Preparations for Meeting New York and Connecticut MTBE Bans

October 2003

Office of Oil and Gas
Energy Information Administration
U.S. Department of Energy
Washington, DC 20585

Contacts and Acknowledgments

This report was prepared by the Office of Oil and Gas of the Energy Information Administration (EIA) under the direction of John Cook, Director, Petroleum Division. Questions concerning the report may be directed to Joanne Shore (202/586-4677), joanne.shore@eia.doe.gov, Team Leader, Petroleum Division.

EIA would like to acknowledge the contributions of contract personnel John Hackworth and Stillwater Associates personnel David Hackett, Greg Haggquist, and David Bulfin.

Table of Contents

Executive Summary

Background

New York and Connecticut use Federal reformulated gasoline (RFG)[1] that contains methyl tertiary butyl ether (MTBE). MTBE is used in RFG to diminish gasoline's air emissions and to improve engine performance. However, detection of MTBE in some water supplies caused these two States, which consume about one quarter of all East Coast RFG, to ban its use in motor fuel by the end of 2003. As MTBE is eliminated, it is widely expected that ethanol, which like MTBE can be used to satisfy the RFG standard for oxygen content while supplying needed octane without adding toxic components, will replace it. Congressman Doug Ose, Chairman of the House Government Reform Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs, asked that the Energy Information Administration (EIA) characterize the progress being made in switching from MTBE to ethanol use in the gasoline supply for these States.

Supply constraints arise in the distribution system when replacing MTBE with ethanol in gasoline. Water is present in most of the gasoline storage and distribution chain. Petroleum does not mix with water, so water accumulates separately at the bottom of petroleum tanks and does not get into engine fuel lines. However, unlike petroleum, ethanol has a strong affinity to water. If ethanol-blended gasoline comes in contact with water, the ethanol is pulled into the water, resulting in gasoline that is not useable. Therefore, ethanol is transported and stored separately from other petroleum products. Refiners produce a base unfinished reformulated gasoline mixture to which the ethanol is added. This base material is referred to as reformulated gasoline blendstock for oxygenate blending, or RBOB. The ethanol is only blended into RBOB as the material is loaded onto trucks to be delivered to retail gasoline stations. RBOB is also a separate product from other gasolines in the system (MTBE-blended RFG and conventional gasoline). Terminals either specialize in a subset of gasolines or carry a greater number of distinct products. The result is a reduction in supply system flexibility.

RFG production constraints arise when switching from MTBE to ethanol use, as explained below, making this fuel change potentially problematic. The constraints occur mainly when producing summer-grade gasoline. Reid vapor pressure (RVP) is a measure of a fuel's inherent tendency to evaporate. Because fuel evaporation occurs more rapidly at higher temperatures and is known to contribute to summer air quality problems, specifications for summer-grade RFG require that it have a lower RVP than winter-grade RFG. Adding ethanol to gasoline in place of MTBE, increases gasoline's RVP and the rate of evaporation, if no other changes are made. To counter this effect, other gasoline

[1] Reformulated gasoline (RFG) is gasoline that, on average, significantly reduces Volatile Organic Compounds (VOC) and air toxics emissions relative to conventional gasoline. It is more difficult to produce than conventional gasoline and originally was required only in the nine cities with the worst ozone nonattainment (Los Angeles, San Diego, Chicago, Houston, Milwaukee, Baltimore, Philadelphia, Hartford, and New York City). Other areas that also have a history of air pollution problems joined the RFG program. Today, RFG represents about 1/3 of U.S. gasoline consumption.

components with relatively high RVP must be removed to lower the RVP of the RBOB to which the ethanol is to be added. This reduces the volume of ethanol-blended RFG that can be produced from a barrel of crude oil relative to MTBE-blended RFG.

An investment is typically required to produce summer-grade RBOB, and while small, some refiners (particularly opportunistic foreign refiners that only occasionally ship cargoes to the U.S.) will choose to wait and see if the economics warrant the investment. Winter-grade RBOB, which can have higher RVP, is easier and less costly to produce. As was the case in the Midwest in 2000 when the Chicago-Milwaukee area first used low-RVP RBOB to meet Phase II RFG requirements, the largest transition problems may occur in late April and May, when production of summer-grade gasoline for the Northeast begins on the East Coast.

The Northeast supply situation when shifting from MTBE to ethanol varies in a number of ways from California and the Chicago-Milwaukee areas that use ethanol. The first major difference is that the Northeast depends to a large degree on gasoline supply from opportunistic foreign refineries that only send occasional volumes to the region. These importers have large incentives to wait until after bans are implemented to see if investing to produce the low-RVP summer-grade RBOB will be economical. The second difference is that the Mobile Source Air Toxics rule (MSAT), which limits total toxic components in gasoline supplied by individual refineries, did not affect supplies from California or Midwest refineries,[2] but does affect East Coast refineries. A number of East Coast refiners are finding that as they increase RBOB production, they are constrained by MSAT.[3] If they only produce RBOB volumes needed to produce levels of RFG historically provided to New York and Connecticut, they are not hindered by this constraint. But MSAT may keep some refiners from being able to increase RBOB production to fill in if other suppliers drop out of the RFG markets for those two States.

Main Conclusions

The questions posed by Congressman Ose focused on the transition period when an MTBE ban is first implemented and temporary supply-demand imbalances result in price surges, and on the longer term, when long-term equilibrium prices may be higher and the potential for price volatility may have increased. The main conclusions EIA reached in answering the questions are:

- Domestic suppliers and terminal operators are preparing to meet the January 2004 deadline. However many of the opportunistic foreign refineries will not find it economic to invest to produce low-RVP RBOB to send to New York and Connecticut until the transition occurs and the market economics are known. These opportunistic suppliers account for about 1/3 of the RFG supply for these two States. If they

[2] Midwest refineries were producing ethanol-blended RFG when the MSAT toxic baselines were established, so they are not affected, and California refineries were excluded from MSAT.
[3] If a refiner's gasoline pool only contains a small fraction of RBOB, the remaining larger volumes of MTBE-blended RFG and conventional gasoline can be adjusted to maintain MSAT requirements and absorb high-RVP components rejected from the RBOB.

subsequently decide to produce RBOB, several months may be needed to make necessary changes. The implication is an increased potential for price volatility in the near term and higher prices in the long term, especially during the summer, as the lower-cost opportunistic RFG importers are replaced with higher-cost Gulf Coast RBOB supply.

- An MTBE ban limited to New York and Connecticut, while challenging, should be far easier for the supply system to accommodate than a ban for the entire Northeast. The Northeast refiners will be able to supply as much as or a bit more RBOB to New York and Connecticut than they supplied MTBE-blended RFG, but if they had to supply all of their Northeast customers with RBOB, they would be limited in supply by MSAT. Also, with only two States banning MTBE, suppliers can realign, with some shifting to supply New York and Connecticut, and others shifting out of those States to supply other East Coast areas. However, this conclusion does not mean that one-at-a-time State bans in the Northeast would be preferable. This situation could mean years of supply readjustments and associated increased price volatility.
- While the transition may be difficult, EIA did not find any evidence that delaying the programs would remove uncertainty and diminish transition problems.

Summary of Responses to Questions

A summary of EIA's responses to the specific questions asked by Congressman Ose is presented below.

Domestic Supply

- What adjustments will the East Coast refinery system need to make to accommodate the New York and Connecticut MTBE bans?

- How are Northeast refiners preparing for the increased difficulty in refining the low Reid vapor pressure (RVP) blendstock associated with ethanol blending?

All refiners switching from MTBE to ethanol have to adjust the gasoline to which ethanol will be added in order to accommodate the different physical and chemical properties of the ethanol to meet emissions and performance requirements. The largest impact is when low-RVP summer-grade gasoline is being produced. To serve the New York and Connecticut markets, which represent about 1/3 of the Northeast[4] RFG market, most refiners are converting only a fraction of their gasoline pool to RBOB. This allows refiners more flexibility than when converting most of their gasoline to RBOB.[5] As such,

[4] Northeast States include: Maine, Vermont, New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, New Jersey, Delaware, and Pennsylvania. Of these States, all but Maine and Vermont use RFG.

[5] Northeast refiners face restrictions on how much RBOB they can produce before they experience significant volume losses. These volume losses stem from reaching the point where the components being removed from low-RVP RBOB during the summer can't be absorbed in the remainder of the gasoline pool, and from bumping against Mobile Source Air Toxics rule constraints. These constraints are not issues at

the total gasoline pool from these refineries should not experience much volume loss. Domestic refiners serving New York and Connecticut will need to make blending operation changes and some small investments. They will have tighter tank scheduling at their facilities as well, since they will be handling more products with the same number of tanks.

Domestic refiners have made or are finishing necessary changes in order to begin production in November on the East Coast (October on the Gulf Coast) to ensure that MTBE-blended product is flushed through the system in time to meet the January ban. Most East Coast refiners currently supplying New York and Connecticut will produce RBOB at or slightly above their current levels of RFG made for these two States. Some of these suppliers indicated they might be capable of modest increases, while a small number indicated production would decline. The net result is that the RBOB supply from domestic refiners should equal or modestly exceed current RFG production for these two States. However, New York and Connecticut will experience a loss in the number of refineries that can serve their needs. That is, while domestic refiners are planning to provide historical-level volumes to New York and Connecticut, they are not changing all of their refineries to produce RBOB.

Import Supply

- Currently, the Northeast imports a significant amount of finished gasoline and gasoline components from Europe. Are European shippers planning to make ethanol-blended gasoline or low Reid vapor pressure blendstock to accommodate the New York or Connecticut market? If not, how will this affect the supply and price of gasoline in New York and Connecticut?

Imports are a significant source of supply to the Northeast, and are a source of large uncertainty that could make the New York and Connecticut transitions in 2004 difficult. Gasoline imports of 434 thousand barrels per day serve about 45 percent of demand in the Northeast, with East Coast refineries supplying most of the rest, and Gulf Coast refineries supplying a very small amount. EIA estimates indicate New York and Connecticut now receive close to 60 percent of their RFG from import sources, with the remainder coming from East Coast refiners.

Imports that arrive in the major terminal areas of New York and New Jersey, which are important supply points for New York and Connecticut, come from many different countries that each supply volumes opportunistically from time to time.
In 2002, over 30 countries brought RFG-quality material into New York and New Jersey, and most of these countries supplied less than 5 thousand barrels per day on average. Approximately 1/3 of New York's and Connecticut's RFG supply comes from these opportunistic suppliers. Foreign refineries that only send occasional, opportunistic cargoes may not be willing to make investments to convert facilities to produce small

---

the level of volumes domestic refiners are planning for New York and Connecticut, but these constraints could become an issue if Northeast refiners need to supply more to New York and Connecticut than they have historically provided.

low-RVP (summer-grade) RBOB volumes, which are unique to the New York and Connecticut markets, in advance of knowing the economics. EIA was unable to confirm any substantive preparations from these opportunistic suppliers.[6] Winter RBOB is no more difficult to produce than MTBE-blended RFG. But many foreign refineries supplying the Northeast may not have the facilities to produce summer-grade low-RVP RBOB for blending with ethanol. Even if they ultimately decide to make the necessary investments, U.S. refinery experience suggests that it could take months for them to generate low-RVP summer RBOB.

Should import volumes fall short of New York's and Connecticut's needs, several options exist to make up the difference: increases in RBOB production from East Coast refineries, increases from Gulf Coast refineries, and/or increases from dedicated foreign refineries in Canada, Virgin Islands, or possibly Venezuela, although Venezuela's refinery capabilities are still uncertain following their recent strike. All of these options will require some substantial shifts in supply patterns, which take time and could result in price volatility during the transition.

Total Supply

- The New York Mercantile Exchange has expressed serious concerns about the impact on overall regional gasoline fungibility and prices associated with the MTBE bans in New York and Connecticut. Will the transition from MTBE to ethanol in New York and Connecticut reduce the overall supply of gasoline in the Northeast? If so, how will this transition affect other Northeastern States?

EIA believes that after the transition from MTBE-blended RFG to ethanol-blended RFG is completed for New York and Connecticut, gasoline supply to the Northeast will still be adequate to meet demand. However, the sources and logistics of supply will be different. Changes in supply patterns may take time, and short-term supply problems may be encountered during the transition process. EIA can account for about 70 percent of needed supply for New York and Connecticut from sources that look fairly certain. Another 20 to 30 percent will come from sources that both EIA and industry speculate should be capable of producing the RBOB.

If large changes in supply sources occur, the required shifts in flow patterns will likely affect other Northeastern States. This, in turn, could create some temporary price pressure in these regions while the system rebalances. Given the uncertainty in flow shifts, it is not clear how long such rebalancing would take.

[6] EIA interviewed a number of major gasoline importers regarding their knowledge of preparations abroad. No one was able to identify any known preparations being undertaken by foreign refineries beyond the dedicated refineries.

Logistics

- What changes were made to the overall gasoline distribution system (e.g., pipelines, storage tanks and truck rack distribution terminals) to accommodate the increased use of ethanol in the Northeast?

- The State of New York not only bans MTBE use in gasoline, but it prohibits the shipment and transport of MTBE through the State. What will the impact be on gasoline supply and fungibility if refiners are unable to ship gasoline containing MTBE through the State of New York?

Ethanol supplies are being lined up, and terminals are preparing to change their operations and adding blending equipment. Blending terminals seem to be on track to be ready in time for the January bans, but timing will be close, and any unforeseen delays in construction or permitting could interfere with their readiness. EIA was not able to identify any preparation problems at this time, but finding many of the affected parties is difficult, as many different parties own the distribution chain between refiners and blending terminals. After the transition begins, the distribution system may find further changes are needed. The complexity of the distribution chain and the uncertainty over ultimate sources of supply leaves uncertainties that won't be resolved until after the bans take effect.

The impact of the New York MTBE ban on transshipments of product through the State is not yet clear. The main area of concern to industry involves water shipments through New York Harbor. EIA did not find any suppliers planning to stop supplies to other States as a result of this uncertainty in the New York legislation banning MTBE. Product that travels by land through New York should not be an issue. The only product EIA was able to identify that would be affected by land movement was gasoline delivered to Vermont, which only uses conventional gasoline. Since New York's conventional gasoline will not contain MTBE, we would expect the product being delivered to Vermont would also not contain MTBE.

