MTBE Presence in Groundwater

Current Legal and Policy Implications for Prevention and Cleanup

PRS Policy Brief 0607-01
December 5, 2006

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EXECUTIVE SUMMARY

Methyl Tertiary Butyl Ether (MTBE) has replaced lead as an octane enhancer frequently added to gasoline in the United States to increase engine combustion efficiency and reduce tailpipe emissions. The use of MTBE was expanded after the 1990 Clean Air Acts Amendments (CAA Amendments) both banned the use of lead as a gas additive and established oxygenate requirements. These oxygen requirements mandated that oxygen must be added to gasoline in areas that do not reach National Ambient Air Quality Standards for both ozone and carbon monoxide.

The CAA Amendments do not specify what type of oxygenate must be used yet petroleum producers prefer to use MTBE because of its low cost and facile production compared to other potential additives such as ethanol. The two programs established to regulate oxygenate use are as follows: 1) the Oxygenated Fuels Program (OXY) in which gasoline must contain 2.7 percent oxygen by weight during the cold season in areas that fail to meet NAAQS for carbon monoxide, and 2) the Reformulated Gasoline Program (RFG) in which gasoline must contain 2.0 percent oxygen by weight year-round in areas which have the highest levels of tropospheric ozone. As a result, MTBE use is higher in colder and more densely populated regions like the Northeast.

However, increased use of MTBE has resulted in extensive groundwater contamination because of its soluble properties making it costly and difficult to remove from the groundwater. The largest source of MTBE contamination is thought to be from leaking underground storage tanks. The health impacts of MTBE contaminated groundwater are not fully understood but its presence causes poor taste and odor in drinking water which is a major concern for public water suppliers. As a result, a number of states, including New Hampshire, have opt-ed out of the Reformulated Gas Program and have banned the use of MTBE as a gas additive as of January 1, 2007. Other states, including Vermont, who are not required to use oxygenates have voluntarily used them in the past and are now banning their use as well as of January 1, 2007.

MTBE is likely to be phased out over the next decade as a gasoline additive through both federal and state legislation. However, its extent and pervasiveness as a groundwater contaminate pose a major problem for public water supplies in states like Vermont and New Hampshire who have existing MTBE groundwater contamination.

A review of the available MTBE case law suggests some degree of MTBE cleanup and remediation will be handed through litigation and settlement suits against responsible parties. A recent multi-district litigation case has set precedent indicating that the Clean Air Act Amendments do not preempt state tort over MTBE contamination. Furthermore, case law indicates that these parties include not only parties responsible for petroleum spills and leaks but also MTBE producers and refiners who can be held liable for producing a defective product that contaminates the groundwater without warning the public about its potential risks. As a provision that would have granted a liability waiver for the MTBE industry failed in the 2005 Energy Policy Act, the use of liability suits by

states, municipalities and individuals to cover cleanup costs is likely to continue. Lastly, case law suggests that states have jurisdictional standing over municipalities in filing suits against the same defendants.

Remediation and cleanup of MTBE groundwater contamination must focus on both cleanup of existing contamination in water supplies as well as addressing priority point source prevention. Public system wells in urban areas are the most vulnerable to contamination by MTBE and should be a priority for state and municipal governments in MTBE cleanup and remediation. Funding for MTBE cleanup in public water supplies is limited, but available through the Clean Water State Revolving Fund as well as other state-based funds such as New Hampshire's Gasoline Remediation and Elimination of Ethers Fund.

Monitoring and cleanup of leaking underground storage tanks is a priority for the prevention of future MTBE contamination. At both the state and federal level, adequate funding exists for petroleum spill prevention and cleanup. However, understaffing of cleanup programs in both New Hampshire and Vermont appear to be a barrier in completing cleanup at leaking underground storage tank sites. A reallocation of funding would likely increase site cleanup success ultimately reducing MTBE groundwater contamination in the future.

1. BACKGROUND

1.1 Definition and Purpose.

Methyl Tertiary Butyl Ether (MTBE) is commonly added to gasoline in the United States as a fuel oxygenate and for octane enhancement. Added to prevent engines from knocking, MTBE is one of a group of chemicals referred to as oxygenates which were introduced as octane enhancers aimed to increase combustion efficiency by increasing the oxygen content of gasoline.

Beyond increasing combustion efficiency, increased oxygen content allows gasoline to burn more completely, thereby reducing levels of ozone and carbon monoxide through tailpipe emissions reductions.[1] Manufactured by the chemical reaction of methanol and isobutylene, MTBE is a volatile and colorless liquid that is highly soluble in water.

1.2 Introduction of MTBE

MTBE has become the most common oxygenate in gasoline replacing lead tetraethyl which had been used as an octane enhancer for over 50 years until it was phased out during the 1970s because of its detrimental health effects and incompatibility with catalytic converters.[2]

The first lead reduction standards were issued in the early 1970s because of the release and dispersal of lead into the environment from car exhaust. Lead exposure had been linked to negative neurodevelopmental effects in unborn and small children, and studies indicated that children living near motorways had lower IQs than those living in areas with less lead pollution.[3]

1.3 Expanded Use of MTBE

The use of MTBE as a fuel oxygenate was expanded as a result of the Clean Air Act (CAA) Amendments of 1990. The CAA Amendments initiated a phase down in lead use and mandated a ban on lead use as a gas additive as of December 31, 1995.[4] The ban on lead coupled with the oxygenate requirements set forth by Congress in the passing of the 1990 CAA expanded the use of MTBE.

1.4 Oxygenate Requirements Set Forth in CAA Amendments

The CAA Amendments mandate that oxygen must be added to gasoline in areas that do not reach National Ambient Air Quality Standards (NAAQS) for both carbon monoxide and ozone (i.e., non-attainment regions).[5] Oxygenate use is required for two gasoline programs under the CAA Amendments. These two programs are as follows: 1) the Oxygenated Fuels Program (OXY) in which gasoline must contain 2.7 percent oxygen by

weight during the cold season in areas that fail to meet NAAQS for carbon monoxide, and 2) the Reformulated Gasoline Program (RFG) in which gasoline must contain 2.0 percent oxygen by weight year-round in areas which have the highest levels of tropospheric ozone.[6]

1.5 Extent of MTBE Use

While the CAA Amendments do not specify what type of oxygenate must be used, MTBE is the one most commonly used. Petroleum producers prefer to use MTBE because of its low cost and facile production relative to other potential additives such as ethanol. To meet the oxygen requirement of the CAA Amendments, gasoline must contain 15 percent MTBE by volume in OXY fuel areas and 11 percent MTBE by volume in RFG areas (see Figure 1).[7]

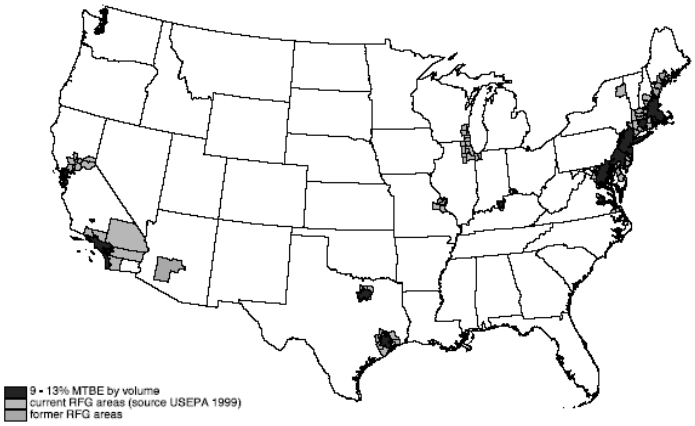

Figure 1. Areas designated as RFG and metropolitan areas where MTBE content in gasoline is 9 to 13 percent by volume. *Source: US Geological Survey.*[8]

Ethanol is the second most commonly used fuel oxygenate and its use varies by region. Ethanol is used more frequently in OXY areas; whereas MTBE is used more frequently in RFG areas to achieve oxygen requirements (see Figure 2). Other alky ether oxygenates have been used to achieve oxygen requirements as well which include tert-amyl methyl ether (TAME), diisopropyl ether (DIPE), and ethyl-tert-butyl ether (ETBE).[9]

