United States
Environmental Protection
Agency

Occurrence Analysis for Potential Source Waters for the Third 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
DBP	disinfection byproduct
EDR	electrodialysis reversal
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
IX	ion exchange
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
NPDWR	National Primary Drinking Water Regulation
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
RO	reverse osmosis
SDWA	Safe Drinking Water Act
TRI	Toxics Release Inventory
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

Executive Summary

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

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

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

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

For Six-Year Review 3, EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2016c), analytical feasibility (USEPA, 2016b), and finished water occurrence (USEPA, 2016a). 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 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 the 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[1]	0.0 (MCLG) 0.002 (MCL)	0.04
Barium[1]	2	6
Beryllium	0.004	0.01
1,1-Dichloroethylene[1]	0.007	0.4
2,4-Dichlorophenoxyacetic acid (2,4-D)	0.07	2
Diquat[1]	0.02	0.04
Lindane (gamma-Hexachlorocyclohexane)[1]	0.0002	0.03
Picloram[1]	0.5	1
1,1,1-Trichloroethane[1]	0.2	14
1,2,4-Trichlorobenzene	0.07	0.7

Source: USEPA, 2016c

1. Although new health effects information indicated a possibility to increase MCLG during the first or second Six-Year Review, EPA made a decision 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 the relative importance to the design and operation of the treatment technology; and
- 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); 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, picloram is not found at levels above either the current MCLG or the possible MCLG in either dataset. Diquat, which is not included in these datasets, potentially occurs infrequently in source water given less frequent use compared to the other pesticides in the table (alachlor, lindane and picloram) and that it tends to dissipate quickly from surface water and be immobile in soils.

Without national estimates of contaminant occurrence in drinking water sources, EPA cannot estimate 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. Use of some technologies would result in higher operational cost savings from reduced use; however, co-occurrence considerations for all of the Best Available Technologies (BAT) could diminish the 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 third Six-Year Review (Six-Year Review 3) of national primary drinking water regulations (NPDWRs). The 1996 Safe Drinking Water Act (SDWA) Amendments require the 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 3, EPA implemented the protocol that it developed for the first Six-Year Review (USEPA, 2003), including minor revisions developed during the second review process (USEPA, 2009). EPA obtained and evaluated new information that could affect a NPDWR, including information on health effects (USEPA, 2016c), analytical feasibility (USEPA, 2016b), and finished water occurrence (USEPA, 2016a). EPA identified new health effects assessments that indicate the possibility to raise maximum contaminant level goal (MCLG) values for a number of regulated contaminants. An MCLG is a concentration at which there is no known health risk. Consequently, EPA reviewed data on contaminant occurrence in source water to determine whether there is a meaningful opportunity to achieve cost savings while maintaining 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 diquat and picloram. The highest relative increase is 150 times the current MCLG for the 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 values are the regulatory standards that limit contaminant concentrations in water distributed by public water systems. The possible MCLG value for each contaminant is greater than the corresponding current MCL value. Thus, a revision to the MCLG for each contaminant would need to be accompanied by an increase in the corresponding MCL. Increasing the regulatory limit could result in reduced treatment costs for drinking water systems that control the contaminant to meet the current MCL while providing the same level of health protection.

Exhibit 1-1. Current and Possible MCLG Values

Contaminant	Current MCLG (mg/L)	Current MCL	Possible MCLG (mg/L)
Alachlor[1]	0	0.002	0.04
Barium[1]	2	2	6
Beryllium[1]	0.004	0.004	0.01
1,1-Dichloroethylene[1]	0.007	0.007	0.4
2,4-Dichlorophenoxyacetic acid (2,4-D)	.07	.07	2
Diquat[1]	0.02	0.02	0.04
Lindane (gamma-Hexachlorocyclohexane)[1]	0.0002	0.0002	0.03
Picloram[1]	0.5	0.5	1
1,1,1-Trichloroethane[1]	0.2	0.2	14
1,2,4-Trichlorobenzene	0.07	0.07	0.7

Source: USEPA, 2016c

1. Although new health effects information indicated a possibility to increase MCLG during the first or second Six-Year Review, EPA made a decision 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 to make this determination.

During the first and second Six-Year Review cycles, EPA made a recommendation not to revise several NPDWRs for which an increase in MCLG was possible, including several under consideration again during the current review. EPA's past recommendations were based on its determination that the potential for cost savings was low. As a result, EPA classified the MCLG revisions as 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 provides a summary of information regarding whether possible changes to the MCLGs constitute a meaningful opportunity to reduce costs while maintaining health protection. USEPA (2016a) provides occurrence analysis information for other contaminants included in the Six-Year Review 3.

2. Cost Savings

MCLG revisions alone do not produce cost-savings. The potential for cost savings comes from subsequent revisions to the MCL values, which could affect treatment activities at regulated public water systems. The magnitude of these cost savings 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 the relative importance to the design and operation of the treatment technology
- The specific treatment technology currently employed.

The following sections address each of these factors.

2.1 Magnitude of Possible MCL Increase

In general, the potential for cost savings increases as the magnitude of the MCL change increases. A larger MCL increase has the potential to affect a greater number of systems and to result in more substantial changes in treatment operations. **Exhibit 2-1** presents the magnitude of possible change for the contaminants of interest.

Exhibit 2-1. Possible MCL Increase

Contaminant	Multiple of Current MCL
Alachlor	20
Barium	3
Beryllium	2.5
1,1-Dichloroethylene	57
2,4-D	29
Diquat	2
Lindane (gamma-Hexachlorocyclohexane)	150
Picloram	2
1,1,1-Trichloroethane	70
1,2,4-Trichlorobenzene	10

Based solely on multiples of the current MCLs, the potential for cost savings appears lower for barium, beryllium, diquat, and picloram than for alachlor, 1,1-dichloroethylene, 1,1,1-trichloroethane and 1,2,4-trichlorobenzene . Given the uncertainty in the possible MCLG range for lindane, the potential ranges from low to high.

2.2 Relative Source Water Concentration

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

- Treatment is no longer required because the source water concentration is less than the possible higher MCL
- Less treatment is required even though the source water concentration is greater than the possible higher MCL.

The potential cost savings under the first scenario are greater than under the second, because a system could cease treatment for the contaminant altogether. There is no comprehensive database of source water quality for public water systems. Therefore, EPA reviewed available data on contaminant releases and ambient water quality to characterize source water occurrence. Section 3 provides contaminant release data from EPA's Toxics Release Inventory (TRI) and pesticide application rate estimates produced by the U.S. Geological Survey (USGS). Section 4 contains occurrence data summaries from two source water quality monitoring programs the National Water Quality Assessment (NAWQA) program conducted by the USGS and the Pesticide Data Program (PDP) conducted by the U.S. Department of Agriculture (USDA).

2.3 Co-Occurring Contaminants

The presence of co-occurring contaminants is a potential limiting factor on the cost savings that can be achieved given an MCL increase. Co-occurring contaminants are relevant when the same treatment process that removes the target contaminant also removes the co-occurring contaminant(s). Potential cost savings depend on the relative importance of each contaminant to the design and operation of the process. If the target contaminant controls treatment operation, then there may be a greater opportunity for cost savings. On the other hand, if a co-occurring contaminant controls treatment operation, then it may not be possible to adjust operations.

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 removes other regulated organic contaminants, the operation may not be able to be adjusted despite a change in the lindane MCL.

2.4 Treatment Technology

Exhibit 2-2 summarizes the best available technologies (BAT) and small system compliance technologies for each of the contaminants.

Exhibit 2-2. Summary of Treatment Technologies

Contaminant	Best Available Treatment	Small System Compliance Technologies
Alachlor	GAC	GAC, POU GAC, PAC
Barium	IX, LS, RO, EDR	CF, IX, LS, RO, EDR, POU IX, POU RO
Beryllium	AA, CF, IX, LS, RO	AA, CF, IX, LS, RO, POU IX, POU RO
Diquat	GAC	GAC, POU GAC, PAC
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)

Contaminant	Best Available Treatment	Small System Compliance Technologies
2,4-D	GAC	GAC, POU GAC, PAC
1,2,4-Trichlorobenzene	PTA, GAC	PTA, GAC, MSBA, Aeration (diffused, tray, shallow tray)

AA = Activated Alumina; CF = Coagulation/Filtration; EDR = Electrodialysis; GAC = Granular Activated Carbon; IX = Ion Exchange; LS = Lime Softening; MSBA = Multi Stage Bubble Aeration; PAC = Powdered Activated Carbon; POU = point-of-use; PTA = Packed Tower Aeration; RO = Reverse Osmosis;

Sources: 40 CFR 141.61 and 141.62, USEPA 1998b.

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.

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

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 circumstance 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 the MCL for one contaminant 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 a co-occurring contaminant, with potential cost savings.

2.4.2 Granular Activated Carbon

Similar to ion exchange, with an increased MCL, granular activated carbon (GAC) systems may be able to be adjusted to extend the 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

An increased MCL could allow packed tower aeration (PTA) systems treating for 1,1-dichloroethylene, 1,1,1-trichloroethane, or 1,2,4-trichlorobenzene 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, 1,1,1-trichloroethane, or 1,2,4-trichlorobenzene treatment controls the air-to-water ratio.

2.4.4 Lime Softening

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 target contaminant would likely be a secondary benefit of the system. Cost savings would be limited to the extent that 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.

2.4.5 Reverse Osmosis and Electrodialysis

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 contaminants 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 ground water.
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 ground water; atmospheric deposition; precipitate out of aquatic media as insoluble salt; adsorb to suspended solids in surface water; not mobile in soil systems.
Beryllium	Wastewater discharge from industry and electric utilities, deposition of atmospheric beryllium, and weathering of rocks and soils.	Metal commonly converted into alloys; used in making electrical and electronic parts, construction materials for machinery, molds for plastics, automobiles, sports equipment, vehicles, and dental bridges.	Does not degrade in the environment; carried to rivers by deposition or land erosion; low mobility in sediment.
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 ground water.
2,4-D	Runoff from agricultural, forest, aquatic, and residential application.	Herbicide used for control of broadleaf weeds, fruit & vegetable crops, forestry, right-of-way, aquatic, and residential applications.	Intermediately to very mobile in soil; leaches to ground water;
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.
Lindane (gamma-Hexachlorocyclohexane)	Agricultural runoff; atmospheric emissions; rain and snow deposition.	Insecticide used to treat a variety of crop seeds until 2011.	Volatile; sorbs to soil, leaching to ground water (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 ground water, no degradation.

Contaminant	Sources of Potential Release to the Environment	Description/Uses	Environmental Fate and Transport
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, may leach to ground water; atmospheric deposition; moderate solubility.
1,2,4-Trichlorobenzene	Atmospheric emissions or wastewater discharge from manufacturing plants, discharge or leaching from landfills.	Industrial chemical used as a solvent, a chemical intermediate (e.g., in dye and pesticide production), a dielectric fluid in transformers, a lubricant, and in synthetic transformer oils.	Volatile; sorbs to soil, sediment and suspended solids; may leach to ground water

Source: USEPA, 1998a; ATSDR, 2002; ATSDR, 2007; USEPA, 2002; USEPA, 1995a; USEPA, 2006; USEPA, 1995b; USEPA, 2007; ATSDR, 2006, ATSDR, 2014, USEPA, 2005.

3.1 Toxic Release Inventory Data

EPA collected the most recently reported state level releases and disposal data for the pollutants of concern from its 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. TRI does not have release or disposal data for 1,1-dichloroethane or diquat. 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.

3.1.1 Alachlor

Alachlor releases occurred only in Iowa, Ohio, and Texas in 2013 (see **Exhibit 3-2** and **Exhibit 3-3**). Most of the 32 pounds were released to air; 4 pounds were disposed off-site.

Exhibit 3-2. Reported Disposal or Release of Alachlor (2013; pounds)

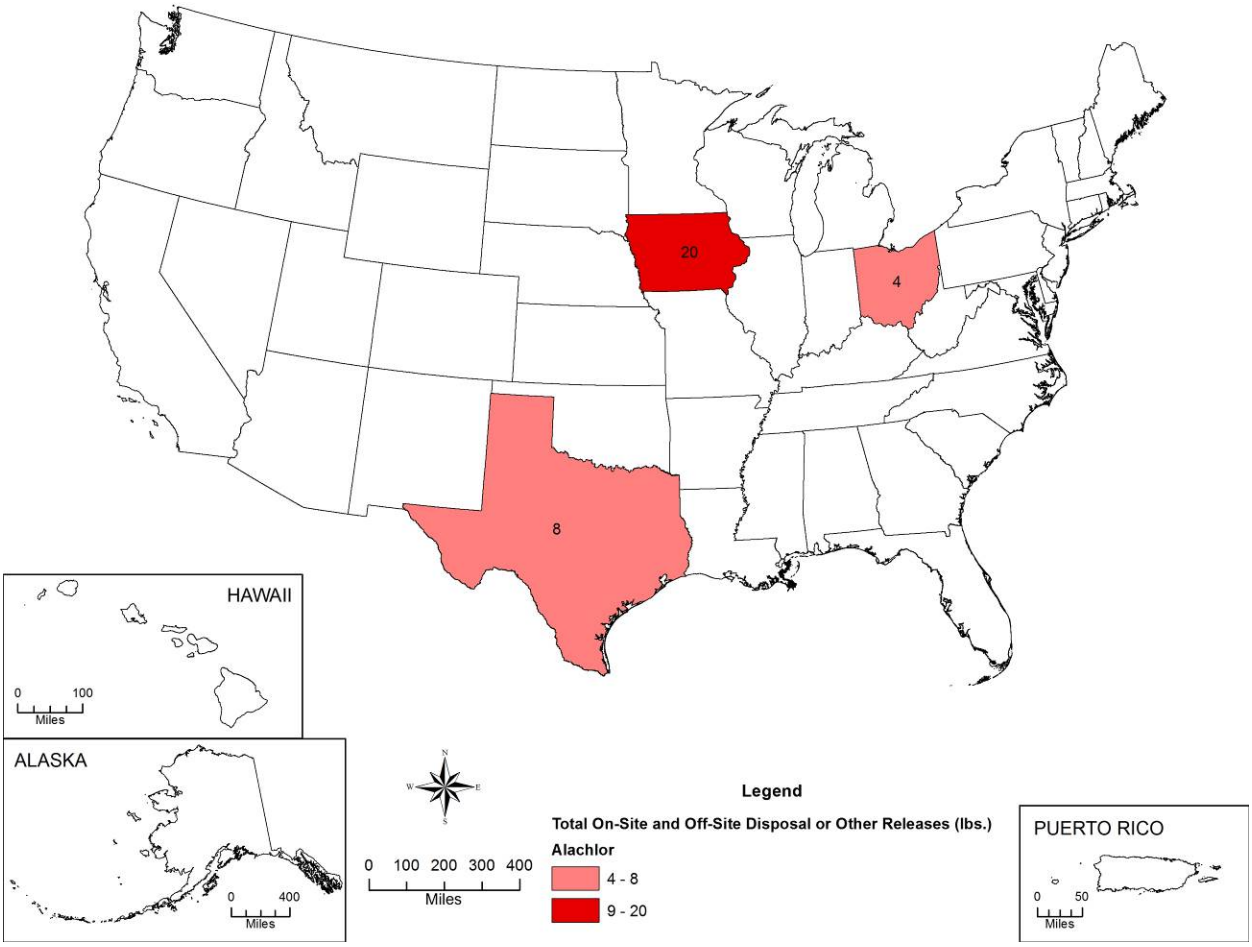
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Iowa	15	1	0	0	0	16	4	20
Ohio	4	0	0	0	0	4	0	4
Texas	8	0	0	0	0	8	ND	8
Total	27	1	0	0	0	28	4	32

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of Alachlor (2013; pounds)



Source: USEPA, 2015

3.1.2 Barium and Barium Compounds

Reported releases and disposal of barium were approximately 5.6 million pounds in 2013. **Exhibit 3-4** and **Exhibit 3-5** show that Arizona reported the greatest release and disposal of 2.8 million pounds (50%) followed by Kansas (0.8 million pounds), Oregon (0.3 million pounds), and Wyoming (0.6 million pounds). In total, 4.6 million pounds of barium (82.4%) releases and disposal came from the electric utilities sector [North American Industry Classification System (NAICS) 2211] and most were disposed of in on-site landfills (USEPA, 2015). Kentucky reported the highest release to surface water of 250 pounds.