Prices

- Given all the factors discussed in the previous questions, what are the expected costs to consumers associated with blending ethanol in gasoline sold in the Northeast? Please delineate the costs between winter and summer gasoline blends.

Two types of price increases may affect consumers in New York and Connecticut using ethanol-blended RFG. The first is short-term price volatility, which results from temporary imbalances between supply and demand that are most likely to occur during transition periods. New York and Connecticut face two transitions in 2004. The first is in January, when the bans first go into effect. The second is when the harder-to-produce summer-grade RBOB is required at retail in June. The large number of opportunistic import suppliers providing occasional cargoes to the two States implies that some portion of the volumes that are currently being imported may not materialize initially,

particularly during the transition from winter- to summer-grade gasoline. Opportunistic suppliers may wait and see if the economics warrant making the needed investments to produce low-RVP RBOB, particularly when they have the option of selling into the market for MTBE-blended RFG outside of New York and Connecticut. Initial reluctance of current suppliers to produce RBOB could result in a large price spike until new supply sources replace the lost volumes.

If the price impacts seen during major fuel transitions in California and Chicago-Milwaukee are any indication, price spikes as large as 30-40 cents per gallon could occur. Any supply-demand imbalances and price surges that occur will likely spill over to a lesser degree to surrounding areas. In addition, since California and Chicago-Milwaukee moved to unique, hard-to-produce gasolines, they have experienced more volatility in general. The Northeast may also begin to experience increased price volatility after the transition due to reduction in flexibility of the supply system and a reduced number of suppliers for New York and Connecticut.

The second price impact is driven by the long-run equilibrium cost to provide ethanol-blended gasoline to New York and Connecticut. As long as refiners only need to produce a small share of their gasoline pool as RBOB, which keeps them from hitting costly production constraints, winter-grade ethanol-blended gasoline would likely experience very little increase in long-run equilibrium costs (perhaps 1 cent per gallon over MTBE-blended RFG). Summer gasoline would be expected to be more expensive, but there is much uncertainty in this cost. It is not clear who the marginal supply source will ultimately be. However, Chicago-Milwaukee prices, combined with the large number of suppliers that can get product to New York and Connecticut, would imply that summer increases over MTBE-blended RFG would be about 5 cents per gallon. The above estimates for long-run winter and summer price impacts assume that the existing ethanol tax credits are extended indefinitely. Without such an extension, price impacts would be 3.1 to 5.1 cents per gallon higher in both seasons, depending on the percentage of ethanol used in RFG.

Emissions

- California has experienced a higher number of ozone alert days in 2003 relative to recent years. Ethanol has a high propensity to evaporate, leading to the emission of ozone-forming particles. Should the Northeast be concerned that it too may see an increased level of ozone formation as a result of the use of ethanol?

Emission issues fall under the purview of the Federal Environmental Protection Agency (EPA) or under State environmental departments. EIA does not review or analyze emission impacts. A letter written by Secretary Winston Hickox of the California EPA to Senator Dianne Feinstein addressing this issue[7] indicated that ethanol-blended gasoline was not the major reason behind the higher number of ozone alert days in 2003; however, it went on to say that the addition of ethanol was contributing to VOC formation.

[7] The letter was published on the web at: http://feinstein.senate.gov/hickox-letter-8-1-03.htm

Potential Regulatory Issues

Regulatory uncertainty can defer industry preparation for any transition in fuels markets. In the case of the New York and Connecticut MTBE bans, uncertainty at both the State and Federal levels have added incentives for industry to wait as along as possible before making changes to meet the requirements. The switchover to ethanol based-RFG, particularly during the initial summer season when low-RVP RBOB must first be provided, increases the likelihood of transitional problems and price spikes. A delay in implementing the scheduled MTBE bans would not, in EIA's judgment, reduce or eliminate these risks. Rather, they would merely be deferred to a later date, while regulatory credibility would itself be damaged.

While delay in program implementation would not avoid transition risks that must be faced at some point if a changeover in RFG formulation is to be made, some consideration of potential enforcement discretion in advance of any problems might help the transitions. In particular, State enforcement discretion at the retail level may help to make the last changes that occur in the supply system go more smoothly. At the Federal level, some consideration of whether changes or temporary flexibility in the certification process for RBOB might aid in resolving any temporary supply problems. Currently the certification and testing process limits movement of some RBOB.

1. Introduction

New York and Connecticut both use Federal reformulated gasoline (RFG) that contains methyl tertiary-butyl ether (MTBE). MTBE is used in RFG to diminish gasoline's air emissions and to improve engine performance. However, detection of MTBE in some water supplies caused these two States to ban the use of MTBE in motor fuel by the end of 2003. Congressman Doug Ose, Chairman of the House Government Reform Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs, asked that the Energy Information Administration (EIA) examine the progress being made in switching from MTBE to ethanol use in the gasoline supply for these States. A copy of his request is provided in Appendix A.

The remainder of this report provides background and answers the questions posed by Congressman Ose. Following Section 2, which covers background information, the questions are arranged by general topic as follows:

Section 3. Domestic Supply

- What adjustments will the East Coast refinery system need to make to accommodate the New York and Connecticut MTBE bans?
- How are Northeast refiners preparing for the increased difficulty in refining the low Reid vapor pressure (RVP) blendstock associated with ethanol blending?

Section 4. Import Supply

- Currently, the Northeast imports a significant amount of finished gasoline and gasoline components from Europe. Are European shippers planning to make ethanol-blended gasoline or low Reid vapor pressure blendstock to accommodate the New York or Connecticut market? If not, how will this affect the supply and price of gasoline in New York and Connecticut?

Section 5. Total Supply Impacts

- The New York Mercantile Exchange has expressed serious concerns about the impact on overall regional gasoline fungibility and prices associated with the MTBE bans in New York and Connecticut. Will the transition from MTBE to ethanol in New York and Connecticut reduce the overall supply of gasoline in the Northeast? If so, how will this transition affect other Northeastern States?

Section 6. Logistics

- What changes were made to the overall gasoline distribution system (e.g., pipelines, storage tanks and truck rack distribution terminals) to accommodate the increased use of ethanol in the Northeast?
- The State of New York not only bans MTBE use in gasoline, but it prohibits the shipment and transport of MTBE through the State. What will the impact be on gasoline supply and fungibility if refiners are unable to ship gasoline containing MTBE through the State of New York?

Section 7. Prices

- Given all the factors discussed in the previous questions, what are the expected costs to consumers associated with blending ethanol in gasoline sold in the Northeast? Please delineate the costs between winter and summer gasoline blends.

Section 8. Emissions

- California has experienced a higher number of ozone alert days in 2003 relative to recent years. Ethanol has a high propensity to evaporate, leading to the emission of ozone-forming particles. Should the Northeast be concerned that it too may see an increased level of ozone formation as a result of the use of ethanol?

Section 9 covers several regulatory issues that arose during our study, and Section 10 highlights the major factors that are likely to affect the Northeast next year.

2. Background on Northeast RFG Supply

MTBE was added to gasoline initially to enhance octane, but large increases in MTBE use occurred in the 1990s, when it was used to add oxygen to gasoline as required by the Clean Air Act Amendments of 1990 to produce cleaner air. MTBE has been subsequently detected in water supplies, and concerns over further water contamination led some States to ban its use.

Removing MTBE from gasoline affects all grades (premium, mid, regular) of RFG.[8] MTBE is also used in premium grade conventional gasoline in order to add octane. (Regular and mid-grade conventional gasoline do not need MTBE for octane purposes.) The removal of MTBE from premium conventional gasoline does not have the supply consequences of its removal from all grades of RFG, where it is used to meet emission requirements as well as octane. As a result, the remainder of this report focuses on RFG.

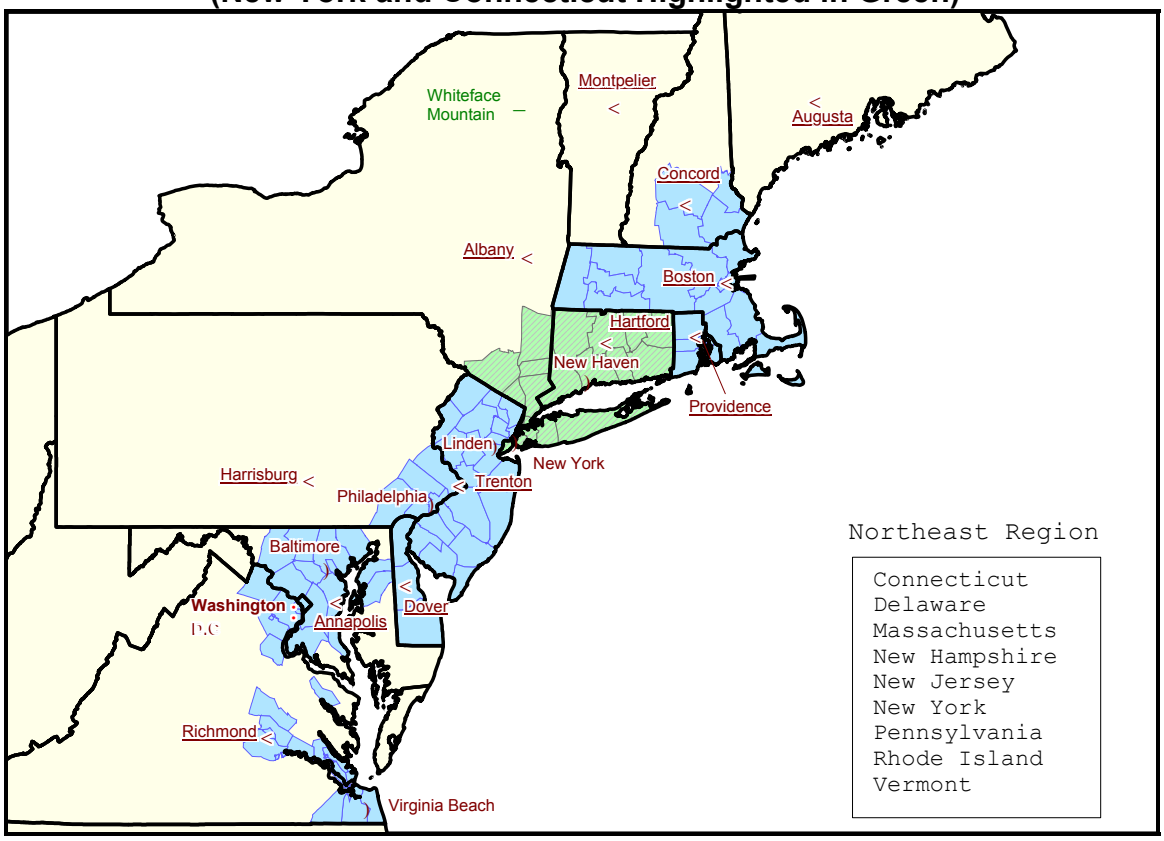
New York and Connecticut are situated in the middle of the RFG-consuming regions of the East Coast (Figure 1). In addition the New York Harbor area is a major port of entry for RFG imports and a staging ground for re-distribution of some of those imports other areas of the Northeast. This raises questions concerning both the effect of the MTBE ban on New York and Connecticut, as well as effects on other RFG-consuming regions.

Removing MTBE from RFG requires significant changes to the gasoline supply system. It costs more to produce ethanol-blended RFG than MTBE-blended RFG. EIA has previously estimated that if MTBE were to be banned from most of the country's RFG supply, the average long-run retail price premium for ethanol-blended RFG over MTBE-

[8] Approximately 95 percent of MTBE is used in RFG. See "MTBE, Oxygenates, and Motor Gasoline," Energy Information Administration, February 2000, http://www.eia.doe.gov/emeu/steo/pub/special/mtbe.html#Which%20areas%20get%20MTBE

blended RFG would be about 7 cents per gallon.[9] With only New York and Connecticut banning MTBE on the East Coast, the long-term price premium is likely to be less, as discussed later. But the complexity of such changes makes estimates of these long-run effects highly uncertain.

Figure 1. RFG-Consuming Areas on the East Coast (New York and Connecticut Highlighted in Green)



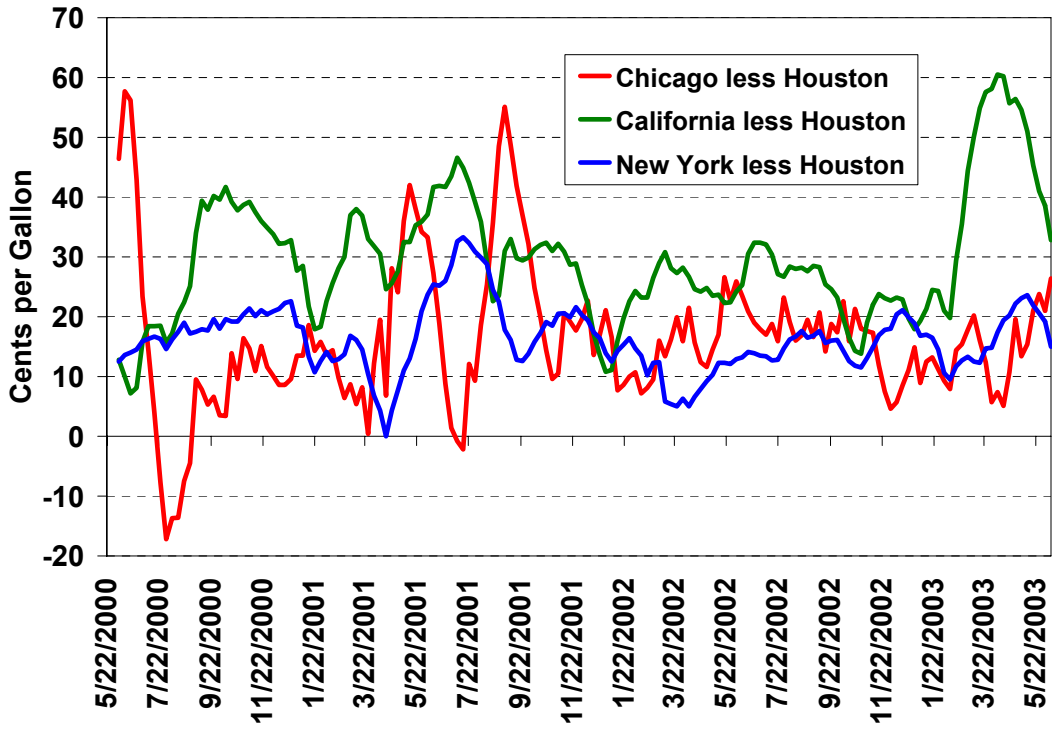
Legend: Green and blue shaded areas represent areas using RFG. New York and Connecticut RFG areas are in green to highlight regions most affected by these States' MTBE bans
Source: Environmental Protection Agency http://www.epa.gov/otaq/regs/fuels/rfg/rfgarea.pdf
Note: EPA lists as an RFG opt-in region the area of Whiteface Mountain that lies above 4,500 feet in elevation. This area is in Essex County, but is not shaded on the map.