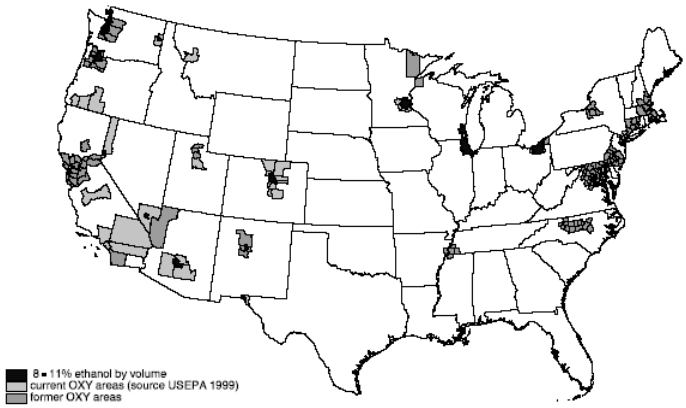

Figure 2. Areas designated as OXY and metropolitan areas with 8 to 11 percent ethanol content by volume. *Source: US Geological Survey.*[10]

Following the enactment of the 1990 amendments, MTBE production rates have increased dramatically as plants were built worldwide to service projected demand. By 1998, MTBE was ranked fourth in bulk chemical production in the United States. [11] By 2004, 20 million tons of MTBE were consumed annually worldwide with the United States accounting for 60 percent of its consumption.[12]

2.0 ENVIRONMENTAL IMPLICATIONS OF MTBE

By the late 1990s, the success of MTBE as a substitute for lead was brought into question. As MTBE is added in higher concentrations in colder regions in order to comply with OXY program oxygen requirements, initial concerns were raised in November 1992 when 200 residents in Fairbanks, Alaska reported feeling nauseous when filling their automobile gas tanks in the arctic weather.[13] Similar health complaints were registered in Anchorage, Alaska; Missoula, Montana and Milwaukee, Wisconsin.[14] These reports, coupled with others that indicated MTBE seeping into the groundwater, raised concerns about the environmental and health implications of MTBE as a substitute additive.[15]

2.1 Health Effects of Exposure to MTBE

The health impacts of MTBE exposure are not completely understood as no long-term study on the effects of MTBE on humans has been conducted. [16] However, studies on the carcinogenicity of MTBE on rodents have shown kidney cancers, liver cancers and testicular cancer in male rodents and lymphatic cancers in females.[17] The impact of MTBE on taste and odor in drinking water is significant, although human responses vary depending on taste sensitivity.

In 1997, the US EPA Office of Water released "Drinking Water Advisory: Consumer Acceptability Advice and Health Effects Analysis on MTBE" which summarizes health impact study results on the health effects of MTBE. It does not impose any regulatory requirements on providers of public drinking water and instead provides recommendations for contaminant levels that would be acceptable to most consumers of public drinking water supplies. It states that thresholds of 20 to 40 ppb or below avert unpleasant taste and odor effects.[18] MTBE is listed as a "hazardous substance" under CERCLA (Superfund) and is considered a "potential human carcinogen" in high doses under the US EPA Office of Water.[19]

Some states have set enforceable drinking water standards for MTBE. New Hampshire has a set standard of 13 ppb, while Vermont has a set standard of 40 ppb.[20] Furthermore, because debate over cleanup costs is driven by concerns over taste and odor of drinking water rather than inconclusive health risks, some utilities are using 5ppb as a threshold for their cleanup cost estimates which is less than EPA threshold recommendations. This

is because some studies have shown that 20 percent of people can taste MTBE in concentrations as low as 1ppb.[21]

2.2 Groundwater Contamination Mechanisms

As a result of its extensive use, MTBE has become one of the most frequently detected volatile organic compounds in groundwater. [22] In addition to its extensive use, MTBE is particularly vulnerable to groundwater contamination due to its chemical and physical properties.

The three most important properties that govern its presence in groundwater are: 1) low air-partitioning coefficient 2) low adsorption onto organic matter and 3) its high water solubility.[23] A low-air partitioning coefficient means that MTBE becomes more highly concentrated in water and does not become diluted or degraded in air. [24] A low-adsorption onto organic matter means that MTBE moves quickly through soil compared to other chemicals whose concentrations can be filtered from contaminating groundwater by adhering to soil particles. [25] Its high water solubility means that groundwater can contain higher concentrations of MTBE compared to other chemicals.

2.3 Nonpoint and Point Sources of MTBE Release

Because the primary use of MTBE in the United States is for the oxygenation of gasoline, the primary source of groundwater contamination is the release of gasoline into the environment (as well as used-motor lubricating oil, home heating oil, and diesel fuel which contain MTBE).[26]

Nonpoint sources of MTBE most likely include evaporative loss from tanks or pipelines, overfilling spills, storm-water runoff from urban areas with small spills, and small (non-reportable) consumer releases of either domestic, commercial, or industrial origin.[27] Additionally, incomplete engine combustion from cars, boats, planes, lawn mowers, chain saws, generators or off-road vehicles could contribute to nonpoint source release of gasoline containing MTBE into the environment.[28]

Point sources of MTBE into the environment most likely include "leaks from large domestic or commercial gasoline, diesel fuel, heating oil, or waste oil storage tanks and associated piping (underground and aboveground), leaks from transport pipelines or bulk stations, larger overfilling spills, motor vehicle or truck accidents, and large consumer releases."[29]

Leaking underground storage tanks (USTs) are considered to be a major source of MTBE as MTBE corrodes gas storage tanks and can leak out undetected from underground tanks. Once it leaks out, MTBE dissolves quickly into the groundwater. More than 400,000 leaking underground storage tank sites with MTBE detections have been identified by the US EPA since 1988. [30]

3.0 LEGISLATIVE AND REGULATORY HISTORY

The legislative and regulatory history of MTBE is complex. A general understanding of it at the state and federal level is essential for understanding future risk of MTBE groundwater contamination. Legislation at both the federal and state level indicates that MTBE will be phased out as a gasoline additive over the next decade. While the phase out of MTBE will not rectify the existing groundwater contamination, an understanding of the legislation will provide a basis for foreseeing the mechanisms of remediation, including legal action.

3.1 Federal Legislative History

As explained, the use of MTBE as a fuel oxygenate was expanded as a result of the Clean Air Act (CAA) Amendments of 1990. The CAA Amendments mandated that oxygen must be added to gasoline in areas that do not meet National Ambient Air Quality Standards (NAAQS) for both carbon monoxide and ozone. These two programs are: 1) the Oxygenated Fuels Program (OXY) in which gasoline must contain 2.7 percent oxygen by weight during the cold season in areas that fail to meet NAAQS for carbon monoxide, and 2) the Reformulated Gasoline Program (RFG) in which gasoline must contain 2.0 percent oxygen by weight year-round in areas having the highest levels of tropospheric ozone.[31]

By 1999, the State of California was the first state to ask for a federal waiver in order to be excused from the Clean Air Act requirement that reformulated gasoline (RFG) contain at least 2.0 percent of oxygen by weight.[32] This request led to the formation of a Blue Ribbon Panel of experts created by the EPA through a Charter from the Clean Air Act Advisory Committee to review the use of MTBE.[33] While the EPA ultimately denied California's request to waive the federal oxygen content requirement in 2001, the US EPA administrator, Carol Browner petitioned Congress in March of 2000 to amend the 1990 Clean Air Act "to significantly reduce or eliminate the use of MTBE in gasoline."[34]

Between 2002 and 2004 there were a number of attempts by Congress to reduce or eliminate the use of MTBE. In April 2002, the US Senate passed a bill to triple the amount of ethanol used while phasing out the use of MTBE as an oxygenate within four years.[35] In June 2003, the Senate passed an amendment onto energy legislation to require refineries to triple the use of ethanol by 2012.[36] However, none of these attempts passed in the House and therefore no reductions in MTBE use occurred.

