December 15, 2000

A Survey of State Experiences with MTBE Contamination at LUST Sites

Executive Summary

The New England Interstate Water Pollution Control Commission (NEIWPCC) received a grant from the EPA Office of Underground Storage Tanks to conduct a survey of all 50 states to determine how MTBE contamination is affecting state LUST programs and the cleanup of contaminated sites. The 34-question survey was developed with input and suggestions from several state leaking underground storage tank (LUST) program MTBE luminaries and one environmental consultant. Responses were received from all 50 states. For various reasons, not all questions were answered by all states.

The following summary of state responses will give you a fairly comprehensive snapshot of state experiences with MTBE, to date. The survey itself also reveals sizable gaps in our collective knowledge of the various issues associated with MTBE in the environment. For many questions, the “don’t know” response was quite common. We hope that by conducting this survey, that more states will begin to seek answers to questions such as these so that, in time, we will all better understand the nature of the MTBE beast.

We urge you to examine the state response data compiled on the questionnaire. In these responses, you will learn far more about state experiences than we could possibly include in this summary. Many states took the time to explain their answers in careful detail. Inasmuch as this survey was designed to capture information from the states for the states, we particularly hope that state UST/LUST program personnel will use this information to learn from each other.

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

State MTBE Standards

Thirty-eight states have action levels, cleanup levels, or drinking water standards for MTBE

- Soil action levels range from 5 ppb to 20,000 parts per billion (ppb).
- Soil cleanup levels range from 5 ppb to 280,000 ppb.
- Groundwater action levels range from 12 ppb to 520 ppb.
- Groundwater cleanup levels range from 20 ppb to 5,000 ppb.
- Primary drinking water standards range from 13 ppb to 240 ppb.
- Secondary Drinking Water Standards range from 5 ppb to 70 ppb.
- Nine states use EPA’s drinking water advisory range (20-40 ppb) as a drinking water standard.
- One state uses the old “health advisory” range (20-200 ppb) as a drinking water standard.

Of the 38 states, 20 have soil action levels, 28 have soil cleanup levels, 26 have groundwater action levels, 32 have groundwater cleanup levels, 8 have primary (health-based) drinking water standards, 6 have secondary (taste and odor) drinking water standards, 8 use the EPA advisory (20 ug/L) drinking water standard, and 12 use a state or some other advisory.

Of the 12 states that do not have action levels, cleanup levels, or drinking water standards, Illinois indicated that it is developing a standard. Washington is close to adopting proposed standards. Many states provided additional comments to explain the details of their standards. These notes provide a more complete picture of how action and cleanup levels are used in remediation decision making. Many responses are dependent on specified factors, such as site specific or risk-based conditions or potability.

Some of the standards and levels are enforceable and some are not. Eight states indicated that all of the levels they use are enforceable while six indicated that none are enforceable. The remaining states that answered stipulated an assortment of variations on the theme.

Sixteen states have recently changed their standards. The primary reasons why changes were made were to lower the levels to be more protective or to adopt a standard where there had been none. Sixteen states indicated that they are considering making a standard change. A few will add MTBE as a chemical of concern in their RBCA program, a few will lower their standard, Delaware's Public Health agency will be establishing and maximum contamination level (MCL) for MTBE. Two states said they would need enabling legislation to make changes, others specified rule change or rule-making requirements.

Thirty-six states indicated that a federal MCL for MTBE would affect their state's remediation process. Many of the states, particularly those that do not currently have a cleanup standard for MTBE, felt that an MCL would lead to the adoption of that standard and hence more protracted and costly cleanups, other states said that they might have to adjust their existing standards up or down, depending on the established MCL. In many states, a numerical federal MCL for MTBE would effectively be adopted by the state. Some states need an MCL in order to require cleanup of MTBE releases.

MTBE Analysis

Forty-two states require sampling and analysis for MTBE in groundwater at LUST sites. Washington will add itself to that number by 2001. Georgia and Arizona request sampling and analysis. Twenty-nine states require such sampling and analysis in soil.

Of the states that require sampling and analysis of MTBE in groundwater, 14 do so for all suspected releases and 30 (including Washington and Georgia) do so for gasoline releases. Of the states that require such sampling and analysis in soil, 10 do so for all releases and 22 do so for gasoline releases.

