

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
--

Staff Report

**Proposed Rule 1193 – Clean On-Road Residential and Commercial
Refuse Vehicles**

June 2000

Deputy Executive Officer

Planning, Rule Development and Area Sources
Jack P. Broadbent

Assistant Deputy Executive Officer

Planning, Rule Development and Area Sources
Elaine Chang, Dr.PH

Planning and Rules Manager

Planning, Rule Development and Area Sources
Henry Hogo

AUTHORS:

Planning, Rule Development and Area Sources

David Coel – Program Supervisor

Larry Irwin – A.Q. Specialist

Vasken Yardemian – Transportation Specialist

REVIEWED BY:

District Counsel

Barbara Baird – District Counsel

Jeri Voge – Senior Deputy District Counsel

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

GOVERNING BOARD

Chair: WILLIAM A. BURKE, Ed.D.
Speaker of the Assembly Appointee

Vice Chair: NORMA J. GLOVER
Councilmember, City of Newport Beach
Cities Representative, Orange County

MEMBERS:

MICHAEL D. ANTONOVICH
Supervisor, Fifth District
Los Angeles County Representative

HAL BERNSON
Councilmember, City of Los Angeles
Cities Representative, Los Angeles County, Western Region

JANE CARNEY
Senate Rules Committee Appointee

CYNTHIA P. COAD, Ed.D.
Supervisor, Fourth District
Orange County Representative

BEATRICE LAPISTO-KIRTLEY
Councilmember, City of Bradbury
Cities Representative, Los Angeles County, Eastern Region

RONALD O. LOVERIDGE
Mayor, City of Riverside
Cities Representative, Riverside County

JON D. MIKELS
Supervisor, Second District
San Bernardino County Representative

LEONARD PAULITZ
Councilmember, City of Montclair
Cities Representative, San Bernardino County

CYNTHIA VERDUGO-PERALTA
Governor's Appointee

S. ROY WILSON, Ed.D.
Supervisor, Fourth District
Riverside County Representative

EXECUTIVE OFFICER

BARRY R. WALLERSTEIN, D.Env.

TABLE OF CONTENTS

Introduction.....	1
Background.....	2
MATES II	2
ARB Identification of Diesel Particulate as a Toxic Air Contaminant.....	3
Refuse Collection Vehicle Operations – General Description	3
Current Use of Natural Gas and Dual-Fuel Refuse Trucks	4
General Description and Explanation of Rule Requirements.....	6
Purpose of the Rule.....	6
Applicability	6
Vehicle Purchase Requirements	6
Exemptions	7
Compliance Auditing and Enforcement.....	7
Emission Benefits	8
Criteria Pollutants	8
Air Toxics	10
Cost Analysis	12
Fleet Cost Impacts	12
Incremental Cost-Effectiveness Analysis	14
Funding Programs.....	14
Public Comments.....	15
Summary and Draft Findings.....	28
Summary	28
Draft Findings Required by the California Health and Safety Code	28

ATTACHMENTS

1. PROPOSED RULE LANGUAGE
2. REFUSE VEHICLE USAGE SURVEY FORM
3. NATURAL GAS REFUSE TRUCKS & ENGINES AVAILABLE IN
2000

4. ENGINES FOR USE IN REFUSE TRUCKS
(FOR INFORMATIONAL PURPOSES ONLY)

INTRODUCTION

The South Coast Air Quality Management District (AQMD) is proposing Rule 1193 (PR1193) to require fleets with 15 or more refuse collection vehicles (refuse trucks) operating in the District to acquire less-polluting vehicles when procuring or leasing these vehicles. This proposed rule applies to refuse collection vehicles operated by government agencies as well as privately owned refuse collection fleets that collect solid wastes, yard waste, or recyclable materials. For the purposes of the proposed rule, refuse collection vehicles are heavy-duty vehicles that collect solid waste, yard wastes, or recyclable materials from residential or commercial establishments, and private or publicly owned transfer stations.

This proposal is based on Health and Safety Code Section 40447.5, which was promulgated in 1987. Specifically, Health and Safety Code Section 40447.5 allows the AQMD to require operators of public and commercial fleets, consisting of 15 or more vehicles, to purchase vehicles powered by methanol or other equivalently clean burning alternative fuel, when adding or replacing vehicle(s) to their fleet. Section 40447.5 specifically authorizes the AQMD to regulate fleets of 15 or more vehicles, operating substantially in the AQMD. This proposal is also based on Health and Safety Code Section 40919, which allows certain nonattainment air districts (those that are designated serious or above for ozone) to adopt measures requiring fleets to use a significant number of low-emission vehicles.

Despite the significant progress that has been made in reducing both mobile and stationary emissions over the past twenty years, the South Coast Air Basin (Basin), which includes Los Angeles, San Bernardino, Riverside, and Orange Counties, continues to experience extremely serious air quality problems, dominated by motor vehicle pollution. The Basin is still the only area in the country classified by U.S. Environmental Protection Agency (EPA) as an extreme ozone nonattainment area. Based on the latest information available, on-road motor vehicles contribute more than half of all hydrocarbons, oxides of nitrogen, and carbon monoxide to the entire emissions inventory. In addition, on-road motor vehicle pollution, specifically from diesel vehicles, has been identified as the principal source of public exposure to air toxics, based on recent work conducted by the AQMD and other agencies.

This proposed rule is being developed in an effort to reduce public exposure to air pollution emitted from refuse collection vehicles, including toxic particulates, and ozone precursor emissions. Many of these fleets emit pollutants, including air toxics, into heavily urbanized areas, where improvements in air quality are critical given environmental justice and other concerns.

Refuse collection vehicles are covered in this proposed rule as part of an overall effort by the AQMD to reduce toxic, particulate, and ozone precursor emissions from public and private fleets operation in the AQMD. Refuse collection vehicles, in particular, represent an important opportunity to reduce these emissions, because of 1) the potential for centralized refueling, and 2) the availability and successful commercial use of lower-emitting refuse trucks.

Proposed Rule 1193 is one of a series of rules being proposed that affect vehicle fleet operations in the District. The AQMD's objective is to promote the use of less-polluting vehicle technologies. Depending on the effectiveness of the implementation of Proposed Rule 1193 and the other fleet rules under consideration, the use of less-polluting technology may spread to other types of fleets.

BACKGROUND

Two important efforts to evaluate and identify air toxics are: (1) the AQMD Multiple Air Toxics Exposure Study II (MATES II); and (2) the California Air Resources Board's (ARB's) identification of particulate matter from diesel engine exhaust (as a surrogate for all diesel exhaust emissions including hydrocarbons) as a toxic air contaminant (TAC). The development of Proposed Rule 1193 is the result of these regulatory research efforts and the need for further criteria pollutant reductions. The development of the proposed rule is also affected by recent state and federal rulemaking efforts and actions that are intended to, or have resulted in, lowering on-road mobile source emissions by reducing tailpipe emissions and/or requiring the sale or purchase of alternative fuel vehicles.

MATES II

In March 2000, the AQMD Governing Board approved the release of the final report of the MATES II study. The objectives of this study were to monitor and evaluate urban air toxics, update the toxics emission inventories for the Basin, and conduct air toxic dispersion modeling to simulate the monitored data. During the course of the study, the ARB listed diesel particulate emissions as a toxic air contaminant. As such, the study provided an analysis of the potential air toxic impacts of diesel emissions. The study represented one of the most comprehensive air toxics programs ever conducted in an urban environment. The

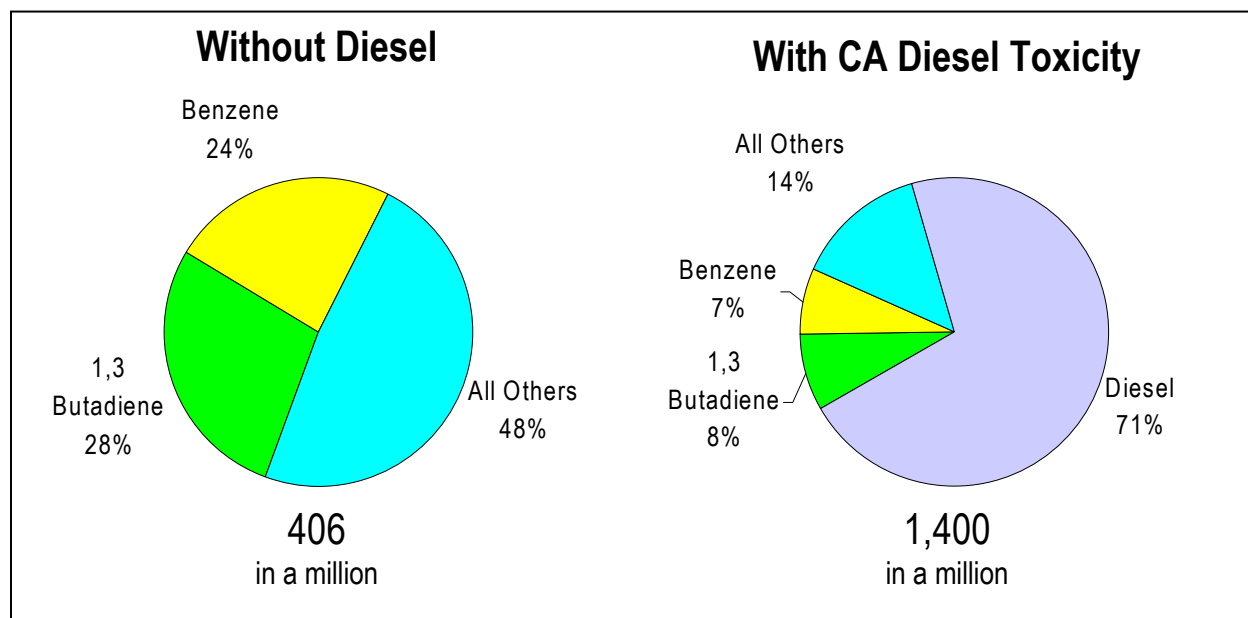


Figure 1
Estimated Average South Coast Air Basin Toxic Risk Contributions
based on findings from the MATES-II Study

scope of the study included the monitoring of more than 30 toxic air pollutants at 24 sites over a one-year period ending in the spring of 1999. The AQMD collected more than 4,500 air samples, and together with the ARB, performed more than 45,000 separate laboratory analyses of these samples.