During the same time period, there were a number of amendment attempts that were initiated in the House of Representatives to shield MTBE producers from any liability associated with product deficiency and groundwater pollution lawsuits.[37] These attempts received strong support by Representatives Barton and DeLay, both of whom were from districts where major MTBE producers were incorporated. In 2003, the Energy Policy Act was filibustered in the Senate over the MTBE liability protection waiver and fell two votes shy of getting the 60 votes needed to thwart the filibuster over MTBE. Congress failed to pass the Energy Bill that year.[38]

In 2005 the future use of MTBE and degree of liability protection were resolved through the passage of the US Energy Policy Act. The issue of MTBE liability waiver protections was the largest challenge in terms of the House and Senate reaching an agreement on appropriate versions of the energy legislation.[39] The liability waiver provision in the House bill was ultimately rejected in the final passage of the Energy Policy Act; meaning that producers of MTBE are not legally shielded from liability suits. Furthermore, the Energy Policy Act mandates the end of the 2 percent oxygenate rule and includes nationwide renewable fuel standards aimed to double the use of ethanol and biodiesel by 2012.[40]

3.2 New Hampshire Legislative History

New Hampshire's four southeastern counties (Merrimack, Hillsborough, Rockingham and Strafford counties) were designated as non-attainment zones based on their high levels of ozone under the CAA. New Hampshire committed to the federal RFG program in 1995 as one of several measures required under CAA to bring the four-county areas into compliance with the NAAQS ozone level stands.

However, by 2001 the New Hampshire Governor and General Court determined that due to increased MTBE detections in groundwater, it was a state priority to remove New Hampshire from the federal RFG program. In March 2001, Governor Shaheen issued Executive Order 2001-02 and the Legislature passed HB 758 both ordering the Department of Environmental Services (DES) to pursue an opt out from the federal RFG program.

In order to opt out of the federal RFG program, New Hampshire had to demonstrate that it would be able to achieve volatile organic carbon (VOC) emissions reductions committed to in its EPA approved State Implementation Plan by replacing the RFG with another program that achieves equivalent reductions.[41] This was accomplished in May 2002 through the DES adopted rule, New Hampshire Code of Administrative Rules, PART Env-A 1611, *Oxygen Flexible Reformulated Gasoline* (OFRFG).[42] By March 2004, the US EPA approved New Hampshire's request to opt out of the federal RFG program. The result allowed New Hampshire to meet the NAAQS for ozone through the state's proposed Oxygen Flexible Reformulated Gasoline Program while also allowing the state the option to ban the use of MTBE.[43]

In the spring of 2005, the New Hampshire General Court passed House Bill 58, which bans the importation, sale and storage of gasoline in New Hampshire with greater than 0.5 percent MTBE. This action effectively bans MTBE as a gas additive across the state and will go into effect as of January 1, 2007.[44]

3.3 Vermont Legislative History

Vermont has not had to opt into the federal RFG program because no nonattainment areas exist in the state of Vermont. Therefore, the legislative history of MTBE has been much

shorter in the state of Vermont compared to states like New Hampshire that were mandated to comply with CAA Amendments.

While the gasoline used in Vermont is not subject to CAA requirements, most gasoline sold in Vermont contains oxygenates including MTBE, although frequently at lower concentrations.[45] Therefore, due to concerns over increasing detections of MTBE in groundwater, the Vermont General Assembly enacted H. 188 on May 23, 2005, banning the sale and storage of gasoline in concentrations greater than 0.5 percent effective as of January 1, 2007.[46]

4.0 LEGAL ACTION AND CASE LAW

A review of the available MTBE case law provides an indication of the degree to which MTBE cleanup and remediation reparations will be handled through the litigation and settlement suits against responsible parties. The review suggests that litigation may play some role in establishing responsibility for MTBE cleanup costs, but that the burden will be on the state to incur cleanup costs.

MTBE litigation and case law falls into two categories: 1) suits in which the plaintiffs--communities, citizens, or groups of cities--sue defendants for clean up reparations associated with a MTBE spill or leak, and 2) suits which seek to bypass this "spiller pays" rule and instead hold the oil industry liable for putting MTBE in gasoline in the first place. These cases claim that MTBE is a defective product.[47]

The first of these types of lawsuits are rather case specific and a review of the case law history associated with them reveals little new about the future of how litigation will relate to establishing responsibility for MTBE cleanup.

In light of the failure of the liability waiver amendment in the 2005 Energy Policy Act, the use of liability suits to cover cleanup costs is likely to continue. Therefore, second of these types of lawsuits are more pertinent in establishing how future litigation will establish responsibility and precedent for MTBE liability.

4.1 Industry Liability

Many states filed product liability suits after the EPA decided in the 1990s that it could not use Superfund authority to order MTBE cleanups.[48] To date, there have been 157 product liability lawsuits filed in 17 states, including New Hampshire and Vermont, against MTBE producers by water municipalities and government entities. These cases include claims that MTBE is a defective product and that its presence in groundwater and drinking water constitutes a "nuisance."[49]

4.2 Case Law for Product Liability

Two major cases serve as case law for product liability suits. However, as is common in defective product suits, the majority of defendants chose to settle before the trial. Nevertheless, this case law does provide significant precedent for liability suits.

In *South Tahoe Public Utility District v. Atlantic Richfield Company et al.*, Civ. No. 999128 (San Francisco Superior Court) (complaint filed April 16, 1999), the plaintiffs claimed that MTBE leaked into the groundwater through leaking underground storage tanks. Because the South Tahoe Public Utility District provides water to the public exclusively through the use of public wells, the District determined the water unfit to drink.

The plaintiffs sued MTBE manufacturers, refiners, gasoline stations, and distributors of gasoline containing MTBE (Atlantic Richfield Company, ARCO Chemical Company (a subsidiary of Lyondell), Shell Oil Company, Shell Oil Products Company, Chevron U.S.A., Inc., Exxon Corporation, B.P. America, Inc., Tosco Corporation, Ultramar, Inc., Beacon Oil Co., USA Gasoline Corp., Terrible Herbst, Inc. Rotten Robbie, J.E. Tveten, Corp., Tahoe Tom's Gas Station, the Southland Corporation, Paradise Chevron, Unocal and Tesoro).[50] The plaintiff alleged that defendants both produced a defective product and caused extensive contamination of the public drinking water supplies and hence were liable for trespass and nuisance as a result.[51]

All but two defendants settled prior to trial for a total settlement of $37 million. The remaining two defendants, Shell Oil and ARCO Chemical Company went to trial. The jury found MTBE to be a defective product in design because "of the risk of harm inherent in its design which outweighed the benefits of that design" and because of "failure to warn" the public about the risks associated with it.[52] Furthermore, the jury found that the defendants acted in malice when they sold MTBE or gasoline containing it because of this "failure to warn" the public.[53] Shell Oil settled for $28 million and ARCO Chemical Company settled for $4 million.[54]

In the *City of Santa Monica v. Shell Oil Company, et al.* Case No. 01CC04331 (Superior Court, Orange County) (complaint filed June 19, 2000), the plaintiffs discovered MTBE in its public water supply during routine sampling of the Charnock well field in 1995. This contaminated well field accounts for half of the city's water supply. Again, the plaintiff sued MTBE manufacturers, suppliers, and refiners claiming MTBE to be a defective product and that the defendants were liable for the well field pollution under strict liability, negligence, trespass, and nuisance theories.[55]

The defendants in this case included Shell Oil Company, Shell Oil Products Company, Shell Pipeline Corporation, Mobil Oil Corporation, Chevron Corporation, Chevron U.S.A. Inc., Chevron Products Company, Lyondell Chemical Company Atlantic Richfield Company, Exxon Mobil Corporation, Tosco Corporation, Ultramar, Inc., Texaco Refining and Marketing, Inc., Equilon Enterprises LLC, ARCO Chemical Company, Exxon Corporation, Unocal Corporation, and Equilon Pipeline Company LLC.[56]

All defendants except for one manufacturer of MTBE settled before the trial for a total settlement of $124.37 million.[57] Beyond this, three of the defendants will pay the full cost of well field remediation once the remediation is completed. Therefore, the total estimated settlement is roughly $313 million.[58]

4.3 Consolidated Multi-District Litigation: Tort Suit Preemption

Three cases from the state of New Hampshire and two cases from Vermont have been filed for MTBE product liability against MTBE producers and refiners (see Table 1). All of these suits were removed to the United State District Court for the Southern District of New York and were consolidated with other MTBE product liability cases filed from around the country (in Re: MTBE Product Liability Litigation).