Exhibit 3-4. Reported Disposal or Release of Barium (2013; pounds)

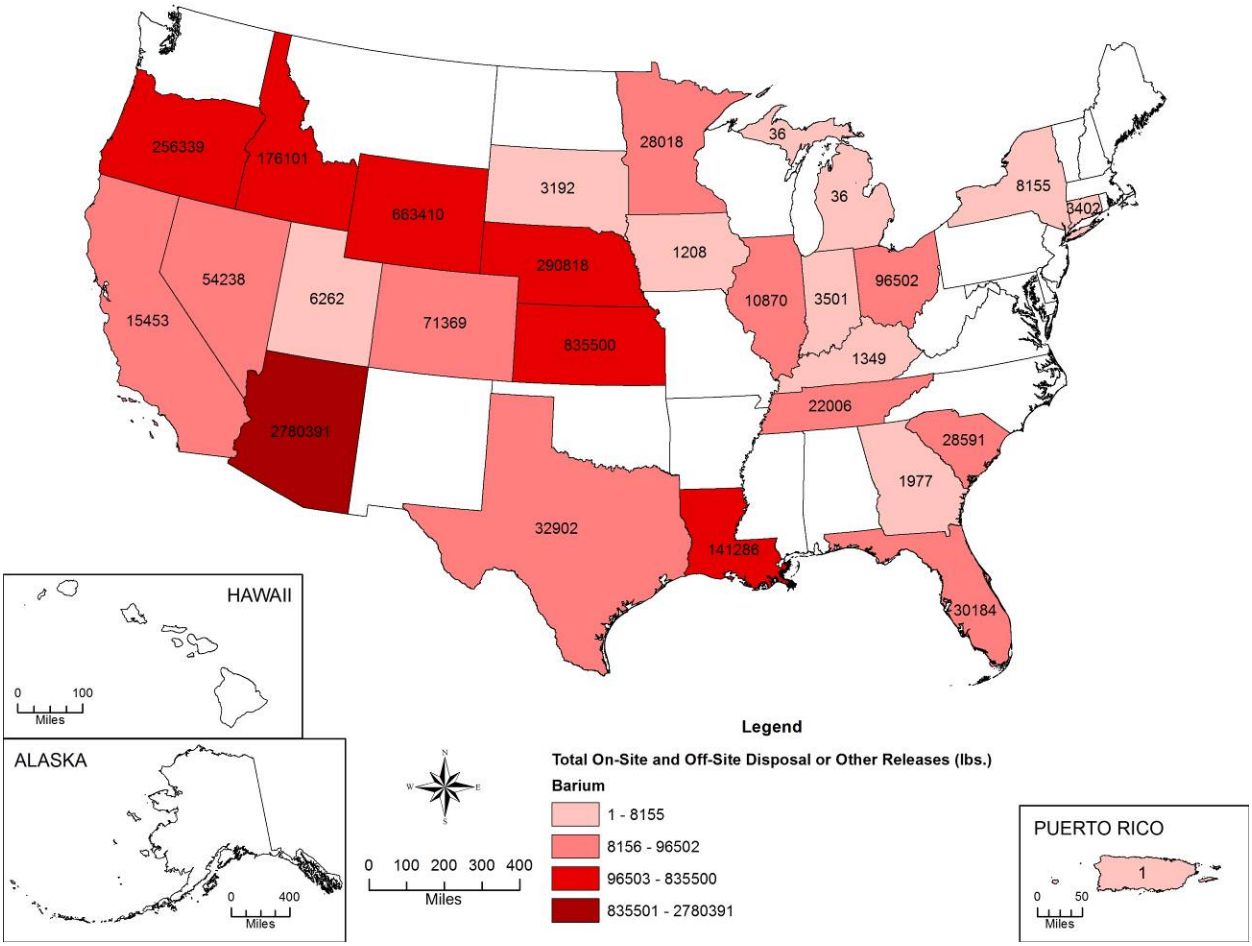
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Arizona	2,086	0	0	2,778,152	153	2,780,391	0	2,780,391
California	3	0	0	15,132	8	15,143	311	15,453
Colorado	5,299	0	0	18,393	47,677	71,369	ND	71,369
Connecticut	3	0	0	0	0	3	3,399	3,402
Florida	17	0	0	0	0	17	30,167	30,184
Georgia	16	0	0	0	0	16	1,960	1,977
Idaho	1,553	0	0	174,547	1	176,101	ND	176,101
Illinois	0	6	0	10,864	0	10,870	ND	10,870
Indiana	11	0	0	0	0	11	3,491	3,501
Iowa	442	0	0	0	0	442	766	1,208
Kansas	7,448	0	0	143,380	0	150,828	684,672	835,500
Kentucky	844	250	0	0	0	1,094	255	1,349
Louisiana	7	0	0	140,004	0	140,011	1,275	141,286
Michigan	36	0	0	0	0	36	ND	36
Minnesota	3	0	0	0	0	3	28,015	28,018
Nebraska	1,048	0	0	0	17,963	19,011	271,807	290,818
Nevada	3	0	0	54,232	0	54,235	3	54,238
New York	0	117	0	3,723	0	3,840	4,315	8,155
Ohio	45	0	0	95,024	0	95,069	1,432	96,502
Oregon	0	0	0	256,077	0	256,077	262	256,339
South Carolina	5	0	0	0	0	5	28,586	28,591
South Dakota	346	0	0	2,846	0	3,192	ND	3,192
Tennessee	10	0	0	0	0	10	21,996	22,006
Texas	0	10	0	31,461	0	31,472	1,430	32,902
Utah	0	0	0	0	0	0	6,262	6,262
Wyoming	3,410	0	0	0	0	3,410	660,000	663,410
Puerto Rico	0	0	0	0	0	0	1	1
Total	22,636	383	0	3,723,836	65,802	3,812,657	1,750,404	5,563,061

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of Barium (2013; pounds)



Source: USEPA, 2015

Reported releases and disposal of barium compounds were approximately 320.6 million pounds in 2013. **Exhibit 3-6** and **Exhibit 3-7** show that Utah reported the greatest release and disposal of 106.2 million pounds (33%) followed by Illinois (18.9 million pounds) and Texas (17.7 million pounds). In total, 62% of the reported releases and disposal came from the electric utilities sector (NAICS 2211) and 32% came from the metals mining sector (NAICS 2122) (USEPA, 2015). The total release directly to surface waters in 2013 was approximately one million pounds. Illinois reported the highest release to surface water of 245,126 pounds followed by Tennessee (122,755 pounds) and Kentucky (65,285 pounds).

Exhibit 3-6. Reported Disposal or Release of Barium Compounds (2013; pounds)

State	Air[1]	Surface Water Discharges[2]	Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Other Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Alabama	38,432	59,789	0	1,357,544	7,203,623	8,659,388	18,387	8,677,775
Alaska	4,582	0	0	302,658	62,644	369,884	332,016	701,900
Arizona	11,222	0	0	3,890,911	1,740,161	5,642,294	8,505	5,650,799
Arkansas	38,708	59,751	0	5,585,929	308,519	5,992,907	24,108	6,017,015
California	987	24	0	949	5	1,965	10,048	12,013
Colorado	5,284	931	0	5,009,452	16,807	5,032,474	1,331,003	6,363,477
Connecticut	1	0	0	0	0	1	46	46
Delaware	387	7,001	0	100,040	0	107,429	8,759	116,187
Florida	14,962	17,253	0	955,953	108,676	1,096,844	61,487	1,158,331
Georgia	26,739	48,673	0	103,413	5,491,030	5,669,855	244,598	5,914,453
Hawaii	24	0	0	0	0	24	146,342	146,366
Idaho	4,971	3	0	84,502	277,029	366,505	63,793	430,298
Illinois	79,374	245,126	0	4,581,218	6,034,451	10,940,169	7,976,699	18,916,869
Indiana	28,801	27,938	0	4,301,383	2,823,815	7,181,937	1,010,572	8,192,509
Iowa	98,588	9,648	0	4,307,547	306,520	4,722,303	1,342,391	6,064,694
Kansas	10,439	3,333	0	4,215,268	192,000	4,421,040	49,179	4,470,219
Kentucky	26,230	65,285	7,938	2,876,150	1,945,163	4,920,766	201,393	5,122,159
Louisiana	50,757	33,131	0	1,884,262	1,972,447	3,940,597	58,295	3,998,892
Maine	2,112	4,500	0	73,404	0	80,016	33,101	113,117
Maryland	1,728	331	0	0	440,580	442,638	653,571	1,096,209
Massachusetts	788	1,440	0	5,320	274	7,822	65,593	73,415
Michigan	61,727	26,886	0	6,983,194	2,873,482	9,945,289	1,889,666	11,834,955
Minnesota	73,065	2,210	0	937,837	8,651,609	9,664,722	1,130,117	10,794,838
Mississippi	2,282	6,744	0	817,313	51,343	877,682	683,974	1,561,656
Missouri	88,822	6,193	0	3,896,682	5,929,364	9,921,061	22,193	9,943,254
Montana	111,563	879	0	8,507,108	117,743	8,737,293	414,955	9,152,248
Nebraska	138,043	4,836	0	5,381,950	24,178	5,549,007	460,697	6,009,704
Nevada	499	0	0	445,343	190,343	636,184	82	636,267
New Hampshire	204	70	0	1,057	0	1,331	17,836	19,167
New Jersey	1,300	12	0	0	0	1,312	98,200	99,512
New Mexico	5,370	3,076	0	2,954,434	906,486	3,869,366	32,438	3,901,804
New York	4,229	5,515	0	131,127	0	140,871	550,460	691,331
North Carolina	50,267	45,002	0	1,291,254	364,900	1,751,423	979,585	2,731,008
North Dakota	41,633	2,402	0	6,792,719	4,281,851	11,118,605	2,585,053	13,703,658
Ohio	16,872	25,186	0	1,485,200	2,250,113	3,777,371	1,834,243	5,611,614
Oklahoma	9,761	7,844	0	1,534,990	368,755	1,921,350	682,706	2,604,055
Oregon	6,936	1,951	0	540,290	60	549,237	75	549,312
Pennsylvania	14,714	31,179	0	1,660,887	789,462	2,496,241	2,457,885	4,954,126
Rhode Island	5	18	0	0	0	23	9,938	9,961
South Carolina	6,573	38,454	0	287,913	179,532	512,472	272,368	784,840
South Dakota	2,465	0	0	531,311	0	533,776	186,545	720,321
Tennessee	10,896	122,756	0	2,033,878	3,447,661	5,615,191	1,779,612	7,394,803

Exhibit 3-6. Reported Disposal or Release of Barium Compounds (2013; pounds)

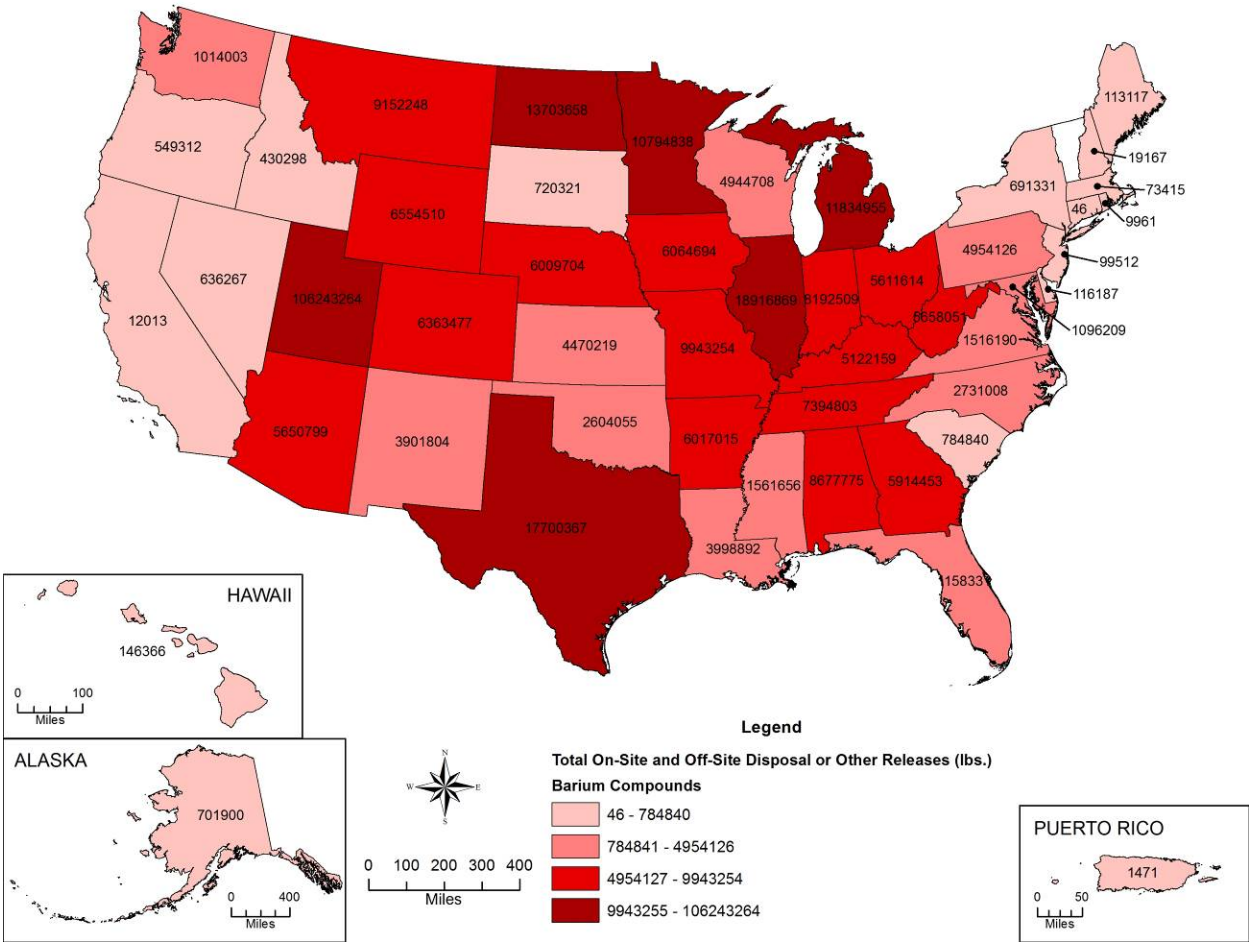
State	Air[1]	Surface Water Discharges[2]	Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Other Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Texas	66,176	57,547	0	15,592,055	1,682,821	17,398,600	301,767	17,700,367
Utah	5,985	162	0	4,570,241	101,600,158	106,176,546	66,718	106,243,264
Virginia	3,152	37,569	0	915,124	412,292	1,368,137	148,053	1,516,190
Washington	1,278	1,329	0	842,965	2,984	848,556	165,447	1,014,003
West Virginia	13,553	9,408	0	1,982,600	1,265,212	3,270,773	2,387,278	5,658,051
Wisconsin	51,442	13,694	0	378,878	397,189	841,203	4,103,505	4,944,708
Wyoming	68,122	4,082	0	4,637,407	919,594	5,629,205	925,305	6,554,510
Puerto Rico	1,471	0	0	0	0	1,471	.	1,471
Total	1,303,522	1,039,160	7,938	114,769,660	165,630,875	282,751,155	37,826,587	320,577,743

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of Barium Compounds (2013; pounds)



Source: USEPA, 2015

3.1.3 Beryllium and Beryllium Compounds

Reported releases and disposal of beryllium were approximately 37,300 pounds in 2013. **Exhibit 3-8** and **Exhibit 3-9** show that Oregon reported the greatest release and disposal of 16,571 pounds (44.4%) followed by Idaho (12,242 pounds), and Ohio (6,800 pounds). Most beryllium was reported to be released to air or disposed of in on-site landfills; only 16 pounds were released to surface waters in 2013.

Exhibit 3-8. Reported Disposal or Release of Beryllium (2013; pounds)

State	Air[1]	Surface Water Discharges[2]	Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Georgia	27	0	0	0	0	27	2	29
Idaho	2	0	0	12,240	0	12,242	0	12,242
Kansas	5	0	0	0	0	5	0	5
Louisiana	133	0	0	0	0	133	0	133
North Carolina	55	0	0	0	0	55	0	55
Ohio	6,800	0	0	0	0	6,800	0	6,800
Oregon	0	0	0	16,571	0	16,571	0	16,571
Pennsylvania	1	16	0	0	0	17	895	912
Tennessee	1	0	0	0	0	1	52	53
Texas	0	0	0	499	0	499	0	499
Total	7,024	16	0	29,309	0	36,349	950	37,299

Source: USEPA, 2015

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 reported.

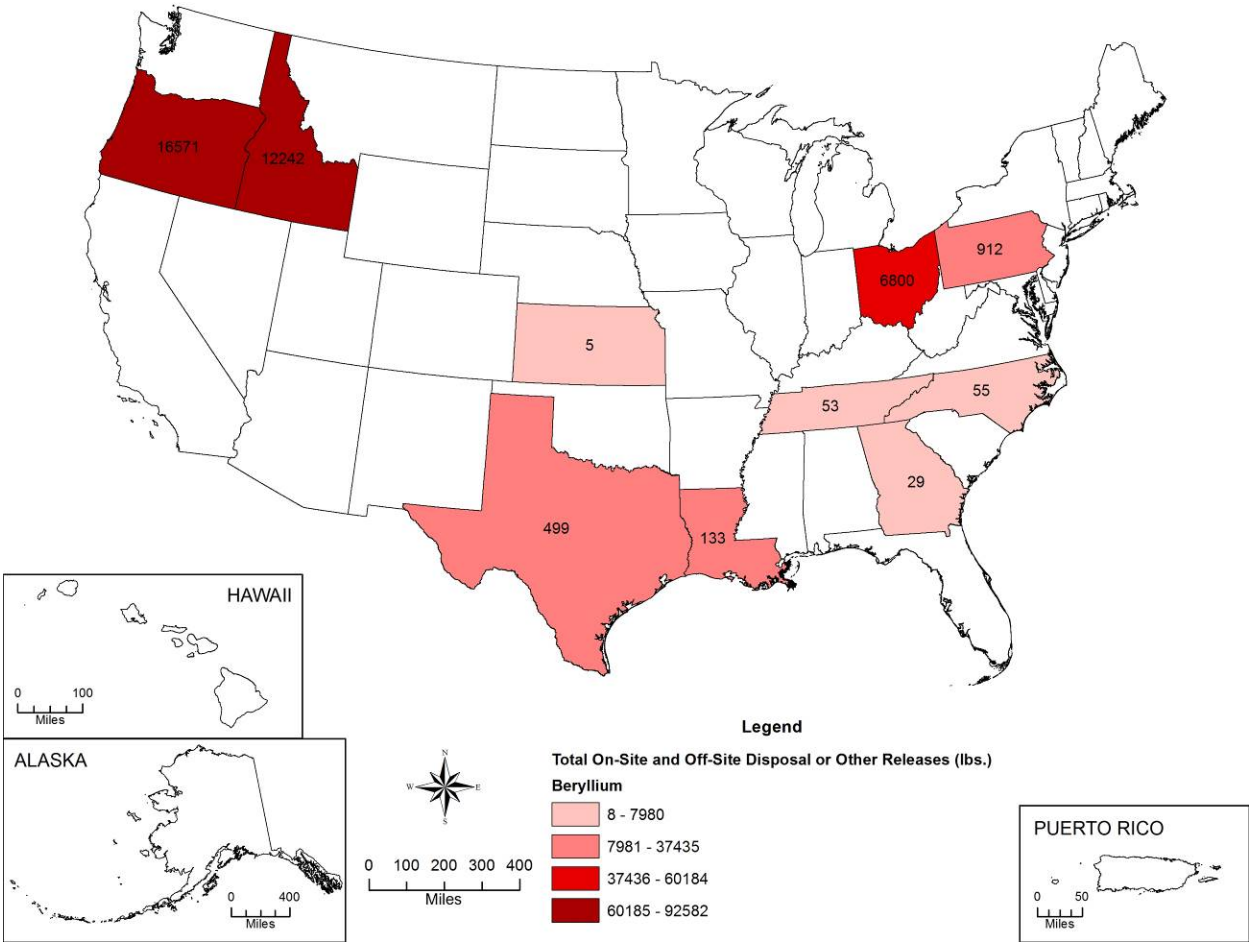
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.

4. Total on-s-Site disposal to Class I underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of Beryllium (2013; pounds)



Source: USEPA, 2015

Reported releases and disposal of beryllium compounds were reported to be approximately 494.4 thousand pounds in 2013. **Exhibit 3-10** and **Exhibit 3-11** show that Ohio reported the greatest release and disposal of 92,582 pounds (18.7%) followed by Utah (77,573 pounds), and Kentucky (60,184 pounds). Most beryllium compounds were disposed of in on-site landfills; only 158 pounds were released to surface waters in 2013.

