A Report to the Joint Standing Committee
on Natural Resources

2000
Maine Fuels Report

February 2001

Prepared by:
Maine Department of Environmental Protection

2000 Maine Fuels Report

Table of Contents

Appendices

2000 Maine Fuels Report

Legislative Requirement

38 M.R.S.A. §585-H, enacted by the Legislature in 2000, requires MTBE monitoring and reductions. Specifically:

> *"The department shall monitor shipments of gasoline to storage terminals in this State and compile annual reports showing the levels of methyl tertiary butyl ether, referred to as "MTBE", in gasoline brought into this State.*
>
> *The Department shall promote and actively participate in regional efforts by state regulatory agencies in the Northeast to develop alternatives to the use of MTBE as a gasoline additive. In these efforts, the department shall work toward the goal of the elimination of MTBE in gasoline sold in the State by January 1, 2003 in a manner that:*
>
> 1. *Market constraints. Adequately accounts for market constraints related to supply and pricing; and*
>
> 2. *Lowest environmental impact. Based on thorough analysis and evaluation of alternatives to the use of MTBE, ensures the lowest possible total environmental impact.*
>
> *The department shall annually, no later than February 1st of each year, present a report to the joint standing committee of the Legislature having jurisdiction over natural resources matters on the levels of MTBE in gasoline brought into this State and the progress made in achieving the goal of eliminating MTBE in gasoline sold in the State by January 1, 2003. The committee may report out to any session of any Legislature legislation relating to MTBE use in gasoline."*

Data Collection

In addition to the requirements of 38 MRSA Section 585-H, Chapter 119, the Motor Vehicle Fuel Volatility Limit requires the following records to be kept at the bulk gasoline terminals:

> *"Any owner or operator of a bulk gasoline terminal shall maintain records on the Reid Vapor Pressure, oxygen content, oxygenate, benzene, aromatics, and sulfur of any gasoline that is delivered to or distributed from such terminal.....Such records shall be maintained for at least three years and shall be available for inspection during normal business hours, and copies shall be provided to the Commissioner or his representative upon request."*

The Department requested the information listed above from each bulk gasoline terminal carrying automotive gasoline. Working with the Maine Petroleum Association, the Department developed a quarterly reporting form for the terminals to fill out and return (Appendix A). In addition, the Department requested the date of delivery, the number of barrels delivered, and any notes that were significant.

The following bulk gasoline terminals carry automotive gasoline and reported gasoline data to the Department:

Terminal	Location
Gulf	Portland
Irving	Bucksport
Mobil	Portland
Motiva	Portland
Webber	Searsport

No data was obtained from any trucking of fuel into the State.

MTBE and Other Oxygenates

The oxygenate data sorted by the reporting terminal and by the date of delivery is included in Appendix B and Appendix C, respectively. "Grey-colored" areas within the Appendices indicate either missing or questionable data.

During calendar year 2000, MTBE was present in all gasoline shipments containing oxygenates, alone or in formulations containing one or more of the following oxygenates: Tertiary Amyl Methyl Ether (TAME), Ethyl Tertiary Butyl Ether (ETBE), Tertiary Butyl Alcohol (TBA), Methanol and t-Butanol. MTBE was found in most of the gasoline and TAME was the second most-used oxygenate. In some cases, there was a combination of up to three different oxygenates in one load of gasoline delivered to the bulk terminals. This is apparently a common occurrence in gasoline, according to the Maine Petroleum Association.

As a reference point, Reformulated Gasoline (RFG) required a minimum oxygen level in gasoline of 2 percent by weight. For MTBE this equates to 11 percent by volume. In general, conventional gasoline prior to RFG commonly contained about 3 to 5 percent by volume MTBE in regular grades and as much as 8 percent by volume in high-test grades.

Table 1 summarizes the MTBE content in the Maine fuel during 2000.

Table 1

Number of shipments of gasoline	329
Number of shipments with missing or questionable data	7
Number of shipments with no oxygenate	43
Number of shipments with MTBE only	207
Number of shipments with MTBE plus other oxygenates	72
Number of shipments with MTBE only with oxygen levels greater than 2% by weight	23
Number of shipments with oxygen levels greater than 2% by weight containing oxygenates other than MTBE alone	6
For all shipments of gasoline:	
Weighted average oxygen level	0.09% by weight

Figure 1 is a scatter-diagram of the percent weight oxygen by delivery date and Figure 2 shows the percent weight oxygen levels by shipment.

In 1999 the Department collected gasoline data from the terminals for May, June, and July of 1999. The average weight percent oxygen by shipment for the 1999 three-month period was 0.26, compared to 0.31 for the same three-month period in 2000.

Table 2 summarizes the other (non-MTBE) oxygenates in the Maine fuel during 2000.

Table 2

	Number of Shipments	**Percent Oxygenate (by volume)**
TAME	67	0.21
ETBE	10	0.22
TBA	1	0.40
Methanol	5	0.13
t-Butanol	2	0.09

Overall, the levels of MTBE have dropped significantly since the state withdrew from the federal RFG program and implemented a "low volatility" gasoline program starting in 1999.1

1 RFG was required only in the seven southern Maine counties.

Figure 1
Percent Weight Oxygen by Delivery Date

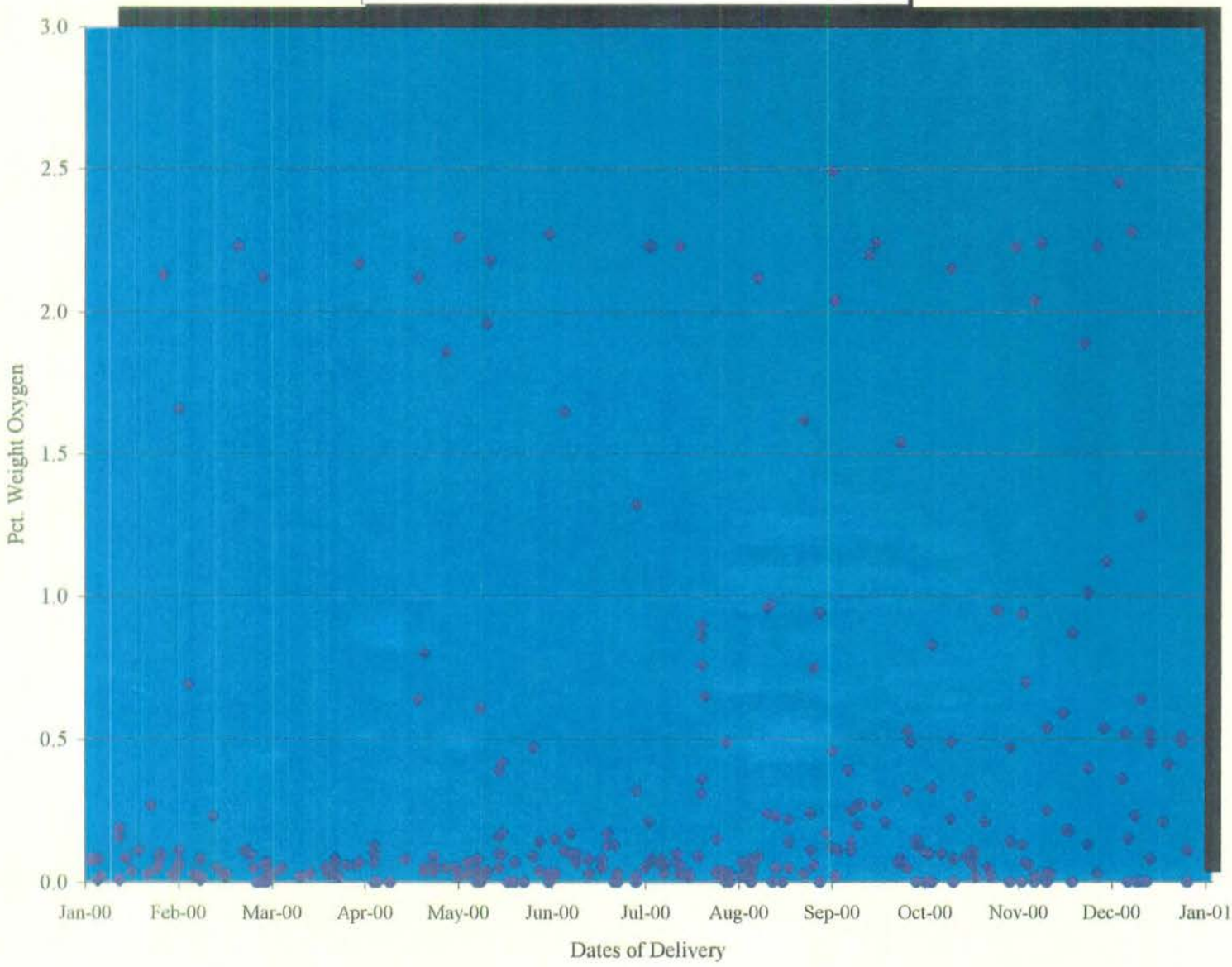
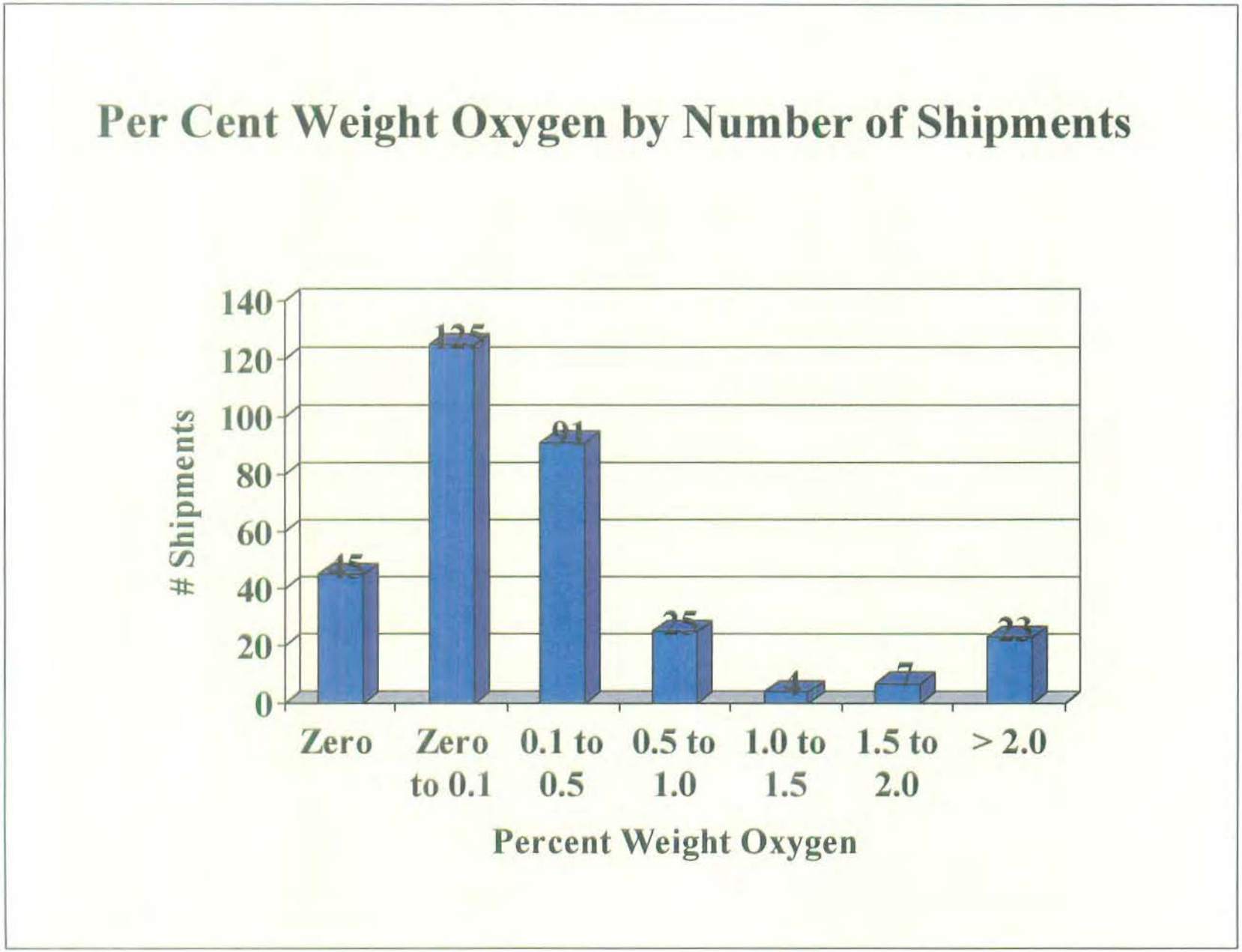


Figure 2


Per Cent Weight Oxygen by Number of Shipments
Shipments
140
120
100
80
60
40
20
0
125
91
45
25
4
7
23
Zero
Zero to 0.1
0.1 to 0.5
0.5 to 1.0
1.0 to 1.5
1.5 to 2.0
> 2.0
Percent Weight Oxygen

Other Gasoline Components

Sulfur, Benzene, and Aromatics

Table 3 lists the statewide weighted averages of Benzene, Aromatics and Sulfur in the 2000 fuel compared to Phase 1 and Phase 2 Reformulated Gasoline (RFG).

Table 3

	Weighted Average	**Ave. Phase 1 RFG**	**Ave. Phase 2 RFG**
Sulfur	125 ppm	170 ppm	150 ppm
Benzene	0.58 % (by volume)	0.8% (by vol.)	0.8% (by vol)
Aromatics	30.55 % (by volume)	26.3% (by vol.)	24.0% (by vol.)

Note: Phase 1 RFG started in 1995; Phase 2 RFG started in 2000. Maine opted-out of the RFG program in 1999.

The sulfur levels have remained consistently low with average sulfur levels of 125 ppm. National average is reported to be around 330 ppm. Six percent of the shipments reported, or about two percent of the volume of gasoline, had sulfur levels over 400 ppm. Figure 3 is a scatter-diagram of the ppm sulfur by delivery date and Figure 4 shows the ppm sulfur levels by shipment.

The overall average of benzene in the gasoline has remained less than the RFG average benzene content. However, 53 out of 323 shipments reported, or 16.5% of the shipments, reported benzene levels over 1 % by volume with maximum levels as high as 4% by volume. RFG is required to have a 1 percent benzene cap. Figure 5 is a scatter-diagram of the percent volume benzene by delivery date and Figure 6 shows the percent volume benzene levels by shipment.

The increase in aromatics was expected. One reason MTBE is added to gasoline is to increase the octane of the fuel. If MTBE is not used or is reduced, then aromatics are commonly used to increase octane in gasoline. The increase in aromatics results in increased emissions in air toxics primarily from combustion of the gasoline as opposed to evaporation. Figure 7 is a scatter-diagram of the percent volume aromatics by delivery date and Figure 8 shows the percent volume aromatic levels by shipment.

A summary of the other fuel components sorted by the reporting terminal is in Appendix D and date of delivery is in Appendix E.

Figure 3
PPM Sulfur by Delivery Date

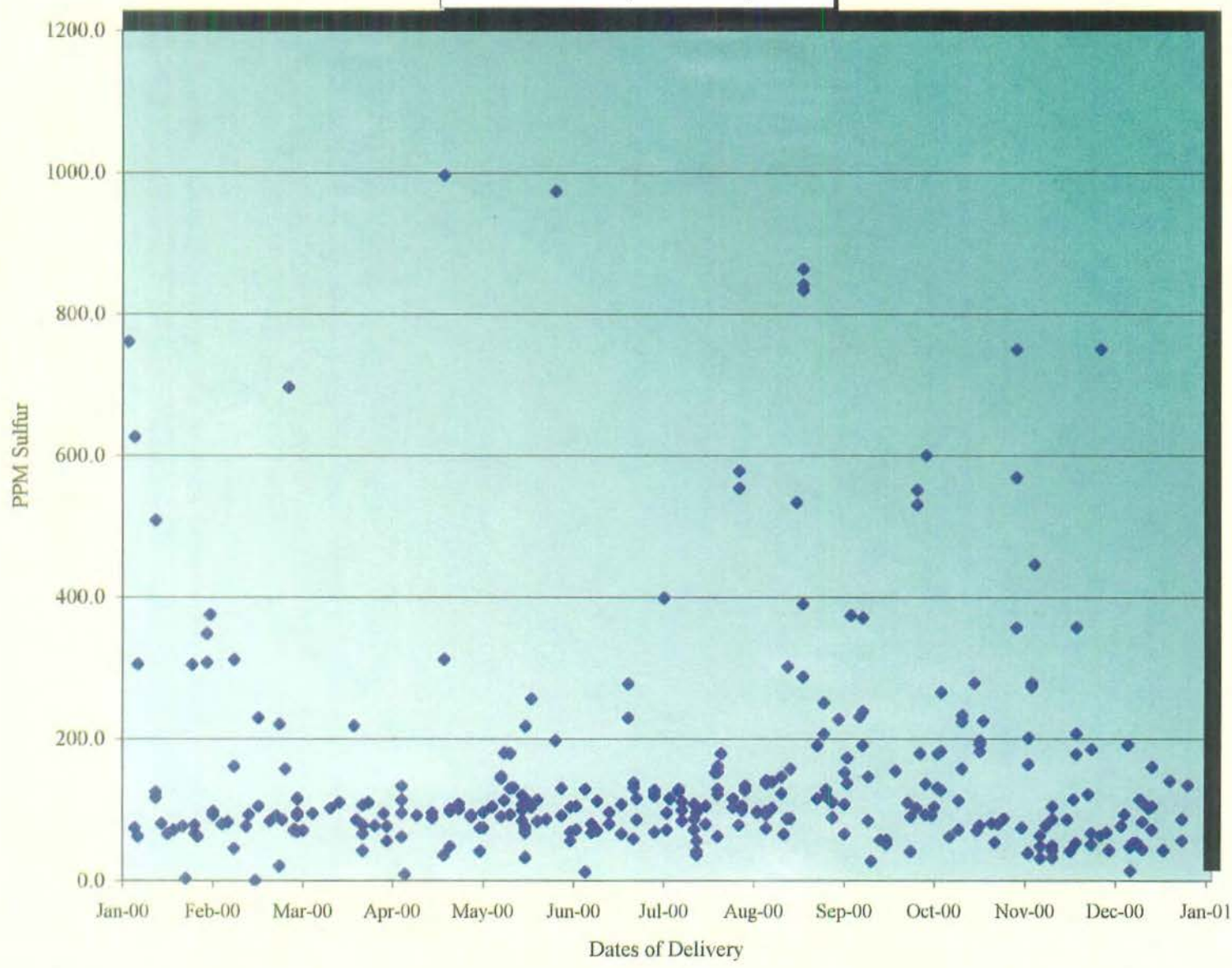


Figure 4

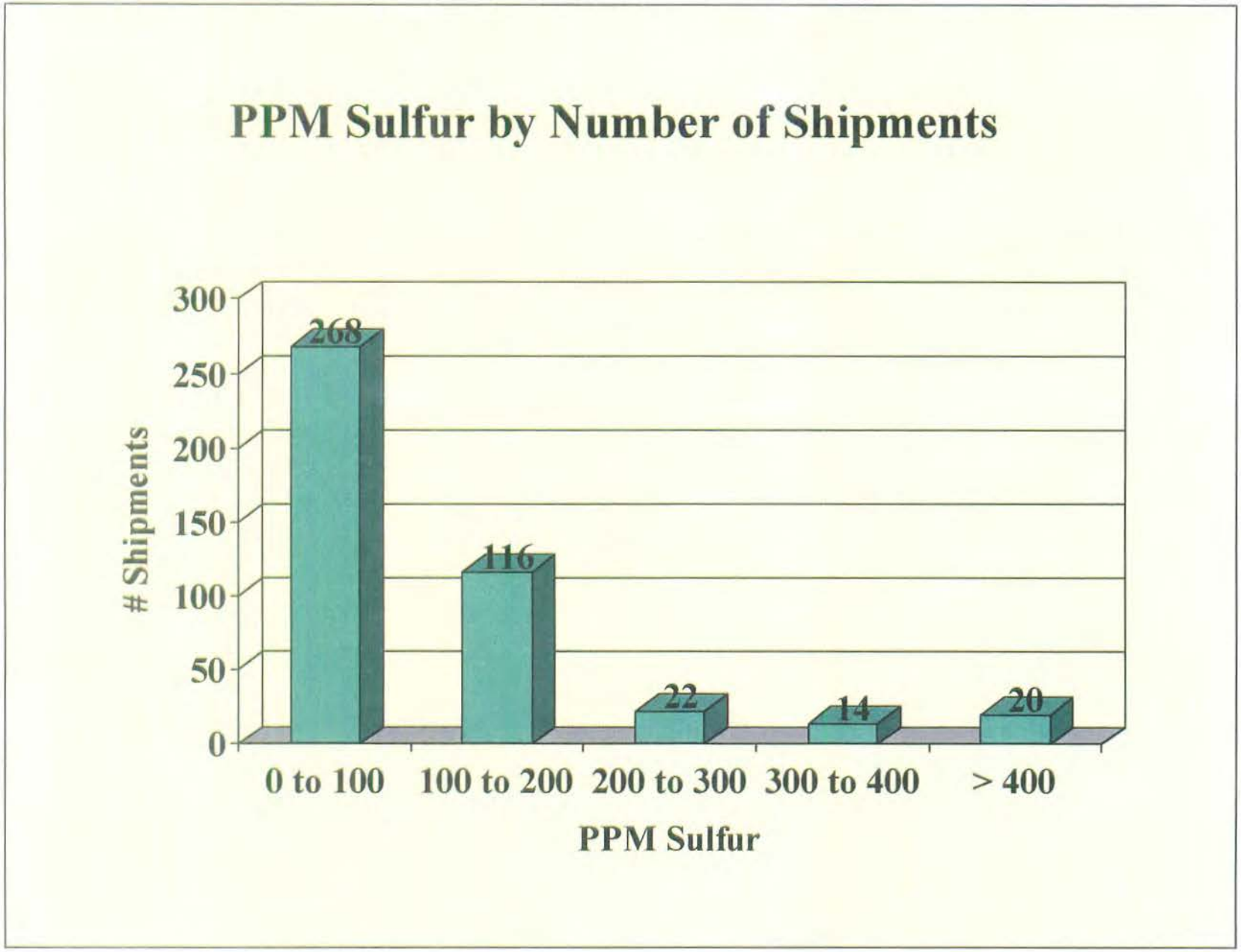

PPM Sulfur by Number of Shipments
Shipments
300
250
200
150
100
50
0
268
116
22
14
20
0 to 100
100 to 200
200 to 300
300 to 400
> 400
PPM Sulfur

