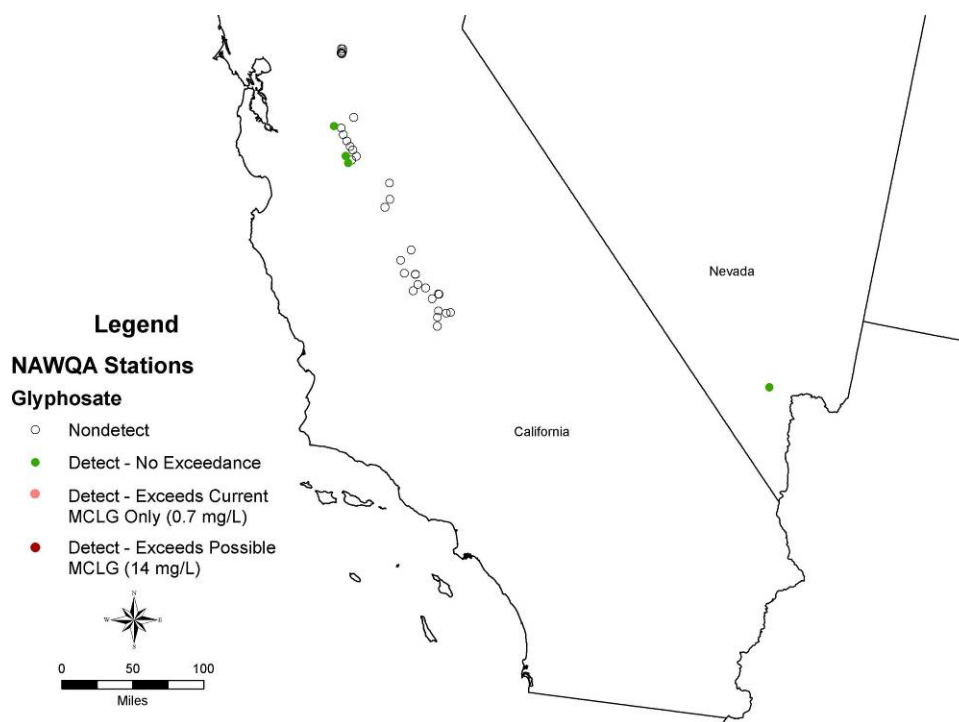
Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	4 (100.0%)	37 (100.0%)	0 (100.0%)	41 (100.0%)
All samples are nondetects	0 (0.0%)	37 (100%)	0 (0.0%)	37 (90.2%)
At least one detection	4 (100%) <sup>2</sup>	0 (0.0%)	0 (0.0%)	4 (9.8%)
Exceeds current MCLG (0.7 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Exceeds possible MCLG (14.0 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: USGS 2006b (national data from 1992 to 9/30/2005).

#### **Exhibit 4-19. Summary of Glyphosate Occurrence Based on Maximum Sample Values for Locations in STORET**

Occurrence Result	Number of Locations (% locations)
Total locations	241 (100.0%)
All samples are nondetects	180 (74.7 %)
At least one detection	61 (25.3 %)
Exceeds current MCLG (0.7 mg/L)	0 (0.0%)
Exceeds possible MCLG (14.0 mg/L)	0 (0.0%)

Source: USEPA 2006b (national data from 1/1/2002 to 5/1/2007).

**Exhibit 4-20. Plot of Glyphosate NAWQA Occurrence Data****4.4.6 Lindane**

**Exhibit 4-21** and **Exhibit 4-22** provide comparisons of maximum lindane concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values. **Exhibit 4-23** presents a spatial representation of the NAWQA data. These data indicate that less than 0.1% of NAWQA locations and 0.3% of the STORET locations have maximum concentrations between the current MCLG and the higher possible MCLG values. **Exhibit 4-24** and **Exhibit 4-25** show lindane raw water concentrations and finished water concentrations, respectively, from the PDP database. No samples contained lindane above the current MCLG or possible MCLG values.

