Introduction

The amendments to the Clean Air Act passed by Congress in 1990 focussed attention on the emissions from mobile sources, such as automobiles and trucks, as they degrade air quality, particularly in urban areas. This degradation is caused by increased ozone, carbon monoxide, and toxic hydrocarbon levels and has serious and demonstrated adverse health effects. The ozone that develops in areas of heavy vehicle traffic results from reactions among hydrocarbons, nitrogen oxides, and air under the influence of sun light. Added to this air pollution are smoke and particulates, emitted primarily from truck exhausts.

In legislating the 1990 amendments, it was recognized that a change in gasoline composition could have as great an effect on improved air quality as design changes in the automobile itself. In order to define a "reformulated gasoline" in more scientific terms, the automotive and petroleum industries agreed in 1989 to conduct a massive research program on air quality to measure emissions from current and older vehicles and relate the results to changes in fuel composition. Included in this Auto/Oil Air Quality Research Program were fuels containing oxygen made by blending ethers or alcohols, since it was known that these materials could reduce some contributors to air pollution.

Actually, the first significant change in gasoline composition to improve air pollution had taken place in the 1970s when catalytic converters were added to automobiles to reduce exhaust unburned hydrocarbons and carbon monoxide. This design change forced the elimination of lead additives, that were used to increase gasoline octane ratings. Without lead available to meet vehicle octane requirements, the refiners increased the use of isoparaffinic ("alkylate") and aromatic streams as blending components and began a search for replacement octane enhancers. More reforming units were added in refineries to produce streams of high aromatic content, a step that fortuitously produced more hydrogen gas for treating other products, such as jet fuel and heavier middle distillates, to reduce sulfur content and improve stability.

The close relationship between motor gasoline and the quality of other products explains why the advent of reformulated gasoline in the 1990s is viewed with concern by refiners, particularly because the government has now decided to also mandate improvements in diesel fuel quality that will require much of the hydrogen that was counted on to treat jet fuels. As a consequence, the fuel subcommittees of Committee D-2 on Petroleum Products decided that the best forum for highlighting the interrelationships between all major fuels and the impending regulations to improve air quality was a symposium on the subject.

Committee D-2 has, therefore, brought together spokesmen for the U. S. Government and the industries most affected by the Clean Air Amendments. The impact of the EPA regulations implementing the Amendments will be felt by many industries, including automobile and truck manufacturers, engine builders, and petroleum refiners. It will also be feld by ASTM itself in its standards development process.

The choice of optimum future fuel quality is a complicated and difficult decision. While gasoline and distillate diesel fuel represents almost two thirds of the entire output of U. S. refineries, a small-scale example of the larger problem of balancing air quality versus fuel quality is demonstrated by the following. A clause in the Amendments forbids the future manufacture of engines requiring leaded fuel in nonroad vehicles. The high output piston engines used by general aviation require the 100/130 grade of aviation gasoline that can only be made using tetraethyl lead. Thus, if implemented, this clause would prohibit the future manufacture of such engines and, in addition, would appear to result in the use of the 100/130 grade for existing high output engines and a different fuel for future engines. Because the 100/130 grade is already a relatively small volume product in the petroleum fuel market, the addition of another low volume premium fuel would put major stresses on the existing distribution system. In the worst case, it could cause the disappearance of the 100/130 grade, a fuel used in over 200 000 engines. A new research effort is therefore needed to balance modifications of existing engines against refinery processing limitations on high octane gasoline production. The Federal Aviation Administration (FAA) has budgeted funds to run the essential engine tests and is working with ASTM and the Coordinating Research Council (CRC) to develop the necessary test fuels. ASTM is awaiting the results of this program to update, and possibly alter, the aviation gasoline specification.

The symposium began with the latest thinking of the Federal and State governments on air quality regulations and results were then presented form the industry Auto/Oil Air Quality Research Program. The impact of these pending changes on petroleum refining was then discussed. Later, the impact on fuel users for various applications and the effect on ASTM standards was presented. To keynote this symposium, we invited an individual uniquely qualified in all these fields. Dr. Wayne France is a former Chairman of the Board of ASTM and a long-time member of Committee D-2. He presently serves as head of the Environmental Science Department of the General Motors Research Laboratories.

It is realized that this entire subject is changing continuously and therefore, there is not an ideal time for a review such as this symposium. Instead, the symposium intended to alert the standards community to the wide variety of changes likely to occur in the near future with the hope that proper, timely, and pertinent standards actions can be taken in response to the challenge.

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