Figure 5
Percent Volume Benzene by Delivery Date

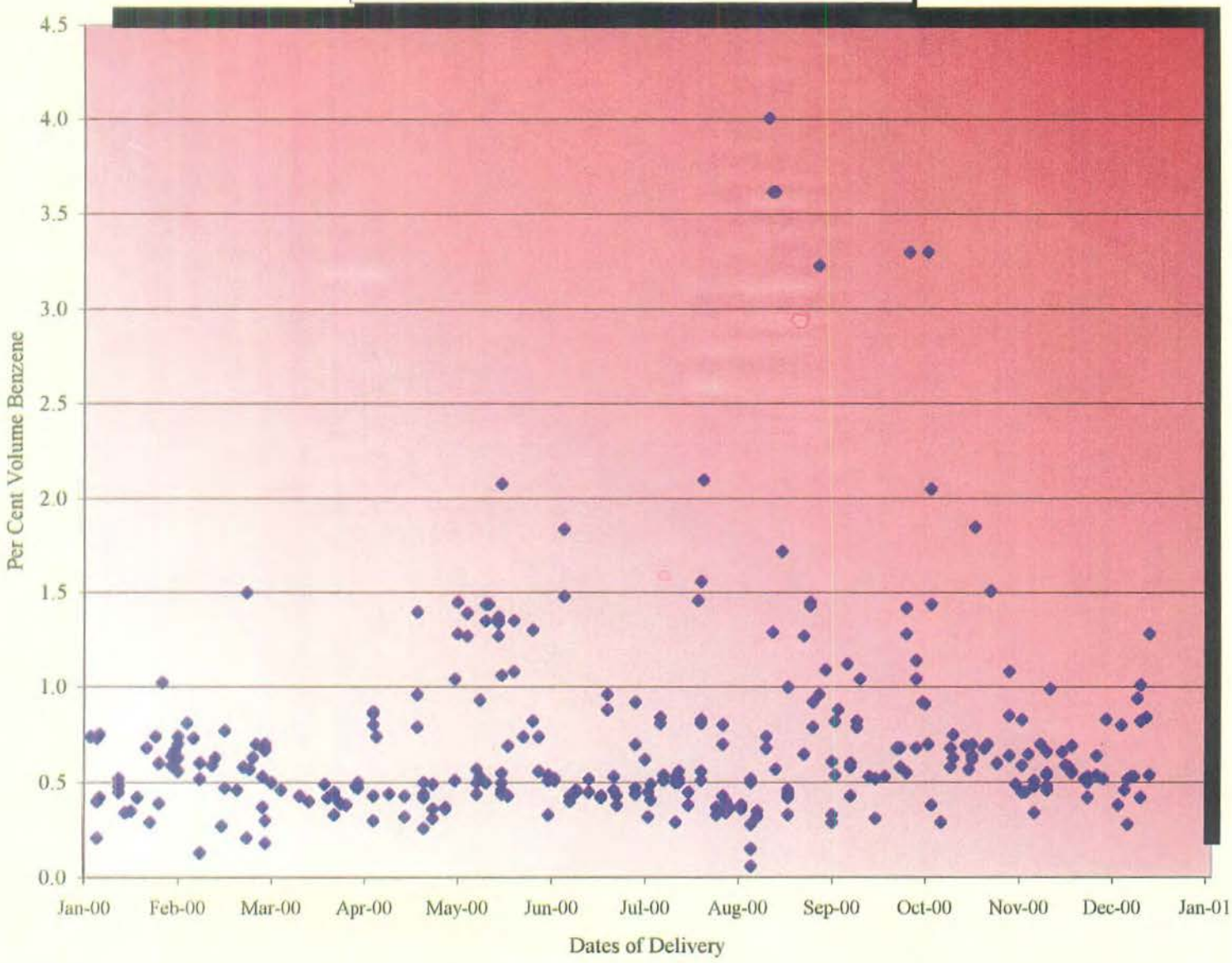


Figure 6

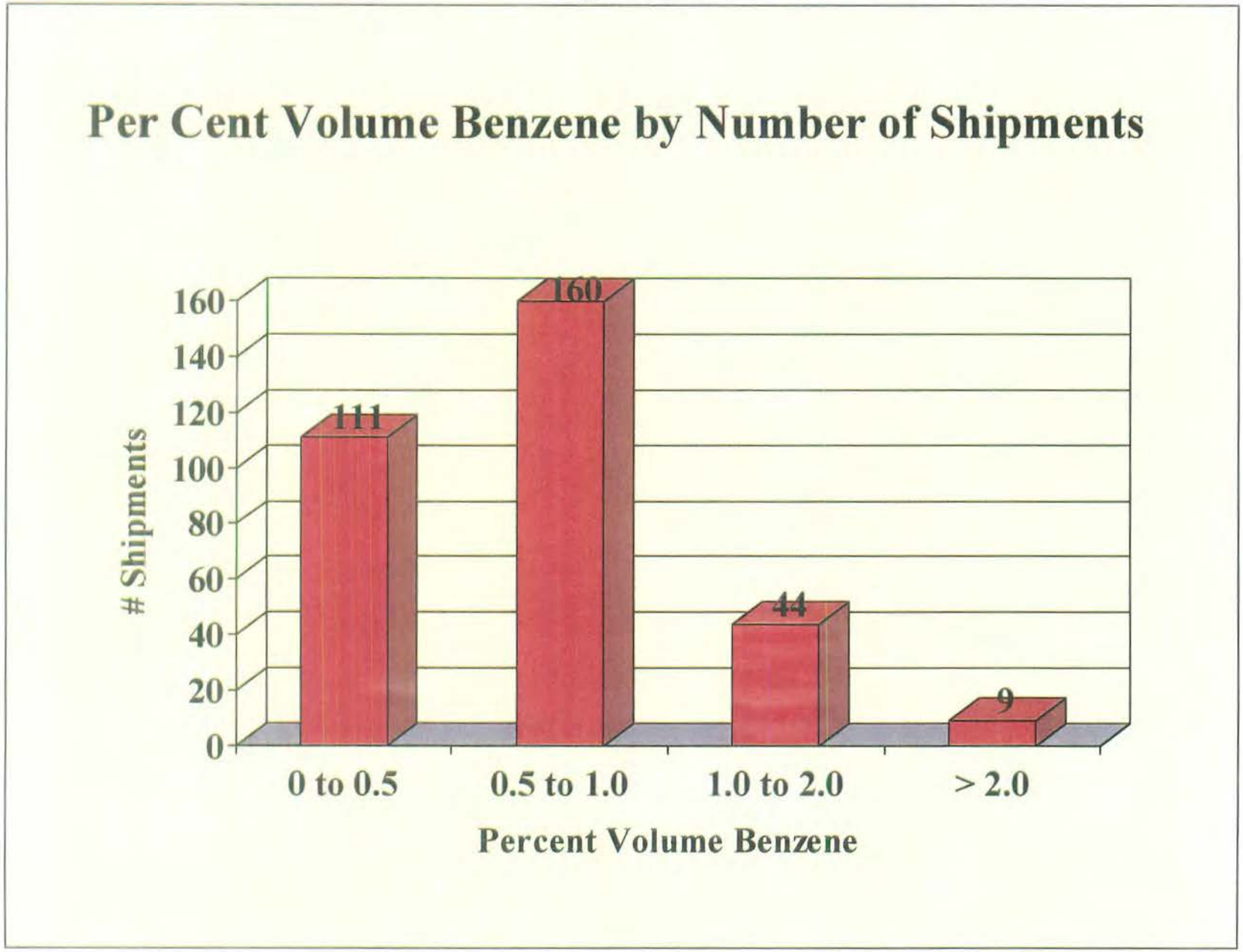

Per Cent Volume Benzene by Number of Shipments
Shipments
160
140
120
100
80
60
40
20
0
111
160
44
9
0 to 0.5
0.5 to 1.0
1.0 to 2.0
> 2.0
Percent Volume Benzene

Figure 7
Percent Volume Aromatics by Delivery Date

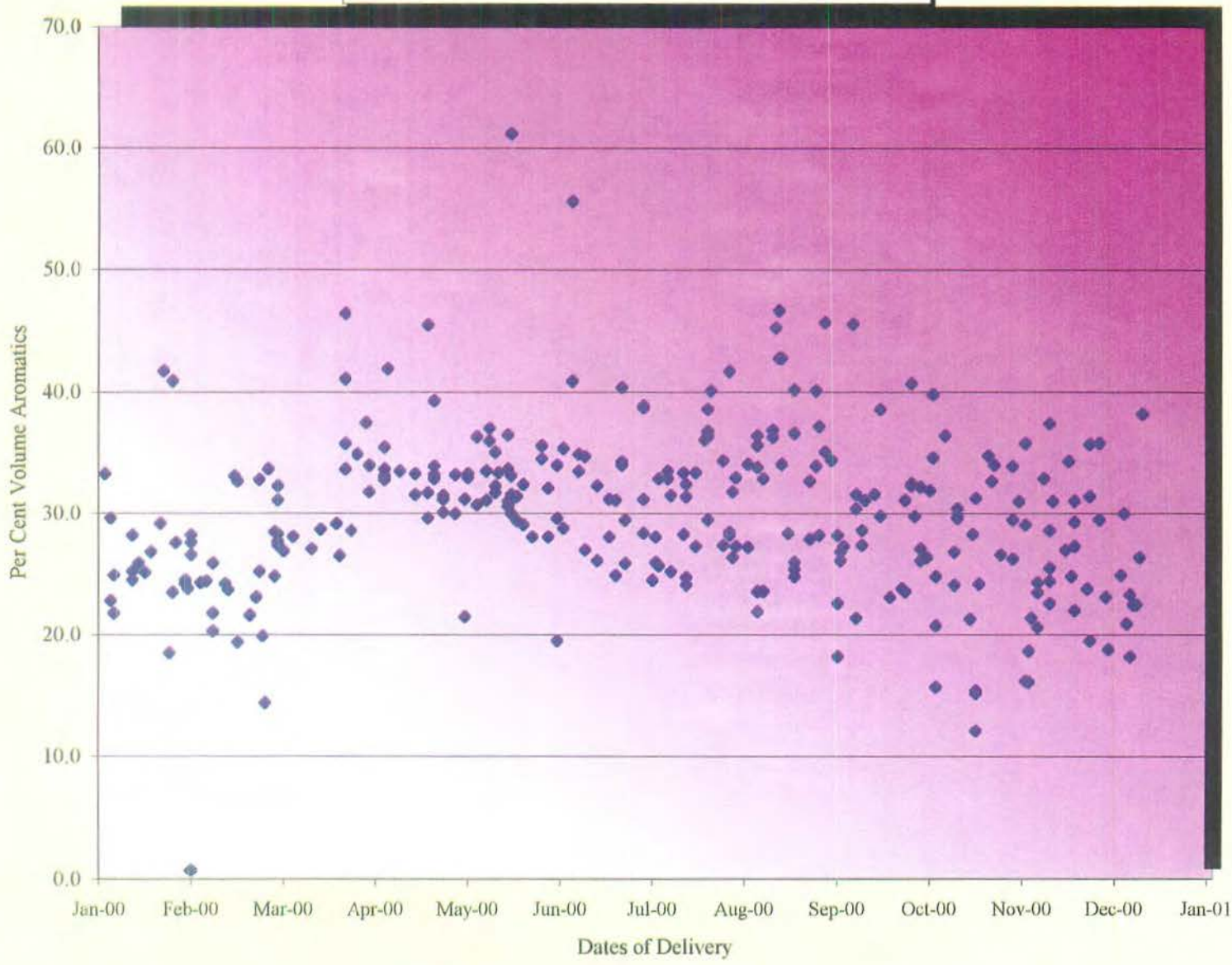
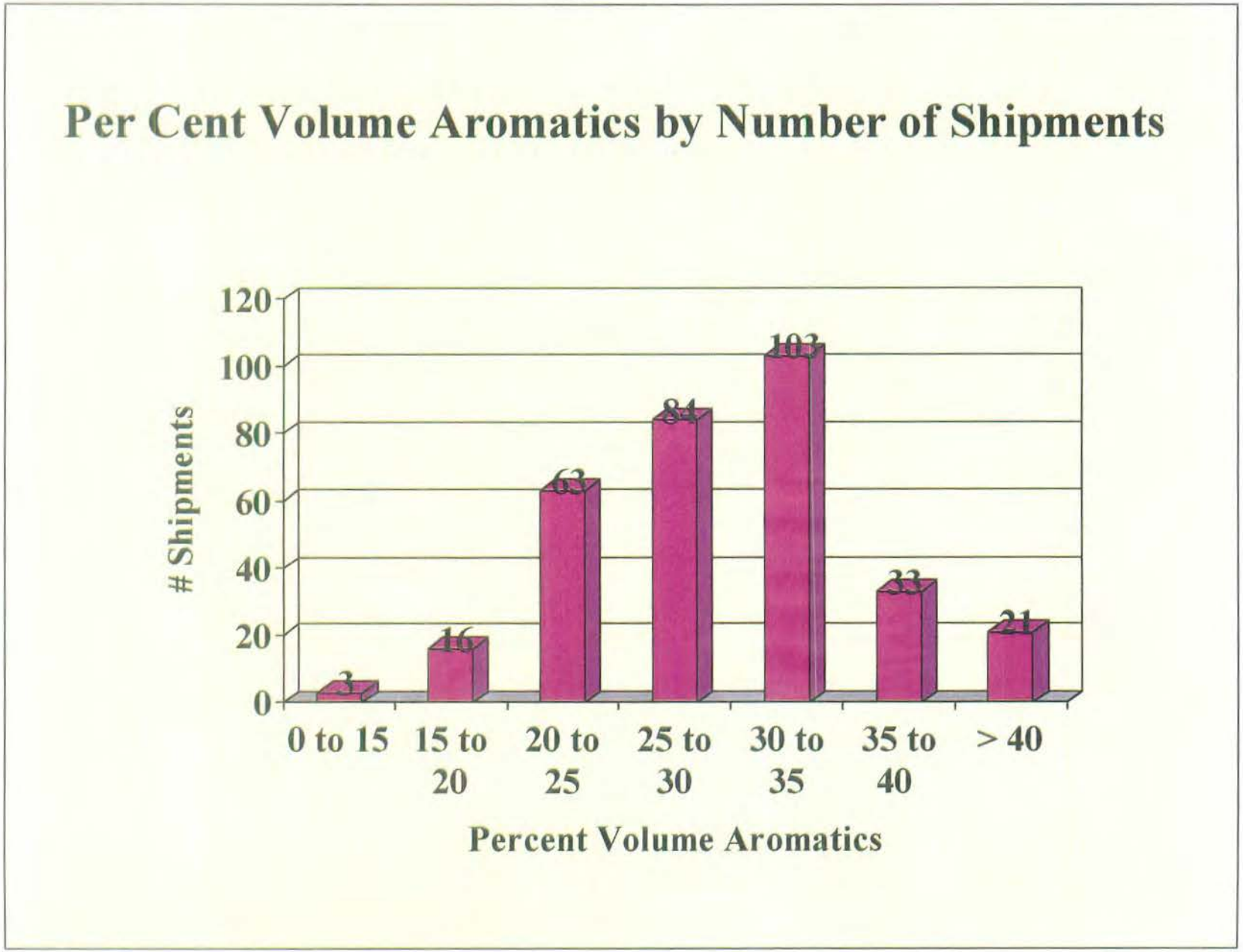


Figure 8


Per Cent Volume Aromatics by Number of Shipments
Shipments
120
100
80
60
40
20
0
3
16
63
84
103
33
21
0 to 15
15 to 20
20 to 25
25 to 30
30 to 35
35 to 40
> 40
Percent Volume Aromatics

Reid Vapor Pressure

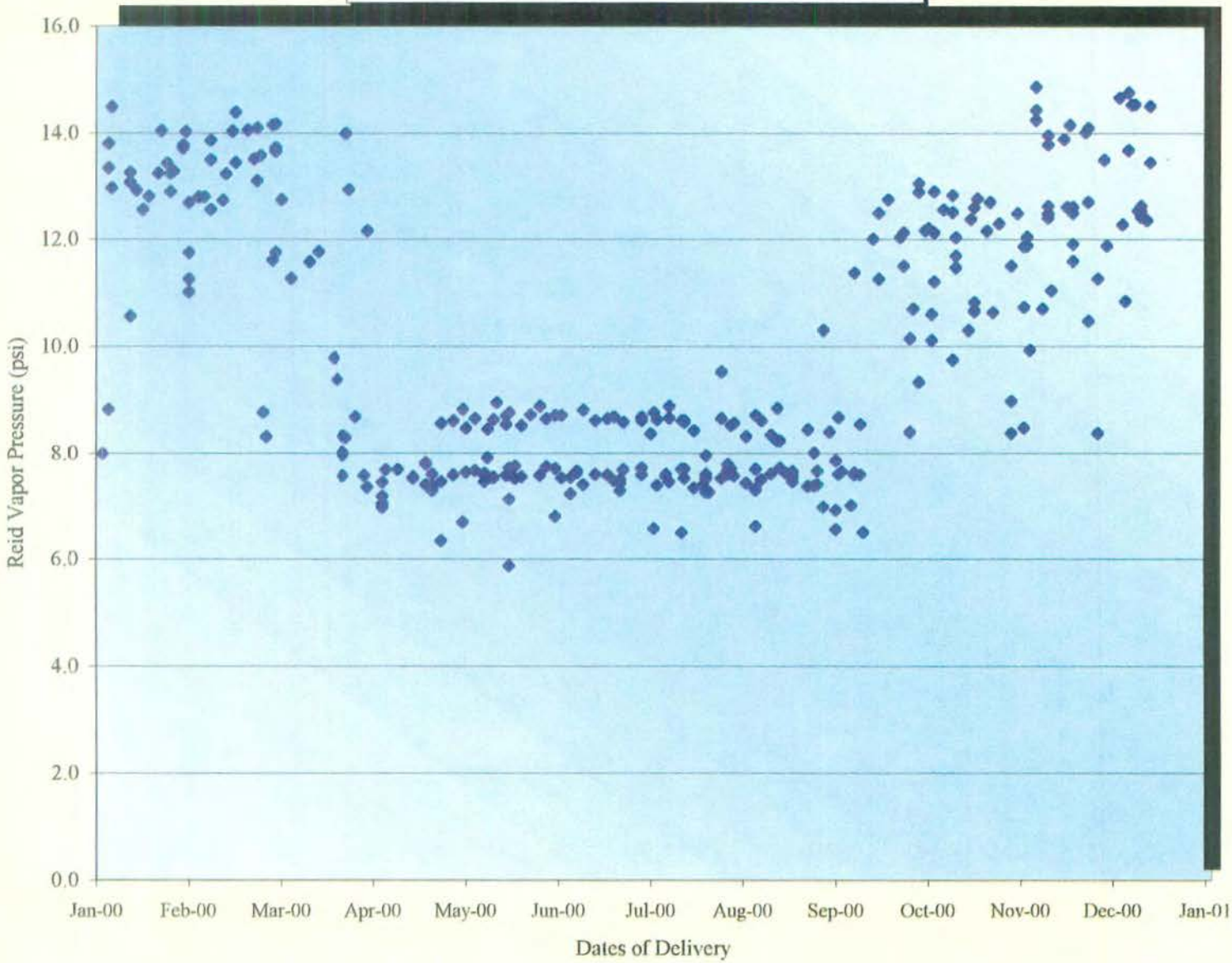
Chapter 119 Motor Vehicle Fuel Volatility Limit requires that the Reid Vapor Pressure (RVP) of gasoline sold in Maine from May 1 to September 15 of each year shall not exceed 9.0 pounds per square inch (psi). The Fuel Volatility Limit further limits the RVP of all gasoline sold in York, Cumberland, Sagadahoc, Androscoggin, Kennebec, Knox and Lincoln counties shall not exceed 7.8 psi from May 1 to September 15 of each year. The average of all summertime fuel sold in Maine beginning in April through Mid-September is shown below in Table 3. A summary of the RVP is included in the other fuel components data, sorted by the reporting terminal in Appendix D and date of delivery in Appendix E.

Table 3

RVP Reported	**RVP Average**
Summertime, 7.8 or less	7.44 psi
Summertime, statewide	7.82 psi

Figure 9 is a scatter-diagram of the Reid Vapor Pressure by delivery date.

Figure 9
Reid Vapor Pressure (psi) by Delivery Date



Overview of Federal Action on RFG/MTBE

This overview was provided by the Northeast States for Coordinated Air Use Management (NESCAUM):

The past year witnessed a flurry of Congressional and administrative actions to address the problem of MTBE groundwater contamination while preserving the air quality and public health benefits of RFG. This discussion will focus on the three efforts in the last year that will form the foundation for future federal action:

1) Federal Legislative Efforts;

2) U.S. EPA's action on California's petition for a waiver of the oxygen mandate in RFG; and

3) U.S. EPA's effort to ban MTBE under the Toxic Substances Control Act (TSCA).

Congressional Action -

During the 106th Congress, well over a dozen bills were introduced seeking to address the problem of MTBE contamination of groundwater. Since both oil interests and ethanol interests have the ability to frustrate legislative efforts if internally united, the challenge is to develop a legislative approach that is acceptable to at least a portion of both interests and protective of the environment and public health. While considerable progress was made, in the end Congress failed to strike the balance between ethanol, oil, and environmental interests needed to craft a comprehensive legislative solution. The following review of past legislative efforts is intended to assist readers in developing an opinion about the likelihood of federal legislative success in the coming year.

The Northeast states played a significant role in advancing federal legislative efforts. Frustrated by the lack of legislative activity in the months following the September 1999 conclusion of the U.S. EPA's Blue Ribbon Panel on Oxygenates and Gasoline, the eight Northeast State air pollution control programs joined together to support of a series of principles for Congressional action. On January 19, 2000, the Northeast States for Coordinated Air Use management (NESCAUM), released the following principles:

1) Repeal the 2 percent oxygen mandate for reformulated gasoline (RFG) in the Clean Air Act;

2) Phase-down and cap MTBE content in all gasoline;

3) Clarify state and federal authority to eliminate MTBE or other oxygenates if necessary to protect public health or the environment;

4) Maintain the full air quality benefits achieved to date by the federal RFG program;

5) Promote consistency in fuel specification through the timely implementation of effective federal requirements; and

6) Provide adequate lead-time for the petroleum infrastructure to adjust in order to ensure adequate fuel supply and price stability.

By the end of January 2000, the Northeast State principles had been endorsed by the American Lung Association (ALA), the Natural Resources Defense Council (NRDC) and the American Petroleum Institute (API). Thus began an unusual coalition effort among states, environmentalists, and oil companies and refineries to secure effective federal legislation. Notably absent from this alliance were the ethanol producers who were unwilling to accept the basic premise to repeal the oxygen mandate. While absent at the outset, it was generally accepted that the ethanol industry would have to have to join in a compromise before legislation would pass in either house.

The Committees with relevant jurisdiction over MTBE and RFG are the Senate Environment and Public Works Committee Chaired by Senator Bob Smith (R-NH) and the House Commerce Committee formerly chaired by Tom Bliley (R- VA).
In the House, a number of representatives introduced legislation representing one of the interests to the exclusion of others. Congressman Jim Greenwood (R-PA) crafted HR 3449 which fairly embodies the northeast legislative principles. However, the divergent interests in the full Commerce Committee membership suggested that the best chance to forward legislation lay in the Senate.

In the Senate EPW Committee, legislation was drafted that effectively reflected the interests of the Northeast States and our partners. At the same time, Senators Daschle (D-SD) and Lugar (R-IL) introduced legislation with the backing of many in the ethanol community that lifted the oxygen mandate and replaced it with a far more flexible, national sales requirement for renewable fuels. Instead of mandating the sale of ethanol only in those states in the RFG program, the Daschle/Lugar approach would allow oil companies to decide where it makes best economic sense to sell ethanol anywhere in the nation. In March 2000, the Clinton Administration proposed their own principles for legislative action. The Administration principles closely matched our own with the exception that they supported the Daschle/Lugar approach that the oxygen mandate must be replaced with a national alternative before it can be repealed. Governors Shaheen (D-NH) and King (I-ME) wrote to senator Daschle expressing cautious support for the concept if properly designed. In early spring, the NE states and environmental community joined Senator Smith in an effort to bring the Daschle/Lugar approach into

his legislation. Unfortunately, the majority of oil companies we had been working with decided they were not interested in discussing any legislative effort that would require the sale of ethanol in any shape or size. This determination signaled the end of the oil interests' participation in our Alliance for the time being.

The next challenge was to secure uniform support from the ethanol supportive states for the revised Smith approach. While the Smith approach was strongly supported by the majority of small ethanol producers and Governors from a host ethanol producing states, the handful of large multi-national ethanol producers remained in opposition to lifting the oxygen mandate even in exchange for a national program. It is surmised that this opposition comes from the fact that competition would increase from small producers under the Smith approach, whereas only the large companies possess the infrastructure and capital to ship hundreds of millions of gallons of ethanol from the Midwest to the Northeast, California and Texas.

