Alternative FUELS
IN TRUCKING
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SWEEPING FEDERAL AIR QUALITY RULES PROPOSED FOR CALIFORNIA

by Allen R. Schaeffer, Vice President, Environmental Affairs, American Trucking Associations

Limits on interstate truck travel, no-drive days, annual fleet emissions reporting, escalating penalties to retire older engines, and the most stringent diesel emissions standards ever proposed highlight this sweeping Federal Air Quality Implementation Plan (FIP).

Acting under a court order, on February 14, 1994, the Environmental Protection Agency announced what appears to be the largest single federal regulation ever proposed. At a cost of four to six billion dollars, it will directly affect the everyday lives of fifteen million people. The comprehensive FIP establishes mandatory federal reductions in the three areas with the worst air quality in the nation—Sacramento, Ventura, and the South Coast Air Basin that includes Los Angeles. The plan hopes to bring these areas into compliance with the federal standards no later than 2010.

The 1,700 page document, which weighs nearly eighteen pounds and is fourteen inches thick, is the culmination of over 6 years of legal efforts, including an unsuccessful EPA appeal, brought by three separate environmental groups dating back to 1987. EPA has been forced to step in and issue the first federal air quality plan because of California's inability to meet national air quality standards.

Provisions of the Plan for Heavy-Duty Trucks

The proposed plan has very broad and significant implications for all commercial truck fleets and businesses operating or based in California, some of which are highlighted below. One of the unique aspects of the FIP is that EPA can impose federal regulations on emissions sources that have not previously been regulated, including many off-road sources such as locomotives, ships, and commercial aircraft. Included in the FIP are provisions to restrict interstate truck traffic in California.

Interstate Trucks and "No-Drive Days"

"Something needs to be done to discourage interstate firms with cheaper, dirtier trucks from taking over." This comment reflects the spirit behind one of the most controversial provisions in the FIP. Increasingly stringent emissions standards will be imposed on trucks based in California in coming years. This will mean that a tractor-trailer belonging to a California-based trucking company will have its overall emissions gradually reduced, leaving interstate trucks traveling into California making up an increasingly large percentage of emissions in California. To deal with this problem and the inequity between California trucks and interstate trucks meeting less stringent emissions standards, EPA has proposed a system to restrict interstate truck travel, limiting these trucks to one stop in the FIP area, and not more than two total stops in the state, per trip. In addition, all vehicles registered in the Sacramento air quality area would be prohibited from operating one day each week, based on licensing and/or registration.

Continued on page 5

INSIDE THIS ISSUE

PROPANE FOCUS

IS THERE A ROLE FOR PROPANE IN HEAVY-DUTY APPLICATION ?

by Robert E. Myers, President, LP Gas Clean Fuels Coalition

Between 1950 and 1974 the Chicago Transit Authority (CTA) operated the largest fleet of heavy-duty propane-powered vehicles in the world. In 25 years of operation nearly one billion miles were travelled by the more than 1,700 buses. With the demise of the propane engine manufacturer and the concurrent arrival of diesel engines and lower-priced diesel fuel, the propane fleet was retired. Now there is again emerging interest in propane in heavy-duty applications. What has changed?

One major factor has been the Clean Air Act Amendments of 1990 (CAAA) and the Energy Policy Act of 1992 (EPACT). The experience of CTA and lesser-known fleets over the years has proven that propane can meet the needs of heavy-duty vehicle operation given the right fleet profile, the fleet's area of operation, and acceptable economics. A combination of concerns about energy security and air quality propels heavy-duty operators to investigate the possible role for alternative fuels.

As motor fuels, propane and butane (the principal fuels that make up the "gas liquids" family of hydrocarbon fuels) have been used successfully in this country and around the world since the 1920's. Most of this use has occurred in light-duty vehicles and industrial engines such as forklift trucks. Propane's advantages are the same in light-duty and heavy-duty applications: It is clean burning, leading to longer engine life; it results in less maintenance costs and generally lower fuel costs compared with gasoline; it is "pilfer proof" because of the scaled fuel system; and it produces lower overall vehicle emissions. It is a non-toxic fuel, doesn't contaminate aquifers or soil, and is exempt from EPA's underground storage regulations.

. . . propane can meet the needs of heavy-duty vehicle operation given the right fleet profile, the fleet's area of operation, and acceptable economics

Compared with diesel and gasoline, the drawbacks of propane have been less energy per gallon (91,500 btu gross heating value), a less prominent refueling infrastructure, and lack of engine availability in the 250 hp and up range. But energy policy is changing the matrix, and propane is looking more attractive for some applications.

