Association of State and Territorial
ASTSWMO
Solid Waste Management Officials

Lead Scavengers Survey Report

FINAL

AUGUST 2014

Prepared by:
LUST Task Force

Association of State and Territorial Solid Waste Management Officials
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ASTSWMO is an organization supporting the environmental agencies of the States and Territories (States). ASTSWMO's mission is to enhance and promote effective State and Territorial programs for waste and materials management, to encourage environmentally sustainable practices and to affect relevant national waste and materials management policies. This report was prepared by the ASTSWMO Tanks Subcommittee's Leaking Underground Storage Tank (LUST) Task Force. The Task Force represents the unique concerns of State LUST Programs responsible for oversight, investigation, and remediation of releases of controlled substances from underground storage tanks (USTs). It serves as a liaison between State and Territorial LUST Programs and the U.S. Environmental Protection Agency (EPA), and acts as a clearinghouse for distributing technical information and ideas among State LUST regulatory officials.

ASTSWMO thanks the following Task Force members for their participation in development of this report:

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The LUST Task Force would like to thank all States that participated in providing information to ASTSWMO and helped make this document possible.

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EXECUTIVE SUMMARY

The lead scavengers ethylene dibromide (EDB) and 1,2-dichloroethane (DCA) remain a serious potential groundwater contaminant and risk to human health and the environment. These two compounds were present in leaded gasoline nationwide from the early 1920s to the late 1980s, and removed from leaded fuels in the late 1980s due to the potential risks lead pose. EDB and 1,2-DCA persist in the environment today due to historic releases from underground storage tank (UST) systems, as concluded in research completed by PhD. Falta of Clemson University and the State of South Carolina in 2004.

In response to this research, the ASTSWMO LUST Task Force and the U.S. Environmental Protection Agency's (EPA's) Office of Underground Storage Tanks (OUST) agreed to collaboratively investigate the potential occurrence of the lead scavengers at LUST sites. We completed this work in 2010 when U.S. EPA OUST issued a memorandum dated May 21, 2010, with the subject title, "Recommendation for State, Tribes, and EPA Regions to Investigate and Clean Up Lead Scavengers When Present at Leaking Underground Storage Tank (LUST) Sites" [**Appendix A**]. The memorandum recommends that regulators:

- Begin (or continue) to monitor and report the presence of the lead scavengers in groundwater at appropriate LUST sites;
- Analyze EDB (1,2-dibromoethane or ethylene dibromide) and 1,2-DCA (1,2-dichloroethane) using EPA Methods with the appropriate detection limits;
- Remediate the lead scavengers, aggressively when such constituents could threaten a source of drinking water; and
- Share information on the presence and remediation of these constituents.

In 2013, the LUST Task Force prepared an information request to identify what States are doing concerning the investigation and remediation of the lead scavengers. The Task Force sent the request to all States and 35 States responded.

Based on the answers from the States, the LUST Task Force found:

- There is still great variation from State to State on how lead scavenger issues are addressed;
- Due to the ASTSWMO LUST Task Force and U.S. EPA OUST investigating the lead scavenger issue, and U.S. EPA OUST issuing the May 21, 2010, lead scavenger memorandum, some States (9) began to look for the lead scavengers at LUST sites;

- In most States, the percentage of sites with the lead scavengers as a contaminant of concern is less than 20% of their total site population;

- The prevalence of sites with EDB and 1,2-DCA above a States Standards is about equal between the States, with a little less than one-third of States saying they have more sites with EDB above their Standard, a little less than one-third of States saying they have more sites with 1,2-DCA above their Standards, and slightly more than one-third saying they have an equal number of sites with EDB and 1,2-DCA above their State Standards;

- Approximately one-third of the States are keeping hard data on the prevalence of the lead scavengers, with most of these States being in U.S. EPA Regions IV and VII;

- Current remedial technologies appear to remediate lead scavengers (with the possible exception of monitored natural attenuation (MNA)); and

- The remediation of the lead scavengers almost always occurs in connection with the remediation of other contaminants of concern.

INTRODUCTION

Lead scavengers were introduced to gasoline in the early 1920s. Automotive gasoline produced prior to the 1920s caused premature ignition, leading to engine "knock" and reduced horsepower. Organic lead compounds added to gasoline were discovered to be effective at reducing "knock", but they also resulted in engine fouling. Lead scavengers (EDB and DCA) react with the lead in gasoline to form volatile lead halides during combustion, eliminating engine-fouling problems. Lead scavengers were added to all leaded gasoline until the late 1980s when leaded gasoline was phased out due to the health concerns that lead posed to human health and the environment. Releases of leaded gasoline from the 1920s through the 1980s occurred at tens of thousands of leaking underground storage tank LUST sites nationwide.

In the late 1980s and early 1990s, as many States struggled to develop LUST cleanup programs, lead was removed from gasoline and other compounds were added to reduce "knock" and improve air quality. Consequently, many of the State LUST cleanup programs believed lead scavenger contaminants of concern were not an issue to public health or the environment, and therefore did not set up appropriate safeguards to monitor for these compounds. Only a handful of State LUST cleanup programs monitored for the lead scavengers at LUST sites at the time.

In 2004, South Carolina, with the assistance of PhD Ron Falta of Clemson University, raised the issue of the lead scavengers remaining as a major risk at LUST sites. In 2004, the South Carolina Department of Public Health identified the lead scavenger EDB at approximately 50% of its LUST sites. Based on these findings, in 2004, the ASTSWMO LUST Task Force and the U.S. EPA OUST agreed to investigate the potential occurrence of the lead scavengers at LUST sites. Representatives from these groups formed a workgroup to assess the potential magnitude and distribution of the lead scavengers at LUST sites in order to develop an appropriate and effective response to this potential problem. The workgroup employed a three-phased approach for this investigation [http://www.epa.gov/oust/cat/leadscav.htm]:

> (1) compiled and evaluated background information gathered from published literature and select State databases to identify whether or not there were gaps in knowledge about lead scavengers,
>
> (2) collected sufficient information and data to plug the data gaps-if any-identified in Phase 1, and
>
> (3) based on the results of Phases 1 and 2, evaluated the potential magnitude of the problem and developed a response to this issue. This work occurred from 2004 through 2008.

The workgroup concluded that the lead scavengers were still present at LUST sites around the country at varying frequencies and concentrations. The information gathered from this effort resulted in the drafting of the report titled, *Natural Attenuation of the Lead Scavengers 1,2-Dibromoethane and 1,2-Dichloroethane (1,2-DCA) at Motor Fuel Release Sites and Implications for Risk Management*,

prepared by the U.S. EPA Office of Research and Development.[1] The prevalence of the lead scavengers varied around the country based on regional conditions such as geology, groundwater geochemistry, and other various factors. Based on the findings of this work, the ASTSWMO LUST Task Force sent a letter to U.S. EPA OUST Director Hoskinson on April 22, 2009, requesting that U.S. EPA OUST recommend that State tank programs and other stakeholders sample and analyze for the lead scavengers EDB and 1,2-DCA at sites where they could be present. U.S. EPA OUST issued a memorandum, subject *Recommendation for State, Tribes, and EPA Regions to Investigate and Clean Up Lead Scavengers When Present at Leaking Underground Storage Tank (LUST) Sites,* on May 21, 2010.

[1] http://nepis.epa.gov/Adobe/PDF/P1002UTI.pdf

U.S. EPA OUST MEMORANDUM, May 21, 2010

U.S. EPA OUST issued *Recommendation for State, Tribes, and EPA Regions to Investigate and Clean Up Lead Scavengers When Present at Leaking Underground Storage Tank (LUST) Sites* on May 21, 2010, recommending that States, Tribes and U.S. EPA Regions investigate and cleaning up the lead scavengers at LUST sites where they could be present. A copy of this memo is provided in **Appendix A** of this report. In the memo, U.S. EPA encouraged the following actions for situations in which U.S. EPA, States, and Tribes were either undertaking investigations and corrective action at LUST sites where leaded motor fuels are or were stored, or where they were requiring UST owners and operator to do so:

- Begin (or continue) to monitor and report the presence of the lead scavengers in groundwater at appropriate LUST sites;
- Analyze EDB (1,2-dibromoethane or ethylene dibromide) and 1,2-DCA (1,2-dichloroethane) using EPA Methods with the appropriate detection limits (see Table 2 in Appendix A);
- Remediate the lead scavengers, aggressively when such constituents could threaten a source of drinking water; and
- Share information on the presence and remediation of these constituents.

DEVELOPMENT OF LEAD SCAVENGERS REQUEST

In 2013, the ASTSWMO LUST Task Force discovered that the last survey of State LUST Programs concerning gasoline additives information was conducted in 2006 by the New England Interstate Water Pollution Control Commission (NEIWPCC). The Task Force decided to request updated information from States on current practices of sampling, analyzing for, and remediation of the lead scavengers. The Task Force completed the information request in 2013, which consisted of 12 main questions and follow up questions to several of the main questions. In August of 2013, ASTSWMO distributed the information to all States.

The Task Force designed the questions in a format that allowed the respondents to answer many questions by either estimating the results for the answer or by using quantitative information in their response. This was done to obtain the greatest number of responses. The questions sent to States are below:

<u>Lead Scavenger Monitoring</u>

1. Does your State routinely monitor for the lead scavengers, 1,2-DCA and EDB at LUST sites?
   a. Yes
   b. No
   c. Sometimes (please explain e.g. only sites that pre- date 1986 when lead was taken out of gasoline).

2. When did your State start monitoring for lead scavengers?
   a. Prior to 1990
   b. Prior to 1996 but after 1990
   c. Prior to 2000 but after 1996
   d. Prior to 2005 but after 2000
   e. After 2005

3. Assuming your State requires EPA Method 8260 for 1,2-DCA, what analysis does your State require for EDB?
   a. EPA Method 8011 or 504.1
   b. EPA Method 8260
   c. Other (please specify)_____

   If your State requirements vary on analysis, please explain when each analytical approach is to be use.

