I.

INTRODUCTION AND SUMMARY

This report presents part of an overall program to reduce emissions from motor vehicles. The overall program is designed to carry out the requirements of the California Clean Air Act. There are two aspects to the program. The first is a low emission vehicles/clean fuels proposal which would require the phase-in of vehicles meeting stringent exhaust emission standards. These standards may require both advanced technology and the use of cleaner burning fuels. The second proposal is for reformulated gasoline which would be made available for use in the existing fleet and would also assist automakers in meeting low emission vehicle standards.

This report addresses the first phase of the reformulated gasoline proposal, specifications for lower volatility, detergent additives, and the elimination of leaded gasoline. It is accompanied by a Technical Support Document which discusses the staff's proposed specifications in greater detail.

A. REPORT SUMMARY

1. What is the general approach proposed by the ARB staff for reformulated gasoline specifications?

The proposal for new gasoline specifications is designed to result in emissions reductions from the current fleet, but will also assist vehicle manufacturers in meeting future more stringent emission standards. The proposal consists of two phases. Phase 1, the subject of this report, provides new specifications for Reid vapor pressure (RVP), and detergents and deposit control additives. Phase 1 also requires the phase out of leaded gasoline. These requirements apply to commercial gasoline sold in California beginning on January 1, 1992. Phase 2, which will be proposed in the fall of 1991, will be a more comprehensive set of specifications for reformulated, or a "cleaner" gasoline. It is expected that these requirements will apply in 1995-96. The objective of the comprehensive gasoline specification will be to define a formulation of gasoline which will maximize reductions of criteria and toxic pollutants and in the mass

and reactivity (ozone-forming potential) of emissions from gasoline fueled vehicles. In addition, the objective is to build in flexibility for manufacturers to produce the "cleanest" possible gasoline at the lowest possible cost to consumers.

2. Why is the staff proposing gasoline specifications in 2 phases?

The staff proposes to regulate the specification of gasoline in two phases for several reasons. In evaluating the current data base relating various fuel parameters to reduced emissions, the staff found that substantial reductions are feasible at reasonable cost. However, adequate data is not available to allow evaluation of the benefits of all parameters and control options. Also, the staff are not able to obtain sufficient data on costs at this time to allow the Board to make reasoned decisions about control options. The proposed Phase 1 specifications are those that can be implemented in the near future at reasonable cost and for which adequate data exists.

The ARB staff, gasoline producers, importers, and distributors are participating in a program to collect and compile information on various gasoline properties which can be used in developing specifications for Phase 2 gasoline. In addition, a number of test programs are being conducted including a joint program being conducted by the automotive and oil industries to investigate the effects of changing fuel properties on emissions from in-use vehicles.

The ARB staff believe that by adopting the more comprehensive specifications in the second phase, staff will be able to match or exceed the benefits of the Federal Clean Air Act proposals now before Congress and do so at lower cost to the oil industry and the public.

3. Why does the ARB need to take action?

The ARB needs to take action to further reduce emissions from motor vehicles to improve air quality and to fulfill statutory requirements. The California Clean Air Act (CCAA) requires the Air Resources Board (ARB) to achieve the maximum degree of emissions reductions possible from vehicular and other mobile sources in order to attain the state ambient air quality standards at the earliest practicable date. In meeting this objective, the CCAA requires the ARB to take actions that are necessary, cost-effective, and technologically feasible in order to reduce emissions of reactive organic gases by 55 percent and oxides of nitrogen by 15 percent from motor vehicles with respect to a 1987 baseline inventory. The ARB is also required to take actions to achieve the maximum feasible reductions for particulate matter, carbon dioxide, and toxic air contaminants from vehicular sources. These reductions are to be attained by December 31, 2000.

To achieve this goal, the CCAA requires that the ARB adopt control measures which will result in the most cost-effective combination of control

measures on all classes of motor vehicles and motor vehicle fuels, including but not limited to, all of the following:

- Reductions in motor vehicle exhaust and evaporative emissions.
- Reductions from in-use motor vehicles through improvements in emissions system durability and performance.
- Requiring the purchase of low-emission vehicles by state fleet operators.
- Specification of vehicular fuel composition.

The CCAA requires that an initial workshop on a regulation governing gasoline volatility be held before February 1, 1990, and that hearings by the ARB to consider the adoption of such a regulation be held before November 16, 1990. The CCAA also requires that workshops on the adoption of regulations governing detergent content and vehicle fuel composition be held before February 1, 1991, and that hearings to consider adoption of proposed regulations be held before November 16, 1991.