Several states indicated that they require sampling and analysis for MTBE of other fuels, such as kerosene, jet fuels, used oil, and diesel.

States that require testing for MTBE were asked when that requirement was initiated. That spectrum ranges from Maine in 1986, Minnesota in 1987, right on up to Kentucky in 2000 and Washington in 2001. When asked approximately how many sites were closed before MTBE analysis was required, 16 states did not know. Many more states, however, indicated that significant numbers of sites had been closed before analysis requirements took effect. It is important to look at these answers with respect to the number of sites, the date at which analysis was required, and the size of the state's tank population. The majority of the states that require analysis do so 80 to 100 percent of the time.

USEPA SW-846 Method 8240/8260 (GC/MS) is the most common method used or permitted for analysis of MTBE in both soil (33 states) and groundwater (37 states); USEPA SW-846 Method

8020/8021 (GC/PID) runs a close second—soil (23 states) and groundwater (30 states). Seventeen states use a combination of 8020/21 and 8240/60 for soil and 22 for groundwater. USEPA Drinking Water Method 502 (GC/PID) is approved by 3 states for soil and 7 states for groundwater. USEPA Drinking Water Method 524 (GC/MS)is approved by 6 states for soil and 20 states for groundwater. California, Massachusetts, and Delaware permitted the use of all or most of the methods listed in the survey.

Ten states indicated that the labs in their state charge extra to test for MTBE, three states said that some do. Thirteen states did not know whether labs charged extra, the rest of the states (25) said that their labs don't charge extra. Additional costs ranged from $10 to $50 per sample.

MTBE Site Assessment

Twenty five states said they have sites where MTBE has been detected in soil or groundwater, but where no release has been documented (e.g., though a leak detection method). Eleven states said they had no such sites and 14 didn't know. Most of the states that said they had such sites responded that they did not know how many. Of the 8 states that offered numbers, 3 had just a few, one had several, two had 20 plus, one had more than 50, and Vermont indicated that this is the case at most of its sites.

We attempted to find out something about what parts of the UST system are implicated more often with MTBE-related releases and what types of tank and piping are implicated most often. The responses in this area were weak. In the case of the parts of the system, the list included piping, sumps, overfills, spill buckets, and dispensers. In terms of types of tanks and piping, five states said steel, particularly unprotected steel. New Hampshire had problems with fiberglass reinforced plastic (FRP). Maryland said FRP and flex piping. Nevada said single-walled piping, and Maine said all types.

Twenty-four states said they are finding MTBE contamination that they are unable to attribute to an UST release. Fourteen states said "no," and 12 didn't know. New York's Snapshot MTBE Survey identified sources of MTBE-contaminated groundwater spills as: UST - 46%, piping - 26%, not identified - 20%, fiberglass UST - 2%, AST - 1%, and other (e.g., overfills, homeowner) - 5%. Many of the states attributed these non-UST to aboveground storage tanks. Other sources included car accidents, leaking automobile fuel tanks, improper disposal of gasoline gas, heating oil tanks, and backyard spills.

When asked how often MTBE is detected in soil and groundwater at gasoline-contaminated sites, states gave the following responses:

- 0 - 20% of the time in soil - 8 states, in groundwater - 11 states
- 20 - 40% in soil - 7 states, in groundwater - 4 states
- 40 - 60% in soil - 1 state, in groundwater - 7 states
- 60 - 80% in soil - 11 states, in groundwater - 15 states
- 80 - 100% in soil - 4 states, in groundwater - 9 states

When asked how often MTBE levels exceed 20 ppb at the groundwater sites, 7 states answered 0 - 20% of the time, 4 answered 20 - 40%, 7 answered 40 - 60%, 10 answered 60 - 80%, 10 answered 80 - 100%, and 9 didn't know.

In an attempt to find out if other non-gasoline fuels had MTBE levels above 20 ppb in groundwater or soil, 36 states did not know. More than anything this may indicate that they are not looking for MTBE in the other fuels. Seven states indicated that they were finding these MTBE levels in heating oil and diesel fuel. Other fuels mentioned included jet fuel, kerosene, K-1 used oil, and waste oil.