Prevalence of 1,2-DCA and EDB

1. At what percentage of sites in your State do you find the lead scavengers?

	EDB	1,2-DCA
0 %		
Between 1% & 20%		
Between 21% and 40%		
Between 41% and 60 %		
Between 61% and 80%		
Between 81% and 99%		
100%		

Are these answers estimates or hard numbers from databases?

2. At LUST sites, do you find more sites with EDB or 1,2-DCA above your State's standards?

Is the above answer an educated opinion or based on hard numbers from databases?

Remedial Techniques

1. What technologies are you currently using to remediate lead scavenger chemicals?

2. At what percentage of sites where lead scavengers have been detected is your State employing active remedial technologies to remediate soils and/or groundwater?

If the focus of the remediation is to remove BTEX compounds, is the active remediation alternative also effectively cleaning up the lead scavengers?

3. At what percentage of sites where lead scavengers have been detected is Monitored Natural Attenuation (MNA) the remedial alternative being used to remediate the site?

Is MNA effectively cleaning up the lead scavengers?

4. Do you have any sites where the sole focus of the remediation project is to address lead scavenger compounds in soil and/or groundwater?

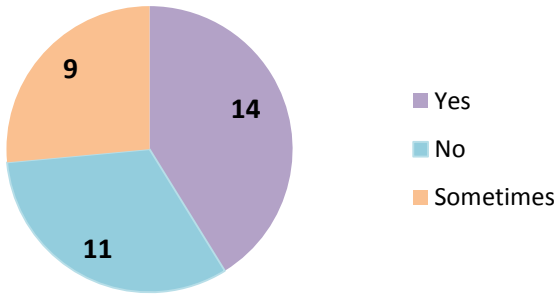
At the end of the two month response period, the ASTSWMO LUST Task Force members contacted States that did not respond in an attempt to obtain a higher response rate. By the end of 2013, 35 States responded to the questionnaire. Specific information received from States is provided in **Appendix B**.

SUMMARY OF RESULTS[2]

Does your State routinely monitor for lead scavengers, EDB and 1,2-DCA, at LUST sites?

Thirty four (34) States responded to this question. Fourteen (14) States answered "Yes", they do routinely monitor for the lead scavengers, 11 States answered "No", they do not routinely monitor for the lead scavengers, and nine (9) States answered that they "Sometimes" monitor for the lead scavengers **(Figure 1)**.

Figure 1: Number of States Monitoring for Lead Scavengers

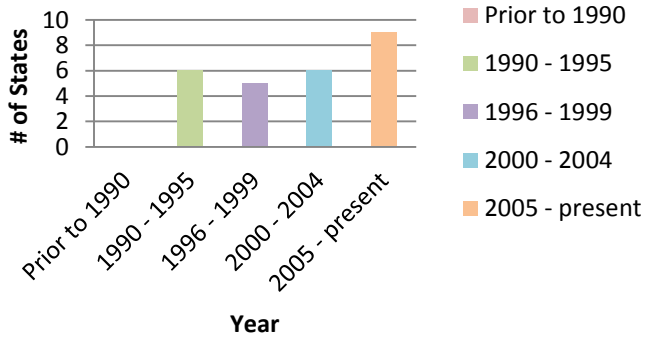


Some of the States that answered No to this question used to monitor for the lead scavengers but they stopped because they were not finding them. An evaluation of the responses does not indicate any clear patterns based on region of the country or size of the State.

When did your State start monitoring for lead scavengers?

The Task Force requested this information to determine if its previous work and U.S. EPA OUST's 2010 memorandum convinced States to begin looking for the lead scavengers. Twenty six (26) States responded to this question and are monitoring for the lead scavengers. Of these, zero (0) started looking prior to 1990, six (6) started looking between 1990-1995, five (5) started looking between 1996-1999, six (6) started looking between 2000-2004, and nine (9) started looking after 2005 (**Figure 2**).

Figure 2: When did States begin monitoring?

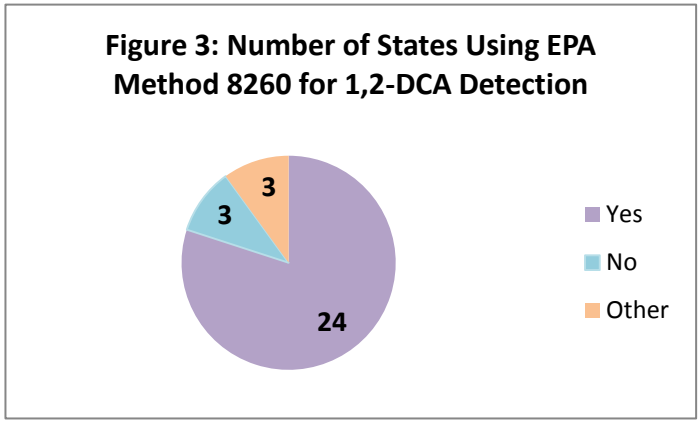


There is no clear pattern in the responses based on region of the country or size of the State. However, speaking in greater depth with several of the States revealed that some stopped monitoring when the lead scavengers were not located. The Task Force did not ask when States stopped monitoring for the lead scavengers in the information request.

[2] Click on the text for each question heading to go to the corresponding data in Appendix B.

Does your State require use of EPA Method 8260B to analyze for 1,2-DCA?

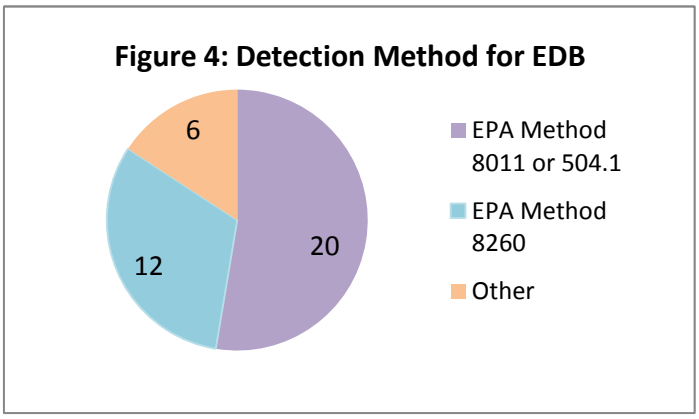
Thirty four (34) States responded to this question. Of these, 24 States responded "Yes", three (3) States responded "No," and three (3) States responded that they are using another analytical method to look for 1,2-DCA (**Figure 3**).



One State that answered No to this question provided that they used EPA Method 8260B analysis on groundwater samples for 1,2-DCA, but that their guidance document on this requirement was unclear so it is not always done. The State added that the guidance is being re-written and that this method would be required in the new guidance document.

What analysis does your State require for EDB? EPA Method 8011 or 504.1, EPA Method 8260, or another Method?

Thirty five (35) States responded to this question. Of these, 20 States responded that they use EPA Method 8011 [the environmental analysis with the lowest detection limits (detection limit as low as 0.01 ug/l)] or EPA Method 504.1 (this analysis is similar to the EPA Method 8011 analysis but for drinking water). Twelve (12) States indicated that they require EPA Method 8260 (with the lowest detection limit for EDB of 0.5 ug/l), and six (6) States indicated that they use another analytical method for the analysis of EDB. Eight (8) States provided that use several different methods to identify EBD in water samples (**Figure 4**).



Of the States that answered Other, one indicated that it uses 8260 SIM, an analytical method that has a lower detection limit of 0.01 ug/l), while another listed EPA Method 504.1, which was an error.

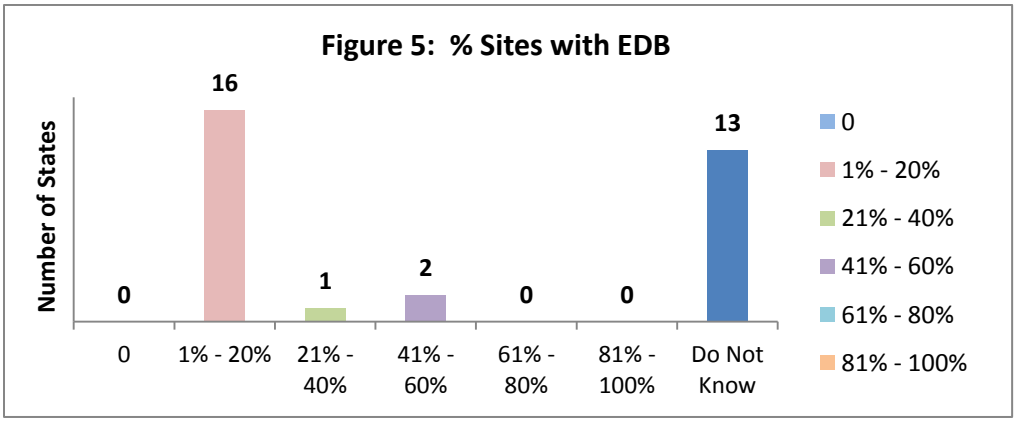
<u>Follow-up: If your State requirements vary on analysis, please explain when each analytical approach is to be used?</u>

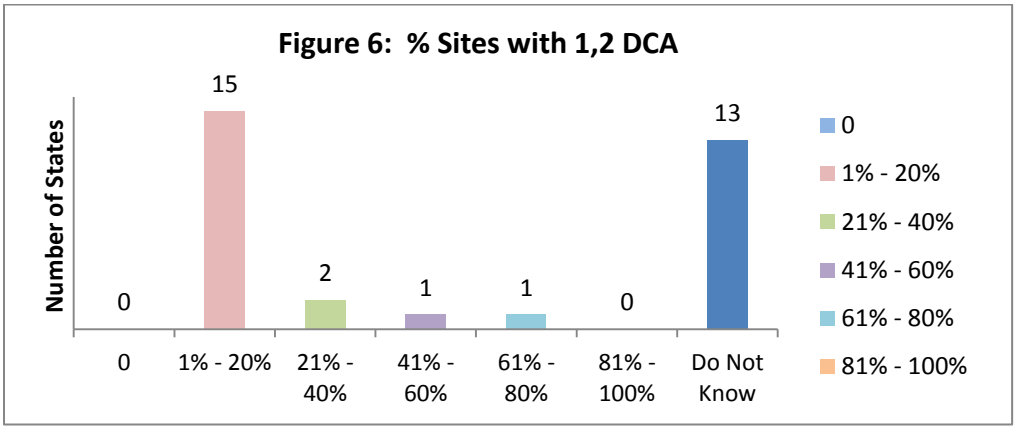
This follow-up question allowed States to explain when and how analytical approaches vary based on site-specific conditions. Appendix B provides the responses to this question. Examples of responses to this question include, "the 8011 and 8260 requirements noted above are for LUST Trust Sites only,"

"use of Method 8011 is required if there is a genuine possibility of a drinking water supply impact," and "8260B SIM."