Although "clean" diesel is listed among the alternative fuels in the CAAA, which apply only to the twenty-two non-attainment areas, it is not an approved alternative fuel in the Energy Policy Act. EPACT applies to any geographical area with population of more than 250,000. So while new technologies show that diesel can be much cleaner than before and can even meet present and some future emission standards, it is not an approved fuel. Therefore, fleet operators subject to mandates to purchase alternative fuel replacement vehicles need options.

Because of the legislation, engine manufacturers have a renewed interest in propane, since many have already ventured into development of natural gas engines. Since both propane and natural gas are "gaseous" by nature, the technology required in engine development is similar. Currently, Caterpillar's 250 hp G3306 is entering the market. Two Cummins L-10 engines modified to operate on propane are currently in demonstration in the Orange County Transit Authority's (OCTA's) mass transit buses. Recent tailpipe emissions tests from the L-10's engines which compare natural gas with propane showed propane 87% lower in total hydro-

Continued on next page

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Timothy R. McGrath, Editor

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The aim of **Alternative Fuels in Trucking** is to keep fleet owners and operators, equipment suppliers, government officials, and other interested parties informed of important developments that affect the use of alternative fuels in heavy-duty trucks. Suggestions and comments are welcome. Articles written by guest authors express their own views, and not necessarily the views of ATAF.

carbons, 50% lower in nitrogen oxides, and 40% lower in particulate matter. Other manufacturers now producing natural gas engines have expressed interest in propane and await indication from the market as to demand.

Vehicle emissions are a function of tailpipe, running, and evaporative losses and contribute to global warming. The OCTA tests prove that low emissions are attainable in heavy-duty application. Since the fuel system is closed to atmosphere, there are no evaporative emissions (although some emissions occur as a result of breaking the connection upon refueling). Regarding global warming, a September 1993 Argonne National Laboratory study showed that propane was 11% better than compressed natural gas, 22% better than methanol made from natural gas, 23% better than reformulated gasoline, 25% better than electric vehicles, and 36% better than ethanol made from corn.

Another emerging technology is the actual conversion of the compression-ignited diesel to spark-ignited propane. Expro Fuels and Vinyard Engine Systems, both of San Antonio, Texas, are now marketing conversion kits. These systems use dedicated fuel, i.e., there are no supplemental or bi-fuel requirements. The Vinyard system is available as an in-frame conversion, shop conversion, or engine swap-out system. Features include optimized pistons and cylinder head, a fuel mixer tailored for the torque curve, and an electronic ignition system. Interestingly, despite the differences in the heating value of propane vs. diesel, the thermal efficiency of the propane version is rated at 36%, vs. 39% for the diesel.

Of the some 350,000 propane vehicles operating in the U.S. today (4 million worldwide), most are conversions from conventional gasoline engines. Few engines are optimized for propane's unique burning characteristics, including its 104 octane rating. However, in the lighter range of heavy-duty vehicles, Ford now offers its F600/F700 chassis with a 7.0 liter propane engine. General Motors offers its Kodiak and TopKick models with a 5.7 liter "gaseous fuel" engine suitable for both propane and natural gas.

. . . many of the siting problems being experienced by other alternative fuels have been overcome by the propane industry

Although the refueling infrastructure consists of more than 10,000 sites available to the public, most fleet operators prefer to have their own on-site storage. Many of the propane public sites are designed to handle recreational vehicles and barbecue grill refueling, with pricing practices not acceptable to many large-volume users. As demand grows, marketers are expected to respond with more competitive prices. The important fact is that propane is out there already. Although propane is not as readily available as gasoline and diesel, many of the siting problems being experienced by other alternative fuels have been overcome by the propane industry.

Clearly, there is a role for propane in the heavy-duty market. It is particularly attractive in urban fleet operation or transportation corridors. A driving range comparable to that of gasoline or diesel is normally provided. The cost of a refueling facility is less than that for gasoline.

The success of any fuel, alternative or not, depends on its making economic sense. Experiments and demonstration projects are nice, make nice press copy, and garner favorable public attention, but long-term viability rests with economics. The history of propane in heavy-duty application coupled with renewed interest from vehicle manufacturers and fleet operators augurs well for an expanded role for propane.