Exhibit 3-10. Reported Disposal or Release of Beryllium Compounds (2013; pounds)

State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Arizona	19	0	0	6,022	0	6,041	0	6,041
Florida	60	0	0	2,231	2	2,293	363	2,656
Georgia	45	0	0	0	10,000	10,045	0	10,045
Illinois	45	12	0	34,059	124	34,240	3,195	37,435
Indiana	100	42	0	1,407	40,400	41,949	9,841	51,790
Kansas	6	0	0	2	0	8	0	8
Kentucky	390	22	0	18,140	41,632	60,184	0	60,184
Michigan	19	31	0	0	6,200	6,250	3	6,253
Montana	20	0	0	7,910	0	7,930	50	7,980
New Mexico	32	0	0	17,590	9,588	27,210	7	27,217
North Carolina	52	12	0	14,630	1,090	15,784	0	15,784
Ohio	299	26	0	47,682	23,766	71,773	20,809	92,582
Pennsylvania	70	1	0	0	0	71	10,219	10,290
South Carolina	6	12	0	57	1,352	1,427	0	1,427
Tennessee	11	0	0	4,200	1,947	6,158	0	6,158
Texas	67	0	0	52,325	3,805	56,197	0	56,197
Utah	27	0	0	104	11,083	11,214	66,359	77,573
West Virginia	51	0	0	11,210	2,565	13,826	11,000	24,826
Total	1,319	158	0	217,569	153,554	372,599	121,846	494,446

Source: USEPA, 2015

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 reported.

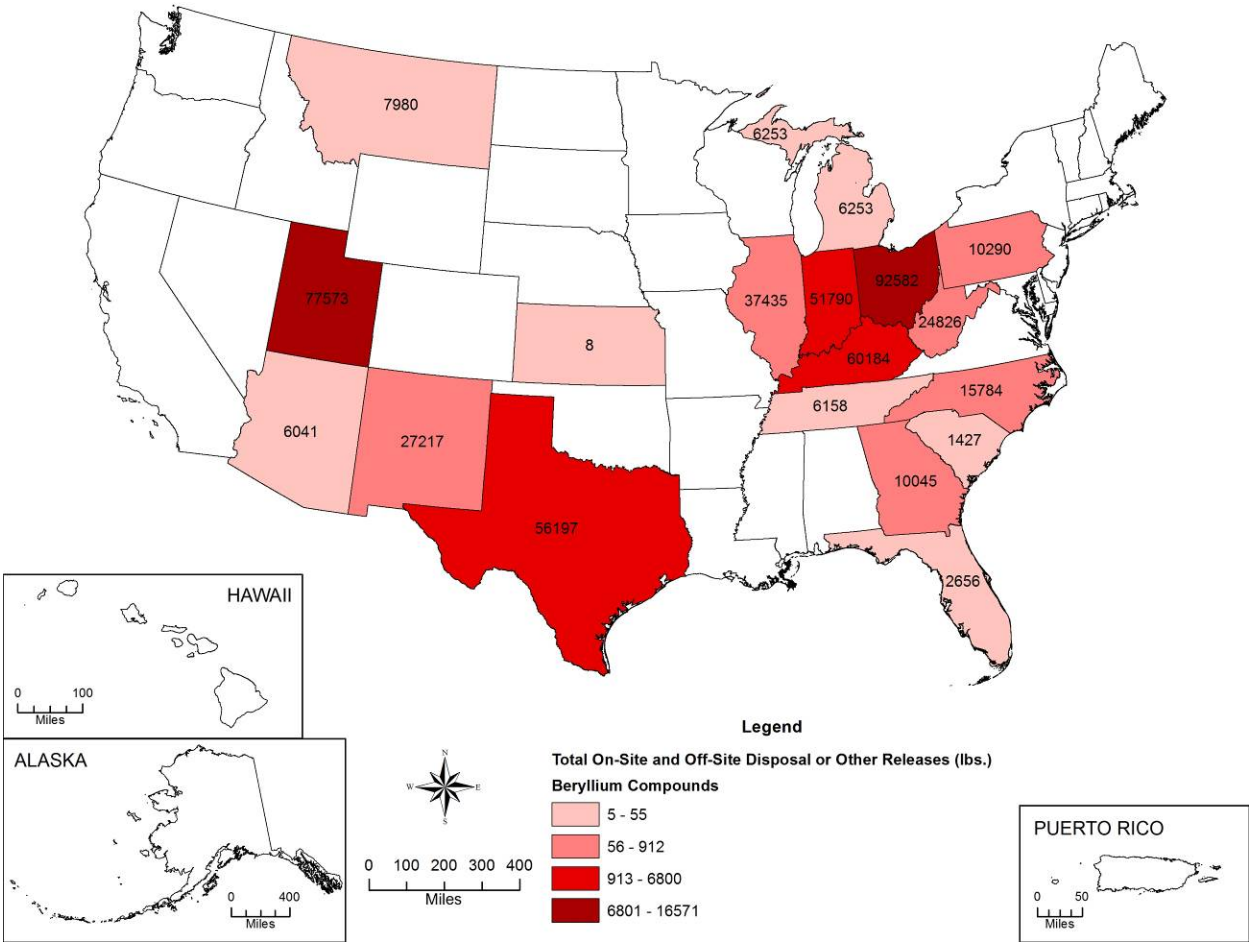
3. Underground injection is the subsurface emplacement of fluids through wells including Class I, II, III, IV, or V wells.

4. Total on-site disposal to Class I underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of Beryllium Compounds (2013; pounds)



Source: USEPA, 2015

3.1.4 2,4-D

Reported releases and disposal of 2,4-D were approximately 2,363 pounds in 2013. **Exhibit 3-12** and **Exhibit 3-13** show that Missouri reported the greatest release and disposal of 866 pounds (37%) followed by Iowa (500 pounds), and Ohio (375 pounds). The majority of 2,4-D was released to air or disposed off-site; the total release directly to surface water in 2013 was only 9 pounds.

Exhibit 3-12. Reported Disposal or Release of 2,4-D (2013; pounds)

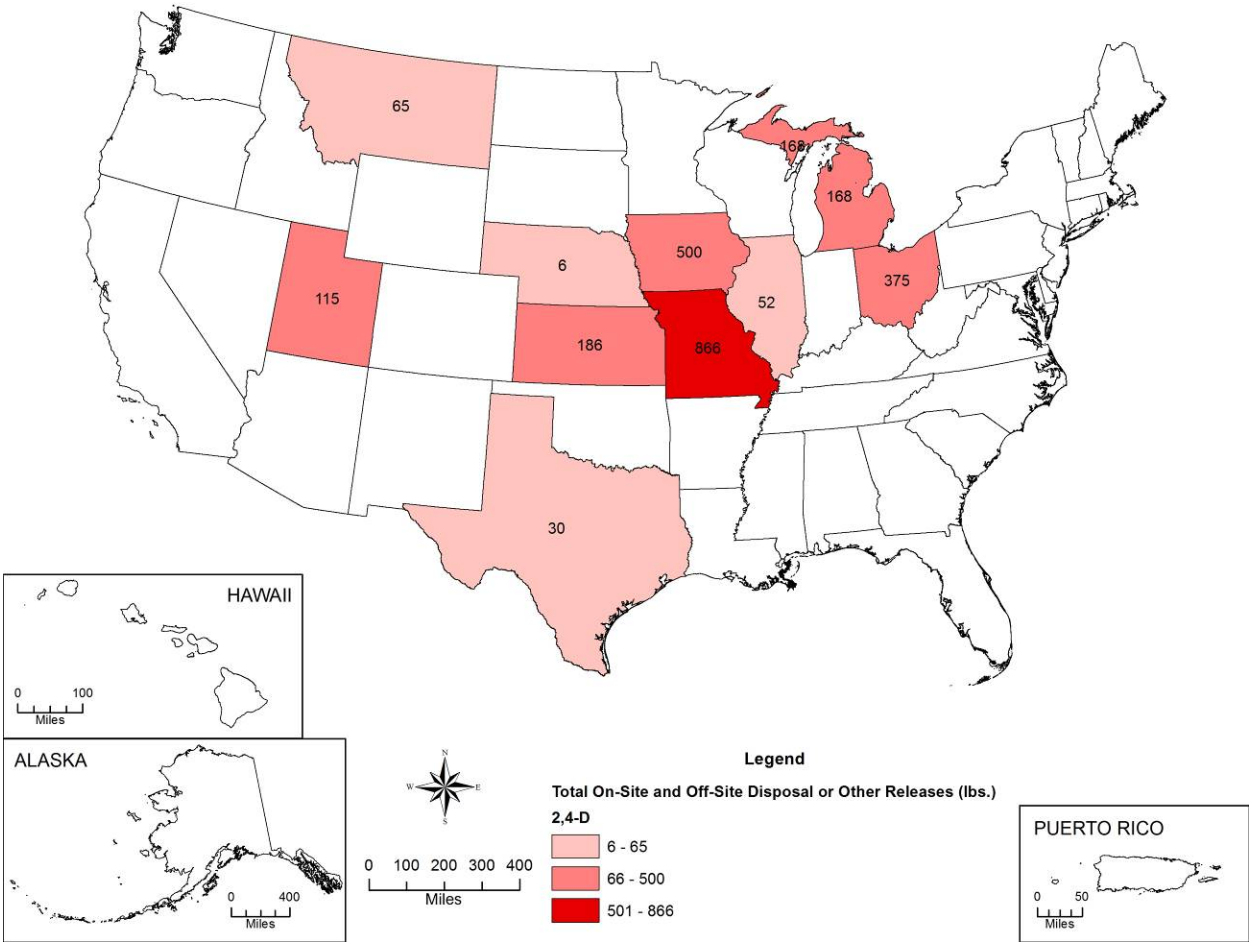
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Illinois	43	0	0	0	0	43	9	52
Iowa	500	0	0	0	0	500	ND	500
Kansas	10	0	0	0	0	10	176	186
Michigan	110	9	0	49	0	168	ND	168
Missouri	179	0	0	0	0	179	687	866
Montana	10	0	0	0	0	10	55	65
Nebraska	6	0	0	0	0	6	ND	6
Ohio	262	0	0	0	0	262	113	375
Texas	30	0	0	0	0	30	ND	30
Utah	115	0	0	0	0	115	ND	115
Total	1,264	9	0	49	0	1,323	1,040	2,363

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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. Reported Disposal or Release of 2,4-D Compounds (2013; pounds)



Source: USEPA, 2015

3.1.5 Lindane

As shown in **Exhibit 3-14** and **Exhibit 3-15**, 9,079 pounds of lindane were reportedly released and disposed of in 2013 from five states. Hazardous Waste and Solvent Recovery facilities (NAICS 562) in Indiana disposed the largest quantity of lindane (9,032 pounds) at off-site facilities.

Exhibit 3-14. Reported Disposal or Release of Lindane (2013; pounds)

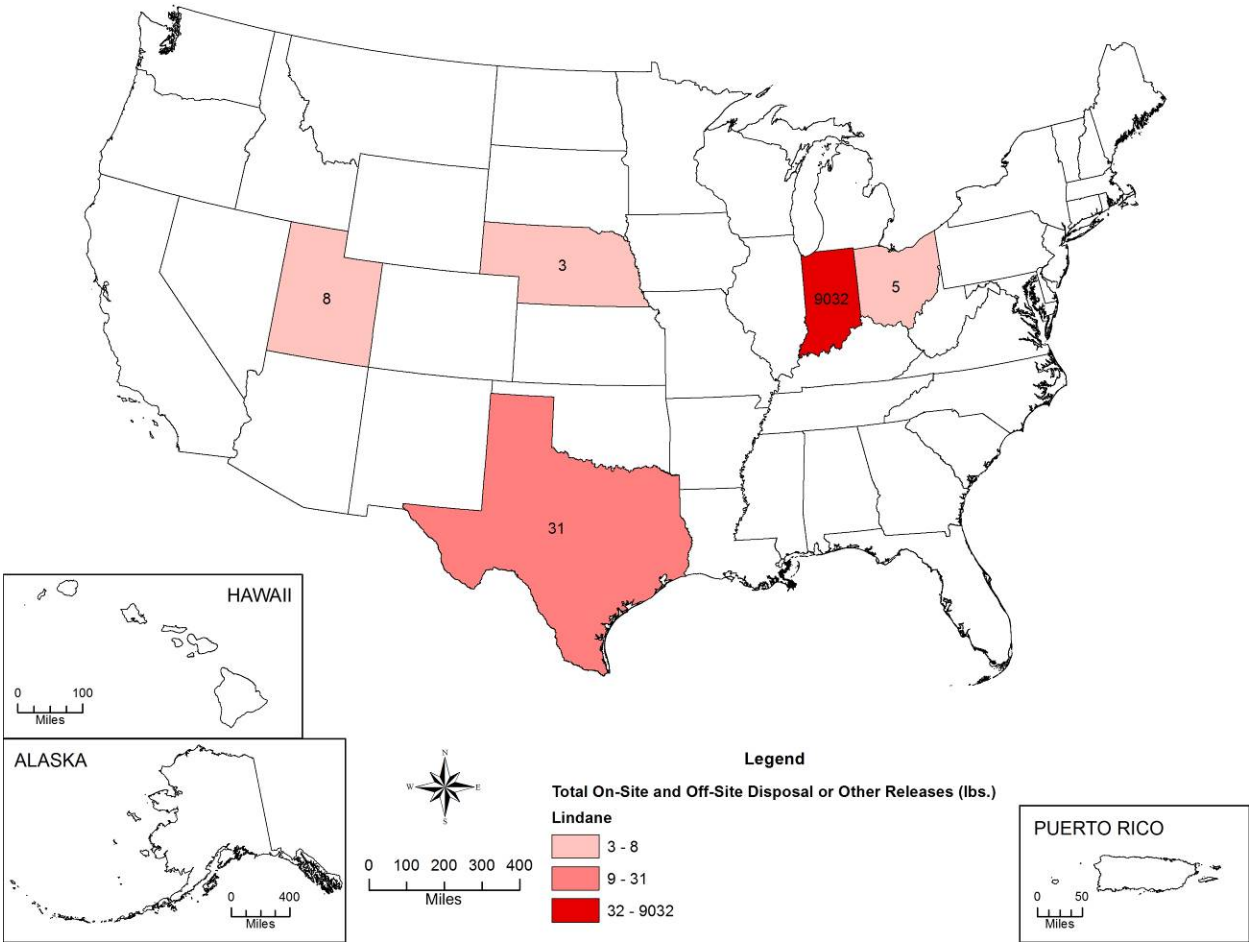
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Indiana	0	0	0	0	0	0	9,032	9,032
Nebraska	3	0	0	0	0	3	ND	3
Ohio	4	0	0	0	0	4	1	5
Texas	31	0	0	0	0	31	ND	31
Utah	8	0	0	0	0	8	ND	8
Total	46	0	0	0	0	46	9,033	9,079

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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 3-15. Reported Disposal or Release of Lindane (2013)



Source: USEPA, 2015

3.1.6 Picloram

Reported releases and disposal of picloram were approximately 245 pounds in 2013. As shown in **Exhibit 3-16** and **Exhibit 3-17**, only Michigan and Texas reported releases. All of the reported releases and disposal came from the chemical sector (NAICS 325) and most was disposed of in on-site landfills (USEPA, 2015). The total release directly to surface water in 2013 was only 18 pounds, all of which was reported in Michigan.

Exhibit 3-16. Reported Disposal or Release of Picloram (2013; pounds)

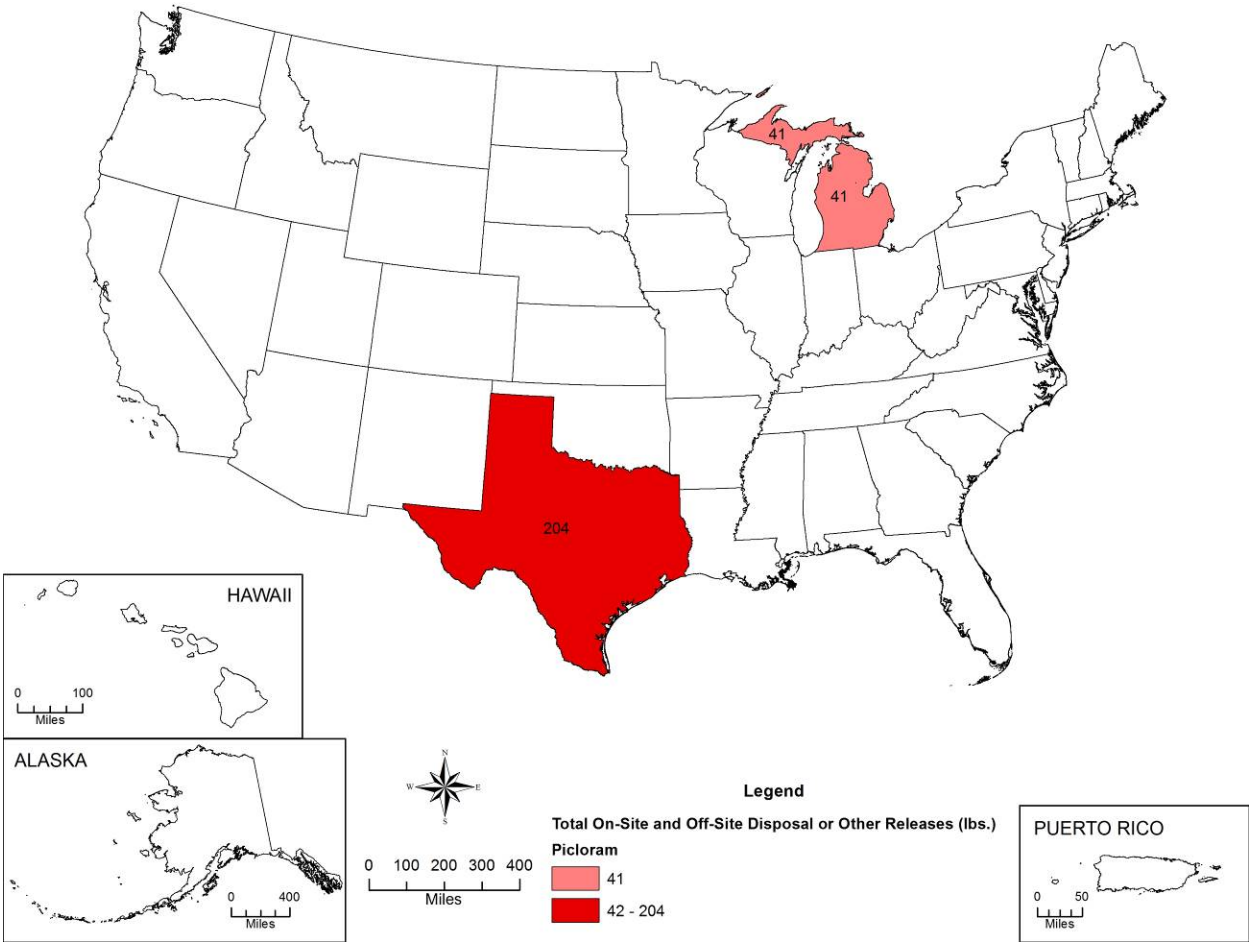
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Michigan	23	18	0	0	0	41	.	41
Texas	204	0	0	0	0	204	.	204
Total	227	18	0	0	0	245	0	245

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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 3-17. Reported Disposal or Release of Picloram (2013; pounds)



Source: USEPA, 2015

3.1.7 1,1,1-Trichloroethane

Reported releases and disposal of 1,1,1-trichloroethane were approximately 110,000 pounds in 2013. **Exhibit 3-18** and **Exhibit 3-19** show that Louisiana reported the greatest release and disposal of 51,461 pounds (47%) followed by New Mexico (22,413 pounds), and Oregon (16,235 pounds). In Louisiana all releases and disposal came from the chemical sector (NAICS 325) and most was released into the air (USEPA, 2015). The total release directly to surface water in 2013 was 1,371 pounds, 1,300 of which were reported by Louisiana.