At what percentage of sites in your State do you find the lead scavengers?

Thirty two (32) States responded to this question and results are broken down by the two lead scavengers, EDB and 1,2-DCA. No States responded that they have not detected either lead scavenger. Sixteen (16) States responded that between 1%-20% of their sites have either lead scavenger. One (1) State responded that 21%-40% of their sites are contaminated with EDB and two indicated that 21%-40% of their sites are contaminated with 1,2-DCA. Two (2) States responded that they have either EDB or 1,2-DCA at 40%-60% of their sites. No States responded that they have greater than 61% of their sites with the lead scavenger EDB, while one State responded that they have the lead scavenger 1,2-DCA at 61%-80% their sites. No States responded that they have greater than 80% of either of the lead scavengers. Thirteen (13) States responded that they do not know what percentage of their sites had the lead scavengers (**Figures 5 and 6**).



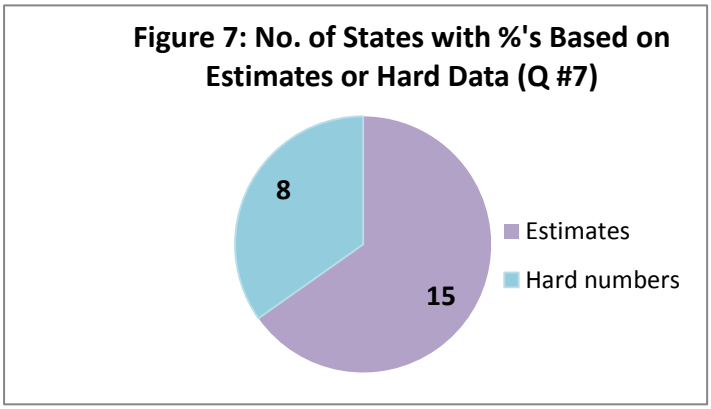


One State that answered it has 41%-60% of its sites contaminated with the lead scavengers indicated that it not sure what percentage of sites is contaminated with the lead scavengers; a possible anomaly with this question. One of the States that answered "Do Not Know" indicated that it has hard data on how many sites it has with the lead scavengers as a contaminant of concern. One State

added that it only has hard data on the percentage of sites contaminated with the lead scavengers (10%) for those funded by the American Recovery and Reinvestment Act (ARRA).

Follow-up: Of the States with reported percentages, are those numbers based on Estimates or Hard Data?

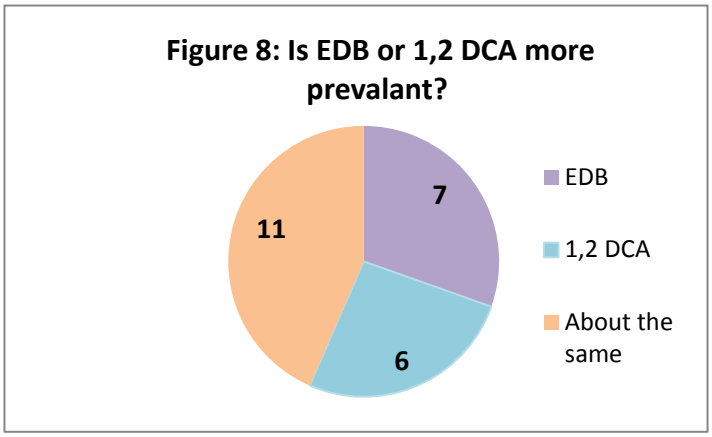
Twenty three (23) States responded to this question. Of these, eight (8) States indicated that the reported percentages are based on hard data and fifteen (15) States indicated that reported percentages are based on Estimates (**Figure 7**).



The States that responded that they have hard data in answering this question are mostly found in U.S. EPA Region IV (the southeast) and U.S. EPA Region VII (the mid-west). These States are also those that have had the greatest problem with lead scavenger contamination at LUST sites.

At LUST sites, do you find more sites with EDB or 1,2-DCA above your States Standards?

Twenty four (24) States responded to this question. Of these States, seven (7) States responded that they have found EDB above their States Standards more than 1,2-DCA, six (6) States responded that they have found 1,2-DCA above their States Standards more than EDB, and eleven (11) States responded that they found about the same number of sites with EDB and 1,2-DCA above their State Standards **(Figure 8).**



Although there was no strong relationship between the contaminant most found at sites and regions of the country, four of the seven States that reported finding more sites above State Standards for EDB are located in the southeastern part of the country, and five of the six States that reported more sites above State Standards for 1,2-DCA are located in the northern part of the country. States reporting that the amount of sites above State Standards for both EDB and 1,2-DCA are spread throughout the country in all regions.

Follow-up: Of the States with reported percentages, are those numbers based on Estimates or Hard Data?

Twenty five (25) States responded to this question. Of these, eight (8) States reported that its figures are based on Hard Data and Seventeen (17) States reported that its figures are based on Estimates.

The States that responded that they have hard data are mostly found in U.S. EPA Region IV (the southeast) and U.S. EPA VII (the mid-west). These States are also those that have had the greatest problem with lead scavenger contamination at LUST sites.

What technologies are you currently using to remediate lead scavenger chemicals?

Twenty nine (29) States responded to this question. Most States responded that remedial technologies that work on other petroleum constituents work well on the lead scavengers. Answers to this question included soil vapor extraction, pump and treat approaches, air sparging, soil removal, and other innovative technologies.

At what percentage of sites where lead scavengers have been detected is your State employing active remedial technologies to remediate soils and/or groundwater?

Thirty two (32) States responded to this question. The percentages vary widely among States, from no lead scavengers detected at LUST sites to less than 5% for one State to 5% for one State to a high of 70-75% in three different States. Most States fell in the range of between 5% to 70% of sites with the lead scavengers being actively remediated. Ten (10) States responded that either they 1) do not know, 2) the lead scavengers are not a driver in remediation, or 3) they are unsure.

Follow-up: If the focus of the remediation is to remove BTEX compounds, is the active remediation alternative also effectively cleaning up the lead scavengers?

Of the States that answered this question, most indicated that many or all of the lead scavenger sites where active remediation is being performed to remediate other petroleum constituents are also successfully remediating the lead scavengers. Seven (7) States responded that they are unsure or do not know if the lead scavengers are being remediated during the cleanup of the site.

At what percentage of sites where lead scavengers have been detected is Monitored Natural Attenuation (MNA) the remedial alternative being used to remediate the site?

Twenty eight (28) States answered this question. Answers ranged from 0% for a number of States, to a high of 70-80% for one State, and a high of 95% in another State. Four (4) States answered in the 30-50% range. A number of States do not know, and three (3) States said they do not use MNA on lead scavenger sites or any other LUST sites. One State added that it is not using MNA alone and is attempting to actively remediate all of their sites.

Follow-up: Is MNA effectively cleaning up the lead scavengers?

Of the 28 States that answered this question, three (3) States provided “yes,” two (2) States provided “sometimes”, and five (5) States provided “no.” Eleven States (11) indicated that they do not know. The remaining 12 States responded that the question is non-applicable.

Do you have any sites where the sole focus of the remediation project is to address lead scavenger compounds in soil and/or groundwater?

Twenty nine (29) States answered this question. Almost all of the States responded “no,” they do not have any sites where the sole focus of remediation is to address the lead scavengers. Of the two (2) States that answered “yes,” one State answered that it has only one site that is being remediated solely due to a lead scavenger, and the other indicated that is has fewer than five sites where the sole focus of remediation was the lead scavengers.

