

# **Final Report**

**2006 Survey of State Experiences with Petroleum and Hazardous Substance  
Releases at LUST Sites, Heating Oil Tanks, and Out of Service Tanks  
(December 2006)**

**A Project of the New England Interstate  
Water Pollution Control Commission (NEIWPCC)  
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## Introduction

In 2000 and 2003, the New England Interstate Water Pollution Control Commission (NEIWPCC) conducted surveys on state experiences with MtBE and oxygenate contamination at LUST sites. In 2006, NEIWPCC received a grant from the U.S. EPA Office of Underground Storage Tanks to develop and conduct a new survey that would address primarily topical LUST-related issues but also other programmatic areas that would help provide insight into state experiences. The new survey is titled *State Experiences with Petroleum and Hazardous Substance Releases at LUST Sites, Heating Oil Tanks, and Out of Service Tanks*.

Ellen Frye of Enosis—the Environmental Outreach Group in Lexington, Massachusetts, developed and conducted the survey for NEIWPCC. Ellen produces *LUSTLine*, NEIWPCC's bulletin dedicated to leaking underground storage tank cleanup and leak prevention issues, and is familiar with issues that arise in state programs. Ellen worked closely with Patricia Ellis, a hydrologist with the Delaware Department of Department of Natural Resources and Environmental Control's Tank Management Branch, to develop a draft set of survey categories and questions. Pat has been an invaluable resource for all three NEIWPCC surveys.

The draft was circulated for comments and further refinement to the following dedicated group of state LUST program staff members: Gary Lynn and Fred McGarry (NH), Read Minor (SC), Richard Spiese (VT), John Menotti (UT), Jeff Kuhn (MT), Greg Hattan (KS), Bruce Hunter (ME), Tim Kelley (CO), and Kevin Graves (CA). Input was also solicited and received from Kara Sergeant, NEIWPCC's project manager for the survey, Mike Martinson, Delta Environmental (standards and cleanup issues), Bruce Bauman, American Petroleum Institute, and Blayne Hartman, H&P Mobile Geochemistry (for soil vapor issues). Thank you one and all!

The survey is very long! The completed questionnaire consists of the following 12 topic sections within which there are a number of questions and subparts:

- 1. State Standards for Specific Gasoline Additives/Blends**
- 2. Fuel Blend/Additive Analysis**
- 3. Site Assessment**
- 4. Drinking Water Impacts**
- 5. Remediation**
- 6. Remediation Costs Impacts**
- 7. Vapor-Intrusion Pathway**
- 8. Hazardous Substance USTs**
- 9. Heating Oil Tanks**
- 10. Out of Service Tanks**
- 11. Ethanol**
- 12. Miscellany**

The survey differs from the previous ones in that it is entirely electronic. State LUST program contacts (or other appropriate personnel) were asked to complete the survey online by logging in, protecting their information by using their own password. Marcel Moreau Associates of Portland, Maine, handled the electronic and data management aspect of the survey. Although it was beta tested, the substantial length of the survey, as well as glitches that were not anticipated, made for a challenging journey to closure. A few questions posed problems because answers entered did not register. A considerable amount of time was

spent reviewing the survey responses in order to follow-up state submissions with supplications for either clarifications or answers for the unanswered. Betty Snowman of Marcel Moreau Associates graciously and patiently worked with Ellen to manage the database and address problems as they popped up.

All 50 state LUST program contacts or their designees logged in to the survey. Keep in mind that responding to this survey was entirely voluntary. Hence, we are pleased to report that all states completed at least Section 1. Only three states (IN, GA, LA) left the survey less than half completed. Forty-seven states substantially answered the questions, and some gave us an amazingly thorough level of detail and thought. The goodwill and professionalism of the state personnel who worked on the survey and responded to our questions and glitches was truly impressive!

