OVERVIEW OF ADVANCED PETROLEUM-BASED FUELS-DIESEL EMISSIONS CONTROL PROGRAM (APBF-DEC)

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Introduction

The Advanced Petroleum-Based Fuels-Diesel Emissions Control Program (APBF-DEC) began in February 2000 and is supported by government agencies and industry. The purpose of the APBF-DEC program is to identify and evaluate the optimal combinations of fuels, lubricants, diesel engines, and emission control systems to meet the projected emission standards for the 2000 to 2010 time period.

APBF-DEC is an outgrowth of the earlier Diesel Emission Control-Sulfur Effects Program (DECSE), whose objective is to determine the impact of the sulfur levels in fuel on emission control systems that could lower the emissions of NO_x and particulate matter (PM) from diesel-powered vehicles in the 2002 to 2004 period. Results from the DECSE studies of two emission control technologies—diesel particle filter (DPF) and NO_x adsorber—will be used in the APBF-DEC program. These data are expected to provide initial information on emission control technology options and the effects of fuel properties (including additives) on the performance of emission control systems.

The APBF-DEC program is directed by a Steering Committee representing the participating government agencies, trade associations, and private industry (see Figure 1). Three systems work groups and three supporting work groups were appointed to analyze and document the effects of fuel and lubricant properties on emissions for a variety of automotive and heavy vehicle engine and emission control systems (see Figure 2). The program's scope includes vehicles ranging from automobiles to heavy-duty trucks.

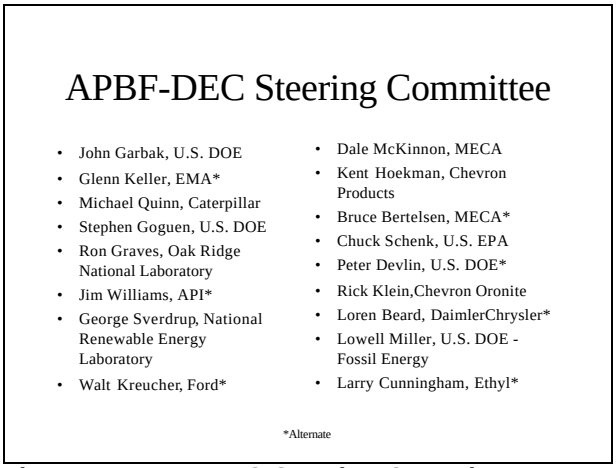

Figure 1. APBF-DEC Steering Committee

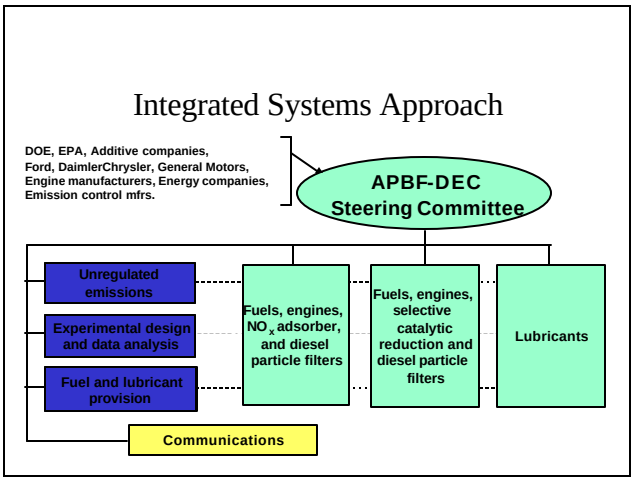

Figure 2. Integrated Systems Approach

APBF-DEC's Mission

The program's mission is to identify the optimal combinations of fuels, lubricants, diesel engines, and emission control systems to:

- Meet projected emission standards during the period 2000 through 2010 while maintaining continuous improvement in engine efficiency and durability
- Meet additional potential constraints (e.g., emissions of unregulated substances such as ultrafine particulate matter).

APBF-DEC has an additional mission: to explore the potential to achieve even lower

- Maintain customer satisfaction with vehicle performance
- Provide the basis for economical transport of people and goods and

emissions of criteria and unregulated pollutants beyond 2010.

Timeline, Funding, In-kind Support

Testing is to begin in early 2001. The four-year program is expected to have a 50/50 government/industry cost share and be funded at about $35 million, including $25 million in funding and $10 million in in-kind contributions. Government agencies are expected to contribute $17 million of the $35 million total. Major funding is currently being provided by two Offices within the U.S. Department of Energy (DOE)--the Energy Efficiency and Renewable Energy and the Fossil Energy.

Other groups providing funding and/or in-kind services are the U.S. Environmental Protection Agency (EPA), the American Petroleum Institute (API), the National Petrochemical and Refiners Association (NPRA), the Engine Manufacturers Association (EMA), the Manufacturers of Emission Controls Association (MECA), the American Chemistry Council, and the California Air Resources Board (CARB). Industry is providing significant in-kind resources (see Figure 3).

The program is managed by staff members at two DOE laboratories, the National Renewable Energy Laboratory (NREL) in Golden, CO, and the Oak Ridge National Laboratory (ORNL) in Oak Ridge, TN.

Work Groups' Goals, Deliverables

The three systems work groups will determine the most appropriate combination of technologies for their systems, develop test plans (for both the light- and heavy-duty programs), select test sites, issue requests for proposals (RFPs), obtain subcontractors, and monitor work. All three groups expect to begin testing in the spring of 2001. Their goals and deliverables are:

Figure 3. Participating Companies/Organizations

- The **fuels, engines, selective catalytic reduction (SCR)/diesel particle filter (DPF) work group's** goal is to demonstrate the low emissions performance attainable with the SCR/DPF technologies and evaluate sensitivities to fuel variables. The work group's deliverables include (1) the emissions performance of three different SCR technologies/DPF on an optimized system for one heavy-duty engine and one light-duty engine; (2) the effects of fuel variables including sulfur and aromatics; (3) data on the durability and emission performance after aging from field demonstrations; and (4) the assessment of urea infrastructure barriers.

- The **fuels, engines, NO_x adsorber/DPF work group's** goal is to demonstrate the low diesel emissions performance and the system's thermal management technologies. The work group's deliverables include (1) optimized NO_x adsorber/DPF systems for testing up to two heavy- and two light-duty engines using late-cycle injection; (2) NO_x/DPF emissions performance over transient test cycles, including unregulated emissions; (3) the effects of fuel variables, such as sulfur, aromatics, and additives; and (3) system

durability, i.e., emissions performance with acceptable driveability at extended mileage.

- The **lubricants work group's** goal is to determine which, if any, lubricant-derived emission components are detrimental to performance or durability of emission control systems. The group plans to use a multi-cylinder diesel engine equipped with exhaust gas recirculation hardware and 3-ppm diesel fuel. The group will measure various types of particulate matter, hydrocarbons, NO_x, and SO_2. The work group's deliverables include: (1) guidelines for lubricant formulation—baseline selection (Group II, others), additive development (a lubricants matrix to cover the range); and (2) design guidelines—engine and bench scale testing to determine the impact of lubricant formulation on the performance and durability of diesel emission control devices.

The unregulated emissions work group will develop methods for compounds most likely to be formed and specify methods to measure emissions and toxicity and effects on the emission control devices. This work group will support the efforts of the three systems work groups.