CONCLUSIONS

Based on the answers from the 35 States that responded to the survey, the ASTSWMO LUST Task Force has developed the following conclusions:

- There is still great variation from State to State on how lead scavenger issues are addressed;

- Due to the ASTSWMO LUST Task Force and U.S. EPA OUST investigating the lead scavenger issue, and U.S. EPA OUST issuing the May 21, 2010, lead scavenger memorandum, some States (9) began to look for the lead scavengers at LUST sites;

- In most States, the percentage of sites with the lead scavengers as a contaminant of concern is less than 20% of their total site population;

- The prevalence of sites with EDB and 1,2-DCA above a States Standards is about equal between the States, with a little less than one-third of States saying they have more sites with EDB above their Standard, a little less than one-third of States saying they have more sites with 1,2-DCA above their Standards, and slightly more than one-third saying they have an equal number of sites with EDB and 1,2-DCA above their State Standards;

- Approximately one-third of the States are keeping hard data on the prevalence of the lead scavengers, with most of these States being in U.S. EPA Regions IV and VII;

- Current remedial technologies appear to remediate the lead scavengers (with the possible exception of MNA); and

- The remediation of the lead scavengers almost always occurs in connection with the remediation of other contaminants of concern.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
Mail Code 5401G

21 MAY 2010

OFFICE OF SOLID
WASTE AND EMERGENCY
RESPONSE

MEMORANDUM

SUBJECT: Recommendation for States, Tribes and EPA Regions to Investigate and Clean Up Lead Scavengers When Present at Leaking Underground Storage Tank (LUST) Sites

FROM: Carolyn Hoskinson, Director
Office of Underground Storage Tanks

TO: UST/LUST Regional Division Directors, Regions 1-10
State UST/LUST Program Managers
Tribal UST/LUST Managers and Staff

The U.S. EPA Office of Underground Storage Tanks (OUST) has become aware that certain, sometimes significant, risks at some LUST sites may not be adequately assessed or analyzed under current practice. Lead scavengers, common additives in leaded gasoline, can pose risks particularly at LUST sites affecting drinking water. Monitoring for lead scavengers at LUST sites is not currently routine in all areas of the country. Therefore, in this memorandum, OUST is encouraging the following actions for situations in which EPA, states, and tribes are either undertaking investigations and corrective action at LUST sites where leaded motor fuels are or were stored, or where they are requiring UST owners and operators to do so:

- Begin (or continue) to monitor and report the presence of lead scavengers in groundwater at appropriate LUST sites (see Table 1);
- Analyze EDB (1,2-dibromoethane or ethylene dibromide) and 1,2-DCA (1,2-dichloroethane) using EPA Methods with the appropriate detection limits (see Table 2);
- Remediate lead scavengers, aggressively when such constituents could threaten a source of drinking water; and
- Share information on the presence and remediation of these constituents.

Because the primary threat posed by lead scavengers at LUST sites is to drinking water sources, OUST recommends particular attention be paid at sites where the presence of lead scavengers could threaten sources of drinking water. If lead scavengers are present and could threaten a source of drinking water, EPA strongly advises that states, tribes, and EPA Regions take or require UST owners and operators to take aggressive

remedial action to address the contamination and prevent human consumption of contaminated drinking water.

OUST recognizes the rather limited information available regarding the efficacy of remediation technologies for EDB. As our programs begin to collect data on the presence of lead scavengers at LUST sites and on the efficacy of remediation technologies, OUST encourages the sharing of this information to more effectively address the threat posed to drinking water sources. Such information can be forwarded to Hal White of my staff at *white.hal@epa.gov*. Our data sharing efforts will increase awareness and improve public understanding of activities underway by EPA, states, and tribes to protect human health and the environment from all chemicals of concern.

Background

Although leaded automotive gasoline was largely phased out by 1986, and banned by 1996, work conducted by EPA in cooperation with ASTSWMO has revealed that significant concentrations of lead scavengers continue to persist at many old leaded gasoline spill sites. Both EDB and 1,2-DCA were present in groundwater at concentrations above their respective maximum contaminant levels (MCLs) at a significant number of sites. EDB was detected above its MCL at 42% of the sites sampled and 1,2-DCA was detected above its MCL at 15% of the sites sampled. EDB was the primary risk driver at 25% of the sites investigated. In other words, the risks from EDB were greater at 25% of sites than risks from BTEX or other chemicals of concern. Despite previous assumptions that these constituents would biodegrade, analysis of product collected from monitoring wells showed further evidence of persistence as 55% of the samples contained EDB and 40% contained 1,2-DCA.

Under federal regulations, owners and operators must investigate contaminants released into the environment from their leaking USTs. 40 CFR 280.52(b) states: *Owners and operators must measure for the presence of a release where contamination is most likely to be present at the UST site. In selecting sample types, sample locations, and measurement methods, owners and operators must consider the nature of the stored substance, the type of initial alarm or cause for suspicion, the type of backfill, the depth of groundwater, and other factors appropriate for identifying the presence and source of the release.*

Similar requirements for owners and operators are found at 40 CFR 280.62(a)(5), 280.65(a), and 280.66(b).

Based on these regulations, it is reasonable for states, tribes, and EPA to require UST owners and operators, in considering the nature of the regulated substance in the UST, to conduct the appropriate investigations of lead scavengers at LUST sites that store or have stored leaded motor fuels. Depending upon site-specific conditions, it may be appropriate to sample soil, groundwater, and non-aqueous phase liquid (NAPL) for lead scavengers. EPA recommends that states, tribes, and EPA Regions, like owners and

operators, take similar action when they undertake their own investigations at such LUST sites.

Appropriate Sites for Investigation

Not all LUST sites are potential candidates for lead scavenger investigation. Only those sites at which leaded motor fuels were or are currently stored are appropriate candidate sites. Both off-road racing fuel and aviation gasoline (Avgas) are leaded fuels. LUST sites where these fuels have been or are still stored should generally be investigated for EDB and 1,2 DCA.

For investigations at LUST sites having stored on-road automotive gasoline, OUST recommends the consideration of when such gasoline was stored and whether the site presents a threat to drinking water. The 1990 Clean Air Act Amendments banned the sale of on-road automotive gasoline containing more than 0.05 gm lead/gallon ("leaded gasoline") by January 1, 1996; therefore, LUST sites where on-road automotive gasoline was stored only after this date would generally not be candidates for sampling for EDB or 1,2 DCA.

The phase-out of lead was achieved over a period of more than a decade. In the early 1970s, the average lead concentration was 4 gm/gallon, and in 1973 EPA mandated a reduction program designed to bring the levels of lead down to 0.5 gm/gallon by 1980 in large refineries and by 1982 in small refineries. Because the standard had not been met by these dates, in 1982 EPA adopted an interim standard of 1.10 gm/gallon with a further reduction to 0.10 gm/gallon to be achieved by 1986. USTs storing gasoline prior to 1986 would be expected to have contained leaded gasoline and these sites should be analyzed for EDB and 1,2 DCA.

The sale of leaded gasoline dropped precipitously after 1986; therefore, some USTs after the mid/late 1980s would not necessarily have been used for the storage of leaded gasoline. Investigators may use their knowledge of a site's history to assess the likelihood of whether leaded gasoline was stored in USTs on the premises between 1986 and 1996. Because the primary threat posed by lead scavengers at LUST sites is to drinking water sources, OUST recommends particular attention be paid at sites where the presence of lead scavengers could threaten sources of drinking water.

TABLE 1

Summary of Recommendations for On-Road Gasoline Sites

Recommendation to sample & analyze for EDB and 1,2-DCA	Recommendation to sample & analyze for EDB and 1,2-DCA dependent upon: - UST's storage history - Threat to drinking water sources	Recommendation to sample and analyze for EDB and 1,2-DCA only at sites where USTs continue to store leaded fuels (off-road racing fuel, aviation gasoline)

1986 — 1996

Years of Storage

Analytical Methods

The federal MCL for EDB is 0.05 µg/L and 5.0 µg/L for 1,2-DCA .[a] The EPA method most commonly used to analyze for organic gasoline constituents in groundwater is Method 8260B, which is a gas chromatograph/mass spectrometry method. In the EPA/ASTSWMO study discussed in the Background section, the operational method detection limit (MDL) achieved for Method 8260B for both EDB and 1,2-DCA was 3.0 µg/L.[b] While this level is sufficiently low to detect 1,2-DCA at its MCL, Method 8260B is not sensitive enough to detect EDB at its MCL even in a laboratory sample. The results of the EPA/ASTSWMO investigation showed that Method 8260B would have discovered only 40% of the survey sites with concentrations of EDB above its MCL.

In contrast to Method 8260B, the MDL for EDB using Method 8011 is approximately 0.01 µg/L; therefore, it is sufficiently sensitive to measure EDB at its MCL.[c] At sites that have not been previously sampled for EDB, it is necessary to use Method 8011 to determine if EDB is present above its MCL.

[a] The maximum contaminant level goal (MCLG) for EDB is zero. However, EPA set the MCL at 0.05 µg/L because EPA believes, given present technology and resources, this is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water.

[b] Using Method 8260B the method detection limit (MDL) for EDB is 0.06 µg/L for a wide bore column and 0.10 µg/L for a capillary column. The MDL for 1,2-DCA is 0.06 µg/L for a wide bore column and 0.02 µg/L for a capillary column. Note that these MDLs are based on laboratory-prepared samples of a single compound in distilled water. Several factors reduce sensitivity of the analytical method such that the operational MDL for environmental samples is typically higher (*i.e.*, not as sensitive) than that achievable for laboratory-prepared samples. Environmental samples (*e.g.*, groundwater, soil) typically contain many different contaminants, some of which can interfere with detection of the target compound(s) such that higher concentrations of EDB may be necessary to detect EDB above the background of natural petroleum hydrocarbons. Furthermore, high concentrations require that a sample be diluted prior to analysis.

[c] Furthermore, EPA Method 8011 is not subject to interference from non-halogenated compounds in petroleum fuels (although samples with high concentrations of contaminants may still require dilution prior to analysis)

At sites where benzene is the primary risk driver, Method 8260B may be appropriate to monitor the quality of groundwater during active remediation. For example, in the EPA/ASTSWMO study Method 8260B would have been appropriate for monitoring remedial progress at sites where the concentration of EDB was greater than 3.0 µg/L. Once the concentration of benzene is reduced to below the MCL (or applicable remediation goal) it would be necessary to switch to Method 8011 (or its equivalent[d]) for monitoring the concentration of EDB to determine whether additional remediation was required in order to reach the MCL for EDB.

TABLE 2

	MCL (ug/L)	8260B	8011*
EDB	0.05	Use limited by sample MDL	Recommended for use
1,2-DCA	5.0	Recommended for use	Not Applicable**

*Though Method 8011 protocol does not specify preservation (acidification) of groundwater samples, preservation of samples may be necessary to prevent biodegradation if the samples are not continuously refrigerated after collection or if the samples are not analyzed within the 14 day holding time. Not all laboratories routinely conduct analyses using 8011, so laboratory capability and capacity should be confirmed during the planning stages of site investigation for lead scavengers.
** Method 8011 does not determine 1,2-DCA; it is only applicable for EDB and 1,2-dibromo-3-chloropentane, DBCP.

