

STATE OF CONNECTICUT  
EXECUTIVE CHAMBERS  
HARTFORD, CONNECTICUT  
06106

JOHN G. ROWLAND  
GOVERNOR

April 22, 2002

The Honorable Christine Todd Whitman  
Administrator  
U.S. Environmental Protection Agency  
Ariel Rios Building  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460

Dear Administrator Whitman:

Pursuant to the authority provided in Section 211(k)(2)(B) of the Clean Air Act, the State of Connecticut plans to formally request a waiver of the federal reformulated gasoline (RFG) program's requirement that complying fuels contain a minimum of 2 percent oxygen by weight. The RFG program provides important public health benefits to the residents of Connecticut. While we are committed to maintaining the full measure of these clean air benefits, Connecticut is equally committed to protecting its precious water resources. MTBE, the additive used to meet the oxygen mandate, presents an unacceptable risk to the state's drinking water. Consequently, I signed into a law a provision that bans the use of MTBE as a gasoline additive beginning October 1, 2003.

Absent relief from the oxygen mandate, Connecticut will be faced with a de facto ethanol mandate since ethanol is the only oxygenate available to satisfy the mandate in place of MTBE. Connecticut supports a national increase in the use of renewable fuels balanced with a reasonable phase-in of renewable fuels. While ethanol appears certain to play a growing role in Connecticut gasoline, I have serious concerns regarding the public health impacts associated with the mandatory use of this additive in the summertime. My technical staff at the DEP will develop documentation to demonstrate that a summertime ethanol mandate will generate more air pollution and interfere with Connecticut's ability to attain the National Ambient Air Quality Standards for ozone and fine particulates. The attached document describes the adverse air quality impacts that would result under an ethanol mandate. In addition, I point your attention to the enclosed technical studies that have been conducted by our regional air and water quality associations, Northeastern States for Coordinated Air Use Management (NESCAUM) and New England Interstate Water Pollution Control Commission (NEIWPC). These studies, commissioned by the New England Governors Conference, provide detailed analysis of the issues surrounding MTBE and ethanol in gasoline.

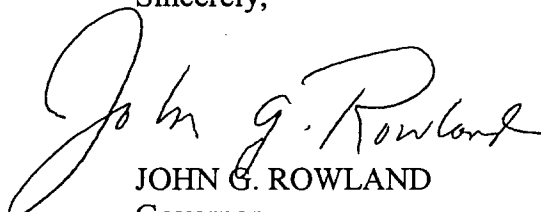
While air quality concerns are paramount in this request, I am also concerned about the negative economic impacts of requiring large quantities of ethanol in Connecticut regardless of cost. Significant infrastructure enhancements would be needed to transport, store and blend ethanol into gasoline. Further, there is considerable uncertainty regarding the ethanol industry's ability to produce sufficient quantities of competitively priced ethanol in the near-term. In these economic times, I believe that we all must be highly sensitive to the impact that our action or inaction will have on the public.

EPA demonstrated sensitivity to these concerns when acting to protect states in the upper Midwest from price spikes related to the use of ethanol in their fuel. As you recall, during the summer of 2000, gasoline prices in the Midwest increased more than 25 cents per gallon in less than a month. While there are several factors that may have played a role in the Midwest gasoline price spikes, the use of ethanol based RFG certainly contributed to the price increase. I request that the same sensitivity be afforded to states like Connecticut that seek to maintain reasonable gasoline prices without sacrificing environmental benefits.

In a clear demonstration of regional consensus, this past summer the other New England Governors and I issued *A Resolution Regarding the Phase Down of MTBE and Lifting the Oxygen Mandate under the Federal Clean Air Act* (see attached). In the resolution, we called on Congress to lift the oxygen mandate. We also made it clear that pending such action by Congress, the EPA should grant individual state requests to waive the RFG program's oxygen requirement.

No state should be forced to choose between clean air and clean water or between public health and environmental protection. It is simply not possible to protect air quality, water quality and Connecticut consumers absent relief from the oxygen mandate. As the date of Connecticut's MTBE ban is rapidly approaching, I urge EPA to evaluate this petition thoroughly and expeditiously.