**Exhibit 4-21. Summary of Lindane Occurrence Based on Maximum Sample Values for Locations in NAWQA**

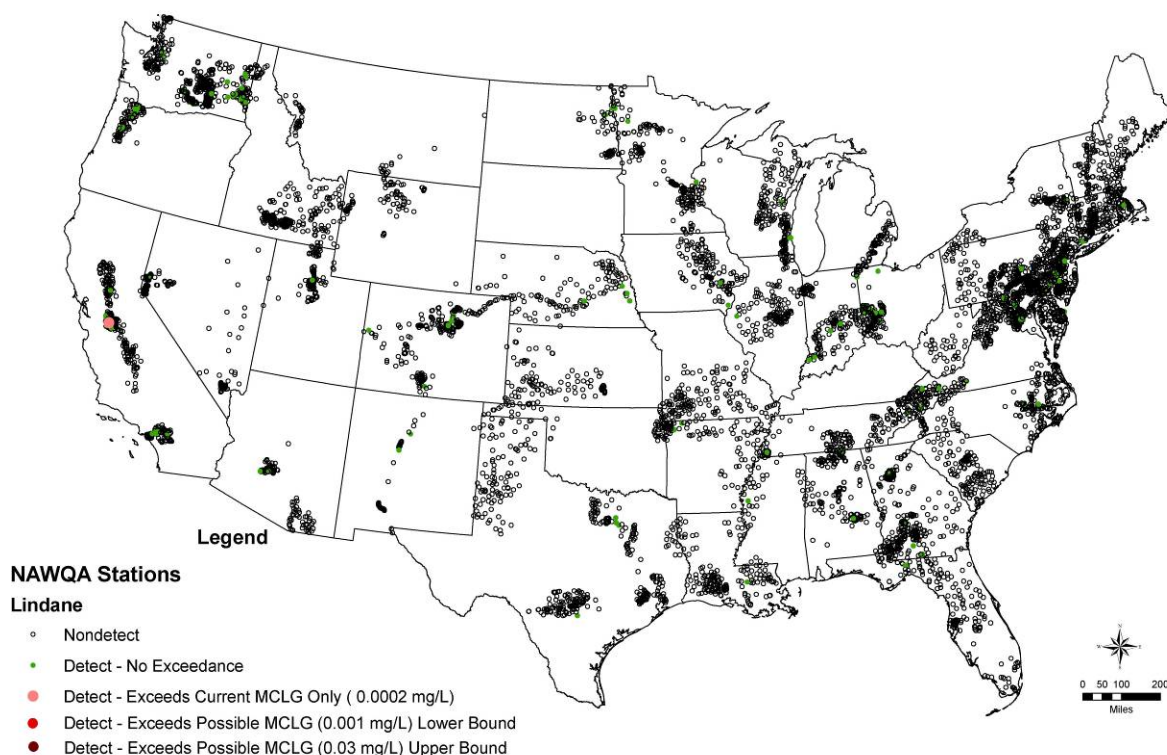
Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	1,846 (100.0%)	6,127 (100.0%)	222 (100.0%)	8,195 (100.0%)
All samples are nondetects	1,718 (93.1%)	6,120 (99.9%)	220 (99.1%)	8,058 (98.3%)
At least one detection	128 (6.9%)	7 (0.1%)	2 (0.9%)	137 (1.7%)
Exceeds current MCLG (0.0002 mg/L)	1 (0.05%)	0 (0.0%)	0 (0.0%)	1 (0.01%)
Exceeds possible MCLG (0.001 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.00%)
Exceeds possible MCLG (0.03 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: USGS 2006b (national data from 1992 to 9/30/2005).

**Exhibit 4-22. Summary of Lindane Occurrence Based on Maximum Sample Values for Locations in STORET**

Occurrence Result	Number of Locations (% locations)
Total locations	2,691 (100.0%)
All samples are nondetects	2,017 (75%)
At least one detection	674 (25%)
Exceeds current MCLG (0.0002 mg/L)	7 (0.26%)
Exceeds possible MCLG (0.001 mg/L)	1 (0.04%)
Exceeds possible MCLG (0.03 mg/L)	1 (0.04%)

Source: USEPA 2006b (national data from 1/1/2002 to 5/1/2007).