If the Smith approach could gain nearly unanimous support from ethanol interests and environmentalists and begrudging acceptance by some in the oil industry, then a legislative solution to the MTBE problem would be possible. In yet another effort to create the broad-based coalition necessary for success, the eight Northeast States joined with the twenty-four state Governor's Ethanol Coalition (GEC) to overcome our historic differences on these issues and advance a joint position. On July 19, 2000, in a letter signed by Governors Pataki (R-NY) and Shaheen (D-NH) on behalf of NESCAUM and Governors Vilsack (D-IA) and Johanns (R-NE) representing the GEC, two organizations representing thirty-two states urged Senator Smith to introduce legislation that phases out MTBE within four years; lifts the oxygen standard and replaces it with a national renewable fuels program and maintains the full air quality benefits of the RFG program.

Shortly thereafter, Senator Smith introduced S. 2962, the Federal Reformulated Fuels Act of 2000. S. 2962 effectively represented the positions advocated by the northeast states and our environmental and Midwest colleagues. With the obvious exception of the renewable fuels requirement, S 2962 also maintained most of the original provisions promoted by our original alliance with API.

S. 2962 was uniformly and actively supported by the NE states, environmental organizations, and virtually all ethanol/renewable fuels interests. Unfortunately, most oil companies and all MTBE companies actively opposed S 2962. The bill came to a vote in the environment and Public Works Committee on September 7,2000. Numerous amendments to the provisions were discussed and defeated during Committee debate. Ultimately the Committee voted 11-6 to report out the bill. Voting in favor of S.2962 were Senators: Baucus, Boxer, Chaffee, Crapo, Graham, Lautenberg, Moynihan, Reid, Voinovich, Wyden, and Smith. Voting against the Bill were: Bennett, Bond, Hutchison, Inhofe, Thomas and Warner. Senator Lieberman did not cast a vote however his staff worked actively to advance the interests of the NE States and environmental community throughout the process.

S.2962 received considerable support subsequent to being reported out of the EPW Committee. NESCAUM and the Governor's Ethanol Coalition sent joint letters to the President and Senate Leaders urging prompt adoption of the Bill. A similar call for action was sent to the President by the leaders of the American Lung Association, Environmental Defense, Friends of the Earth, Natural Resources Defense Council, Physicians for Social Responsibility and U.S. Public Interest Research Group. However, considerable opposition from the oil industry coupled with a stark lack of time before the end of the session made it impossible to move S.2962 any further during the 106th Congress. S. 2962 should be considered a starting point for discussion in the approaching legislative session. While the effort will benefit considerably if we can move a bill though Committee early in the session, the structural challenge of finding an acceptable midpoint between the interests of the environment, ethanol and oil remain. A pared down version of the Short Title to S. 2962 is attached below.

Federal Reformulated Fuels Act of 2000 (Reported in the Senate)

SEC. 2. WAIVER OF OXYGEN CONTENT REQUIREMENT FOR REFORMULATED GASOLINE.

`(I) IN GENERAL- Notwithstanding any other provision of this subsection, a Governor of a State, upon notification by the Governor to the Administrator during the 90-day period beginning on the date of enactment of this subparagraph, may waive the application of paragraphs (2)(B) and (3)(A)(v) to gasoline sold or dispensed in the State.

(ii) TREATMENT AS REFORMULATED GASOLINE- In the case of a State for which the Governor invokes the waiver described in clause (i), gasoline that complies with all provisions of this subsection other than paragraphs (2)(B) and (3)(A)(v) shall be considered to be reformulated gasoline for the purposes of this subsection.

(iii) EFFECTIVE DATE OF WAIVER- A waiver under clause (i) shall take effect on the earlier of-- `(I) the date on which the performance standard under subparagraph (C) takes effect; or `(II) the date that is 270 days after the date of enactment of this subparagraph.

`(C) MAINTENANCE OF TOXIC AIR POLLUTANT EMISSION REDUCTIONS-

(i) IN GENERAL- As soon as practicable after the date of enactment of this subparagraph, the Administrator shall `(I) promulgate regulations consistent with subparagraph (A) and paragraph (3)(B)(ii) to ensure that reductions of toxic air pollutant emissions achieved under the reformulated gasoline program under this section before the date of enactment of this subparagraph are maintained in States for which the Governor waives the oxygenate requirement under subparagraph (B)(I)

(ii) PERFORMANCE STANDARD- The Administrator, in regulations promulgated under clause (i)(I), shall establish an annual average performance standard based on `(I) compliance survey data; `(II) the annual aggregate reductions in emissions of toxic air pollutants achieved under the reformulated gasoline program during calendar years 1998 and 1999, determined on the basis of the volume of reformulated gasoline containing methyl tertiary butyl ether that is sold throughout the United States; and `(III) such other information as the Administrator determines to be appropriate.

`(I) IN GENERAL- The performance standard under clause (ii) shall be applied on an annual average refinery-by-refinery basis to all reformulated gasoline that is sold or introduced into commerce by the refinery in a State for which the Governor waives the oxygenate requirement under subparagraph (B)(i).

(II) MORE STRINGENT REQUIREMENTS- The performance standard under clause (ii) shall not apply to the extent that any requirement under section 202(l) is more stringent than the performance standard.

(III) STATE STANDARDS- The performance standard under clause (ii) shall not apply in any State that has received a waiver under section 209(b)

`(IV) CREDIT PROGRAM- The Administrator shall provide for the granting of credits for exceeding the performance standard under clause (ii) in the same manner as provided in paragraph (7)

(iv) STATUTORY PERFORMANCE STANDARD (I) IN GENERAL- Subject to subclause (III), if the regulations under clause (i)(I) have not been promulgated by the date that is 270 days after the date of enactment of this subparagraph, the requirement described in subclause (II) shall be deemed to be the performance standard under clause (ii) and shall be applied in accordance with clause (iii).
(II) TOXIC AIR POLLUTANT EMISSIONS- The aggregate emissions of toxic air pollutants from baseline vehicles when using reformulated gasoline shall be 27.5 percent below the aggregate emissions of toxic air pollutants from baseline vehicles when using baseline gasoline.

SEC. 3. SALE OF GASOLINE CONTAINING MTBE.

DETERMINATION BY THE ADMINISTRATOR WHETHER TO BAN USE OF MTBE-
(A) IN GENERAL- Not later than 4 years after the date of enactment of this paragraph, the Administrator shall ban use of methyl tertiary butyl ether in gasoline unless the Administrator determines that the use of methyl tertiary butyl ether in accordance with paragraph (6) poses no substantial risk to water quality, air quality, or human health.

(B) REGULATIONS CONCERNING PHASE-OUT- The Administrator may establish by regulation a schedule to phase out the use of methyl tertiary butyl ether in gasoline during the period preceding the effective date of the ban under subparagraph (A).

(C) TEMPORARY WAIVER OF LIMITATIONS-
(i) IN GENERAL- If the Administrator, in consultation with the Secretary of Energy, finds, on the Administrator's own motion or on petition of any person, that there is an insufficient domestic capacity to produce or import gasoline, the Administrator may, in accordance with section 307, temporarily waive the limitations.

(v) STATE AUTHORITY- At the option of a State, a waiver under clause (i) shall not apply to any area with respect to which the State has exercised authority under any other provision of law (including subparagraph (D)) to limit the sale or use of methyl tertiary butyl ether.

`(D) STATE PETITIONS TO ELIMINATE USE OF MTBE -]
`(i) IN GENERAL- A State may submit to the Administrator a petition requesting authority to eliminate the use of methyl tertiary butyl ether in gasoline sold or introduced into commerce in the State in order to protect air quality, water quality, or human health.

`(ii) DEADLINE FOR ACTION ON PETITIONS- the Administrator shall grant or deny any petition submitted under clause (i) within 180 days after the date of receipt of the petition.'.

SEC. 4. CONVENTIONAL GASOLINE.

`(i) IN GENERAL- Not later than October 1, 2007-(I) the Administrator shall determine whether the use of conventional gasoline during the period of calendar years 2005 and 2006 resulted in a greater volume of emissions of criteria air pollutants listed under section 108, and precursors of those pollutants, determined on the basis of a weighted average of those pollutants and precursors, than the volume of such emissions during the period of calendar years 1998 and 1999; and

`(II) if the Administrator determines that a significant increase in emissions occurred, the Administrator shall promulgate such regulations concerning the use of conventional gasoline as are appropriate to eliminate that increase.

SEC. 6. COMPREHENSIVE FUEL STUDY.
`(1) IN GENERAL- Not later than 5 years after the date of enactment of this paragraph and every 5 years thereafter, the Administrator shall submit to Congress a report-- (A) describing reductions in emissions of criteria air pollutants listed under section 108, or precursors of those pollutants, that result from implementation of this section; (B) describing reductions in emissions of toxic air pollutants that result from implementation of this section; (C) in consultation with the Secretary of Energy,

describing reductions in greenhouse gas emissions that result from implementation of this section; and (D)(i) describing regulatory options to achieve reductions in the risk to public health and the environment posed by fuels and fuel additives--(I) taking into account the production, handling, and consumption of the fuels and fuel additives.

SEC. 7. ADDITIONAL OPT-IN AREAS UNDER REFORMULATED GASOLINE PROGRAM`(i) IN GENERAL- In accordance with section 110, a State may submit to the Administrator, and the Administrator may approve, a State implementation plan revision that provides for application of the prohibition specified in paragraph (5) in any portion of the State that is not a covered area or an area referred to in subparagraph (A)(i).

SEC. 8. LEAKING UNDERGROUND STORAGE TANKS
`(A) IN GENERAL- The Administrator and the States may use funds made available under subparagraph (B) to carry out corrective actions with respect to a release of methyl tertiary butyl ether that presents a risk to human health, welfare, or the environment. (C) AUTHORIZATION OF APPROPRIATIONS- There is authorized to be appropriated from the Leaking Underground Storage Tank Trust Fund to carry out subparagraph (A) $200,000,000 for fiscal year 2001, to remain available until expended.

California Request to EPA for a Waiver of the Oxygen Mandate

In March 1999, California Governor Gray Davis ordered the phase-out of MTBE under Executive OrderD-5-99. California, like all states containing "severe" or "extreme" ozone non-attainment areas or wintertime carbon monoxide (CO) non-attainment areas must use oxygenated gasoline. The Clean Air Act Oxygenate requirements coupled with the elimination of MTBE will result in a de facto ethanol mandate in California, as in Connecticut, unless the oxygenate mandate is removed.

Like Connecticut and the rest of the Northeast, California refiners and distributors have relied almost exclusively on MTBE to satisfy the Clean Air Act oxygenate requirement. The industry's reliance on MTBE arose primarily from the fact that ethanol can not easily be transported by pipeline because it mixes with water and becomes unusable. Hence, moving hundreds of millions of gallons of ethanol from the middle of the country where it is produced to the coasts where it is required is a substantial logistical challenge. In addition, ethanol is highly volatile when mixed with gasoline. To offset the pollutant impacts of the resulting mixture, refiners must devote resources to lower the volatility of the base fuel before it is mixed with ethanol.

Beyond these economic impacts, the volatility of ethanol as well as its transportation create potentially substantial environmental impacts. Under §211(k)(2)(b) of the Clean Air Act, the Administrator is authorized to waive the oxygen requirement, "if the requirement will prevent or interfere with attainment...in a non-attainment areas."

Citing this authority, Governor Davis wrote to Administrator Browner on April 12, 1999 formerly requesting a waiver on the grounds that the oxygenate requirement is interfering with California's ability to attain both the ozone and PM10 NAAQS. California has submitted thousands of pages of technical support for its request. The gist of California's argument is that the requirement to use ethanol will increase NOx emissions compared to what CA could do with the flexibility to continue to design their own fuel specifications. These NOx increases they assert undermine both ozone and PM10 non-attainment efforts. Second, California focuses on the greater evaporative emissions and their impact on ozone formation. While the statute is seemingly limited to non-attainment concerns, California also analyzes the toxic emission impacts of using ethanol. Finally, CA adds several arguments related to speeding the reduction of MTBE and cost savings that are compelling but do not seem to have a role in the EPA decision.

The decision rendered by EPA will have a significant effect not only on California but also on other states that find themselves in a similar predicament. However, the precedential impact of EPA's action will substantially depend not only upon the decision but also on the grounds the Agency relies upon to reach it. California possesses a degree of unique authority in the regulation of fuel and therefore can make some comparative claims regarding the limitations of the mandate that may be harder to assert n the Northeast. NOx also plays a greater role in particulate formations in CA than it does in the Northeast. However, if EPA grants California's request other states will be significantly encouraged to pursue similar relief. The eight northeast states have already begun working together to establish the scientific and technical foundation for waiver requests here in the region.

EPA had committed to take final action on the California request by last summer. The technical complexity of the issues and political scrutiny of the ultimate decision has resulted in EPA pursuing a very detailed analysis and cautious approach. EPA is said to be close (as of January 5, 2001) to finalizing a decision its waiver request. Sources report that EPA was considering four options: a full waiver, a temporary waiver, a denial, or a reduction of the oxygen mandate to 1 percent. The decision will go through a comment process once the White House Office of Management and Budget signs off on the decision.

Federal MTBE Ban under the Toxic Substances Control Act (TSCA)

On March 24, 2000, the U.S. EPA published an Advanced Notice of Proposed Rulemaking (ANPRM) to "Initiate Rulemaking under the Toxic Substances Control Act to Eliminate or Limit the Use of MTBE as a Fuel Additive in Gasoline." The notice indicates that the authority for such an action is found in TSCA section 6, 15 USC 2605. The standard for action under TSCA is extremely high and the process is quite cumbersome. By point of comparison, EPA's efforts to use this same authority to ban asbestos was unsuccessful.

The EPA action under TSCA should be understood as an effort by the Agency to demonstrate that it is leaving no stone unturned in its effort to address MTBE. The use of an ANPRM as opposed to a Notice of Proposed Rulemaking is consistent with the desire to make a statement rather than a law. The resort to TSCA section 6 is also a clear statement of the inadequacy of EPA's authority under the Clean Air Act and Clean Water Act to address the problem. It would be unwise to rely solely upon EPA action under TSCA to address concerns about MTBE.

Ethanol as an Alternative to MTBE

The Department in conjunction with the other New England States and the New England Interstate Water Pollution Control Commission has investigated the role of Ethanol as a replacement to MTBE. Attached is a January 18, 2001 draft Executive Summary of the resultant report (Appendix F).

APPENDIX A

Fuel Data Report for _____ Appendix A Location: _____

	Date of transfer	Octane	RVP (psi)	Oxygen (% wt O_2)	MTBE (% Vol)	Other Oxygenate(s) in Fuel (Other Oxy. Name)	(% Vol)	BENZ (% Vol)	ARO (% Vol)	SULF (ppm)	Barrels	Notes
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

APPENDIX B

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Gulf	01/11/2000	88	0.01	0.06			49000
Gulf	01/13/2000	93	0.02	0.12			40072
Gulf	01/14/2000	88					100000
Gulf	02/07/2000	88	0.06	0.33			124457
Gulf	02/23/2000	93	2.23	6.66	TAME	6.29	40229
Gulf	03/03/2000	88	0.00	0.00			62000
Gulf	03/04/2000	88	0.00	0.00			83694
Gulf	03/26/2000	87	0.03	0.15			115000
Gulf	04/25/2000	88	0.64	3.60	TBA	0.40	100138
Gulf	04/25/2000	88	0.80	4.40			71301
Gulf	04/30/2000	93	1.86	10.40			20109
Gulf	05/17/2000	93	2.18	11.73	TAME	0.62	35674
Gulf	05/18/2000	88	0.39	1.90	TAME	0.30	55876
Gulf	05/22/2000		0.00	0.00			68095
Gulf	05/29/2000	87	0.09	0.48			75208
Gulf	06/25/2000	87	0.13	0.51	TAME	0.23	73990
Gulf	07/07/2000	88	0.21	1.14			100595
Gulf	07/13/2000	93					39564
Gulf	07/26/2000	87	0.15	0.20	TAME	0.70	49465
Gulf	07/30/2000	88					78669
Gulf	08/17/2000	87	0.23	1.24			80000
Gulf	08/18/2000	88	0.00	0.00			58181
Gulf	09/03/2000	87	0.46	1.90	TAME	0.70	58500
Gulf	09/05/2000	93	2.49	13.45			13000
Gulf	09/14/2000	87	2.20	12.12			75010
Gulf	09/19/2000	93	2.24	11.18			10000
Gulf	09/30/2000	87	0.00	0.00			39299
Gulf	10/06/2000	87	0.10				19934
Gulf	10/06/2000	93	0.83	4.63			18925
Gulf	10/07/2000	87	0.33	1.79			29770
Gulf	10/07/2000	87	0.10	0.53			49810
Gulf	10/20/2000	88	0.10	0.53			110273

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Gulf	11/05/2000	88	0.70	3.68			79783
Gulf	11/07/2000	93	2.04	10.96	TAME	0.06	19870
Gulf	11/19/2000	87	0.18	1.00			38864
Gulf	11/21/2000	87	1.89	10.13			50408
Gulf	11/29/2000	88	2.23	11.00	TAME	0.80	29093
Gulf	11/29/2000	93	0.54	2.60	TAME	0.40	10215
Gulf	12/02/2000	87	2.45	13.04			65072
Gulf	12/08/2000	89	0.00	0.00			35000
Gulf	12/11/2000	89	0.00	0.00			44961
Gulf	12/15/2000	93	0.49	2.40	TAME	0.30	40000
Gulf	12/16/2000	87	0.08	0.45			80000
Irving	01/14/2000	91	0.19	1.05			43678
Irving	01/24/2000	87	0.11	0.57			25841
Irving	01/29/2000	87	0.27	1.45			20802
Irving	02/02/2000	87	0.08	0.43			45003
Irving	02/02/2000	93	2.13	11.91			23032
Irving	02/11/2000	87	0.03	0.18			35115
Irving	02/20/2000	87	0.03	0.16			22647
Irving	02/29/2000	87	0.11	0.57			66948
Irving	03/06/2000	93	2.12	11.67			10460
Irving	03/06/2000	87	0.07	0.37			44848
Irving	03/18/2000	87	0.03	0.17			89395
Irving	03/31/2000	91	0.06	0.34			22748
Irving	04/06/2000	93	2.17	12.07			8763
Irving	04/06/2000	87	0.07	0.37			44299
Irving	04/21/2000	87					66561
Irving	05/07/2000	88	0.05	0.27			44893
Irving	05/07/2000	94	2.26	12.40			22055
Irving	05/21/2000	88	0.16	0.89			34927
Irving	05/21/2000	87	0.42	2.31			44989
Irving	06/06/2000	93	0.03	0.15			60592
Irving	06/06/2000	98	2.27	12.38			18526
Irving	06/06/2000	87	0.15	0.82			22413

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Irving	07/08/00	87	2.23	12.32			29082
Irving	07/08/00	94	2.23	12.32			8719
Irving	07/17/00	87	0.07	0.36			54531
Irving	07/17/00	87	0.10	0.56			18406
Irving	07/17/00	93	2.23	12.29			16246
Irving	07/18/00	87	0.03	0.18			12911
Irving	07/18/00	87	0.03	0.15			8710
Irving	08/02/00	87	0.00	0.00			21874
Irving	08/02/00	87	0.03	0.17			21453
Irving	08/10/00	87	0.06	0.32			44537
Irving	08/10/00	88	0.08	0.42			22121
Irving	08/10/00	93	2.12	11.63			16242
Irving	08/16/00		0.00	0.00			40055
Irving	09/05/00	88	0.12	0.67			49927
Irving	09/05/00	94	2.04	11.21			22274
Irving	09/13/00	89	0.27	1.47			29112
Irving	09/19/00	90	0.21	1.13			21686
Irving	09/27/00	89	0.05	0.25			21990
Irving	10/02/2000	91	0.11	0.57			26203
Irving	10/05/2000	89	0.00	0.00			37972
Irving	10/13/2000	87	0.22	1.19			34804
Irving	10/13/2000	93	2.15	11.83			21961
Irving	10/20/2000	88	0.02	0.12			16169
Irving	10/25/2000	87	0.02	0.11			45918
Irving	11/09/2000	87	0.02	0.11			44276
Irving	11/09/2000	93	2.24	12.07			22182
Irving	11/13/2000	88	0.03	0.17			44862
Irving	11/26/2000	88	0.03	0.17			43949
Irving	12/09/2000	89	0.15	0.80			44408
Irving	12/09/2000	88	2.28	12.31			22208
Irving	12/16/2000	89	0.21	1.12			44825
Irving	12/26/2000	88	0.11	0.62			45606
Mobil	01/03/2000	87	0.09	0.51			134667

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Mobil	01/06/2000	87	0.09	0.49			54305
Mobil	01/07/2000	93	0.08	0.42			65697
Mobil	01/13/2000	87	0.08	0.45			115237
Mobil	01/22/2000	87	0.04	0.20			139725
Mobil	01/26/2000	87	0.03	0.17			76433
Mobil	01/30/2000	93	0.05	0.25			61328
Mobil	02/03/2000	87	0.03	0.17			112791
Mobil	02/08/2000	87	0.07	0.38			148326
Mobil	02/13/2000	87	0.08	0.43			112092
Mobil	02/19/2000	87	0.05	0.24			126233
Mobil	02/22/2000	93	0.02	0.13			68305
Mobil	02/23/2000	87	0.03	0.14			171213
Mobil	02/27/2000	87	0.11	0.57			125291
Mobil	03/02/2000	87	0.05	0.27			90017
Mobil	03/09/2000	87	0.05	0.28			169226
Mobil	03/12/2000	87	0.02	0.12			147457
Mobil	03/21/2000	87	0.05	0.26			147470
Mobil	03/27/2000	87	0.08	0.46			124082
Mobil	04/02/2000	87	0.06	0.32			100265
Mobil	04/05/2000	87	0.07	0.39			36384
Mobil	04/11/2000	87	0.13	0.74			67922
Mobil	04/12/2000	93	0.00	0.10			49226
Mobil	04/16/2000	87	0.08	0.47			67488
Mobil	04/21/2000	87	0.08	0.47			100716
Mobil	04/25/2000	93	2.12	12.03	TAME	0.04	50072
Mobil	04/30/2000	87	0.06	0.32			56371
Mobil	04/30/2000	87	0.09	0.53			67827
Mobil	05/04/2000	87	0.05	0.25			56978
Mobil	05/04/2000	87	0.05	0.29			66538
Mobil	05/08/2000	87	0.02	0.11			110901
Mobil	05/08/2000	87	0.03	0.15			67603
Mobil	05/11/2000	87	0.07	0.40			22146
Mobil	05/11/2000	87	0.08	0.44			22842