The large supply system changes required also add complexity to transitions and add to the potential for price volatility. The long-run impact on price is much smaller than the temporary price spikes that can occur during a difficult transition. The Chicago-Milwaukee area, and more recently, California, are using ethanol in much of their reformulated gasoline and provide some indications of what can occur. The Chicago-Milwaukee area had effectively phased out MTBE by 1998, but the region experienced some fuel transition issues when RFG changed from Phase I to stricter Phase II requirements in 2000. In 2003, California replaced MTBE with ethanol in much of its gasoline.

[9] http://tonto.eia.doe.gov/FTPROOT/service/question2.pdf

In recent years, California and the Midwest have demonstrated the type of price volatility consumers can experience during major fuel transitions, as well as the volatility that can occur in regions using unique fuels[10] that are difficult to produce. Figure 2 shows recent retail prices in three RFG areas relative to Houston RFG prices. Houston is used as a base because it not only uses RFG, but also is a major refining center supplying products to the rest of the country. By looking at these price differences rather than price alone, the effect of crude oil price increases and other general market price factors are removed. The price swings mainly reflect regional differences. New York was the least volatile region during this time. The Midwest had a large price spike when it moved to Phase II of the RFG program in 2000, and the region experienced several more price spikes in 2001 due to refinery problems in a tight petroleum market. California's price surge in early 2003 was the result of refinery problems and logistical issues.[11] The price spikes in California and the Midwest were in the vicinity of 30 to 40 cents per gallon.

Figure 2. Retail Regular Gasoline Price Differentials Between Selected RFG Areas



Source: EIA weekly retail gasoline prices.

[10] The number of distinct types of gasoline used across the United States has grown as a result of both Federal requirements to use cleaner burning fuels in some areas and State requirements to use cleaner fuels in particular regions in order to reduce air pollution.

[11] Energy Information Administration, *2003 California Price Study: Preliminary Findings*, SR/O&G/2003-1 http://www.eia.doe.gov/pub/oil_gas/petroleum/feature_articles/2003/cagasoline/cagasoline.pdf

During transitions, temporary supply-demand imbalances occur that can cause price spikes. Once the transition is complete, such price spikes usually subside. However, in the cases of California and the Chicago-Milwaukee areas, the new markets after the transition exhibited more price spikes than were experienced prior to the changes. These two regions now seem to have a higher potential for volatility apart from transition effects. The Midwest had several large price swings in 2001 after its transition to Phase II RFG in 2000, and California has experienced increased price volatility since it began using its unique California Air Resources Board (CARB) gasoline throughout the State in 1996.

California and the Midwest provide an indication of conditions that can increase price volatility. Supply issues arising during transitions from one fuel type to another can be different from those that exist once the transition is complete. Several key dimensions increase the potential for price volatility in the California and Chicago-Milwaukee post-transition markets:

- Limited excess gasoline production capacity to meet unexpected needs;
- Gasoline that is distinctly different from that used in neighboring markets;
- Distance from marginal supply (geographic isolation);
- Limited number of suppliers, which is due in large part to having unique, hard-to-produce gasoline.

Both California and the Midwest evolved into regions with unique fuels that other regions did not use and that were hard to produce. Most regular suppliers for these two regions are located nearby. The majority of supply for the Chicago-Milwaukee RFG area comes from Midwestern refiners, and almost all of the CARB gasoline is produced by refineries in California. Little extra capacity exists among the regular suppliers to increase production if there is an unexpected loss of production. Extra supply must come from a limited set of suppliers able to produce the products and must travel long distances, which takes time. When production problems arise, the net result can be an extended time during which supplies are tight and prices rise, decreasing demand somewhat and encouraging new supply.

The gasoline supply system is changing in the Northeast as a result of New York and Connecticut shifting from MTBE-blended RFG to ethanol-blended RFG. The next section explores how these changes compare with gasoline supply characteristics of California and the Chicago-Milwaukee areas.

2.2 Comparison of Gasoline Supplies Among Northeast, California, and Chicago-Milwaukee Areas

The experiences of California and the Midwest may be able to shed light on areas for attention in the Northeast, and may help identify ways in which the Northeast may be in any better or worse situation than California and the Midwest. A comparison of gasoline supplies in each of these areas may help to identify potential issues for the Northeast.

The first distinction is that most of the Nation's RFG consumption is on the West and East Coasts. The West Coast represents 38 percent of U.S. RFG demand and the East Coast 41 percent, whereas the Gulf Coast consumes less than 10 percent, and the Midwest represents about 12 percent.[12] The small Midwest market for RFG does not attract a large number of suppliers to serve the area, and the loss of a single supplier could represent a significant share of that market. The removal of MTBE from New York and Connecticut in the Northeast creates a fuel island more like the Midwest market than the California market in size. A Federal ban in MTBE would create a Northeast market more like the California market in size.

Next consider the distance RFG must travel to the three regions under normal circumstances, as illustrated by the amount of demand that is supplied from imports or other regions. Table 1 shows balances for several Petroleum Administration for Defense Districts (PADDs), defined in Appendix B. The West Coast (PADD 5) is almost self-sufficient. It receives a small amount of blending components and finished gasoline from outside the region, but most gasoline is produced internally. California gasoline is produced mainly by California refineries, with a small amount from refineries in Washington State. Thus, California supply is relatively close to its consumers, although more supply is expected to come from outside the region in the future as demand grows and as refineries lose some capability to produce gasoline when shifting from MTBE to ethanol.

Midwest (PADD 2) RFG supply comes mainly from refineries located within the region (57 percent in 2002), with 43 percent of its supply coming from other regions, primarily the Gulf Coast. The Chicago-Milwaukee area represents about two-thirds of the RFG consumption in the Midwest. This region is even more dependent on Midwest refiners than is the Midwest as a whole. Additional supply from the Gulf Coast takes several weeks to travel by pipeline or barge to terminals serving the Chicago-Milwaukee area.

The East Coast (PADD 1) is the region most dependent on distant RFG supply, with well less than half (38 percent) of its demand being met by refineries within the region. Receipts from other regions, mainly the Gulf Coast, served 26 percent of demand in 2002, and imports from other countries supplied 37 percent. It takes about 18 or 19 days for product to travel up the Colonial pipeline from the Gulf Coast to New York Harbor, and about 2 weeks to receive product from Europe or Venezuela. Imports into the East Coast from Canada and Virgin Islands take closer to a week to arrive. The East Coast is unique among regions in its large dependence on import supply.

To understand the impacts of the New York and Connecticut MTBE bans, the East Coast also needs to be viewed on a sub-regional basis. Supply into New York, Connecticut, and States further north comes mainly from refineries in the Northeast and imports, whereas pipeline shipments from the Gulf Coast supply States south of New York.

[12] These shares were calculated from product supplied data published in the Energy Information Administration's *Petroleum Supply Annual 2002*, Volume , DOE/EIA-0340(2002)/1, June 2003, Tables 5, 7, 9, 13. The percentages do not add to 100 percent due to rounding.

Table 1. Estimated RFG Sources By PADD in 2002

	PADD Production	Imports	Net Receipts from Other PADDs	Stock Change	Product Supplied
			Thousand Barrels per Day		
PADD 1	463	451	320	--	1,235
PADD 2	199	-	149	(3)	351
PADD 5	1,045	17	40	(3)	1,105
			Percent of Demand		
PADD 1	37.5%	36.5%	25.9%	---%	
PADD 2	56.7%	0.0%	42.5%	0.9%	
PADD 5	94.6%	1.5%	3.6%	0.3%	

Source: Energy Information Administration Form EIA-810, Petroleum Supply Annual 2002, Volume 1, DOE/EIA-0340(2002)/1,Tables 5, 7, 13, Petroleum Marketing Annual 2002, DOE/EIA-0487(2002), Table 48. See Note for details.

Note: Table includes adjustments to reflect that blending components contain RBOB and, in the case of imports, volumes that end up as RFG. For PADD 1, demand is prime supplier demand (*Petroleum Marketing Annual*, 2002, DOE/EIA-0487(2002), Table 48); Production is refinery production (Form EIA-810); Net Receipts is taken from Tables 5, 7, 13 of the *Petroleum Supply Annual 2002*, Volume I, DOE/EIA-0340(2002)/1; and imports are calculated as the balance to meet demand. Prime supplier demand was used because of the need to do State-level balances later in the report. For PADD 2 and PADD 5, Imports and Net Receipts from Other PADDs represent EIA published imports and net receipts increased by blending component imports and net receipts. PADD Production for PADDs 2 and 5 represents total published production less those blending component imports and net receipts.

Most of the East Coast refineries are concentrated in two areas of the Northeast that are less than 100 miles apart. Because most of the crude oil processed by these refineries is foreign crude oil delivered by ocean tankers, the facilities are located to accommodate the crude oil deliveries. Most of the capacity is in the lower Delaware River basin and south of Philadelphia. This capacity includes refineries at Philadelphia and Marcus Hook, Pennsylvania; Delaware City, Delaware; and Westville (Eagle Point) and Paulsboro, New Jersey. There is also some capacity in the New York Harbor area, including ConocoPhillips' large Bayway and Hess's Port Reading, New Jersey refineries.

In 2002, 94 percent of all RFG and blending component imports into the East Coast arrived in ports that serve the New York area and New England States. EIA estimates almost 60 percent of RFG demand in New York and Connecticut is supplied by imports, and 60 percent of those imports come from opportunistic suppliers of gasoline blending components. The remainder is almost all supplied from East Coast refineries. This dependence on imports becomes an important consideration when analyzing the New York and Connecticut bans on MTBE, as will be discussed in more detail later in the report.

The use of ethanol in RFG adds another product to the RFG supply chain that must travel to blending terminals near to consumers. Ethanol is mainly produced in the Midwest, so that ethanol supply sources are near Chicago-Milwaukee Midwest suppliers. However,

ethanol must be shipped by rail or water to the East and West Coasts. The West Coast currently receives most of its supply by rail. The East Coast is expected to receive ethanol supply both by water and by rail. But the East Coast has historically experienced more supply line disruptions than the West Coast due to harsh weather in the winter that can interfere with both water and rail traffic.

3. Domestic Supply

What adjustments will the East Coast refinery system need to make to accommodate the New York and Connecticut MTBE bans?

How are Northeast refiners preparing for the increased difficulty in refining the low Reid vapor pressure (RVP) blendstock associated with ethanol blending?

3.1 Domestic Supply Impacts on East Coast Refineries

Several production issues are discussed in this section. The first is the loss of volume that occurs when refineries switch from using MTBE to using ethanol in RFG. This volume loss stems from the different physical and chemical properties of MTBE and ethanol. The second issue is the potential loss of volume that results from constraints the Mobile Source Air Toxics Rule (MSAT) has on a number of major East Coast suppliers, and the last is reduction in refinery production flexibility.

Loss of Volume

Refiners that switch from MTBE-blended RFG to ethanol-blended RFG experience a loss in their ability to produce the same amount of gasoline from a barrel of crude oil. This loss stems from differences in characteristics of MTBE and ethanol.

Federal RFG standards require that gasoline contain 2 percent oxygen by weight. MTBE and ethanol are both oxygenates (i.e., contain oxygen), and are added to satisfy the Federal oxygen requirement. Refiners add 11 volume percent of MTBE to meet the 2-weight-percent oxygen requirement. Ethanol, however, has about twice the oxygen content per unit volume as does MTBE, so only half as much is needed to meet the oxygen requirement. In practice, the 2-weight-percent oxygen requirement can be met using about 5.7 volume percent of ethanol. When switching from MTBE to ethanol, refiners experience production yield losses, which vary between winter and summer. When switching to a 5.7 percent ethanol blend, refiners experience the following changes in production volume during the winter product specification period before any other changes are made:

- Lose -11 percent MTBE;
- Gain +6 percent ethanol;
- Net loss -5 percent by volume.

The situation is different during the summer because stricter emission standards exist during the high ozone pollution season when the ozone-forming VOCs and nitrogen oxides (NO_x) are restricted. Ethanol increases gasoline's tendency to evaporate, as measured by Reid vapor pressure (RVP), more than does MTBE. Put another way, ethanol has a higher blending RVP than does MTBE. Even though less ethanol is used in the gasoline, a switch from MTBE to ethanol with no other changes would cause the gasoline to exceed summer emission requirements. Refiners must remove other high-vapor-pressure gasoline components in order to lower the RVP and to bring the mixture into compliance. For summer-grade gasoline, refiners could experience a loss of gasoline productive capability of as much as 10 percent, which would typically occur as follows:

- Lose -11 percent MTBE;
- Gain +6 percent ethanol;
- Lose -5 percent other gasoline components to adjust for the RVP and distillation impacts that occur from the first two steps;
- Net loss -10 percent by volume.

The 10-percent net loss has been the level of yield impact during the summer experienced by California refiners that switched to ethanol. The CARB emission formula limits ethanol to about the 6 percent maximum due to the CARB NO_x limit. The Federal Complex Model that determines Federal RFG constraints does not have this NO_x limitation when using ethanol. The loss also reflects the fact that California refiners produce a very high fraction of their gasoline as CARB RFG, which effectively eliminates the opportunity to shift the high vapor pressure components to a non-CARB gasoline product.