The findings of this study indicated that the cancer risk from some air toxics in the Basin has declined by as much as 75 percent over the last decade. However, it also showed that based upon more extensive monitoring of the variety of toxic compounds in the air, the current potential cancer risk from toxic air pollution averages about 1,400 in a million in the region. As shown in Figure 1, the study found that about 71 percent of this cancer risk is attributable to diesel particulate. Other important toxic species contributing significantly to this cancer risk, originating from both gasoline- and diesel-powered mobile sources as well as stationary sources, are 1,3 butadiene (8 percent of risk), benzene (7 percent of risk), and carbonyls, which include formaldehyde and acetaldehyde (3 percent of risk). One objective of proposed Rule 1193, based on the findings of this study, is to reduce the contribution of overall toxic risk of diesel engine exhaust emitted by refuse collection fleets operating in the region, by accelerating the implementation of currently available less-polluting vehicle technology.

ARB Identification of Diesel Emissions as a Toxic Air Contaminant

In the early 1980s, the ARB established one of the nation's first comprehensive state air toxics programs — the California Air Toxics Program. Its goal is to protect public health by reducing toxic air emissions that pose the highest risk to Californians. This requires two separate steps. During the first step, risk assessment, the ARB identifies the highest risk substances called toxic air contaminants. In the second step, risk management, the ARB and local air pollution control districts investigate and adopt measures requiring air toxics sources to minimize risk to public health.

There are approximately 200 substances on the TAC list. More than 30 of these are found in diesel exhaust. On August 27, 1998, the TAC list was expanded to include particulate emissions from diesel engine exhaust, culminating a near-decade long scientific investigation into the health effects of exposure to the fine particles and other pollutants in diesel exhaust. Similar to the findings of the MATES II study, the ARB identification of diesel exhaust particulate matter (as a surrogate for all diesel exhaust emissions) as a TAC, provides another driving force for the AQMD to pursue the development of a refuse truck fleet rule as a strategy to mitigate public exposure to this pollutant.

Refuse Collection Vehicle Operations – General Description

Waste hauling companies are regulated by local city and county governments. Section 40059 of the Public Resources Code specifically delegates state authority in this area to local government agencies. Local governments provide the public with refuse collection services utilizing their own vehicle fleet and/or they permit a private company to provide this service in their area of jurisdiction. The vast majority of refuse collection services in the District are provided by private companies. Based on the best available information, only 19 local

agencies utilized their own fleet vehicles to provide this service. Specific waste collection services provided by public or private fleets that are affected by PR1193 include (1) municipal solid waste collection to landfills, (2) recyclable materials collection, and (3) green waste collection.

Private companies are allowed to provide refuse collection services through a contract or franchise with local jurisdiction, in return for rate regulation. Alternatively, the local jurisdiction may permit a number of waste haulers to compete for business within that jurisdiction. Typically, services for residential solid waste collection are permitted by exclusive contract or franchise, whereas commercial accounts are serviced by a number of permitted waste hauling companies that compete with each other.

In general, the transfer of solid waste can be either from the source directly to a landfill, or from the source to a transfer station (e.g., a materials recovery facility) and finally to the landfill. The transfer station is an intermediary location where curbside waste collection vehicles deposit their solid waste, and larger trucks, with much greater load capacity, transport solid waste from the transfer station to the landfill. Both transfer stations and landfills are either publicly or privately owned.

Because the waste hauling industry is regulated by local city and county governments, no single government listing has been compiled of refuse companies offering services throughout the District. Nevertheless, based on industry input, staff currently estimates that there may be approximately 6000 refuse trucks affected by PR1193. In an effort to refine this number, staff has surveyed local governments to provide the District with a list of waste hauling companies permitted to operate in their jurisdiction. To date, staff has compiled a list of approximately 300 waste hauling companies operating in the District, which was expected based on input from the waste hauling industry. Staff has surveyed these companies directly to obtain a profile of their fleet population and related data, such as fuel consumption and average vehicle life, that could help estimate the emissions benefit of the rule. (See Attachment 2, Refuse Vehicle Usage Survey Form.)

There are two basic chassis/engine combinations used for refuse trucks. The first type, for waste hauler use for curbside refuse collection or roll-off (refuse trucks that carry large bins to and from commercial sites) are typically of a GVW between 50,000 and 60,000 lb., and are generally powered by heavy-duty engines in the range of about 280 to 330 horsepower. These types of refuse trucks, based on industry input, constitute about 95 percent of all waste hauling vehicles. The second basic type of waste hauling vehicle is called a transfer vehicle. These resemble the largest line-haul trucks, in that they are designed with a GVW of up to 80,000 lb. and are powered by heavy-duty engines of about 400 hp. These vehicles specialize in transferring solid waste from transfer facilities to the landfills.

Current Use of Natural Gas and Dual-Fuel Refuse Trucks

Characteristics of a Natural Gas Waste Hauler. Natural gas refuse trucks can be powered by engines operated on LNG or CNG, or by dual-fuel engines that use both diesel fuel and natural gas. The natural gas fuel tanks add approximately 500 to 1500 lb. of weight to a refuse truck, which affects its payload capacity. Natural gas refuse truck engines are typically rated at 250 to 400 hp.

Although the cost of natural gas is generally less than that for diesels, natural gas usage is up to 20% greater when compared to diesel usage. However, one engine manufacturer claims equivalent fuel usage for their diesel and natural gas engines. In addition, elimination of alternative emission control devices on diesel heavy-duty engines may narrow the fuel economy gap as well, per the 1998 settlement agreement between ARB, U.S. EPA and the seven HDE manufacturers.

Attachment 3 lists information on the availability of natural gas engines and engine/chassis combinations that could be used in waste hauling vehicles. Attachment 4 lists the corresponding emissions related information for these engines. Engine manufacturers producing dedicated natural gas engines for waste hauling applications include Cummins Engine Company, Deere Power Systems, Detroit Diesel Corporation, and Mack Truck Corporation. Certified conversion systems for Caterpillar electronic diesel engines are available from Caterpillar dealers. These conversion systems convert the diesel engine into a compression ignition natural gas engine (commonly known as a “dual-fuel” or “bi-fuel” engine). Chassis manufacturers currently offering or planning to offer refuse trucks utilizing these engines are Crane Carrier, Freightliner Trucks, Mack Truck Corporation, Peterbilt, Western Star, and Alternative Fuel Technology (AFT). A number of these refuse trucks and engines are currently operating in the District. These include natural gas waste hauling operations in Orange, Riverside, and LA counties. Waste Management of the Desert in Palm Desert and Waste Management of Orange County use spark ignited natural gas engines in their refuse trucks, while Taormina in Anaheim uses compression ignited natural gas/diesel dual-fuel refuse and transfer trucks.

Based on industry input and staff observations, the operation of spark ignited natural gas powered refuse trucks has been successfully demonstrated from an overall operational standpoint. This has been specifically reported by Waste Management to District staff, based on their experience natural gas powered refuse trucks in the District and in other areas of the country. Within the District, Waste Management operates 30 natural gas powered refuse trucks in Coachella Valley (Waste Management of the Desert) and in Orange County. Natural gas powered refuse trucks have been successfully demonstrated to the point where Waste Management plans to convert their entire fleets, operating in the Coachella Valley to using natural gas.

The advantage of compression ignition natural gas over spark ignition natural gas are: a lower weight penalty from fuel tanks due to the superior fuel efficiency, less space required for fuel tanks due to the superior fuel efficiency, longer range due to the better fuel efficiency, lower capital cost due to fewer fuel tanks and lower capital cost due to the use of a standard base engine rather than a custom built spark ignition engine.