Clearly, there is a role for propane in the heavy-duty market

For more information about propane as a vehicle fuel, please contact the LP Gas Clean Fuels Coalition, 2102 Business Center Drive, Irvine, California 92715, telephone (714) 253-5757.

Robert E. Myers became President of the LP Gas Clean Fuels Coalition in 1990. Before 1990, Mr. Myers spent 25 years in the propane industry in various executive roles with the nation's largest propane marketer. Much of that time was devoted to propane's role as a motor fuel.

NATURAL GAS FOCUS

ON THE ROAD WITH NATURAL GAS

by Jeffrey Seisler, Executive Director, Natural Gas Vehicle Coalition

Natural gas, the same fuel that heats half the homes in the United States, is beginning to take the lead as the alternative fuel of choice for all types of vehicles, from forklifts to heavy-duty trucks. Natural gas engines are even turning up in boats and trains, demonstrating the wide range of applications now available for this gaseous fuel.

Supporters and users of natural gas are enthusiastic about natural gas vehicles for a variety of reasons:

- It is an inexpensive fuel — about 30-50% cheaper than gasoline and somewhat cheaper than diesel.
- It is a clean burning fuel relative to either gasoline or diesel. Natural gas engines emit about 90% less carbon monoxide and 85% less ozone-forming hydrocarbons than gasoline engines, and no particulates, making even heavy-duty natural gas engines characteristically clear of the familiar black soot. Additionally, unlike liquid fuel vehicles, dedicated natural gas vehicles emit no evaporative emissions (from the heated engine) or emissions during fueling.
- Natural gas is among the safest fuels on the road today. While diesel is inherently safer than gasoline, natural gas is lighter than air and dissipates into the atmosphere if a leak occurs. Additionally, it is stored in above-ground tanks, eliminating problems associated with leaking underground storage tanks.
- Natural gas is abundant and domestic. About 93% of the natural gas used in the U.S. comes from the U.S., which has a 200-year supply; the balance comes mostly from Canada.

In terms of trucking applications, there are more and more alternatives, although for heavy-duty, over-the-road long haulers, the industry still continues to develop options. Most major heavy-duty engine manufacturers are experimenting with or developing dedicated heavy-duty engines that use the original block and pistons with modifications to take advantage of the long-life characteristics of diesel, yet run on natural gas.

Natural gas engines emit about 90% less carbon monoxide and 85% less ozone-forming hydrocarbons than gasoline engines

Diesel engine manufacturers such as Hercules (with 3.7 and 5.6 liter natural gas engines), Cummins (with a natural gas L-10), and Mack have developed engines that are in trucking applications today. The Hercules engines commonly are found in medium and light/heavy applications, such as bread trucks, 30-passenger buses, and other vehicles. About 450 transit buses around the country are operating with the Cummins L-10. Mack has experimental garbage trucks in Boston and New York City.

These vehicles use engines redesigned to take advantage of natural gas's 130 octane rating. Because natural gas burns at about 1,200 degrees F and diesel ignites at about 650 degrees F, a spark plug has to be added to the typical diesel engine block to enable the engine to use natural gas. This requirement effectively changes the engine from compression ignition to spark ignition.

There are some "dual fuel" applications in which some diesel is injected as a pilot fuel with the natural gas. In these systems, the engine runs on 100% diesel at idle. As the vehicle moves, a larger percentage of natural gas is injected, to about 80% at full throttle, and the diesel "pilot" provides the ignition at a lower temperature. In this option, the compression feature of the diesel is retained.

Natural gas is abundant and domestic . . . 93% of the natural gas used in the U.S. comes from the U.S.!

Continued on page 6

AIR QUALITY

Continued from page 1

Annual Fleet Emissions Reporting and Excess Emissions Fees

By January 31 of each year, fleets operating in California (either inter- or intra-state) will have to file fleet emissions profile reports with the Air Resources Board for each vehicle license number, engine model year, engine identification number, and gross vehicle weight rating. Further, fleets will be required to calculate average fleet emissions for each category of vehicles over 19,501 lb gvwr.

Measures to force the replacement of older, more polluting engines with cleaner engines will include a graduated fee, based on a fleet average, beginning in 1999 and increasing each year thereafter. This measure will make the operation of all but the cleanest, least polluting engines more expensive each year. The rule will seek a declining average emission level for fleets starting in the year 2000, reflecting the desired penetration of new engines.

