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Commonly Available Ethanol and MTBE Gasoline Blends Do Little to Reduce Smog

WASHINGTON -- The two principal types of oxygen additives used in reformulated gasolines in the United States contribute little to reducing ozone pollution, says a new report by a committee of the National Research Council. In a study undertaken to examine the differences between the additives ethanol and methyl tertiary-butyl ether (MTBE), the committee found that reformulated gasoline made with ethanol is less effective, but that the overall impact of either oxygen additive on reducing ozone -- a major component of smog -- is very small.

"Motor-vehicle emissions of chemicals that form ozone pollution have decreased in recent years," said committee chair William Chameides, Regents Professor of Earth and Atmospheric Sciences at the Georgia Institute of Technology, Atlanta. "But that's largely because of better emissions control equipment and components of reformulated gasolines -- other than oxygen additives -- that improve air quality. Although additives do reduce some pollutants from motor vehicles emissions, the oxygenates appear to have little impact on lowering ozone levels. Moreover, it is not possible to attribute a significant portion of past reductions in smog to the use of these gasoline additives."

The Clean Air Act amendments of 1990 require the use of reformulated gasoline with oxygen additives in areas of the United States that have substantial ozone pollution. These gasolines are sold in cities on the East Coast, in the Midwest, Texas, and California -- particularly during the summer months, when near-ground ozone is most prevalent. This ozone is formed when pollutants from many different sources, including automobiles, react chemically in the presence of sunlight. Reformulated gasolines are designed to lower the emissions of vehicle pollutants, including those that contribute to ozone formation. In addition to oxygen additives, the fuels have a number of other characteristics that lower emissions.

But the oxygen additives in reformulated gasolines have raised environmental concerns. MTBE, for example, has leaked into drinking water

in California, leading the state to phase out the use of the additive. Because questions persist over which types of reformulated gasolines are preferable in improving air quality, the Environmental Protection Agency (EPA) asked the Research Council to study methods for certifying gasoline blends with oxygen additives.

The committee found that, compared with MTBE blends, ethanol blends result in more pollutants evaporating from vehicle gas tanks. Ethanol blends also increase the overall potential of emissions to form ozone. However, available data indicate that the potential for either additive to lower smog levels is small and will continue to decrease as other measures to reduce vehicle emissions take effect, the committee said. Tougher air-quality regulations and improvements to vehicles over the last few decades have substantially reduced emissions that help create near-ground ozone.

Projections indicate that motor vehicle emissions could decrease further in the next several years as more new technologies are incorporated, the report says. If these projections are correct, the impact that reformulated gasolines have in reducing ozone concentrations will continue to decline. Even if the contributions that motor vehicle emissions make to ozone formation have been underestimated -- which has occurred in the past -- oxygen additives in reformulated gasolines will have little impact on reducing smog, the committee said.

The committee noted that available data on reformulated gasolines are limited because they are mostly derived from tests on properly functioning motor vehicles. A disproportionate amount of pollutants originate from a small number of high-emitting vehicles, such as older vehicles that have malfunctioning catalytic converters. There is considerable uncertainty surrounding the effects of reformulated gasolines on these vehicles, making it difficult to quantify total overall vehicle emissions and evaluate the effects of different fuel blends.

Certifying Fuels

Peak ozone concentrations in many U.S. metropolitan areas declined by about 10 percent from 1986 to 1997, but approximately 48 million people still live in areas where ozone concentrations exceed EPA's standard for health protection. Most of the Earth's ozone is found in the stratosphere, where the gas protects against harmful ultraviolet radiation from the sun. But ozone that is formed and trapped near the ground can present a significant health and environmental hazard, impairing lung function and damaging forests, crops, and other vegetation.

The Clean Air Act, which mandated the reformulated gasoline program, stipulated a minimum oxygen content in the reformulated blends to help reduce emissions. EPA must certify reformulated blends to ensure that they meet program standards. The agency currently certifies reformulated gasoline blends by measuring the total mass of volatile compounds that are emitted, rather than by examining the potential for these compounds to form ozone. Because ethanol-blended gasoline is more volatile, meaning that more pollutants are evaporated into the atmosphere, it is difficult for such blends to meet EPA's standards unless the ethanol is blended with a more expensive, lower-volatility gasoline that is not readily available in many markets. Ethanol proponents have argued that EPA should evaluate the fuels by the extent to which their emissions will react in the atmosphere and contribute to ozone formation.

Reactivity has reached a level of substantial rigor as a tool for assessing the ozone-forming potential of emissions, the committee said, but there are no compelling scientific reasons at this time to recommend that reformulated fuels be certified based on reactivity. The basic results of comparing the MTBE and ethanol fuel blends were the same regardless of whether they were evaluated by reactivity or the mass of their emissions. In addition, an evaluation of carbon monoxide emissions should be included in assessments of the effects of reformulated gasoline, the committee said. Carbon monoxide can be a significant factor in ozone formation, but often it is overlooked in assessments of reformulated gasolines.

The study was funded by the Environmental Protection Agency. The National Research Council is the principal operating arm of the National Academy of Sciences and the National Academy of Engineering. It is a private, non-profit institution that provides independent advice on science and technology issues under a congressional charter. A committee roster follows.

Read the full text of *Ozone-Forming Potential of Reformulated Gasoline* for free on the Web, as well as more than 1,800 other publications from the National Academies. Printed copies are available for purchase from the **National Academy Press** Web site or at the mailing address in the letterhead; tel. (202) 334-3313 or 1-800-624-6242. Reporters may obtain a pre-publication copy from the Office of News and Public Information at the letterhead address (contacts listed above).

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Board on Environmental Studies and Toxicology
and
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