GENERAL DESCRIPTION AND EXPLANATION OF RULE REQUIREMENTS

Purpose of the Rule

The purpose of PR 1193 is to reduce criteria pollutants (NO_x) and toxic (PM) emissions from municipal solid waste collection operations in the District. This is accomplished by requiring purchasers of fleet refuse trucks, when adding or replacing heavy-duty refuse trucks to their

fleets, to purchase cleaner-burning, lower-emitting, alternative-fuel or dual-fuel heavy-duty refuse trucks, as commercially available. Alternative fuel is defined as compressed or liquefied natural gas, liquefied petroleum gas, methanol, electricity, fuel cells, or other advanced technology that does not rely on diesel fuel. Dual-fuel vehicles are equipped with a diesel engine that uses an alternative fuel in combination with the diesel fuel to enable compression ignition.

Applicability

The proposed rule applies to public agencies and private companies that operate solid waste collection vehicles and their fleets consist of 15 or more solid waste collection (vehicles that operate on fixed routes and collect solid waste at residential or commercial establishments), transfer, or rolloff vehicles. PR1193 maximizes the air quality benefit for this fleet segment by taking advantage of the significant benefits of natural gas engine technology in terms of its inherently low NO_x and PM emissions. In an effort to facilitate the transition from diesel to dedicated natural gas operation, PR1193 allows compression ignited dual-fuel technology for a limited time (prior to July 1, 2002) for purchases of solid waste collection vehicles. However, dual-fuel vehicle purchases or leases is provided for transfer or rolloff vehicles with no time limitations. The time restriction is placed on the solid waste collection vehicles so that AQMD staff can further evaluate the emission benefits of the dual-fuel technology in the solid waste collection duty cycle. Unlike the other vehicles where dual-fuel is allowed with no time limitations, these vehicles may use natural gas for a smaller part of their duty cycle and may not be as low emitting as in other duty cycles. As part of this evaluation, AQMD staff intends to evaluate all engine technologies as they are applied in the refuse collection operations.

For the purposes of PR1193, a heavy-duty truck is a vehicle having a GVW of at least 14,000 pounds. A refuse truck is one that is used for the express purpose of collecting and/or transporting solid waste, except hazardous waste, as defined in Section 40191(a) of the Public Resources code.

Vehicle Purchase Requirements

The proposed rule would require that beginning July 1, 2001, public and affected private operators of fleets consisting of 50 or more solid waste collection vehicles and beginning July 1, 2002, for public and private operators with 15 or more solid waste collection vehicles or a combined total of 15 or more rolloff, transfer, or solid waste collection vehicles, when adding or replacing a heavy-duty refuse truck to their fleets, to purchase or lease an alternative-fuel heavy-duty refuse truck, as commercially available. In addition, the rule requirements would provide, the option of purchasing or leasing any solid waste collection vehicle having a dual-fuel engine that has been ARB-certified to meet an optional NO_x standard and a particulate emissions level equivalent to an alternative-fuel engine. Beginning July 1, 2001, for public or private operators with a combined total of 15 or more transfer or rolloff vehicles, all new purchases of transfer or rolloff vehicles must be equipped with an alternative-fueled or a dual-fuel engine. Vehicles that are contracted for purchase prior to the rule-effectiveness date are not required to comply with PR1193 purchase requirements. However, options to purchase vehicles exercised after the adoption of Rule 1193 would be subject to the rule requirements.

Permitted alternative fuels include compressed or liquefied natural gas, propane, methanol, electricity, fuel cells or other advanced technologies that do not rely on diesel fuel, consistent with allowable alternative fuels in ARB transit bus regulation. For the purposes of this rule, a dual-fuel engine is one that uses a combination of natural gas and diesel fuel, as described in the above sections.

Exemptions

In response to comment from entities potentially affected by the proposed rule, PR1193 exempts certain types vehicles purchased from the utilization of alternative fuels. These include evaluation/test vehicles, vehicles not used for the express purpose of collecting and transporting solid waste from residential or commercial establishments to transfer stations or landfills, and alternative fuel model unavailability. These exemptions allow for promising experimental technologies to be demonstrated, clarify the intent of the rule, and address concerns regarding the possibility that a satisfactory alternative-fuel refuse truck may not be available for a specific niche application. In addition, under emergency situation such as a natural disaster, conventionally-fueled refuse collection vehicles may be brought into the District as allowed under the AQMD Rule 118 if the Governor or President declares a state of emergency.

Comments were made that for smaller operators there may still be a need to provide some relief from the rule requirements if the infrastructure or funding for alternative fuel vehicles are not available. PR 1193 now provides language that the operator may make a case before the AQMD Hearing Board as provided in AQMD Regulation V to seek relief from the rule requirements, in some cases. Persons in violation of this rule are subject to all penalties and enforcement proceedings specified in the Health and Safety Code until such time as they obtain a variance from the District Hearing Board.

Compliance Auditing and Enforcement

PR1193 will require that affected public agencies keep sufficient vehicle data records to document rule compliance, and that these records be maintained for a minimum of two years. The AQMD intends to audit these records, either at the vehicle fleet location or by requesting appropriate documents to be submitted to the AQMD for review. The specific data to be kept for each new vehicle will include the DMV Certificate of Title and registration, vehicle manufacturer, model-year, model, engine family number, fuel type, and fuel usage. In addition, to the preceding, affected fleets utilizing the exemption provision of the proposed rule must supply documentation proving the exemption of each exempt vehicle purchase to AQMD upon request. If a public agency is found to be in non-compliance with rule requirements, then the public agency will be subject to penalties specified in Health and Safety Code Division 26, Part 4, Chapter 4, Article 3. The AQMD also plans to develop an enforcement guideline document that will stress the implementation of corrective actions by public fleets rather than punitive monetary penalties during the initial years of rule implementation, for first time violators.

EMISSION BENEFITS

Criteria Pollutants

The goal of the proposed fleet rule is to reduce PM and NOx emissions through the introduction and use of cleaner-burning vehicles. These emission benefits are expected to primarily consist of reduced toxic exposure to diesel particulate matter and reduced emissions of nitrogen oxides. With regard to the criteria pollutants, PR1193 is specifically based on achieving emission reductions beyond the mandatory U.S. EPA and ARB heavy-duty engine emission standards. The emission benefits for PR1193 are based on refuse truck fleets purchasing alternative-fueled refuse trucks instead of diesel refuse trucks.

Emission reduction estimates were originally developed for the entire suite of fleet rules using an approach based on vehicle-miles-traveled (VMT) data from the latest ARB-approved emissions inventory model, EMFAC7G. Based on this approach and on general assumptions that apply to all heavy-duty vehicles in all of the proposed fleet rules, estimates for the year 2010 would be 11 to 16 tons per year of PM and 75 tons per year of NOx.

However, one of the largest waste hauler fleet operators noted that, for a typical refuse truck operation, much of the fuel consumption (and, thereby, emissions) occurs in activities that produce substantially more emissions compared to an average heavy-duty vehicle – that is, in the loading of curbside trash into the refuse truck, in frequent or prolonged engine idle, and in frequent low-speed stop-and-go driving conditions. Therefore, the emission reduction estimates presented below have been based on total fuel consumption, covering both travel and collection activities. Emission reductions were specifically determined using input provided by the waste hauling industry, and the Carl Moyer Program methodology for quantifying emission reductions for natural gas heavy-duty vehicle projects, including waste hauling projects. In addition, based on input from ARB staff, this methodology should provide an improved estimate of emission reductions from clean fuel fleet operations. The following formula and assumptions are utilized the emission reductions for PR1193.

$$\text{Annual ER} = (\text{Number of vehicles}) * (\text{Annual Fuel consumption, gal}) * \\ (18.5 \text{ bhp-hr/gal}) * (\text{Mandatory std} - \text{Optional std}) / \text{Useful life}$$

Assumptions:

1. Incorporate adopted ARB & U.S. EPA emission standards, to ensure surplus emission reductions only.
2. Rule implementation starts July 1, 2001.
3. Rule affects 6000 refuse trucks (based on industry input).
4. Diesel fuel consumption equals 10,000 gallons per vehicle per year (based on industry input).
5. Useful life equals 12 years (industry input is 10 to 15 years).

6. The following NO_x emission rates are used for diesel powered refuse trucks:

<u>Timeframe</u>	<u>Rate</u>	<u>Explanation</u>
2001 - 9/2002	4.0 g/bhp-hr	Mandatory ARB/U.S. EPA Emission Std.
10/2002 - 2010	2.0 g/bhp-hr	Nominal NO _x emission level assumed by ARB as the NO _x portion of the mandatory 2.5 g/bhp-hr NMHC+NO _x emission standard, based on ARB staff input.

7. The following NO_x emission rates are used for alternative-fuel powered refuse trucks:

<u>Timeframe</u>	<u>Rate</u>	<u>Explanation</u>
2001 - 9/2002	2.5 g/bhp-hr	Based on ARB staff input and certification standards for natural gas heavy-duty engines.
10/2002 - 2010	1.4 g/bhp-hr	Based on discussions and concurrence with ARB technical staff regarding the appropriate nominal NO _x emission level that corresponds with the expected certification level of 1.8 g/bhp-hr NMHC+NO _x for alternative-fuel heavy-duty engines in this time frame.