**Exhibit 4-23. Plot of Lindane NAWQA Occurrence Data****Exhibit 4-24. Summary of Lindane Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program**

Occurrence Result	Number of Samples (% total samples)
Total Samples	1,116 (100%)
Nondetect	1,116 (100%)
Detected quantity <sup>1</sup>	0 (0%)
Exceeds current MCL (0.0002 mg/L)	0 (0%)
Exceeds possible MCLG (0.001 mg/L)	0 (0%)
Exceeds possible MCLG (0.03 mg/L)	0 (0%)

Source: USDA (2004, 2005, 2006). Detection limits range from  $10 \times 10^{-6}$  mg/L to  $66 \times 10^{-6}$  mg/L.

1. There are no detected quantities.

**Exhibit 4-25. Summary of Lindane Occurrence for Finished Water Samples in  
USDA Agricultural Marketing Service Pesticide Data Program**

Occurrence Result	Number of Samples (% total samples)
Total Samples	2,181 (100%)
Nondetect	2,181 (100%)
Detected quantity <sup>1</sup>	0 (0%)
Exceeds current MCL (0.0002 mg/L)	0 (0%)
Exceeds possible MCLG (0.001 mg/L)	0 (0%)
Exceeds possible MCLG (0.03 mg/L)	0 (0%)

Source: USDA (2001, 2002, 2003, 2004, 2005, 2006). Detection limits range from  $10 \times 10^{-6}$  mg/L to  $66 \times 10^{-6}$  mg/L.

1. There are no detected quantities.

#### 4.4.7 Picloram

**Exhibit 4-26** and **Exhibit 4-27** provide comparisons of maximum picloram concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values. **Exhibit 4-28** presents a spatial representation of the NAWQA data.

**Exhibit 4-29** and **Exhibit 4-30** show picloram raw water concentrations and finished water concentrations, respectively, from the PDP database. Data from all three sources indicate no occurrence of this contaminant above the current MCLG and the higher possible MCLG values.

**Exhibit 4-26. Summary of Picloram Occurrence Based on Maximum Sample  
Values for Locations in NAWQA**

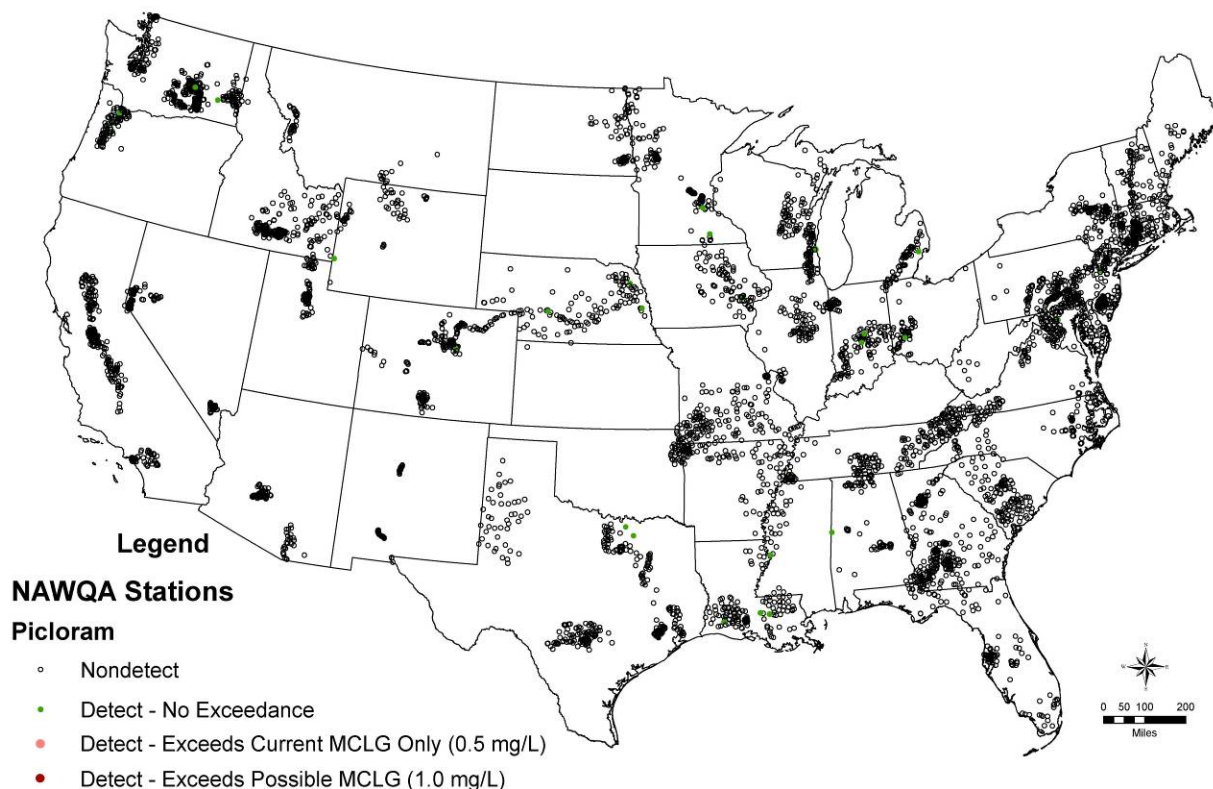
Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	971 (100.0%)	4,603 (100.0%)	198 (100.0%)	5,772 (100.0%)
All samples are nondetects	947 (97.5%)	4,588 (99.7%)	198 (100.0%)	5,733 (99.3%)
At least one detection	24 (2.5%)	15 (0.3%)	0 (0.0%)	39 (0.7%)
Exceeds current MCLG (0.5 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: USGS 2006b (national data from 1992 to 9/30/2005).