When asked if they investigate MTBE plumes differently from BTEX plumes because of the potential for diving plumes, 4 states answered “yes,” and 15 answered “sometimes.” When asked if they require three-dimensional characterization of MTBE plumes, 14 of the 19 states that answered “yes” to the previous question answered that they do “occasionally,” 3 answered “most of the time,” and 1 said “always.” Delaware indicated that the answer depended on the project officer whether it was “occasionally” or “most of the time.” Montana commented that if a vertical gradient is apparent, nested wells will be required to verify if a diving plume exists.

States indicated average ranges of MTBE concentrations in the core of a plume as follows: 0 - 100 ppb - 4 states, 100 -500 ppb - 4 states, 500 - 1,000 ppb - 6 states, 1,000 - 10,000 ppb - 13 states, 10,000 - 50,000 ppb - 2 states, and 50,000 - 250,000 - 1 state. Kansas straddled 500 - 10,000 ppb. Seventeen states didn’t know.

Almost all of the states indicated that average MTBE concentrations detected at receptors are in the 0 -100 ppb range. Massachusetts responded in the 100 - 500 ppb range, Maryland in the 500 - 1,000 ppb range, Delaware in the 1,000 - 10,000 ppb range, and 18 states didn’t know.

Fifteen states indicated that their worst MTBE concentration at an impacted receptor was in the less than 1,000 ppb range. Twelve states had levels in the 1,000 - 10,000 ppb range, 3 in the 10,000 - 50,000 ppb range, 1 in the 50,000 - 250,000 ppb range, 4 in the 250,000 - 1,000,000 ppb range, and 15 didn’t know.

Twenty states indicated that they track the length of MTBE plumes from gasoline releases. Of these states, 6 states responded that their average plume lengths are in the 100 - 250 feet range, 8 said theirs were in the 250 - 500 feet range, one said greater than 500 feet. Five said they didn’t know. Fifteen states indicated that MTBE plumes were often longer that typical BTEX plumes, 11 states said they were sometimes longer. Vermont notes that the MTBE plumes were sometimes longer, particularly in bedrock. When asked about the maximum length of any plume observed in their state, 16 states reported plumes in the range of 1,000 to 5,000 feet. Kansas’ longest plume was in excess of one mile. New York’s East Patchogue site extended over 6,000 feet.

Twenty-four states said their drinking water program requires routine analysis for MTBE. Three states didn’t know, the rest said “no.” Most of the states that answered in the affirmative began routine analysis over a spread of years in the 1990s. A few states just began. Minnesota, New Hampshire, and Rhode Island began in the late 1980s.

The answers to the question of how many public and private wells have been contaminated by MTBE at any level seems to be a function of whether or how hard a state is looking for MTBE. Fifteen states indicated that they didn’t know the answer to this question. Five states answered that none of their public wells were contaminated; six indicated that over 40 of their public wells has MTBE contamination.

Looking at private wells, the answers are murky if one considers the sheer volume of private wells nationwide. States such as New York and Maine that had taken steps to assess the potential for private well contamination had higher numbers. Of the states that answered this question, 10 estimated that they have identified more than 40 private wells with MTBE contamination.

States provided a wide range of answers regarding the contaminant levels at which they would replace or provide point-of-use treatment at public or private wells. The most common range was 20-40 ppb. A number of states indicated they would do so at any detect.

MTBE Remediation

Thirteen (of 45) states indicate that MTBE is never the remediation driver. Twenty-two states indicate that MTBE drives remediation less than 20 percent of the time. Fifteen states indicate that MTBE drives remediation greater than 20 percent of the time. BTEX and/or free product is the primary remediation driver in 37 states.

Ten states indicated that none of their LUST sites are undergoing remediation for MTBE. It is not surprising that most of these states do not have MTBE standards and/or do not analyze for MTBE. Seventeen states indicated that they do not know what percent of their LUST sites are undergoing remediation for MTBE. Of the states that could provide percentages, answers ranged from less than 1 to 80 percent.

Answers concerning percentage of LUST sites where MTBE is the only concern ranged from zero (18 states) to 30 to 40 percent.

Our question on technologies used to remediate MTBE in soil and groundwater and successes failed to fulfill the promise. With respect to soil cleanup, soil vapor extraction is used most frequently. For groundwater, point-of-use-treatment, pump and treat, air sparging/SVE, natural attenuation, dual-phase and multi-phase extraction, and soil excavation are in use most frequently. We recommend that those who are interested read the comments provided by several states.

Most states do not require analysis for MTBE in the effluent stream from SVE or air stripping systems. A few that do, however, provide information on reduction in MTBE mass.