It is important to note that by their nature, many questions lend themselves to judgments/estimates based on the professional experience of the respondent and should be taken as an indication of trend. All state representations are directly taken from the database, except in the rare instance when a personal clarification was needed. That being said, however, we cannot guarantee that all states understood a given question and answered it accordingly. All states were given an opportunity to check their answers. If a state is misrepresented, changes can be sent to Kara Sergeant at [KSERGEANT@neiwpc.org](mailto:KSERGEANT@neiwpc.org) so that that changes can be noted on the NEIWPCC website.

Given the fact that this survey was designed to provide states with a snapshot of what their peers in other states are doing about relevant issues at this point in time, we hope that those in the state UST/LUST programs will take the time to find out how each other answered. Others in the industry may also find the information provided in the survey helpful in understanding state responses to areas of interest. Some questions parallel those asked in 2003, and some of the results are compared in the “State Response Summary” attachment. The many comments states made regarding these questions are of particular interest because they provide nuance that underlines the uniqueness of these 50 programs. (Unfortunately, some comments were cutoff due to character limits programmed within each question.) We hope that by conducting this survey, more states will begin to seek answers to the kinds of questions we’ve asked.

Besides finding out about what kind of information states can provide, it is also worth pointing out that there are many “don’t know” responses that also tell us something. It is not always clear whether a state database does not have this information, whether it is difficult to access...or what. When a state does keep a thorough database, it has the invaluable ability to call up informational and programmatic profiles that can serve many purposes...like filling out surveys.

To see the full report go to: <http://www.neiwpc.org/mtbe.asp>

The report has three important Attachments:

- Attachment 1 – “State Response Summary”
- Attachment 2 – “State Standard Summaries”
- Attachment 3 – “Contact List for State LUST Site Action Levels, Cleanup Levels, and Drinking Water Standards”
- Attachment 4 - “Compiled 2006 Survey Results” for all the states

The remainder of this report consists of a brief synopsis of information contained in each survey section.

We thank all who took the time to respond to this survey.

## 1. State Standards for Specific Gasoline Additives/Blends

This section consists of 17 questions, most of which with subparts, that focus on gasoline additives and blends. Why do we care about this? Those who have been dealing with LUSTs for more than 15 years will probably remember that MtBE was barely, if ever, mentioned in cleanup discussions in the early days of the LUST programs. But that changed as states began looking for and finding MtBE in soil and groundwater, particularly in RFG areas. Despite the fact that there wasn't and still isn't a federal MCL for MtBE, many states tried to address the problem by adopting action and cleanup levels based on the EPA Drinking Water Advisory or some toxicity or risk-based criteria. Now because of lawsuits, state bans, the removal of the 2 percent oxygenate mandate for RFG as part of the Energy Policy Act of 2005, and U.S. EPA's subsequent rule to amend the RFG regulations in order to eliminate regulatory standards requiring the use of oxygenates in RFG, MtBE is fast disappearing from gasoline. But that doesn't mean that we're off the hook and back to analytical basics.

If there is one thing we should have learned from MtBE it is that it is a very good idea to pay attention to the kinds of compounds that are being added or blended into our gasoline, not only from a specific health risk point of view, but also in terms of how that compound interacts with or affects another compound in that gasoline in a groundwater/soil setting. For example, it is now fairly widely understood that ethanol in the environment is the preferred meal for many of the microorganisms that would otherwise chow down on a BTEX plume. As another example, TBA and TBF can be found as MtBE degradation byproducts. Research has shown time and again we really need to understand these processes and pay attention to what's in our gasoline.

Through this survey, we have sought to better understand how much states are paying attention to certain components of a gasoline release, the occurrence and extent of potentially harmful fuel additives and blends in LUST-related soil and groundwater environs, and what states have learned. The first section of the survey asks questions about state action levels, cleanup levels, or drinking water standards for 12 different compounds—MtBE, TBA, Ethanol, TAME, ETBE, DIPE, EDB, 1,2 DCA, lead, TBF, ETBA, and TAA—and if states have standards, what are they? (See Attachment 1 – “State Response Summary” and Attachment 2 – “State Standard Summaries.”) The last six compounds were added to this list since the last survey because they have either become compounds of concern with regard to UST releases (i.e., EDB, 1,2 DCA, lead) or they could be an emerging concern (i.e., TBF, ETBA, TAA).