Exhibit 3-18. Reported Disposal or Release of 1,1,1-Trichloroethane (2013; pounds)

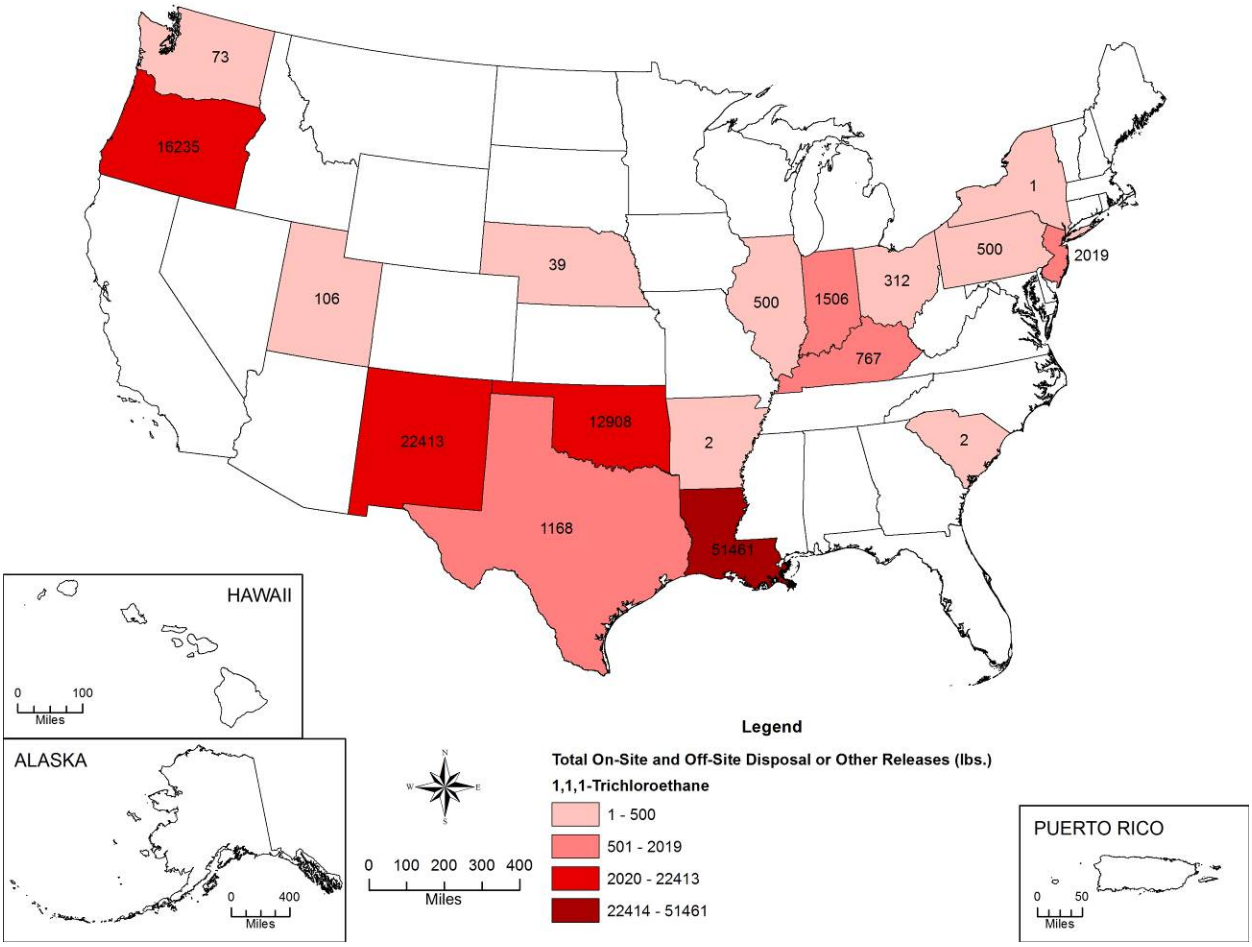
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Other Releases	Total Off-site Disposal or Other Releases[6]	Total On- and Off-site Disposal or Other Releases
Arkansas	2	0	0	0	0	2	ND	2
Illinois	500	0	0	0	0	500	ND	500
Indiana	1,506	0	0	0	0	1,506	ND	1,506
Kentucky	706	61	0	0	0	767	ND	767
Louisiana	50,161	1,300	0	0	0	51,461	0	51,461
Nebraska	39	0	0	0	0	39	0	39
New Jersey	2,009	10	0	0	0	2,019	ND	2,019
New Mexico	465	0	0	0	21,948	22,413	ND	22,413
New York	1	0	0	0	0	1	ND	1
Ohio	77	0	0	0	0	77	235	312
Oklahoma	0	0	0	12,908	0	12,908	ND	12,908
Oregon	11	0	0	16,224	0	16,235	ND	16,235
Pennsylvania	500	0	0	0	0	500	ND	500
South Carolina	2	0	0	0	0	2	ND	2
Texas	917	0	0	1	0	918	250	1,168
Utah	9	0	0	0	0	9	97	106
Washington	73	0	0	0	0	73	0	73
Total	56,978	1,371	0	29,133	21,948	109,430	582	110,012

Source: USEPA, 2015

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 reported.
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 underground injection Resource and Conservations Recovery Act 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 includes discharges to publicly owned treatment works 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 3-19. Reported Disposal or Release of 1,1,1-Trichloroethane (2013; pounds)



Source: USEPA, 2015

3.1.8 1,2,4-Trichlorobenzene

Reported releases and disposal of 1,2,4-trichlorobenzene were approximately 8,000 pounds in 2013. **Exhibit 3-20** and **Exhibit 3-23** and show that Ohio reported the greatest release and disposal of 6,844 pounds (84%) followed by West Virginia (955 pounds), and Pennsylvania (273 pounds). In Ohio, all releases and disposal came from the chemical sector (NAICS 325) and the hazardous waste/chemical recovery sector (NAICS 562). There were no reported releases directly to surface water in 2013.

Exhibit 3-20. Reported Disposal or Release of 1,2,4-Trichlorobenzene (2013; pounds)

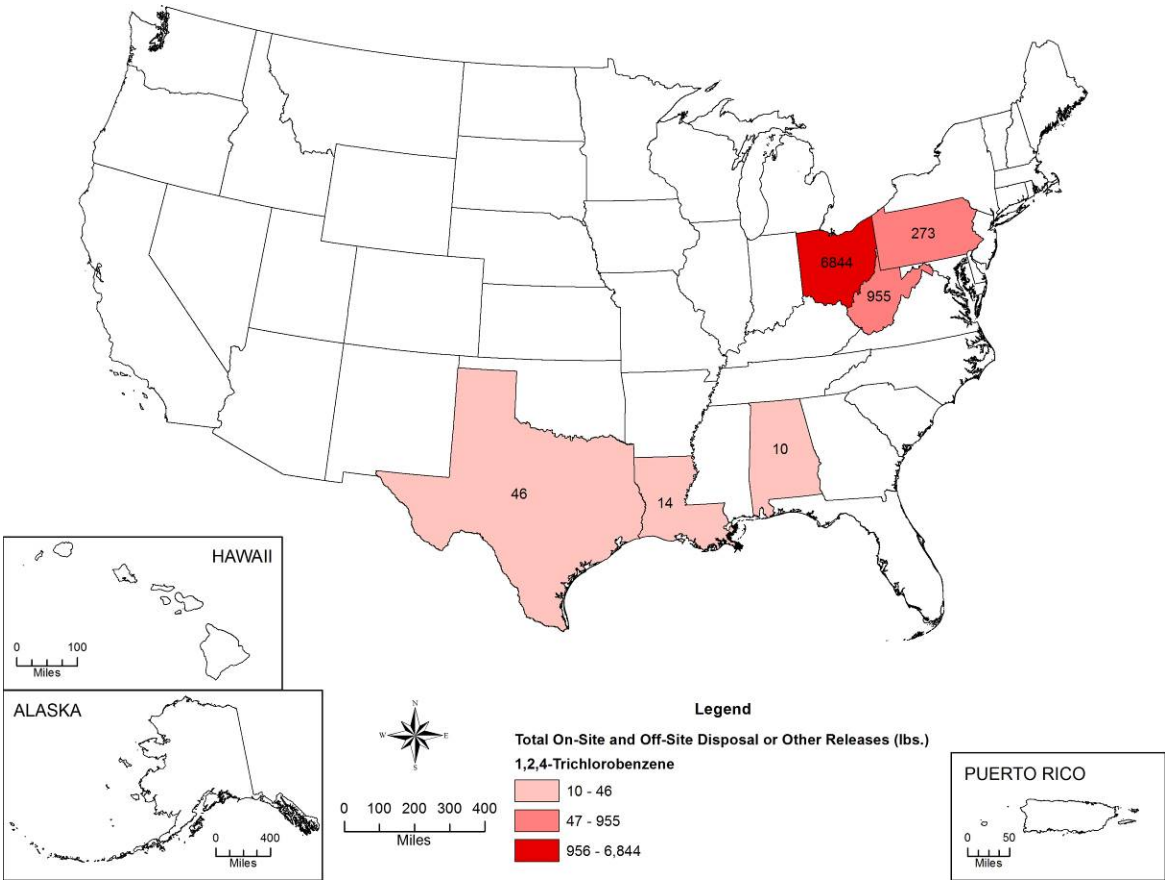
State	On-site Air[1]	On-site Surface Water Discharges[2]	On-site Under-ground Injection[3]	On-site Landfill Disposal[4]	Other On-site Releases[5]	Total On-site Disposal or Releases	Total Off-site Disposal or Releases[6]	Total On- and Off-site Disposal or Releases
Alabama	10	0	0	0	0	10	.	10
Louisiana	12	0	0	0	0	12	2	14
Ohio	6,573	0	0	0	0	6,573	271	6,844
Pennsylvania	23	0	0	0	0	23	250	273
Texas	46	0	0	0	0	46	.	46
West Virginia	955	0	0	0	0	955	.	955
Total	7,618	0	0	0	0	7,618	523	8,141

Source: USEPA, 2015

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 reported.
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 underground injection Resource Conservation and Recovery Act 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 includes discharges to publicly owned treatment works 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 3-21. Reported Disposal or Release of 1,2,4-Trichlorobenzene (2013; pounds)



Source: USEPA, 2015

3.2 Pesticide Usage Estimates

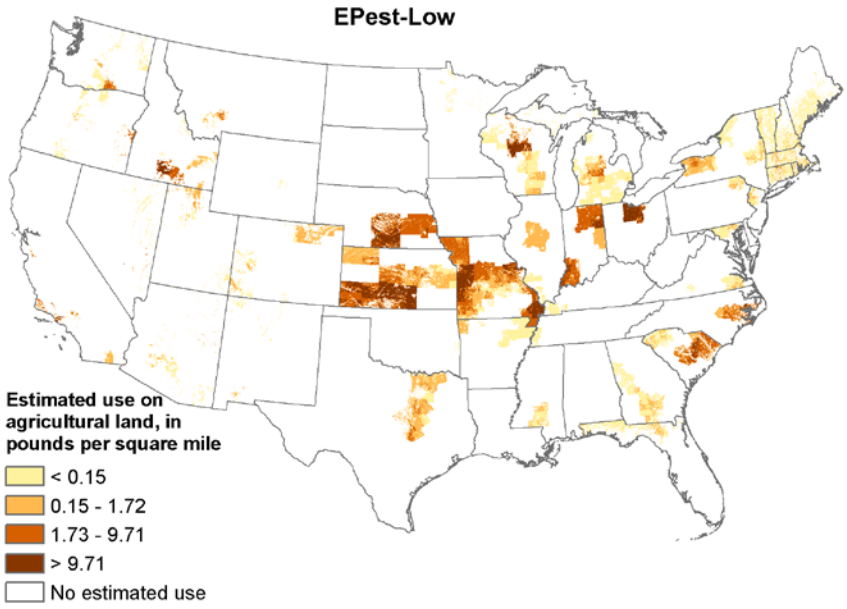
A second source of environmental release information is the USGS estimates of pesticide use. The USGS estimates annual pesticide use at the county level based on crop-specific usage rates (pounds per acre) obtained via survey and county-level crop production data obtained from the U.S. Department of Agriculture (USDA; Baker and Stone, 2015). The usage rates reflect practices at a sample of farms in each of 15 USDA Crop Reporting Districts. Whenever the sample usage rate was zero, the USDA used two extrapolation approaches to generate upper and lower bounds the uncertainty estimates. The "low" estimate reflects a usage rate of zero and the "high" estimate reflects usage rates in adjacent Crop Reporting Districts.

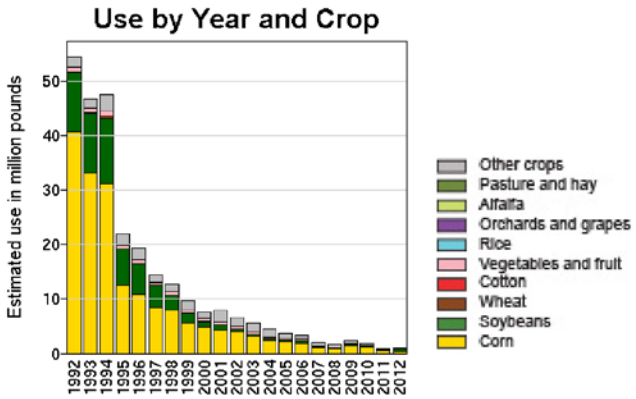
Estimates compiled for 2012 include several of the contaminants in this report: alachlor, 2,4-D, diquat, lindane, and picloram. The following figures come from the USGS online data analysis tool, which generates application rate maps and annual national usage charts by pesticide for both the low and high estimate scenarios, labeled EPest-Low and EPest-High in the USGS figures.

3.2.1 Alachlor

Exhibit 3-22 and **Exhibit 3-23** show that the alachlor application rates are highest in the Midwest, with primary application to corn and soybean crops. Annual usage rates have declined substantially from more than 50 million pounds in 1992 to less than 10 million pounds in 2012.

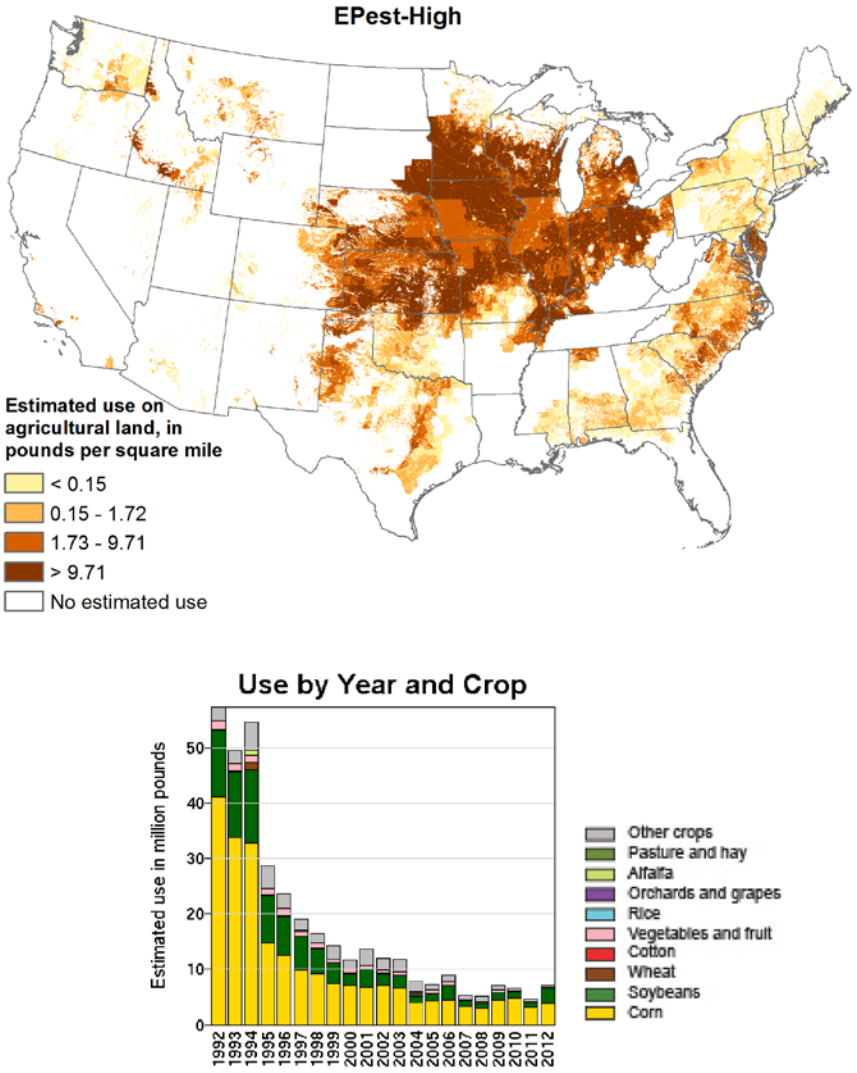
Exhibit 3-22. Lower Bound Estimated Agricultural Use of Alachlor, 2012