8. PM standard for diesel HDEs is based on 0.1 g/bhp-hr emission standard.

9. For alternative fuels (e.g., natural gas), an average PM level of 0.03 g/bhp-hr is assumed, based on ARB input and certification data for HDEs. Also, this emission level is consistent with the PM standard for the alternative-fuel path in the recently adopted ARB Urban Bus Fleet Rule.

Based on the methodology and assumptions above, Table 3 details the emission reductions on a yearly basis for the years 2001 through 2010.

Table 3
Proposed Rule 1193 Emission Reduction Estimates
 (Tons per year)

Year	Oxides of Nitrogen		Particulate Matter	
	Current	Cumulative	Current	Cumulative
7/2001 - 2002	76	76	4	4
2002 - 2003	130	206	7	11
2003 - 2004	61	267	7	18
2004 - 2005	61	329	7	25
2005 - 2006	61	390	7	32

2006 - 2007	61	451	7	39
2007 - 2008	61	512	7	46
2008 - 2009	61	573	7	53
2009 - 2010	61	634	7	61
2010 - 2011	61	695	7	68

Air Toxics

Estimated Relative Toxicity of Diesel and Natural Gas Powered Refuse Trucks.

The relative air toxic risks of diesel and corresponding natural gas refuse trucks were estimated using an approach based on determining weighted toxic risk factors for the two fuels under consideration. The weighted toxic risk factor is determined by multiplying the individual toxic constituents of the exhaust by their respective cancer potency factor, and then proportionately adjusting these values by an estimated annual mass emission rate of particulate matter (PM) and non-methane hydrocarbon emissions (NMHC). The purpose of this analysis is to use these weighted toxicity factors to estimate the number of natural gas refuse trucks roughly equivalent to one diesel refuse trucks based on toxic risk.

For the purposes of this analysis, the toxic component analyzed for diesel refuse trucks is limited to total PM emissions. This is because ARB staff has indicated that the toxic risk factor for diesel PM already incorporates toxic risks from all other constituents in diesel exhaust. For natural gas refuse trucks, the relative toxic risk was estimated based on the PM contribution of nickel and hexavalent chromium emissions, and the NMHC emissions of formaldehyde, acetaldehyde, benzene, and 1,3 butadiene. ARB speciation profiles were used to develop nickel and hexavalent fraction of the natural gas PM exhaust. With regard to NMHC components, a paper from West Virginia University (SAE paper 972971) was used to develop the benzene and 1,3 butadiene NMHC fractions, and an ARB speciation profile from an industrial natural gas-powered internal combustion engine was used to develop the formaldehyde and acetaldehyde NMHC fractions. (The West Virginia University paper provided speciation data generated from a CNG-powered engine used in on-road vehicle applications, but did not specifically include formaldehyde and acetaldehyde data.)

For the purposes of this specific analysis, the annual PM emission rates for diesel and natural gas refuse trucks were developed using the same assumptions contained in the criteria pollutant benefit methodology. These assumptions include diesel refuse truck emissions of 0.1 g/bhp-hr for 2000 and subsequent years, and natural gas refuse truck emissions of 0.03 g/bhp-hr for 2000 and beyond. The annual mass emission rate of NMHC emissions for natural gas engines is highly variable based on input received by engine manufacturers, as evidenced by ARB certification data for natural gas engine families approved for sale in California. For the purposes of this analysis, a range of NMHC emissions was estimated using this certification data. Using this range, which corresponds to 0.3 g/bhp-hr to 0.8 g/bhp-hr, for the 2000-to-9/2002 time period and 0.3 to 0.5 g/bhp-hr for the 10/2002-and-later time period, assumed conversion factor of 18.5 bhp-hr/gal for refuse trucks, and an assumed fuel consumption for refuse trucks of 10,000 gal/yr, annual NMHC emissions were determined.

Table 4 shows the annual PM and NMHC mass emission rates, relative toxicity factors for PM and NMHC exhaust components, and the overall weighted toxicity factor. Based on these overall weighted toxicity factors, Table 5 shows the number of CNG refuse trucks that is roughly equivalent to one corresponding diesel-powered refuse trucks. The number is equal to the overall weighted toxicity factor for the diesel refuse trucks divided by the corresponding value for the natural gas refuse trucks. Different time frames are utilized in this analysis to account for more stringent emission standards for NO_x, and NMHC that are implemented in the overall time frame being analyzed.

Based on this analysis, it can be concluded that significant toxic emission benefits will occur on a per vehicle basis from the use on a natural gas refuse truck versus a diesel refuse truck. Depending on the time frame, one diesel refuse truck is estimated to have the same toxicity as up to 74 corresponding natural gas refuse trucks, as shown in Table 5. Depending on the availability of particulate traps that are still under development by control device and engine manufacturers, this ratio may be expected to decrease.

Table 4
ESTIMATED RELATIVE TOXIC RISK

POLLUTANT	COMPOUND	2000 THRU 9/2002		10/2000 & LATER	
		DIESEL	CNG	DIESEL	CNG
PM (lb/yr)		40.7	12.2	40.7	12.2
NMHC (lb/yr)		----	122-326	----	122-204

Resultant Emission-weighted Toxicity Risk Factors

	DIESEL PM¹	122.2	----	122.2	-----
	METALS²	----	0.41	----	0.41
	NMHC³	----	1.24-3.31	----	1.24-2.08
OVERALL WEIGHTED TOXIC RISK		122.2	1.65-3.72	122.2	1.65-2.49

1. Based on ARB input, the unit risk factor associated with diesel PM includes toxic risk contributions for all other compounds in exhaust.
2. Toxic risk for PM exhaust in CNG vehicles based on nickel and hexavalent chromium (Cr⁺⁶).
3. Toxic compounds in NMHC exhaust emissions for CNG vehicles included in this analysis are formaldehyde, acetaldehyde, benzene, and 1,3 butadiene.

Table 5
ESTIMATED VEHICLE TOXIC RISK RATIO¹

TIME PERIOD	RISK RATIO	
	MINIMUM	MAXIMUM
2000 thru 9/2002	33	74
10/2002 and later	49	74

1. Number of CNG vehicles equal to one equivalent diesel vehicle based on toxic risk.

COST ANALYSIS

Fleet Cost Impacts

Increased capital and operational cost associated with compliance with the proposed rule is expected. However, individual cost impacts will vary depending on the individual public agency or private fleet. Cost impacts may be incurred through increased purchase,

maintenance, building upgrade, and refueling infrastructure costs. These impacts may be partially offset by lower fuel costs.

The capital cost of a spark ignition natural gas vehicle is more expensive than a comparable diesel model by a differential of approximately \$40,000 per truck while compression ignition gas versions of similar trucks have demonstrated a price differential of \$25,000 to \$30,000. This is primarily a result of the current low-volume production of natural gas vehicles. It is possible with larger production volumes and economies of scale, the capital cost is projected to decrease, based on an industry estimate, to about \$25,000 per vehicle for a spark ignition natural gas vehicle in the near term.

The maintenance costs of current CNG engines used in waste hauling operations are generally higher, but manageable, according to waste hauling industry representatives. It is expected that these maintenance costs will decrease as natural gas engine technology matures, according to natural gas heavy-duty engine industry input. As is common with new technologies, the maintenance costs for the first generation of natural gas vehicles are generally higher than for diesels. With increasing experience and training, maintenance issues have been resolved. At the same time, fleets have changed their preventative maintenance schedules to take advantage of the benefits of natural gas – especially the greatly increased oil life and reduced engine wear. For example, John Deere advertises “diesel-like fuel economy, longer service intervals, easier servicing, less downtime, and longer engine life” with regard to natural gas powered heavy-duty engines. The result has been a steady reduction in NGV maintenance costs. There have been numerous examples of fleets, in transit operations, that have experienced natural gas vehicle maintenance cost impacts that have been very comparable to their diesel counterparts. Staff believes that fleets operating natural gas powered refuse trucks as well will experience these positive results.

For example, Pierce Transit in Washington, with a fleet including many first and second generation CNG engines, has experienced total maintenance and oil costs of 16.4 cents per mile on its CNG buses, compared to 16.2 cents per mile for its diesel buses. The Antelope Valley School district experienced average maintenance costs of 13 cents per mile on 16 CNG school buses equipped with Deere engines, compared to 21 cents per mile for diesel buses purchased about the same time, and 24 cents per mile for its existing diesel buses. For a fleet of 136 1993-1996 CNG buses, Sacramento Regional Transit District found its maintenance costs to be 18.1 cents per mile in 1997, compared to 27.7 cents per mile for its fleet of 73 1985-1990 diesel buses. Sunline Transit Agency in the Palm Springs area reported average maintenance costs of 18.4 cents per mile for 34 1993-model CNG buses. Sunline has estimated that their overall costs have decreased by 27 percent through the use compressed natural gas (CNG) urban buses compared to diesel-powered buses.

The socioeconomic report prepared by the AQMD staff provides additional information relative to the costs and potential economic impacts of PR1193. Using the cost impacts ascribed to PR1193 and the emission benefits as detailed above based on best-available information, the cost-effectiveness ranges between \$8,000 per ton of emission reduction for the “best-case funding scenario” and \$40,000 per ton of emission reduction for the worst-case funding scenario. The “most likely funding scenario” is \$25,000 per ton of emission reduction.