In the cases of EDB, 1,2 DCA, and lead, which have federal MCLs, we ask if the LUST program enforces the federal MCL or has separate action levels, cleanup levels, or drinking water standards. This question is an example of how you need to be very careful about how you ask a question. In the case of EDB, for example, states like Florida and Oregon answered “no” because they have stricter standards, others answered “no” because they don't enforce the federal MCL. States like Massachusetts, Montana, North Carolina, and Rhode Island answered “yes” but they actually have stricter standards than the federal MCL. Clearly, because there are MCLs for these substances, the LUST programs are largely analyzing for them and using either federal MCLs or more conservative levels.

The remaining compounds of interest in this survey do not have federal MCLs and thus may or may not have standards. If they do have standards, they are either risk-based or highly variable state-specific standards. Regarding MtBE, 41 states have standards of some kind. One less state has standards than 2003. At that time Virginia was in the “yes” column. This time, Virginia reported that “legislation repealed the requirement that

required operators of water supplies to report to VDEQ and VDH MTBE levels greater than 15 ppb.” This time around, Vermont has set the lowest groundwater action level of 1 ppb for MtBE, TBA, ethanol, TAME, ETBE, and DIPE.

Regarding TBA, ethanol, TAME, ETBE, and DIPE, more states have standards today than in 2003—for TBA-15 states indicated they have standards versus 7 in 2003; for ethanol-7 states indicated they have standards versus 4 in 2003; for TAME-11 states indicated they have standards versus 4 in 2003; for ETBE-10 states indicated they have standards versus 3 in 2003; and for DIPE-11 states indicated they have standards versus 6 in 2003. A few more states indicated that action levels for some of these compounds are in the works. As would be expected, only a few states had any semblance of a standard for TBF, ETBA, and TAA, but as learned in a later question, a few states are beginning to think about these compounds.

## **2. Fuel Blend/Additive Analysis**

According to state responses in this section, 11 states receive information of the composition of fuels in their state, and that information comes primarily from state weights and measures offices. This section seeks more information on if, when, and for what fuel blends/additives states require sampling and analysis in groundwater and soil. Again, MtBE gets the most attention, although EDB, 1,2 DCA, and lead are getting some attention on a site-specific basis in gasoline. When asked how often during sampling events at their LUST sites, *groundwater* samples are analyzed for each of the compounds of interest, 31 states selected the option of 81-100% of the time for MtBE; the other compounds were substantially lower in frequency.

This section asks about detection limits/analytical methods for the various compounds of interest in groundwater and soil. The “State Response Summary” provides a chart for question 2-4a that shows the state responses for groundwater. For example, the chart shows that USEPA SW-846 Method 8240/8260 (GC/MS) is the most widely used method for all of the analytes. Within this method, detection limits range from 0.2 to 70 ppb for MtBE. For EDB, however, this method is used as well as USEPA Drinking Water Method 524 (GC/MS), SW-846 Method 8011, and USEPA Method 504.

## **3. Site Assessment**

This section asks states about various aspects of site assessment. Asked if they are using U.S. EPA TRIAD or similar expedited site-characterization approaches, 10 states said “yes,” 2 said “most of the time,” 22 said “no,” 15 said “rarely,” and one “don’t know.” Asked if they use advanced site characterization technologies (e.g., MIPS, geophysical investigation), 12 states said “yes,” 1 said “most of the time,” 10 said “no,” and 26 “rarely.” With regard to questions on considering diving plumes and conducting vertical characterization of groundwater at LUST sites, most states do this on a site-specific basis. Fourteen states say they see constituents other than MtBE in diving plumes. Thirty-one states say they use a 10-foot monitoring well screen interval. Other questions address cross-contamination incidents, changes in observed MtBE levels as the compound exits gasoline, and frequency with which contaminants exceed action levels. This section also contains a series of charts that document hotspot levels for the compounds of concern, levels at receptors, and distances between hotspots and receptors.