Source: USGS, 2015b

Exhibit 3-23. Upper Bound Estimated Agricultural Use of Alachlor, 2012

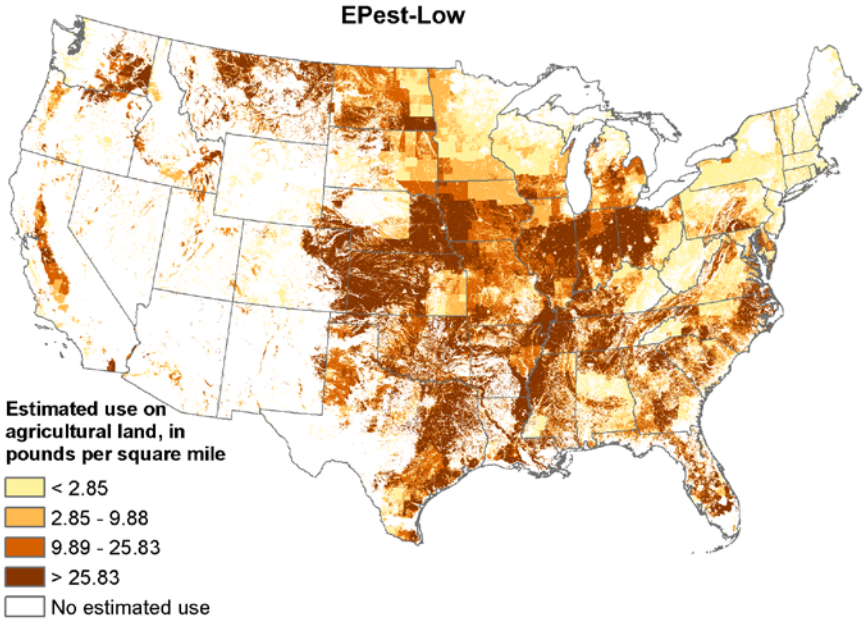


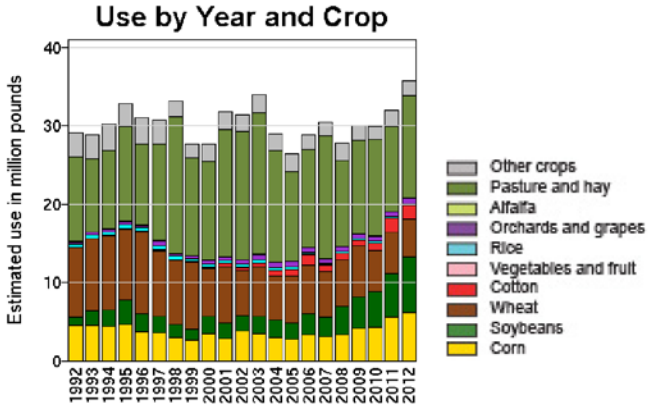
Source: USGS, 2015b

3.2.2 2,4-D

Exhibit 3-24 and **Exhibit 3-25** show widespread 2,4-D application rates primarily in the Midwest, South, and Southeastern regions, with primary application to pasture and row crops (corn, soybeans, wheat). Annual usage rates are in the 30 to 40 million pounds range throughout the period

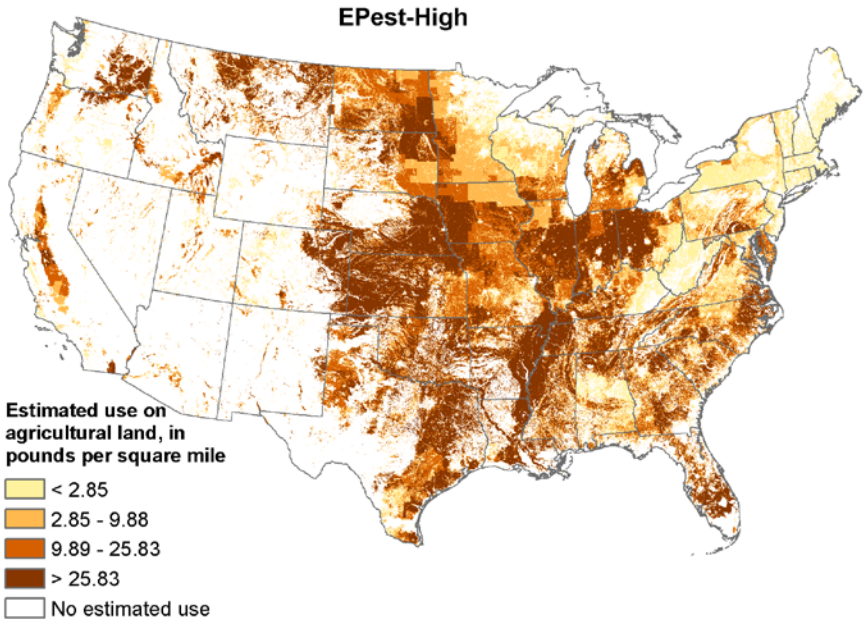
Exhibit 3-24. Lower Bound Estimated Agricultural Use of 2,4-D, 2012

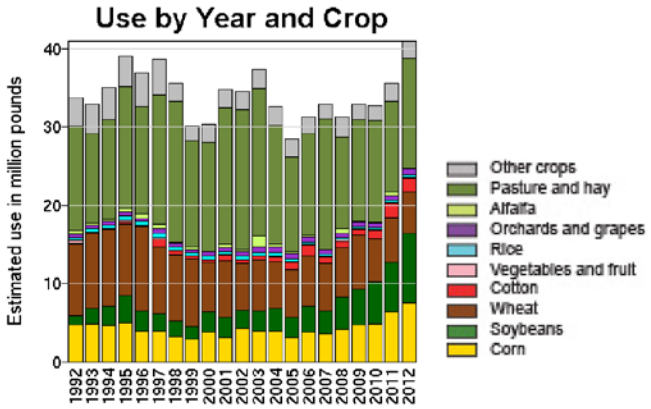




Source: USGS, 2015b

Exhibit 3-25. Upper Bound Estimated Agricultural Use of 2,4-D, 2012



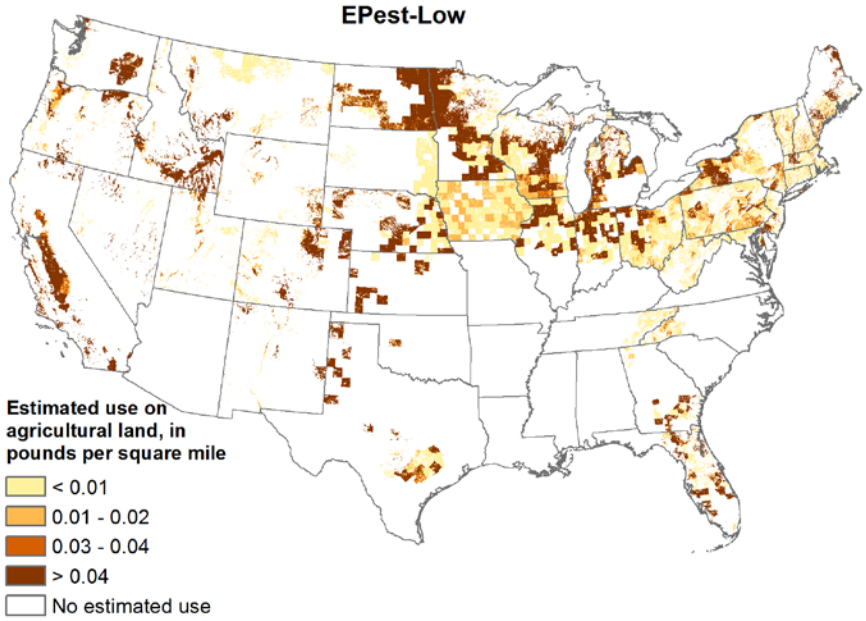


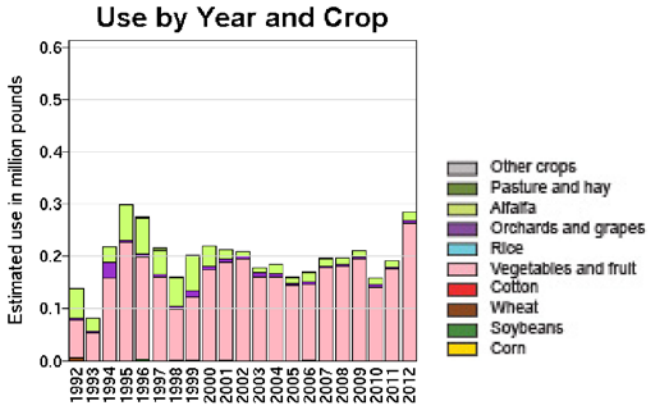
Source: USGS, 2015b

3.2.3 Diquat

Exhibit 3-26 and **Exhibit 3-27** show diquat application rates primarily in the Northern latitudes, especially in the Great Lakes states. The pesticide is primarily applied to vegetables and fruit. Uncertainty regarding 2,4-D application rates for alfalfa predominate differences between the low and high use estimates. Annual usage rates are around 0.2 million pounds for the last decade.

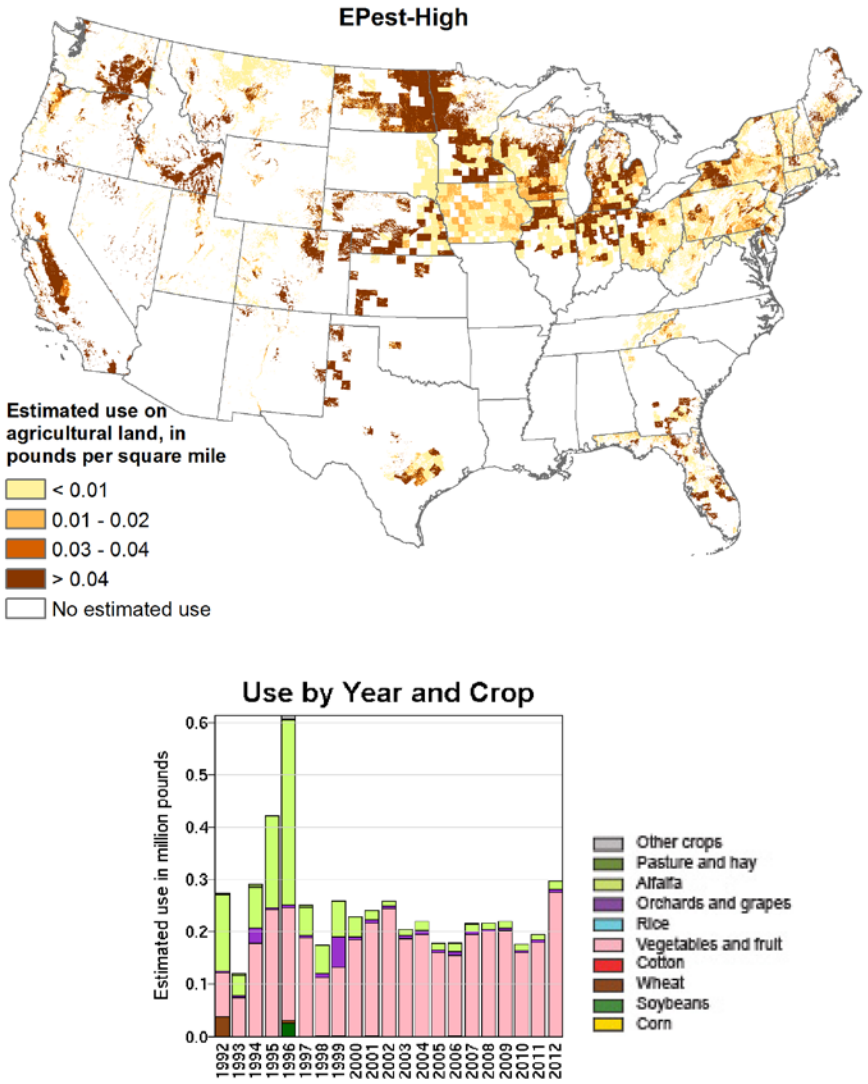
Exhibit 3-26. Lower Bound Estimated Agricultural Use of Diquat, 2012





Source: USGS, 2015b

Exhibit 3-27. Upper Bound Estimated Agricultural Use of Diquat, 2012

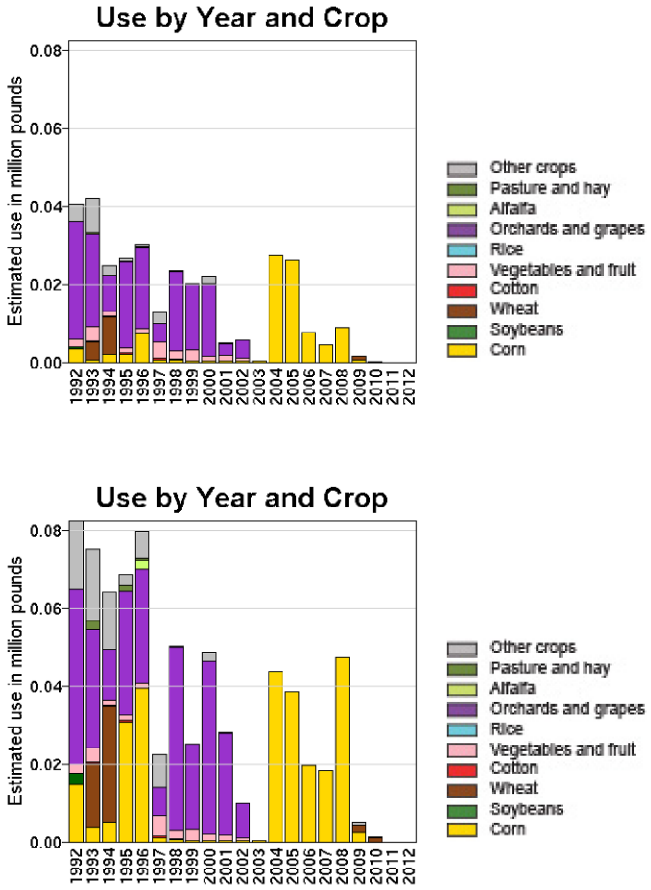


Source: USGS, 2015b

3.2.4 Lindane

Exhibit 3-28 shows that lindane use ended in 2011. Lindane application to corn occurred from 2004 to 2010. Prior to that, applications to orchards and grapes dominated use, especially for the lower bound estimates. The higher bound estimates included corn and wheat applications.

Exhibit 3-28. Lower and Upper Bound Estimated Agricultural Use of Lindane, 2012

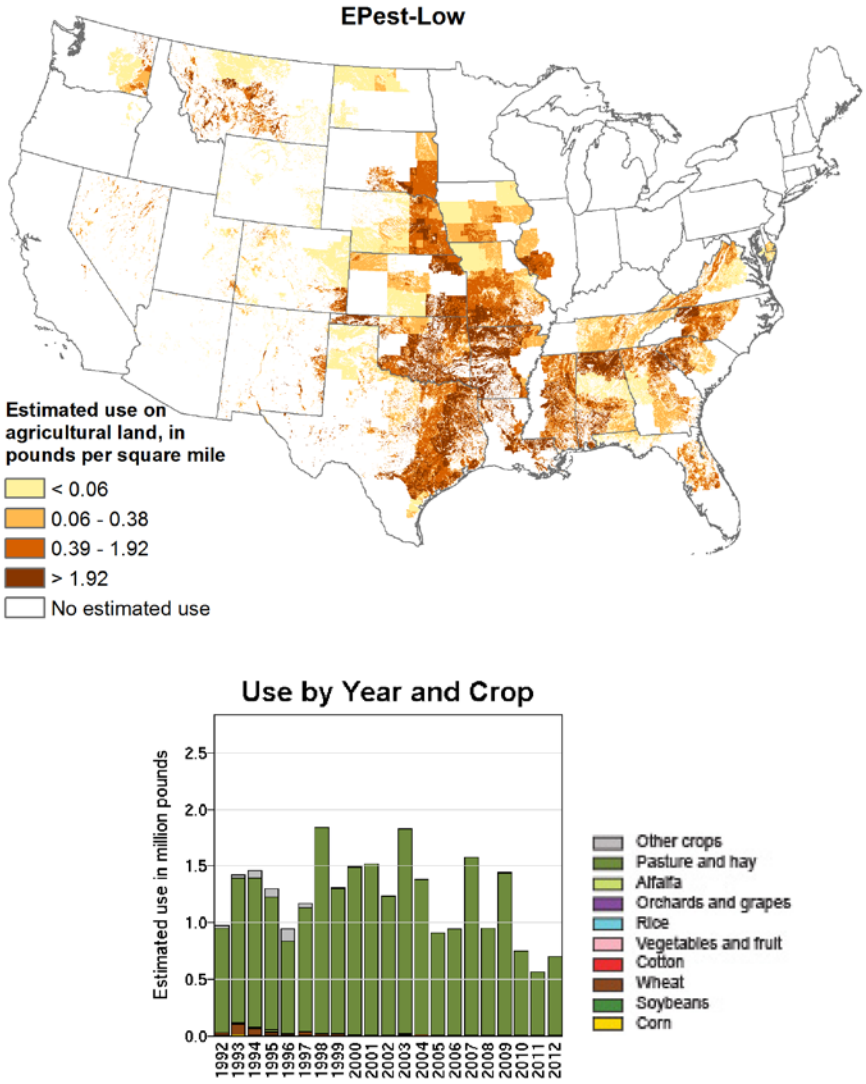


Source: USGS, 2015b

3.2.5 Picloram

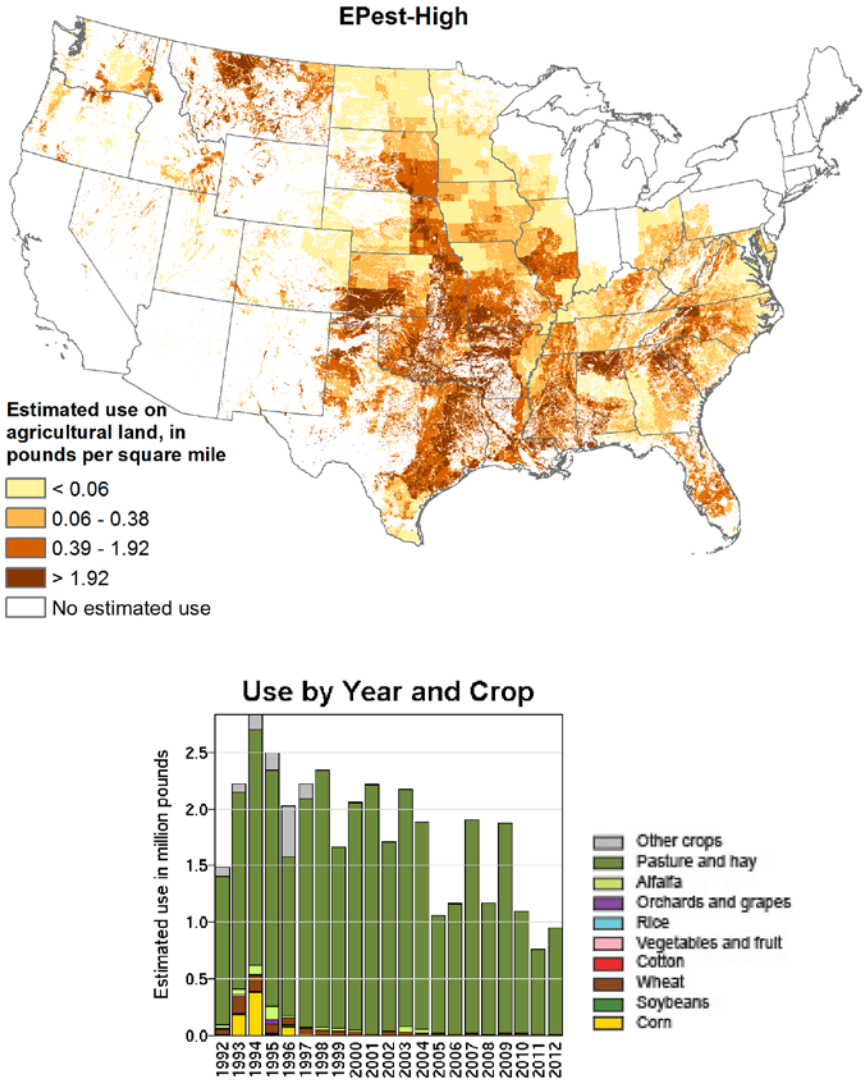
Exhibit 3-29 and **Exhibit 3-30** show picloram application primarily in the Great Plains states and the South. Picloram is primarily applied to pasture. Annual usage rates are somewhat lower in the last three years, but generally range from 1 to 2 million pounds in the low estimates.