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Mobil	05/15/2000	93	0.61	3.31	TAME	0.10	29713
Mobil	05/15/2000	93	1.96	10.39	TAME	0.75	29599
Mobil	05/17/2000	87	0.03	0.19			44802
Mobil	05/17/2000	87	0.04	0.24			45172
Mobil	05/21/2000	87	0.10	0.54			57288
Mobil	05/21/2000	87	0.05	0.30			67017
Mobil	05/22/2000	93	0.17	0.70	TAME	0.30	39606
Mobil	05/26/2000	87	0.07	0.37			111304
Mobil	05/26/2000	87	0.00	0.00			67282
Mobil	06/03/2000	87	0.04	0.24			89164
Mobil	06/03/2000	87	0.00	0.00			79208
Mobil	06/08/2000	87	0.03	0.15			78835
Mobil	06/08/2000	87	0.11	0.62			66272
Mobil	06/11/2000	93	1.65	8.30	TAME	1.20	49655
Mobil	06/11/2000	93	0.17	0.80			29930
Mobil	06/15/2000	87	0.07	0.37			43716
Mobil	06/15/2000	87	0.08	0.44			44793
Mobil	06/19/2000	87	0.03	0.17			43806
Mobil	06/19/2000	87	0.08	0.45			43207
Mobil	06/23/2000	87	0.05	0.28			65326
Mobil	06/23/2000	87	0.13	0.72			57462
Mobil	06/28/2000	87	0.00	0.00			100697
Mobil	06/28/2000	87	0.00	0.00			88566
Mobil	07/04/2000	93	0.32	1.81			31013
Mobil	07/04/2000	93	1.32	6.26	TAME	1.32	45721
Mobil	07/04/2000	87	0.02	0.13			44268
Mobil	07/04/2000	87	0.05	0.25			44536
Mobil	07/09/2000	87	0.08	0.44			40985
Mobil	07/09/2000	87	0.08	0.44			44239
Mobil	07/13/2000	87	0.03	0.14			78590
Mobil	07/13/2000	87	0.07	0.38			77287
Mobil	07/18/2000	87	0.06	0.32			101005
Mobil	07/18/2000	87	0.06	0.35			64282

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Mobil	07/21/2000	87	0.02	0.11			111029
Mobil	07/21/2000	87	0.09	0.48			44115
Mobil	07/25/2000	87	0.36	2.00			19151
Mobil	07/25/2000	93	0.86	0.71	TAME	0.15	34602
Mobil	07/25/2000	93	0.90	4.15	TAME	1.00	44329
Mobil	07/30/2000	87	0.03	0.16			91401
Mobil	07/30/2000	87	0.04	0.20			85831
Mobil	08/03/2000	87	0.00	0.00			61460
Mobil	08/03/2000	87	0.02	0.10			50518
Mobil	08/07/2000	87	0.07	0.37			65432
Mobil	08/07/2000	87	0.00	0.00			78871
Mobil	08/12/2000	87	0.09	0.51			40056
Mobil	08/12/2000	87	0.24	1.33			21895
Mobil	08/15/2000	93	0.96	3.96	TAME Methanol	1.11 0.15	39599
Mobil	08/15/2000	93	0.97	3.79	TAME Methanol t-Butanol	1.31 0.14 0.08	31974
Mobil	08/17/2000	87	0.00	0.00			149951
Mobil	08/18/2000	87	0.05	0.25			44530
Mobil	08/20/2000	87	0.22	1.17	TAME	0.04	64935
Mobil	08/27/2000	87	0.03	0.18			78772
Mobil	08/27/2000	87	0.11	0.58			43330
Mobil	08/29/2000	87	0.24	1.35	TAME	0.19	37491
Mobil	08/29/2000	87	0.06	0.35	TAME	0.18	98988
Mobil	08/30/2000	93	0.75	3.07	TAME Methanol	0.82 0.13	32047
Mobil	08/30/2000	93	0.94	4.00	TAME Methanol	0.93 0.14	41548
Mobil	09/06/2000	87	0.02	0.10			44329
Mobil	09/06/2000	87	0.11	0.59			22008
Mobil	09/10/2000	87	0.14		TAME		66829
Mobil	09/13/2000	87	0.27	1.51			30230

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Mobil	09/17/2000	87	0.27	1.50			98802
Mobil	09/22/2000	87	0.07	0.40			44617
Mobil	09/26/2000	87	0.08	0.43			101334
Mobil	09/27/2000	93	1.54	7.89	Methanol t-Butanol TAME	0.12 0.09 0.17	66854
Mobil	10/02/2000	87	0.13	0.68			66941
Mobil	10/04/2000	87	0.00	0.00			85068
Mobil	10/07/2000	87	0.00	0.00			112256
Mobil	10/10/2000	93	0.49	2.76			67557
Mobil	10/14/2000	87	0.00	0.00			38509
Mobil	10/18/2000	87	0.30	1.46			74179
Mobil	10/19/2000	87	0.06	0.33			63178
Mobil	10/21/2000	87	0.21	1.11			49682
Mobil	10/24/2000	87	0.05	0.23			100540
Mobil	10/26/2000	93	0.95	5.26			67190
Mobil	10/28/2000	87	0.00	0.00			123619
Mobil	11/03/2000	87	0.00	0.00			123455
Mobil	11/09/2000	87	0.00	0.00			80196
Mobil	11/13/2000	87	0.03	0.17			146076
Mobil	11/14/2000	93	0.59	2.91	TAME	0.38	67318
Mobil	11/18/2000	87	0.18	0.17			146439
Mobil	11/20/2000	87	0.87	4.79			124308
Mobil	11/25/2000	87	0.13	0.13			102063
Mobil	12/01/2000	87	1.12	6.16			41987
Mobil	12/06/2000	87	0.36	1.98			146319
Mobil	12/07/2000	93	0.52	2.81	TAME	0.30	33718
Mobil	12/10/2000	87	0.23	1.27			79953
Mobil	12/12/2000	93	0.64	3.11	TAME	0.45	34012
Mobil	12/16/2000	87	0.52	2.86			45501
Mobil	12/20/2000	87	0.41	2.26			147831
Mobil	12/22/2000	93	0.49	2.51	TAME	0.24	34328
Mobil	12/26/2000	87	0.51	2.81			57680

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Mobil ***	03/07/2000	93	0.02	0.12			25234
Mobil ***	03/07/2000	93	0.03	0.10	TAME	0.04	25234
Mobil ***	03/30/2000	93					50426
Mobil ***	03/30/2000	93					50426
Mobil ***	10/13/2000	87					
Motiva	01/02/2000	87	0.00	0.00	TAME	0.00	2015709
Motiva	01/02/2000	87	0.00	0.00	TAME	0.00	2923697
Motiva	01/02/2000	87	0.00	0.00	TAME	0.00	2939732
Motiva	01/13/2000	87	0.01	0.01	TAME	0.01	838073
Motiva	01/20/2000	87	0.01	0.07			487696
Motiva	01/20/2000	87	0.16	0.86			3298455
Motiva	01/20/2000	87	0.09	0.47			2540467
Motiva	02/06/2000	87	0.03	0.14			2112523
Motiva	02/06/2000	87	0.03	0.13	TAME	0.14	1856209
Motiva	02/08/2000	87	0.11	0.61	TAME	0.10	2216120
Motiva	02/08/2000	93	1.66	8.95	TAME	0.11	505199
Motiva	02/08/2000	87	0.69	3.30	TAME	0.60	418548
Motiva	02/15/2000	87	0.01	0.10	TAME	0.10	3060382
Motiva	02/15/2000	87	0.02	0.12	TAME	0.10	598606
Motiva	02/15/2000	93	0.23	1.22	TAME	0.10	2104352
Motiva	03/07/2000	87	0.00	0.00			3223222
Motiva	03/07/2000	87	0.00	0.00			3032358
Motiva	03/07/2000	87	0.06	0.35			1312478
Motiva	03/29/2000	93	0.06	0.34			1899617
Motiva	03/29/2000	87	0.03	0.15			3215726
Motiva	03/29/2000	87	0.03	0.19			3215930
Motiva	03/29/2000	87	0.02	0.12			417413
Motiva	04/11/2000	93	0.10	0.40	TAME	0.10	2083631
Motiva	04/11/2000	87	0.10	0.10	TAME	0.10	3405188
Motiva	04/11/2000	87	0.00	0.00			700857
Motiva	04/11/2000	87	0.00	0.00			2376402
Motiva	04/27/2000	93	0.05	0.25			1778789
Motiva	04/27/2000	87	0.04	0.22			3357956

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Motiva	04/27/2000	87	0.04	0.23			3347351
Motiva	04/27/2000	87	0.04	0.21			1379267
Motiva	05/14/2000	87	0.00	0.00			3557313
Motiva	05/14/2000	87	0.04	0.20	TAME	0.20	103684
Motiva	05/14/2000	87	0.00	0.00			3192184
Motiva	05/22/2000	87	0.10	0.18	TAME	0.10	826968
Motiva	05/22/2000	87	0.10	0.10	TAME	0.10	3022642
Motiva	05/22/2000	87	0.10	0.10	TAME	0.10	373485
Motiva	05/22/2000	93	0.10	0.17	TAME	0.10	1678495
Motiva	05/24/2000	87	0.00	0.00			259810
Motiva	05/24/2000	87	0.00	0.00			2184634
Motiva	06/13/2000	87	0.10	0.10	TAME	0.10	2881480
Motiva	06/13/2000	87	0.10	0.10	TAME	0.10	3040043
Motiva	06/25/2000	87	0.17	0.96			1665393
Motiva	06/27/2000	87	0.00	0.00			3409154
Motiva	06/27/2000	87	0.00	0.00			3331656
Motiva	06/27/2000	93	0.03	0.14			1467642
Motiva	07/12/2000	87	0.06	0.33			68526
Motiva	07/12/2000	87	0.06	0.33			60095
Motiva	07/24/2000	87	0.31	1.73			39565
Motiva	07/25/2000	87	0.76	0.97	ETBE TAME	0.12 3.19	55055
Motiva	07/25/2000	93	0.65	1.83	ETBE TAME	0.10 1.47	29877
Motiva	08/01/2000	87	0.04	0.23			65282
Motiva	08/01/2000	87	0.02	0.12			79730
Motiva	08/01/2000	93	0.49	2.77	TAME	2.66	40757
Motiva	08/10/2000	87	0.03	0.19			81588
Motiva	08/10/2000	87	0.05	0.26			71662
Motiva	08/22/2000	87	0.05	0.30			40301
Motiva	08/22/2000	87	0.14	0.21	ETBE TAME	0.29 0.10	46090

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Motiva	08/22/2000	87	0.14	0.23	ETBE TAME	0.28 0.10	77365
Motiva	08/22/2000	87	0.14	0.21	ETBE TAME	0.29 0.10	62793
Motiva	08/22/2000	93	1.62	4.77	ETBE TAME	0.10 4.03	34104
Motiva	09/07/2000	87	0.39	1.59	TAME	0.63	24748
Motiva	09/11/2000	87	0.25	1.34			62265
Motiva	09/11/2000	87	0.11	0.63			15147
Motiva	09/11/2000	87	0.20	1.09			68547
Motiva	09/29/2000	87	0.53	2.90	ETBE	0.38	36619
Motiva	09/29/2000	93	0.32	1.76	TAME	0.87	43780
Motiva	09/29/2000	87	0.49	2.71	ETBE	0.03	28247
Motiva	10/02/2000	87	0.15	0.80			60029
Motiva	10/14/2000	87	0.08	0.45	0		48222
Motiva	10/14/2000	87	0.09	0.49	0		51977
Motiva	10/20/2000	87	0.11	0.55	ETBE	0.39	79446
Motiva	10/20/2000	87	0.09	0.49	ETBE	0.25	75060
Motiva	11/05/2000	87	0.13	0.69	TAME	2.41	49446
Motiva	11/05/2000	93	0.94	5.15	TAME	0.96	9832
Motiva	11/06/2000	87	0.07	0.35	0		51215
Motiva	11/06/2000	87	0.06	0.31	0		49318
Motiva	11/11/2000	93	0.54	2.97	TAME	0.16	19212
Motiva	11/13/2000	87	0.00	0.00			68685
Motiva	11/13/2000	87	0.03	0.15	TAME	0.46	69094
Motiva	11/13/2000	93	0.25	1.35	TAME	0.41	29783
Motiva	11/21/2000	87	0.00	0.00			64903
Motiva	11/21/2000	87	0.00	0.00			47843
Motiva	11/21/2000	87	0.00	0.00			27387
Motiva	11/26/2000	87	1.01	5.44	0		39782
Motiva	11/26/2000	93	0.40	2.22	0		20357
Motiva	12/13/2000	93	1.28	1.26	TAME	0.15	25022
Motiva	12/13/2000	87	0.00	0.00			66257

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Motiva	12/13/2000	87	0.00	0.00			33661
Motiva	12/28/2000	87	0.00	0.00			61807
Motiva	12/28/2000	87	0.00	0.00			68453
Webber	Jan-00	87	0.16	0.83			40662
Webber	Feb-00	87	0.10	0.55			66003
Webber	Mar-00	87	0.10	0.55			55532
Webber	Mar-00	93	0.10	0.55			12943
Webber	Jun-00	87	0.47	2.60			44005
Webber	Jun-00	87	0.14	0.80			58915
Webber	Sep-00	87	0.00	0.00			66927
Webber	Sep-00	87	0.17	0.30	TAME	0.50	399452
Webber	Nov-00	87	0.14	0.73	TAME	0.06	50505
Webber ***	Nov-00	87	0.47	2.60			31800.5
Webber ***	Nov-00	87	2.23	11.00	TAME	0.80	31800.5
Averages			**0.09**	**0.39**	**TAME**	**0.21**	
		MTBE Only	**0.05**		**ETBE**	**0.22**	
					TBA	**0.40**	
					Methanol	**0.13**	
					t-Butanol	**0.09**	

*** These two tests at Webber were a blend of two land tanks into a barge with only one number of barrels given. To make sure both were reported we split the total barrels 50/50. No testing of the blended barge load was done.

*** From Mobil Product came from two different tanks. Two separate results given.

APPENDIX C

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Webber	Jan-00	87	0.16	0.83			40662
Motiva	01/02/2000	87	0.00	0.00			2015709
Motiva	01/02/2000	87	0.00	0.00			2923697
Motiva	01/02/2000	87	0.00	0.00			2939732
Mobil	01/03/2000	87	0.09	0.51			134667
Mobil	01/06/2000	87	0.09	0.49			54305
Mobil	01/07/2000	93	0.08	0.42			65697
Gulf	01/11/2000	88	0.01	0.06			49000
Mobil	01/13/2000	87	0.08	0.45			115237
Motiva	01/13/2000	87	0.01	0.01	TAME	0.01	838073
Gulf	01/13/2000	93	0.02	0.12			40072
Gulf	01/14/2000	88					100000
Irving	01/14/2000	91	0.19	1.05			43678
Motiva	01/20/2000	87	0.01	0.07			487696
Motiva	01/20/2000	87	0.16	0.86			3298455
Motiva	01/20/2000	87	0.09	0.47			2540467
Mobil	01/22/2000	87	0.04	0.20			139725
Irving	01/24/2000	87	0.11	0.57			25841
Mobil	01/26/2000	87	0.03	0.17			76433
Irving	01/29/2000	87	0.27	1.45			20802
Mobil	01/30/2000	93	0.05	0.25			61328
Webber	Feb-00	87	0.10	0.55			66003
Irving	02/02/2000	87	0.08	0.43			45003
Irving	02/02/2000	93	2.13	11.91			23032
Mobil	02/03/2000	87	0.03	0.17			112791
Motiva	02/06/2000	87	0.03	0.14			2112523
Motiva	02/06/2000	87	0.03	0.13	TAME	0.14	1856209
Gulf	02/07/2000	88	0.06	0.33			124457
Mobil	02/08/2000	87	0.07	0.38			148326
Motiva	02/08/2000	87	0.11	0.61	TAME	0.10	2216120
Motiva	02/08/2000	93	1.66	8.95	TAME	0.11	505199
Motiva	02/08/2000	87	0.69	3.30	TAME	0.60	418548

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Irving	02/11/2000	87	0.03	0.18			35115
Mobil	02/13/2000	87	0.08	0.43			112092
Motiva	02/15/2000	87	0.01	0.10	TAME	0.10	3060382
Motiva	02/15/2000	87	0.02	0.12	TAME	0.10	598606
Motiva	02/15/2000	93	0.23	1.22	TAME	0.10	2104352
Mobil	02/19/2000	87	0.05	0.24			126233
Irving	02/20/2000	87	0.03	0.16			22647
Mobil	02/22/2000	93	0.02	0.13			68305
Mobil	02/23/2000	87	0.03	0.14			171213
Gulf	02/23/2000	93	2.23	6.66	TAME	6.29	40229
Mobil	02/27/2000	87	0.11	0.57			125291
Irving	02/29/2000	87	0.11	0.57			66948
Webber	Mar-00	87	0.10	0.55			55532
Webber	Mar-00	93	0.10	0.55			12943
Mobil	03/02/2000	87	0.05	0.27			90017
Gulf	03/03/2000	88	0.00	0.00			62000
Gulf	03/04/2000	88	0.00	0.00			83694
Irving	03/06/2000	93	2.12	11.67			10460
Irving	03/06/2000	87	0.07	0.37			44848
Motiva	03/07/2000	87	0.00	0.00			3223222
Motiva	03/07/2000	87	0.00	0.00			3032358
Motiva	03/07/2000	87	0.06	0.35			1312478
Mobil ***	03/07/2000	93	0.02	0.12			25234
Mobil ***	03/07/2000	93	0.03	0.10	TAME	0.04	25234
Mobil	03/09/2000	87	0.05	0.28			169226
Mobil	03/12/2000	87	0.02	0.12			147457
Irving	03/18/2000	87	0.03	0.17			89395
Mobil	03/21/2000	87	0.05	0.26			147470
Gulf	03/26/2000	87	0.03	0.15			115000
Mobil	03/27/2000	87	0.08	0.46			124082
Motiva	03/29/2000	93	0.06	0.34			1899617
Motiva	03/29/2000	87	0.03	0.15			3215726
Motiva	03/29/2000	87	0.03	0.19			3215930

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	Date of transfer	Octane	(% wt O2)	(% Vol)	Oxy. Name	% Vol	Barrels
Motiva	03/29/2000	87	0.02	0.12			417413
Mobil ***	03/30/2000	93					50426
Mobil ***	03/30/2000	93					50426
Irving	03/31/2000	91	0.06	0.34			22748
Mobil	04/02/2000	87	0.06	0.32			100265
Mobil	04/05/2000	87	0.07	0.39			36384
Irving	04/06/2000	93	2.17	12.07			8763
Irving	04/06/2000	87	0.07	0.37			44299
Mobil	04/11/2000	87	0.13	0.74			67922
Motiva	04/11/2000	93	0.10	0.40	TAME	0.10	2083631
Motiva	04/11/2000	87	0.10	0.10	TAME	0.10	3405188
Motiva	04/11/2000	87	0.00	0.00			700857
Motiva	04/11/2000	87	0.00	0.00			2376402
Mobil	04/12/2000	93	0.00	0.10			49226
Mobil	04/16/2000	87	0.08	0.47			67488
Mobil	04/21/2000	87	0.08	0.47			100716
Irving	04/21/2000	87					66561
Mobil	04/25/2000	93	2.12	12.03	TAME	0.04	50072
Gulf	04/25/2000	88	0.64	3.60	TBA	0.40	100138
Gulf	04/25/2000	88	0.80	4.40			71301
Motiva	04/27/2000	93	0.05	0.25			1778789
Motiva	04/27/2000	87	0.04	0.22			3357956
Motiva	04/27/2000	87	0.04	0.23			3347351
Motiva	04/27/2000	87	0.04	0.21			1379267
Mobil	04/30/2000	87	0.06	0.32			56371
Mobil	04/30/2000	87	0.09	0.53			67827
Gulf	04/30/2000	93	1.86	10.40			20109
Mobil	05/04/2000	87	0.05	0.25			56978
Mobil	05/04/2000	87	0.05	0.29			66538
Irving	05/07/2000	88	0.05	0.27			44893
Irving	05/07/2000	94	2.26	12.40			22055
Mobil	05/08/2000	87	0.02	0.11			110901
Mobil	05/08/2000	87	0.03	0.15			67603

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Mobil	05/11/2000	87	0.07	0.40			22146
Mobil	05/11/2000	87	0.08	0.44			22842
Motiva	05/14/2000	87	0.00	0.00			3557313
Motiva	05/14/2000	87	0.04	0.20	TAME	0.20	103684
Motiva	05/14/2000	87	0.00	0.00			3192184
Mobil	05/15/2000	93	0.61	3.31	TAME	0.10	29713
Mobil	05/15/2000	93	1.96	10.39	TAME	0.75	29599
Mobil	05/17/2000	87	0.03	0.19			44802
Mobil	05/17/2000	87	0.04	0.24			45172
Gulf	05/17/2000	93	2.18	11.73	TAME	0.62	35674
Gulf	05/18/2000	88	0.39	1.90	TAME	0.30	55876
Mobil	05/21/2000	87	0.10	0.54			57288
Mobil	05/21/2000	87	0.05	0.30			67017
Irving	05/21/2000	88	0.16	0.89			34927
Irving	05/21/2000	87	0.42	2.31			44989
Mobil	05/22/2000	93	0.17	0.70	TAME	0.30	39606
Motiva	05/22/2000	87	0.10	0.18	TAME	0.10	826968
Motiva	05/22/2000	87	0.10	0.10	TAME	0.10	3022642
Motiva	05/22/2000	87	0.10	0.10	TAME	0.10	373485
Motiva	05/22/2000	93	0.10	0.17	TAME	0.10	1678495
Gulf	05/22/2000		0.00	0.00			68095
Motiva	05/24/2000	87	0.00	0.00			259810
Motiva	05/24/2000	87	0.00	0.00			2184634
Mobil	05/26/2000	87	0.07	0.37			111304
Mobil	05/26/2000	87	0.00	0.00			67282
Gulf	05/29/2000	87	0.09	0.48			75208
Webber	Jun-00	87	0.47	2.60			44005
Webber	Jun-00	87	0.14	0.80			58915
Mobil	06/03/2000	87	0.04	0.24			89164
Mobil	06/03/2000	87	0.00	0.00			79208
Irving	06/06/2000	93	0.03	0.15			60592
Irving	06/06/2000	98	2.27	12.38			18526
Irving	06/06/2000	87	0.15	0.82			22413

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Mobil	06/08/2000	87	0.03	0.15			78835
Mobil	06/08/2000	87	0.11	0.62			66272
Mobil	06/11/2000	93	1.65	8.30	TAME	1.20	49655
Mobil	06/11/2000	93	0.17	0.80			29930
Motiva	06/13/2000	87	0.10	0.10	TAME	0.10	2881480
Motiva	06/13/2000	87	0.10	0.10	TAME	0.10	3040043
Mobil	06/15/2000	87	0.07	0.37			43716
Mobil	06/15/2000	87	0.08	0.44			44793
Mobil	06/19/2000	87	0.03	0.17			43806
Mobil	06/19/2000	87	0.08	0.45			43207
Mobil	06/23/2000	87	0.05	0.28			65326
Mobil	06/23/2000	87	0.13	0.72			57462
Motiva	06/25/2000	87	0.17	0.96			1665393
Gulf	06/25/2000	87	0.13	0.51	TAME	0.23	73990
Motiva	06/27/2000	87	0.00	0.00			3409154
Motiva	06/27/2000	87	0.00	0.00			3331656
Motiva	06/27/2000	93	0.03	0.14			1467642
Mobil	06/28/2000	87	0.00	0.00			100697
Mobil	06/28/2000	87	0.00	0.00			88566
Mobil	07/04/2000	93	0.32	1.81			31013
Mobil	07/04/2000	93	1.32	6.26	TAME	1.32	45721
Mobil	07/04/2000	87	0.02	0.13			44268
Mobil	07/04/2000	87	0.05	0.25			44536
Gulf	07/07/2000	88	0.21	1.14			100595
Irving	07/08/00	87	2.23	12.32			29082
Irving	07/08/00	94	2.23	12.32			8719
Mobil	07/09/2000	87	0.08	0.44			40985
Mobil	07/09/2000	87	0.08	0.44			44239
Motiva	07/12/2000	87	0.06	0.33			68526
Motiva	07/12/2000	87	0.06	0.33			60095
Mobil	07/13/2000	87	0.03	0.14			78590
Mobil	07/13/2000	87	0.07	0.38			77287
Gulf	07/13/2000	93					39564