## **4. Drinking Water Impacts**

Due to the very mutual interests of drinking water/groundwater protection, this section has a line of questioning meant to ascertain how much state drinking water and LUST programs communicate and share information. The survey responses indicate that there is communication between programs at some level, but it doesn't appear that many states have made a concerted effort to connect. Thirty-four states say they give cleanup priority to sites located in source water protection areas, another seven say they do sometimes.

In 2003, 24 states reported that their drinking water program requires routine analysis for M/BE in drinking water. (This number was the same in 2000.) In this 2006 survey, 21 states say their drinking water program requires routine analysis for M/BE. But there is another option in this survey that wasn't in the previous surveys—"not required, but analyzed"—which eight states checked off.

The summary chart for question 4-6 provides information on numbers of private, public community, and private non-community wells that have been contaminated with MtBE. Fifteen states did not know or did not have access to information. In comparing the results from the 2003 and 2006 surveys, the 2006 numbers were slightly lower in the private and public community well categories, except for numbers of wells ranging from 500 to more than 900. In 2003, two states answered that they had more than 500 MtBE-impacted private wells. In 2006, three states had 501 to 700 MtBE-impacted wells and two states had more than 900 MtBE-impacted wells. One state had more than 900 impacted public community wells and one state had 501-700 impacted public non-community wells.

In question 4-7 we attempted to find out if any of the other compounds of interest had impacted wells. While most responses were "don't know," there were a few cases of impacts by TBA, TAME, EDB, and 1,2 DCA. Two questions address whether or how many private well users have been provided with bottled water or point-of-use treatment or if private wells have been replaced with new wells or public water because of fuel blends/additive contamination.

## **5. Remediation**

In this section we attempted find out about state experiences with remediating EDB, 1,2 DCA, and E10 and E85. While this section is heavy with "don't knows," this was expected because, especially for ethanol, states don't have much experience. For example, eight states have remediated sites with EDB and/or 1,2 DCA contamination and provide information on technologies used (primarily pump and treat and soil vapor extraction) and if they worked (looks good). With regard to ethanol releases, a few states have noted fate and transport characteristics associated with cosolvency, anaerobic groundwater, methane gas generation, and remobilization of NAPL.

This section has a group of questions concerning NAPL removal and allowable levels for closure. Question 5-8 provides respondent ratings for free-product removal technologies. Excavation, multiphase extraction, and soil vapor extraction had the highest ratings.

## **6. Remediation Cost Impacts**

Question 6-1 asks states to indicate the percentage of sites where MtBE has had a noticeable impact on the cost of remediation. This set of answers is provided in a table. While a large portion of states feel MtBE has caused no increase in the cost of remediation, there are a number of states that feel that MtBE increases costs at some sites a little bit, significantly, and very significantly. Question 6-2 asks about increased cleanup costs because of the other compounds of interest. Again, while most states said “no,” a few others said “yes,” especially for TBA, EDB, 1,2 DCA, and lead. Top factors that drive up costs include longer plumes, longer monitoring period, and substance recalcitrance.

## **7. Vapor-Intrusion Pathway**

Forty-one states say that vapor intrusion is a concern at LUST sites in their state. Twenty-eight states have guidance/policy for evaluating the vapor-intrusion pathway. Ten states say they are considering implementing vapor-intrusion pathway guidance. Question 7-3 lists websites that states provided if they have guidance that is on the Web.

## **8. Hazardous Substance USTs**

When asked how many federally regulated hazardous substance (non-petroleum) USTs are registered in their state, 18 states answered “don’t know” or didn’t answer. This is partly because these tanks are sometimes regulated under a different state program. But with 18 states answering “don’t know,” all hopes of getting any sense of the total number of hazardous substance USTs in the United States fades. Nevertheless, 34 states have provided this information. They have also provided state websites if the state has developed guidance/regulations for hazardous substance USTs (at least 32 have) and an indication of how frequently these tanks are inspected. Very few releases from these tanks have been reported and thus there is little information about product released and no information on fate and transport. Thirty-four states felt that these tanks are being adequately addressed, nine didn’t know, and three had concerns. We asked about these tanks because there is so little at all said about them; however, most are now aboveground.