Exhibit 3-29. Lower Bound Estimated Agricultural Use of Picloram, 2012



Source: USGS, 2015b

Exhibit 3-30. Upper Bound Estimated Agricultural Use of Picloram, 2012



Source: USGS, 2015b

4. Contaminant Occurrence Data Sources

EPA obtained data from two sources that provide information on contaminant occurrence in source water: USGS' NAWQA Program 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 contaminants of interest.

4.1 NAWQA

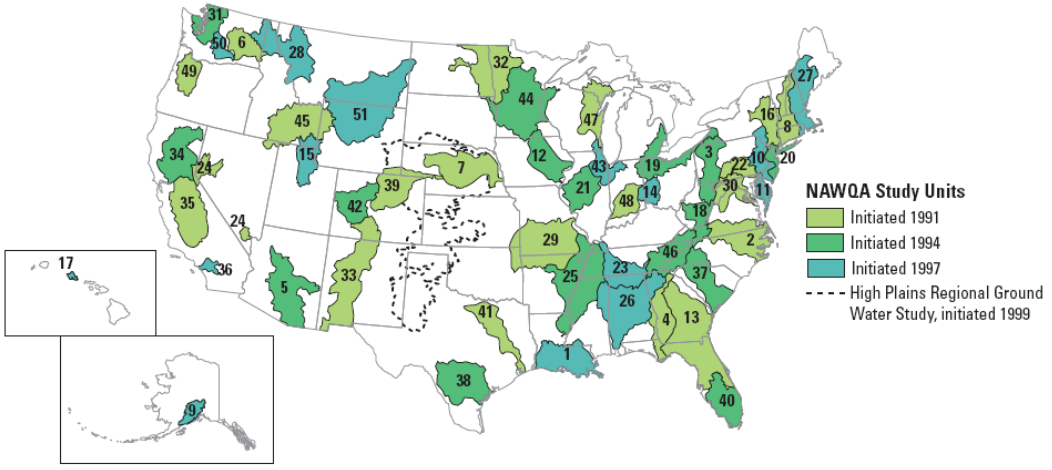
In 1991, USGS implemented the NAWQA Program, in part, to characterize the condition of streams, rivers, and ground water in the United States. For the NAWQA Program, the USGS conducted interdisciplinary assessments, including water chemistry, hydrology, land use, stream habitat, and aquatic life, and 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% of total water use (excluding thermoelectric and hydropower) and more than 50% of the supply of drinking water (Gilliom et al., 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 continued in 42 of the 51 Study Units.

USGS has made most of this data available through the NAWQA Warehouse (USGS, 2015a). EPA analyzed all available water quality sampling data for the contaminants of interest. EPA selected the maximum reported concentration for each contaminant analyzed at each location for analysis purposes. The results shown below are based on these maximum concentrations and, therefore, represent upper bounds on contaminant occurrence in the NAWQA database.

Exhibit 4-1. NAWQA Study Units



NAWQA Study Units

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

Source: USGS, 2006b.

4.2 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 began in 2001 and ended in 2013.

The USDA collects and publishes annual databases. Each database contains:

- residual concentrations of more than 300 pesticides in drinking water, raw food, and processed food
- results from consumables originating in 43 countries, 50 states, Washington D.C., and Puerto Rico

The drinking water data in the PDP provide information to support the Food Quality Protection Act authorized in 1996 by Congress. When data collection began in 2001, USDA limited sampling 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 again in 2004 to include systems in Michigan, North Carolina, Ohio, Oregon, Pennsylvania, and Washington.

Although the USDA collects both raw water and treated water samples, the data reported below reflects only the raw water samples, which are better indicators of source water quality. The treated water samples reflect the effects of water treatment on contaminant removal. For years of 2009 through 2013, the PDP data also include a few samples taken from source waters of schools and day care centers. Because these facilities may be classified as non-transient, non-community water systems that are subject to most of the same drinking water standards as a municipal system, EPA included those samples in the occurrence estimates below.

4.3 Contaminant Occurrence

The following sections discuss the occurrence of contaminants of interest, and present summary data from the NAWQA 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 developed maps that plot the NAWQA data to demonstrate the spatial extent of the sampling locations and occurrence results.

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.

4.3.1 Alachlor

Exhibit 4-2 provides comparisons of the maximum alachlor concentrations found at locations in the NAWQA database with the current MCL (which is greater than the MCLG of zero) and the possible MCLG value. The maximum concentrations at less than 0.4% of NAWQA sampling locations exceed the current MCL and the maximum concentration at only one location exceeds the possible MCLG. **Exhibit 4-3** presents a spatial representation of the NAWQA data. **Exhibit 4-4** shows alachlor raw water concentrations from the PDP database. None of the samples contained alachlor concentrations that exceeded either the current MCL or possible MCLG. Together, data from these sources indicate minimal occurrence of this contaminant above the current MCLG and the higher possible MCLG value.

Exhibit 4-2. Summary of Alachlor Occurrence in NAWQA – Number and Percent of Locations by Location Type

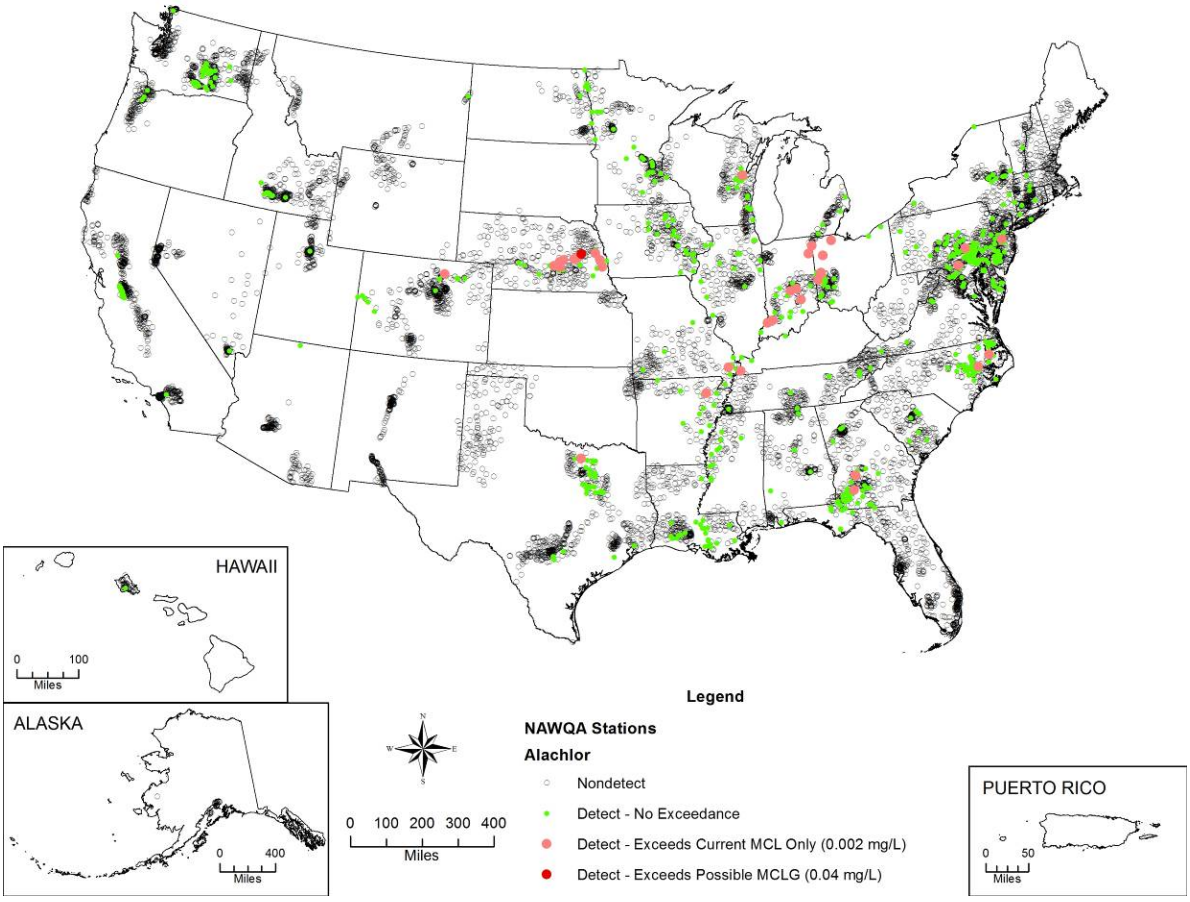
Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	2,371 (100%)	8,702 (100%)	211 (100%)	11,284 (100%)
All samples are nondetects[1]	1,813 (76.5%)	8,578 (98.6%)	203 (96.2%)	10,594 (93.9%)
At least one detection	558 (23.5%)	124 (1.4%)	8 (3.8%)	690 (6.1%)
Maximum concentration exceeds current MCL[2] (0.002 mg/L)	33 (1.4%)	4 (<0.1%)	0 (0%)	37 (0.3%)
Maximum concentration exceeds possible MCLG (0.04 mg/L)	1 (<0.1%)	0 (0%)	0 (0%)	1 (<0.1%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.038 to 0.1 mg/L; the mode is 0.000002 mg/L.

2. 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 4-3. NAWQA Occurrence Data for Alachlor Based on Maximum Sample Values



Source: USGS, 2015a

Exhibit 4-4. Summary of Alachlor Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program (2007 - 2013)

Occurrence Result	Number of Samples (% total samples)
Total Samples	2,405 (100%)
Detected quantity [1]	24 (1%)
Exceeds current MCL (0.002 mg/L)	0 (0%)
Exceeds possible MCLG (0.04 mg/L)	0 (0%)

Source: USDA, 2014a; 2014b; 2013; 2012; 2011; 2009; and 2008.

1. Detected quantities range from 1.3 X 10^{-5} mg/L to 7.5 X 10^{-5} mg/L. Detection limits range from 1.0 X 10^{-5} mg/L to 9.8 X 10^{-6} mg/L.

4.3.2 Barium

Exhibit 4-5 provides a comparison of maximum barium concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-6** 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.

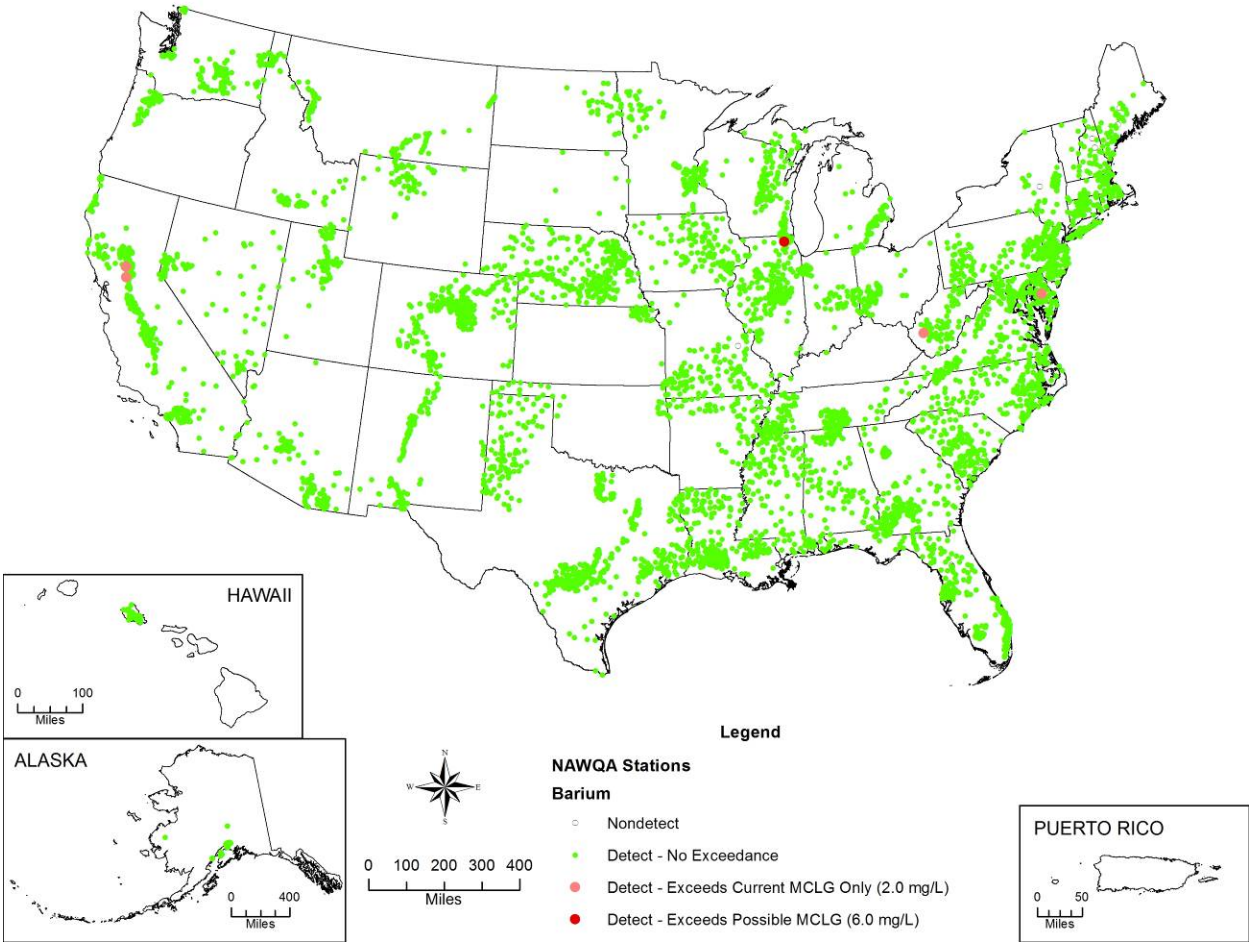
Exhibit 4-5. Summary of Barium Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	523 (100%)	6,934 (100%)	9 (100%)	7,466 (100%)
All samples are nondetects[1]	1 (0.2%)	31 (0.4%)	1 (11.1%)	33 (0.4%)
At least one detection	522 (99.8%)	6,903 (99.6%)	8 (88.9%)	7,433 (99.6%)
Exceeds current MCLG (2.0 mg/L)	0 (0%)	5 (0.1%)	0 (0%)	5 (0.1%)
Exceeds possible MCLG (6.0 mg/L)	0 (0%)	1 (<0.1%)	0 (0%)	1 (<0.1%)

Source: USGS, 2015s (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.00001 to 0.185 mg/L; the mode is 0.001 mg/L.

Exhibit 4-6. NAWQA Occurrence Data for Barium Based on Maximum Sample Values



Source: USGS, 2015a

4.3.3 Beryllium

Exhibit 4-7 provides comparisons of maximum beryllium concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-8** 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 possible MCLG.

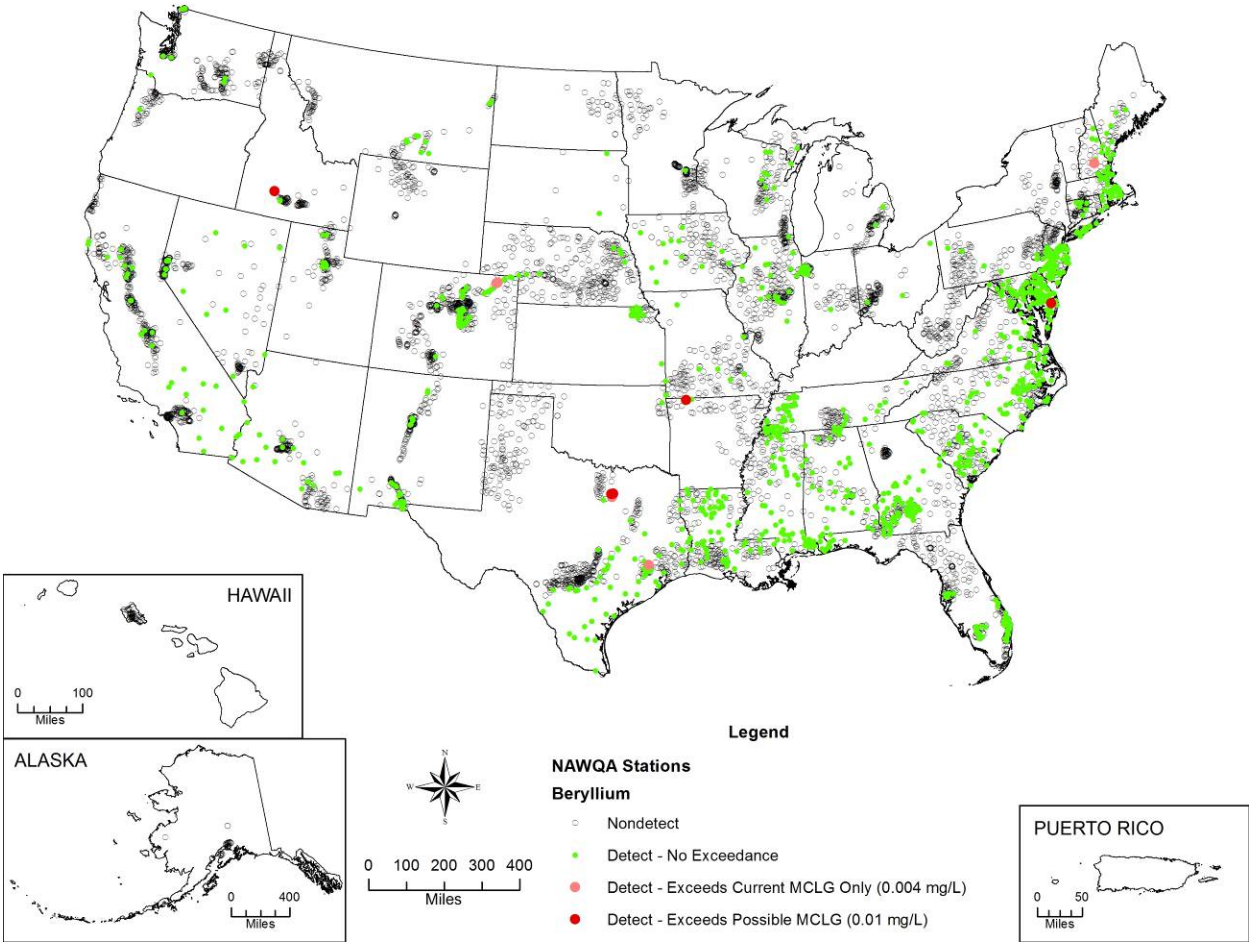
Exhibit 4-7. Summary of Beryllium Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	487 (100%)	6913 (100%)	4 (100%)	7404 (100%)
All samples are nondetects[1]	465 (95.5%)	5679 (82.1%)	4 (100%)	6148 (83.0%)
At least one detection	22 (4.5%)	1234 (17.9%)	0 (0%)	1256 (17.0%)
Exceeds current MCLG (0.004 mg/L)	2 (0.4%)	8 (0.1%)	0 (0%)	10 (0.1%)
Exceeds possible MCLG (0.01 mg/L)	2 (0.4%)	3 (<0.1%)	0 (0%)	5 (0.1%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.000006 to 0.032 mg/L; the mode is 0.001 mg/L.