**Exhibit 4-27. Summary of Picloram Occurrence Based on Maximum Sample  
Values for Locations in STORET**

Occurrence Result	Number of Locations (% locations)
Total locations	870 (100%)
All samples are nondetects	745 (85.6%)
At least one detection	125 (14.4%)
Exceeds current MCLG (0.5 mg/L)	0 (0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0%)

Source: USEPA 2006b (national data from 1/1/2002 to 5/1/2007).

**Exhibit 4-28. Plot of Picloram NAWQA Occurrence Data****Exhibit 4-29. Summary of Picloram Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program**

Occurrence Result	Number of Samples (% total samples)
Total Samples	1,122 (100%)
Nondetect	1,120 (99.82%)
Detected quantity <sup>1</sup>	2 (0.18%)
Exceeds current MCL (0.5 mg/L)	0 (0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0%)

Source: USDA (2004, 2005, 2006). Detection limits range from  $22 \times 10^{-6}$  mg/L to  $4,407 \times 10^{-6}$  mg/L.

1. Detected quantity is  $37 \times 10^{-6}$  mg/L.

**Exhibit 4-30. Summary of Picloram Occurrence for Finished Water Samples in USDA Agricultural Marketing Service Pesticide Data Program**

Occurrence Result	Number of Samples (% total samples)
Total Samples	1,876 (100%)
Nondetect	1,875 (99/95%)
Detected quantity <sup>1</sup>	1 (0.05%)
Exceeds current MCL (0.5 mg/L)	0 (0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0%)

Source: USDA (2001, 2003, 2004, 2005, 2006). Detection limits range from  $22 \times 10^{-6}$  mg/L to  $5,000 \times 10^{-6}$  mg/L.

1. Detected quantity is  $37 \times 10^{-6}$  mg/L.

#### 4.4.8 1,1,1-Trichloroethane

**Exhibit 4-31** and **Exhibit 4-32** provide comparisons of maximum 1,1,1-trichloroethane concentrations for locations in the NAWQA and STORET databases, respectively, with the current MCLG and possible MCLG values. **Exhibit 4-33** presents a spatial representation of the NAWQA data. The NAWQA data indicate that none of the sampling locations for this contaminant have maximum concentrations between the current MCLG and the possible MCLG values. Fewer than 0.3% of the STORET locations have maximum concentrations between the current MCLG and the possible MCLG.

**Exhibit 4-31. Summary of 1,1,1-Trichloroethane Occurrence Based on Maximum Sample Values for Locations in NAWQA**

Occurrence Result	Number of Locations (% of locations)			
	Surface Water	Ground Water	Other	Total
Total locations	210 (100.0%)	5,468 (100.0%)	110 (100.0%)	5,788 (100.0%)
All samples are nondetects	146 (69.5%)	5,043 (92.2%)	101 (91.8%)	5,290 (91.4%)
At least one detection	64 (30.5%)	425 (7.8%)	9 (8.2%)	498 (8.6%)
Exceeds current MCLG (0.2 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Exceeds possible MCLG (14 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

