## V.

## PHASE 2 PROGRAM

The specifications for Phase 2 reformulated gasoline are scheduled for proposal to the Board in the fall of 1991. The staff's objective is to define the "cleanest" possible gasoline to achieve maximum reductions in emissions of toxic air pollutants and ozone forming potential and to achieve these emission reductions at the lowest cost to the consumer. In developing these specifications, staff will take into account federal requirements which may be specified in any amendments to the Federal Clean Air Act and information that will be available from test programs currently underway to evaluate the impact on changing gasoline specifications on vehicular emissions.

### A. POTENTIAL FEDERAL ACTIONS ON FUEL SPECIFICATIONS

The United States Senate and House of Representatives have adopted separate bills proposing to amend the Federal Clean Air Act. These bills contained specifications for a reformulated "clean" gasoline which include specifications for aromatic hydrocarbon content, oxygen content, olefin content, requirements for additives, ban on leaded gasoline, and reductions in ozone-forming emissions. These specifications are summarized in Table 7. The House-approved bill also has a provision for reductions of hazardous air pollutants. The House and Senate is in the process of forming a joint conference committee to work out a compromise plan which will then be considered by both Houses of Congress. It is probable that amendments to the Federal Clean Air Act will contain gasoline specifications for a reformulated gasoline.

The U. S. EPA is proposing, as part of its Federal Implementation Plan (FIP) for the South Coast Air Quality Management District, Reid vapor pressure limits for gasoline of 7.0 psi from June 1 to September 15 and 10.0 psi for the winter months. The 7.0 psi Reid vapor pressure standard is intended to achieve greater evaporative emission reductions on high temperature days. The 10.0 psi Reid vapor pressure limit in the winter

TABLE 7

**Gasoline Specifications In The House Of Representatives And United States Senate Approved Amendments To The Federal Clean Air Act**

| Specification | House Bill | Senate Bill |
|---|---|---|
| Additives | January 1994 | Similar |
| Aromatic Content Cap | 30% by volume in 1992<br>28% by volume in 1994<br>25% by volume in 1996 | Similar |
| Benzene Cap | 0.8% by volume | 1.0% by volume |
| Lead Ban | January 1994 | January 1992 |
| Hazardous Air Pollutants | 15% reduction by 1995<br>20% reduction by 1997<br>25% reduction by 2000 | No provisions |
| Oxygen Content | 2.0% by weight in 1992<br>2.5% by weight in 1993<br>2.7% by weight in 1994 | Similar |
| Ozone-Forming Emissions | 15% reduction by 1995<br>20% reduction by 1997<br>25% reduction by 2000<br>and no NOx increases. | Similar, but has no NOx increase provision. |

months is intended to reduce carbon monoxide emissions to help meet the ambient air quality standard for carbon monoxide.

## B. ARB'S EVALUATION OF OPTIONS FOR PHASE 2

The ARB's gasoline specifications program is being developed in two phases that will result in reduction of toxic and ozone precursor compounds at least equivalent to those that may be specified in the Federal Clean Air Act. Phase 1 specifications, the subject of this report, are those that can be implemented in the near future, at a reasonable cost, and for which adequate data exist to document the expected emissions reductions and the associated cost impacts.

Additional information is needed to allow the development of the most effective Phase 2 specifications. Tests programs and data collection programs are being conducted which will be invaluable in developing the regulatory proposals for Phase 2. The specifications that are being considered include the following:

- Benzene Content - Reducing benzene emissions is important because benzene has been identified by the board as a toxic air contaminant. Setting a benzene content limit for gasoline will result in reductions of benzene exhaust emissions. However, a complete evaluation of a benzene specification needs to include consideration of the impact of lower motor vehicle exhaust standards and aromatic hydrocarbon limits because these strategies will also impact benzene emissions.

- Aromatic Hydrocarbon Content - Data from some test programs indicate that emission reductions of oxides of nitrogen (NOx) can be achieved by reducing the aromatic hydrocarbon content of gasoline. Data from other test programs indicate no correlation between NOx emissions and aromatic hydrocarbon content. Additional information is needed for determining the relationship of aromatic hydrocarbon content to NOx emissions. In addition, this specification has an impact on benzene emissions. A decrease in aromatic hydrocarbon content will decrease benzene emissions.