## **9. Heating Oil Tanks**

Many states do not rely on heating oil and therefore do not have to worry about heating oil tanks. Northern states are most likely to have substantial numbers of heating oil tanks, especially home heating oil tanks. Some of these tanks are buried underground, some are outdoors aboveground, and others are indoors in a basement or shed. There is no question that heating oil tanks leak. In many cases realtors and/or banks have pushed to have buried tanks removed and placed indoors or outdoors in a well-constructed system where owners can visually inspect them. But to the extent we were able to get information from the states on heating oil tanks for this survey, we have to admit it is sketchy from a big picture perspective. The chart for question 9-3 shows that some aspects of heating oil tanks are regulated in some states. The fact that most heating oil tanks either are not regulated or are minimally regulated explains why so many states couldn’t really answer the questions in this section.

On the heating oil cleanup side, 18 states have a state fund that covers heating oil tanks in some form or fashion. Five states have some other type of fund that helps out when needed. There is a little bit of information on the percentage of cleanup fund monies spent on heating oil tanks and the percentage of UST releases that come from heating oil tanks.

## **10. Out of Service Tanks**

In question 10-1, we asked states about numbers of tanks in the following categories of out-of-service tanks—Temporarily Closed (legal), Permanently Closed (closed in place or removed) (legal), and Orphaned/Abandoned (out of service but not properly closed with or without known responsible party). We got very good hard data from most of the states. We wanted to provide a national snapshot of where the states are now with these tanks. Nine state answered “don’t know” for temporarily closed and seven for permanently closed; however, the remaining state responses give us a good sense of the magnitude of tanks that have been permanently closed and the large number of temporarily closed tanks that are being monitored and inspected pretty much in the same way as in-service tanks. The orphaned/abandoned tanks are less well documented, but 22 states have estimates or hard numbers for these tanks as well. Seventeen states indicated that they have programs to remove orphaned/abandoned tanks.

Respondents provided a range of answers as to how many LUST sites in their state are being redeveloped for another use through a brownfields program. The question was referring to any brownfields-type program. Minnesota answered with the staggering number of “approximately 2,400.” When we checked in to verify that number, we were assured that they have had that type of program for many years and that it has been very successful.

## **11. Ethanol**

One thing seems clear with regard to ethanol and USTs: we are in the early stages of understanding what this substance will mean to fuel storage systems and the potential for releases and the effect of a release in the subsurface environment. In this survey, 34 states said that E85 is used in their state. Clearly, there are just a few here and there in each case. Only two states, Iowa and Minnesota, knew of E85 releases in their state. On a more general level, 14 states said they knew of ethanol releases in their state from E10 to neat ethanol. Thirteen states describe the releases. On ethanol compatibility issues, states still know more about concerns they have read about than that they have seen. Michigan expressed concern that tank owners would not consider compatibility issues before filling tanks with E85 and that not all E85 tanks are registering as required.

## **12. Miscellany**

We asked states to rank the primary ways releases are identified/reported in their state. Tank removal was ranked highest, followed by property transfer, and then leak detection. We asked states to rank tank leak-detection methods. Top rankings went to interstitial monitoring, followed by automatic tank gauges, and then tank tests. We asked states to rank piping leak-detection methods. Top rankings went to electric line-leak detectors (LLDs), followed by piping tests, then interstitial monitoring, then the mechanical LLD.



Seventeen states said they have a pay-for-performance (PFP) program. Delaware is just getting started. But it doesn't appear that PFP is chugging along in most of those states. Only two states indicated they use PFP at 76-100% of their sites. The remaining states said they used it at 1-25% of their sites.

Only five states say their UST leak prevention rules address MtBE vapor releases. However, 16 states say they have sites where vapor releases are believed to be the source of contamination.

Finally, responses to the last question in the survey show that more than 30 states consider the compounds of concern in this survey other than MtBE to be a current, impending, potential, or unknown problem.