Sincerely,



JOHN G. ROWLAND  
Governor

JGR/JF/emw/rs  
Enclosures

## Technical Rationale for Connecticut's Oxygen Waiver Request

### Introduction

Connecticut, along with several other states that participate in the federal reformulated gasoline (RFG) program, has taken action to ban Methyl Tertiary Butyl Ether (MTBE) as a fuel blendstock. Connecticut's MTBE ban, like those in other states, was enacted to address the unacceptable risk that MTBE poses to groundwater and potable resources. These concerns are effectively documented in the study and final Report of the Blue Ribbon Panel on oxygenates and gasoline that was conducted by the U.S. EPA and released in July of 1999. Information specific to the risks posed by MTBE in Connecticut and the Northeast region can be found in the study performed by the Northeast States for Coordinated Air Use Management (NESCAUM) entitled *RFG/MTBE Findings & Recommendations*.

MTBE bans leave ethanol as the only additive produced in sufficient quantities to meet the RFG mandate that complying fuels contain two-percent oxygen by weight. In Connecticut, the oxygen mandate will result in 75 to 135 million gallons of ethanol entering the State's gasoline pool each year. The use of significant quantities of fuel ethanol will degrade the air quality of Connecticut.

Compared to MTBE and non-oxygenated fuels, gasoline containing ethanol will increase emissions of volatile organic compounds (VOCs), oxides of nitrogen (NO<sub>x</sub>) and several air toxics, particularly during the summer "ozone season." Increases in these pollutants will interfere with the state's ability to attain and maintain the federal ozone standard and undermine on-going efforts to reduce the public health risk from mobile source toxics. In spite of the tremendous improvements in air quality achieved over the last couple of decades, Connecticut has not yet attained the one-hour ozone standard and faces a difficult challenge to design a control program to meet the eight-hour standard. Preliminary data from 2001 ozone season show that the one-hour standard was exceeded on nine days in Connecticut, which includes seven days that the one-hour standard was exceeded in the New York City metropolitan area (which includes Fairfield County, CT). There were twenty-six days this past summer when the eight-hour ozone standard was exceeded in Connecticut. We also face the prospects of meeting a new fine particulate matter (PM<sub>2.5</sub>) standard. Given that nitrates are a precursor to PM<sub>2.5</sub>, any increase in NO<sub>x</sub> emissions associated with the introduction of large quantities of fuel ethanol will also interfere with Connecticut's ability to meet that National Ambient Air Quality Standards (NAAQS).

The adverse air quality impacts associated with ethanol usage can be diminished by exempting states and the petroleum sector from the use of ethanol in RFG during the summer months. Key to enabling an environmentally acceptable use of ethanol is granting a state's requested relief from the RFG program's oxygen requirements. According to the Clean Air Act, EPA can waive RFG's oxygen content requirement upon a demonstration that the presence of these compounds, at certain levels, prevent or interfere with a state's ability to attain or maintain a federal air quality standard.

The following discussion outlines the legal and technical arguments that require EPA to grant the state relief from the RFG program's 2 percent by weight oxygen requirement.

### The Legal and Administrative Process for Obtaining a Waiver

EPA has provided little guidance or interpretation of the statutory language in §211(k)(2)(B) of the Clean Air Act, which states:

*(t)he Administrator may waive, in whole or in part, the application of [the oxygenate requirement] for any ozone nonattainment area upon determination by the Administrator that compliance with such a requirement would prevent or interfere with the attainment by the area of a national primary ambient air quality standard.*

The statute's explicit allowance for EPA to grant state waiver requests on the basis of "interference," with attainment indicates that Connecticut need not demonstrate that the impacts of the oxygen requirement alone will prevent attainment or maintenance of a NAAQS. Instead, we must demonstrate that the oxygen mandate is obstructing or delaying attainment or maintenance of a single NAAQS. Connecticut must demonstrate that the use of ethanol to meet the oxygen requirement will increase emissions of the very pollutants that must be reduced in order for Connecticut to attain the current and imminent ozone and PM NAAQS.