Exhibit 4-8. NAWQA Occurrence Data for Beryllium Based on Maximum Sample Values



Source: USGS, 2015a

4.3.4 1,1-Dichloroethylene

Exhibit 4-9 provides a comparison of maximum 1,1-dichloroethylene concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-10** 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.

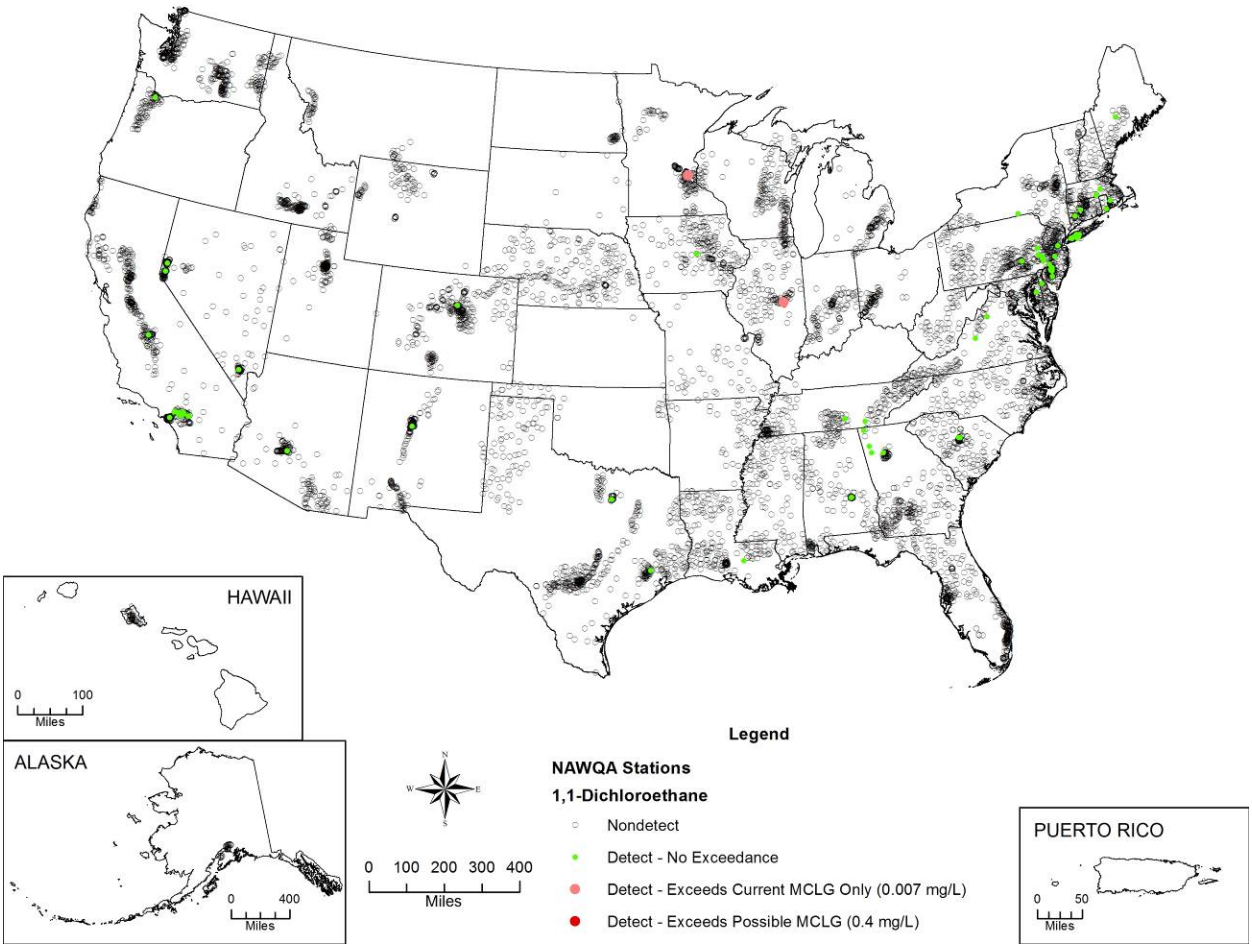
Exhibit 4-9. Summary of 1,1-Dichloroethylene Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	262 (100%)	7,523 (100%)	197 (100%)	7,982 (100%)
All samples are nondetects[1]	254 (96.9%)	7,450 (99.0%)	192 (97.5%)	7,896 (98.9%)
At least one detection	8 (3.1%)	73 (1.0%)	5 (2.5%)	86 (1.1%)
Exceeds current MCLG (0.007 mg/L)	1 (0.4%)	1 (<0.1%)	0 (0%)	2 (<0.1%)
Exceeds possible MCLG (0.4 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.00002 to 0.1 mg/L; the mode is 0.00004 mg/L.

Exhibit 4-10. Plot of 1-1-Dichloroethylene NAWQA Occurrence Data



Source: USGS, 2015a

4.3.5 2,4-D

Exhibit 4-11 provides comparisons of maximum 2,4-D concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-12** presents a spatial representation of the NAWQA data. The NAWQA data indicate that only one of the sampling locations for this contaminant had a maximum concentration between the current MCLG and the possible MCLG values. **Exhibit 4-13** shows 2,4-D raw water concentrations from the PDP database. Data from both sources indicate little occurrence of this contaminant above the current MCLG and no occurrence above the higher possible MCLG values.

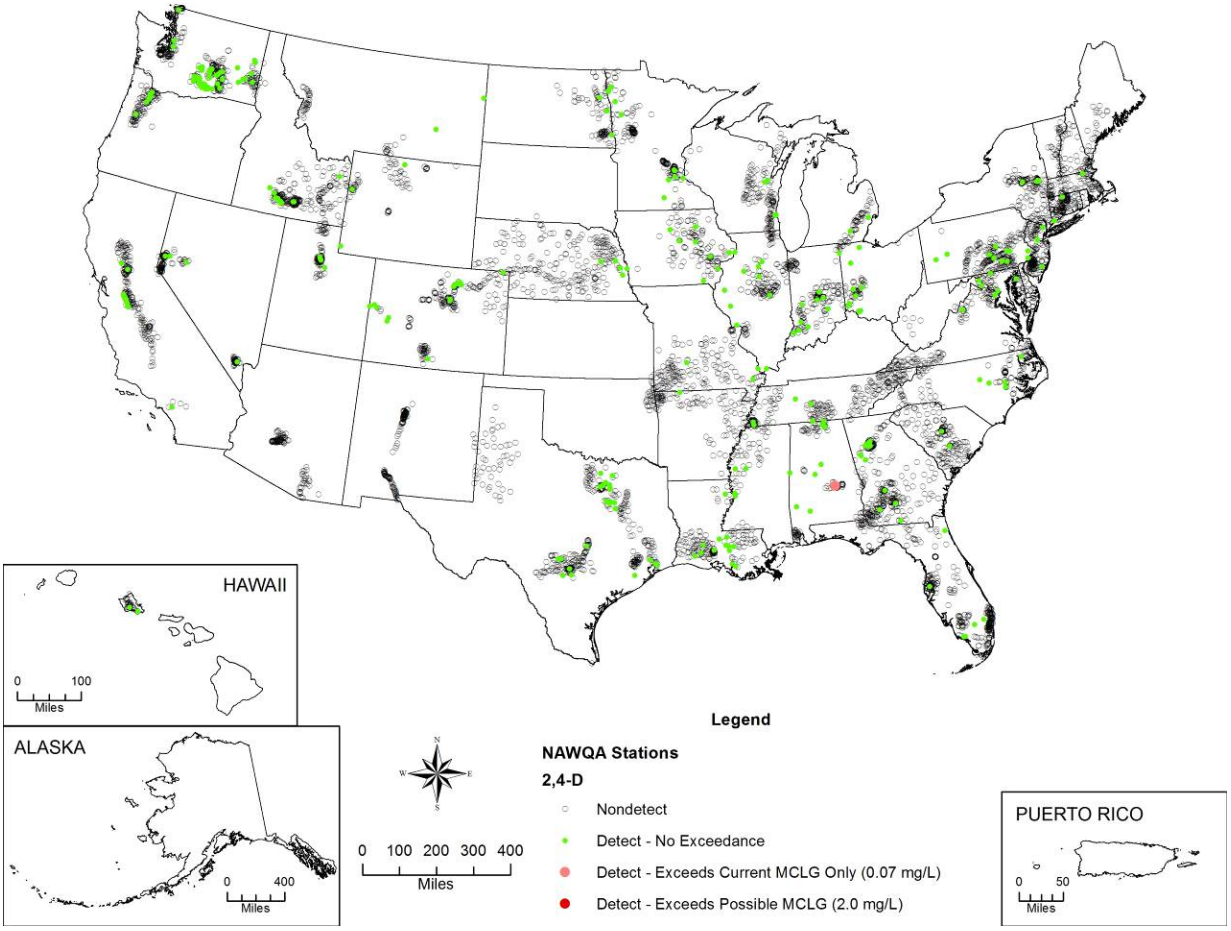
Exhibit 4-11. Summary of 2,4-D Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	1,083 (100%)	5,729 (100%)	167 (100%)	6,979 (100%)
All samples are nondetects[1]	774 (71.5%)	5,707 (99.6%)	157 (94.0%)	6,638 (95.1%)
At least one detection	309 (28.5%)	22 (0.4%)	10 (6.0%)	341 (4.9%)
Exceeds current MCLG (0.07 mg/L)	1 (0.1%)	0 (0%)	0 (0%)	1 (<0.1%)
Exceeds possible MCLG (2 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.000013 to 0.00083 mg/L; the mode is 0.000035 mg/L.

Exhibit 4-12. Plot of 2,4-D NAWQA Occurrence Data



Source: USGS, 2015a

Exhibit 4-13. Summary of 2,4-D Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program (2007 - 2013)

Occurrence Result	Number of Samples (% total samples)
Total Samples	2,400 (100%)
Detected quantity [1]	1467 6(1%)
Exceeds current MCLG (0.07 mg/L)	0 (0%)
Exceeds possible MCLG (2 mg/L)	0 (0%)

Source: USDA, 2014a; 2014b; 2013; 2012; 2011; 2009; and 2008.

1. Detected quantities range from 0.004 mg/L to 1.0 X 10^{-6} mg/L. Detection limits range from 9.0 X 10^{-5} mg/L to7.0 X 10^{-7} mg/L.

4.3.6 Diquat

Water quality results for diquat were not available in NAWQA. To characterize potential source water occurrence, EPA obtained pesticide application estimates because the primary uses of diquat are as an algaecide, defoliant, desiccant, and herbicide (USEPA, 1995a).

As Exhibit 3-26 and Exhibit 3-27 show, the annual diquat application to crops is generally about 0.2 million pounds. These estimates do not include non-agricultural applications, however. Pesticide application data from California indicate the potential for crop usage estimates to understate total diquat use. The State maintains a comprehensive pesticide use reporting database. **Exhibit 4-14** provides a summary of detailed pesticide application estimates for 2012. Major non-crop used include right-of-way (49,773 pounds), landscape maintenance (14,411 pounds), and water plant treatment (4,160 pounds). The top crop uses were alfalfa (16,796 pounds) and potatoes (5,098 pounds). Total diquat use is almost four times higher than reported crop use.

Exhibit 4-14. Crop and Noncrop Diquat Application for California in 2012

Use[1]	Pounds	Percent of Total
Crop Application	23,970	27%
Non Crop Application	64,864	73%
Total Application	88,834	100%

Source: California Department of Pesticide Regulation, 2013.

1. Crop total comprises the following use categories: alfalfa, almonds, figs, grapes, olive, peach, pistachio, pomegranate, potato, strawberry, tangerine, and uncultivated agriculture. Non-crop total includes all other use categories.

Of the pesticides addressed in this document, only lindane has lower national usage rates than diquat. **Exhibit 4-15** provides national crop use estimates for diquat and the other pesticides included in this report that were developed by USGS. These data suggest that even if the actual national use of diquat is several times greater than the crop use estimate indicates, the usage rate for diquat would be one of the lowest in terms of pounds applied.

Exhibit 4-15. National Pesticide Use for Crops (2000 to 2009, pounds)

Pesticide	Low	High
2,4-D	297,373,764	326,500,950
Alachlor	45,414,057	91,001,139
Diquat	1,939,863	2,157,264
Lindane	109,614	259,637
Picloram	13,591,501	17,472,227

Source: Thelin and Stone, 2013

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 unlikely 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, 1995a). These factors indicate the possibility of low occurrence in drinking water sources.

4.3.7 Lindane

Exhibit 4-16 provides a comparison of maximum lindane concentrations for locations in the NAWQA database with the current MCLG and the possible MCLG value. **Exhibit 4-17** 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 value. **Exhibit 4-18** shows lindane raw water concentrations from the PDP database. Data from both sources indicate almost no occurrence of this contaminant above the current MCLG and no occurrence above the higher possible MCLG value.

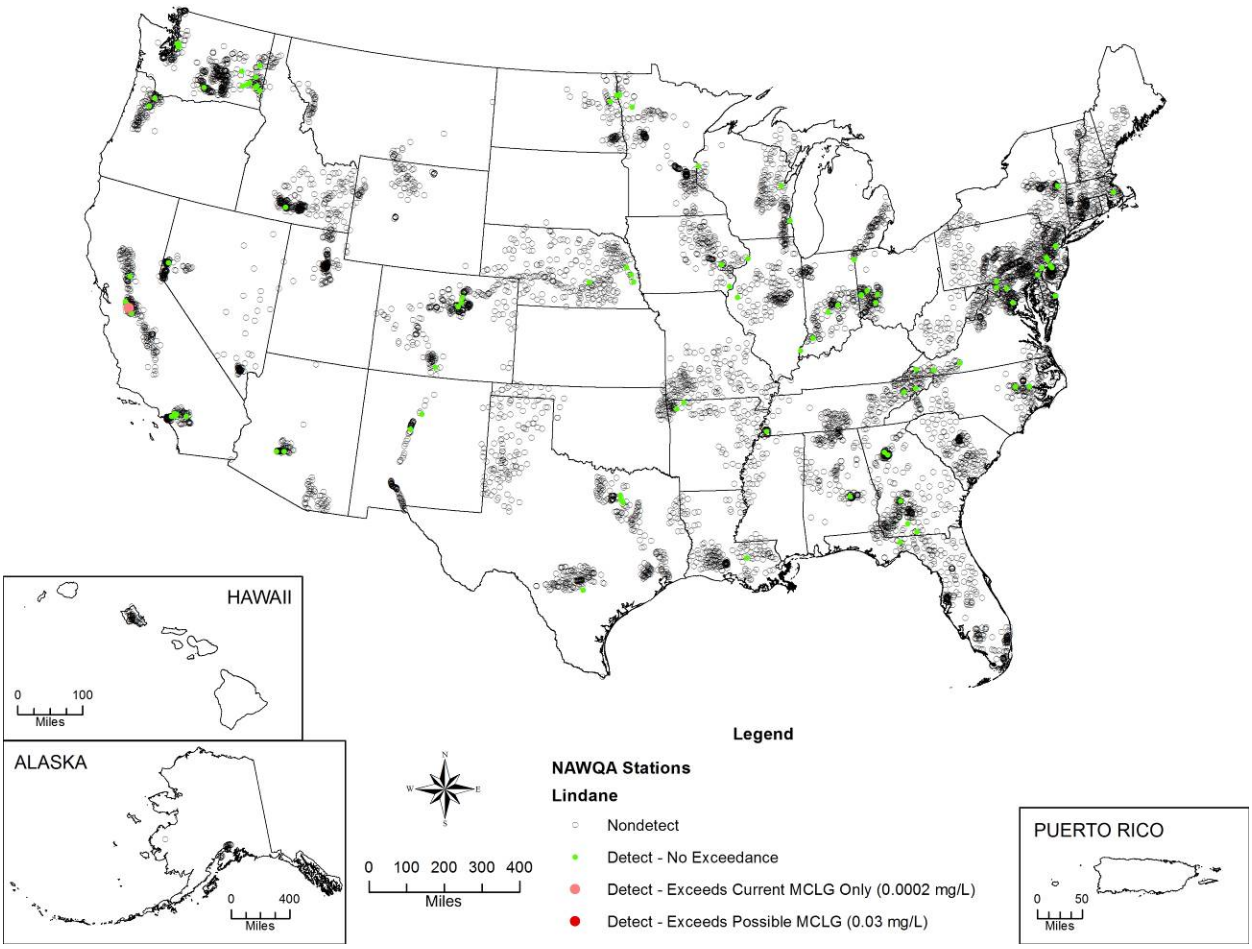
Exhibit 4-16. Summary of Lindane Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	1994 (100%)	6766 (100%)	6 (100%)	8766 (100%)
All samples are nondetects[1]	1891 (94.8%)	6758 (99.9%)	6 (100%)	8655 (98.7%)
At least one detection	103 (5.2%)	8 (0.1%)	0 (0%)	111 (1.3%)
Exceeds current MCLG (0.0002 mg/L)	1 (0.1%)	0 (0%)	0 (0%)	1 (<0.1%)
Exceeds possible MCLG (0.03 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.000001 to 0.0939 mg/L; the mode is 0.000004 mg/L.

Exhibit 4-17. Plot of Lindane NAWQA Occurrence Data



Source: USGS, 2015a

Exhibit 4-18. Summary of Lindane Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program (2007 - 2013)

Occurrence Result	Number of Samples (% total samples)
Total Samples	1,881 (100%)
Detected quantity [1]	3 (0%)
Exceeds current MCL (0.0002 mg/L)	0 (0%)
Exceeds possible MCLG (0.03 mg/L)	0 (0%)

Source: USDA, 2014a; 2014b; 2013; 2012; 2011; 2009; and 2008.

1. Detected quantities range from 1.0 X 10^{-4} mg/L to 3.3 X 10^{-5} mg/L. Detection limits range from 1.0 X 10^{-5} mg/L to 2.0 X 10^{-5} mg/L.