Additional Information

Additional information about lead scavengers can be found in the following EPA publications:

- **Lead Scavengers Compendium: Overview of Properties, Occurrence, and Remedial Technologies** (EPA, 2006) accessible at *http://www.epa.gov/oust/cat/PBCOMPND.HTM*

- **Natural Attenuation of the Lead Scavengers 1,2-Dibromoethane (EDB) and 1,2-Dichloroethane (1,2-DCA) at Motor Fuel Release Sites and Implications for Risk Management** (EPA/600/R-08/107, September 2008) accessible at *http://www.epa.gov/ada/download/reports/600R08107/600r08107.pdf*

[d] EPA Method 504.2 for drinking water is an equivalent method.

If you have policy questions about work OUST is undertaking regarding lead scavengers, please contact Adam Klinger of my staff at (703) 603-7167; for more technical information, contact Hal White at (703) 630-7177.

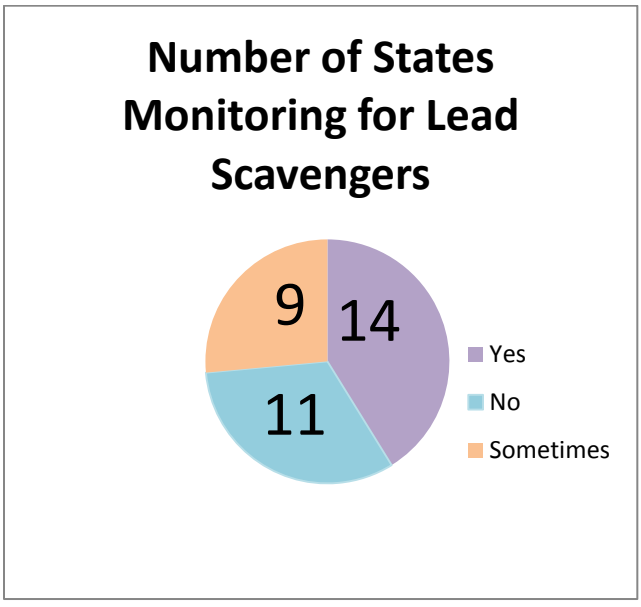
cc: UST/LUST Regional Deputy Division Directors, Regions 1-10
UST/LUST Regional Branch Chiefs, Regions 1-10
Regional UST Program Managers, EPA Regions 1-10
Association of State and Territorial Solid Waste Management Officials (ASTSWMO) LUST Task Force
Institute for Tribal Environmental Professionals (ITEP) Tribal Steering Committee
Adam Klinger, Division Director, OUST Mark
Barolo, Division Director, OUST John Wilson,
ORD, NRMRL
Fran Kremer, ORD, NRMRL Jim
Weaver, ORD, NERL OUST Regional
Liaisons

APPENDIX B: LEAD SCAVENGER INFORMATION REQUEST RESULTS

Does your State Routinely monitor for lead scavengers EDB and 1,2-DCA at LUST sites?

Responses	Yes	No	Sometimes
Region 1			
Connecticut	1		
Massachusetts	1		
New Hampshire			1
Rhode Island		1	
Vermont	1		
Region 3			
Delaware	1		
District of Columbia			1
Maryland	1		
Virginia			1
West Virginia		1	
Region 4			
Alabama			1
Georgia			1
Mississippi			1
South Carolina	1		
Tennessee	1		
Region 5			
Indiana	1		
Ohio		1	
Region 6			
Arkansas		1	
Louisiana		1	
New Mexico	1		
Oklahoma		1	
Region 7			
Iowa		1	
Kansas	1		
Missouri			1
Nebraska			1

Responses	Yes	No	Sometimes
Region 8			
Colorado		1	
Montana	1		
South Dakota		1	
Utah		1	
Wyoming	1		
Region 9			
Arizona			1
Hawaii		1	
Region 10			
Idaho	1		
Oregon	1		
Totals	**14**	**11**	**9**



Additional Comments:

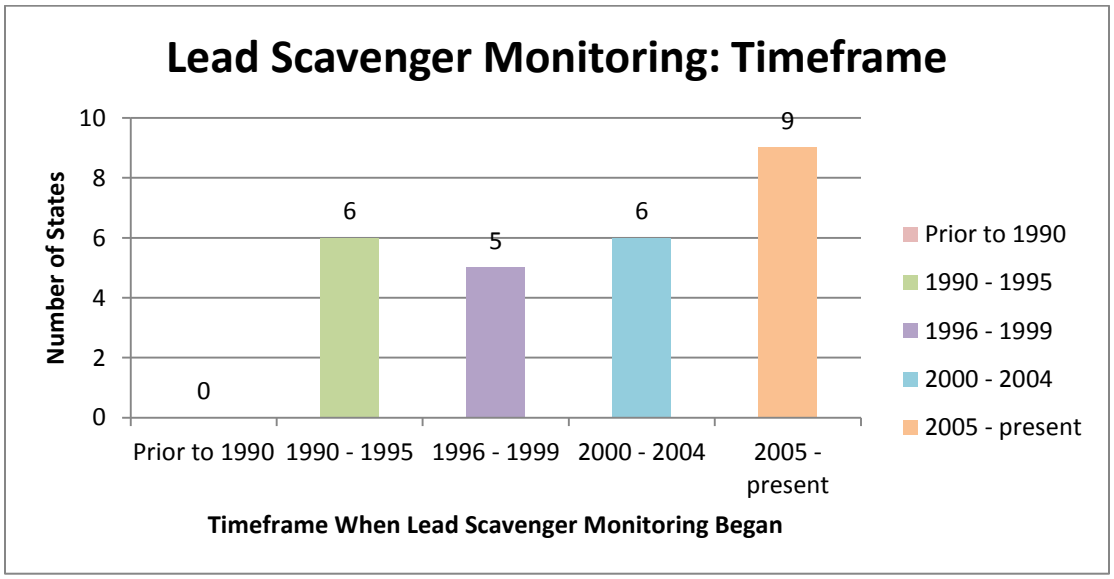
Region 1	
Massachusetts	Privatized program, Audits of cleanup is reviewed to ensure LSP is monitored for EDB and 1,2-DCA at LUST sites.
New Hampshire	EDB low level testing is completed only at sites that pre-date 1986. Higher level EDB and DCA testing is completed at all sites.
Vermont	Lower detection limits when drinking water supplies at risk (504), 8260 when only groundwater is impacted or threatened.
Region 3	
Virginia	We look for lead scavengers when a release has occurred or is suspected from a facility that stored or may have stored leaded gasoline and private water supplies are in the area.
Region 4	
Alabama	At most LUST & ARRA sites where the release is suspected to be pre-1986
Georgia	On LUST Grant-funded state contractor sites and on Georgia UST Fund state contractor sites.
Mississippi	At Federal LUST Trust Fund Sites
Tennessee	All ground water monitoring wells at LUST Trust Fund sites are sampled at least once for EDB and 1,2-DCA. The information provided in this questionnaire are based on the LUST Trust site data.
Region 7	
Iowa	Analyses for these chemicals is only done when federal funds are expended at LUST sites. Sampling is not required by Iowa regulations.
Kansas	Regarding question 4: 1,2-DCA analysis became routine in 1994. EDB analysis became routine in 2004.
Missouri	Only sites that pre-date 1980. This to be changed to 1986 with our new regs.
Nebraska	We do at all orphan sites.
Region 8	
Montana	We focus on the release sites where lead scavengers could heve present based on tank usage dates.
Utah	We do not currently sample, but did in the past
Region 9	
Arizona	For those sites that do not have a history of leaded gasoline use, there is no requirement for monitoring for lead scavengers. 1,2-DCA, though, is part of the EPA Method 8260B that is required to be ran on all LUST sites.

When did your State start monitoring for lead scavengers?

Responses	Prior to 1990	1990 - 1995	1996 - 1999	2000 - 2004	2005 - present
Region 1					
Connecticut			1		
Massachusetts		1			
New Hampshire					1
Vermont				1	
Region 3					
Delaware			1		
District of Columbia					1
Maryland				1	
Virginia				1	
Region 4					
Alabama					1
Georgia				1	
Mississippi					1
South Carolina		1			
Tennessee					1
Region 5					
Indiana					1
Region 6					
Arkansas		1			
New Mexico		1			
Region 7					
Iowa					1
Kansas		1			
Missouri				1	
Nebraska				1	
Region 8					
Montana					1
Utah		1			
Wyoming					1

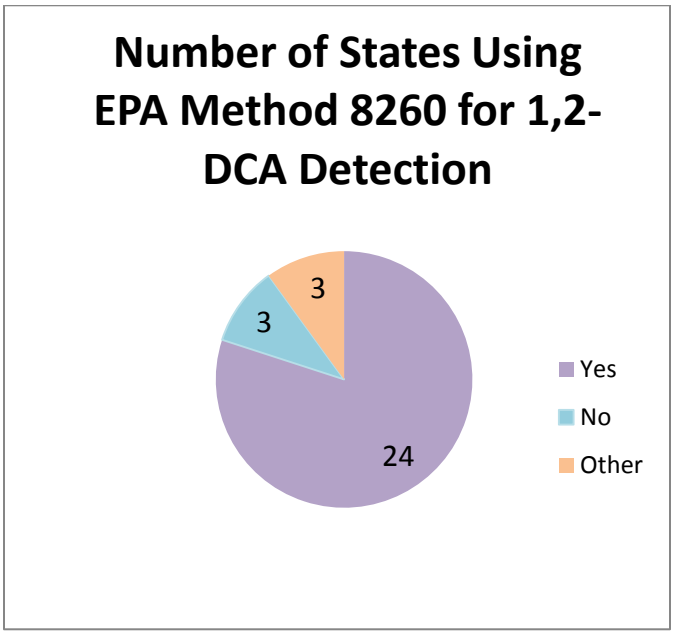
When did your State start monitoring for lead scavengers? (continued)

Responses	Prior to 1990	1990 - 1995	1996 - 1999	2000 - 2004	2005 – present
Region 9					
Arizona			1		
Region 10					
Idaho			1		
Oregon			1		
Totals	**0**	**6**	**5**	**6**	**9**



Does your State require use of EPA Method 8260B to analyze for 1,2-DCA?