Since a failure to decrease NO<sub>x</sub> and VOC emissions is cause for EPA sanctions, demonstrating a significant increase in these pollutants must be understood to interfere with attainment under §211(k)(2)(B). Connecticut's state implementation plan (SIP) demonstrates that in aggregate, a host of discrete control measures will bring the state into attainment of the ozone NAAQS according to the timelines set forth in the Clean Air Act. RFG is a primary component of Connecticut's effort to reduce emissions from motor vehicles, the largest source of ozone-forming pollutants in the state. Connecticut is legally obligated to achieve those reductions claimed in the SIP. The loss of projected benefits from any SIP control measures, such as limiting the effectiveness of the RFG program, must be offset by comparable reductions through other measures. Connecticut has implemented other emission control measures that have resulted in substantial reductions but there are not feasible measures to achieve additional significant reductions from stationary sources. Therefore, emission reductions must come from the mobile sector. Projected emissions increases associated with the oxygen mandate will interfere with Connecticut's ability to attain the ozone standard in a timely fashion. In a waiver request, the state will demonstrate that a measurable increase in ozone precursor pollutants would occur as a result of enforcing the RFG program's oxygen requirements in the presence of an MTBE ban.

### Air Quality Basis for the Waiver

The state will show that the oxygen mandate adversely affects Connecticut's ability to control emissions of the NO<sub>x</sub> and VOCs, the primary ozone precursors. Wide-scale

replacement of MTBE with ethanol will result in increased emissions from vehicles operating on either RFG or conventional gasoline. Moreover, off-road gasoline equipment from jet-skis to lawnmowers will experience emission increases when ethanol is present in gasoline. These increases would come from: (1) tailpipe emissions; (2) evaporative emissions; and (3) indirect emissions from transporting hundreds of millions of gallons of ethanol to the Northeast by truck, barge and rail. The need for a waiver is predicated on the cumulative impact of excess emissions from all these sources. Under this weight of evidence approach, all potential sources of increased emissions will be explored and quantified, to the extent possible.

### Increased Tailpipe Emissions

#### *Waiver Basis #1: Increased NO<sub>x</sub> Emissions not Captured in the Complex Model*

The Phase II RFG regulations require refiners to achieve a 6.8 percent reduction in NO<sub>x</sub> and a 27.4 percent reduction in VOC emissions compared to 1990 levels, as calculated by EPA's Complex Model. Refiners will have to make other formulation changes to offset any increased tailpipe emissions associated with the addition of ethanol. However, there are data showing that the Complex Model, which is based on 1990 vehicle emissions and information, does not fully capture the effects that oxygenates, particularly ethanol, have on emissions from the current fleet of vehicles. Existing test data indicate that NO<sub>x</sub> emissions from some newer technology vehicles increase with ethanol. These studies show that oxygenates increase NO<sub>x</sub> emissions in a non-linear fashion. Little effect is seen until the oxygen content exceeds 2 percent by weight; beyond the 2 percent level, these studies show significant NO<sub>x</sub> increases. The data quantifying these effects, drawn from studies that included newer vehicles, are missing from the Complex Model. The effect appears to be particularly strong when ethanol is used as the oxygenate; with studies indicating that NO<sub>x</sub> emissions may be more than 3 percent higher with ethanol as the oxygenate.

While the Complex Model does not fully capture the emission increases caused by oxygenates, these excess emissions can exacerbate ambient ozone concentrations. Consequently, Connecticut contends that the oxygen mandate creates a NO<sub>x</sub> shortfall, since a portion of the emission reductions assumed in our SIP for the RFG program do not exist in the real world. Though it may be technically possible to remedy this shortfall through new fuel formulations that include oxygenates, a waiver of the minimum oxygen content requirement will allow our state to overcome these adverse impacts in a more timely and cost-effective manner. Denial of Connecticut's waiver request would interfere with our ability to make up the shortfall and attain the one-hour ozone standard by 2007, as required by the CAA.

Using available studies, Connecticut will document the increased NO<sub>x</sub> emissions that will occur from today's fleet of modern vehicles and seek to employ the California predictive model which incorporates some of these newer data to quantify the excess NO<sub>x</sub> emissions that will occur absent relief from the federal oxygen requirement.