In the case of the New York and Connecticut bans, the volume yield impact could be comparatively small if refiners choose to replace 11-percent MTBE with 10-percent ethanol.[13] Economics are currently favoring 10 percent blends, which elevate gasoline's vapor pressure about the same level as blending 5.7 percent (i.e. no more other light components need to be removed at 10 percent than at 5.7 percent), and increase the tax credit benefit.[14] Moreover, the additional 4.3 percent volume (over the 5.7 percent blend) is a clean fuel diluent that helps to reduce the toxics level over the 5.7 percent ethanol blend. Finally, with only two Northeast States banning MTBE, most refiners would be producing a low enough volume of RBOB that some of the light, high vapor pressure material removed from the RBOB for ethanol blending could be used in other gasoline produced at the refinery. Thus, the net yield loss for all gasoline produced in this situation, as shown below, could be well less than that seen in California or than would be experienced under a full Northeast MTBE ban.

[13] Another potential volume issue that has been mentioned, but that EIA cannot quantify, is the impact of the Unocal patent on RFG. This patent is more difficult to avoid when using ethanol. As a result, refiners blending around this patent today will lose some refinery production flexibility or will pay Unocal for the right to produce the RFG. It is not clear what, if any, volume impacts this may have.

[14] The current Federal excise tax on gasoline is 18.4 cents per gallon. However, the IRS allows 3 discrete subsidies for gasoline blended with 10 percent, 7.7 percent and 5.7 percent ethanol. At 10 percent ethanol, the excise tax subsidy is 5.2 cents per gallon (i.e., the excise tax is 13. 2 cents), at 7.7 percent ethanol the subsidy is 4.0 cents, and at 5.7 percent ethanol the subsidy is 3.0 cents per gallon.

- Lose -11 percent MTBE;
- Gain +10 percent ethanol;
- Lose -5 percent other gasoline components to adjust for the RVP and distillation impacts when ethanol is substituted for MTBE;
- Net loss -6 percent from RBOB volumes;
- Add back some, if not all, of the components that were removed from RBOB to remaining MTBE-blended RFG and conventional gasoline being produced. Thus, the total gasoline pool should lose little if any volume.

Another production issue is the need for octane when removing MTBE. MTBE and ethanol both have high octane, which is one of the reasons why some refiners will choose to use ethanol after an MTBE ban, even if the Federal oxygen requirement is removed. Premium conventional gasoline also requires high-octane materials. Today, premium grade is where MTBE is most likely to be used in conventional gasoline, and replacing this octane is not easy. It is not clear at this time if refiners will use ethanol to produce premium or will find other means of adding octane in order to avoid having to keep the premium grade of conventional gasoline segregated.

MSAT

The Mobile Source Air Toxics rule (MSAT)[15] targets toxic air emissions, but it has supply implications when MTBE is banned and ethanol is used in its place. As will be discussed below, the Northeast RFG regions are the areas mainly affected by the MSAT supply constraints. MSAT would have the largest supply implications if the entire Northeast were to ban MTBE. Under a total ban, RFG production may be reduced unless EPA is able to adjust some refinery MSAT constraints. MSAT should have much less effect with only the New York and Connecticut bans. The remainder of this section describes the MSAT constraint and explains how the New York and Connecticut bans may allow refiners to stay below the major MSAT constraint threshold as long as they keep RBOB production at a small portion of their gasoline pool.

The Clean Air Act Amendments specify toxic emission requirements for RFG. Refineries must keep toxic emissions at or below a target amount that is not refinery specific. MSAT, which went into effect in January 2002, established new toxic emission gasoline baselines for individual refineries using the baseline period 1998-2000. MSAT requires individual refineries to maintain toxic emissions at or below their individual emission levels in the baseline period. The baseline emissions for some refineries were well below the Clean Air Act Amendment requirements. These baselines "maintain current levels of over-compliance with toxic emissions performance standards that apply to Federal reformulated gasoline (RFG) and anti-dumping standards that apply to conventional gasoline (CG)."[16] Thus, the MSAT rule is also sometimes referred to as the "anti-backsliding" regulation.

[15] *Control of Emissions of Hazardous Air Pollutants from Mobile Sources*, Final Rule, 40 CFR Part 80,86.
[16] Ibid., Summary section.

MTBE bans create a disproportionate impact on some refineries that historically have used MTBE, produced gasoline with very low toxic emissions, and produced a high fraction of reformulated rather than conventional gasoline. To understand the effect on different refineries, it is necessary to understand some features of MTBE and ethanol. MTBE has high oxygen content, is relatively clean burning, and has a high octane value. MTBE is used mostly in reformulated gasoline (RFG), where the oxygen requirement of the Clean Air Act Amendments of 1990 and its clean burning properties make it a very attractive material. Although there are no easy substitutes for the volumes of MTBE being lost, ethanol is one of the materials many refiners will use. Ethanol has good octane characteristics and is relatively clean compared to many gasoline components, but it creates higher toxics emissions than MTBE. Gasoline toxic emissions increase with ethanol for several reasons. Ethanol produces more toxic material than an equivalent amount of MTBE, and other clean-burning light hydrocarbons are pushed out of the RFG blend because of ethanol's higher blending RVP. Thus, when ethanol is substituted for MTBE, toxic emissions increase and MSAT will be violated unless the refiner can take steps to reduce the toxic emissions, which may be very difficult for refiners with historically low toxic-emission gasoline (high toxic reduction baselines).

Refiners needing to reduce toxics can do so by reducing the benzene and sulfur content of the gasoline. But some refiners have already made refining changes to reduce sulfur and benzene in their gasoline to very low levels. Many East Coast refiners, for instance, use low-sulfur crude oil so their RFG already has relatively low sulfur content. As a result, they already have very clean toxic baselines, and can do little more to reduce toxics and counter the increases in toxic content when ethanol is used instead of MTBE. In order to comply with MSAT, these refiners may reduce their production of RFG, incorporating their cleanest gasoline component streams, and leaving the remaining streams for use in conventional gasoline, if the volumes of that product are large enough to dilute the material and not exceed anti-dumping and MSAT requirements.

Refineries in California producing CARB gasoline are exempt from the MSAT, and refineries in the Midwest producing RFG were using ethanol when their baselines were established, so they should not be affected. Hence, MTBE bans in these areas do not provide a basis for assessing the MSAT impact in the Northeast.

Some very clean refiners serving the East Coast have indicated that, if MTBE is banned entirely, they may have to reduce significantly the volumes of RFG they produce as a result of the MSAT restrictions. At this time, it does not appear that the Gulf Coast refineries are being constrained to the same degree as those on the East Coast. The consequence of MSAT in a case where MTBE is banned throughout the Northeast could be a net increase in the toxic content of gasoline in the Northeast over that of today. MSAT would tend to result in some relatively clean East Coast refinery RFG production (from a toxics standpoint) being replaced with RFG from "dirtier" refineries on the Gulf Coast or "dirtier" import sources filling in the volumes that the "cleaner" refineries on the East Coast are no longer producing.

Now consider supplying RFG to New York and Connecticut only. The RFG volumes affected by these two States' MTBE bans are small enough to allow refiners supplying those States to only convert a part of their gasoline to RBOB production, keeping MTBE in their remaining RFG. The remainder of their individual gasoline pools is large enough to help accommodate some the changes that must be made to the RBOB fraction of their gasoline. In addition, several refiners that previously supplied New York and Connecticut are working with the EPA to receive some adjustment to their MSAT baselines for the upcoming State bans. If successful, the relief would ease some of the production constraints they otherwise would experience when serving New York and Connecticut. The EPA relief combined with refiners only needing to produce a fraction of their gasoline pool as RBOB to serve New York and Connecticut are keeping MSAT from becoming a major constraint at this time. However, if a supply shortfall occurs, the ability of these refiners to increase RBOB production could be hampered by MSAT. As will be discussed later, the limited ability of East Coast refineries to increase production could make transition adjustments more problematic.

Loss of Flexibility

While production of RBOB for New York and Connecticut is small enough to keep from triggering major refinery production constraints, refiners likely will experience some loss of flexibility due to physical tank limitations. Refinery tanks are not usually designed to empty completely. Some material from the last batch produced is left in the bottom of the tank. As a result, many refiners dedicate tanks to particular products to prevent contamination. Producing a new gasoline type such as RBOB will require giving up an existing product or reducing the number of tanks being used for a specific product. The net result is that refiners adding RBOB to their product slate will not be as capable of surging the production and output of different gasoline products when an unexpected need arises. Such loss of flexibility contributes to delay in resolving unexpected supply-demand imbalances.

3.2 Refinery Preparation

The New York and Connecticut RFG market is only about 1/3 of the total Northeast RFG market, which moderates the challenges for East Coast refineries in providing RBOB for ethanol blending. For a refinery that has been producing RFG with MTBE, it is easier to make a partial conversion and produce some gasoline base stock to be blended with ethanol (RBOB) and some MTBE-blended RFG, than it is to produce all RBOB (assuming adequate refinery tanks to meet shipping schedules). In many cases, refiners are going to be able to produce the fraction of their gasoline needed as RBOB for the New York and Connecticut markets with little or no additional investment. However, most domestic refiners are not preparing to produce this RBOB at all of their refineries currently supplying RFG for the Northeast market.

As mentioned in Section 2, refiners partially converting to RBOB production will experience less volume loss than those converting to all RBOB. First, some of the light

ends that have to be removed from the RBOB fraction of the gasoline pool will likely be able to be put back into the refiner's MTBE-blended RFG or conventional gasoline. Second, the refiner is less likely to be constrained by the MSAT limitations, as described previously.

EIA has conferred with most of the East Coast refiners about their preparations and plans for producing RBOB for New York and Connecticut. Most of those refiners indicated they would produce at least at the current levels of RFG production that they made for these two States, and some of the refiners indicated they might be capable of a modest increase. A small number indicated that production would decline. Those refiners who might be able to increase volumes indicated the extent of any increase would be limited by MSAT considerations. Furthermore, the facilities' changes that refiners have made so far to produce RBOB have been limited to what was needed to produce the historical volumes supplied to New York and Connecticut. The net result is that RBOB supply from East Coast refineries likely will be equal to or modestly exceed current RFG supply to New York and Connecticut from these facilities.

Domestic suppliers realize that import volumes that normally serve New York and Connecticut. They are preparing to produce more RBOB for these two States than they historically supplied, but the additional volumes may fall short of the import losses. Until refiners are more certain about actual import supply, they are unlikely to make further investments. In summary, the expected RBOB volume for New York and Connecticut from domestic refineries on both the East and Gulf Coasts is about 100 percent of what they currently supply to these States plus a possible 20 to 30 percent increase.

It is not clear how refiners are preparing to supply MTBE-free conventional gasoline to New York and Connecticut. They indicated an awareness of the issue, and did not indicate any production problems. But they also did not indicate what, if any, changes were going to be needed. Several refiners and importers expressed some concern about having adequate high-octane components to make the current level of premium gasoline without MTBE, but in general, conventional gasoline was not viewed as a major problem.

New York and Connecticut are likely to experience a loss in number of suppliers, which can add to the potential for price volatility. In the long term, these two States can expect their regular suppliers to provide product to the area, but these regular suppliers are not planning to produce RBOB at all refineries that serve the Northeast. For example, some companies now supply the Northeast with MTBE-blended RFG from several refineries so that, when one of their refineries is producing less, the company's other refineries can compensate. In the future, if an RBOB-producing refinery has a problem, there may be limited excess production capability to compensate. However, of the refineries that are preparing to produce RBOB for New York and Connecticut, some should have some ability to raise RBOB production over their usual volumes.

RFG currently is produced on the Gulf Coast to supply East Coast markets. However, both by EIA estimates and as confirmed in industry discussions, the Gulf Coast RFG that flows to the East Coast is almost entirely used in RFG States south of New York and

Connecticut. It is not clear if more Gulf Coast supply will be needed when New York and Connecticut require low-RVP summer RBOB in 2004. Most refining companies now supplying product to New York and Connecticut indicated that supplying RBOB from Gulf Coast refineries is not part of their supply planning. When looking beyond the East Coast for more RBOB, most Northeast market participants look to the refiners of Atlantic Canada, the Virgin Islands, and Venezuela. There are indications that preparations are being made in some of these refineries to produce RBOB. The greatest uncertainties within this group of suppliers lie with Venezuela because of the reported difficulties that country had producing RFG this year. Venezuela may be targeting the large MTBE-blended RFG market still in demand on the East Coast, postponing a decision to produce RBOB until the market need becomes clearer.

4. Import Supply

Currently, the Northeast imports a significant amount of finished gasoline and gasoline components from Europe. Are European shippers planning to make ethanol-blended gasoline or low Reid vapor pressure blendstock to accommodate the New York or Connecticut market? If not, how will this affect the supply and price of gasoline in New York and Connecticut?

This chapter describes how gasoline is currently supplied to the Northeast states, and the different roles played by imports of finished RFG and gasoline blending components. The analysis then focuses on the supply of gasoline to the States of New York and Connecticut. Much of EIA data is on a regional PADD (Petroleum Administration for Defense District) basis, so analyzing the Northeast and individual States requires estimating flows into and between the States to achieve a historical understanding of supply-demand balances. Once the pattern of supply in the Northeast for RFG containing MTBE has been developed, the changes required to switch to ethanol-blended RFG can be analyzed.

For this study, the Northeast will be defined as EIA's New England States plus New York, New Jersey, Pennsylvania, and Delaware.[17] Delaware is included in this group because one of the refineries considered as a Northeast refinery is located in the State (Motiva, Delaware City) and because RFG is required in Delaware. The demand and supply for RFG gasoline in the Northeast and in the southern States of the East Coast are shown below in Table 2.

Table 2 shows that the refineries in the Northeast supply about half of the Northeast's RFG needs, with the other half coming mostly from imports. A small volume of RFG also comes from Gulf Coast refineries. The distinction between imports of finished RFG and gasoline blending components becomes important when estimating how New York

[17] In particular, Northeast States for this paper includes: Maine, Vermont, New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, New Jersey, Delaware, and Pennsylvania. Of these States, all but Maine and Vermont use RFG.

and Connecticut will be supplied after MTBE is banned. Table 3 shows demand and supply for several groups of States in the Northeast. These quantities are estimated using data for State destinations of imported RFG and the flow of PADD 1 RFG.