Responses	Yes	No	Other
Region 1			
Connecticut	1		
Massachusetts	1		
New Hampshire	1		
Rhode Island	1		
Vermont	1		
Region 3			
Delaware	1		
District of Columbia	1		
Maryland	1		
Virginia			1
Region 4			
Alabama	1		
Georgia	1		
Mississippi	1		
South Carolina	1		
Tennessee	1		
Region 5			
Indiana	1		
Ohio		1	
Region 6			
Arkansas	1		
New Mexico	1		
Oklahoma		1	
Region 7			
Iowa			1
Kansas	1		
Missouri	1		
Nebraska	1		
Region 8			
Colorado		1	
Montana	1		
Utah			1
Wyoming	1		
Region 9			
Arizona	1		
Region 10			
Idaho	1		
Oregon	1		
Totals	**24**	**3**	**3**



If No (or Other), What method does your State use?

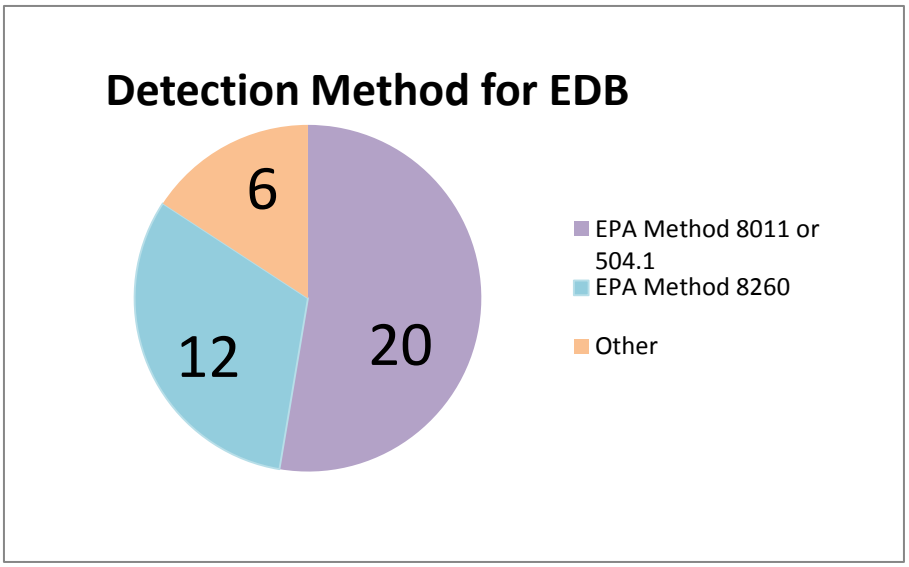
Region 3	
Virginia	Method 8260B is most commonly used, however, the Storage Tank Program also would accept Method 524.2 for a drinking water sample.
Region 5	
Ohio	Ohio does not test for lead scavengers.
Region 6	
Oklahoma	Haven't started sampling for lead scavengers yet
Region 7	
Iowa	Lab method requirements are not specified in Iowa regulations for these chemicals. Typically, if analyzed, the EPA Method 8260B will be used.
Region 8	
Utah	RP's can use method 8260 or 8021 to sample for BTEX. However, we do not require them to report on 1, 2 DCA if they use 8260.

What analysis does your State require for EDB? Select all that apply.

Responses	EPA Method 8011 or 504.1	EPA Method 8260	Other
Region 1			
Connecticut		1	1
Massachusetts		1	
New Hampshire	1		1
Rhode Island		1	
Vermont	1	1	
Region 3			
Delaware	1	1	
District of Columbia	1	1	
Maryland		1	
Virginia	1		
West Virginia			1
Region 4			
Alabama	1		
Mississippi	1		
Georgia	1		
South Carolina	1		
Tennessee	1		
Region 5			
Indiana	1	1	
Region 6			
Arkansas	1	1	
New Mexico	1	1	
Oklahoma			1
Region 7			
Iowa			1
Kansas	1		
Missouri	1	1	
Nebraska	1		
Region 8			
Montana	1		
Wyoming	1		
Utah			1

What analysis does your State require for EDB? Select all that apply. (cont.)

Region 9			
Arizona	1		
Region 10			
Idaho	1		
Oregon		1	
Totals	**20**	**12**	**6**



If your State requirements vary on analysis, please explain when each analytical approach is to be used.

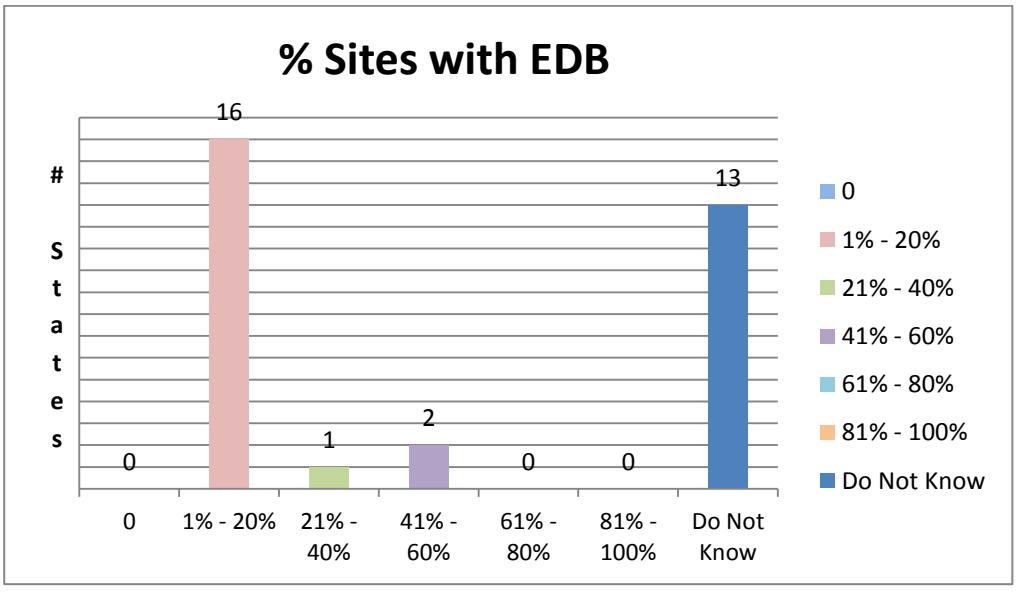
Region 1	
Connecticut	504.1 is used
New Hampshire	8260B SIM
Vermont	Lower detection limit when drinking water supplies impacted or threatened (EPA Method 504.2), only EPA Method 8260 when only groundwater is impacted or threatened.
Region 3	
Delaware	8011 is typically required at first or if EDB is present but at concentrations below the MDL of 8260
West Virginia	We do not require analysis for lead scavengers.
Region 4	
Tennessee	The 8011 and 8260 requirements noted above are for LUST Trust sites only.
Region 6	
Arkansas	Use of Method 8011 is required if there is a genuine possibility of a drinking water supply impact.
New Mexico	Method 8011 or 504.2 initially, 8260B of initial analysis suggests no EDB
Oklahoma	No variation - Haven't started sampling for lead scavengers yet
Region 7	
Iowa	Lab method requirements are not specified in Iowa regulations for these chemicals. Typically, if analyzed, the EPA Method 8260B will be used.
Missouri	If the groundwater is being utilized for drinking water (currently or in the future) and the release occurred (or could have occurred) prior to 1980 then Method 8011 is required. Otherwise 8260 is utilized.
Region 8	
Montana	Not Applicable
Utah	Do not require sampling for EDB. 8260 or 8021 for BETX 8015 for TPH (D) 8015 or 8260 for TPH (G) 1664 for used oil

At what percentage of sites in your State do you find the lead scavengers – EDB?

	EDB						
Responses	0	1% - 20%	21% - 40%	41% - 60%	61% - 80%	81% - 100%	**Do Not Know**
Region 1							
Connecticut							1
Massachusetts				1			
New Hampshire		1					
Rhode Island							1
Vermont		1					
Region 3							
Delaware							1
District of Columbia		1					
Maryland		1					
Virginia							1
West Virginia							1
Region 4							
Alabama		1					
Georgia							1
Mississippi		1					
South Carolina				1			
Tennessee			1				
Region 5							
Indiana		1					
Region 6							
Arkansas		1					
Louisiana							1
New Mexico		1					
Oklahoma							1
Region 7							
Iowa		1					
Kansas		1					
Missouri		1					
Nebraska		1					

At what percentage of sites in your State do you find the lead scavengers - EDB? (cont.)