In recognition of the need to reduce vehicular-related emissions, the United States Senate and House of Representatives have passed separate bills to revise the Federal Clean Air Act (FCAA). These bills contain, among other things, specifications for a reformulated "clean" gasoline. The specifications in the House of Representatives-approved version include: aromatic hydrocarbon content limits, minimum oxygen content limits, limit on benzene content, requirements for additives, ban of leaded gasoline, reductions in ozone-forming emissions, and reductions of hazardous air pollutants.

The Senate-approved version has identical specifications for the aromatic hydrocarbon limits, oxygen content, and additives; however, this bill specifies a slightly higher benzene limit, less reductions in ozone-forming emissions, an earlier ban of leaded gasoline, and does not have provisions for reductions in hazardous air pollutants. The Senate bill provides less flexibility in how refiners meet these specifications. A joint conference committee comprised of members from the Senate and House of Representatives has been formed to work out a compromise bill which can then be considered by both Houses of Congress. It is likely that amendments to the FCAA will be enacted later this year.

4. <u>What factors did the staff consider in the development of the two-phase approach</u>?

To carry out the California Clean Air Act (CCAA) requirements, the ARB staff evaluated the feasibility of adopting new specifications for gasoline to result in the "cleanest" gasoline possible for use in all gasoline vehicles no later than 1996. In its evaluation, staff considered the feasibility of changing fuel parameters, the interrelationships and tradeoffs between options available to refiners to alter certain fuel parameters, and the costs associated with altering the parameters as well as

costs to the consumer. The staff found that the current database relating various fuel parameters to evaporative and vehicle exhaust emissions has the following characteristics:

- Substantial reductions are feasible at reasonable cost for some parameters. Information is available to show that emission reductions can be achieved at a reasonable cost by reducing the volatility of gasoline as represented by Reid vapor pressure, requiring the use of detergent and deposit control additives, and eliminating the use of leaded gasoline. More limited data is available for other parameters but substantial additional reductions are feasible.

- Inconsistent results are available for some parameters. Data from some test programs indicate a reduction in oxides of nitrogen (NOx) can result from reducing the aromatic hydrocarbon content of gasoline; however, data from other test programs indicate no significant correlation between aromatic hydrocarbon content and NOx emissions.

- Incomplete results are available for some parameters. Limited data indicate that not only is the volatility of gasoline as measured by Reid vapor pressure important to emissions, but the volatility of gasoline as measured by other indices may be at least as important for reducing emissions. Setting specifications for the distillation characteristics of gasoline may ultimately be a more effective control option, both in cost and emission reductions, than just setting a very low (less than 7.8 psi) Reid vapor pressure specification.

- Interrelationships and tradeoffs exist between options available to refiners to alter certain fuel parameters which impact the cost and feasibility of those options. It may turn out that refining costs may be minimized by requiring a more stringent specification on one parameter in exchange for a less stringent specification on another. For example, setting an aromatic hydrocarbon content limit for gasoline can result in reductions of benzene exhaust emissions, so that a benzene content standard may not be necessary.

- Incomplete data on cost is available for some parameters. Little information is available on costs to limit aromatic hydrocarbon content. Also, even less information is available on costs to control multiple parameters such as simultaneously reducing aromatic hydrocarbon content, olefinic content, and restricting the distillation distribution of gasoline.

In general, while there is sufficient data to achieve significant emissions reductions through changes in some gasoline specifications, there is a substantial body of testing and data collection occurring at the present time. This new information will be valuable in producing better defined regulatory proposals for the near future.

5. What is the staff proposing for the Phase 1 specifications?

The proposed Phase 1 gasoline specifications are those that can be implemented in the near future at a reasonable cost and for which adequate data exists to document the expected emissions reductions and the associated energy, economic, and environmental impacts. The proposed Phase 1 specifications address RVP, detergents and deposit control additives, and lead content of gasoline. These specifications will be required for gasoline sold in California beginning on January 1, 1992. Based on staff's evaluation, it is believed that these specifications can be achieved at a relatively inexpensive cost.

- Proposed Revisions of the Regulation for RVP of Motor Vehicle Gasoline. The staff is proposing to limit the RVP of gasoline sold in California during the RVP season to 7.8 pounds per square inch (psi). On June 11, 1990, EPA promulgated its Phase 2 RVP regulation which requires, beginning in 1992, a RVP limit of 9.0 psi for the month of May for gasoline distributors upstream from service stations and 7.8 psi for the period of June 1 through September 15 throughout the distribution system. However, the staff's proposed limit of 7.8 psi will cover a longer RVP season in California than EPA's RVP limits. Staff believes that based on currently available information, gasolines with a RVP of 7.8 psi will result in a favorable combination of emissions reductions and minimal impacts on vehicle performance. Staff estimates that the proposal will achieve approximately 80 tons per day of emissions reductions in 1992 at a cost of 0.4 to 0.6 cent per gallon and at a cost effectiveness of $1.10 to $1.90 per pound of volatile organic compounds reduced.