Incremental Cost-Effectiveness Analysis

Health and Safety Code Section 40920.6 requires an assessment of incremental cost effectiveness for proposed regulations relative to ozone, CO, SO_x, NO_x, and their precursors. Incremental cost effectiveness is defined as the difference in control costs divided by the difference in emission reductions between two potential control options that can achieve the same emission reduction goal of a regulation. Compared to Proposed Rule 1193, incremental cost effectiveness of including non-waste hauling vehicles into the vehicle count as a result of including fleets where the total number of vehicles is 15 or more, but do not have 15 vehicles used in waste hauling activities, for determining the proposed rule's applicability is \$28,900 per ton of combined pollutants (NO_x and PM) assuming no funding. Approximately 1,200 waste hauling vehicles and five natural gas refueling stations would be added as a result of the analysis.

Funding Programs

Various federal, state and local funding programs are available to assist public waste hauling agencies (and, in some programs, their private partners) in the acquisition and operation alternative-fuel heavy-duty refuse trucks. These are generally described below. In addition, a more detailed discussion of these funding sources is included in the socioeconomic report that is currently being prepared by AQMD staff.

State Energy Program. States will promote the conservation of energy, reduce the rate of growth of energy demand, and reduce dependence on imported oil through the development and implementation of a comprehensive State Energy Program. The State Energy Program is the result of the consolidation of two formula grant programs – the State Energy Conservation Program and the Institutional Conservation Program. The State Energy Program includes provisions for competitively awarded financial assistance for a number of state-oriented special project activities, including alternative fuels. In addition to funding for special project activities, states may choose to allocate base formula funds to programs to accelerate the use of alternative fuels for government vehicles.

For more information, contact your State Energy Office or the DOE Regional Office for your region, listed under the Points of Contact section for your state, or contact Ron Santoro at DOE Headquarters at (202) 586-8296.

The Carl Moyer Program was established by ARB to provide incentives to encourage and expedite implementation of the cleanest commercially available vehicles, and specifically to reduce emissions from heavy-duty engines. The incentives are grants for offsetting the higher costs of primarily alternative-fuel heavy-duty vehicles, and for supporting the fueling infrastructure. The ARB has established overall program requirements and allocates funds to local air districts, including AQMD, for local program administration. To date, both dedicated natural gas and dual-fuel refuse trucks have been approved for funding by the Governing Board.

The AQMD contact is Cindy Sullivan (AQMD) at 909-396-3249.

Mobile Source Air Pollution Reduction Review Committee's (MSRC) Discretionary Funds. This annual work program, that typically includes an HDV incentive program, pays the incremental cost for the purchase of new OEM alternative-fuel engines and vehicles.

Thirty percent of the funds collected each year from a \$4 surcharge on vehicle registration created by **AB 2766** (Sher) goes to the Mobile Source Air Pollution Reduction Review Committee (**MSRC**) to be used to implement programs to reduce mobile source emissions. Managers of the program have apportioned the available funding into several technology-specific categories, including alternative-fuel heavy-duty refuse trucks. To date, both dedicated natural gas and dual-fuel refuse trucks have been approved for MSRC Program funding by the Governing Board.

The AQMD contact is Ray Gorski (MSRC Technical Advisor) at 909-396-2479.

Local Government Subvention Funds. Forty percent of the **AB 2766** funds collected go to local governments based on a pro-rated share of population and must be used to reduce mobile source emissions. Cities can use their funds to purchase alternative-fuel vehicles or engines. While these funds are used primarily by municipalities for their own projects, these monies can be allocated by the city for public-private partnerships to pursue AFV and EV projects. Funds not expended carry over from year to year.

The AQMD staff contacts are Larry Rhinehart (AQMD) at 909-396-2898 and Oscar Abarca (AQMD) at 909-396-3242.

Current and recent users and applicants of the above co-funding programs include the following. Waste Management, Inc., currently operates 30 natural gas refuse trucks in the District, and plans an additional 200 CNG and LNG trucks during the next two years, along with six new natural gas fueling stations. The Carl Moyer Program will provide partial funding for 50 refuse trucks, 9 new and 41 re-powers. Burrtec Waste Industries, Inc., operates 175 refuse trucks in Riverside, Fontana, Victorville, Irwindale, and Yucaipa. Burrtec replaced 13 diesel trucks in last year's Carl Moyer Program and is planning to replace 42 more this year. The new trucks are powered by dual-fuel (LNG/diesel) engines. Other applicants to the Carl Moyer Program this year are BFI (Sunshine Canyon) for 10 dual-fuel trucks, CalMet Services (Montebello-Downey-Cerritos) for 30 repowered CNG trucks, USA Biomass Corporation for 13 repowers to dual-fuel trucks, Spartan Cleanup Corporation for 8 repowers to dual-fuel trucks, and Palm Spring Disposal Services for the purchase of 6 new CNG refuse trucks.

PUBLIC COMMENTS

Comments and Responses

The following summarizes key public comments and staff responses regarding the development of Proposed Rule 1193 – Clean On-Road Residential and Commercial Refuse Collection Vehicles. These comments were received in writing and in discussions at various meetings, including public workshops and the PR1193 working group meetings. The AQMD received comments from representatives of local government agencies and commercial waste hauler operators, as well as other interested parties.

Comment 1. The proposed rule language will not require hundreds of small private haulers with less than 15 vehicles to purchase alternative fuel trucks, while

larger companies will be forced to convert to natural gas waste hauler operation. Since the larger haulers often compete in the same markets with the small haulers, the larger waste haulers will have larger costs with a resultant loss in market share.

- Response 1. The AQMD is sensitive to this issue, as we have attempted to craft PR1193 to include as many public and private waste haulers as practically feasible at the present time, to minimize these competitive impacts. Staff generally believes that the larger vehicle fleets will be better positioned to accommodate the gradual utilization of alternative-fueled vehicles because many of these fleets are centrally fueled. Another mitigating factor, based on industry input, is that the larger fleets tend to have lower overall costs compared to smaller fleets, because of economies of scale, and the larger fleets generally implement more sophisticated and effective approaches in reducing fleet operating costs.
- Comment 2. Many medium-sized companies may be motivated to split their fleets into separate legal entities for purposes of avoiding the fleet conversion requirements of PR1193.
- Response 2. AQMD staff will evaluate this issue very closely at the time PR1193 begins implementation. If waste hauling companies are split into smaller entities to avoid rule compliance and circumvent the rule, the AQMD will attempt to apply the PR1193 to these separate entities, to the greatest degree possible.
- Comment 3. PR1193 should focus first on public agencies providing waste hauling services and private waste hauling operators with exclusive contractual arrangements to avoid competitive inequities.
- Response 3. AQMD staff has evaluated this comment regarding exclusion of private fleets from PR1193 that openly compete with each other to provide waste hauling services. Staff believes that since the rule in its current form would result in substantially the same cost impacts for these fleets, and these cost impacts would have to be passed through to the customer, there should not be any competitive inequities for these fleets.
- Comment 4. PR1193 contains a number of terms and definitions that are inconsistent with the basic body of state law that governs the solid waste industry. Most of the definitions in the proposed rule can be eliminated in favor of references to an existing definition in the Public Resources Code.
- Response 4. AQMD staff has been working very closely with the solid waste industry from the standpoint of maximizing the use of existing definitions and terminology utilized in the waste hauling industry, while maintaining the specific objectives and intent of the rule language. For example, the definition of solid waste references the Public Resources Code. Staff will continue to work with the waste hauling industry to ensure that the PR1193 is consistent as possible with terminology used in existing statutes affecting waste hauling operations.

- Comment 5. An exemption should be added to the PR1193 for vehicles deployed to respond to public emergencies such as floods, fires, or earthquakes.
- Response 5. The principal area of concern is whether there would be sufficient refueling infrastructure to support alternative-fuel refuse trucks during an emergency situation. Since PR1193 would result in the gradual introduction of alternative-fuel refuse trucks into fleet operations, staff believes that there would be sufficient time for the refueling infrastructure to develop, corresponding to the gradually increasing fleet penetration of alternative-fueled vehicles. Staff will continue to monitor this situation to ensure that emergency response capabilities of the waste hauling fleet are not substantially impaired subsequent to rule implementation.
- Comment 6. The District should delay the effective date for PR1193 to July, 2002. This added time will provide engine manufacturers the market certainty needed to expand their production capability of natural gas heavy-duty engines and should lead to a significant reduction in engine costs.
- Response 6. PR1193 specifies a phased-in implementation schedule from July 1, 2001 to July 1, 2002 depending on the size and types of vehicles in the fleet, which provides approximately a one- to two-year lead-time subsequent to the planned rule adoption date. Staff believes that, based on the current model availability of alternative-fuel refuse trucks and input from industry regarding necessary lead-time, this implementation schedule is justified. It should be noted that current AQMD regulations can potentially allow conventionally powered refuse trucks to be deployed in the District subsequent to rule implementation, if they are needed for emergency response purposes. Under AQMD Rule 118, the Executive Officer may suspend certain District rules during a state or federally declared state of emergency.
- Comment 7. There are already a number of dedicated natural gas heavy-duty engines available that can power refuse trucks, including engines produced by Mack Truck, Cummins Engine Company, Detroit Diesel, and Deere Power Systems. In addition, the percent of natural gas supplied to power dual-fuel engines could range as low as 55% (the remaining 45% being diesel fuel), which is substantially below the 70% figure indicated by promoters of this technology. Therefore, PR1193's permitted use of dual-fuel engines would not create a level playing field unless the dual-fuel engine achieves the same NO_x and particulate reductions (current and longer term) as dedicated natural gas, and dual-fuel engines are tamper proof to prevent higher reliance on diesel fuel.
- Response 7. With regard to emission reductions, s there may be a potential for higher NO_x and PM in-use emissions from dual-fuel engines compared to dedicated natural gas engines. Particulate matter is an especially important concern due to ARB's identification of particulate mater in diesel engine exhaust as a Toxic Air Contaminant, as well as the District's finding in the MATES II study that the majority of cancer risk from

ambient air results from diesel engine generated particulate matter emissions. The AQMD will be evaluating the emission benefits of all engine technologies as they are applied in refuse collection operations. With regard to the tampering issue, ARB staff indicated that the most recent certification conditions to ensure that tampering does not occur have been addressed..