	0	1% - 20%	21% - 40%	41% - 60%	61% - 80%	81% - 100%	Do Not Know
Region 8							
Colorado							1
Montana		1					
Utah							1
Wyoming		1					
Region 9							
Arizona							1
Hawaii							1
Region 10							
Idaho		1					
Oregon							1
Totals	**0**	**16**	**1**	**2**	**0**	**0**	**13**



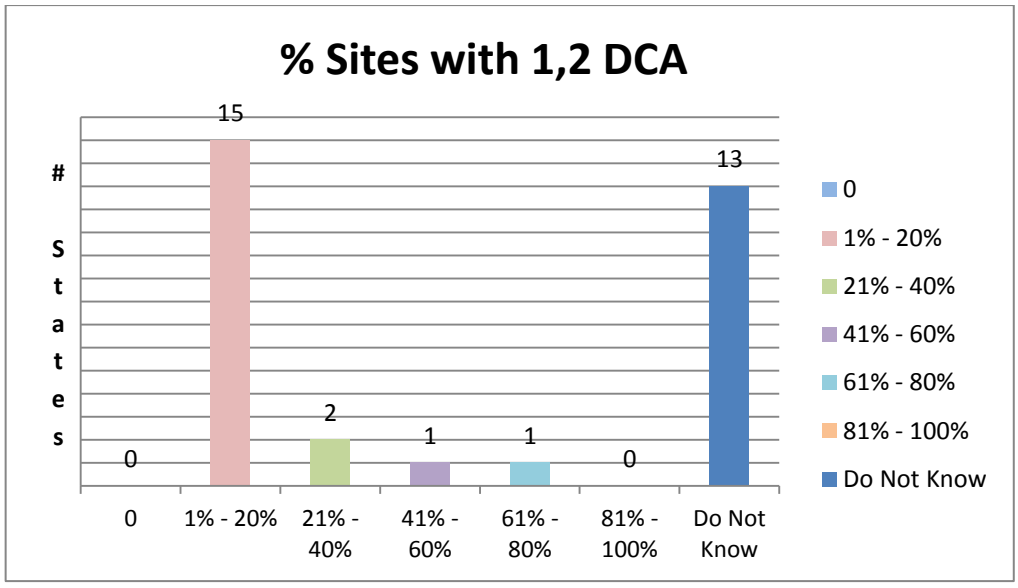
At what percentage of sites in your State do you find the lead scavengers – 1,2-DCA?

1,2-DCA

Responses	0	1% - 20%	21% - 40%	41% - 60%	61% - 80%	81% - 100%	Do Not Know
Region 1							
Connecticut							1
Massachusetts				1			
New Hampshire		1					
Rhode Island							1
Vermont		1					
Region 3							
Delaware							1
District of Columbia		1					
Maryland		1					
Virginia							1
West Virginia							1
Region 4							
Alabama		1					
Georgia							1
Mississippi		1					
South Carolina		1					
Tennessee			1				
Region 5							
Indiana		1					
Region 6							
Arkansas		1					
Louisiana							1
New Mexico		1					
Oklahoma							1
Region 7							
Iowa		1					
Kansas					1		
Missouri		1					
Nebraska		1					

At what percentage of sites in your State do you find the lead scavengers – 1,2-DCA? (continued)

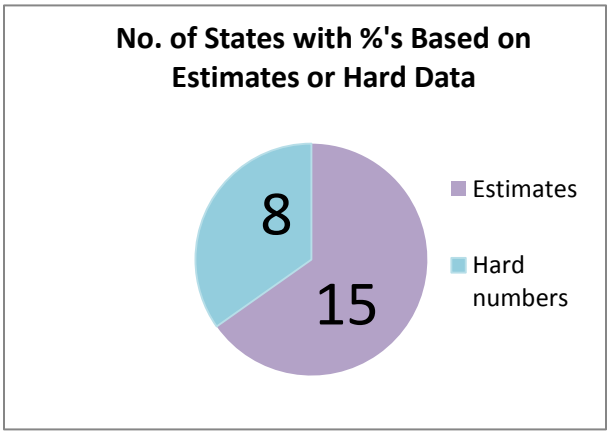
Responses	0	1% - 20%	21% - 40%	41% - 60%	61% - 80%	81% - 100%	Do Not Know
Region 8							
Colorado							1
Montana		1					
Utah							1
Wyoming			1				
Region 9							
Arizona							1
Hawaii							1
Region 10							
Idaho		1					
Oregon							1
Totals	**0**	**15**	**2**	**1**	**1**	**0**	**13**



Follow-up to previous question - % of LUST sites with EDB and/or 1,2-DCA detections: Are these answers estimates or hard numbers from databases?

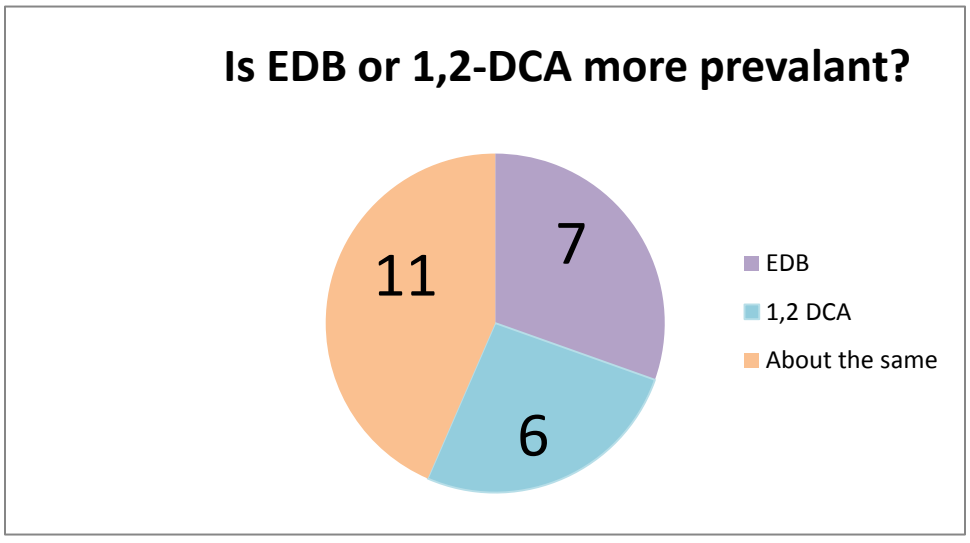
Responses	Estimates	Hard numbers
Region 1		
Connecticut	1	
Massachusetts	1	
New Hampshire		1
Vermont	1	
Region 3		
District of Columbia	1	
Maryland	1	
Virginia	1	
Region 4		
Alabama		1
Mississippi	1	
South Carolina		1
Tennessee		1
Region 5		
Indiana	1	
Region 6		
Arkansas	1	
New Mexico	1	
Oklahoma		1
Region 7		
*Iowa		1
Kansas	1	1
Missouri		
Nebraska		1
Region 8		
Montana	1	
Wyoming	1	
Region 9		
Arizona	**1**	
Region 10		
Idaho	1	
Totals	**8**	**15**

***Actual data, but based only on the ARRA (federally-funded) project sites (40 sites). One site tested positive for EDB; three sites tested positive for 1,2-DCA.



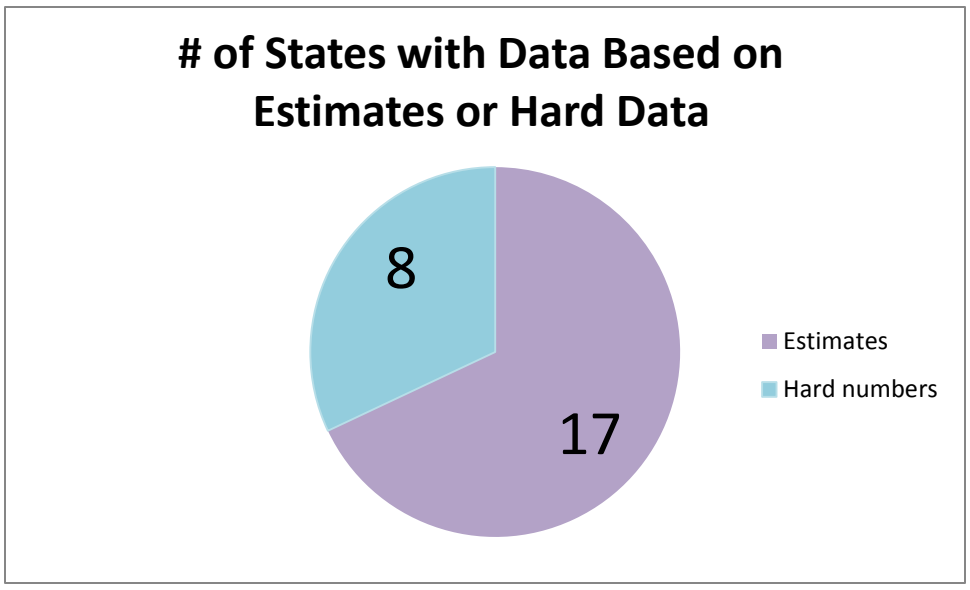
At LUST sites, do you find more sites with EDB or 1,2-DCA above your States Standards?

	EDB	1,2-DCA	About the same
Region 1			
Massachusetts			1
New Hampshire	1		
Rhode Island		1	
Vermont			1
Region 3			
Delaware	1		
District of Columbia			1
Maryland			1
Virginia	1		
Region 4			
Alabama			1
Mississippi	1		
South Carolina	1		
Tennessee	1		
Region 5			
Indiana		1	
Region 6			
New Mexico	1		
Region 7			
Iowa			1
Kansas		1	
Missouri			1
Nebraska			1
Region 8			
Montana		1	
Utah			1
Wyoming		1	
Region 9			
Arizona		1	
Region 10			
Idaho			1
Oregon			1
Totals	**7**	**6**	**11**



Follow-up to question on prevalence of ECB and 1,2-DCA: Is the above answer an educated opinion or based on hard numbers from databases?

	Estimates	Hard numbers
Region 1		
Massachusetts	1	
New Hampshire		1
Rhode Island	1	
Vermont	1	
Region 3		
Delaware	1	
District of Columbia	1	
Maryland	1	
Virginia	1	
Region 4		
Alabama		1
Mississippi	1	
South Carolina		1
Tennessee		1
Region 5		
Indiana	1	
Region 6		
New Mexico	1	
Oklahoma	1	
Region 7		
Iowa		1
Kansas		1
Missouri	1	
Nebraska	1	
Region 8		
Montana	1	
Utah		1
Wyoming	1	
Region 9		
Arizona	1	
Region 10		
Idaho		1
Oregon	1	
Totals	**8**	**17**



What technologies are you currently using to remediate lead scavenger chemicals?