Table 1. New Hampshire and Vermont MTBE defective product lawsuits. *Source: http://www.ewg.org/reports/oilandwater/lawsuits.php.*

State	Client	Case Status
NH	City of Dover	Filed 11-20-03
NH	City of Portsmouth	Filed 10-24-03
NH	State of New Hampshire	Filed 9-30-03
VT	Craftsbury Fire District #2	Filed 1-12-04
VT	Town of Hartland	Filed 11-18-03

The consolidation of these cases is referred to as Multi-District Litigation (MDL) and is commonly used when civil actions involving one or more common questions of basic fact are brought to suit in different districts.[59] These suits were consolidated for discovery, after which they will be returned to state and local courts.

The debate in question is that industry attorneys see MTBE groundwater contamination as an issue of leaking underground gasoline storage tanks whereas the 80 plaintiffs from 15 states who make up the consolidate claim see it as a classic case of defective product liability.[60]

The specific legal question in consideration is whether or not the Clean Air Act preempts state tort lawsuits over contamination of MTBE as an additive.[61] The MTBE producers and refiners argue that they are not responsible for the defective product because they were following the directive of Congress to add oxygenates to gasoline when both Congress and EPA intended and expected MTBE to be the primary additive to fulfill that mandate.[62] The plaintiff lawyers claim the industry knew of its widespread water contamination potential as far back as the early 1980s.[63]

Furthermore, the plaintiff lawyers contend that the entire industry is culpable because once contamination has occurred it is difficult to pinpoint the original sources of contamination. This legal strategy is called "market share" liability theory and has been used in a number of defective product liability suits.[64]

US District Court Judge Scheindlin ruled on June 23, 2006 that the Clean Air Act does not preempt state tort lawsuits writing that "the 1990 Clean Air Act Amendments aimed to give states flexibility in setting emissions standards and not to give "unfettered discretion to defendants to use any oxygenate, regardless of safety."[65] Furthermore, Judge Scheindlin added that tort claims produce not "clear restriction on the implementation of the [Clean Air Act] Amendments" and that "the fact that the EPA expected MTBE to be used does not amount to a means-related objective or a mandate that defendants use MTBE."[66]

Additionally, Judge Scheindlin creates a new theory for imposing liability in the MDL ruling. This theory, commingled liability, allows plaintiffs to pursue all defendants for groundwater contamination caused by MTBE even if they were not directly responsible for producing the chemical.[67]

"When a plaintiff can prove that certain gaseous or liquid products of many suppliers were present in a completely commingled or blended state [...] and the commingled product caused a single indivisible injury, then each of the products should be deemed to have caused the harm," the ruling states.[68]

Commingled liability is different from market liability theory because it provides "some assurance that all defendants found to be liable would actually have caused a plaintiff's losses."[69] Comparing the case to state tobacco claims, plaintiff's lawyers claim it could force the industry into a nationwide settlement by exposing chemical manufacturers of MTBE to lawsuits around the country.[70] Some estimate that an MTBE settlement could cost the industry between $15 billion to $65 billion.[71]

Four of the cases within the MDL may go to trial as soon as September of 2007. The results of the MDL case determines allowable strategies for plaintiffs' attorneys in terms of establishing who can received reparations for damages incurred as well as who is responsible for cleaning up MTBE.[72] Additionally, the MDL ruling means that any new cases can throw out the preemption argument, which is a fundamental argument in the industry's defense.[73] The implication of the MDL rulings, thus far, suggests that more cases against MTBE producers and refiners will be brought by states, communities and water suppliers.

4.4 State Versus Municipalities: Judicial Standing

While the plaintiffs in the consolidate MDL case *in Re: MTBE Product Liability Litigation* is comprised of states as well as communities and water suppliers, there has been dispute over what polities have jurisdictional authority to file suit against

manufacturers, suppliers, and distributors of MTBE. The issue of jurisdictional authority is important in considering what levels of government, state or municipal, are eligible to file suits and thus receive reparations from industry defendants.

The *State of New Hampshire vs. City of Dover and City of Portsmouth* (153 N.H. 181, 891 A.2d 524) is an example of such a case where the municipalities aim to seek reparations separate from those of the state in pursuing product liability suits. This case refers to the three claims from New Hampshire consolidated under *in Re: MTBE Product Liability Litigation* (see Table 3).

The State of New Hampshire brought suit against thirty out-of-state MTBE manufacturers and refiners on September 30, 2003, alleging that MTBE had polluted the ground and surface waters of New Hampshire. The suit alleged seven courses of action: 1) strict product liability; 2) strict product liability based upon failure to warn; 3) public nuisance; 4) strict liability under RSA chapters 146-A (2005) and 146-G (2005 & Supp. 2005); 5) trespass; 6) negligence; and 7) unfair or deceptive business acts in violation of the Consumer Protection Act, RSA 358-A:2 (Supp. 2005). The State Attorney General distributed a memorandum on October 16, 2003 to all public water suppliers in the State, including cities, explaining the State's suit and informing them that separate suits by public water suppliers would be considered duplicative.[74]

By October 24, 2003, the City of Portsmouth filed suit against sixty-one MTBE manufacturers and refiners including various in-state entities not sued by the State. The City of Dover filed a similar suit against the same sixty-one defendants on November 19, 2003 in superior court. Both cities' suits allege the same cause of action in addition to 1) civil conspiracy and 2) private nuisance.[75]

While all three suits were then consolidated under *in Re: MTBE Product Liability Litigation*, the State of New Hampshire brought a suit on superior court seeking that the cities' MTBE suits be dismissed because under New Hampshire law they yield to the State's suit.

The cities referenced the Groundwater Protection Act (RSA 485-C;1, II (2001) stating that because "groundwater is primarily a local resource, cities and towns should have the first opportunity to institute programs for groundwater protection." However the court found that "the first opportunity to institute programs does not expressly confer upon municipalities the power to sue for contamination of public water supplies. Rather it confers upon the state 'general responsibility for groundwater management in the public trust and interest." However, the trial court ruled that the State had *parens patriae* standing and which required that cities yield to the State's suit. [76]

On appeal, the cities argued that trial court's ruling as erroneous because 1) the State has not met the requirements for asserting *parens patriae* standing; 2) even if the State has *parens patriae* standing, the cities have a compelling interest in maintaining separate suits against the defendants; 3) the ruling contravenes a comprehensive statutory framework, by which the legislature has authorized and directed municipalities to bring

MTBE contamination suits; and 4) requiring the cities' suits to yield to the State's suit violates the cities' constitutional right to a certain and complete remedy and the separation of powers doctrine *(N.H. CONST. pt. I, arts. 14, 37)*. The Supreme Court of New Hampshire denied all four of the cities' claims on appeal. [77]

The result of this case shows that the burden of proof is on the cities and municipalities to show that they cannot obtain complete relief through the state's suits. The motivation behind this case was that cities feared the state would not distribute financial reparations to the cities in accordance with individual damages but rather will establish a public fund managed by the attorney general. This case sets as strong precedent for conflicts that will inevitably arise as more states and municipalities seek to take legal action against MTBE manufacturers and refiners to fund clean up costs and provide financial reparations for contaminated public water supplies.