Comment 8. Outstanding issues remain regarding PR1193; however, many of these issues can be resolved if District staff forms an industry task force and makes adequate time available to resolve these issues, prior to District Board consideration of the proposed rule.

Response 8. District staff is attempting to resolve outstanding issues with affected parties through the PR1193 Working Group, which consists of representatives of private and public waste hauling fleets, local trade associations, fuel suppliers, and other interested parties. In addition, District staff has held numerous public workshops in an effort to solicit input from affected organizations. The District staff will not bring a proposed rule to the Governing Board for consideration unless we believe that the viability of a proposed rule has been adequately researched and outstanding issues have been addressed to the maximum degree possible. AQMD will continue to utilize the working group to serve as an implementation oversight group. AQMD will also add rule language requiring fuel usage records and other enforcement approaches.

Comment 9. Based on the operation of our waste hauling fleet, a considerable amount of fuel consumption and possibly emissions is due to the operation of the engine to provide necessary power to transfer curbside trash into the waste hauling vehicle. In addition, a significant amount of fuel consumption and possibly emissions is generated at idle and as a result of the stop and go nature of waste hauling operations. Rather than basing the emission reduction calculation on vehicle miles traveled, this calculation should more appropriately be based on fuel consumption, which will better reflect the overall amount of emissions and potential emission reductions from clean fuel operation. In addition, appropriate assumptions can be developed for waste hauling vehicle fuel consumption rather than vehicle miles traveled, since the former is usually tracked by waster hauling fleets for cost accounting purposes.

Response 9. AQMD staff agrees with this comment and has developed a revised emission reduction methodology for waste hauling vehicle operation using fuel consumption. This methodology is consistent with the methodology used in ARB issued guidelines for the Carl Moyer program, for quantifying emission reductions for heavy-duty engine emission reduction projects. In addition, based on input from ARB staff, this methodology should provide an improved estimate of emission reductions from clean fuel fleet operation. Previously, AQMD staff used a vehicle-miles-traveled approach, consistent with EMFAC7G (ARB's latest approved emissions inventory model) to calculate the overall heavy-duty vehicle emission reduction for the entire suite of fleet rules.

- Comment 10. There is a lack of proven, reliable alternative-fuel technology for waste hauling vehicles, that would allow for performance at a level where it could provide safe, efficient, and cost-effective service to the industry and its customers.
- Response 10. Based on input from engine manufacturers and vehicle fleets operating various types of heavy-duty natural gas vehicles, including waste hauling fleets, the first generations of dedicated natural gas engine technology were less reliable and cost more to maintain, which is usually true for most new technologies. However, many of these sources have indicated that the technology has matured and can potentially result in maintenance costs that are not significantly different compared to diesel technologies. There have been at least two heavy-duty vehicle fleets that have reported lower maintenance costs for natural gas heavy-duty vehicles compared to corresponding diesel vehicles. One of the largest waste hauling fleets operating in the District with significant heavy-duty natural gas vehicle experience has indicated that these first generation problems have been largely overcome, and is planning to expand their fleet of dedicated natural gas refuse trucks. At one location, this waste hauling company is planning to convert all of their vehicles to natural gas operation.
- Comment 11. The availability of suppliers for alternative-fuel refuse trucks is insufficient.
- Response 11. Staff believes that the suppliers of engine/chassis combinations for waste hauling applications may be somewhat limited; however it should be sufficient to support the gradual introduction of alternative-fuel refuse trucks as required in PR1193. This assessment is based on input received by one of the largest waste hauling fleets operating natural gas powered refuse trucks, as well as information received from engine and chassis manufacturers regarding the near term availability of these vehicle models to support fleet rule implementation (see Attachment 3). In addition, upon demonstration that an alternative fuel engine/chassis configuration is not commercially available, a conventionally-fueled vehicle may still be purchased.
- Comment 12. The alternative-fueling infrastructure is insufficient to support clean vehicle operation, and there are not enough vendors available to support the alternative fuel refueling station operation.
- Response 12. It is acknowledged that the alternative fuel infrastructure must grow to accommodate the increased demand for these fuels as a result of PR1193 implementation. Based on input received from a variety of natural gas suppliers indicating their ability to support PR1193 implementation by designing, building, and operating refueling stations using their own capital, staff does not believe that insufficient numbers of alternative fuel vendors is a significant issue.

- Comment 13. There are insufficient financial incentives available from public and private sources to offset all costs associated with rule compliance.
- Response 13. There is a cost for improved air quality. With regard to PR1193, public funding opportunities are available to potentially offset a significant amount of the rule implementation cost. (See Economic Assessment, Assumption, Funding Sources, and Socioeconomic Report, Proposed Rule 1190 Series – Clean On-Road Vehicles.)
- Comment 14. The scope of PR1193 should be expanded to include private fleets that openly compete for business within a local jurisdiction.
- Response 14. District staff agrees with the Commentor and has crafted PR 1193 to include private fleets (with 15 or more vehicles) that openly compete for business within a jurisdiction within the scope of the proposed rule.
- Comment 15. Diesel vehicle pollution should be reduced through the use of clean fuel vehicles. They are available and cost-effective, and there are significant public monies to help make the transition to cleaner fuels. The use of green diesel technologies is problematic since in use testing demonstrates that add-on technologies for which clean and green diesel technologies depend deteriorate more rapidly that are therefore considered less durable than clean engines that burn cleaner without the use of add-on technologies. Also, green diesel technology is not certified by ARB and diesel PM is a toxic air contaminant.
- Response 15. AQMD staff agrees with the commentator, in that clean fuel technologies are inherently clean, commercially available, currently being successfully demonstrated in the District, and should be used to the maximum extent feasible by public transit fleets operating in the District. Green diesel technology is a promising technology, but the area of concern, as identified in the comment, is that ARB has not certified its use in California. In addition, green diesel technology, unlike clean fuel technology, will not result in NO_x reductions.
- Comment 16. The AQMD does not have the legal authority to include an option for diesel vehicles in the proposed rule.
- Response 16. AQMD staff disagrees with this comment, since the allowance for the use of vehicles powered by conventional fuels (including diesel) under certain limited circumstances (alternative fuel vehicle model unavailability and state of emergency situations) is based on Health and Safety Code Section 40447.5. This section allows the AQMD to require fleets to operate vehicles to the "maximum extent feasible" on the alternative fuel when

operating in the District. In addition, staff believes reasonable exemptions and equivalent alternative methods of compliance may be allowed in the fleet rules.

Comment 17. Dual fuel engine technology should only be permitted if dedicated natural gas engines do not supply necessary power required for a specific waste collection fleet operation. Also, dual fuel engine technology should only be permitted until July 1 2002, as this technology serves as a transitional tool to the goal of 100 percent dedicated alternative fuel engine operation.

Response 17. AQMD staff believes that the permitted use of dual fuel technology should be based on emissions performance, which is directly related to the proportion of natural gas/diesel usage in a refuse vehicle application. The proposed rule includes a limited timeframe for the use of dual fuel engine technology only for solid waste collection vehicles until its emissions performance can be more fully evaluated (See response to Comment 7). Based on recent data, dual-fuel technology has been shown to operate primarily on the alternative fuel for other refuse hauling vehicles such as transfer and rolloff vehicles.

Comment 18. AQMD's legal authority to regulate fleets may be preempted by the Clean Air Act.

Response 18. PR1193 is not a rule setting motor vehicle emission standards as contemplated by the Clean Air Act's preemption provision, but is a requirement that fleets purchase cleaner vehicles than they may have otherwise purchased in the absence of the proposed rule. Staff believes that such fleet requirements are consistent with the Clean Air Act. It should be noted that the authority being utilized for PR1193 is based on Health & Safety Code sections 40447.5 and 40919. If the Clean Air Act preempts AQMD's authority, then these statutes would be invalid.