Region 1	
Connecticut	We are not remediating solely lead scavenger chemicals. We focus on VOC's and SVOCs.
Massachusetts	SVE, Pump & Treat with GAC, Sparging (not many)
New Hampshire	Source area remedation, especially soil excavation.
Rhode Island	The technologies that we use concentrate on the cleanup of BTEX & MTBE compounds as well as the removal of free-phase petroleum products.
Vermont	All technologies that we use on other petroleum contaminated sites.
Region 3	
Delaware	AS/SVE has had the best success so far
District of Columbia	Nothing particulary different from the technology used for other chemicals of concern, e.g. surfact injection, ISCO, SVE, etc.
Maryland	Pump and Treat Dual Phase
Virginia	We do not have any remedial systems that are focused on remediating lead scavengers. Our primary concern with scavengers is their impact or risk of impact to water supplies. In the case of a confirmed impact, the Agency would require installation of a carbon filtration system as an initial abatement measure. In instances of lead scavenger contamination of a water supply, the Agency would require replacement of the water supply as the corrective action in instances where contamination levels were above risk management levels.
Region 4	
Alabama	Ozone sparge, SVE, MNA
Georgia	It hasn't been necessary yet.
Mississippi	Dual Phase Extraction and Bio-remediation
South Carolina	Contractors are attempting to use air sparging, soil vapor extraction, bioremediation, and chemical oxidation.
Tennessee	State owned dual phase corrective action systems are utilized to address contamination above the risk-based levels. There are no sites that lead scavengers are the sole focus.
Region 5	
Indiana	No special remedial treatments are utilized.
Region 6	
Arkansas	no specific remedial goals are applied for the scavengers.
Louisiana	n/a
New Mexico	SVE in Soil, air sparge and pump and treat with GAC in groundwater
Oklahoma	Do not currently assess or remediate

What technologies are you currently using to remediate lead scavenger chemicals? (continued)

Region 7	
Iowa	None specific to these chemicals. Remediation is not required under the LUST program.
Kansas	SVE/air sparge
Missouri	No site is currently remediating lead scavengers.
Nebraska	AS/SVE
Region 8	
Colorado	none specifically for lead scavengers
Montana	Air sparging and SVE for 1,2-DCA and pump and treat for EDB
Utah	Lead scavengers is not a remediation driver.
Wyoming	These technologies are being used to address gasoline and diesel constituents where lead scavengers have been found: AS/SVE, AS/DPE, Persulf/Ox injection, MNA, pump & treat with SVE, Ozone Sparge
Region 9	
Arizona	At our state lead sites ISCO (peroxide/ozone mixture), ozone injection, and air sparging are mainly used. Perozone and ozone appear to work very well in AZ. Monitored natural attenuation is used when the level of concentrations do not warrant active remediation.
Region 10	
Idaho	Normal methods used to address BTEX.

At what percentage of sites where lead scavengers have been detected is your State employing active remedial technologies to remediate soils and/or groundwater?

Region 1	
Connecticut	Don't know of any sites being remediated with just lead scavengers.
Massachusetts	75%
New Hampshire	We haven't conducted a remediation solely for lead scavengers. More than half of our sites require remediation of some type to get to closure. About 5% of our sites are undergoing some type of remedial action in a given year.
Rhode Island	Lead scavengers have not been detected at LUST sites to our knowledge.
Vermont	About half, the other half are in MNA.
Region 3	
Delaware	I can not answer that with with too much confidence, this is likely around 15%
District of Columbia	Not only for lead scavengers but for other contaminants also, >25% in general
Maryland	<5%
Virginia	Perhaps around 10% and most of this is aimed at dealing with the BTEX constituents and/or MTBE.
Region 4	
Alabama	About 40%
Georgia	Have not tracked that number. Most I think are already in remediation for benzene and free product.
Mississippi	70%
South Carolina	70%
Tennessee	70% of the sites where lead scavengers were detected above MCLs, a dual phase corrective action system is utilized to address other chemicals of concern. For sites that the lead scavengers were above risk-based levels, 82% of those have a dual phase corrective action system for remediation.
Region 5	
Indiana	Unknown, this is not noted in current data base to track.
Region 6	
Arkansas	5%
Louisiana	NA
New Mexico	Unknown
Oklahoma	None we are aware of

At what percentage of sites where lead scavengers have been detected is your State employing active remedial technologies to remediate soils and/or groundwater? (continued)

Region 7	
Iowa	Active remediation has been conducted at all three sites where lead scavengers were found; however, the remediation was targeting BTEX compounds.
Kansas	Unknown. Not tracked.
Missouri	No site is currently remediating lead scavengers.
Nebraska	not available
Region 8	
Montana	<10%
Utah	Do not require sampling for lead scavengers, so no active systems for soil or groundwater.
Wyoming	60%
Region 9	
Arizona	Unsure.
Region 10	
Idaho	They tend to not be the driver so it is addressed when treating the driver.

At what percentage of sites where lead scavengers have been detected is Monitored Natural Attenuation (MNA) the remedial alternative being used to remediate the site?

Region 1	
Connecticut	Don't know
Massachusetts	2
New Hampshire	About 20%
Rhode Island	MNA is not used to cleanup lead scavengers.
Vermont	About 50%
Region 3	
Delaware	I don't believe we have any, the risk based screening levels are so low and lead scavengers are very persistant
District of Columbia	very small percentage, <20%
Maryland	95%
Virginia	Probably 70 – 80%.
Region 4	
Alabama	30%
Georgia	Most sites overall.
Mississippi	0%
South Carolina	30%
Tennessee	0%
Region 5	
Indiana	An educated guess would be the majority, however we have no data to support that claim.
Region 6	
Arkansas	MNA by itself is not employed as a remedial alternative.
Louisiana	n/a
New Mexico	none
Oklahoma	Unknown
Region 7	
Iowa	0%
Kansas	Unknown. Not tracked.
Missouri	We do not have any site that is currently using MNA as a remediation method
Nebraska	None

At what percentage of sites where lead scavengers have been detected is Monitored Natural Attenuation (MNA) the remedial alternative being used to remediate the site? (continued)

Region 8	
Montana	Montana is not utilizing MNA at any active sites where lead scavengers are present
Utah	Unsure
Wyoming	40%
Region 9	
Arizona	Unsure.
Region 10	
Idaho	Most of these sites will end up with an environmental covenant which will address any lead scavengers.

Follow-up to question on using MNA to remediate the site: Is MNA effectively cleaning up the lead scavengers?

Region 1	
Connecticut	Don't know
Massachusetts	No
New Hampshire	No
Rhode Island	Not applicable.
Vermont	Effectively managing the cleanup, MNA take time.
Region 3	
Delaware	As long as there is enough time and a lack of receptors I would think MNA could be effective with anything
District of Columbia	50:50, depends on the site and concentration of contaminants.
Maryland	Yes
Virginia	Sometimes where lead scavengers are present at very low (barely detectable levels) in water supplies located at a distance from the source, MNA can eventually lead to below-detectable levels of the lead scavengers in the water supply.
Region 4	
Alabama	Not yet determined
Georgia	Not sure.
Mississippi	NA
South Carolina	No. At many MNA sites, the EDB is stable but is not being cleaned up.
Tennessee	Not Appplicable

Is MNA effectively cleaning up the lead scavengers? (continued)

Region 5	
Indiana	Unknown
Region 6	
Arkansas	Not known
Louisiana	NA
New Mexico	MNA (biological) does not appear to be effective means of remediation. If EDB is the driver, often the subsurface environment is aerobic and not conducive to biologic degradation. Physical (dispersion/dilution) can be effective but rarely desirable
Oklahoma	Unknown
Region 7	
Iowa	NA
Kansas	Unknown. Not tracked.
Missouri	We do not have any site that is currently using MNA as a remediation method
Nebraska	NA
Region 8	
Montana	Not applicable
Utah	Unsure
Wyoming	Not enough data to know.
Region 9	
Arizona	There appears to be slow attenuation rates. In some cases, though, this may be due to source area not being fully removed or controlled.
Region 10	
Idaho	We are currently reevaluating MNA sites to determine if they can be considered effective.

Do you have any sites where the sole focus of the remediation project is to address lead scavenger compounds in soil and/or groundwater?

Region 1	
Connecticut	No
Massachusetts	Unknown but estimate is NO
New Hampshire	No
Rhode Island	No.
Vermont	No?
Region 3	
Delaware	None that I know of. I really doubt it.
District of Columbia	Not currently. Thanks!
Maryland	No
Virginia	No
Region 4	
Alabama	No
Georgia	No
Mississippi	No
South Carolina	Yes
Tennessee	No
Region 5	
Indiana	No. Please note that we recently had a site with sandy soil conditions sampled by purge, non-purge, and low-flow sampling. The purge method had the highest levels of lead indicated.
Region 6	
Arkansas	No
Louisiana	No
New Mexico	Less than 5
Oklahoma	No
Region 7	
Iowa	No
Kansas	No.
Missouri	No
Nebraska	No

Do you have any sites where the sole focus of the remediation project is to address lead scavenger compounds in soil and/or groundwater? (continued)

Region 8	
Colorado	No.
Montana	Yes, one known site.
Utah	No.
Wyoming	Yes; only 1
Region 9	
Arizona	In Arizona, it appears that when 1,2-DCA is discovered at a site, it is usually along with high concentrations of BTEX and other compounds. So, when site remediation begins, the focus depends on the concentration level of the lead scavengers. If the lead scavenger concentrations are high, the focus of remediation will be to use the ISCO or ozone techniques to reduce the lead scavenger concentrations (and BTEX will also be reduced through this effort).
Region 10	
Idaho	No.