Table 2. 2002 RFG Supply-Demand Balance for PADD 1 and the Northeast

	RFG Demand	RFG Refinery Production (Excluding Blenders)	Receipts from PADD 3	RFG Finished Gasoline Imports	RFG from Blending Component Imports
Northeast States	953	463	56	209	224
Remaining PADD 1	283	0	264	19	0

Source: Demand – *Petroleum Marketing Annual 2002*, DOE/EIA 0487(2002), Table 48; Production and Receipts – Form EIA-810; Imports – Form EIA-814.
Notes: Northeast States include: Maine, Vermont, New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, New Jersey, Delaware, and Pennsylvania. Of these States, all but Maine and Vermont use RFG.

Table 3. 2002 Summary Northeast RFG Demand & Supply

Northeast RFG Demand & Supply	RFG Demand	PADD 1 RFG Production Estimated Destinations	Imported Gasoline Blending Comp-onents	Blending Comp-onents To RFG	Imported Finished RFG	Estimated Blending Component & Finished RFG Imports	Estimated Shipments from NY/NJ Ports	Estimated RFG Receipts from PADD 3
New England	346	104	6	5	176	182	60	0
NY & NJ	486	268	258	217	29	247	-60	31
PA & DE	121	90	2	2	4	6		25
Totals	953	463	267	224	209	434		56

Source: Demand – *Petroleum Marketing Annual 2002*, DOE/EIA 0487(2002), Table 48; Production and Receipts – Form EIA-810; Imports – Form EIA-814; EIA estimates.
Note: Totals may not add due to rounding

Table 3 shows that more than half of New England's supply of RFG comes from foreign refiners. The New York and New Jersey areas also receive a substantial volume of imports, but their imports are gasoline blending components. These volumes can be individual blending components, a "near RFG blend" that is not quite RFG quality, or simply RFG that has not yet been certified. The source countries for gasoline blending components are different than source countries for finished RFG gasoline. Ultimately, these source country differences provide insights into the potential initial availability of RBOB in 2004.

As shown in Table 4, in 2002, 96 percent of New England's import supply to meet RFG demand arrived as finished RFG, and only 4 percent entered the New England States as blending components. Table 5 shows that Canada, Venezuela, and the Virgin Islands supplied 86 percent of the finished RFG into New England. The RFG from these three source countries comes from a few refineries for which the U.S. East Coast represents the major part of their gasoline market. Since the East Coast is such a large part of their

market, these refineries likely will continue to supply RBOB for New York and Connecticut after the switch to ethanol.

Table 4. 2002 Gasoline Imports to the Northeast

	New England		New York & New Jersey	
Types of Imports	**MB/D**	**Percent**	**MB/D**	**Percent**
Blend Stocks	6	4	258	90
RFG	176	96	29	10
Total	183	100	288	100

Source: Energy Information Administration, Form EIA-814.
Notes: MB/D = Thousand barrels per day. Totals may not add due to rounding.

Table 5. 2002 Source Countries for Northeast Gasoline Imports

Source Countries	**New England Finished RFG Imports**		**New York & New Jersey Blending Component Imports**	
	MB/D	**Percent**	**MB/D**	**Percent**
Canada	81	46	28	11
Venezuela	36	21	8	3
Virgin Islands	34	19	0	0
Western Europe	21	12	118	46
Rest of World	3	2	103	40
Total	176	100	258	100

Source: Energy Information Administration, Form EIA-814.
Notes: MB/D = Thousand barrel per day.

The import picture is dramatically different for New York and New Jersey than for New England, and the New York/New Jersey area is the main entry point for imports serving New York and Connecticut. Of the imports coming into the ports of Northern New Jersey and the New York City area that might meet RFG needs, 90 percent are gasoline blending components. EIA estimates that 84 percent of these blending components are actually made into RFG. In 2002, gasoline blending components delivered to New York and New Jersey ports came from 36 different countries (Table 6). The country from which the area received the largest import volume was Belarus. The Netherlands and the United Kingdom also sent significant volumes.

The blending component imports are critical to the New York and Connecticut markets, but a variety of supply options are available to fill the need if imports from opportunistic suppliers fall off. The question is how difficult it might be for the system to realign to accommodate these paths. First consider the sources of RFG supply for New York and Connecticut, which are estimated in Table 7. The estimates indicate that about 116 thousand barrels per day of New York and Connecticut RFG demand, or more than 1/3 of the total RFG demand, is supplied from blending components imported into the New Jersey-New York terminal areas. Once MTBE is banned, this volume will likely come from different supply sources, particularly when summer-grade product is required.

Table 6. 2002 Source of Blending Components to New York & New Jersey

Western Europe		Rest of World	
Number of Exporting Countries	12	Number of Exporting Countries	24
Top Five Exporters	**MB/D**	**Top Five Exporters**	**MB/D**
Netherlands	22.1	Belarus	30.6
United Kingdom	21.0	Romania	10.9
France	13.8	India	10.4
Finland	12.2	Estonia	8.1
Belgium	10.2	Argentina	6.3

Source: Energy Information Administration, Form EIA-814.

Table 7. 2002 Estimated RFG Supply to New York and Connecticut

RFG Sources	Thousand Barrels Per Day	Percent
PADD 1& PADD 3 Refineries	134	42
Finished Imports	73	23
Blending Component Imports	116	36
Total	323	100

Source: Energy Information Administration estimations

Historically, New York and Connecticut could be served from volumes brought in by any one of the 36 countries bringing RFG-quality material into New York and New Jersey. EIA and the refiners and importers interviewed believe, however, that many opportunistic import suppliers currently serving New York and Connecticut will not initially shift to summer-grade, low-RVP RBOB (see *Summary of Traders' Supply Views* Box). Winter-grade RBOB, which is not as difficult to produce, will likely have more suppliers, but as of September 2003, refiners and importers with whom EIA has spoken indicated that they have seen no preparation in Europe to provide such material next summer.

Summary of Importers' and Traders' Supply Views

The traders and importers with whom we spoke had several common themes:

- No one can pin point from where RBOB will be sourced. No preparations are being made in Europe to provide summer RBOB, outside the major refiners for their integrated systems.
- The Unocal Patent is more difficult to blend around when using ethanol. Blenders are still working the issue for summer RBOB.
- Reduction in New York and Connecticut market liquidity will likely create increased volatility and sharp differentiation between gasoline prices in adjacent states.
- Most import suppliers will wait for clear price signals before isolating or upgrading gasoline streams suitable for summer RBOB.

Suppliers of small volumes, or opportunistic suppliers, of RFG to New York and Connecticut will have strong incentives to see what RBOB prices will be before committing to low-RVP RBOB production. Many of today's importers supplying New York and Connecticut only provide occasional cargoes, as implied by the country import volumes shown in Table 6. Of the 36 countries importing blending components into New

York and New Jersey in 2002, most supplied less than 5 thousand barrels per day. In most cases, refiners have to make some minor investments to change fractionation capability for refinery streams in order to produce the low-RVP RBOB or components for RBOB. The investments will likely be almost as great for a refinery producing 5 thousand barrels per day as one producing 30 thousand barrels per day. Furthermore, the investment is for material unique to the United States. Thus, the foreign refinery will earn no return on that investment from the gasoline supplied to its other customers. Keep in mind that these refiners still have markets for their MTBE-blended RFG. As a result, many of the opportunistic blending component import suppliers, which provide the bulk of New York area imports, will have a strong incentive to wait and see what RBOB economics will be compared to moving product to other markets before committing to production of low-RVP RBOB.

Lack of preparation by opportunistic suppliers to produce low-RVP RBOB is consistent with what occurred when Chicago-Milwaukee changed to Phase II RBOB in 2000. Few refineries outside of the Midwest made the modest equipment changes needed to produce this unique gasoline blend. Only a very few Gulf Coast refiners made the changes and those were refineries that send gasoline to the Midwest on a regular basis. EIA expects many opportunistic importers such as those in Europe to wait until after the transition before making any changes. If price incentives appear adequate to justify the investment, they will then re-enter the New York and Connecticut markets. But consistent with the situation in the Midwest, EIA expects the number of suppliers able to supply these two States in the future to be less than were historically available.

While many import suppliers may stop supplying New York and Connecticut, EIA and industry representatives see various other ways that these States can be supplied after the MTBE bans go into effect. As previously discussed, producing winter-grade RBOB is not as difficult as producing summer-grade RBOB. There is a possibility that, when the summer gasoline season begins, changes in supply sources will require significant logistical realignments. The following illustrations show the variety of potential solutions should net imports of blending components to New York and Connecticut be less than historical volumes:

- **Increases from PADD 1**: The East Coast refiners are preparing to produce RBOB for New York and Connecticut and may provide increased volumes compared to current RFG levels. However, as indicated previously, MSAT limits and other market requirements will mean that the added volumes may fall well short of the volume of RFG the two States required to fulfill demand.

- **Increases from PADD 3**: While most refiners have indicated that they will not supply RBOB to New York and Connecticut from the Gulf Coast, a small number do plan to take this path. These Gulf Coast volumes would provide for an increase in supply.

- **Increases from dedicated import sources**: About 130 thousand barrels per day of finished RFG is currently imported into Maine, New Hampshire,

Massachusetts and Rhode Island. The largest import sources are refineries in Atlantic Canada, the Virgin Islands (Hovensa), and Venezuela. Some of these refineries are among the world's most capable, and they will provide low-RVP RBOB to New York and Connecticut. The volumes supplied, however, will depend on the economics. A higher price for RBOB in New York Harbor than for RFG in Boston, for instance, could cause RBOB to move from Atlantic Canada to New York and MTBE RFG to move from New York Harbor to Boston to replace the decreased flow from Canada.

In summary, the supply scenario for meeting the low-RVP RBOB demand will likely require a considerable realignment of supply involving increased supplies from several refining areas and added economic incentive to bring about that realignment. It is not possible to compile a New York and Connecticut supply-demand balance for summer 2004 based solely on volumes that EIA knows refiners are planning to supply. Twenty to thirty percent of supply is in the speculative category of what some refiners, both domestic and foreign, might or should be able to do. Supply will be found, but how high an incentive will be required to bring about the changes in supply patterns and how long it will take, given the substantial volumes involved, are uncertainties that indicate a potentially difficult transition.

5. Total Gasoline Supply Impacts

The New York Mercantile Exchange has expressed serious concerns about the impact on overall regional gasoline fungibility and prices associated with the MTBE bans in New York and Connecticut. Will the transition from MTBE to ethanol in New York and Connecticut reduce the overall supply of gasoline in the Northeast? If so, how will this transition affect other Northeastern States?

The view of EIA is that after the transition from MTBE-blended RFG to ethanol-blended RFG for New York and Connecticut, gasoline supply to the Northeast will still be adequate to meet demand. However, the sources of supply will be different, which will change supply logistics. Changes in supply patterns may take time, and short-term supply problems may be encountered in the transition process. Currently, imports of RFG and blending components for RFG production supply 46 percent of the Northeast RFG market, and for the States of New York and Connecticut imports of blending components and RFG serve almost 60 percent of demand. Much of the supply uncertainty for New York and Connecticut stems from the 36 percent of New York and Connecticut RFG supply that is currently produced from blending component imports brought into the ports in the northern New Jersey and New York City areas. There is a widely held view among industry personnel that many of the historical import sources for that material will not prepare for RBOB production and thus will not initially be able to provide the low-RVP RBOB next summer. The blending component importers not preparing may simply seek new markets in other areas of the Northeast, leaving New York and Connecticut to other suppliers in the long term.

Many in industry point out that the potential loss of low-RVP summer RBOB from some import sources can be made up by more production from refineries on the East Coast, Canada, the Virgin Islands, and on the Gulf Coast. There clearly are refineries that can produce the summer RBOB, but how many will be prepared and will be making the low-RVP RBOB next March and April is not clear. Supply has not yet been committed since actual market need and economic incentives to attract alternative supplies are currently unknown.

Assessing the supply situation for the MTBE ban transition in New York and Connecticut is much different than it was for California or for the Phase II change to low-RVP ethanol RFG gasoline in the Chicago-Milwaukee area. In both of those cases, nearly all of the supply came from regional refineries that primarily supplied their own company needs. By contrast, much of the retail volume in the Northeast is provided through exchanges, purchases from merchant refiners[18], and imports. Then there are firms with distribution and wholesaling businesses including Gulf/Cumberland Farms, Warren Equities, Getty and Sprague. These firms are significant players in the gasoline business in New York and Connecticut, yet produce no gasoline themselves. While some of their supply is known, uncertainty remains over how many of their typical import sources may be committed to next summer's RBOB market. The uncertainties revolve around the following issues:

- Some importers see a decline in their availability of blending components for RBOB production in summer 2004. They, however, do see the potential for other sources to replace the volumes they will not provide and express the view that their customers, who are not wholly dependent on them, are no doubt lining up supply from other sources.

- The Northeast is different from California and the Chicago-Milwaukee areas, where most gasoline was produced and delivered to retail in the same region. In those cases, EIA could assess if refining companies would make and provide the gasoline to their branded outlets. In the case of New York and Connecticut, some companies have a large number of outlets that are supplied mostly, sometimes entirely, by product that is imported or obtained on exchange. Under these circumstances, it is more difficult to gauge the level of assurance that supply will be adequate.

- Some East Coast refiners indicate they will have the capability to make more RBOB than the volume of RFG they now supply to New York and Connecticut. Their current New York and Connecticut volumes are largely produced for other sellers, and it is unclear to these refiners how much RBOB volume they might be called upon to provide next summer. Thus, they cannot provide us with likely

[18] An exchange is when Company A agrees with Company B to provide Company B's retail stations with volumes from Company A's terminal in exchange for Company B providing equivalent volumes from Company B's terminal to Company A's market. Thus, all terminals do not have to carry all types of products. Merchant refiners sell most of their product to marketers outside of their own company. In many cases, they have few, if any, of their own retail outlets.

2004 volume estimates. The same is true for potential volumes from Gulf Coast refineries.