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Irving	07/17/00	87	0.07	0.36			54531
Irving	07/17/00	87	0.10	0.56			18406
Irving	07/17/00	93	2.23	12.29			16246
Mobil	07/18/2000	87	0.06	0.32			101005
Mobil	07/18/2000	87	0.06	0.35			64282
Irving	07/18/00	87	0.03	0.18			12911
Irving	07/18/00	87	0.03	0.15			8710
Mobil	07/21/2000	87	0.02	0.11			111029
Mobil	07/21/2000	87	0.09	0.48			44115
Motiva	07/24/2000	87	0.31	1.73			39565
Mobil	07/25/2000	87	0.36	2.00			19151
Mobil	07/25/2000	93	0.86	0.71	TAME	0.15	34602
Mobil	07/25/2000	93	0.90	4.15	TAME	1.00	44329
Motiva	07/25/2000	87	0.76	0.97	ETBE TAME	0.12 3.19	55055
Motiva	07/25/2000	93	0.65	1.83	ETBE TAME	0.10 1.47	29877
Gulf	07/26/2000	87	0.15	0.20	TAME	0.70	49465
Mobil	07/30/2000	87	0.03	0.16			91401
Mobil	07/30/2000	87	0.04	0.20			85831
Gulf	07/30/2000	88					78669
Motiva	08/01/2000	87	0.04	0.23			65282
Motiva	08/01/2000	87	0.02	0.12			79730
Motiva	08/01/2000	93	0.49	2.77	TAME	2.66	40757
Irving	08/02/00	87	0.00	0.00			21874
Irving	08/02/00	87	0.03	0.17			21453
Mobil	08/03/2000	87	0.00	0.00			61460
Mobil	08/03/2000	87	0.02	0.10			50518
Mobil	08/07/2000	87	0.07	0.37			65432
Mobil	08/07/2000	87	0.00	0.00			78871
Motiva	08/10/2000	87	0.03	0.19			81588
Motiva	08/10/2000	87	0.05	0.26			71662
Irving	08/10/00	87	0.06	0.32			44537

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Irving	08/10/00	88	0.08	0.42			22121
Irving	08/10/00	93	2.12	11.63			16242
Mobil	08/12/2000	87	0.09	0.51			40056
Mobil	08/12/2000	87	0.24	1.33			21895
Mobil	08/15/2000	93	0.96	3.96	TAME Methanol	1.11 0.15	39599
Mobil	08/15/2000	93	0.97	3.79	TAME Methanol t-Butanol	1.31 0.14 0.08	31974
Irving	08/16/00		0.00	0.00			40055
Mobil	08/17/2000	87	0.00	0.00			149951
Gulf	08/17/2000	87	0.23	1.24			80000
Mobil	08/18/2000	87	0.05	0.25			44530
Gulf	08/18/2000	88	0.00	0.00			58181
Mobil	08/20/2000	87	0.22	1.17	TAME	0.04	64935
Motiva	08/22/2000	87	0.05	0.30			40301
Motiva	08/22/2000	87	0.14	0.21	ETBE TAME	0.29 0.10	46090
Motiva	08/22/2000	87	0.14	0.23	ETBE TAME	0.28 0.10	77365
Motiva	08/22/2000	87	0.14	0.21	ETBE TAME	0.29 0.10	62793
Motiva	08/22/2000	93	1.62	4.77	ETBE TAME	0.10 4.03	34104
Mobil	08/27/2000	87	0.03	0.18			78772
Mobil	08/27/2000	87	0.11	0.58			43330
Mobil	08/29/2000	87	0.24	1.35	TAME	0.19	37491
Mobil	08/29/2000	87	0.06	0.35	TAME	0.18	98988
Mobil	08/30/2000	93	0.75	3.07	TAME Methanol	0.82 0.13	32047
Mobil	08/30/2000	93	0.94	4.00	TAME Methanol	0.93 0.14	41548
Webber	Sep-00	87	0.00	0.00			66927

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Webber	Sep-00	87	0.17	0.30	TAME	0.50	6101723
Gulf	09/03/2000	87	0.46	1.90	TAME	0.70	58500
Gulf	09/05/2000	93	2.49	13.45			13000
Irving	09/05/00	88	0.12	0.67			49927
Irving	09/05/00	94	2.04	11.21			22274
Mobil	09/06/2000	87	0.02	0.10			44329
Mobil	09/06/2000	87	0.11	0.59			22008
Motiva	09/07/2000	87	0.39	1.59	TAME	0.63	24748
Mobil	09/10/2000	87	0.14		TAME		66829
Motiva	09/11/2000	87	0.25	1.34			62265
Motiva	09/11/2000	87	0.11	0.63			15147
Motiva	09/11/2000	87	0.20	1.09			68547
Mobil	09/13/2000	87	0.27	1.51			30230
Irving	09/13/00	89	0.27	1.47			29112
Gulf	09/14/2000	87	2.20	12.12			75010
Mobil	09/17/2000	87	0.27	1.50			98802
Gulf	09/19/2000	93	2.24	11.18			10000
Irving	09/19/00	90	0.21	1.13			21686
Mobil	09/22/2000	87	0.07	0.40			44617
Mobil	09/26/2000	87	0.08	0.43			101334
Mobil	09/27/2000	93	1.54	7.89	Methanol t-Butanol TAME	0.12 0.09 0.17	66854
Irving	09/27/00	89	0.05	0.25			21990
Motiva	09/29/2000	87	0.53	2.90	ETBE	0.38	36619
Motiva	09/29/2000	93	0.32	1.76	TAME	0.87	43780
Motiva	09/29/2000	87	0.49	2.71	ETBE	0.03	28247
Gulf	09/30/2000	87	0.00	0.00			39299
Mobil	10/02/2000	87	0.13	0.68			66941
Motiva	10/02/2000	87	0.15	0.80			60029
Irving	10/02/2000	91	0.11	0.57			26203
Mobil	10/04/2000	87	0.00	0.00			85068
Irving	10/05/2000	89	0.00	0.00			37972

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Gulf	10/06/2000	87	0.10				19934
Gulf	10/06/2000	93	0.83	4.63			18925
Mobil	10/07/2000	87	0.00	0.00			112256
Gulf	10/07/2000	87	0.33	1.79			29770
Gulf	10/07/2000	87	0.10	0.53			49810
Mobil	10/10/2000	93	0.49	2.76			67557
Irving	10/13/2000	87	0.22	1.19			34804
Irving	10/13/2000	93	2.15	11.83			21961
Mobil ***	10/13/2000	87					
Mobil	10/14/2000	87	0.00	0.00			38509
Motiva	10/14/2000	87	0.08	0.45	0		48222
Motiva	10/14/2000	87	0.09	0.49	0		51977
Mobil	10/18/2000	87	0.30	1.46			74179
Mobil	10/19/2000	87	0.06	0.33			63178
Motiva	10/20/2000	87	0.11	0.55	ETBE	0.39	79446
Motiva	10/20/2000	87	0.09	0.49	ETBE	0.25	75060
Gulf	10/20/2000	88	0.10	0.53			110273
Irving	10/20/2000	88	0.02	0.12			16169
Mobil	10/21/2000	87	0.21	1.11			49682
Mobil	10/24/2000	87	0.05	0.23			100540
Irving	10/25/2000	87	0.02	0.11			45918
Mobil	10/26/2000	93	0.95	5.26			67190
Mobil	10/28/2000	87	0.00	0.00			123619
Webber	Nov-00	87	0.14	0.73	TAME	0.06	50505
Webber ***	Nov-00	87	0.47	2.60			31800.5
Webber ***	Nov-00	87	2.23	11.00	TAME	0.80	31800.5
Mobil	11/03/2000	87	0.00	0.00			123455
Motiva	11/05/2000	87	0.13	0.69	TAME	2.41	49446
Motiva	11/05/2000	93	0.94	5.15	TAME	0.96	9832
Gulf	11/05/2000	88	0.70	3.68			79783
Motiva	11/06/2000	87	0.07	0.35	0		51215
Motiva	11/06/2000	87	0.06	0.31	0		49318
Gulf	11/07/2000	93	2.04	10.96	TAME	0.06	19870

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Mobil	11/09/2000	87	0.00	0.00			80196
Irving	11/09/2000	87	0.02	0.11			44276
Irving	11/09/2000	93	2.24	12.07			22182
Motiva	11/11/2000	93	0.54	2.97	TAME	0.16	19212
Mobil	11/13/2000	87	0.03	0.17			146076
Motiva	11/13/2000	87	0.00	0.00			68685
Motiva	11/13/2000	87	0.03	0.15	TAME	0.46	69094
Motiva	11/13/2000	93	0.25	1.35	TAME	0.41	29783
Irving	11/13/2000	88	0.03	0.17			44862
Mobil	11/14/2000	93	0.59	2.91	TAME	0.38	67318
Mobil	11/18/2000	87	0.18	0.17			146439
Gulf	11/19/2000	87	0.18	1.00			38864
Mobil	11/20/2000	87	0.87	4.79			124308
Motiva	11/21/2000	87	0.00	0.00			64903
Motiva	11/21/2000	87	0.00	0.00			47843
Motiva	11/21/2000	87	0.00	0.00			27387
Gulf	11/21/2000	87	1.89	10.13			50408
Mobil	11/25/2000	87	0.13	0.13			102063
Motiva	11/26/2000	87	1.01	5.44	0		39782
Motiva	11/26/2000	93	0.40	2.22	0		20357
Irving	11/26/2000	88	0.03	0.17			43949
Gulf	11/29/2000	88	2.23	11.00	TAME	0.80	29093
Gulf	11/29/2000	93	0.54	2.60	TAME	0.40	10215
Mobil	12/01/2000	87	1.12	6.16			41987
Gulf	12/02/2000	87	2.45	13.04			65072
Mobil	12/06/2000	87	0.36	1.98			146319
Mobil	12/07/2000	93	0.52	2.81	TAME	0.30	33718
Gulf	12/08/2000	89	0.00	0.00			35000
Irving	12/09/2000	89	0.15	0.80			44408
Irving	12/09/2000	88	2.28	12.31			22208
Mobil	12/10/2000	87	0.23	1.27			79953
Gulf	12/11/2000	89	0.00	0.00			44961
Mobil	12/12/2000	93	0.64	3.11	TAME	0.45	34012

			Oxygen	MTBE	Other Oxygenate(s)		
Terminal	**Date of transfer**	**Octane**	(% wt O2)	(% Vol)	Oxy. Name	% Vol	**Barrels**
Motiva	12/13/2000	93	1.28	1.26	TAME	0.15	25022
Motiva	12/13/2000	87	0.00	0.00			66257
Motiva	12/13/2000	87	0.00	0.00			33661
Gulf	12/15/2000	93	0.49	2.40	TAME	0.30	40000
Mobil	12/16/2000	87	0.52	2.86			45501
Gulf	12/16/2000	87	0.08	0.45			80000
Irving	12/16/2000	89	0.21	1.12			44825
Mobil	12/20/2000	87	0.41	2.26			147831
Mobil	12/22/2000	93	0.49	2.51	TAME	0.24	34328
Mobil	12/26/2000	87	0.51	2.81			57680
Irving	12/26/2000	88	0.11	0.62			45606
Motiva	12/28/2000	87	0.00	0.00			61807
Motiva	12/28/2000	87	0.00	0.00			68453
Averages			**0.09**	**0.39**	**TAME**	**0.21**	
		MTBE only	**0.05**		**ETBE**	**0.22**	
					TBA	**0.40**	
					Methanol	**0.13**	
					t-Butanol	**0.09**	

*** These two tests at Webber were a blend of two land tanks into a barge with only one number of barrels given. To make sure both were reported we split the total barrels 50/50. No testing of the blended barge load was done.

*** From Mobil Product came from two different tanks. Two separate results given

APPENDIX D

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Gulf	01/11/2000	88	8.00	0.74	33.30	761	49000
Gulf	01/13/2000	93	13.81	0.21			40072
Gulf	01/14/2000	88	14.50	0.75	21.80	306	100000
Gulf	02/07/2000	88	14.03	0.67	23.80	376	124457
Gulf	02/23/2000	93	14.40	0.77	32.70	230	40229
Gulf	03/03/2000	88	8.78	0.63	14.40	158	62000
Gulf	03/04/2000	88	8.32	0.70	33.70	697	83694
Gulf	03/26/2000	87	9.79	0.49	29.20	219	115000
Gulf	04/25/2000	88	7.80	0.79	29.60	313	71301
Gulf	04/25/2000	88	7.83	0.96	31.70	997	100138
Gulf	04/30/2000	93	6.35	0.49	31.20	109	20109
Gulf	05/17/2000	93	7.54	0.50	31.70	180	35674
Gulf	05/18/2000	88	8.96	1.44	33.40	132	55876
Gulf	05/22/2000		8.77	1.06	31.10	218	68095
Gulf	05/29/2000	87	8.73	0.74	28.10	87	75208
Gulf	06/25/2000	87	8.69	0.88	24.90	230	73990
Gulf	07/07/2000	88	8.37	0.62	24.50	399	100595
Gulf	07/13/2000	93	8.89			112	39564
Gulf	07/26/2000	87	7.27	2.10	40.10	180	49465
Gulf	07/30/2000	88	9.53				78669
Gulf	08/17/2000	87	8.85	1.29	46.70	302	80000
Gulf	08/18/2000	88	8.24	3.62	42.80	88	58181
Gulf	09/03/2000	87	8.41	1.09	34.40	228	58500
Gulf	09/05/2000	93	6.93	0.29	18.20	66	13000
Gulf	09/14/2000	87	6.51	1.04	31.10	28	75010
Gulf	09/19/2000	93	12.50	0.31	29.80	58	10000
Gulf	09/30/2000	87	10.70	3.30	29.80	180	39299
Gulf	10/06/2000	93	10.11	0.70	34.60	131	18925
Gulf	10/06/2000	87	10.60	3.30	39.80	180	19934
Gulf	10/07/2000	87	11.21	2.05	15.70	183	29770
Gulf	10/07/2000	87	12.90	1.44	20.80	266	49810
Gulf	10/20/2000	88	10.65	0.62	12.10	193	110273
Gulf	11/05/2000	88	11.87	0.45	16.20	165	79783
Gulf	11/07/2000	93	9.93	0.65	21.40	446	19870
Gulf	11/19/2000	87	12.61	0.59	34.30	42	38864

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Gulf	11/21/2000	87	11.91	0.69	22.00	53	50408
Gulf	11/29/2000	88	8.38	0.64	29.50	750	29093
Gulf	11/29/2000	93	11.26	0.54	35.80	63	10215
Gulf	12/02/2000	87	11.88	0.83	18.80	43	65072
Gulf	12/08/2000	89	10.84	0.46	20.90	192	35000
Gulf	12/11/2000	89	14.54	0.53	22.50	53	44961
Gulf	12/15/2000	93	12.36	0.84	33.10	103	40000
Gulf	12/16/2000	87	13.45	1.28	17.60	161	80000
Irving	01/14/2000	91	12.97	0.42	24.90	63	43678
Irving	01/24/2000	87	12.56	0.35	25.10	67	25841
Irving	01/29/2000	87	13.25	0.68	29.20	77	20802
Irving	02/02/2000	93	12.90	0.39	40.90	79	23032
Irving	02/02/2000	87	13.25	0.60	23.50	67	45003
Irving	02/11/2000	87	12.80	0.81	24.30	80	35115
Irving	02/20/2000	87	13.24	0.63	23.70	94	22647
Irving	02/29/2000	87	13.52	0.58	23.10	92	66948
Irving	03/06/2000	87	11.61	0.53	24.80	71	44848
Irving	03/06/2000	93	14.16	0.37	28.50	73	10460
Irving	03/18/2000	87	11.58	0.43	27.10	103	89395
Irving	03/31/2000	91	12.94	0.39	28.60	111	22748
Irving	04/06/2000	87	7.36	0.47	34.00	77	44299
Irving	04/06/2000	93	12.16	0.50	31.80	56	8763
Irving	04/21/2000	87	7.53	0.43	33.30	89	66561
Irving	05/07/2000	94	6.70	0.51	21.50	42	22055
Irving	05/07/2000	88	8.83	1.04	31.20	75	44893
Irving	05/21/2000	87	7.59	1.27	33.70	100	44989
Irving	05/21/2000	88	8.71	1.34	30.60	108	34927
Irving	06/06/2000	93	6.81	0.51	29.60	69	60592
Irving	06/06/2000	87	7.72	0.54	34.00	104	22413
Irving	06/06/2000	98	8.72	0.33	19.50	56	18526
Irving	07/08/00	94	6.58	0.32	26.00	72	8719
Irving	07/08/00	87	8.77	0.45	28.10	96	29082
Irving	07/17/00	93	6.50	0.29	28.30	72	16246
Irving	07/17/00	87	7.71	0.50	33.40	109	18406
Irving	07/17/00	87	8.62	0.53	28.30	87	54531
Irving	07/18/00	87	7.71	0.56	32.40	56	8710

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Irving	07/18/00	87	8.62	0.50	24.10	97	12911
Irving	08/02/00	87	7.71	0.40	31.80	100	21453
Irving	08/02/00	87	8.53	0.34	26.40	106	21874
Irving	08/10/00	93	6.62	0.06	21.90	74	16242
Irving	08/10/00	88	7.71	0.28	33.80	138	22121
Irving	08/10/00	87	8.72	0.15	23.60	94	44537
Irving	08/16/00			4.01	45.30	66	40055
Irving	09/05/00	94	6.56	0.33	22.60	108	22274
Irving	09/05/00	88	7.87	0.61	28.20	153	49927
Irving	09/13/00	89	8.55	0.82	28.60	85	29112
Irving	09/19/00	90	11.26	0.52	38.60	52	21686
Irving	09/27/00	89	12.13	0.68	23.60	91	21990
Irving	10/02/2000	91	13.06	1.04	26.10	93	26203
Irving	10/05/2000	89	12.21	0.91	31.90	104	37972
Irving	10/13/2000	93	12.51	0.58	26.80	72	21961
Irving	10/13/2000	87	12.83	0.68	24.10	113	34804
Irving	10/20/2000	88	12.60	0.64	31.30	78	16169
Irving	10/25/2000	87	12.70	0.70	32.70	54	45918
Irving	11/09/2000	87	14.44	0.48	23.50	64	44276
Irving	11/09/2000	93	14.87	0.34	20.60	32	22182
Irving	11/13/2000	88	13.96	0.55	28.60	49	44862
Irving	11/26/2000	88	14.10	0.53	31.40	67	43949
Irving	12/09/2000	88	13.68	0.28	18.20	13.56	22208
Irving	12/09/2000	89	14.77	0.52	23.30	48	44408
Irving	12/16/2000	89	14.40	0.56	20.20	105	44825
Irving	12/26/2000	88	14.30	0.58	26.90	87	45606
Mobil	01/03/2000	87	14.04	0.26	22.50	101	134667
Mobil	01/06/2000	87	13.19	0.29	23.20	89	54305
Mobil	01/07/2000	93	13.87	0.25	33.60	12	65697
Mobil	01/13/2000	87	13.35	0.40	22.80	75	115237
Mobil	01/22/2000	87	12.93	0.34	25.90	81	139725
Mobil	01/26/2000	87	12.81	0.42	26.80	72	76433
Mobil	01/30/2000	93	14.05	0.29	41.70	4	61328
Mobil	02/03/2000	87	13.29	1.02	27.60	63	112791
Mobil	02/08/2000	87	11.75	0.70	26.60	93	148326
Mobil	02/13/2000	87	12.80	0.73	24.40	83	112092

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	02/19/2000	87	12.74	0.59	24.20	77	126233
Mobil	02/22/2000	93	14.04	0.27	33.10	1	68305
Mobil	02/23/2000	87	13.45	0.47	19.40	106	171213
Mobil	02/27/2000	87	14.06	0.46	21.60	85	125291
Mobil	03/02/2000	87	13.58	0.57	19.90	86	90017
Mobil	03/09/2000	87	12.75	0.50	26.90	71	169226
Mobil	03/12/2000	87	11.27	0.46	28.10	95	147457
Mobil	03/21/2000	87	11.77	0.40	28.70	111	147470
Mobil	03/27/2000	87	9.39	0.42	26.50	86	124082
Mobil	04/02/2000	87	8.69	0.38	34.90	78	100265
Mobil	04/05/2000	87	7.59	0.48	37.50	95	36384
Mobil	04/11/2000	87	7.46	0.43	33.70	96	67922
Mobil	04/12/2000	93	7.70	0.74	41.90	10	49226
Mobil	04/16/2000	87	7.70	0.44	33.50	92	67488
Mobil	04/21/2000	87	7.56	0.32	31.60	96	100716
Mobil	04/25/2000	93	7.41	1.40	45.50	36	50072
Mobil	04/30/2000	87	7.47	0.31	31.50	109	67827
Mobil	04/30/2000	87	8.57	0.36	30.10	101	56371
Mobil	05/04/2000	87	7.60	0.37	33.20	91	66538
Mobil	05/04/2000	87	8.62	0.36	30.00	93	56978
Mobil	05/08/2000	87	7.65	1.28	33.00	97	67603
Mobil	05/08/2000	87	8.48	1.45	33.30	75	110901
Mobil	05/11/2000	87	7.68	1.27	36.30	105	22842
Mobil	05/11/2000	87	8.66	1.39	30.70	104	22146
Mobil	05/15/2000	93	7.92	0.53	37.00	181	29599
Mobil	05/15/2000	93	8.46	0.93	36.00	114	29713
Mobil	05/17/2000	87	7.56	1.44	35.10	131	45172
Mobil	05/17/2000	87	8.64	1.35	32.30	94	44802
Mobil	05/21/2000	87	7.59	1.37	36.50	121	67017
Mobil	05/21/2000	87	8.55	1.36	31.00	85	57288
Mobil	05/22/2000	93	5.88	2.08	61.20	68	39606
Mobil	05/26/2000	87	7.56	1.35	32.40	115	67282
Mobil	05/26/2000	87	8.53	1.08	29.10	84	111304
Mobil	06/03/2000	87	7.76	0.74	32.10	131	79208
Mobil	06/03/2000	87	8.66	0.56	28.10	92	89164
Mobil	06/08/2000	87	7.54	0.51	35.40	106	66272

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	06/08/2000	87	8.72	0.52	28.80	72	78835
Mobil	06/11/2000	93	7.24	1.84	55.60	13	29930
Mobil	06/11/2000	93	7.55	1.48	40.90	130	49655
Mobil	06/15/2000	87	7.41	0.45	34.70	113	44793
Mobil	06/15/2000	87	8.82	0.46	27.00	71	43716
Mobil	06/19/2000	87	7.61	0.45	32.30	97	43207
Mobil	06/19/2000	87	8.62	0.52	26.10	80	43806
Mobil	06/23/2000	87	7.60	0.43	31.20	108	57462
Mobil	06/23/2000	87	8.66	0.42	28.10	67	65326
Mobil	06/28/2000	87	7.70	0.43	29.50	116	88566
Mobil	06/28/2000	87	8.59	0.38	25.90	86	100697
Mobil	07/04/2000	93	7.60	0.92	38.70	126	45721
Mobil	07/04/2000	87	7.73	0.47	31.20	120	44536
Mobil	07/04/2000	93	8.62	0.70	38.90	69	31013
Mobil	07/04/2000	87	8.69	0.44	28.40	128	44268
Mobil	07/09/2000	87	7.40	0.49	32.90	116	44239
Mobil	07/09/2000	87	8.64	0.41	25.70	117	40985
Mobil	07/13/2000	87	7.47	0.51	31.50	100	77287
Mobil	07/13/2000	87	8.67	0.54	25.20	85	78590
Mobil	07/18/2000	87	7.53	0.51	31.40	41	64282
Mobil	07/18/2000	87	8.59	0.52	24.70	37	101005
Mobil	07/21/2000	87	7.35	0.45	33.40	80	44115
Mobil	07/21/2000	87	8.43	0.38	27.30	106	111029
Mobil	07/25/2000	87	7.27	1.56	36.30	162	19151
Mobil	07/25/2000	93	7.61	0.83	36.80	130	44329
Mobil	07/25/2000	93	7.96	0.81	36.50	122	34602
Mobil	07/30/2000	87	7.53	0.37	34.40	104	85831
Mobil	07/30/2000	87	8.66	0.33	27.40	116	91401
Mobil	08/03/2000	87	7.58	0.37	33.00	134	50518
Mobil	08/03/2000	87	8.57	0.36	27.30	128	61460
Mobil	08/07/2000	87	7.44	0.38	27.20	98	78871
Mobil	08/07/2000	87	8.32	0.36	34.10	97	65432
Mobil	08/12/2000	87	7.51	0.35	32.90	140	21895
Mobil	08/12/2000	87	8.62	0.32	23.60	103	40056
Mobil	08/15/2000	93	7.62	0.74	36.30	124	31974
Mobil	08/15/2000	93	8.35	0.68	36.90	147	39599