However, if this rule is preempted, such preemption can be overcome by submitting the rule to U.S. EPA for waiver pursuant to the federal Clean Air Act Section 209, which directs U.S. EPA to waive preemption except in specified circumstances.

Comment 19. PR1193 is not fuel neutral. Vehicle emission standards should be specified rather than allowable fuels.

Response 19. The AQMD cannot specify vehicle emission standards because of legal restrictions. The AQMD's authority over fleets is primarily based on California Health & Safety Code Section 40447.5, which basically allows the AQMD to require fleet operators of 15 or more vehicles to purchase only vehicles powered by methanol or equivalently clean-burning vehicles. Because of methanol's inherently low particulate matter (PM) emissions when used as a heavy-duty engine application, equivalently

clean-burning fuels (including equivalent technologies) have been determined to include CNG, LNG, LPG, battery-electric, and fuel cells. These fuels are also consistent with permitted alternative fuels as contained in ARB's recently adopted Urban Bus Fleet Rule, and other state and federal definitions of alternative fuels.

Comment 20. The proposed rule should only apply to centrally fueled fleets.

Response 20 AQMD staff agrees that the applicability of the proposed rule should consider centrally fueled fleets as a criterion for developing the scope of the rule, as well as assuring that the rule's applicability is as wide as possible in order to maximize the emission reduction potential of the proposed rule. Central fueling capability was one of the main considerations for applying the proposed rule to refuse truck fleets. However, fleets that are capable of operating on alternative fuel, even if not centrally fueled at this point should also be covered by the rule.

Comment 21. The proposed rule is likely to have the effect of slowing fleet conversion and undermining the policy objective of reducing fleet emissions.

Response 21. Staff acknowledges this issue, but it is speculative to assume that this will generally occur throughout affected vehicle fleets. It is possible that some fleets may purchase diesel powered refuse trucks in advance of the rule implementation date in an effort to delay the purchase of alternative fuel refuse trucks. In addition, fleets may keep diesel powered refuse trucks longer than they would have in the absence of the rule. However, staff has not received significant input from affected fleets indicating that these actions would take place on a widespread basis among affected fleets. This is because, staff believes, that keeping older vehicles in commercial service after their normal retirement date may involve significantly higher maintenance cost impacts for the affected fleet. In addition, staff believes that there are competitive advantages for fleets operating newer clean burning alternative fuel refuse trucks versus much older higher polluting diesel powered refuse trucks. However, the CEQA analysis takes this factor into account.

Comment 22. "Green diesel technology" provides emissions performance that is environmentally better than the compliance options in the proposed rule.

Response 22. Staff believes that "green diesel technology" is promising; however, there are significant concerns with the use of this technology at the present time for rule compliance purposes (See response to Comment 15).

Comment 23. The proposed rule will increase CO and hydrocarbon emissions.

Response 23. Diesel engines, because they operate with excess air, produce inherently low CO and hydrocarbon emissions. Natural gas powered engines are

also inherently low emitters of CO and hydrocarbons (nonreactive) as well, since this fuel combusts easily during cold start conditions and nonreactive methane is the primary component of natural gas (i.e., the fuel itself is primarily nonreactive). Overall, based on existing certification emission data, it can be concluded that diesel engines have lower CO and hydrocarbon emission levels based on current technology. However, staff believes that this is not a significant issue since the natural gas CO emissions are substantially below the applicable emission standard. In addition, with the implementation of the 2.5 g/bhp-hr non-methane hydrocarbon + NO_x emission standard in October 2002, natural gas engine manufacturers will have to further reduce hydrocarbon emissions to levels that would not be significantly different than corresponding diesel engine levels.

- Comment 24. The proposed fleet rule will eliminate MSRC and Carl Moyer monies as potential funding sources to help pay for the increased costs associated with implementation of the proposed rule.
- Response 24. With respect to MSRC, this committee is in the process of directing substantial resources to supporting the fleet rules in next year's work program. With respect to Carl Moyer, AQMD staff has been evaluating this issue with ARB, and based on their comments, the proposed rule, as crafted, will not eliminate these funding sources from being utilized by affected fleets to help pay for rule implementation costs. This is because the proposed rule does not specify the alternative fuel engine emission compliance level; this level can be designated by MSRC and Carl Moyer for funding justification purposes.
- Comment 25. The proposed rule violates interstate commerce laws.
- Response 25. AQMD staff disagrees with this comment. The proposed rule affects government agency vehicle fleets and private fleets whose areas of jurisdiction and operation are within the District boundaries.
- Comment 26. The AQMD is inappropriately becoming involved with local fleet government contracts. Specifically, fleets that receive incentive money to help subsidize their operations would have a competitive advantage for receiving a government contract.
- Response 26. AQMD staff believes that this is speculative, and it is an issue that can be satisfactorily addressed as part of the funding selection process utilized by the funding source in determining which projects are able to secure monies to help pay for the additional incremental costs associated with alternative fuel vehicle operation.
- Comment 27. Costs for rule implementation are a concern for cities.

- Response 27. AQMD staff acknowledges this concern, and has been attempting to identify funding sources to help mitigate the cost impacts of this rule for both public and private fleets. Subsequent to rule adoption, staff will continue to increase available funding sources in an effort to further address this concern. It should be noted that there is already a precedent for significant funding availability from the Carl Moyer and MSRC programs for alternative fuel refuse truck programs.
- Comment 28. The AQMD should adopt a voluntary program in lieu of the current mandatory rule and acquire all funds necessary for the program.
- Response 28. AQMD staff believes that this concept is already being implemented with regard to the various government based funding programs (e.g., Carl Moyer, MSRC) being used to solicit voluntary private and public fleet participation in air pollution reduction programs. During the past several years, AQMD staff has been actively involved in attempting to secure the maximum amount of available public funding for use in these voluntary programs. With regard to the proposed rule, AQMD's goal is to achieve further air quality benefits beyond current voluntary efforts by requiring certain fleets to use commercially available clean vehicle technology, that is already being successfully demonstrated within the District. With regard to acquiring all funds necessary for program implementation, as mentioned previously, the AQMD will always strive towards achieving maximum available public funding to help pay for air quality programs, but the AQMD does not have the authority to increase our existing revenue base to the extent necessary to pay for all program costs. In this regard, the fleet rules are similar to AQMD stationary source rules, which impose some compliance costs on affected industries.
- Comment 29. Government should assert leadership in the campaign to clean air and support alternative fuels and other clean technologies.
- Response 29. Staff agrees with the commentator, and this is the primary reason why the proposed rule focuses on public agency transit fleets. Since public funds are primarily being used to support the operation of these fleets, and these fleets are used in highly urbanized areas where there is significant public exposure to their emissions, government agencies should take a leadership position in using clean vehicle technologies.
- Comment 30. The term alternative fuel includes reformulated gasoline and diesel.
- Response 30. Under the federal Clean Air Act, Section 241(2) does have a definition of clean alternative fuel that includes reformulated gasoline and diesel. However, the Code of Federal Regulations, Section 86.000-02 explicitly excludes gasoline and diesel. Under state law, Title 13, Section 2290 of the California Code of Regulations list alternative fuels explicitly and does not include gasoline or diesel. In any event, the AQMD is governed by

Health and Safety Code Section 40447.5, which refers to “equivalently clean burning alternative fuel”. Diesel is not an equivalently clean burning fuel.

Comment 31. Dual-fuel technology should be allowed indefinitely because it is the only technology that can meet all power requirements of the waste disposal industry, and it has the lowest weight/range penalty.

Response 31. The commentator is referred to Responses 7 and 17. In addition, AQMD staff has evaluated and has received input from the one of the largest refuse collection fleets, with significant experience with natural gas refuse trucks, indicating that there are sufficient models of dedicated natural gas powered heavy duty engines used in refuse truck applications that would satisfactorily address power requirements concerns. Staff acknowledges that dual fuel engine technology, due to diesel fuel usage in combination with natural gas, has lower weight/range penalties compared to dedicated natural gas powered heavy duty engines.

Comment 32. The definitions of fleet operator, collection vehicles, and transfer vehicles should be clarified.

Response 32. The commentator is referred to response to Comment 4.

Comment 33. Fleets with 50 or more vehicles should commence alternative fuel replacement on July 1, 2001, and fleets of 15 to 49 vehicles should be required to use low-sulfur diesel with exhaust traps.

Response 33. AQMD staff acknowledges this comment and has modified the proposed rule implementation timeframe to provide a phased implementation for fleets depending on fleet size and truck type over the July 1 2001 to July 1 2002 time period. Rather than requiring fleets of 15 to 49 vehicles to use low-sulfur diesel with exhaust traps, staff believes that it is more beneficial, from a NOx emissions standpoint and for other reasons (see response to Comment 15) to require these fleets to start purchasing alternative fuel refuse truck at the end of the implementation period (July 1, 2002), in recognition that these smaller fleets need additional time to accommodate the use of alternative fuel vehicles.

Comment 34. An advisory committee should be set up to develop a regional implementation plan.