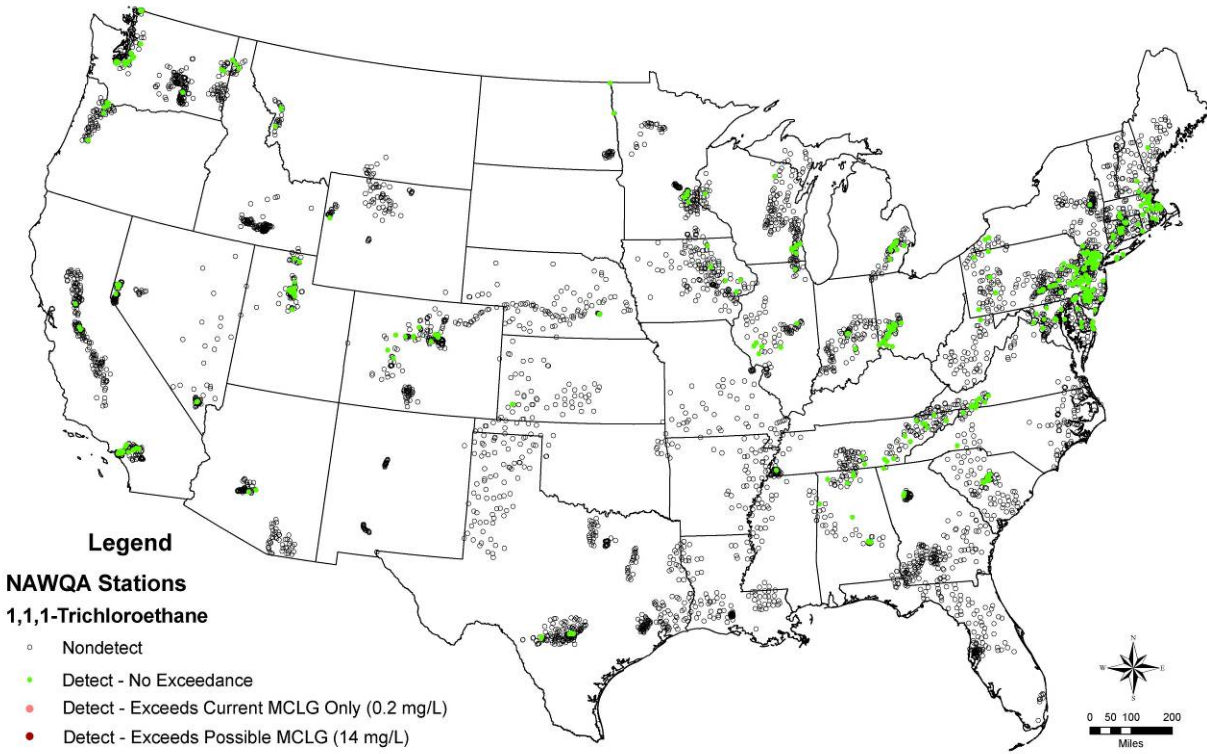
Source: USGS 2006b (national data from 1992 to 1/1/2008).

**Exhibit 4-32. Summary of 1,1,1-Trichloroethane Occurrence Based on Maximum Sample Values for Locations in STORET**

Occurrence Result	Number of Locations (% locations)
Total locations	3,429 (100.0%)
All samples are nondetects	2,304 (67.2%)
At least one detection	1,125 (32.8%)
Exceeds current MCLG (0.2 mg/L)	5 (0.1%)
Exceeds possible MCLG (14 mg/L)	0 (0.0%)

Source: USEPA 2006b (national data from 1/1/2002 to 1/1/2008).

**Exhibit 4-33. Plot of 1,1,1-Trichloroethane NAWQA Occurrence Data**



## 5. Conclusions

In this report, EPA addressed contaminants that the Six-Year Review 2 identified as having possible MCLG increases based on new health effects information. A possible MCLG increase and accompanying MCL increase raises the possibility of cost savings among systems treating for the contaminant. The potential for cost savings from possible MCL increases is system-specific and depends on various factors including the magnitude of the MCL increase, the concentration of a contaminant in a system's source water, the specific treatment technology in use, and the extent to which co-occurring contaminants control the operation of a specific technology. **Exhibit 5-1** and **Exhibit 5-2** present a summary of this information.