## Changes in Evaporative Hydrocarbon Emissions

The potential for changes in evaporative emissions due to the wide-scale replacement of MTBE with ethanol is likely to be more significant than the potential for changes in tailpipe emissions. However, these emission increases are difficult to quantify precisely. The federal RVP limits for summertime gasoline will constrain the potential increase in direct evaporative emissions from vehicles. However, the large-scale replacement of MTBE with ethanol to comply with the RFG program's minimum oxygen requirement could impact overall evaporative emissions by:

1. increasing evaporative emissions due to front-end volatility parameters that are not captured by refiner compliance models;
2. raising overall volatility when ethanol and non-ethanol blends are inadvertently *commingled* in vehicle fuel tanks; and
3. increasing fuel permeation through fuel lines and hoses and potentially impairing the performance of onboard vapor recovery systems.

### *Waiver Basis #2: General Increases in Evaporative Emissions*

Increased evaporative emissions occur with ethanol blends compared to hydrocarbon (HC) fuels even when RVP is matched. Fuels with ethanol tend to increase front-end volatility parameters (i.e., the percentage evaporative emissions at 130 degrees F), even when both fuels have the same RVP. These volatility parameters are not included in the Complex Model, but are correlated with evaporative emissions that occur when the vehicle fuel system is heated above 100 degrees F during driving. Since fuel tanks can approach 120-130 degrees F on hot, summer days, conditions exist where ethanol fuels will have measurably higher evaporative emissions than equivalent HC fuels. Further, these emission increases would occur on days when the threat of an ozone episode is greatest.

Connecticut will present data that quantify the evaporative emission effect that ethanol has compared to HC blends. Using the projected fuel formulations discussed previously to establish the levels of ethanol expected in waiver and non-waiver scenarios, the state will estimate the evaporative HC increases that would occur on days when weather patterns are conducive to ozone formation. More evaporative emissions lead to more reactive mixing in the air that, on hot summer days, is most conducive at forming ground level ozone. Also, increased evaporative emissions would impair other states' (i.e., eastern Massachusetts and Rhode Island) ability to achieve compliance with the 1-hour ozone standard since they are marginally over the standard now and this increase could further delay their ability to attain the ozone standard.

### *Waiver Basis #3: Commingling*

For areas with both RFG and conventional gasoline, the inadvertent commingling of ethanol and non-ethanol blended gasolines in automobile fuel tanks may result in significant increases in VOC emissions. Ethanol-blended RFG can be formulated to meet

stringent RVP limits, at a cost, however, if even a small amount of it is subsequently mixed with a gasoline that is not similarly formulated for low RVP, the volatility of the overall mixture will increase. This would be the case if ethanol-blended RFG and conventional gasoline were inadvertently mixed in a vehicle fuel tank. It would also occur when MTBE and ethanol-based RFG are mixed, which will occur unless all states ban MTBE. Both of these scenarios are likely in Connecticut given the regional nature of the fuel distribution system in the Northeast. For example, this issue would be particularly problematic under a scenario where ethanol blends were used in Connecticut, conventional gasoline used in upstate New York and federal RFG containing MTBE sold in Massachusetts and Rhode Island. Contrary to EPA's determination in California, we will demonstrate, based on travel patterns and projected ethanol sales patterns that the commingling issue in Connecticut will be mitigated if the waiver is granted.

The potential emission impacts of fuel commingling have been explored in a number of studies. The Energy and Environmental Research Center at the University of North Dakota recently measured the RVP characteristics of a series of mixtures composed of non-ethanol gasoline and 10 percent ethanol blends (E-10). The unpublished results confirm that commingling increases RVP and evaporative hydrocarbon emissions. RVP increases were most pronounced when E-10 constituted 5 to 35 percent of the overall mixture; the effect was less pronounced when the ratio of E10 to non-ethanol blended gasoline exceeded 50 percent. Gasoline with an overall ethanol content of 2 percent by volume (achievable, for example, by mixing 20 percent E10 with 80 percent non-ethanol blended gasoline) showed RVP increases ranging from 0.66 to 0.93 psi over the base fuel RVP. According to the Complex Model, an RVP increase of 0.93 psi would increase VOCs by 14 percent, primarily from increased evaporative hydrocarbon emissions, for a typical summertime fuel in the Northeast.