5.0 EXTENT OF GROUNDWATER CONTAMINATION BY MTBE

5.1 Nationwide Extent of Groundwater Contamination

Contamination of groundwater by MTBE exists across the United States but is most concentrated in the Northeast region as well as parts of California (see Figure 3). Studies conducted by the US Geological Survey indicate that MTBE detection in groundwater was strongly associated with population density and use of MTBE in gasoline.[78] Population density is related to MTBE contamination because: 1) RFG and OXY areas are more likely to be in urban areas like the Northeast and parts of California, and 2) highly populated areas have the highest gasoline use (see Figure 4).[79]

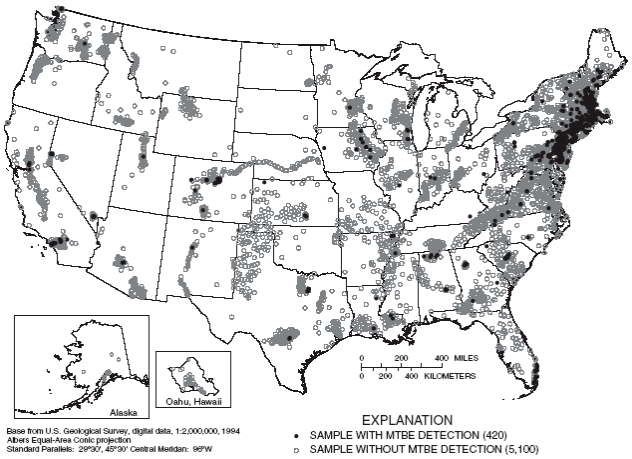

Figure 3. Locations of samples of ground water, source water, and drinking water that were analyzed for MTBE and the locations of samples with detections of MTBE using no assessment level.
Source: US Geological Survey.[80]

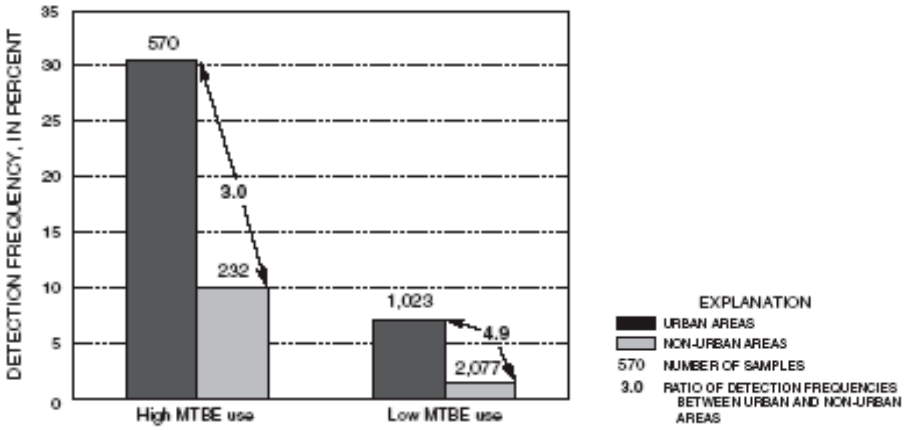

Figure 4. Detection frequencies of MTBE in samples of ground water for areas of urban and non-urban land use and by areas of high and low MTBE use using no assessment level. *Source: US Geological Survey.*[81]

Detections of MTBE in groundwater are more frequent in areas where MTBE is used as a gasoline oxygenate compared to areas where MTBE is not used as a gasoline oxygenate.[82] Therefore, OXY and RFG areas are more likely to have increased MTBE groundwater contamination. However, MTBE has been detected in groundwater in many others areas beyond strictly OXY and RFG areas (see Figure 5).[83]

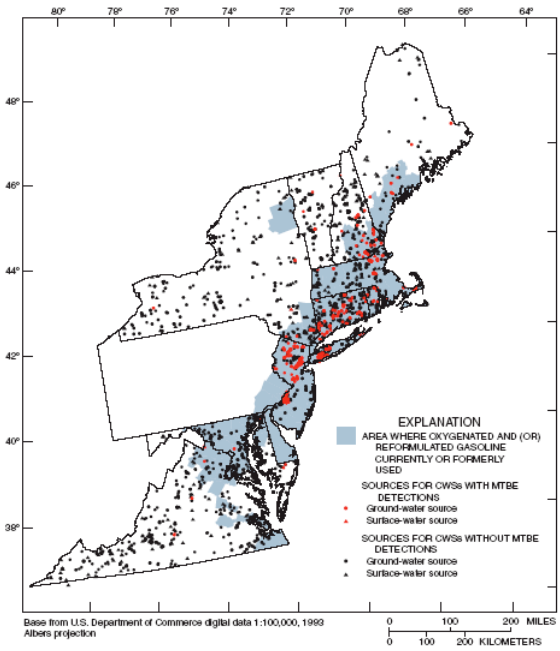

Figure 5. Results of USGS study which randomly selected and sampled community water systems in the study area, showing systems with analytical data and those systems with reported detectable concentrations for methyl tert-butyl ether, in relation to areas where oxygenated and (or) reformulated gasoline is currently or was formerly used (US Environmental Protection Agency, 1998c, 1998d). *Source: US Geological Survey.*[84]

5.2 Extent of Groundwater Contamination in New Hampshire

Four New Hampshire counties are part of the RFG program (Hillsborough County, Merrimack County, Rockingham County and Strafford County). Therefore, it is not surprising that these counties have the highest reported levels of MTBE groundwater contamination among public-water supply wells in the state (see Figure 6).[85]

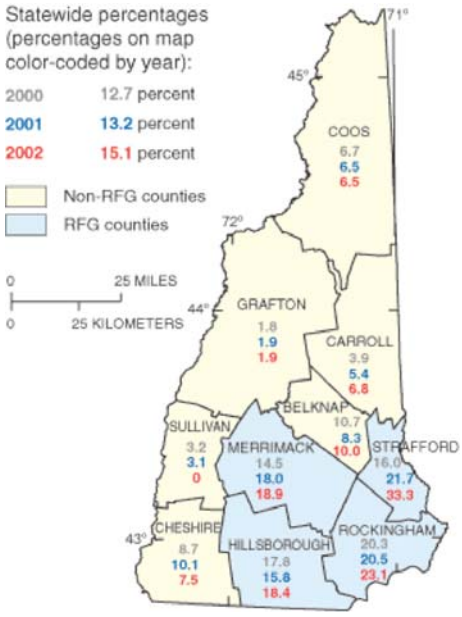

Figure 6. Percentage of public water-supply wells with MTBE concentrations greater than or equal to 0.5 microgram per liter by county for 2000, 2001, and 2002, showing counties where reformulated gasoline (RFG) is and is not required. *Source: US Geological Survey.*[86]

Beyond this, the percentage of public water-supply wells with MTBE levels at or above detection level of 0.5 µg/L, has increased statewide from 12.7 percent in 2000 to 15.1 percent in 2002; although only four percent of public wells exceed the state limit of 13 ppb.[87] While this occurrence is greatest in the four New Hampshire counties that use reformulated gasoline, the occurrence of MTBE contamination in the water supply is increasing statewide, even in regions where reformulated gasoline is not required.[88]

5.3 Extent of Groundwater Contamination in Vermont

Vermont has not been part of the RFG or OXY program and therefore is not required to add MTBE to gasoline sold in the state of Vermont. However, nearly all gasoline sold in Vermont contains MTBE. Therefore, MTBE has been found throughout Vermont's water supply.

Statewide, the Vermont Department of Natural Resources has found 1,500 sites with MTBE contamination, including 300 drinking water wells that exceed the state limit of 40ppb.[89] According to a study conducted in 2002 by the Vermont Agency of Natural

Resources, over 85 percent of petroleum contaminated sites contain MTBE contamination.[90] Furthermore, the number of petroleum-contaminated sites in Vermont has increased over time but does appear to be stabilizing somewhat due presumably to investments in double-walled underground storage tanks.[91] This suggests that the leaking of underground storage tanks are the main contributors to MTBE groundwater contamination (see Figure 7).

