

## California Low Sulfur Diesel Fuel

### Background

Adopted in 1988, California diesel fuel regulations set limits on aromatic hydrocarbon content (10 percent by volume) and on sulfur content (500 parts per million by weight, ppmw). These regulations, in effect since 1993, reduce emissions from diesel engines and equipment: 7 percent Oxides of Nitrogen (NO<sub>x</sub>), 25 percent Particulate Matter (PM), 80 percent Sulfur Oxides (SO<sub>2</sub>), and several toxic substances, such as benzene and Polynuclear Aromatic Hydrocarbons (PAHs). The regulations also provide flexibility to meet the 10 percent aromatic hydrocarbon limit. Refiners can use an alternative diesel fuel formulation that produces emissions equivalent to that obtained with the specified 10 percent aromatic reference fuel, as determined through a series of engine tests.

Diesel-powered vehicles account for about 4 percent of California motor vehicles, but produce a disproportionate amount of directly emitted PM, about 60 percent. In addition to causing adverse health effects as PM, diesel PM is also a Toxic Air Contaminant (TAC). At current exposure levels, the potential cancer risk associated with exposure to diesel PM is greater than the combined risks of all other TACs. As a result, the Air Resources Board (ARB) is implementing a risk reduction plan that will greatly reduce Californians' exposure to diesel PM. The plan calls for low sulfur diesel fuel, 15 ppmw or less, to enable the use of catalyzed particulate filters, NO<sub>x</sub> after-treatment, and other advanced emission control technologies, both for new and for retrofitted existing engines.

In 2000, the South Coast Air Quality Management District (SCAQMD) adopted low sulfur diesel fuel rules for the South Coast air basin that will take effect in 2004 for stationary source engines and in 2005 for mobile source engines, unless the ARB adopts similar rules for 2006. In 2001, the United States Environmental Protection Agency (U.S. EPA) adopted a low sulfur limit for diesel fuel used in on-road motor vehicles, effective June 2006. The U.S. EPA has also proposed to extend this low sulfur requirement to off-road vehicles.

### The Proposed Amendments to the California Diesel Fuel Regulations, July 2003

#### *Low Sulfur Limit*

The proposed amendments to the California diesel fuel regulations would reduce diesel fuel maximum sulfur content from 500 ppmw to 15 ppmw, starting in mid-2006. This lower sulfur limit would align California's sulfur requirement with the U.S. EPA's existing on-road rule, and the proposed off-road rule. However, the ARB's proposed diesel fuel sulfur limit would apply to both on-road and off-road engines in California in 2006. The new sulfur standard will enable the use of the emissions control technologies required to ensure compliance with the new emissions standards adopted by the U.S. EPA for 2007 and subsequent model-year heavy-duty engines and vehicles. The proposed low sulfur requirement will further reduce the following emissions: SO<sub>2</sub> by 88 percent and PM by 4 percent. Low sulfur diesel fuel is expected to add two to four cents per gallon to the production cost of making diesel fuel. Given that the SCAQMD and the U.S. EPA adopted low sulfur rules, most of these costs will occur with or without any ARB rule.

### *Lubricity Standard*

The ARB is proposing a diesel fuel lubricity standard to ensure that California low sulfur diesel fuel provides adequate lubrication to the fuel system of existing and future diesel engines. Based on experience from other countries, equipment manufacturers and consumers have expressed concern regarding the lubricity of California diesel fuel as sulfur levels are further lowered. Unfortunately there is no currently accepted standard used for lubricity by the industry, therefore a lubricity standard has been included in the ARB's proposal. The proposed initial phase will be to immediately adopt a standard that is at least as protective as the current voluntary standard to protect current in-use engines. The proposed standard is a High Frequency Reciprocating Rig (HFRR) maximum wear scar diameter (WSD) of 520 microns, implemented on a 90-day phase-in schedule, commencing August 1, 2004. The proposed second phase would be to determine a 2006 lubricity standard protective of advanced technology fuel systems via a technology assessment.

### *Alternative Diesel Fuel Formulations*

The existing diesel fuel regulations limiting aromatic hydrocarbons include a provision that enables producers and importers to comply with the regulations by qualifying through testing an alternative diesel fuel formulation. The alternative formulation must be shown through emissions testing to provide emission benefits equivalent to that obtained with a 10 percent aromatic reference fuel. Most refiners have taken advantage of the regulation's flexibility to produce alternative diesel formulations that provide the required emission reduction benefits at a lower cost. A new option that provides additional flexibility to refiners or importers to comply with the existing 10 percent aromatic hydrocarbon specification is also being proposed. The proposed option would enable fuel that contains 21 percent or less aromatics to be sold in California, if a number of other specifications are met. Fuels meeting these specifications provide the same lower emission benefits as fuel that complies with the 10 percent aromatic limit.

### *Other Amendments*

In addition, the ARB is proposing to revise the sulfur specifications for diesel certification fuel used to test if new diesel engines comply with California's emission standards. Other technical changes include updates to the test procedure for the alternative fuel certification option.