Fleets registered to addresses in California will have to demonstrate compliance each year with that year's fleet average emissions level or pay a fee proportional to their net excess emissions, calculated to reflect differences in engine type and amount of use. Enforcement of payment of excess emissions fees will be assisted by EPA-issued stickers.

Tighter Emissions Standards for New Vehicles

New heavy-duty trucks with primary registration in California in model years 1999 and later must meet emissions standards that are nearly 63% lower than the 1998 federal standard established under the Clean Air Act Amendments of 1990. Fleets would be allowed a one-time opportunity to purchase trucks that meet a less stringent standard and pay a one-time purchase fee based on the excess emissions calculated on a basis of $10,000 per ton per day.

Any trucking company operating in California will be significantly affected by this rule and must get involved in the rulemaking process

Increasing Emissions Durability During Operational Life

In addition to tighter standards for new engines, a major theme of the federal plan is enhanced control over vehicle emissions once the vehicle is in the hands of the fleet owner. EPA has proposed to control the rebuilding of heavy-duty diesel engines beyond their useful emissions-warranted life of 290,000 miles for trucks over 33,000 lb gvwr. Engine rebuilding must be conducted with EPA-approved equipment, and full recall liability is required. This requirement will be enforced during each registration renewal of a vehicle. Additional requirements to properly maintain trucks are included in the enhanced emissions inspection program for gasoline trucks over 8,500 lb gvwr.

Broad Freight Transportation Impacts

In addition to the provisions restricting truck traffic, this plan also includes many stringent requirements for previously unregulated marine vessel emissions, commercial aircraft emissions, and locomotive emissions. Marine vessels exceeding emissions standards would be required to pay excess emissions fees or possibly be prevented from entering ports in the FIP area.

Timing, Hearings, Comment Periods

The FIP was expected to be published in the Federal Register in the first two weeks of March as a Notice of Proposed Rulemaking. Formal public hearings, with the opportunity for public comment, will begin in July 1994. The entire rule must be finalized by February 1995. ATA and the California Trucking Association will coordinate the industry response. Any trucking company operating in California will be significantly affected by this rule and must get involved in the rulemaking process. For more information, contact Allen Schaeffer at (703) 838-1844.

Allen R. Schaeffer is Vice President of the Environmental Affairs Department at the American Trucking Associations. Mr. Schaeffer manages the regulatory, legislative, and environmental issues that affect the trucking industry. Most recently he served as Director of Environmental Affairs and before that as Assistant Director of Engineering and Manager of Environmental Affairs from July 1990 to January 1992.

NATURAL GAS

Continued from page 4

The major drawback of natural gas is that, because it is a gaseous fuel, much less fuel can be stored in the same volume space as liquids — either gasoline or diesel. Cylinderical fuel storage containers are used, and while they are extremely safe, they are also somewhat heavier and bulkier than diesel fuel tanks. The natural gas vehicle industry is responding by experimenting with liquefied natural gas (LNG), which is created by chilling natural gas to 263 degrees F below zero. This procedure is commonly used to transport natural gas from remote locations, such as Algeria.

Roadway has been experimenting for about two years with LNG, and growing transit bus fleets in Houston and Seattle are now using LNG to take advantage of natural gas benefits with less constraint on travelling distance than is imposed by compressed natural gas. For over-the-road haulers, LNG may be the wave of the future for natural gas. Certainly, it may provide a competitive cost advantage over diesel, and will not leave the telltale particulate trail behind. And, at 130 octane, the characteristic rattle of diesel engines is reduced significantly, making LNG vehicles stand out among sooty, noisy diesels.

For over-the-road haulers, LNG may be the wave of the future for natural gas

For more information about natural gas as a vehicle fuel, please contact the Natural Gas Vehicle Coalition, 1515 Wilson Boulevard, Suite 130, Arlington, Virginia 22209, telephone (703) 527-3022.

Jeffrey Seisler has been the Executive Director of the Natural Gas Vehicle Coalition since its inception in August 1988. Jeff spent five years at the American Gas Association (AGA), where he was the Associate Director of New Market Development. Before joining AGA he ran his own management consulting business, specializing in energy and marketing analysis for the gas and electric industries as well as for other private sector and government clients. He has also worked for several consulting firms in the areas of energy conservation, utility and solar energy policy, and marketing analysis.

ATA Foundation Alternative Fuels Task Force Meeting . . .

Thursday, June 23, 1994; 2-4 p.m. at the Crystal Gateway Marriott in Arlington, VA. Please call Timothy R. McGrath, (703) 838-1966, for more information.

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