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	08/17/2000	87	8.24	3.62	42.80	88	149951
Mobil	08/18/2000	87	7.73	0.57	34.10	158	44530
Mobil	08/20/2000	87	7.63	1.72	28.40	534	64935
Mobil	08/27/2000	87	7.38	1.27	27.90	191	43330
Mobil	08/27/2000	87	8.45	0.65	32.70	116	78772
Mobil	08/29/2000	87	7.39	1.45	40.10	251	98988
Mobil	08/29/2000	87	8.01	1.43	33.90	207	37491
Mobil	08/30/2000	93	7.41	0.92	37.20	129	41548
Mobil	08/30/2000	93	7.67	0.79	28.20	120	32047
Mobil	09/06/2000	87	7.61	0.82	26.80	174	22008
Mobil	09/06/2000	87	8.68	0.54	26.10	138	44329
Mobil	09/10/2000	87	7.02	1.12	45.60	232	66829
Mobil	09/13/2000	87	7.60	0.79	27.40	147	30230
Mobil	09/17/2000	87	12.01	0.53	31.60	58	98802
Mobil	09/22/2000	87	12.75	0.53	23.10	155	44617
Mobil	09/26/2000	87	12.04	0.68	23.80	110	101334
Mobil	09/27/2000	93	11.50	0.58	31.10	41	66854
Mobil	10/02/2000	87	12.89	1.14	32.20	137	66941
Mobil	10/04/2000	87	12.17	0.92	26.40	92	85068
Mobil	10/07/2000	87	12.13	0.38	24.80	128	112256
Mobil	10/10/2000	93	12.56	0.29	36.40	62	67557
Mobil	10/14/2000	87	12.04	0.63	29.60	158	38509
Mobil	10/18/2000	87	10.30	0.69	21.29	279	74179
Mobil	10/19/2000	87	12.38	0.57	28.30	71	63178
Mobil	10/21/2000	87	12.77	1.85	24.20	226	49682
Mobil	10/24/2000	87	12.16	0.68	34.80	81	100540
Mobil	10/26/2000	93	10.63	1.51	34.00	80	67190
Mobil	10/28/2000	87	12.30	0.60	26.60	88	123619
Mobil	11/03/2000	87	12.49	0.49	31.00	75	123455
Mobil	11/09/2000	87	14.25	0.51	24.30	48	80196
Mobil	11/13/2000	87	13.79	0.54	25.50	43	146076
Mobil	11/14/2000	93	11.04	0.99	31.00		67318
Mobil	11/18/2000	87	13.89	0.66	27.00	86	146439
Mobil	11/20/2000	87	14.16	0.58	24.80	115	124308
Mobil	11/25/2000	87	14.02	0.52	23.80	122	102063
Mobil	12/01/2000	87	13.50	0.52	23.10	68	41987

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	12/06/2000	87	14.67	0.38	24.90	77	146319
Mobil	12/07/2000	93	12.28	0.80	30.00	94	33718
Mobil	12/10/2000	87	14.54	0.53	22.50	53	79953
Mobil	12/12/2000	93	12.54	0.94	26.40	115	34012
Mobil	12/16/2000	87	14.51	0.54	20.30	72	45501
Mobil	12/20/2000	87	14.44	0.62	21.80	43	147831
Mobil	12/22/2000	93	12.72	1.05	30.10	141	34328
Mobil	12/26/2000	87	14.22	0.65	23.10	56	57680
Mobil ***	03/07/2000	93	13.73	0.30	32.30	117	25234
Mobil ***	03/07/2000	93	14.18	0.18	31.10	115	25234
Mobil ***	03/30/2000	93	8.30				50426
Mobil ***	03/30/2000	93	14.00				50426
Mobil ***	10/13/2000	87	9.75				
Motiva	01/02/2000	87	13.13	0.62	21.20	76	2939732
Motiva	01/02/2000	87	13.39	0.46	19.90	94	2015709
Motiva	01/02/2000	87	13.56	0.48	20.40	95	2923697
Motiva	01/13/2000	87	8.83	0.73	29.60	627	838073
Motiva	01/20/2000	87	10.56	0.52	28.20	509	487696
Motiva	01/20/2000	87	13.08	0.45	25.20	118	3298455
Motiva	01/20/2000	87	13.27	0.48	24.50	126	2540467
Motiva	02/06/2000	87	13.72	0.64	24.20	349	2112523
Motiva	02/06/2000	87	13.78	0.59	24.50	308	1856209
Motiva	02/08/2000	87	11.02	0.74	0.74	98	2216120
Motiva	02/08/2000	87	11.26	0.56	27.60	97	418548
Motiva	02/08/2000	93	12.69	0.63	28.20	94	505199
Motiva	02/15/2000	93	12.56	0.13	25.90	46	2104352
Motiva	02/15/2000	87	13.50	0.52	20.30	162	3060382
Motiva	02/15/2000	87	13.87	0.60	21.80	312	598606
Motiva	03/07/2000	87	11.76	0.68	27.70	96	1312478
Motiva	03/07/2000	87	13.66	0.70	27.40	70	3223222
Motiva	03/07/2000	87	13.68	0.67	28.30	92	3032358
Motiva	03/29/2000	93	7.58	0.33	46.40	43	1899617
Motiva	03/29/2000	87	7.97	0.43	33.70	79	3215726
Motiva	03/29/2000	87	8.03	0.45	41.10	67	3215930
Motiva	03/29/2000	87	8.33	0.45	35.80	107	417413
Motiva	04/11/2000	87	6.98	0.86	33.10	134	700857

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Motiva	04/11/2000	93	6.99	0.30	35.50	62	2083631
Motiva	04/11/2000	87	7.05	0.87	33.00	115	3405188
Motiva	04/11/2000	87	7.19	0.80	32.80	114	2376402
Motiva	04/27/2000	93	7.30	0.26	39.30	48	1778789
Motiva	04/27/2000	87	7.36	0.50	33.90	101	1379267
Motiva	04/27/2000	87	7.39	0.44	33.20	98	3357956
Motiva	04/27/2000	87	7.61	0.42	32.90	100	3347351
Motiva	05/14/2000	87	7.47	0.57	31.10	148	3557313
Motiva	05/14/2000	87	7.60	0.44	33.50	91	103684
Motiva	05/14/2000	87	7.63	0.50	31.10	145	3192184
Motiva	05/22/2000	93	7.14	0.44	33.10	33	1678495
Motiva	05/22/2000	87	7.60	0.50	31.20	76	826968
Motiva	05/22/2000	87	7.60	0.46	31.60	70	3022642
Motiva	05/22/2000	87	7.73	0.55	30.00	116	373485
Motiva	05/24/2000	87	7.53	0.43	31.40	104	259810
Motiva	05/24/2000	87	7.77	0.69	29.40	257	2184634
Motiva	06/13/2000	87	7.64	0.43	33.50	68	2881480
Motiva	06/13/2000	87	7.67	0.40	34.90	80	3040043
Motiva	06/25/2000	87	7.49	0.96	31.10	278	1665393
Motiva	06/27/2000	93	7.30	0.46	40.40	59	1467642
Motiva	06/27/2000	87	7.44	0.53	34.30	139	3409154
Motiva	06/27/2000	87	7.51	0.46	34.00	132	3331656
Motiva	07/12/2000	87	7.56	0.84	33.50	127	60095
Motiva	07/12/2000	87	7.61	0.81	32.90	130	68526
Motiva	07/24/2000	87	7.40	1.46	36.10	153	39565
Motiva	07/25/2000	93	7.53	0.51	38.60	62	29877
Motiva	07/25/2000	87	7.54	0.56	29.50	154	55055
Motiva	08/01/2000	87	7.61	0.70	28.20	554	79730
Motiva	08/01/2000	87	7.69	0.80	28.50	578	65282
Motiva	08/01/2000	93	7.80	0.43	41.70	79	40757
Motiva	08/10/2000	87	7.31	0.50	35.60	98	71662
Motiva	08/10/2000	87	7.34	0.52	36.40	142	81588
Motiva	08/22/2000	87	7.47	1.00	36.60	391	40301
Motiva	08/22/2000	87	7.57	0.46	25.40	834	46090
Motiva	08/22/2000	87	7.64	0.42	26.00	842	77365
Motiva	08/22/2000	87	7.66	0.44	24.80	864	62793

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Motiva	08/22/2000	93	7.66	0.33	40.20	288	34104
Motiva	09/07/2000	87	7.66	0.88	27.30	374	24748
Motiva	09/11/2000	87	7.60	0.60	31.60	191	68547
Motiva	09/11/2000	87	7.64	0.58	30.40	239	15147
Motiva	09/11/2000	87	11.37	0.43	21.40	371	62265
Motiva	09/29/2000	87	8.40	1.42	32.50	551	36619
Motiva	09/29/2000	87	8.41	1.28	32.30	531	28247
Motiva	09/29/2000	93	10.15	0.55	40.70	103	43780
Motiva	10/02/2000	87	9.34	0.68	27.10	600	60029
Motiva	10/14/2000	87	11.47	0.75	30.40	225	48222
Motiva	10/14/2000	87	11.69	0.63	29.70	234	51977
Motiva	10/20/2000	87	10.67	0.70	15.40	198	75060
Motiva	10/20/2000	87	10.82	0.70	15.20	183	79446
Motiva	11/05/2000	87	8.48	0.59	29.10	39	49446
Motiva	11/05/2000	93	10.73	0.83	35.80	202	9832
Motiva	11/06/2000	87	11.88	0.45	16.10	279	51215
Motiva	11/06/2000	87	12.05	0.45	18.70	274	49318
Motiva	11/11/2000	93	10.70	0.70	32.90	78	19212
Motiva	11/13/2000	87	12.41	0.46	24.40	87	69094
Motiva	11/13/2000	93	12.49	0.66	37.40	33	29783
Motiva	11/13/2000	87	12.63	0.48	22.60	105	68685
Motiva	11/21/2000	87	11.59	0.55	31.00	358	27387
Motiva	11/21/2000	87	12.49	0.56	27.30	208	64903
Motiva	11/21/2000	87	12.61	0.55	29.30	179	47843
Motiva	11/26/2000	87	10.47	0.50	19.50	186	39782
Motiva	11/26/2000	93	12.70	0.42	35.70	51	20357
Motiva	12/13/2000	93	12.42	0.42	38.20	44	25022
Motiva	12/13/2000	87	12.52	1.01	23.70	83	66257
Motiva	12/13/2000	87	12.63	0.82	26.50	111	33661
Motiva	12/28/2000	87	13.78	0.87	20.60	134	68453
Motiva	12/28/2000	87	13.94	0.82	22.80	135	61807
Webber	Jan-00	87	13.97	1.05	23.20	411	40662
Webber	Feb-00	87	13.44	0.74	18.50	305	66003
Webber	Mar-00	87	13.11	1.50	25.20	221	55532
Webber	Mar-00	93	14.10	0.21	32.80	21	12943
Webber	Jun-00	87	7.59	0.82	34.50	974	58915

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Webber	Jun-00	87	8.89	1.30	35.60	198	44005
Webber	Sep-00	87	6.99	0.96	45.70	89	#REF!
Webber	Sep-00	87	10.30	3.23	35.10	111	66927
Webber	Nov-00	87	11.50	0.85	26.27	357	50505
Webber ***	Nov-00	87	8.38	0.64	29.50	750	31800.5
Webber ***	Nov-00	87	8.98	1.08	33.90	569	31800.5
Averages				**0.58**	**30.55**	**124.86**	

*** These two tests at Webber were a blend of two land tanks into a barge with only one number of barrels given. To make sure both were reported we split the total barrels 50/50. No testing of the blended barge load was done.

*** From Mobil Product came from two different tanks. Two separate results given.

APPENDIX E

			RVP	BENZ	ARO	SULF	
Terminal	Date of transfer	Octane	(psi)	(% Vol)	(% Vol)	(ppm)	Barrels
Webber	Jan-00	87	13.97	1.05	23.20	411	40662
Motiva	01/02/2000	87	13.13	0.62	21.20	76	2939732
Motiva	01/02/2000	87	13.39	0.46	19.90	94	2015709
Motiva	01/02/2000	87	13.56	0.48	20.40	95	2923697
Mobil	01/03/2000	87	14.04	0.26	22.50	101	134667
Mobil	01/06/2000	87	13.19	0.29	23.20	89	54305
Mobil	01/07/2000	93	13.87	0.25	33.60	12	65697
Gulf	01/11/2000	88	8.00	0.74	33.30	761	49000
Motiva	01/13/2000	87	8.83	0.73	29.60	627	838073
Mobil	01/13/2000	87	13.35	0.40	22.80	75	115237
Gulf	01/13/2000	93	13.81	0.21			40072
Irving	01/14/2000	91	12.97	0.42	24.90	63	43678
Gulf	01/14/2000	88	14.50	0.75	21.80	306	100000
Motiva	01/20/2000	87	10.56	0.52	28.20	509	487696
Motiva	01/20/2000	87	13.08	0.45	25.20	118	3298455
Motiva	01/20/2000	87	13.27	0.48	24.50	126	2540467
Mobil	01/22/2000	87	12.93	0.34	25.90	81	139725
Irving	01/24/2000	87	12.56	0.35	25.10	67	25841
Mobil	01/26/2000	87	12.81	0.42	26.80	72	76433
Irving	01/29/2000	87	13.25	0.68	29.20	77	20802
Mobil	01/30/2000	93	14.05	0.29	41.70	4	61328
Webber	Feb-00	87	13.44	0.74	18.50	305	66003
Irving	02/02/2000	93	12.90	0.39	40.90	79	23032
Irving	02/02/2000	87	13.25	0.60	23.50	67	45003
Mobil	02/03/2000	87	13.29	1.02	27.60	63	112791
Motiva	02/06/2000	87	13.72	0.64	24.20	349	2112523
Motiva	02/06/2000	87	13.78	0.59	24.50	308	1856209
Gulf	02/07/2000	88	14.03	0.67	23.80	376	124457
Motiva	02/08/2000	87	11.02	0.74	0.74	98	2216120
Motiva	02/08/2000	87	11.26	0.56	27.60	97	418548
Mobil	02/08/2000	87	11.75	0.70	26.60	93	148326
Motiva	02/08/2000	93	12.69	0.63	28.20	94	505199
Irving	02/11/2000	87	12.80	0.81	24.30	80	35115
Mobil	02/13/2000	87	12.80	0.73	24.40	83	112092
Motiva	02/15/2000	93	12.56	0.13	25.90	46	2104352

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Motiva	02/15/2000	87	13.50	0.52	20.30	162	3060382
Motiva	02/15/2000	87	13.87	0.60	21.80	312	598606
Mobil	02/19/2000	87	12.74	0.59	24.20	77	126233
Irving	02/20/2000	87	13.24	0.63	23.70	94	22647
Mobil	02/22/2000	93	14.04	0.27	33.10	1	68305
Mobil	02/23/2000	87	13.45	0.47	19.40	106	171213
Gulf	02/23/2000	93	14.40	0.77	32.70	230	40229
Mobil	02/27/2000	87	14.06	0.46	21.60	85	125291
Irving	02/29/2000	87	13.52	0.58	23.10	92	66948
Webber	Mar-00	87	13.11	1.50	25.20	221	55532
Webber	Mar-00	93	14.10	0.21	32.80	21	12943
Mobil	03/02/2000	87	13.58	0.57	19.90	86	90017
Gulf	03/03/2000	88	8.78	0.63	14.40	158	62000
Gulf	03/04/2000	88	8.32	0.70	33.70	697	83694
Irving	03/06/2000	87	11.61	0.53	24.80	71	44848
Irving	03/06/2000	93	14.16	0.37	28.50	73	10460
Motiva	03/07/2000	87	11.76	0.68	27.70	96	1312478
Motiva	03/07/2000	87	13.66	0.70	27.40	70	3223222
Motiva	03/07/2000	87	13.68	0.67	28.30	92	3032358
Mobil ***	03/07/2000	93	13.73	0.30	32.30	117	25234
Mobil ***	03/07/2000	93	14.18	0.18	31.10	115	25234
Mobil	03/09/2000	87	12.75	0.50	26.90	71	169226
Mobil	03/12/2000	87	11.27	0.46	28.10	95	147457
Irving	03/18/2000	87	11.58	0.43	27.10	103	89395
Mobil	03/21/2000	87	11.77	0.40	28.70	111	147470
Gulf	03/26/2000	87	9.79	0.49	29.20	219	115000
Mobil	03/27/2000	87	9.39	0.42	26.50	86	124082
Motiva	03/29/2000	93	7.58	0.33	46.40	43	1899617
Motiva	03/29/2000	87	7.97	0.43	33.70	79	3215726
Motiva	03/29/2000	87	8.03	0.45	41.10	67	3215930
Motiva	03/29/2000	87	8.33	0.45	35.80	107	417413
Mobil ***	03/30/2000	93	8.30				50426
Mobil ***	03/30/2000	93	14.00				50426
Irving	03/31/2000	91	12.94	0.39	28.60	111	22748
Mobil	04/02/2000	87	8.69	0.38	34.90	78	100265
Mobil	04/05/2000	87	7.59	0.48	37.50	95	36384

Terminal	Date of transfer	Octane	RVP (psi)	BENZ (% Vol)	ARO (% Vol)	SULF (ppm)	Barrels
Irving	04/06/2000	87	7.36	0.47	34.00	77	44299
Irving	04/06/2000	93	12.16	0.50	31.80	56	8763
Motiva	04/11/2000	87	6.98	0.86	33.10	134	700857
Motiva	04/11/2000	93	6.99	0.30	35.50	62	2083631
Motiva	04/11/2000	87	7.05	0.87	33.00	115	3405188
Motiva	04/11/2000	87	7.19	0.80	32.80	114	2376402
Mobil	04/11/2000	87	7.46	0.43	33.70	96	67922
Mobil	04/12/2000	93	7.70	0.74	41.90	10	49226
Mobil	04/16/2000	87	7.70	0.44	33.50	92	67488
Irving	04/21/2000	87	7.53	0.43	33.30	89	66561
Mobil	04/21/2000	87	7.56	0.32	31.60	96	100716
Mobil	04/25/2000	93	7.41	1.40	45.50	36	50072
Gulf	04/25/2000	88	7.80	0.79	29.60	313	71301
Gulf	04/25/2000	88	7.83	0.96	31.70	997	100138
Motiva	04/27/2000	93	7.30	0.26	39.30	48	1778789
Motiva	04/27/2000	87	7.36	0.50	33.90	101	1379267
Motiva	04/27/2000	87	7.39	0.44	33.20	98	3357956
Motiva	04/27/2000	87	7.61	0.42	32.90	100	3347351
Gulf	04/30/2000	93	6.35	0.49	31.20	109	20109
Mobil	04/30/2000	87	7.47	0.31	31.50	109	67827
Mobil	04/30/2000	87	8.57	0.36	30.10	101	56371
Mobil	05/04/2000	87	7.60	0.37	33.20	91	66538
Mobil	05/04/2000	87	8.62	0.36	30.00	93	56978
Irving	05/07/2000	94	6.70	0.51	21.50	42	22055
Irving	05/07/2000	88	8.83	1.04	31.20	75	44893
Mobil	05/08/2000	87	7.65	1.28	33.00	97	67603
Mobil	05/08/2000	87	8.48	1.45	33.30	75	110901
Mobil	05/11/2000	87	7.68	1.27	36.30	105	22842
Mobil	05/11/2000	87	8.66	1.39	30.70	104	22146
Motiva	05/14/2000	87	7.47	0.57	31.10	148	3557313
Motiva	05/14/2000	87	7.60	0.44	33.50	91	103684
Motiva	05/14/2000	87	7.63	0.50	31.10	145	3192184
Mobil	05/15/2000	93	7.92	0.53	37.00	181	29599
Mobil	05/15/2000	93	8.46	0.93	36.00	114	29713
Gulf	05/17/2000	93	7.54	0.50	31.70	180	35674
Mobil	05/17/2000	87	7.56	1.44	35.10	131	45172

Other Gasoline Components Data Sorted by Date

Appendix E

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	05/17/2000	87	8.64	1.35	32.30	94	44802
Gulf	05/18/2000	88	8.96	1.44	33.40	132	55876
Mobil	05/21/2000	87	7.59	1.37	36.50	121	67017
Irving	05/21/2000	87	7.59	1.27	33.70	100	44989
Mobil	05/21/2000	87	8.55	1.36	31.00	85	57288
Irving	05/21/2000	88	8.71	1.34	30.60	108	34927
Mobil	05/22/2000	93	5.88	2.08	61.20	68	39606
Motiva	05/22/2000	93	7.14	0.44	33.10	33	1678495
Motiva	05/22/2000	87	7.60	0.50	31.20	76	826968
Motiva	05/22/2000	87	7.60	0.46	31.60	70	3022642
Motiva	05/22/2000	87	7.73	0.55	30.00	116	373485
Gulf	05/22/2000	[illegible]	8.77	1.06	31.10	218	68095
Motiva	05/24/2000	87	7.53	0.43	31.40	104	259810
Motiva	05/24/2000	87	7.77	0.69	29.40	257	2184634
Mobil	05/26/2000	87	7.56	1.35	32.40	115	67282
Mobil	05/26/2000	87	8.53	1.08	29.10	84	111304
Gulf	05/29/2000	87	8.73	0.74	28.10	87	75208
Webber	Jun-00	87	7.59	0.82	34.50	974	58915
Webber	Jun-00	87	8.89	1.30	35.60	198	44005
Mobil	06/03/2000	87	7.76	0.74	32.10	131	79208
Mobil	06/03/2000	87	8.66	0.56	28.10	92	89164
Irving	06/06/2000	93	6.81	0.51	29.60	69	60592
Irving	06/06/2000	87	7.72	0.54	34.00	104	22413
Irving	06/06/2000	98	8.72	0.33	19.50	56	18526
Mobil	06/08/2000	87	7.54	0.51	35.40	106	66272
Mobil	06/08/2000	87	8.72	0.52	28.80	72	78835
Mobil	06/11/2000	93	7.24	1.84	55.60	13	29930
Mobil	06/11/2000	93	7.55	1.48	40.90	130	49655
Motiva	06/13/2000	87	7.64	0.43	33.50	68	2881480
Motiva	06/13/2000	87	7.67	0.40	34.90	80	3040043
Mobil	06/15/2000	87	7.41	0.45	34.70	113	44793
Mobil	06/15/2000	87	8.82	0.46	27.00	71	43716
Mobil	06/19/2000	87	7.61	0.45	32.30	97	43207
Mobil	06/19/2000	87	8.62	0.52	26.10	80	43806
Mobil	06/23/2000	87	7.60	0.43	31.20	108	57462
Mobil	06/23/2000	87	8.66	0.42	28.10	67	65326