4.3.8 Picloram

Exhibit 4-19 provides a comparison of maximum picloram concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-20** presents a spatial representation of the NAWQA data. **Exhibit 4-21** shows picloram raw water concentrations from the PDP database. Data from both sources indicate no occurrence of this contaminant above the current MCLG and the higher possible MCLG values.

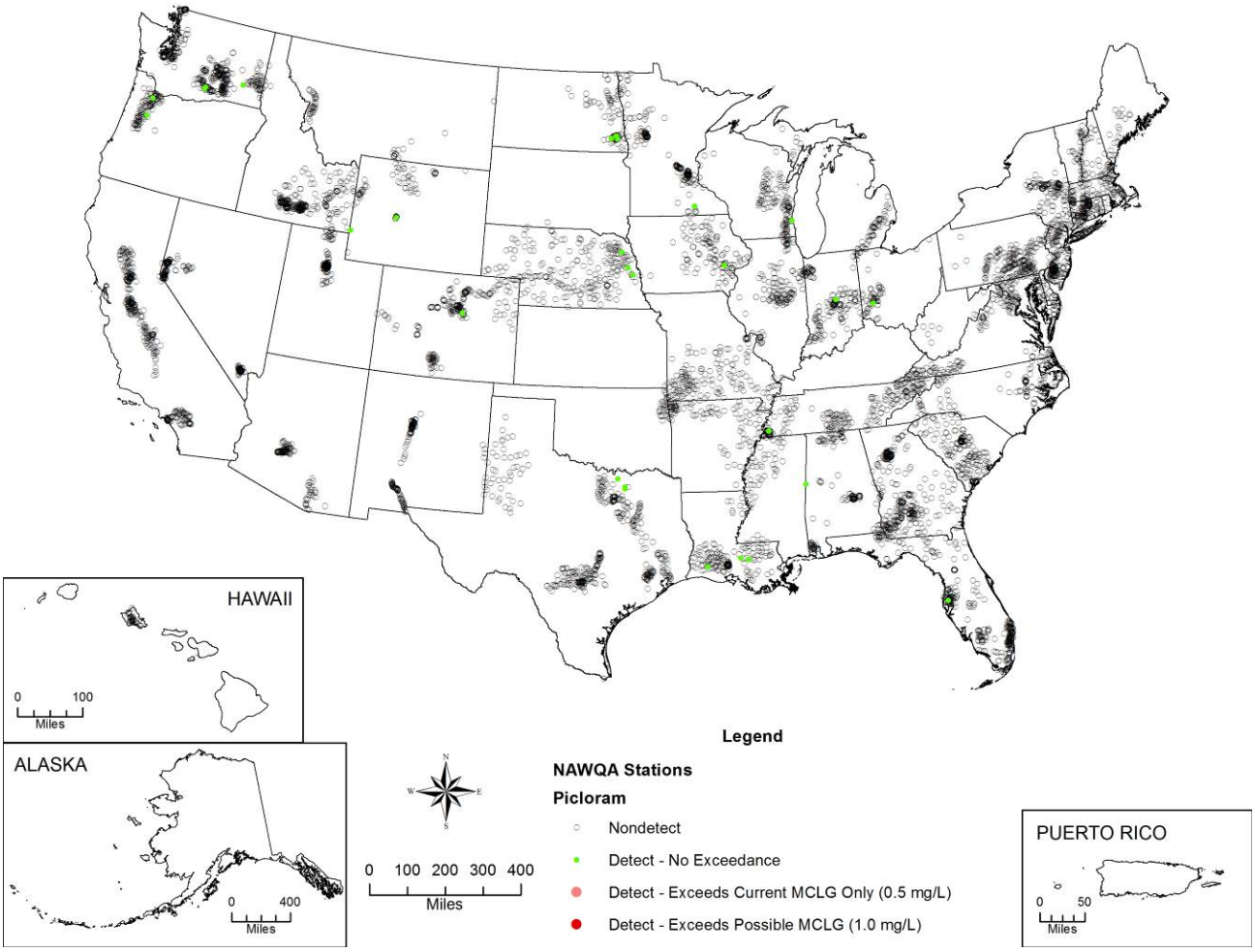
Exhibit 4-19. Summary of Picloram Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	1081 (100%)	5790 (100%)	174 (100%)	7045 (100%)
All samples are nondetects[1]	1065 (98.5%)	5777 (99.8%)	174 (100%)	7016 (99.6%)
At least one detection	16 (1.5%)	13 (0.2%)	0 (0%)	29 (0.4%)
Exceeds current MCLG (0.5 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.0000198 to 0.00073 mg/L; the mode is 0.00005 mg/L.

Exhibit 4-20. Plot of Picloram NAWQA Occurrence Data



Source: USGS, 2015a

Exhibit 4-21. Summary of Picloram Occurrence for Raw Water Samples in USDA Agricultural Marketing Service Pesticide Data Program (2007 - 2013)

Occurrence Result	Number of Samples (% total samples)
Total Samples	2,407 (100%)
Detected quantity [1]	25 (1%)
Exceeds current MCLG (0.5 mg/L)	0 (0%)
Exceeds possible MCLG (1.0 mg/L)	0 (0%)

Source: USDA, 2014a; 2014b; 2013; 2012; 2011; 2009; and 2008.

1. Detected quantities range from 3.0×10^{-4} mg/L to 2.0×10^{-5} mg/L. Detection limits range from 4.0×10^{-4} mg/L to 1.0×10^{-5} mg/L.

4.3.9 1,1,1-Trichloroethane

Exhibit 4-22 provides a comparison of maximum 1,1,1-trichloroethane concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-23** 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.

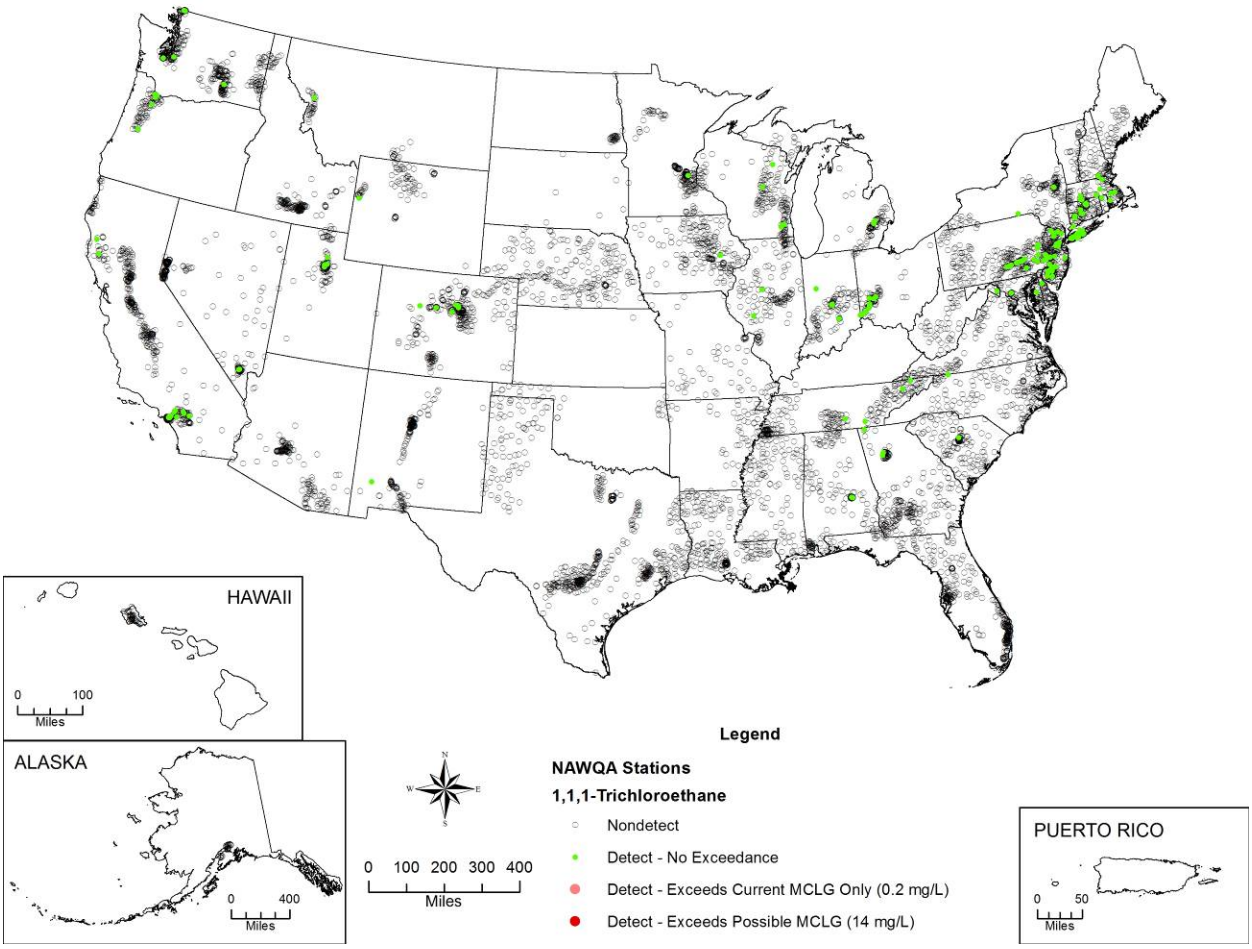
Exhibit 4-22. Summary of 1,1,1-Trichloroethane Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	261 (100%)	7,522 (100%)	197 (100%)	7,980 (100%)
All samples are nondetects[1]	247 (94.6%)	7,350 (97.7%)	194 (98.5%)	7,791 (97.6%)
At least one detection	14 (5.4%)	172 (2.3%)	3 (1.5%)	189 (2.4%)
Exceeds current MCLG (0.2 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Exceeds possible MCLG (14 mg/L)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.00002 to 0.1 mg/L; the mode is 0.000032 mg/L.

Exhibit 4-23. Plot of 1,1,1-Trichloroethane NAWQA Occurrence Data



Source: USGS, 2015a

4.3.10 1,2,4-Trichlorobenzene

Exhibit 4-24 provides a comparison of maximum 1,2,4-trichlorobenzene concentrations for locations in the NAWQA database with the current MCLG and possible MCLG values. **Exhibit 4-25** 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.

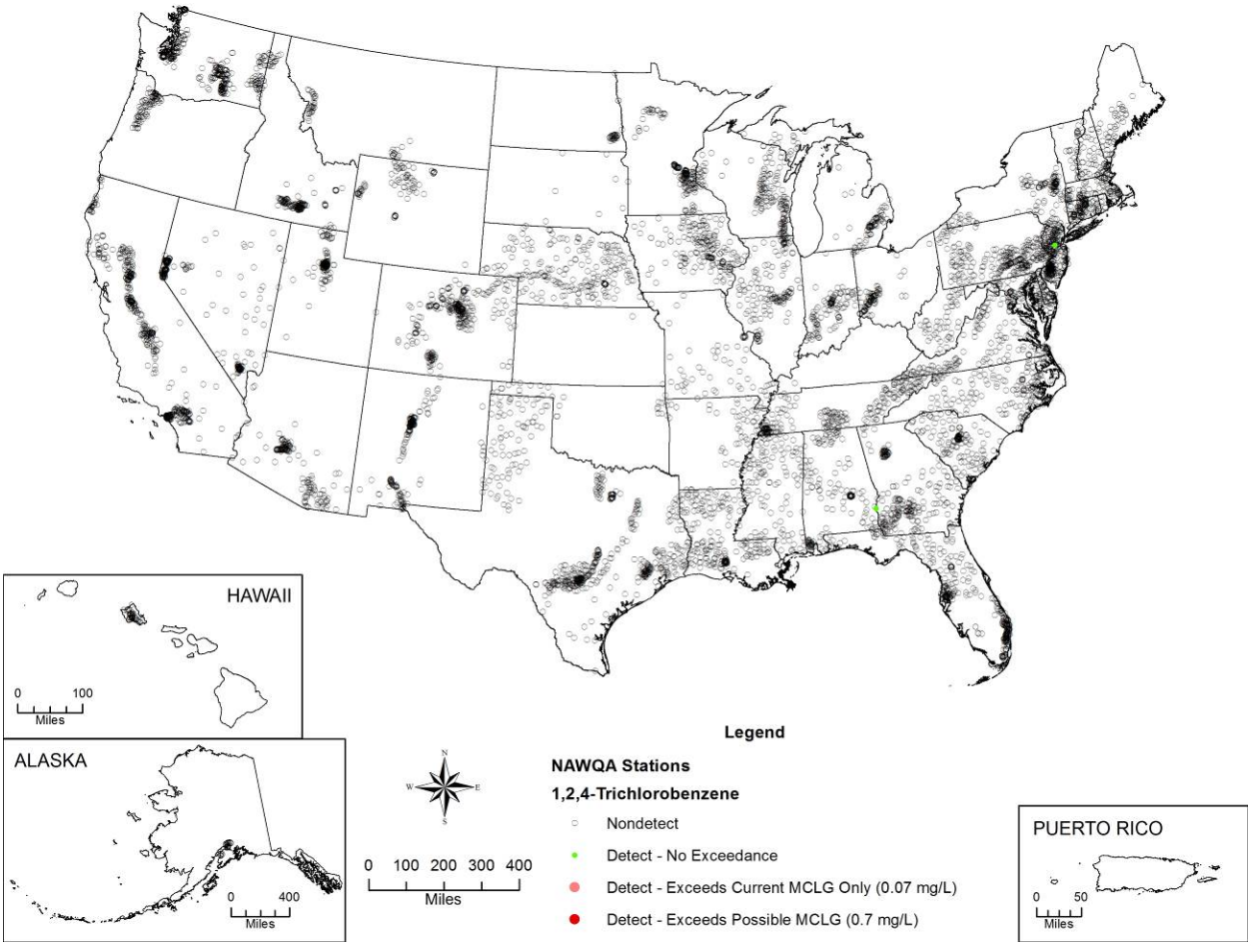
Exhibit 4-24. Summary of 1,2,4-Trichlorobenzene Occurrence in NAWQA – Number and Percent of Locations by Location Type

Occurrence Result	Surface Water Locations	Ground Water Locations	Other Locations	Total Locations
Total locations	253 (100.0%)	7558 (100.0%)	197 (100.0%)	8008 (100.0%)
All samples are nondetects[1]	252 (99.6%)	7557 (100.0%)	197 (100.0%)	8006 (100.0%)
At least one detection	1 (0.4%)	1 (0.0%)	0 (0.0%)	2 (0.0%)
Maximum concentration exceeds current MCL (0.07 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Maximum concentration exceeds possible MCLG (0.7 mg/L)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Source: USGS, 2015a (national data from 1991 to 2014; estimates based on maximum sample values at each location).

1. The detection limits range from 0.04 to 12.0 mg/L; the mode is 0.12 mg/L.

Exhibit 4-25. Plot of 1,2,4-Trichlorobenzene NAWQA Occurrence Data



Source: USGS, 2015a

5. Conclusions

In its third Six-Year Review, EPA identified the potential to increase the MCLG for several contaminants based on new health effects information. A possible MCLG increase and accompanying MCL increase raises the possibility of cost savings to 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 source water, the specific treatment technology in use, and the extent to which co-occurring contaminants can affect decisions to change treatment operation. **Exhibit 5-1** and **Exhibit 5-2** present a summary of this information.

Exhibit 5-1. Summary of Potential for Cost Savings Based on Source Water Concentrations

Contaminant	Magnitude of MCLG Increase[1]	NAWQA – Exceed the Current MCLG	NAWQA – Exceed the Possible MCLG	PDP– Exceed the Current MCLG	PDP– Exceed the Possible MCLG
Alachlor	20	0.3%	<0.1%	0%	0%
Barium	3	0.1%	<0.1%	--	--
Beryllium	2.5	0.1%	0.1%	--	--
1,1-Dichloroethylene	57	<0.1%	0%	--	--
2,4-D	29	<0.1%	0%	0%	0%
Diquat	2	--	--	--	--
Lindane	150	<0.1%	0%	0%	0%
Picloram	2	0%	0%	0%	0%
1,1,1-Trichloroethane	70	0%	0%	--	--
1,2,4-Trichlorobenzene	10	0%	0%	--	--

--: No data were available.

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

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 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. The TRI release data indicate relatively widespread releases for barium, beryllium, and 1,1-dichloroethylene, but sparse releases of the other contaminants. The USGS pesticide use maps show widespread applications of 2,4-D and picloram, more limited applications of alachlor and diquat, and no application of lindane since 2011. Despite these environmental release patterns, water quality data from the NAWQA Program and PDP indicate minimal occurrence above current MCLG or MCL values. EPA notes that these monitoring datasets are not based on

random or representative sampling events. Furthermore, the datasets include samples from water resources that are not drinking water sources. Therefore, these datasets cannot be used directly to derive quantitative estimates of national occurrence in drinking water sources.

Exhibit 5-2. Summary of Potential for Cost Savings Based on Treatment Technology

Contaminant	Best Available Technology	Cost Savings Potential	Co-occurring Contaminants Limit Savings?
Alachlor	Granular Activated Carbon	High	Yes
Barium	Ion Exchange	High	Yes
	Lime Softening	Moderate	Yes
	Reverse Osmosis	Low	Yes
	Electrodialysis	Low	Yes
Beryllium	Activated Alumina	High	Yes
	Coagulation Filtration	Moderate	Yes
	Ion Exchange	High	Yes
	Lime Softening	Moderate	Yes
	Reverse Osmosis	Low	Yes
1,1-Dichloroethylene	Packed Tower Aeration	Low	Yes
	Granular Activated Carbon	High	Yes
2,4-D	Granular Activated Carbon	High	Yes
Diquat	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
1,2,4-Trichlorobenzene	Packed Tower Aeration	Low	Yes
	Granular Activated Carbon	High	Yes

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 indicate that alachlor, barium, beryllium, 1,1-dichlorethylene, 2,4-D, and lindane occur in concentrations that exceed current MCLG values. Only alachlor, barium, and beryllium occur in concentrations that exceed the possible MCLG values, and these exceedances are rare. Three contaminants – picloram, 1,1,1-trichlorethane, and 1,2,4-trichlorobenzene – are not found at levels above either the current MCLG or the possible MCLG. Diquat, which is not included in the either the NAWQA or PDP datasets, may occur infrequently in source water given less frequent use compared to the other pesticides in the table based on usage patterns (alachlor, lindane, and picloram) and the tendency of diquat to dissipate quickly from surface water and be immobile in soils.

As Exhibit 5-2 shows, there is higher potential for operational cost savings for some BAT; however, co-occurrence considerations for all BAT could diminish the potential to alter treatment for possible higher MCLGs. 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 by drinking water systems to control these contaminants.

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.

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