Nineteen states indicated that they are taking any extra steps to make sure MTBE is not migrating beyond standard monitoring parameters. Most of these states indicated that they are using multilevel wells, nested wells, deeper wells, and/or more wells located further downgradient from the source.

Thirty-seven states report closing sites which had MTBE contamination (range is from 1-65 percent of MTBE sites). Twenty-eight states report success remediating sites to closure. Twelve states report that they have reopened previously closed LUST sites because of post-closure detection of MTBE.

Ten states report more aggressive efforts on free product recovery. Eleven other states indicated that they have always been aggressive with free product recovery.

Fifteen states have experienced increased costs associated with MTBE remediation; most report the increase has been less than 20 percent. Five states, however, indicated that their costs had doubled. States attribute increased costs to longer plumes, higher site investigation costs, difficulty to air strip, and inefficiency of carbon primarily.

A handful of state cleanup fund programs account for or plan for MTBE-related contingencies, such as increased cleanup costs or reopening of sites for additional investigation, cleanup, and closure. More of the funds have contingency plans for existing sites where MTBE has been detected and additional MTBE-targeted investigation or cleanup is required.

All but five states use some form of risk-based decision making (RBDM) in corrective action at LUST sites. Of the states that use RBDM, 34 say their process accounts for MTBE. The states provided an array of answers as to how the process works with respect to MTBE.

The states provide a variety of answers as to how clean treated effluent needs to be for discharge to a sanitary or storm sewer. Many provide information on how this number was determined.

Other Oxygenates

States were asked if they analyze for any of the following oxygenates: ethanol, TBA, TAME, ETBE, DIPE, or any others. The overwhelming majority of states indicated that they never analyze for any of these substances. Of the states that do:

- One state analyzes for ethanol "most of the time," nine states "occasionally." South Carolina and Nevada indicated that they have sites where it has been detected.
- Six states analyze for TBA most of the time, 16 do occasionally. Six of these states have multiple sites where TBA has been detected.
- Four states analyze for TAME most of the time, 13 do occasionally. Four indicated that they have a few to several sites where TAME has been detected.
- Four states analyze for ETBE most of the time, 10 do occasionally. Three states have sites where ETBE has been detected, Iowa had 33.
- Five states analyze for DIPE most of the time, 10 do occasionally. Four have multiple sites where it has been detected.
- Missouri monitors for EDB occasionally and South Carolina monitors for ETBA, TAA, and TBF occasionally.

Only five states monitor for ethanol, two others say they do sometimes. Seven states indicated that they have ethanol-contaminated LUST sites. Not surprisingly, 36 states indicated that they did not know if they have ethanol-contaminated LUST sites. Kansas has identified 70 sites that have sold a 10% ethanol/gasoline mix. They are in the process of analyzing these sites.

GIS

Twenty-nine states say they use Geographic Information Systems (GIS) in remedial-action decision making. Of the 21 states that are currently not using GIS, 19 would like to develop and use GIS. The states use GIS in different ways; one of the most common ways is to identify wellhead protection areas. Most of the states that have a GIS system have information on LUST sites, public and private well locations, Superfund sites, and wellhead protection areas. Some state GIS systems provide information on recharge areas, analytical data for LUST sites, screened intervals of wells, dry cleaners, ASTs, groundwater aquifers, landfills, and a selection of other resource information that can be useful tools for UST/LUST programs.

Information Needs

Finally, the top information needs identified by the states were MTBE remediation technologies (e.g., design, applicability, cost, performance), site characterization, MTBE compatibility, MCL for MTBE, leak detection, and health effects of MTBE.

An Evolving Target

This survey is a snapshot in time of state experiences with MTBE. If we examine the state responses carefully we will see a picture—albeit fuzzy in some places—of where states were with respect to MTBE and other oxygenates in the fall of 2000. Changes will continue to take place with regard to MTBE standards, site assessment and cleanup policies. New discoveries of MTBE in public and private wells may catapult some states to greater vigilance. As alternatives to MTBE, such as ethanol, come into focus, there will be changes in the way some states address these potential environmental threats.

Inasmuch as this survey has sought to shed light on a very dynamic issue, we encourage states to check in with us from time to time, so that we can keep this information up to date. Remember, this is a survey of states for states. We have a lot to learn from each other.

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