An EPA study by Caffrey and Machiele estimates that the aggregate impact of commingling could increase RVP by 0.1 to over 0.4 psi "depending on assumptions for the market share of ethanol-containing gasolines, consumers' brand loyalty, and the distribution of fuel tank levels before and after refueling events." Caffrey and Machiele further concluded that RVP increases from commingling approach a maximum when the market share for ethanol blends reaches 30 to 50 percent, and decline thereafter as ethanol blends account for larger market shares.

To demonstrate commingling, Connecticut will:

- (1) Project fuel formulations for both RFG and Conventional Gasoline (CG) markets. Once MTBE is banned, both RFG and CG markets will likely increase the use of ethanol as an octane enhancer. How much is used in each market and when during the year ethanol is used will be substantially affected by the presence or absence of the oxygen mandate. Other factors such as whether states allow the 11b. RVP relaxation in CG will also be evaluated.

- (2) Assess how much commingling takes place between RFG and CG markets. This task will require either regional studies or well-grounded assumptions on the refueling behavior of consumers, especially in Connecticut which borders RFG and conventional gasoline markets. It will also be necessary to examine interstate driving behavior that takes travelers through different markets in the Northeast; and
- (3) Predict total increases in VOCs. Studies such as the Caffrey and Machiele study will provide a base for putting these data points together for emissions estimates.

Waiver Basis #4: *Other Evaporative Emissions Increases: Outside Vehicle Fuel Tanks, at Fueling Stations, from Non-Road engines, and via Impairment of On-Board Vapor Recovery (ORVR) Systems*

There are numerous smaller sources of emissions increases that will be caused by increasing the amount of ethanol in gasoline, from the impairment of various vapor recovery systems to increased evaporative emissions from non-road engines. Some of these effects have been studied. Others will need additional assessment to accurately quantify the impact.

The emission impacts of changes in fuel volatility will be limited to an extent by the presence of Stage II vapor recovery systems at refueling stations and increasingly by the advent of advanced on-board evaporative control systems. New “on-board vapor recovery” systems use carbon canisters to trap vapors from the fuel tank and are extremely effective at reducing evaporative emissions, achieving removal efficiencies as high as 98 percent. Such systems were introduced on new vehicles in 1998, but are not expected to fully penetrate the Northeast fleet until 2014, as much as a decade after Connecticut has phased out MTBE.

In all cars, even those without on-board vapor recovery, ethanol blends produce increased evaporative emissions from lines and hoses and from the engine crankcase. Ethanol molecules not only evaporate more readily than other fuel constituents, they are relatively small and hence more easily permeate rubber, plastics, and other materials found in components of the fuel delivery system. This may explain why, in hot soak evaporative hydrocarbon emissions tests for a car equipped with on-board vapor recovery, the reduction efficiency of the on-board system drop from a baseline of 98.7 to 96.3 percent when using a 10 percent ethanol blend. Recent data from several automakers suggests that the permeation effect is far greater than earlier believed. Finally, a related and perhaps more important issue concerns the potential for ethanol blends to degrade the performance of on board vapor recovery systems over time. Specifically, it has been suggested that ethanol blends could reduce the working capacity of the carbon canisters used in these systems because of ethanol’s propensity to be tightly held by activated carbon and its tendency to attract water.



Ethanol may also effect the efficiency of Stage II enhanced vapor recovery (EVR) controls, though this potential impact will have to be explored in more depth.

Finally, gasoline is used in a variety of nonroad engines, including motor boats, jet skis, and lawn and garden equipment. Evaporative emissions from these engines are already relatively high and ethanol blends may exacerbate this problem. Unlike automobiles, the engines used in this equipment are not equipped with on-board vapor recovery systems. Further, their fuel tanks are not Stage II compatible. This effect is being explored by EPA's Office of Transportation and Air Quality.