The new health effects information results in a wide range of possible MCL increases (see Exhibit 5-1). The lowest relative increase is 2 times the current MCL for both diquat and picloram. The highest relative increase is 150 times the current MCL for the upper bound possible MCLG for lindane.

EPA's analysis of the potential for cost savings was constrained to readily available data. The data available to characterize contaminant occurrence was especially limited because there is no comprehensive dataset that characterizes source water quality for drinking water systems. Water quality data from the NAWQA Program, STORET data system, and PDP provide useful insights into potential contaminant occurrence in source water, even though they are not based on random or representative sampling events and, therefore, cannot be used directly to derive quantitative estimates of national occurrence in drinking water sources.

Nevertheless, the summary of the available data in Exhibit 5-1 shows relatively infrequent contaminant occurrence in potential source waters at the levels of interest. The NAWQA data, which provide the most extensive coverage of potential source waters, indicate that only alachlor is found in concentrations that exceed the possible MCLG. In particular, two contaminants – glyphosate and picloram – are not found at levels above either the current MCLG or the possible MCLG in any of the three datasets. Diquat, which is not included in any of these datasets, has the potential to occur infrequently in source water given its less frequent use compared to the other pesticides in the table (alachlor, glyphosate, lindane, and picloram) and its tendency to dissipate quickly from surface water and be immobile in soils.

Without national estimates of contaminant occurrence in drinking water sources, EPA cannot determine how many systems currently treat for the contaminants listed in Exhibit 5-2. EPA also does not have national data regarding the treatment technologies being utilized to control these contaminants. As Exhibit 5-2 shows, some BATs have higher potential for operational cost savings; however, co-occurrence considerations for all of the BATs could diminish the potentially affected system's ability to alter treatment for possible higher MCLGs.

Despite the possibility for changes in MCLG values that range from 2 to 150 times higher than current MCLs, the available occurrence data for potential drinking water sources indicate relatively low contaminant occurrence in the concentration ranges of interest. As a consequence, EPA cannot conclude that there is a meaningful opportunity for system cost savings.



**Exhibit 5-1. Summary of Potential Cost Savings Factors – Occurrence**

Contaminant	Magnitude of Increase <sup>1</sup>	Occurrence Summary (percent of sample locations)					
		Exceed Current MCLG or MCL			Exceed Current MCLG or MCL		
		NAWQA	STORET	PDP	NAWQA	STORET	PDP
Alachlor	20	0.38%	1.8%	0.0%	0.01%	0.0%	0.0%
Barium	3	0.1%	1.4%	--	0.0%	1.0%	--
Diquat	2	--	--	--	--	--	--
Glyphosate	14	0.0%	0.0%	--	0.0%	0.0%	--
1,1-Dichloroethylene	50	0.02%	6.7%	--	0.0%	0.2%	--
Lindane	5 to 150	0.01%	0.26%	0.0%	0.0%	0.04%	0.0%
Picloram	2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
1,1,1-Trichloroethane	50	0.0%	0.1%	--	0.0%	0.0%	--

--: No data were available.

1. Number indicates times higher the possible MCLG is than the current MCL. For example the possible MCLG for alachlor (0.04 mg/L) is 20 times higher than the current MCL (0.002 mg/L).

**Exhibit 5-2. Summary of Potential Cost Savings Factors – Treatment**

Contaminant	Best Available Technology	Cost Savings Potential of Technology	Presence of Co-occurring Contaminants Could Limit Savings
Alachlor	Granular Activated Carbon	High	Yes
Barium	Ion Exchange	High	Yes
	Lime Softening	Moderate	Yes
	Reverse Osmosis	Low	Yes
	Electrodialysis	Low	Yes
Diquat	Granular Activated Carbon	High	Yes
Glyphosate	Oxidation (Chlorine or Ozone)	Low	Yes
1,1-Dichloroethylene	Packed Tower Aeration	Low	Yes
	Granular Activated Carbon	High	Yes
Lindane	Granular Activated Carbon	High	Yes
Picloram	Granular Activated Carbon	High	Yes
1,1,1-Trichloroethane	Packed Tower Aeration	Low	Yes
	Granular Activated Carbon	High	Yes

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