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Motiva	06/25/2000	87	7.49	0.96	31.10	278	1665393
Gulf	06/25/2000	87	8.69	0.88	24.90	230	73990
Motiva	06/27/2000	93	7.30	0.46	40.40	59	1467642
Motiva	06/27/2000	87	7.44	0.53	34.30	139	3409154
Motiva	06/27/2000	87	7.51	0.46	34.00	132	3331656
Mobil	06/28/2000	87	7.70	0.43	29.50	116	88566
Mobil	06/28/2000	87	8.59	0.38	25.90	86	100697
Mobil	07/04/2000	93	7.60	0.92	38.70	126	45721
Mobil	07/04/2000	87	7.73	0.47	31.20	120	44536
Mobil	07/04/2000	93	8.62	0.70	38.90	69	31013
Mobil	07/04/2000	87	8.69	0.44	28.40	128	44268
Gulf	07/07/2000	88	8.37	0.62	24.50	399	100595
Irving	07/08/00	94	6.58	0.32	26.00	72	8719
Irving	07/08/00	87	8.77	0.45	28.10	96	29082
Mobil	07/09/2000	87	7.40	0.49	32.90	116	44239
Mobil	07/09/2000	87	8.64	0.41	25.70	117	40985
Motiva	07/12/2000	87	7.56	0.84	33.50	127	60095
Motiva	07/12/2000	87	7.61	0.81	32.90	130	68526
Mobil	07/13/2000	87	7.47	0.51	31.50	100	77287
Mobil	07/13/2000	87	8.67	0.54	25.20	85	78590
Gulf	07/13/2000	93	8.89			112	39564
Irving	07/17/00	93	6.50	0.29	28.30	72	16246
Irving	07/17/00	87	7.71	0.50	33.40	109	18406
Irving	07/17/00	87	8.62	0.53	28.30	87	54531
Mobil	07/18/2000	87	7.53	0.51	31.40	41	64282
Irving	07/18/00	87	7.71	0.56	32.40	56	8710
Mobil	07/18/2000	87	8.59	0.52	24.70	37	101005
Irving	07/18/00	87	8.62	0.50	24.10	97	12911
Mobil	07/21/2000	87	7.35	0.45	33.40	80	44115
Mobil	07/21/2000	87	8.43	0.38	27.30	106	111029
Motiva	07/24/2000	87	7.40	1.46	36.10	153	39565
Mobil	07/25/2000	87	7.27	1.56	36.30	162	19151
Motiva	07/25/2000	93	7.53	0.51	38.60	62	29877
Motiva	07/25/2000	87	7.54	0.56	29.50	154	55055
Mobil	07/25/2000	93	7.61	0.83	36.80	130	44329
Mobil	07/25/2000	93	7.96	0.81	36.50	122	34602

Other Gasoline Components Data Sorted by Date

Appendix E

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Gulf	07/26/2000	87	7.27	2.10	40.10	180	49465
Mobil	07/30/2000	87	7.53	0.37	34.40	104	85831
Mobil	07/30/2000	87	8.66	0.33	27.40	116	91401
Gulf	07/30/2000	88	9.53				78669
Motiva	08/01/2000	87	7.61	0.70	28.20	554	79730
Motiva	08/01/2000	87	7.69	0.80	28.50	578	65282
Motiva	08/01/2000	93	7.80	0.43	41.70	79	40757
Irving	08/02/00	87	7.71	0.40	31.80	100	21453
Irving	08/02/00	87	8.53	0.34	26.40	106	21874
Mobil	08/03/2000	87	7.58	0.37	33.00	134	50518
Mobil	08/03/2000	87	8.57	0.36	27.30	128	61460
Mobil	08/07/2000	87	7.44	0.38	27.20	98	78871
Mobil	08/07/2000	87	8.32	0.36	34.10	97	65432
Irving	08/10/00	93	6.62	0.06	21.90	74	16242
Motiva	08/10/2000	87	7.31	0.50	35.60	98	71662
Motiva	08/10/2000	87	7.34	0.52	36.40	142	81588
Irving	08/10/00	88	7.71	0.28	33.80	138	22121
Irving	08/10/00	87	8.72	0.15	23.60	94	44537
Mobil	08/12/2000	87	7.51	0.35	32.90	140	21895
Mobil	08/12/2000	87	8.62	0.32	23.60	103	40056
Mobil	08/15/2000	93	7.62	0.74	36.30	124	31974
Mobil	08/15/2000	93	8.35	0.68	36.90	147	39599
Irving	08/16/00			4.01	45.30	66	40055
Mobil	08/17/2000	87	8.24	3.62	42.80	88	149951
Gulf	08/17/2000	87	8.85	1.29	46.70	302	80000
Mobil	08/18/2000	87	7.73	0.57	34.10	158	44530
Gulf	08/18/2000	88	8.24	3.62	42.80	88	58181
Mobil	08/20/2000	87	7.63	1.72	28.40	534	64935
Motiva	08/22/2000	87	7.47	1.00	36.60	391	40301
Motiva	08/22/2000	87	7.57	0.46	25.40	834	46090
Motiva	08/22/2000	87	7.64	0.42	26.00	842	77365
Motiva	08/22/2000	87	7.66	0.44	24.80	864	62793
Motiva	08/22/2000	93	7.66	0.33	40.20	288	34104
Mobil	08/27/2000	87	7.38	1.27	27.90	191	43330
Mobil	08/27/2000	87	8.45	0.65	32.70	116	78772
Mobil	08/29/2000	87	7.39	1.45	40.10	251	98988

Terminal	Date of transfer	Octane	RVP (psi)	BENZ (% Vol)	ARO (% Vol)	SULF (ppm)	Barrels
Mobil	08/29/2000	87	8.01	1.43	33.90	207	37491
Mobil	08/30/2000	93	7.41	0.92	37.20	129	41548
Mobil	08/30/2000	93	7.67	0.79	28.20	120	32047
Webber	Sep-00	87	6.99	0.96	45.70	89	#REF!
Webber	Sep-00	87	10.30	3.23	35.10	111	66927
Gulf	09/03/2000	87	8.41	1.09	34.40	228	58500
Irving	09/05/00	94	6.56	0.33	22.60	108	22274
Gulf	09/05/2000	93	6.93	0.29	18.20	66	13000
Irving	09/05/00	88	7.87	0.61	28.20	153	49927
Mobil	09/06/2000	87	7.61	0.82	26.80	174	22008
Mobil	09/06/2000	87	8.68	0.54	26.10	138	44329
Motiva	09/07/2000	87	7.66	0.88	27.30	374	24748
Mobil	09/10/2000	87	7.02	1.12	45.60	232	66829
Motiva	09/11/2000	87	7.60	0.60	31.60	191	68547
Motiva	09/11/2000	87	7.64	0.58	30.40	239	15147
Motiva	09/11/2000	87	11.37	0.43	21.40	371	62265
Mobil	09/13/2000	87	7.60	0.79	27.40	147	30230
Irving	09/13/00	89	8.55	0.82	28.60	85	29112
Gulf	09/14/2000	87	6.51	1.04	31.10	28	75010
Mobil	09/17/2000	87	12.01	0.53	31.60	58	98802
Irving	09/19/00	90	11.26	0.52	38.60	52	21686
Gulf	09/19/2000	93	12.50	0.31	29.80	58	10000
Mobil	09/22/2000	87	12.75	0.53	23.10	155	44617
Mobil	09/26/2000	87	12.04	0.68	23.80	110	101334
Mobil	09/27/2000	93	11.50	0.58	31.10	41	66854
Irving	09/27/00	89	12.13	0.68	23.60	91	21990
Motiva	09/29/2000	87	8.40	1.42	32.50	551	36619
Motiva	09/29/2000	87	8.41	1.28	32.30	531	28247
Motiva	09/29/2000	93	10.15	0.55	40.70	103	43780
Gulf	09/30/2000	87	10.70	3.30	29.80	180	39299
Motiva	10/02/2000	87	9.34	0.68	27.10	600	60029
Mobil	10/02/2000	87	12.89	1.14	32.20	137	66941
Irving	10/02/2000	91	13.06	1.04	26.10	93	26203
Mobil	10/04/2000	87	12.17	0.92	26.40	92	85068
Irving	10/05/2000	89	12.21	0.91	31.90	104	37972
Gulf	10/06/2000	93	10.11	0.70	34.60	131	18925

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Gulf	10/06/2000	87	10.60	3.30	39.80	180	19934
Gulf	10/07/2000	87	11.21	2.05	15.70	183	29770
Mobil	10/07/2000	87	12.13	0.38	24.80	128	112256
Gulf	10/07/2000	87	12.90	1.44	20.80	266	49810
Mobil	10/10/2000	93	12.56	0.29	36.40	62	67557
Mobil ***	10/13/2000	87	9.75				
Irving	10/13/2000	93	12.51	0.58	26.80	72	21961
Irving	10/13/2000	87	12.83	0.68	24.10	113	34804
Motiva	10/14/2000	87	11.47	0.75	30.40	225	48222
Motiva	10/14/2000	87	11.69	0.63	29.70	234	51977
Mobil	10/14/2000	87	12.04	0.63	29.60	158	38509
Mobil	10/18/2000	87	10.30	0.69	21.29	279	74179
Mobil	10/19/2000	87	12.38	0.57	28.30	71	63178
Gulf	10/20/2000	88	10.65	0.62	12.10	193	110273
Motiva	10/20/2000	87	10.67	0.70	15.40	198	75060
Motiva	10/20/2000	87	10.82	0.70	15.20	183	79446
Irving	10/20/2000	88	12.60	0.64	31.30	78	16169
Mobil	10/21/2000	87	12.77	1.85	24.20	226	49682
Mobil	10/24/2000	87	12.16	0.68	34.80	81	100540
Irving	10/25/2000	87	12.70	0.70	32.70	54	45918
Mobil	10/26/2000	93	10.63	1.51	34.00	80	67190
Mobil	10/28/2000	87	12.30	0.60	26.60	88	123619
Webber ***	Nov-00	87	8.38	0.64	29.50	750	31800.5
Webber ***	Nov-00	87	8.98	1.08	33.90	569	31800.5
Webber	Nov-00	87	11.50	0.85	26.27	357	50505
Mobil	11/03/2000	87	12.49	0.49	31.00	75	123455
Motiva	11/05/2000	87	8.48	0.59	29.10	39	49446
Motiva	11/05/2000	93	10.73	0.83	35.80	202	9832
Gulf	11/05/2000	88	11.87	0.45	16.20	165	79783
Motiva	11/06/2000	87	11.88	0.45	16.10	279	51215
Motiva	11/06/2000	87	12.05	0.45	18.70	274	49318
Gulf	11/07/2000	93	9.93	0.65	21.40	446	19870
Mobil	11/09/2000	87	14.25	0.51	24.30	48	80196
Irving	11/09/2000	87	14.44	0.48	23.50	64	44276
Irving	11/09/2000	93	14.87	0.34	20.60	32	22182
Motiva	11/11/2000	93	10.70	0.70	32.90	78	19212

Terminal	Date of transfer	Octane	RVP (psi)	BENZ (% Vol)	ARO (% Vol)	SULF (ppm)	Barrels
Motiva	11/13/2000	87	12.41	0.46	24.40	87	69094
Motiva	11/13/2000	93	12.49	0.66	37.40	33	29783
Motiva	11/13/2000	87	12.63	0.48	22.60	105	68685
Mobil	11/13/2000	87	13.79	0.54	25.50	43	146076
Irving	11/13/2000	88	13.96	0.55	28.60	49	44862
Mobil	11/14/2000	93	11.04	0.99	31.00	[illegible]	67318
Mobil	11/18/2000	87	13.89	0.66	27.00	86	146439
Gulf	11/19/2000	87	12.61	0.59	34.30	42	38864
Mobil	11/20/2000	87	14.16	0.58	24.80	115	124308
Motiva	11/21/2000	87	11.59	0.55	31.00	358	27387
Gulf	11/21/2000	87	11.91	0.69	22.00	53	50408
Motiva	11/21/2000	87	12.49	0.56	27.30	208	64903
Motiva	11/21/2000	87	12.61	0.55	29.30	179	47843
Mobil	11/25/2000	87	14.02	0.52	23.80	122	102063
Motiva	11/26/2000	87	10.47	0.50	19.50	186	39782
Motiva	11/26/2000	93	12.70	0.42	35.70	51	20357
Irving	11/26/2000	88	14.10	0.53	31.40	67	43949
Gulf	11/29/2000	88	8.38	0.64	29.50	750	29093
Gulf	11/29/2000	93	11.26	0.54	35.80	63	10215
Mobil	12/01/2000	87	13.50	0.52	23.10	68	41987
Gulf	12/02/2000	87	11.88	0.83	18.80	43	65072
Mobil	12/06/2000	87	14.67	0.38	24.90	77	146319
Mobil	12/07/2000	93	12.28	0.80	30.00	94	33718
Gulf	12/08/2000	89	10.84	0.46	20.90	192	35000
Irving	12/09/2000	88	13.68	0.28	18.20	13.56	22208
Irving	12/09/2000	89	14.77	0.52	23.30	48	44408
Mobil	12/10/2000	87	14.54	0.53	22.50	53	79953
Gulf	12/11/2000	89	14.54	0.53	22.50	53	44961
Mobil	12/12/2000	93	12.54	0.94	26.40	115	34012
Motiva	12/13/2000	93	12.42	0.42	38.20	44	25022
Motiva	12/13/2000	87	12.52	1.01	23.70	83	66257
Motiva	12/13/2000	87	12.63	0.82	26.50	111	33661
Gulf	12/15/2000	93	12.36	0.84	33.10	103	40000
Gulf	12/16/2000	87	13.45	1.28	17.60	161	80000
Irving	12/16/2000	89	14.40	0.56	20.20	105	44825
Mobil	12/16/2000	87	14.51	0.54	20.30	72	45501

			RVP	BENZ	ARO	SULF	
Terminal	**Date of transfer**	**Octane**	(psi)	(% Vol)	(% Vol)	(ppm)	**Barrels**
Mobil	12/20/2000	87	14.44	0.62	21.80	43	147831
Mobil	12/22/2000	93	12.72	1.05	30.10	141	34328
Mobil	12/26/2000	87	14.22	0.65	23.10	56	57680
Irving	12/26/2000	88	14.30	0.58	26.90	87	45606
Motiva	12/28/2000	87	13.78	0.87	20.60	134	68453
Motiva	12/28/2000	87	13.94	0.82	22.80	135	61807
Averages				**0.58**	**30.55**	**124.86**	

*** These two tests at Webber were a blend of two land tanks into a barge with only one number of barrels given. To make sure both were reported we split the total barrels 50/50. No testing of the blended barge load was done.

*** From Mobil Product came from two different tanks. Two separate results given.

APPENDIX F

Draft

Evaluation of Ethanol As An Alternative To MTBE In The Northeast

Executive Summary

January 18, 2001

NEIWPCC • Boott Mills South • 100 Foot of John Street • Lowell, MA 01852

Draft
Evaluation of Ethanol as an Alternative to MTBE in the Northeast

Executive Summary

Methyl tertiary butyl ether (MTBE) is an oxygenate that is widely added to gasoline to comply with the 1990 federal Clean Air Act Amendments (CAAAs). The amendments require all states with carbon monoxide pollution problems to implement "oxygenated gasoline (oxyfuels) programs," and all states with ozone pollution problems to implement "reformulated gasoline (RFG) programs. Oxyfuel must contain at least 2.7 percent oxygen by weight (about 15% volume MTBE or 8% ethanol) and RFG at least 2 percent oxygen by weight (about 11% volume MTBE or 6% ethanol). With passage of the CAAAs, MTBE quickly emerged as the oxygenate of choice for gasoline refiners because of its low cost and high-octane characteristics.

While the RFG program has been an important air pollution control and public health protection strategy in the Northeast, to underground storage tank regulators, whose job is to protect human health, safety, and the environment, MTBE has become a major concern. Because MTBE is highly water soluble, but not readily biodegradable, its use in gasoline has resulted in widespread contamination of private wells and groundwater resources in New England as well as surface waters, such as Lake Winnipisake.

Blue Ribbon Panel

As a result of these groundwater contamination concerns, in November 1998, the U.S. EPA commissioned a Blue Ribbon Panel on MTBE and Oxygenates in Gasoline to review the important issues posed by the use of MTBE and other oxygenates in gasoline. On July 27, 1999 the Panel issued recommendations on ways to maintain air quality while protecting water quality from the risks associated with MTBE. Significantly, the Panel called for a substantial reduction in the use of MTBE as well as action by Congress to remove the current 2 percent oxygenate requirement from the CAAA.

State Actions

At the state level, California led the charge in calling for a phaseout of MTBE. In the Northeast, only Massachusetts, New Hampshire, and Vermont have taken no official action to regulate or ban the use of MTBE. The remaining states have taken the following action:
Connecticut - Eliminate MTBE in state by October 1, 2003.
Maine - Eliminate MTBE in state by January 1, 2003.
New York - Prohibit sale, use, and importation of MTBE in state beginning January 1, 2004.
Rhode Island - House resolution 6989 urged DEM to look into MTBE and determine whether state should regulate or ban it.

EPA Actions

In December 1997, the U.S. Environmental Protection Agency (EPA) issued a Drinking Water Advisory for MTBE, based on taste and odor thresholds, of 20 to 40 ppb. The primary purpose of the health advisory is to provide information to public drinking water suppliers so that they can make more informed decisions about acceptable levels of a contaminant.

EPA intends to issue a secondary standard or National Secondary Drinking Water Regulation (NSDWR) for MTBE, based on taste and odor by 2001. NSDWRs were established to control contaminants in drinking water that primarily affect the aesthetic qualities relating to public acceptance of drinking water. These secondary levels represent reasonable goals for drinking water quality but are not federally enforceable. Rather, they are intended as guidelines for states. This standard will pull from the existing information presented in the Drinking Water Advisory and analyze additional information to determine an acceptable taste and odor level for MTBE. States can adopt this standard.

In March 2000, EPA announced it would begin regulatory action aimed at eliminating MTBE from gasoline. Under Section 6 of the federal Toxic Substances Control Act, EPA issued what is called an Advance Notice of Proposed Rulemaking to ban MTBE from gasoline.

At the same time, EPA called on Congress to amend the Clean Air Act to significantly reduce or eliminate the use of MTBE in gasoline, in order to protect drinking water. The

agency also calling on Congress to strengthen the Clean Air Act to guarantee that clean air benefits are preserved. And finally, it called on Congress to remove the requirement from the Clean Air Act that had led to a three-fold increase in the use of MTBE, while, at the same time, taking the unprecedented step of providing content levels for ethanol and other safe biofuels in gasoline.

Legislative Actions

On September 28, 2000, Senate Bill 2962—legislation sponsored by Committee Chair Bob Smith to address MTBE—was reported out of the Environment and Public Works Committee and placed on the Senate legislative calendar. The bill is expected to be addressed during the 2001 legislative session.

As amended by the committee, the bill does the following:

- Bans the use of MTBE in 4 years;
- Allows the Governor of a state to request a waiver from of the oxygen content requirement for reformulated fuel;
- Creates a Clean Alternative Fuel Program to replace the reformulated gasoline oxygen content requirement; the program includes a renewable fuel content requirement which will triple the demand for ethanol over the next ten years;
- Requires the EPA to study the air quality impacts of eliminating the oxygen requirement and provides the EPA with the authority to regulate on the basis of those studies to preserve the emissions benefits of the reformulated gasoline.
- Includes a cap on the level of aromatics used in reformulated gasoline to prevent air quality backsliding.
- Allows use of LUST funds for remediation of MTBE contamination and for conducting inspections at tank sites and authorizes appropriation of additional money from the LUST Trust Fund for this purpose.

The Ethanol Alternative

In light of MTBE's ever widening impacts on the water environment, it is important that environmentally friendly alternatives be identified. Ethanol is currently the most likely gasoline oxygenate alternative to MTBE. While other alternatives should be evaluated, ethanol is considered to be the most viable near-term alternative to MTBE, largely because it is the only oxygenate that can be produced in quantities capable of meeting the demand as an MTBE replacement.

Ethanol is currently used in oxygenated gasoline, albeit not as widely as gasoline. Meeting the federal oxygen requirement would call for 8 percent (by volume) ethanol for oxyfuel and 6 percent for RFG. However, because of a 54 cents per gallon of ethanol used federal subsidy, the blending of ethanol at 10 percent with gasoline is popular.

Ethanol (also called alcohol, ethyl alcohol, or grain alcohol) is a naturally occurring substance that is composed of hydrogen, carbon, and oxygen. It is a small, straight chain molecule (C_2H_5OH), 34.7 percent oxygen by weight, that occurs naturally in animal wastes and as a by-product of natural fermentation processes.

At room temperature, ethanol is a colorless liquid with a sweet odor. It is flammable, volatile, extremely soluble in water, readily biodegradable, and does not sorb to sediments or soils. Given its polar, hydrophilic nature, extraction of ethanol from water is extremely difficult. Ethanol does not bioaccumulate in the tissues of living organisms, which have physiological mechanisms that provide for its metabolic breakdown.

While it is best known in association with the production of alcoholic beverages, ethanol is used widely, either pure or denatured, as a solvent and in the production and manufacturing of organic chemicals, cleaning solutions, pharmaceuticals, cosmetics, and many other products.

Ethanol is produced with carbon dioxide from the fermentation of sugars, usually dextrose, converted from starches of grains, a process known as saccharification. When produced as a fuel additive, the alcohol is distilled and dehydrated to increase the ethanol content, and denaturing products are added to make the resulting product unfit for human consumption.

NEIWPCC's Role

In May 2000, the New England Water Pollution Control Commission (NEIWPCC) received a request from the New England Governor's Conference, Committee on the Environment to assist in evaluating alternatives to MTBE. Recognizing the importance for the Northeast states to be in a position of having evaluated potential alternatives to MTBE with regard to health effects and potential environmental issues, the committee called for the states to work as a region to find alternatives to MTBE as soon as possible.

"As the regional water pollution control commission," stated the letter, "NEIWPCC is perfectly positioned to ensure that water impacts associated with any alternative(s) to MTBE are fully investigated and considered as part of our regional efforts."

To do this, NEIWPCC organized an MTBE subcommittee, made up of staff representatives from state health and UST and site remediation programs, to address tank-related MTBE and alternative oxygenate (ethanol) concerns. Based on a meeting of the Northeast States RFG/MTBE Task Force in Boston in May, NEIWPCC developed a draft outline of an investigation specific to the use of ethanol as an alternative to MTBE.

At that meeting, there was consensus that while there may be many possible alternatives to the use of MTBE as an additive in gasoline in the Northeast, ethanol will play a major role and will likely be more widely used in this region and throughout the country. For this reason, the NEIWPCC subcommittee proceeded to focus its evaluation on the potential environmental impacts of a release of ethanol and ethanol-blended (E-blend) gasoline. Alternative oxygenates other than ethanol were reviewed briefly with an eye toward the possibility of a more thorough evaluation at a future date.

The subcommittee further divided into focus groups to work on the key areas of concern. The summaries below reflect the findings on the following areas of concern: Health Effects, Aquatic Impacts, Storage and Handling, Environmental Impacts, and Other Alternatives.

Health Effects of Ethanol

The Health Effects section of this report (Chapter 2) focused on the neurologic and developmental effects of ethanol, while also considering the evidence for carcinogenic effects and internal organ (particularly liver) damage. This information was put into a risk context for the drinking water pathway in relation to health risks from MTBE. This analysis leads to the following conclusions regarding health risks associated with exposure to ethanol in cases where drinking water has been contaminated by gasoline containing ethanol:

• Low-level ethanol contamination of groundwater (i.e., less than 400 ug/L, a draft drinking water Health Protection Value derived in this chapter), is not expected to substantially alter blood alcohol concentrations, and is unlikely to produce a significant health risk under the assumption, supported by available data, that blood alcohol is an accurate biomarker of the potential for alcohol to cause health effects. In coming to this conclusion, the potential health effects in sensitive subjects, such as pregnant women or those who may have aldehyde dehydrogenase deficiency, were also considered.