- When adding the information together, EIA can account for about 70 to 80 percent of needed supply for New York and Connecticut from sources that look fairly certain. At this time, EIA was not able to determine supply sources for about 20 to 30 percent of the RBOB needed in these two States. This does not mean these two States will experience a 20 to 30 percent shortfall. It does indicate that the probability of some shortfall is higher than if closer to 100 percent of the potential demand volumes could be identified at this time.

If there is an initial shortfall in New York and Connecticut, other regions in the Northeast can expect to see prices increase as well, although probably not as severely. While supply of MTBE-blended RFG should be plentiful, the logistical changes that would occur to remedy the shortfall of low-RVP RBOB would likely spill over into other regions. For example, Canadian refiners now send much supply into the New England States, but they may be capable of producing extra RBOB to supply New York and Connecticut, should the need arise. They would shift their New England volumes to New York and Connecticut, and other importers would shift their supplies to the New England States. That shift could leave New England supplies tight for a brief period and elevate prices.

Another spillover effect may occur. Currently the Gulf Coast refineries are providing some high-quality gasoline blending components to California. Gulf Coast refiners that can produce low-RVP gasoline for California would also be able to provide summer-grade RBOB for New York and Connecticut. If New York and Connecticut prices are high enough, they may attract some of the Gulf Coast volumes to the Northeast that previously would have gone to California. In addition, refiners in Atlantic Canada, Virgin Islands, and Finland all provided product to California in 2003, but may focus on nearby New York Harbor in 2004 if the economics dictate this shift.

6. **Logistics**

What changes were made to the overall gasoline distribution system (e.g., pipelines, storage tanks and truck rack distribution terminals) to accommodate the increased use of ethanol in the Northeast?

The State of New York not only bans MTBE use in gasoline, but it prohibits the shipment and transport of MTBE through the State. What will the impact be on gasoline supply and fungibility if refiners are unable to ship gasoline containing MTBE through the State of New York?

6.1 Historic Gasoline Movements to New York and Connecticut

Gasoline makes its way from refineries to New York and Connecticut through several major routes. Much gasoline enters through the New York Harbor area at a major terminal hub located in New Jersey, west of the Arthur Kill waterway that separates Staten Island and New Jersey. This terminal area receives product by pipeline from the East Coast refineries in the Philadelphia area and from Gulf Coast refineries. It also receives ocean-going vessels bringing in finished gasoline and gasoline blending components from foreign refineries. The New Jersey terminal area is the primary hub supplying RFG to metropolitan New York and Long Island. Conventional gasoline also moves from this hub by pipeline across Pennsylvania and up to terminals in the western New York cities of Binghamton, Syracuse, Rochester, and Buffalo. Conventional gasoline is barged from this hub to Albany, New York and RFG is barged to New Haven, Connecticut and other New England ports. Conventional gasoline for New York is also sent directly from the Philadelphia refiners to the Buckeye Pipeline connection near Allentown, Pennsylvania to move into northern and western New York.

Connecticut gasoline is primarily supplied by water to New Haven. The Buckeye Pipeline then moves it north through the State to various terminals around Hartford. This pipeline extends to Springfield, Massachusetts, bringing RFG to the middle part of that State. The New Haven, Connecticut port receives ocean-going vessels from foreign countries as well as from the New York Harbor area. Some product is also be brought into Connecticut by water to Bridgeport and by truck from the marine terminal in Providence, Rhode Island.

6.2 Changes to the Distribution System

Many different companies are involved in changes to the distribution system to handle the switch from MTBE- to ethanol-blended gasoline. Most product movements in the Northeast occur on pipelines and barges which are owned and operated by third parties, and are delivered to terminals again run by third parties. A significant volume of product is distributed via exchanges and buy/sell contracts. Custody, as well as ownership, of a given barrel of gasoline can change several times during the product's movement from a refinery to a retail station. As a result, individual companies do not have physical control over product handling for the most part. For example, product sold at an Exxon station may have been produced at a merchant refinery, such as the ConocoPhillips Bayway refinery in Linden, New Jersey, and delivered by a third party to a terminal owned and operated by yet another company, before being delivered to the Exxon retail outlet, which may be owned by Gulf/Cumberland Farms. While the product specifications meet Exxon's requirements, that company is neither producing nor delivering nor selling the product. Nor is the refinery that produces the product even controlling the distribution. This makes it difficult to ensure that all the links in the distribution chain are lining up.

Ethanol Movements

Ethanol will be moved separately from gasoline as it travels from its production plants in the Midwest to major terminal hubs in the Northeast. Both water and rail will be used for this leg of the journey. After arriving at major terminal hubs, it will be barged or trucked to truck rack terminals, where it will be blended with RBOB to produce ethanol-blended RFG. No major supply issues were identified concerning ethanol availability. It is still too early to determine if trucking availability will be an issue. The changes needed at terminals to store and blend the ethanol are discussed below.

Planned Terminal Changes

When New York and Connecticut ban MTBE, the primary gasoline delivery system will change. Additional products will now be carried at the major terminal hub in New Jersey. In addition to the products carried in 2003 (multiple grades of conventional gasoline and MTBE-blended RFG), this hub will accommodate ethanol and different types of RBOB (e.g., a fungible RBOB that can be blended with any level of ethanol from 5.7 percent to 10 percent, or RBOBs that must be blended at a specific percent, such as RBOB than can only be blended with 10 percent ethanol.).

When speaking with suppliers, EIA found frequent concern about the increased number of products they expect pipelines and blending terminals to handle. The pipelines will need to dispose of the increased amount of interface that is generated between each grade of product being shipped,[19] and the sequencing of all the grades will become more complex. At the blending terminals, the issue is to avoid getting MTBE into the RBOB that is earmarked for ethanol blending. Often, several tanks are filled by a common line from the manifold, and one line is used for several different product transfers. Appropriate line-flushing procedures and dedicated tanks will have to be established in many areas. No mention was made of investments needed to handle these issues. The current plan is to deal with the additional grades of product by changing the operating methods.

Concern was also expressed among terminal operators about contaminating ethanol with water. Assuming water does not get into the ethanol barge and railcar shipments, the other source of water would be from the RBOB itself. Water is inadvertently introduced into the distribution system at many different points, but it always accumulates in the bottom of the tanks at the truck-loading terminals. The tanks are filled slowly at the start of each delivery and allowed to settle to get the water out of the product going to the truck-loading rack. Most of the water is then drained from the bottom of the tank through a water-draw pipe. During periods of tight product supply arising from a lack of

[19] Batches of different products are shipped one after the other through these pipelines. Where one product interfaces with another, there is some mixing of the two. A small amount of this mixed material, called transmix, can sometimes be absorbed into one of the products, where the small volumes of transmix are diluted adequately to not create a problem. Any remaining volumes of transmix are removed for reprocessing to separate the two materials when necessary. Pipelines operate to minimize the volume of transmix.

available product or disruptions in the distribution system, tank inventories would be low. Suppliers would want to move product more quickly, which could increase the risk of disturbing the water in the tank bottom and decrease the time for settling. The current plan to deal with this issue is through operational safeguards rather than increased investments.

EIA found little mention of new tankage investment in the New York Harbor area. Terminal operators are planning to handle the additional products by reallocating existing tanks to store RBOB and ethanol. Terminals carrying more products without additional tanks will have lower average inventory levels for each product. The greatest change in operations will be how the tanks may be used. Historically, tank use was switched from product to product as needs changed. Now some tanks may need to be devoted to MTBE-free gasoline and ethanol, which would require new approaches for system operators and some loss of flexibility.

Most of the predictable terminal investment required to handle ethanol will be at the truck-loading terminals where the ethanol is delivered and blended with the RBOB. This investment is focused on installing blending equipment. Construction is in progress at many of the terminals that will be blending ethanol and many terminal operators seem to be looking at mid-November 2003 to complete all construction. Tracking terminal readiness is difficult because, in most cases, the product supplier is not the terminal operator. While no one EIA interviewed indicated any terminal construction problems, most companies were cautionary. Construction permitting, as well as the availability of contractors, is expected to be timely, but the terminal work is just accelerating at this time, and it is too early to know if the strain on available permitting and construction resources will become an issue.

The companies EIA interviewed that will be receiving barged ethanol felt appropriate arrangements were being made by barge operators to deal with water contamination issues. Recall that ethanol has an affinity to water. If a barge with some water on the bottom is filled with ethanol, the ethanol will pull the water into the liquid. This ethanol-water mixture cannot then be mixed with gasoline.

Unanticipated Terminal Changes

The terminal changes that are now occurring are based on estimates about how much volume of RBOB and ethanol will flow through different distribution channels. Even if all planned terminal construction and scheduling changes are finished on time, additional unpredictable needs may become apparent during the transition. As discussed previously, the supply sources may shift significantly from what has occurred historically and what is being planned, particularly when the summer transition occurs. For example, should blending component imports for New York and Connecticut decline from opportunistic suppliers in Europe, supply from other areas would likely increase. If Gulf Coast suppliers begin to send more product to the Northeast, it may be moved by Jones

Act tankers[20] from the Gulf Coast, which have limited capacity, or through the Colonial Pipeline, to eventually reach Linden, New Jersey. Such shifts require significant scheduling and handling changes.

If receipts of ethanol by truck cause congestion at the truck rack terminals and impede the loading of gasoline shipments to the service stations, then modifications would become necessary. Similarly, pipeline operators do not currently see the need for physical changes to their pipelines. However, if they incur problems sequencing all the different grades of product, then they would need to invest in additional facilities or alter the way they operate, which would be difficult, as mentioned earlier.

Changes at Retail Outlets

The use of ethanol in the Midwest and California has given many companies experience in the changeover that needs to occur at retail outlets. Many are or will soon be holding educational sessions for retail operators in New York and Connecticut on the changes they need to make. Retail stations are the last leg of the distribution chain to prepare for the transition, and several transition problems could occur at this level of the distribution system.

It is our understanding that converting to ethanol-blended fuel at retail stations in New York requires bringing in pumping trucks to remove any remaining MTBE-blended gasoline and any sediment and water before introducing ethanol-blended RFG into the stations. Scheduling and handling the large number of stations that need to be pumped before the first load of ethanol-blended gasoline is added will be a challenge, particularly if everyone is trying to do this during a short time period. New York and Connecticut may wish to consider enforcement discretion at the retail level to allow for resolution of temporary problems in an orderly manner.

6.3 New York Transshipment Issue

New York's MTBE ban does not explicitly prohibit transshipment of product through the State, but the language leaves industry uncomfortable.[21] A letter[22] that was issued by the New York legislators who sponsored the ban indicated "it was never the Legislature's intent to ban the transshipment of MTBE products through the State to surrounding States." But the uncertainty in the legislation remains, and the industry would prefer that the uncertainty be removed by adding language to explicitly address both transshipments and allowable trace quantities of MTBE , which is also not included in the current

[20] The Jones Act and associated statutes requires that vessels used to move cargo or passengers between U.S. ports be owned by U.S. citizens, built in U.S. shipyards, and staffed by U.S. citizen crews.
[21] 2000 N.Y. Laws Ch. 35. The pertinent language is that "No person shall import into, or sell, dispense or offer for sale any gasoline which contains methyl tertiary butyl ether." The issue evolves around the definition of "import."
[22] Letter issued May 29, 2003 by Carl Marcellino, 5th Senate District, and Thomas DiNapoli, 16th Assembly District of New York.

legislative language. The main transshipment area of concern involved water shipments through New York Harbor. However, most companies with whom EIA spoke felt this was not likely to be a major issue. Product that travels through the State by land should also not be an issue. The only product EIA was able to identify that would be affected by land movement was conventional gasoline delivered to Vermont, which only uses conventional gasoline. Since New York's conventional gasoline will not contain MTBE, EIA expects product being delivered to Vermont would also not contain MTBE.

7. Prices

Given all the factors discussed in the previous questions, what are the expected costs to consumers associated with blending ethanol in gasoline sold in the Northeast? Please delineate the costs between winter and summer gasoline blends.

Two costs to consumers must be considered. The first is the potential for price volatility, particularly during transitions, and the second is the long-run equilibrium price.

7.1 Price Volatility

The experiences of California and Chicago-Milwaukee when making changes to new fuels indicate that the Northeast may see increased price volatility as New York and Connecticut switch from MTBE to ethanol. California and the Chicago-Milwaukee areas saw price swings as high as 30 or 40 cents per gallon during fuel transitions. The Northeast is facing two significant transitions in 2004 related to the shift from MTBE. The first is January 2004, when the New York and Connecticut MTBE bans are scheduled to begin. At that time, winter-grade gasoline, which is easier to produce than summer-grade, will be in use. However, as previously described, many elements of the supply chain will be unknown until the program starts. Mismatches between supply and demand will become evident quickly and the system will realign, but it may take some time to realign. The longer it takes to move supply and demand back into balance, the higher prices will rise.

The second transition, which will occur when the Northeast moves from winter- to summer-grade gasoline, could be more difficult. Although the industry will have the lessons of the January transition to help during the summer transition, new issues will likely arise. Normally, East Coast refiners would begin production of summer gasoline in April to ensure terminal compliance by May 1. Retail facilities are required to be selling summer-grade gasoline by June 1. (Refiners on the Gulf Coast or from distant import sources could begin production as early as March if they were supplying contracts for the beginning of the summer season.) EIA expects to see fewer suppliers that are able to produce summer-grade RBOB than winter-grade. As a result, the system may have to realign again. This time there will be fewer suppliers to respond. If more supply must come from the Gulf Coast, for example, two issues will delay the full resolution of the problem. First, even assuming the Gulf Coast refiners can produce extra RBOB quickly,

the material takes almost 3 weeks to reach the Northeast. Second, very little Gulf Coast supply is now being used to meet RFG demand in the Northeast, which means delivery patterns must change substantially. When a new supply route must be established, the effects can ripple through the distribution chain. Such shifts could be expected to result in spillover effects into other areas of the Northeast. There is no way of knowing in advance of the transition where all bottlenecks might appear, how much additional supply may be needed, or how long it will take for new supply flows to rebalance the system.