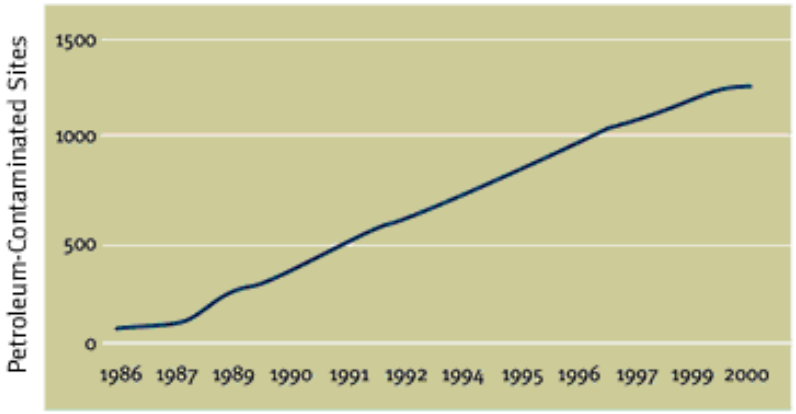

Figure 7. Number of Petroleum-Contaminated Sites in Vermont. *Source: VT Agency of Natural Resources*.[92]

6.0 PRIORITIZING MTBE REMEDIATION AND PREVENTION

Cleanup costs associated with MTBE groundwater contamination are incurred primarily by states. Therefore, states have to prioritize remediation options. As there are a number of point and nonpoint source leading to MTBE contamination of groundwater, there are a number of potential strategies and options for addressing the remediation of MTBE. The issue of extensive MTBE groundwater contamination can be broken into two problems, both of which require state involvement to rectify. The two problems are as follows: 1) prioritizing the cleanup options for once MTBE contamination has occurred, and 2) identifying the priority sources leading to MTBE contamination in the first place.

6.1 Prioritizing Cleanup Options: Public System Wells

The first problem involves prioritizing cleanup options to treat contaminated water supplies once MTBE has entered the groundwater. Groundwater contamination impacts both public water supplies as well as private wells. There are a number of factors to consider when prioritizing strategies for cleanup.

Prioritizing strategies for remediation will vary for states depending on the distribution of water sources. Financing and coordinating the remediation of public water supplies is different from coordinating the remediation of private wells. Therefore, the priorities for contamination cleanup vary specifically based on local needs. New Hampshire and

Vermont have fairly similar distributions of water sources across the state (see Table 2). While the majority of households in each state use public system wells, over 35 percent of households use private well systems. In terms of prioritizing remediation strategies, this would suggest that states need to address both public and private wells which together comprise nearly 90 percent of household water sources in both states.

Table 2. Source of Water Supply for New Hampshire and Vermont Households. *Source: US Bureau of Census, 1990 Census of Population and Housing.*

	New Hampshire Households	***Percentage of Households***	***Vermont Households***	***Percentage of Households***
Public System Well	303,911	60.31 %	137,953	50.86%
Private Well	188,825	37.47%	99,781	36.79%
Surface Source	11,168	2.22%	33,480	12.34%

However, an evaluation of prioritization options for MTBE remediation needs to take into account factors that could govern spatial variation in MTBE occurrence levels. A study conducted by the New Hampshire Department of Environmental Services (NHDES) reveals a number of important variables in terms of MTBE occurrence in groundwater.

First, public wells appear to be more contaminated with MTBE than private wells, at least in Rockingham Country, New Hampshire Additionally, there was higher percentage of wells with MTBE detections for public wells on bedrock aquifers compared to public wells on unconsolidated deposits (41.8 and 31.8 percent, respectively) (see Table 3).

Table 3. MTBE Detection Frequency by Well Type, Public-Supply Establishment Type, and Public-System Category in Rockingham County, NH. *Source: US Geological Survey.*[93]

	Number of samples	***Percentage of wells with MTBE concentrations higher than 0.2 µg/L***
Well/aquifer type		
Private (all bedrock)	103	21.4
Public	120	40.0
Bedrock	98	41.8
Unconsolidated deposits	22	31.8
Public-supply establishment type		
Residences	38	63.1
Commercial	27	40.7
Schools/recreation	39	20.5
Large community systems (serving at least 1,000 people)	16	31.3

This study further demonstrates that population density and distance from underground storage tanks are the two factors which contribute to the probability of MTBE detection in groundwater (see Figure 8). This study also suggests that leaking underground storage tanks are a primary contributor to MTBE groundwater contamination and that resources focused on addressing leaking underground storage tanks may be the most effective in dealing with MTBE groundwater contamination.

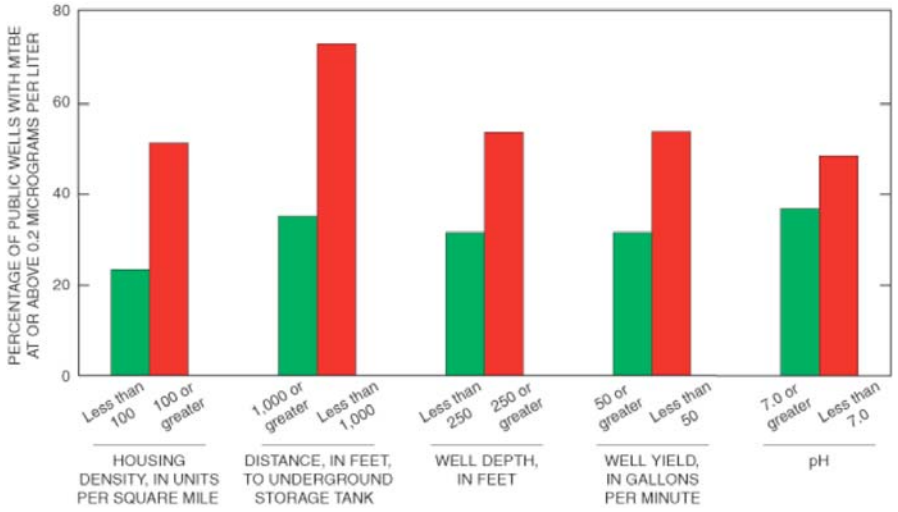

Figure 8. MTBE Occurrence: public wells related to housing density, distance to nearest underground gasoline storage tank (UST), well depth, well yield and pH of the water sample, Rockingham County, New Hampshire. *Source: US Geological Survey.*[94]

The results of this study suggest that urban areas should be prioritized for MTBE remediation. Therefore, a consideration of the distribution of water supply sources needs to be taken into account in terms of prioritizing effective remediation strategies. According to the US Census Bureau, public system wells account for over 90 percent of water sources for urban areas in New Hampshire (see Table 4). Presumably a similar trend exists in Vermont although there is no available data to confirm this assumption.

Table 4. Sources of Water Supply In Two Urban Areas In New Hampshire. *Source: US Bureau of Census, 1990 Census of Population and Housing.*

	Households in Manchester, NH	***Percentage of Households***	***Households in Portsmouth, NH***	***Percentage of Households***
Public System Well	48408	96.86%	43326	92.17%
Private Well	1541	3.08%	3585	7.63%
Other Source	30	0.06%	97	0.21%

This information suggests that remediation priority should be given to public system wells in urbanized areas for two reasons: 1) urban areas rely more heavily on public system wells, and 2) MTBE is more likely to contaminate groundwater in urban areas.

6.2 Available Funding Sources for MTBE Remediation in Public System Wells

The cleanup costs associated with MTBE-contaminated water supplies in the US for public water systems are estimated to be approximately $25 billion dollars.[95] Cleanup of MTBE-contaminated water supplies will be extremely costly and challenging and lack of funding is a major obstacle in addressing MTBE remediation in groundwater. However, some federal and state funding sources do exist for public drinking water source protection and remediation. Identifying key federal and states sources of funding available for public water system cleanup allow a targeted approach for remediation of MTBE contaminated groundwater.