- Proposed Regulation Requiring Deposit Control Additives in Motor Vehicle Gasoline. This proposal requires that motor vehicle gasoline sold in California contain detergents and deposit control additives in concentrations to control deposits in carburetors, port fuel injectors, and intake systems, starting January 1, 1992. Studies have shown that the use of these additives can control deposits in engine components and result in performance and emissions benefits. The performance benefits include maintaining vehicle fuel economy, engine power output, and engine driveability which generally results in reduced emissions compared to vehicles with deposits. Staff conservatively estimates that the proposal will result in emission reductions of about 40 tons per day of criteria pollutants. This will be achieved at an estimated cost of 0.1 to 1 cent per gallon and a cost effectiveness of $0.50 per pound of pollutant reduced.

- Proposal to Eliminate Leaded Gasoline in California. The staff's regulatory proposal will eliminate leaded gasoline in California in a two step process. The first step requires that gasoline sold beginning on January 1, 1992 have a lead content to not exceed 0.05 gram per gallon (g/gal) and not be produced with the use of any lead additive. The second step is to require that all gasoline sold after January 1, 1994 be represented as unleaded and meet all specifications currently required of unleaded gasoline. In addition to the lead content requirements, unleaded gasoline must meet a sulfur content limit of 300 parts per

million (ppm) and a phosorphous content limit of 0.005 gram per gallon. Also, manganese or manganese-containing compounds cannot be added to the gasoline. The sulfur, phosorphous, and manganese requirements will ensure that the catalysts in catalyst-equipped vehicles will not be poisoned. An added benefit is there will be no misfueling of catalyst equipped vehicles when the proposal is in effect. Gasoline sold for farm and construction equipment would be exempt from these requirements.

Staff estimates that emissions of lead, ethylene dibromide, and ethylene dichloride will be reduced by about 1 ton per day. Sulfur oxides are estimated to be reduced by 5 tons per day. The emission reductions of these toxic and criteria pollutants will be achieved at a cost of 0.4 cent per gallon and cost effectiveness of $2.00 per pound of pollutants removed.

6. <u>What is the staff considering for Phase 2 gasoline specifications</u>?

The ARB staff, gasoline producers, importers and distributors are participating in a program to collect and compile information on various gasoline properties which can be used in developing the specifications for Phase 2. In addition, a number of studies are being conducted by both private industry and government. The ARB is sponsoring a study to evaluate the effect on evaporative emissions caused by the failure of evaporative control systems on in-use vehicles to control evaporative emissions during vehicle operation. The ARB is also sponsoring a study to evaluate the effect of adding oxygenates to gasoline on vehicle exhaust emissions. A joint test program is being conducted by the automotive and oil industries to investigate the effects of changing fuel specifications on emissions from in-use vehicles. These programs will provide information which can be incorporated into the development of the Phase 2 specifications. Some of the specifications that are being evaluated include: aromatic hydrocarbon content limits; lower RVP limits (summer and winter), such as 7.0 psi; olefin content limits (Bromine number limit); distillation distribution; benzene content limits; and oxygen content limits, as well as overall performance standards for the ozone-forming and toxic potential of gasoline.

The Phase 2 specifications for clean gasoline are being developed for consideration at a September 1991 Board hearing. Staff intends that gasolines meeting the Phase 2 specifications be required starting in the 1995-96 period.

7. <u>About this report</u>.

In developing the proposed Phase 1 regulations, the ARB staff held three to five consultation workshops (depending on the proposed specification) to discuss the basis for the proposals, projected emission inventories, emission reduction estimates, cost estimates, and the regulatory language. Staff also met with representatives from the refinery trade organizations and individual companies to discuss the special concerns of each group. Staff solicited information regarding costs and the effects on emissions of each of the proposals. Staff is continuing to solicit and evaluate information from affected parties.

This report presents a summary of the background information for the proposed regulations for Phase 1 specifications and is accompanied by a Technical Support Document (TSD). The TSD contains detailed discussions of the information presented in this report.

B. RECOMMENDATION

We recommend that the Board adopt or amend as appropriate, the following sections of Title 13, California Code of Regulations:

- Section 2251 - Reid Vapor Pressure for Gasoline
- Section 2251.5 - Reid Vapor Pressure of Gasoline Sold After January 1, 1992
- Section 2257 - Required Additives in Gasoline
- Section 2253.2 - Lead in Gasoline
- Section 2253.4 - Lead in Gasoline
- Section 2254 - Manganese Additive Content
- Section 2252 - Sulfur Content of Gasoline and of Motor Vehicle Diesel Fuel Sold in the South Coast Air Basin or Ventura County Before October 1, 1993