After the transitions, New York and Connecticut could see more price volatility than in the past for many of the same reasons California and the Chicago-Milwaukee areas have seen increased volatility. New York and Connecticut will have fewer suppliers available to meet their needs than in the past, and some of the nearby suppliers on the East Coast may be constrained in their ability to increase production of RBOB when an unexpected need arises. The "surge" capacity is likely to be some distance away, which means unexpected supply-demand imbalances may take longer to resolve than in the past.

EPA has defined different types of RBOB based on the type and amount of oxygenate that must be added to the material to produce finished RFG.[23] The existence of different RBOBs and their associated regulatory requirements can also delay response to an unexpected supply-demand imbalance. For example, refineries can produce a specific RBOB that is designed for blending only with 10 percent ethanol (refinery-specified RBOB). Refiners are required to track and ensure through testing that this refinery-specified RBOB retains its quality and that the correct amount of oxygenate is eventually added. This ensures that the finished gasoline, created after the ethanol is added, will meet RFG requirements. This RBOB could not be easily diverted to another buyer where the refiner does not have tracking and testing arrangements.

EPA has also defined a more fungible RBOB. The refinery can produce an "any-oxygenate" RBOB, which has the flexibility of meeting RFG specifications using various ethanol volumes (e.g., 5.7 percent, 7.7 percent, 10 percent). The any-oxygenate RBOB does not require the contractual and quality assurance steps of the refinery-specified RBOB, since the finished gasoline will remain within RFG requirements if 5.7 percent ethanol is added or if 10 percent is added. Since the any-oxygenate RBOB does not require the refiner to track and test this material from the refinery through to blending, it is the only RBOB that can be sold into the spot market. The flexibility of the any-oxygenate RBOB means it must meet the most stringent emission requirements, and it is thus more expensive to produce.[24] If refiners do not produce much of the fungible any-oxygenate RBOB, spot volumes of RBOB may be scarce, which reduces market flexibility.

Any-oxygenate RBOB and less fungible refinery-specified RBOBs must be kept segregated. If a refiner has found it economic to produce a refinery-specified blend, it cannot divert the refinery-specified material to a market where it cannot track and test the

[23] Code of Federal Regulations, Title 40, Volume 13, Revised July 1, 2001, Section 80.69.
[24] For purposes of certification, MSAT and other calculations, the refiner must assume 2 percent by weight ethanol is added, which translates to about 5.7 percent by volume, regardless of what is eventually added.

RBOB through the system to the point after the ethanol is added. Furthermore, tank capacity limitations, either at the refinery or at terminals, could keep the refinery from being able to quickly switch to and deliver any-oxygenate RBOB. Thus, the flexibility to produce more and move RBOB quickly to relieve a supply-demand imbalance may be more limited than when using MTBE-blended RFG, which is fungible.

Supply-demand imbalance problems are likely to be greatest in New York and Connecticut following the bans, since finding extra supplies of RBOB to fix any shortfalls will be more difficult than finding MTBE-blended RFG for the remainder of the Northeast. As a result, price surges in those two States are likely to be higher than in the rest of the Northeast, but the higher prices will provide large incentives for suppliers to go to extraordinary means if necessary to bring in product. Other areas in the Northeast may also experience increased volatility as a result of the change. Terminals in New York and possibly Connecticut that serve areas outside of those two States will now be carrying MTBE-blended RFG, RBOB and ethanol. Thus, the amount of MTBE-blended RFG immediately available will be reduced, which can result in more price volatility in the MTBE-blended RFG market.

7.2 Long-term Equilibrium Price Effects

In addition to increased short-term volatility, in the long term, underlying costs to provide RBOB to New York and Connecticut would be higher than providing MTBE-blended RFG (see *Northeast Refinery Costs to Produce RBOB* Box). While refining and distribution costs are expected to increase in general, the potential change in suppliers with their different underlying costs makes estimation of the potential price impact difficult.

In California and the Chicago-Milwaukee areas, it was appropriate to study the added cost of regional refiners as an indication of how prices would likely change when shifting to a low-RVP RBOB. New York and Connecticut are different in that the marginal price-setting suppliers lie outside the region. Historically, East Coast refineries produced all the MTBE-blended RFG gasoline they could and delivered it to the Northeast and other parts of the East Coast. Export refineries supplied almost all the remainder of Northeast needs, which

Northeast Refinery Costs to Produce RBOB
Refineries in the Northeast will not likely see much higher production costs for producing a small amount of RBOB for New York and Connecticut than for producing MTBE-blended RFG. Winter-grade RBOB is very similar to MTBE-blended gasoline. Northeast refiners' costs may not increase much. While summer RBOB is more expensive to produce, Northeast refiners may not experience large cost increases in this case either. During the summer, some of the light components being removed from the RBOB to reduce its RVP may be shifted to MTBE-blended RFG or conventional gasoline, helping to keep costs down. In general, if East Coast refiners do not have to produce a large fraction of their gasoline pool as RBOB, they may be able to avoid the major constraints that increase costs when having to produce larger fractions of RBOB. As a result, when the market is in equilibrium (i.e., not responding to a supply-demand imbalance) the Northeast refineries are not likely to be the marginal suppliers (i.e., price determining suppliers).

means they were able to produce and deliver MTBE-blended RFG or RFG blending components more cheaply to the Northeast than were refineries on the Gulf Coast. The shift to RBOB may radically alter that supply situation. Some of the historically "inexpensive" sources of imports are expected to drop out of the New York and Connecticut markets, with Gulf Coast supply filling the gap. This alone implies higher costs and therefore higher long-term prices without knowing the specific underlying cost structures. Furthermore, this dynamic indicates that the relative prices of ethanol and MTBE will have very little to do with the change in price to consumers. The marginal cost producer of RBOB will drive price, but what that cost will be is highly uncertain.

While the Northeast is different in many ways from the Chicago-Milwaukee area, prices in that Midwest market may still provide some insights into what long-run equilibrium cost increases might be. After the transition to low-RVP Phase II RFG in 2000, the Midwest had several years of increased price volatility.[25] In 2002, the Chicago-Milwaukee market was relatively calm. As a result, 2002 prices provide some indication of a long-term equilibrium price relative to prices prior to Phase II RFG. An inspection of summer-season spot prices from 1996 through 1999 compared to 2002 indicates that Chicago-Milwaukee prices may have increased from 5 to 9 cents per gallon[26] over what would have been the case had the region not had to switch to the low-RVP RBOB. During the winter months, when Phase II RBOB RVP is higher, RBOB is not as hard to make and prices seem to be similar to prices for Phase I RBOB.

If only New York and Connecticut require ethanol-blended gasoline, the small volume needed and large number of suppliers that eventually may provide product would imply that the price impact would likely be at the lower end of the Chicago-Milwaukee range. Ironically, the large number of suppliers that can provide product to New York and Connecticut may ultimately help to keep long-run equilibrium costs lower than in the Midwest, but this same factor is adding much uncertainty to the transition and could result in more short-term volatility in 2004. In the short-term opportunistic export refiners are expected to be reluctant to invest in this small market, creating turmoil while the market realigns; however, over the long term after the market economics become evident, the ease with which many refiners can access the Northeast provides much opportunity for the most efficient refineries to serve that market. Thus, we would expect to see cost increases closer to 5 cents per gallon than 9 cents per gallon during the summer in the long run, and very little difference in the winter.

Winter gasoline would see cost effects due to the logistical changes required (as would the summer gasoline), but the long-run equilibrium storage and distribution costs to

[25] The RBOB that the region used during the Phase I requirements did not require as low an RVP during the summer, and more refiners could produce the Phase I product.

[26] The analysis was based on comparing two Chicago RBOB differentials (the difference between Chicago-Milwaukee RBOB and Gulf Coast RFG and between Chicago RBOB and New York RFG), which were averaged over the summer gasoline production season (May through September 15) in the years 1996 through 1999 with the 2002 summer average price.

accommodate the MTBE bans are expected to be small. EIA noted in a previous paper[27] that terminal and retail conversions to carry and blend ethanol into gasoline when amortized probably add less than 1 cent per gallon to costs. In addition, the changes to shipping and trucking that may occur in the Northeast could add slightly more cost. For example, some suppliers indicated they might have to use dedicated barges (i.e., barges that can only ship one product), which cost more that a barge that can be used to carry more types of products, and thus can be used more efficiently. Also, dealing with more segregated products generally lowers the efficiency of a system designed to handle fungible products. Still, the long-run equilibrium distribution system cost effects are likely to be in the range of 1-2 cents per gallon, and some of these costs will be felt by MTBE-blended RFG in the Northeast as well.

In summary, as long as refiners only need to produce a small share of their gasoline pool as RBOB, the underlying costs and experiences in Chicago-Milwaukee imply that winter-grade ethanol-blended gasoline would likely experience very little increase in long-run equilibrium costs (perhaps 1 cent per gallon). Summer gasoline would be expected to be more expensive, but there is much uncertainty in this cost. It is not clear what the marginal supply source for New York and Connecticut RBOB will ultimately be. However, Chicago-Milwaukee prices, combined with the large number of suppliers that can get product to New York and Connecticut, would imply that summer increases over MTBE-blended RFG would be about 5 cents per gallon.[28] These estimate for long-run winter and summer price impacts assume that the existing ethanol tax credits are extended indefinitely. Without such an extension, price impacts would be 3.1 to 5.1 cents per gallon higher in both seasons, depending on the percentage of ethanol used in RFG.

7.3 NYMEX

The futures market provides price transparency and adds flexibility to petroleum product trading. Suppliers can hedge physical barrels, for example, to minimize losses (while capping profits). Currently the New York Mercantile Exchange (NYMEX) futures contract is written for Phase II Complex Model Reformulated Gasoline, with delivery into New Jersey, having been changed recently from delivery into New York due to New York's MTBE ban. For a futures contract to be successful, a large volume of trading interest must exist. Thus, an RBOB contract for New York Harbor might not attract adequate volume to be successful.

While the uncertainty in the Northeast market affects the NYMEX contract, the current RFG NYMEX contract, based in New Jersey, still promises to hold sufficient liquidity, in that it will still be a hedging tool for States along the entire Eastern Seaboard, exclusive

[27] Energy Information Administration, *Review of Transportation Issues and Comparison of Infrastructure Costs for a Renewable Fuels Standard*, September 2002, Table 1, page 7, http://www.eia.doe.gov/oiaf/servicerpt/fuel/pdf/question3.pdf

[28] EIA estimated in other studies that the cost ethanol-blended RFG under a full MTBE ban or an 87 percent ban would be close to 10 cents per gallon higher than MTBE-blended RFG. The higher costs result from the higher volumes triggering refinery constraints not experienced when only New York and Connecticut ban MTBE.

of New York and Connecticut. The RBOB (ethanol-based) producers and customers, on the other hand, will have no futures contract by which to hedge their market risk[29]; or, in the case of foreign blending component suppliers, no transparent means for "locking in" the delivered value of their products. It can be argued that other OTC instruments will quickly be created to fill the void. But these instruments are not as transparent and may not have much liquidity.

One of the implications for Northeast RBOB suppliers is that even when a price spike occurs, it may be more difficult to attract cargoes from long distances. A refinery in Europe may not have the means to lock in profits from the increased prices, and thus it faces the risk of losing money if, by the time its cargo arrives, prices have collapsed. This has the effect of prolonging price spikes when they occur.

8. Emissions

California has experienced a higher number of ozone alert days in 2003 relative to recent years. Ethanol has a high propensity to evaporate, leading to the emission of ozone-forming particles. Should the Northeast be concerned that it too may see an increased level of ozone formation as a result of the use of ethanol?

Emission issues fall under the purview of the Federal Environmental Protection Agency (EPA) or under State environmental departments. The EIA does not review or analyze emission issues such as this. We can, however, refer to a letter written by Secretary Winston Hickox of the California EPA to Senator Dianne Feinstein addressing this issue. In particular, it noted:

> All of the causes of this year's increased ozone are not yet known. In the two weeks since you wrote, the ARB [Air Resources Board] has not had sufficient time to fully determine the role that ethanol-blended gasoline has played relative to other factors. We do know that weather conditions have played a very important role, and that increased use of ethanol-blended gasoline has increased emissions over what they otherwise would have been. That said, I also think it is fair to point out that the impact of ethanol-gasoline blends, while significant and of great concern in California's ongoing efforts to reduce ozone, is not large enough to explain the majority of air quality deterioration that occurred in the SCAQMD [South Coast Air Quality Management District] this summer. [30]

The letter went on to say that, while the impacts of ethanol's role in emission increases could not be precisely quantified, the staff's "current best estimate is that the increase in

[29] RBOB suppliers can hedge on the current gasoline contract, but with increased basis risk (i.e., the risk that RBOB price cannot be predicted with certainty from the MTBE-blended RFG price).
[30] The letter was published on web at: http://feinstein.senate.gov/hickox-letter-8-1-03.htm

the use of ethanol-blended gasoline has likely resulted in about a one percent increase in emissions of volatile organic gases (VOC) in the SCAQMD in the summer of 2003."

9. Potential Regulatory Issues

9.1 Uncertain Regulations

Regulatory uncertainty, both at the State and the Federal levels, may have contributed to delays in preparation for the New York and Connecticut MTBE bans. Initially the lack of definition for acceptable trace levels of MTBE and the silence on whether product containing MTBE cold be moved across New York and Connecticut created large incentives to wait and see if clarification would be forthcoming. Connecticut has since clarified its position, but New York has not yet amended its law or issued a regulation to reduce the uncertainty. Trace elements of MTBE will likely remain in the gasoline system. For example, minute amounts of MTBE can be in RBOB delivered from import vessels that also carry MTBE-blended product. The volume of trace material allowed affects supply planning. Terminals that carry MTBE products as well as RBOB may have to install different equipment or even new tanks if allowable trace elements are so small as to prevent standard line washing techniques from removing adequate amounts of MTBE. Not knowing what will be allowed provides incentives to wait and see if clarification will be forthcoming to avoid unnecessary or uncompetitive investments.

At the Federal level, the potential legislation to remove the oxygen requirement for RFG provided strong incentives for industry to wait until the last minute to adjust refineries and arrange for ethanol contracts. Even terminal planning was affected, as non-oxygenated RFG still must be kept segregated from RBOB and ethanol.