Clean Water State Revolving Fund (CWSRF) is a federal program created through the Clean Water Act of 1987. Its primary mission is to promote water quality. The CWSRF has $30 billion in assets and annual funds allocate approximately $3 billion in water quality projects.[96] The MTBE Blue Ribbon Panel on Oxygenates in Gasoline encouraged states to consider targeting State Revolving Funds in their findings in order to accelerate treatment and remediation in high priority areas.[97] Furthermore, the use of CWSRF funds to remediate point source contamination of MTBE within high priority public system wells is an appropriate use of the CWSRF funds. The Clean Water Act stipulates that point source CWSRF projects must be publicly owned in order to be eligible for CWSRF funds.[98]

Vermont has no such additional funding program for the remediation of water supplies. However, New Hampshire, which has the highest levels of MTBE groundwater contamination in New England, has established an additional fund in 2001 for the remediation of MTBE in groundwater. The State of New Hampshire has initiated the Gasoline Remediation and Elimination of Ethers Fund (GREE) under its Petroleum Reimbursement Fund. The GREE fund aims to facilitate the remediation and cleanup of water supplies which have been contamination with petroleum ethers including MTBE. This fund is financed through a $.025/gallon tax on gasoline containing ethers sold within the state.[99] For 2006, the fund has an annual budget of $2,886,747 and has undertaken a total of 100 projects since its creation.[100] The fund covers costs associated with site monitoring, cleanup and for the provision of potable drinking water during the duration of the project.[101]

6.3 Prioritizing Prevention of MTBE Groundwater Contamination

The second problem relates to the source of MTBE contamination and prioritization of the mechanisms that most contribute to MTBE contamination. As described, MTBE enters the groundwater through nonpoint sources including evaporative loss from tanks, storm-water runoff, and small spills as well as point sources including large spills leaks from transport pipelines and leaks from large domestic or commercial storage tanks.

Leaks from underground storage tanks are thought to be the largest contributor to MTBE groundwater contamination. As US EPA has identified over 400,000 leaking underground storage tank sites (LUST sites) with MTBE detections since 1988, prioritizing the identification, prevention and containment of LUST sites is a top priority for addressing the primary contamination source of MTBE into groundwater.

Both New Hampshire and Vermont are below the national average in terms of compliance with the Significant Operational Compliance (SOC) Standards (see Table 5). These SOC standards were implemented in 2003 by the EPA to measure the quality of USTs.[102] Release Prevention standards assess the operation and maintenance of the storage tanks, corrosion protection measures, and spill and release prevention measures.[103] The Release Detection standards assess that the UST has a functional method to detect releases as well as release monitoring records taken on a monthly basis.[104] Vermont has more stringent requirements that stipulate that tanks must be monitored weekly and that controlling inventory is not an acceptable means of release detection.[105] However, even with Vermont's more stringent standards on release detection, the percentage of LUST sites that comply with those detections standards is roughly equal to those of New Hampshire and over 25 percent less than the national average.

Table 5. UST/LUST Program Status in Vermont and New Hampshire as of Sept, 2005. *Source: US EPA.*[106]

Corrective Action Measures			
	Vermont	**New Hampshire**	**Nationwide**
Number of Active Underground Storage Tanks	3,011	2,935	653,621
Number of Confirmed Releases	1,930	2,218	452,041
Number of Cleanups Completed	1,136	1,389	332,799
Backlog of Cleanups to be Completed	794	829	119,242
Percentage of Confirmed Releases With Completed Cleanups	59%	63%	74%
Significant Operational Compliance (SOC) Standards			
	Vermont	**New Hampshire**	**Nationwide**
% of USTs That Meet Release Prevention Standards	57%	54%	77%
% of USTs That Meet Release Detection Standards	46%	45%	72%
% of USTs That Meet Both Standards	46%	31%	63%

Furthermore, both Vermont and New Hampshire have a significant number of confirmed releases from LUST sites (1,930 and 2,218 respectively). While both states have completed cleanup for a majority of the LUST sites, both Vermont and New Hampshire are below the national average in terms of percentage of UST sites with completed cleanups. Nationwide, 74 percent of confirmed LUST sites have completed cleanups. Vermont has only complete 59 percent of cleanups for confirmed LUST sites while New Hampshire has completed cleanup for 63 percent of its confirmed LUST sites (see Figure 9).

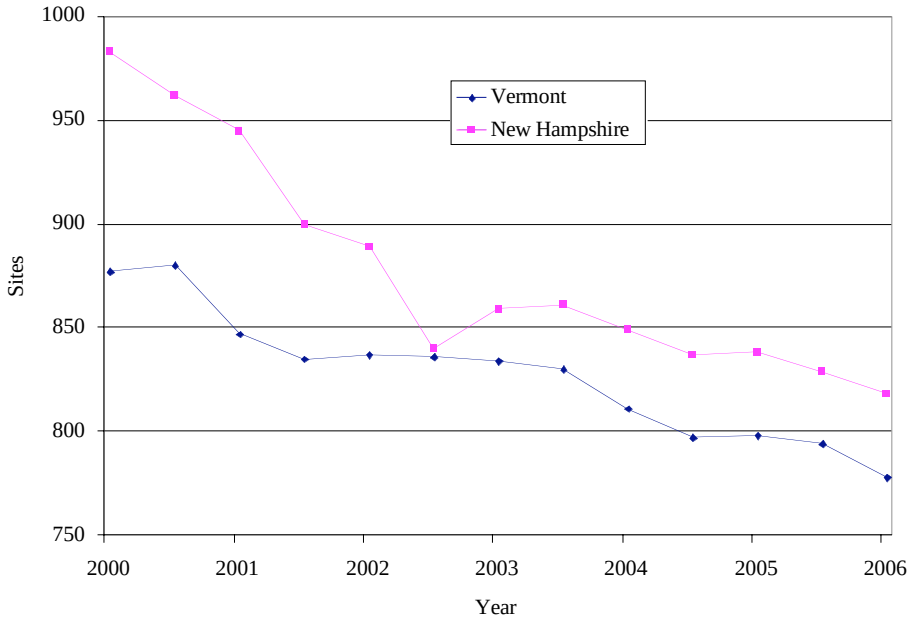

Figure 9. Backlog of UST Releases in Vermont and New Hampshire.
Source: Funding Brownfield Development, Dartmouth College: Rockefeller Center.[107]

6.4 Federal and State Funding Sources For UST Cleanup

Petroleum leaks associated with LUST sites often qualify as Brownfield and are eligible for a number of state and federal funding sources aimed at Brownfield Remediation. The sources of funding associated with Brownfield Remediation are complex and beyond the scope of this report.[108] However, identifying the key federal and states sources of funding available for LUST sites provides a targeted approach to seeking funding for MTBE contamination prevention associated with LUST sites and provides key insights into the barriers affecting cleanup.

When a UST leak occurs, the tank owners or operators are required under the EPA federal underground storage tank regulations to report the incident to the state agency implementing the LUST program and then initiate cleanup.[109] While the circumstances vary by state, the state generally then requires that the tank owner or operator pay for some portion of the cleanup while covering the remainder of the cleanup through state funding programs.[110] However, because SOC standards exist, most releases are not discovered until the tanks are taken out of service and, in some cases, the owners or operators are unable to perform the cleanup or cannot be identified.[111] Therefore, states depend on federal or state sources of funding to cover the cost of cleanup.

Numerous sourcing of funding for petroleum cleanup exist at the both the federal and state level. At the federal level, Congress annually provides states with grants from the LUST Trust Fund it created in 1986.[112] The purposes of the fund are twofold. First, it provides funding for the oversight and enforcement of corrective action by responsible parties (owners and operators at the LUST site). Second, it provides funding for cleanups

at sites where owner or operator is unknown, unwilling or unable to respond, or those sites which require emergency action. However, only about four percent of all cases have been without a responsible party.[113]

This fund is replenished primarily through a $.001/gallon federal tax on gasoline and other fuels which annually generates about $70 million. By the end of fiscal year 2001, the LUST trust fund had a balance of $1.7 billion.[114] Eighty percent of the generated revenue is allocated to the states for administration, oversight and cleanup of LUST sites. States receive funding based on their cleanup workload and usually about one-third of funding is for state administration, one-third for state oversight and enforcement and one-third for cleanups.[115]

At the state level, most states do not receive appropriations from their legislatures to cover cleanup costs, but rather pay for them out of funds made available through state gasoline tax revenues, annual tank fees or both.[116] Both Vermont and New Hampshire have a variety of programs at the state level for petroleum cleanup, financed primarily through taxes on petroleum products.