- Volatility (Reid Vapor Pressure and Distillation Distribution) - Reid vapor pressure and distillation distribution of gasoline are two indices of measuring the volatility of gasoline and both may be effective in reducing emissions, however, it is not clear which one is the more effective option. EPA, in its development of a 7.0 psi RVP limit for the proposed Federal Implementation Plan for the South Coast Air Basin, determined that this limit can achieve more evaporative emissions reductions during high temperature days when compared to a 7.8 psi RVP limit. However, data also indicate that emissions from the use of 7.0 RVP gasoline on lower temperature days may be higher than emissions from the use of 7.8 RVP gasoline. Other information indicates that restricting the distillation distribution of gasoline may be a more effective way to limit the

volatility of gasoline which will result in reductions of both evaporative and exhaust emissions. This approach may also result in improve driveability.

- Olefin Content (Bromine Number) - The olefin content of gasoline affects the olefin content of evaporative emissions and perhaps, the olefin content of exhaust emissions; however, there is insufficient information to relate olefin content of the gasoline to its impacts on exhaust emissions from motor vehicles. Without information on the impact of olefin content on exhaust emissions, staff cannot evaluate the benefits or the cost effectiveness of controlling olefin content. Olefin content affects reactivity which is important to the ozone forming potential of emissions.

- Oxygen Content - Studies have shown that the addition of oxygenates to gasoline can result in reduced hydrocarbon and carbon monoxide emissions; however, studies have also shown increases in NOx emissions. Additional information is needed to determine if there is an optimum oxygen content, in conjunction with other specifications, which will achieve the greatest overall benefits in terms of volatile organic compounds, NOx, and carbon monoxide emission reductions.

## C. ONGOING STUDIES

A number of studies are being conducted by both industry and the ARB to assess the effects of fuel parameters on emissions. A joint test program sponsored by the oil and automotive industries is being conducted to investigate the effects of gasoline specifications on exhaust and evaporative emissions from current in-use vehicles. Part of this test program has been completed and the information is being evaluated. Some of the information may be available before the September 1990, Board hearing. The second part of the program will evaluate the effects of fuel specifications on vehicles with advanced or new technology emission control systems. This test program is being developed and is scheduled to be conducted next year.

The ARB is sponsoring a study to evaluate the effect on emissions caused by evaporative control systems failing to control emissions during vehicle operation. This program is underway and will be completed by the end of the year. The ARB is also sponsoring a study to evaluate the effect on exhaust emissions from the addition of oxygenates or alcohols to gasoline. This program is just getting underway with results expected by next summer.

These on-going studies by industry and the ARB will provide information which will be used in the development of the ARB's Phase 2 specifications.

## D. PROGRAM TO EVALUATE GASOLINE PROPERTIES

The ARB staff and representatives of the oil refining industry, gasoline importers, and gasoline producers are developing a cooperative, voluntary program to collect information on the properties of gasoline produced for sale in California. This program is being conducted in recognition that there is a need to obtain information by refinery on gasoline properties. This information will allow staff to determine the range of values of gasoline properties and to assess how these properties vary with time. This information is needed for use in developing the Phase 2 gasoline specifications which will be presented to the Board next year.

The properties of gasoline for which information will be collected tentatively include: (1) benzene; (2) aromatic hydrocarbon content and speciation of aromatic hydrocarbons; (3) olefin content and speciation of olefins; (4) RVP; (5) determinations for 10 percent, 50 percent, and 90 percent distillation temperatures; and (6) sulfur content analysis. The analytical methods to be used in determining these properties will be agreed upon by participants to ensure consistency of the information to be collected.

Each company will submit a quarterly report to the ARB staff with the information for each batch of gasoline they produced. Included in the reports will be changes in the refinery operation which can account for significant changes to the information being collected. Examples of the changes are equipment breakdowns, maintenance turnaround of refinery equipment, or changes in crude slate. The reports submitted to the ARB staff will be treated as confidential information to protect the interest of the participants. The program will run for one year and after that period, the program will be reevaluated.