• Higher concentrations of ethanol in water may begin to increase health risks but are not expected to materially add to endogenous ethanol concentrations until there is daily exposure to at least 10,000 to 100,000 ug/L. Thus, the strong hazard potential of ethanol is mitigated by the fact that relatively high environmental concentrations compared to MTBE would be needed to reach a level of public health concern.

• Although overexposure of ethanol can have more severe consequences than overexposure to MTBE, the "acceptable" level of ethanol in drinking water appears to be at least as high, if not higher than MTBE.

• While this chapter on health effects does not consider whether ethanol is more or less likely to reach high levels in potable water or whether the warning properties (i.e., odor, taste) would be sufficient to prevent high level exposures, it is noteworthy that the air odor threshold of ethanol (approx. 100 ppm) is three orders of magnitude higher than that of MTBE. Thus it appears that the warning properties of MTBE are stronger, making overexposure to MTBE less likely than overexposure to ethanol.

• Ethanol does not appear to be a public health concern when considering the combustion byproducts related to ethanol use in gasoline. The expected increase in acetaldehyde formation from ethanol may be counterbalanced by the decrease in formaldehyde production that occurs when MTBE is used in gasoline. To fully address this last point, more environmental data are needed concerning ambient acetaldehyde and formaldehyde

concentrations as well as exhaust and evaporative emissions in relation to different types of gasoline usage.

Uncertainties

On the basis of relative toxicity and comparison across possible drinking water guidelines (this report stops short of fully evaluating exposure potential), replacement of MTBE with ethanol is not expected to increase the public health risks associated with gasoline spills into groundwater. However, the following uncertainties need to be more fully evaluated before a high degree of confidence can be placed upon this conclusion:

- When ethanol is spilled into groundwater it may appear in a contaminated well by itself either because it is ahead of the rest of the gasoline plume or because it was spilled by itself (e.g., from an ethanol storage tank). In these cases, there is an uncertainty as to whether high levels of ethanol could possibly reach a well and for how long the levels would stay elevated. It is possible that groundwater contaminated by ethanol alone would not be noticed by water consumers because of ethanol's poor warning properties (as mentioned above) and because other hydrocarbons would not be present in the well to affect taste/odor. In this scenario, a pregnant woman might unknowingly ingest substantial concentrations of ethanol, which for even relatively short periods of time (days to weeks) would lead to potential pregnancy risk concerns. Thus, more information is needed regarding the possibility that ethanol could reach high levels in groundwater in the absence of other hydrocarbons.

- The possibility that ethanol can have a cosolvency effect on other hydrocarbons leads to the concern that greater amounts of benzene (a known carcinogen), toluene, ethylbenzene, and xylene could reach potable wells than would otherwise occur. Any increase in the public's exposure to these chemicals in drinking water should be avoided.

- The possibility that ethanol can interact with benzene by increasing benzene metabolism in the body to more toxic chemicals is a potential health concern. While it is known that alcoholics have higher levels of enzymes that make benzene more toxic and carcinogenic, there is uncertainty as to whether lower levels of ethanol exposure could also produce this interaction.

- The risk assessment relies on the premise of a threshold for fetal effects from maternal ethanol ingestion. While evidence from both human and monkey studies

is generally supportive of such a threshold, there may be certain endpoints and subtle neurodevelopmental effects for which a threshold may be difficult to demonstrate. This increases the uncertainty regarding low ethanol exposures, especially as the sensitivity of different windows of pregnancy to ethanol is also unknown. Because of these concerns, the American Academy of Pediatrics concludes that the current data do not support the concept of a "safe level" of alcohol consumption by pregnant women, and many obstetricians routinely advise pregnant women to avoid all alcohol during pregnancy.

This analysis addresses the uncertainty surrounding low-dose ethanol effects during pregnancy by deriving a draft drinking water Health Protection Value that lowers the apparent threshold (as seen in monkey and some human studies) by a 3,000-fold factor. This factor is meant to ensure that the acceptable level of ethanol in drinking water is far below any levels of exposure know to produce fetal effects and to also cover a variety of other uncertainties. While fetal effects are unlikely at ethanol drinking water concentrations below the draft Health Protection Value of 400 ug/L, additional low dose ethanol research in animals and humans is needed to solidify this conclusion.

Effects of Ethanol on Aquatic Life

The effect of ethanol on aquatic communities was evaluated to determine if adverse environmental impacts could potentially occur. Based on these evaluations, we can conclude the following:

• Ethanol is toxic to aquatic life. However, it is 3.7 times less acutely toxic than MTBE. Over a longer-term exposure period, toxicity to aquatic life resulting from exposure to ethanol is similar, although somewhat less, than that associated with longer-term exposure to MTBE.

• Ethanol is not likely to bioaccumulate or bioconcentrate in the tissues of living organisms due both to its chemical properties and the ability of most organisms to breakdown and eliminate ethanol from their bodies.

• The breakdown of ethanol in surface waters through biological and chemical processes could potentially result in the consumption of significant quantities of dissolved oxygen

in the surface water body. Depending on the conditions in the surface water body and the amount of ethanol introduced, it is possible that sufficient amounts of dissolved oxygen could be consumed to bring about a detrimental affect on aquatic life, potentially leading to a fish kill.

Ethanol Storage and Handling

The Ethanol Storage and Handling section (Chapter 4) reviewed the pure (neat) ethanol/ethanol-blended (E-blend) gasoline life cycle from feedstock production to end user (e.g., automobile, lawnmower) to evaluate the major points associated with the chemical compatibility of storage components and the environmental impact of producing and transporting ethanol to New England. This review included the following issues associated with ethanol storage and handling:

- Ethanol production.
- Bulk storage, blending, and distribution,
- Materials compatibility relating to components of underground storage tanks, piping, dispensing devices, and sealants.
- An overview of the UST programs in the New England states and New York, focusing specifically on release prevention efforts.
- E-blend end users—automobiles and smaller gasoline-powered recreational and power equipment.

Ethanol, both as a pure product and blended with gasoline, introduces different problems for tank and piping components than MTBE-blended gasoline. However, much is known about these problems and their solutions. Concerns with storing ethanol and E-blend fuels can be summarized into three categories:

- Compatibility with storage tank components.
- Ethanol is a solvent and will loosen rust and deposits from the interior walls of storage systems.
- Ethanol is electrically conductive and when blended with gasoline, will cause the blended fuel to be conductive.

This review leads to the following conclusions:

• Introduction of ethanol into gasoline will enhance suspension of water and other deposits scoured or cleaned from UST/AST systems. Water and scoured deposits that are not eliminated from UST systems could cause premature failure of the following components: leak monitoring systems (ATG probes and line leak detectors), submersible pumps, fuel dispensers, piping, hoses, nozzles and swivels, and, potentially, gasoline engines.

• The compatibility of UST/AST systems with E-blend fuels is a function of a system's fabrication materials, bearing in mind that materials have evolved over time for the storage of ethanol and E-blend fuels. Each component of the tank system must be checked for compatibility, especially in the case of an existing facility. Particular attention must be given to the design or retrofit of a bulk facility storing neat ethanol.

• Caution must be taken with the storage of E-blend fuels in single-walled fiberglass tank systems fabricated prior to January 1, 1984.

• Questions exist concerning the compatibility of the following tank/dispensing system components and materials with E-blended: lining materials, secondary containment materials, adhesives, glues, sealants and gaskets, as well as any polymer or elastomer compounds found on dispensing or monitoring devices such as automatic tank gauge (ATG) probes.

• Some component materials (e.g., cork and Buna-N) associated with dispensers, submersible pumps, and other distribution equipment that come into contact with E-blend gasoline may have long-term compatibility problems.

• Ethanol in gasoline may impair the operation of capacitance ATG probes because of increased electrical conductivity to E-blend gasoline.

• The introduction of ethanol into the Northeast gasoline supply will come with the added cost of retrofitting many of the region's tank systems to make them ethanol compatible.

• UST/AST components that are not compatible with E-blend fuels may cause system failures and/or product leaks. Based on the New England and New York UST program experience, it is expected that many owner/operators will not have their facilities evaluated for compatibility prior to the introduction of E-blend fuels into their tank

systems. At current staff levels, state programs are showing a rate of 4 to 17 years between facility inspections.

• Most automotive manufacturers approve the use of E-blend fuels. Many nonautomotive engine manufacturers now address oxygenated fuels and permit or approve the use of E-blend fuels. However, some older engine models may have components (e.g., swollen carburetor floats) that have exhibited compatibility problems with alcohol. Many of these manufacturers, however, provide recommendations for handling and modifying their equipment when E-blend fuel is used.

Recommendations

If E-blend gasoline is to be introduced into the Northeast region, the following steps should be taken to ensure that tank owners and operators are informed and prepared to make the transition with regard to ensuring tank system integrity:

• Develop a guidance document that standardizes a process by which owner/operators or their contractors may assess the compatibility/functionality (e.g., capacitance probes) of their storage tank systems with E-blend fuels. The document should inform owner/operators of proper operating procedures for the continuous management of storage tank systems, particularly focusing on the initial conversion of facilities to E-blend fuels and problems associated with ethanol introduction. Such procedures would include replacement of filters, system checks for loosened deposits (e.g., rusts, scales and other loosened deposits), system dewatering, especially at the time of initial conversion, and continuous monitoring of water in the system.

• Based on the inspection rate at operating facilities, state and/or the federal government should look for ways to increase inspection resources during the transition to E-blend fuels and afterwards.

• Conduct more studies on the compatibility of FRP tanks (especially with respect to structural integrity), particularly single-walled FRP tanks fabricated before January 1, 1984 and FRP and flexible piping that haven't been specifically fabricated for E-blend gasoline.

• Educate automobile and power engine equipment owners on the need for checking fuel compatibility specifications in their owners manuals. E-blend fuels may have some minor

impacts on engine operation and may adversely effect some fuel system components, particularly those that depend on lubrication.

Impacts from Releases of Gasohol or Ethanol to the Environment

The life cycle of ethanol-blended (E-blend) gasoline (typically 10 percent ethanol by volume) was examined to identify potential sources of releases for both pure (neat) ethanol or E-blend gasoline. Pure ethanol releases can occur at the biomass ethanol plant or anywhere along the transport system to the point where ethanol and gasoline are blended at a gasoline distribution terminal or bulk plant. Shipment is expected to be by rail or marine cargo to the terminal, followed by rail or truck delivery to retail facilities. E-blend gasoline spills can occur from the blending point to gasoline retail facilities (aboveground and underground storage tanks) all the way to the end point of use (e.g., automobile, backyard lawnmowers).

Environmental impacts were evaluated from the standpoint of :

- Neat ethanol and E-blend gasoline releases,
- The potential pathways (i.e., surface runoff, infiltration into soil, groundwater transport) of ethanol/E-blend once released into the environment,
- The behavior (fate and transport) of such releases in the soil, groundwater, and surface water environments,
- The behavior of ethanol in contrast with that of MTBE, and
- The remediation of neat ethanol and E-blend releases into the environment and associated costs in comparison with MTBE.

This analysis leads to the following conclusions:

- Both ethanol and MTBE have a relatively high solubility in water and high mobility in the subsurface. Ethanol, the more soluble, is completely miscible in water (100 percent soluble, compared with 4 percent for MTBE). Once released to the environment, alone or in a gasoline mixture, both ethanol and MTBE readily dissolve in rainwater, surface water, and groundwater.

• The differences between ethanol and MTBE with regard to their expected impacts on the subsurface environment are largely based on their initial concentration in the aqueous plume, the very different rates at which they biodegrade, and possibly their residence time in the nonaqueous phase. MTBE is recalcitrant to biodegradation and therefore able to migrate a significant distance from the release. Thus it has a negative impact on groundwater quality for extended periods. Ethanol is rapidly biodegraded, preferentially to the other components of gasoline, however, it's behavior in the environment is not well documented. It is hoped that a release of neat ethanol will be degraded in periods from several days to one or two years.

• Three environmental transport properties associated with ethanol are of particular concern:

  • A cosolvency effect that makes other gasoline constituents more soluble in groundwater.
  • Depletion of oxygen and other nutrients in groundwater due to rapid biodegradation of ethanol that inhibits the degradation of toxic components in gasoline.
  • A surface tension effect that takes place when ethanol is in contact with a layer of gasoline on top of the water table and could cause greater lateral spreading of the neat gasoline.

• The biodegradation of ethanol in the soil and water environment would first deplete the oxygen and then the anaerobic electron acceptors, preventing the biodegradation of the benzene, toluene, ethylbenzene, and xylene (BTEX) constituents in gasoline and resulting in longer BTEX plumes. MTBE does not interfere with the natural biodegradation of the other gasoline components, most importantly BTEX.

• Lab studies and mathematical models have estimated the potential for E-blend gasoline to cause the toxic BTEX compounds of gasoline to travel up to 2.5 times farther than normal (cosolvency effect). This is a serious problem, however, the predicted lengths of the BTEX plumes will still be shorter than MTBE plumes from reformulated gasoline.

• Although ethanol degrades rapidly when released to the environment, if spilled where a stabilized zone of gasoline-contaminated soil already exists (e.g., at oil terminals), it can

remobilize the gasoline components, especially the most toxic BTEX compounds (cosolvency effect). This may cause contamination of groundwater and nearby wells.

• Because of the cosolvency and oxygen depletion factors associated with ethanol, there is a concern that a significant and continuing release (e.g., from a significant undetected leak from a UST) could result in an extended plume of benzene (and other gasoline components).

• Spills of ethanol into surface water bodies that have low aeration rates (e.g., ponds, lakes and large, nonturbulent, rivers) can cause massive killings of fish and other aquatic organisms by asphyxiation, the result of oxygen depletion of the water caused by ethanol degradation. For example, in May 2000, a 500,000-gallon release of Wild Turkey bourbon (250,000-gallons ethanol) into the Kentucky River caused the worst fish kill in 50 to 60 years in the river.

• Smaller spills of E-blend, such as incidental spillage at gas stations and homeowner spills, are not expected to enhance the migration of benzene. In fact, because of the high biodegradability of ethanol, it is not expected that such small spills will have any significant effect on groundwater quality. This is in stark contrast to the widespread, frequent instances of drinking water contamination with MTBE from such minor spills of MTBE gas.

• For one-time releases of larger quantities of E-blend gasoline (e.g., a tanker truck accident), the effects of cosolvency are not expected to significantly affect the localized extent of the resulting plume. In this case, the incident would be known, and as in the case of conventional gas formulation, appropriate and prompt responses, evaluation, and follow-up would be taken.

• Ethanol plumes should be no more difficult to control hydraulically than MTBE. plumes. Much of the technology developed to remediate gasoline and MTBE in soil can be expected to work on the remediation of neat ethanol and E-blend gasoline. However these tools have not been tested on environmental releases, so until they are we will not be know precisely which methods will work the best and how effective they will be.

• Treatment technologies that rely on the physical separation of ethanol from ground water are not effective. While biodegradation of ethanol in the environment is rapid,

removal of ethanol from drinking water once pumped out of a well or reservoir is problematic. It's high solubility makes it very difficult to treat using carbon filters that are effective on private wells for other gasoline contaminants. Treatment of large public water supplies is limited by the large volume and short time between pumping and distribution.

• Biological treatment technologies are effective for ethanol contamination, as ethanol is highly biodegradable.

• The expected high concentrations of ethanol in plumes and the resulting high levels of BOD will probably require that treatment systems utilizing in-situ bioremediation technologies be up-sized (over those currently in use).

• There is not enough information regarding the effect of ethanol plumes on the concentrations of terminal electron acceptors and the assimilative capacity of aquifers to predict the effectiveness of natural attenuation.

• The use of ethanol as a gasoline additive will likely have minimal impact on the technology employed or the costs associated with soil remediation. The impact on groundwater remediation is not yet well understood.

• The ideal gasoline additive for air pollution control would be less water soluble and more biodegradable than MTBE.

• Overall, ethanol, as an additive, would generally be preferable to MTBE. Widespread adverse effects on groundwater and drinking water resources caused by MTBE would not occur with ethanol. Concerns that ethanol would be a public health concern in and of itself or that the migration of benzene in groundwater would be enhanced would be limited to only those circumstances when there was a significant, undetected and continuing release of neat ethanol or E-blend..

Uncertainties

• Ethanol should be seriously considered for use as an oxygenate alternative to MTBE in the Northeast because it is less toxic. The potential detriments to its use are less problematic than MTBE-blended gasoline. However, the Northeast states do not have any

experience in remediating spills from LUSTs that contained ethanol or E-blend gasoline. Thus prediction of the effects of this new fuel on state environmental programs is speculation.

• It is very important to understand that this evaluation is based on predictions from scientific estimations of what will happen to soil and groundwater in the event of a release of E-blend gasoline, and not field data. The relative impacts of large-volume spills during transport, transfer and storage are hard to generalize due to the uncertainties in quantifying the effects of ethanol on BTEX plume length, the concentration of terminal electron acceptors, and secondary effects on groundwater quality, such as increased levels of dissolved iron.

• Modeling studies have shown that benzene plume lengths increase if ethanol is in the released gasoline, but these studies have not been confirmed by field studies. Although ethanol gasoline has been in use for years, little information exists on subsurface ethanol plumes, because ethanol concentrations have not been monitored significantly anywhere in the United States.

• It is likely that the overall effect of ethanol is site specific and depends on the release scenario and characteristics such as site hydrogeology and the nature and amount of nutrients in the aquifer. The relative environmental impacts expected resulting from releases of neat ethanol and E-blend gasoline depend on the release scenarios.

For example, ethanol would likely have much less impact than MTBE in small-volume residential spill scenarios. While gasoline hydrocarbons would stay adsorbed onto soil and volatilize or degrade before ever reaching groundwater, both ethanol and MTBE would be carried to the groundwater by infiltrating rainwater. Once in the groundwater, ethanol would rapidly degrade, whereas MTBE would persist and could contaminate drinking water wells.

• The release of neat ethanol would likely be significant in a scenario where there is existing subsurface contamination from a previous release of gasoline. High concentrations of ethanol can increase the dissolved equilibrium concentrations of gasoline components, resulting in the remobilization of residual contamination. If the ethanol comes into contact with a layer of undissolved gasoline on the water table in an aquifer, it can cause increased lateral spreading of the lens of gasoline.

• To understand the impacts to the environment of E-blend gasolines, a thorough understanding of the life cycle is necessary. Since ethanol has never been extensively distributed in large volumes in the Northeastern States, the logistics of the life cycle as they would take place in this region are not established.

• Finally, it is premature to attempt to compare the costs associated with the remediation of groundwater contaminated with ethanol verses MTBE contamination. Additional knowledge of and experience with such issues as degradation rates and the effects of soluble iron must be understood.

Recommendations

Additional studies on E-blend gasoline should be carried out before this new fuel gains widespread introduction into the Northeast so that problems similar to those of MTBE do not occur. Given the uncertainties associated with the potential affects of ethanol releases into the environment, the following efforts designed to gain more conclusive information should be undertaken:

• Conduct field experiments to understand the true extent of the behavior of ethanol in the environment and confirm modeling studies. A recently published report from Brazil (November, 2000) of the first known controlled release of ethanol blended gasoline in a sand aquifer showed the decay rate for ethanol to be 100 times slower than predicted from laboratory studies, meaning that ethanol can exist in the environment 100 times longer than expected.

Controlled field experiments of neat ethanol and E-blend gasolines should be carried out to determine the precise nature of their impact on the environment and the potential for threats to human health before they are introduced to the area. If this timing is not possible, the experiments should be done as soon as possible so that fate and transport principles are better understood with regard to addressing the cleanup of neat ethanol and E-blend gasoline releases. These investigations should include:

• Field tests of remediation technologies to determine which work and how effective they are before ethanol use in fuels is increased in the Northeast.

• An analysis of spill investigations from states that have been using gasohol for the past few decades to answer questions about cosolvency, the fate and transport of ethanol, and the effects of ethanol on the biodegradation of BTEX compounds at a field scale.

• An analysis of remedial actions and the performance of remedial technologies employed in states that have been using gasohol for the past few decades to answer questions concerning the appropriateness and efficiency of the technologies favored for cleanups in the Northeast.

• A controlled field study to measure the rate at which ethanol dissolves or separates out of gasohol and is transferred into groundwater.

• Additional research into and analysis of other states' experiences with significant and continuing releases of gasohol to quantify and address concerns over the potential cosolvency effect of ethanol and the potential that biodegradation of gasoline components in larger releases will be retarded.

• Monitoring for ethanol and terminal electron acceptors. These analytes should be included as a standard part of the remedial investigations at petroleum release sites. Appropriate test methods and detection limits must be identified.

• A comparison of remedial costs at spill sites where ethanol has been identified to the cost of similar spills where no ethanol is present.

• Because of the national focus of this issue, funding to complete a field study such as "A Field Assessment of the Impact of Ethanol in Gasoline on BTEX Plumes in Groundwater" as proposed by J.F. Baker et al, University of Waterloo, should be pursued from national organizations and contributions from concerned states in the Northeast..

• Evaluate the potential environmental impacts of an ethanol release along the entire life cycle. Work with the ethanol industry to better determine what the life cycle will look like before distribution activities are initiated.

• Adopt a standardized analytical method for the determination of ethanol in environmental water samples. The difficulty in separating ethanol from water in the preparation of samples for analysis has resulted in high detection limits. Consensus on

acceptable detection limits is also needed. Start testing for ethanol at gasoline releases. The bad effects of MTBE on groundwater were unknown until regulatory agencies started to test or require testing of MTBE.

• If ethanol is to be used as an oxygenate, it should be used at the minimum concentration of 5.4 percent to minimize the affects of oxygen depletion and cosolvency, at least until it is determined to have fate and transport characteristics that are manageable. Accordingly, the federal tax incentive that results in formulations that exceed the minimum necessary for air pollution benefits should be repealed.

• If ethanol is to be used as an oxygenate, the use of an additive that would impart a taste and odor at lower thresholds than ethanol to act as an early indicator of the presence of ethanol in drinking waters should be investigated (comparable to the sulfur compound added to natural gas for leak detection).

Other Oxygenate and Nonoxygenate Alternatives to MTBE

We should continue to seek alternatives to MTBE that will ultimately do the best job of protecting both air and water quality. Other ethers, like MTBE, that could be used as oxygenates include: ethyl tertiary butyl ether (ETBE), tert amyl methyl ether (TAME), and diisopropyl ether (DIPE). These ethers, however, will likely present the same kinds of impacts on the water environment as MTBE because of their similar chemical compositions. More data is needed on their expected behavior and health effects.

There are also nonoxygenate alternatives to MTBE that could serve to enhance gasoline octane. These alternatives would only be viable if the current 2 percent oxygenate requirement were repealed. Toluene, an aromatic compound, is one such alternative. A Maximum Contaminant Level (MCL) for toluene in drinking water has been set at 1 ppm. There are health effect concerns associated with the compound, but it has not been found to cause cancer. In the case of a spill, it will evaporate from surface waters and leach into groundwater, where biodegradation will be slow.

Alkylates are another nonoxygenate alternative to MTBE. These highly branched alkanes have a low water solubility and high volatility, an indication that they would not pose as much a threat to surface and groundwater as MTBE. In groundwater they would bond strongly to soil particles and biodegrade slowly. Currently, their is little health effects data on alkylates.

Methylcyclopentadienyl manganese tricarbonyl, or MMT, is a manganese-based oxygen enhancer. Some data suggest that airborne manganese at high doses can cause disabling neurological impairments with symptoms similar to those of Parkinson's disease. More study is needed, however, for both health and environmental effects.