### **Emissions Increase Due to the Transport of Ethanol**

#### *Waiver Basis #5: Emissions Associated With the Transport of Ethanol to and within the Northeast*

A final category of emissions impacts associated with the wide-scale use of fuel ethanol in Connecticut relates to the transport of ethanol from production centers in the Midwest to gasoline distribution terminals in Connecticut and elsewhere in the Northeast. At present ethanol is not shipped via pipeline due to its affinity for water. Instead, ethanol is likely to be transported to the region by truck, barge, and rail.

Connecticut will demonstrate the impact of transporting ethanol by determining how much ethanol would be demanded both with the waiver and without the waiver. The state will use the calculations in NESCAUM's report, *Health and Economic Impacts of Adding Ethanol to Gasoline in the Northeast States*, to determine how much additional transportation would be required and how much this would increase emissions.

### **Summary**

Connecticut will demonstrate that the 2 percent oxygen requirement in RFG causes excess emissions of precursor pollutants that interfere with Connecticut's ability to attain and maintain the ozone NAAQS. As outlined above, there are several different bases for demonstrating that the oxygen requirement, in the presence of the state's ban of MTBE, will result in increased emissions of ozone precursors. The weight of evidence to be outlined in a waiver request will demonstrate that the oxygen requirements of the RFG program interfere with Connecticut's ability to fulfill its requirements under the Clean Air Act.

## NEW ENGLAND GOVERNORS' CONFERENCE, INC.

RESOLUTION NUMBER 158

### A Resolution Regarding the Phase Down of MTBE and Lifting the Oxygen Mandate under the Federal Clean Air Act

WHEREAS, the New England Governors' Conference, Inc. (NEG) Committee on the Environment has endorsed the report entitled *Health, Environmental, and Economic Impacts of Adding Ethanol to Gasoline in the Northeast States*, prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) and the Northeast States for Coordinated Air Use Management (NESCAUM), and the following conclusions from the study:

- *MTBE (methyl tertiary-butyl ether) has been beneficial to air quality* -The use of RFG (reformulated gasoline) in the Northeast has provided substantial reductions in smog forming emissions and has drastically reduced emissions of benzene and other known carcinogens found in vehicle exhaust.
- *MTBE has been harmful from a water quality perspective*- The unique characteristics of MTBE pose an unacceptable risk to the region's groundwater.
- *Economic implications of eliminating MTBE* - MTBE and ethanol are the only two oxygenates currently produced in quantities sufficient to meet the demand created by the RFG program. Therefore, under current federal law, eliminating MTBE represents a de facto mandate for ethanol. The consequences of introducing hundreds of millions of gallons of ethanol into the region's gasoline pool will have significant economic impacts. Conservative estimates cite potential increases of the cost of gasoline in the range of 3-11 cents per gallon; and

WHEREAS, MTBE has been the primary additive to fulfill the oxygenate requirement in the region, and in states that have passed legislation requiring a ban on gasoline containing MTBE, ethanol serves as a de facto mandate to meet a state's requirement for RFG;

**NOW, THEREFORE, BE IT RESOLVED** that the New England Governors' Conference, Inc. acknowledges the need for a coordinated strategy that includes congressional action to lift the oxygen mandate for RFG, and pending effective Congressional action, US EPA should grant individual state requests to waive the RFG program's oxygen requirements; and


**BE IT FURTHER RESOLVED** that in an effort to continue to pursue the mutually important goals of clean water and clean air, the New England Governors' Conference, Inc. directs its Committee on the Environment to work with their respective stakeholders to pursue a

coordinated regional phase down of MTBE and establish an air toxic performance standard based on actual reductions achieved by RFG; and

BI: IT FURTHER RESOLVED that the New England Governors will instruct their respective responsible agencies to develop a model waiver request and technical support documentation for interested states to utilize in pursuing a waiver of oxygen mandate; and

BI: IT FURTHER RESOLVED that the New England Governors' Conference, Inc. directs its Committee on the Environment to diligently explore opportunities to develop local sources to produce fuel ethanol from cellulosic biomass in the region.

ADOPTION CERTIFIED BY THE NEW ENGLAND GOVERNORS' CONFERENCE, INC. ON August 7, 2001.

  
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John G. Rowland  
Governor of Connecticut  
Chairman