9.2 Planning Ahead for Temporary Relief

This is the first time New York and Connecticut have undergone a major fuel change in isolation. Several areas of enforcement discretion, therefore, may merit consideration in advance of the transition. Because retail stations are the last part of the supply chain to be changed, some initial enforcement discretion at the retail level may help ease the transition locally.

At the Federal level, consideration might be given to exploring what actions could be taken to increase movement flexibility of refinery-specific RBOB if supply problems evolve. For example, an RBOB that can only be blended with 10 percent ethanol must be certified and tested along its path from the refinery through to where the ethanol is added to ensure it is not inadvertently mixed with other product and that the correct amount of ethanol is added. Unlike any-oxygenate RBOB, this 10-percent-ethanol RBOB must stay within the production refinery's certification paths to be able to follow current testing and certification procedures. This diminishes the ability to move RBOB to where it may be

most needed during a supply-demand imbalance. The question to be addressed is whether a more flexible certification process could be established, or whether a temporary procedure could be used if a shortage existed.

10. Conclusions

New York and Connecticut are facing the potential for price volatility during their transitions to ethanol-blended RFG in 2004. If price volatility during major fuel transitions in California and Chicago-Milwaukee are any indication, prices could surge 30 to 40 cents per gallon for brief periods. The largest supply problems may arise when the region moves in the spring to low-RVP summer-grade gasoline, which is harder to make. While domestic suppliers seem to be ready to produce their historical volumes for sale into the two States, opportunistic import suppliers, which comprise a significant share of the market, will have large incentives to wait and see if economic incentives are adequate to merit the investment. At this time, EIA cannot account for approximately 20 to 30 percent of likely supply of RBOB expected to be required by New York and Connecticut next summer. If import volumes fall short, volume flows from other areas will likely make up the difference, but these flows will require significant shifts in the distribution system from flows that are now occurring. This could delay resolution of any supply problems long enough for prices to surge. After the transitions are complete, the long-term equilibrium price during the summer months might be in the range of 5 cents per gallon higher than MTBE-blended RFG. However, this estimate is highly uncertain.

At this time, ethanol supplies are being lined up, terminals are preparing to change their operations, and truck rack terminals are adding blending equipment. Blending terminals are on track to be ready in time for the January bans, but timing will be close, and any unforeseen delays in construction or permitting could interfere with their readiness. East Coast production of RBOB will begin by November; the Buckeye Pipeline will not accept MTBE-containing gasoline beginning November 9; and any Gulf Coast refineries supplying RBOB will begin production in early October. EIA was not able to identify any preparation problems at this time, but finding affected parties is difficult. The distribution chain between refiners and blending terminals is owned by different parties, which makes it difficult to check on readiness and to ensure that all the appropriate links are aware of and proceeding with needed changes.

Delaying implementation of these bans would not remove much of the uncertainty that could create transition problems. The largest issue is supply from opportunistic importers, who are waiting for implementation to make their decisions. It is also unclear if domestic suppliers would reverse their ongoing actions and abandon investments made towards producing ethanol-blended RFG in January 2003.

This report highlights issues arising from the need to segregate MTBE- and ethanol-blended gasoline, which would have been avoided had all the Northeast RFG-consuming States banned MTBE at one time. But other, perhaps much more severe, supply

problems could have occurred had all the Northeast States banned MTBE in 2004. While New York and Connecticut represent about one-third of the Northeast RFG market, the other two-thirds provides some supply flexibility. Various suppliers may initially hold back from the New York and Connecticut RBOB markets, but other suppliers may switch from supplying MTBE-blended RFG markets to supplying RBOB to New York and Connecticut if the need arises. This flexibility would not exist if the entire region moved to ethanol-blended RFG at one time. Furthermore, the RFG volumes affected in New York and Connecticut are small enough to keep from triggering major refinery constraints. For example, under a Federal ban, refiners would not be able to use much of the gasoline components volume they had to remove from RBOB in their remaining gasoline. Also under a Federal ban, a number of refiners on the East Coast would be producing a large portion of their gasoline pool as RBOB (versus the small portion needed for just New York and Connecticut), which will push them up against Mobile Source Air Toxics rule constraints, causing them to reduce RFG production.
While the New York and Connecticut MTBE bans may result in a difficult transition with increased price volatility, the transition would likely be less problematic than if the entire Northeast banned MTBE at one time.

While dealing with an MTBE ban in only New York and Connecticut would be less challenging than a ban across the entire Northeast at this time, a progressive one-state-at-a-time series of MTBE bans would also create problems. Each transition would require storage and delivery changes, and supply sources could continue to shift, potentially leaving the region in a continuous state of transition for years, with associated price volatility. If other States in the region want to ban MTBE, the transition in New York and Connecticut may provide insights into the best way for the area to proceed.

APPENDIX A. Letter Requesting the Northeast Analysis

ONE HUNDRED EIGHTH CONGRESS

Congress of the United States

House of Representatives

COMMITTEE ON GOVERNMENT REFORM
2157 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515–6143

MAJORITY (202) 225–5074
FACSIMILE (202) 225–3974
MINORITY (202) 225–5051
TTY (202) 225–6852

www.house.gov/reform

August 6, 2003

The Honorable Guy F. Caruso
Administrator
Energy Information Administration
Department of Energy
1000 Independence Ave, S.W.
Washington, DC 20585

Dear Administrator Caruso:

On July 2, 2003, the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs held a hearing to review California's transition from Methyl Tertiary-Butyl Ether (MTBE) to ethanol in its gasoline. At the request of the Subcommittee, the Energy Information Administration (EIA) completed a detailed study of the effects of this transition on gasoline supply and prices in California. Your report and testimony at the hearing were extremely helpful in explaining the challenges that California faced and faces in executing the transition.

During the hearing, you were asked to characterize the progress that two other States - New York and Connecticut - have made in making the same transition from MTBE to ethanol. Both of these States must phase-out MTBE by the end of 2003. We are writing to request that EIA complete a similar study on progress that New York and Connecticut have made in phasing out MTBE and phasing in ethanol use in their gasoline supply. The study should address the following questions:

1. How are Northeast refiners preparing for the increased difficulty in refining the low Reid Vapor Pressure blendstock associated with ethanol blending?

2. What changes were made to the overall gasoline distribution system (e.g., pipelines, storage tanks, and truck rack distribution terminals) to accommodate the increased use of ethanol in the Northeast?

3. The State of New York not only bans MTBE use in gasoline, but it prohibits the shipment and transport of MTBE through the state. What will the impact be on gasoline supply and fungibility if refiners are unable to ship gasoline containing MTBE through the State of New York?

4. The New York Mercantile Exchange has expressed serious concerns about the impact on overall regional gasoline fungibility and prices associated with the MTBE bans in New York and Connecticut. Will the transition from MTBE to ethanol in New York and Connecticut reduce the overall supply of gasoline in the Northeast? If so, how will this transition affect other Northeastern States?

5. What adjustments will the East Coast refinery system need to make to accommodate the New York and Connecticut MTBE bans?

6. Currently, the Northeast imports a significant amount of finished gasoline and gasoline components from Europe. Are European shippers planning to make ethanol-blended gasoline or low Reid Vapor Pressure blendstock to accommodate the New York or Connecticut market? If not, how will this effect the supply and price of gasoline in New York and Connecticut?

7. Given all the factors discussed in the previous questions, what are the expected costs to consumers associated with blending ethanol in gasoline sold in the Northeast? Please delineate the costs between winter and summer gasoline blends.

8. California has experienced a higher number of ozone alert days in 2003 relative to recent years. Ethanol has a high propensity to evaporate, leading to the emission of ozone forming particles. Should the Northeast be concerned that it too may see an increase level of ozone formation as a result of the use of ethanol?

We recognize that a study of this scope could take several months to complete. However, please provide the Subcommittee with a preliminary report by September 29, 2003. Please hand-deliver this report to the Subcommittee majority staff in B-377 Rayburn House Office Building and the minority staff in B-350A Rayburn House Office Building. If you have any questions about this request, please contact Dan Skopec at 225-4407. Thank you for your attention to this request.

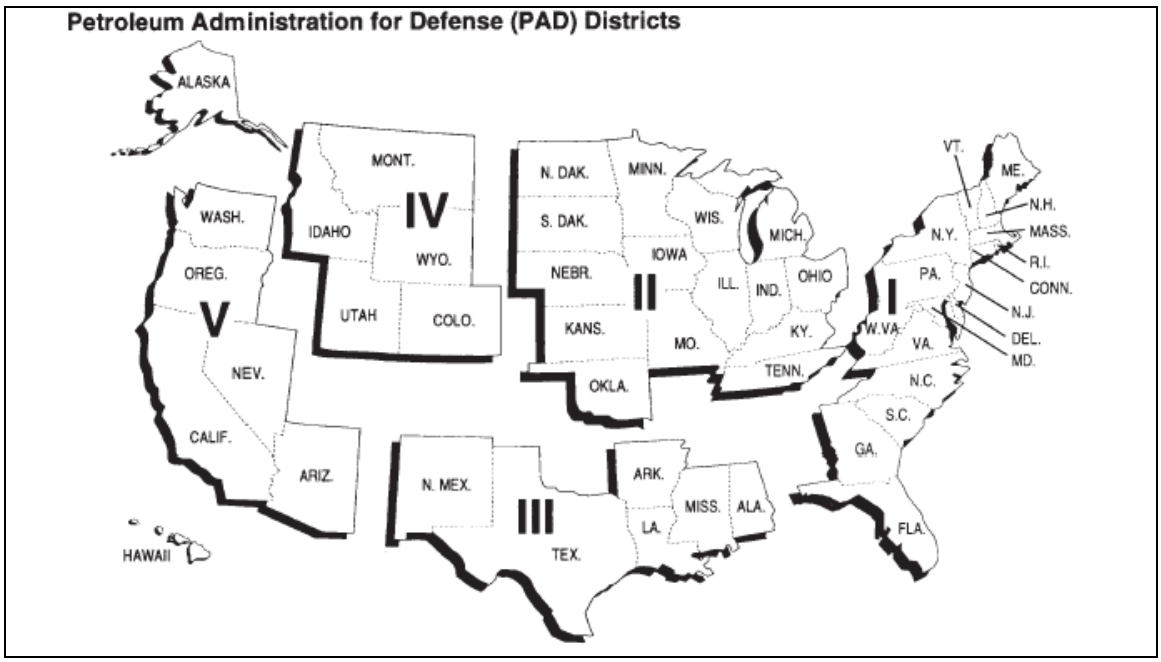
Sincerely,

Doug Ose
Chairman
Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs

Christopher Shays
Vice Chairman
Committee on Government Reform

cc The Honorable Tom Davis
The Honorable Henry Waxman
The Honorable John Tierney

APPENDIX B. Petroleum Administration for Defense District (PADD) Definitions



PADD 1

Connecticut, Delaware, District of Columbia, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia.

New England is a subdivision that contains Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

For this study, a **Northeast subdivision** was discussed that included: Maine, Vermont, New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, New Jersey, Delaware, and Pennsylvania. Of these States, the following use RFG: New Hampshire, Massachusetts, New York, Rhode Island, Connecticut, New Jersey, Delaware, and Pennsylvania.

PADD 2

Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, Wisconsin.

PADD 3
Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas

PADD 4
Colorado, Idaho, Montana, Utah, Wyoming

PADD 5
Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington

APPENDIX C. Glossary

Alkylate: The product of an alkylation reaction. It usually refers to the high-octane product from alkylation units. Alkylate is used in blending high-octane gasoline.

Alkylation: A refining process for chemically combining isobutane with olefin hydrocarbons (for example, propylene, butylenes) through the control of temperature and pressure in the presence of an acid catalyst, usually sulfuric acid or hydrofluoric acid. The end product is alkylate, an isoparaffin, which has high-octane value and is blended with motor and aviation gasoline to improve the anti-knock value of the fuel.

Aromatics: Hydrocarbons characterized by unsaturated ring structures of carbon atoms. The basic ring has six carbon atoms and is shaped like a hexagon. Heavier aromatics with two or more hexagonal rings with common sides (polycyclic aromatics) are also present in gasoline; some are formed during combustion. Some aromatics are ozone forming; some are toxic. Benzene and polycyclics are toxic; xylenes and some of the more complex aromatics are active ozone formers. Commercial petroleum aromatics are benzene, toluene, and xylene.

Benzene: A hydrocarbon of the composition C_6H_6 and the initial member of the aromatic or benzene series. Its molecular structure is conceived as a ring of six carbon atoms with double linkage between each alternating pair and with hydrogen attached to each carbon atom. Benzene is a minor constituent of most crude oils and is produced mainly by the catalytic reforming of petroleum naphthas and from the various cracking processes. Benzene is a toxic compound.

Nitrogen Oxides – NO_x: Chemical compounds containing nitrogen and oxygen; reacts with volatile organic compounds in the presence of heat and sunlight to form ozone. It also contributes to acid rain.

Octane Number: A number used to indicate gasoline's antiknock performance in motor vehicle engines. The two recognized laboratory engine test methods for determining the antiknock rating, i.e., octane rating of gasoline, are the Research method and the Motor method. To provide a single number as guidance to the consumer, the antiknock index (R + M) /2, which is the average of the Research and Motor octane numbers, was developed.

Olefins: Olefins are highly reactive unsaturated organic compounds (that is, the carbon atoms in the molecule are able to accept additional atoms such as hydrogen or chlorine). Some are present in gasoline as a result of refinery manufacturing processes such as cracking. Some are created in the engine during combustion; most of these can be removed in the catalytic converter. They tend to be ozone formers and toxic.

RBOB: Reformulated gasoline blendstock for oxygenate blending. This is the base mixture of gasoline components that is created at refineries and shipped to blending terminals to be blended with ethanol. It becomes finished gasoline when the ethanol has been added.

Reformate: The product of the reforming process which runs at high temperature with a catalyst to convert paraffinic and naphthenic hydrocarbons into high octane stocks, primarily aromatics suitable for blending into finished gasoline.

Reid Vapor Pressure (RVP): A measure of product volatility, measured in pounds per square inch (psi). The higher the RVP, the more volatile a gasoline is and the more readily it evaporates.

Volatile Organic Compounds (VOCs): Organic compounds which participate in atmospheric photochemical reactions.