The State of Vermont has a Petroleum Cleanup Fund (PCF) that contains two separate accounts with similar provisions. One account is for motor fuel and the other is for heating oil. In 2005, the fund provided $3,409,452 for motor cleanup and $1,579,587 for heating oil cleanup. $2,903,051 was provided for remediation at 1,292 LUST sites. The revenue for the motor fuel account comes from a combination of an annual assessment fee of up to $200/tank on most underground storage tanks and a tax of $.01/gal on all motor fuel sold within the state. Additional revenue comes from repayment of loans and interest accruing on the fund's cash balance. More recently, recovery of costs from responsible parties has made up a larger share of annual revenue for the PCF (see Figure 10).[117] This suggests that recovery from increased litigation may significantly contribute to cleanup funding in the future.

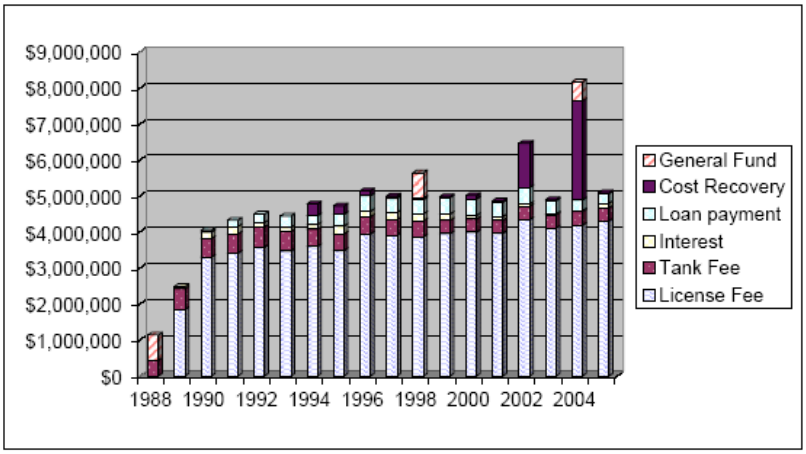

Figure 10. Vermont's Annual Petroleum Cleanup Fund Income. *Source: VT Agency of Natural Resources.*[118]

The state of New Hampshire has the Petroleum Reimbursement Fund's Oil Discharge and Disposal Cleanup Fund which provides state level funding to reimburse the cleanup of spills at LUST sites. The Oil Discharge and Disposal Cleanup Fund operates similarly to Vermont's PCF in that it is financed by a $.0125/gallon tax on motor fuels sold within the state. It has generated an annual budget in 2006 of $13,812,797. Recipients pay a deductible at the start of the project ranging from $5,000 to $30,900 depending on the size of the facility and funding can range up to $1.5 million.[119]

Overall, 1,461 projects have been undertaken since the fund's creation in 1988. However, only five new projects have been undertaken through the Oil Discharge and Disposal Cleanup Fund since 2004.[120] This is curious considering that the state of New Hampshire has a backlog of over 800 LUST sites where cleanup has not yet been completed. This suggests that the challenge in LUST site remediation may have little to do with a lack of available funding at the state and federal level (see Table 7).

In May 2001, Vermont conducted a survey of state funding programs which indicated the availability of state and federal funding had little to do with the backlog of LUST sites whose cleanup has yet to be completed.[121] It identified the lack of staff to oversee the cleanups as a barrier to cleanup progress. On average across the states surveyed, each staff member was responsible for overseeing about 130 tank sites per year. [122]

Vermont for example, received $400,000 in LUST trust funds in 2006 which provided salaries for the nine employees that managed the site cleanups that year.[123] Therefore, each employee was responsible for managing 143 site cases during 2006. While state and federal funding has allowed for an increasing budget for LUST site remediation, the funding allocated to administrative costs has remained relatively constant over time (see Figure 11).

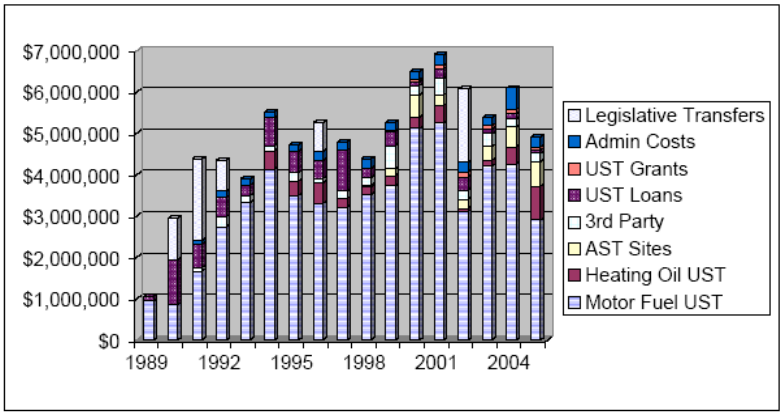

Figure 11. Vermont Petroleum Cleanup Fund Spending. *Source: VT Agency of Natural Resources.*[124]

The result appears to have generated a barrier in terms of addressing the remaining backlog of LUST sites which require remediation. This suggests a reallocation of funding for administrative costs and increased staffing is required to remove this barrier to successful remediation of LUST site contamination by MTBE.

7.0 FINDINGS

Legislative Findings

State and federal level legislation indicates the phase out of the MTBE as a oxygenate additive over the next decade. Both New Hampshire and Vermont bans on the use of MTBE will reduce the likelihood of the future MTBE contamination of groundwater sources. Federal legislation pass through the 2005 Energy Policy Act will end the use of 2.0 percent oxygenates and encourage the use of ethanol and other biofuels. Additionally, the rejection of the MTBE liability waiver in the 2005 Energy Policy Act prevents the shielding of MTBE producers and consumers from liability suits.

Legal Precedent

Legal precedent suggests that states will use litigation to seek reparations against both parties responsible for point source MTBE spills as well the industry's producers and refiners for defective product liability. Case law precedent exists that finds MTBE producers and refiners liable for defective product liability and malice in failing to warn the public about the risks associated with MTBE. In addition, many producers and refiners of MTBE have opted to settle out of court with plaintiffs for defective product charges. Furthermore, precedent has been established through in the MDL Consolidated Case in Southern New York that the Clean Air Act does not preempt state tort litigation against contamination of MTBE. This ruling establishes a precedent that may encourage additional suits against MTBE producers and refiners for MTBE contamination. However, precedent has also been established that states have jurisdictional authority over states and municipalities through *parens patriae* in filing suit against responsible parties of MTBE contamination. Lastly, the establishment of 'commingled liability' suggests that plaintiff lawyers may try to force the entire MTBE industry into a settlement suit at some point in the future.

Remediation Priorities

Public system wells in urban areas are the most vulnerable to contamination by MTBE and should be a priority for state and municipal governments in MTBE cleanup and remediation. Funding for MTBE cleanup in public water supplies is limited, but some is available for cleanup projects through the Clean Water State Revolving Fund as well as other state-based funds. Because funding is limited, states could consider implementing additional programs that rely on revenue generation like New Hampshire's Gasoline Remediation and Elimination of Ethers Fund. Prevention of MTBE contamination focused on monitoring and cleanup of leaking underground storage tanks is a priority. Funding for petroleum spill prevention and cleanup associated with underground storage

tanks exists at both the state and federal level. Additional funding may also exist through Brownfield remediation programs. However, the barrier to MTBE cleanup and prevention through underground storage tanks does not appear to be an issue of adequate funding. Rather, understaffing of cleanup programs appears to be preventing complete LUST site cleanup. A reallocation of funding would likely increase LUST site cleanup success.

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