Response 34. AQMD staff intends to include a provision in the adopting resolution for the proposed rule that would include a directive from the Governing Board for the staff to establish a working group comprised of representatives from private and public refuse collection or processing fleet operations, engine manufacturers, fuel suppliers, and the ARB to evaluate various PR1193 implementation issues.

- Comment 35. The rule should contain an exemption to provide relief when refueling infrastructure is not readily available in close proximity to the vehicle storage and/or maintenance yards.
- Response 35. AQMD staff acknowledges this concern, and has included specific language referencing existing Hearing Board procedures that may be used by an affected fleet operator to provide regulatory relief if adequate refueling infrastructure becomes an implementation issue.
- Comment 36. Loss in fuel efficiency, reduced engine life and reduced torque characteristics will ultimately result in spark ignited natural gas engine technology being rejected for truck applications.
- Response 36. AQMD staff disagrees with this comment. There have been numerous successful commercial demonstrations of alternative fuel (spark ignition) engine technologies in a variety of fleets located in the District, including refuse truck fleets. One of the largest refuse hauling fleets operating in the District has provided input to staff indicated the specific acceptability of this technology in this application.
- Comment 37. Proposed Rule 1193 will immediately end the sale of dual-fuel natural gas engine products for residential trash collection and trash transfer operations that fall under the jurisdiction of the proposed rule, since this technology is excluded in the rule language.
- Response 37. The purpose of PR1193 is to produce air quality benefits utilizing current alternative fuel heavy-duty engine technology for refuse truck applications. This may require certain engine manufacturers to further develop their engine technologies to the extent that refuse truck fleets affected by the proposed rule will be able to utilize their technology subsequent to rule implementation. To allege that a certain engine technology will not be immediately saleable subsequent to rule adoption, when rule implementation is phased-in over July 1, 2001 to July 1, 2002 is speculative at this time.
- Comment 38. The proposed rule language must specify that qualifying engine technologies must meet an optional emission standard.
- Response 38. Current AQMD authority to require vehicles powered by clean burning alternative fueled vehicle, as well as state and federal law, does not allow the AQMD to specify emission standards (see response Comment 18).
- Comment 39. There is no scientific basis for excluding dual-fuel engine technology in the proposed rule.

- Response 39. AQMD staff disagrees with this comment. The proposed rule allows the use of dual-fuel technology for a limited time frame only for refuse collection vehicles (but not transfer or rolloff vehicles), in concert with an evaluation of the emissions performance of this technology for refuse truck applications. This is based on the fact that the certification emissions of dual fuel technology indicate significantly higher PM emission levels compared to nearly all corresponding dedicated natural gas powered heavy-duty engines that can be used in refuse collection truck applications. It should be noted that because of similar concerns, ARB staff indicated to District staff that they are currently evaluating the emission performance of dual-fuel technology to determine the quantification of emission reductions from vehicles using this technology, for Carl Moyer funding purposes.
- Comment 40. Availability of trained technicians is an obstacle to program implementation.
- Response 40. AQMD staff acknowledges this comment. A document is currently being developed by AQMD staff to document current repair technician training resources that can be utilized by affected fleets. In addition, it should be noted that there is available funding (MSRC) that will help address training cost impacts.
- Comment 41. The staff report should clarify the potential future incremental costs of natural gas engines compared to corresponding diesel engines.
- Response 41. Based on input from one of the major heavy duty engine manufacturers (both diesel and natural gas powered engines), the future incremental costs of natural gas engines versus corresponding diesel engines is projected to decrease. Specifically, Deere Power Systems Group has indicated to the District that “vehicles powered by the latest technology Deere natural gas engines are demonstrating 35% lower operating costs than the latest production diesel engines.” They further indicate that “the proposed rules will contribute significantly to lower cost natural gas engines” because of increased production volume for these engines (resulting in price reductions due to economies of scale).

SUMMARY AND DRAFT FINDINGS

Summary

Proposed Rule 1193 is part of the AQMD's strategy to attain federal and state ambient air quality standards. Long-term air quality benefits are expected from attaining and maintaining the ambient air quality standards for particulate matter, nitrogen dioxide, and ozone. Improved air quality will ultimately reduce negative public health impacts from these criteria pollutants, and toxic pollutants.

Proposed Rule 1193 is technologically feasible and cost-effective, while reducing particulate matter and nitrogen dioxide emissions from diesel-powered vehicles; and the proposed rule addresses concerns raised by the public, wherever possible. Therefore, staff recommends the adoption of Proposed Rule 1193.

These findings are being made in compliance with state law requirements.

Draft Findings Required by the California Health and Safety Code

Health and Safety Code Section 40727 requires the AQMD to adopt written findings of necessity, authority, clarity, consistency, non-duplication and reference.

Necessity - The emission reductions associated with Proposed Rule 1193 are needed for the following reasons:

- a) State and federal health-based ambient air quality standards for particulate matter and ozone are regularly and significantly violated in the South Coast Air Basin. The reduction of particulate matter and nitrogen dioxide emissions from diesel powered vehicles from Proposed Rule 1193 is needed to meet federal and state air quality standards.
- b) By exceeding state and federal air quality standards, the health of people within the South Coast Air Basin is impaired.
- c) By exceeding state and federal air quality standards, the quality of life is reduced in the South Coast Air Basin in numerous respects.
- d) The California Clean Air Act (CH&SC Section 40910 et seq.) requires that the air districts make every effort to attain federal and state ambient air quality standards as soon as practicable. Proposed Rule 1193 makes progress toward that goal.
- e) About 71 percent of cancer risk from air toxics is attributed to diesel particulate emissions, which would be reduced by the proposed rule.

Authority - The AQMD Board obtains its authority to adopt, amend, or repeal rules and regulations from Health & Safety Code Sections 40000, 40001, 40440, 40441, 40463, 40702, 40725 through 40728, and 40910 through 40920.

Clarity - The AQMD Board determines that Proposed Rule 1193 is written or displayed so that its meaning can be easily understood by persons directly affected by it.

Consistency - The AQMD Board determines that Proposed Rule 1193 is in harmony with, and not in conflict with or contradictory to, existing federal or state statutes, court decisions, or regulations.

Non-Duplication - Proposed Rule 1193 does not impose the same requirements as any existing state or federal regulation and is necessary and proper to execute the powers and duties granted to, and imposed upon, the AQMD.

Reference - In adopting this proposed rule, the Board references the following statutes which the AQMD hereby implements, interprets or makes specific: H&S Code Sections 40001 (rules to achieve ambient air quality standards), 40440(a) (rules to carry out AQMP), and 40447.5(a) (rules to require fleets of 15 or more vehicles operating substantially in the AQMD to purchase vehicles powered by methanol or other equivalently clean burning alternative fuel when adding or replacing vehicles), 40919(a)(4).

ATTACHMENT 1

PROPOSED RULE LANGUAGE

PROPOSED RULE 1193 IS PROVIDED IN AN EARLIER PART OF THE BOARD PACKAGE AND WILL BE INSERTED HERE UPON ADOPTION BY THE AQMD GOVERNING BOARD.

ATTACHMENT 2

REFUSE VEHICLE USAGE SURVEY FORM

Company Name: _____
 Address: _____
 Telephone: _____
 Contact Person: _____
 E-Mail: _____

Date: _____

Confidentiality claimed for
 information submitted on
 this form.

Refuse Vehicle Usage Survey*

(Please complete for Each Vehicle Yard Location)

1.	How many refuse vehicles does your organization operate?	_____ Collection / Recycling / Roll-off _____ Transfer
2.	How many vehicles operate under exclusive contract or franchise with public agency?	_____
3.	Are your vehicles new or used when purchased? If used, what is the average vehicle age when purchased?	<input type="checkbox"/> New <input type="checkbox"/> Used <input type="checkbox"/> Both _____ Years Old
4.	What is your best estimate for how long vehicles are kept?	_____ Years
5.	On average, how much fuel is annually consumed for vehicle fleet in Question 1?	_____ Gallons
6.	What fuel(s) do your refuse vehicles use?	_____
7.	What is the approximate number of annual hours of operation for one refuse vehicle?	_____ Hours per year
8.	What vehicle range do your refuse vehicles need in one day?	_____ Miles
9.	What is your geographic area of Operation (e.g., cities)?	_____
10.	What is Your Vehicle Yard Location? (Street Address)	_____ _____

**Please copy this form if additional pages are needed to complete this survey.*

Please return this form via fax or e-mail to:

Henry Pourzand, South Coast AQMD, 21865 East Copley Drive, Diamond Bar, CA 91765
 Telephone: 909-396-2414
 Fax: 909-396-3324
 E-mail: hpourzand@aqmd.gov

ATTACHMENT 3

**NATURAL GAS REFUSE TRUCKS & ENGINES
– AVAILABLE IN 2000 –**

Attachment 3
(FOR INFORMATIONAL PURPOSES ONLY)
Natural Gas* Refuse Trucks & Engines
– Available in 2000 –

Truck Manufacturer	Truck Model	Engine Model	Horse-power	Torque lb-ft
Crane Carrier	(Model to be determined July, 2000)	Cummins C8.3G Deere 8.1 L	275 280	800 900
Freightliner Trucks	Business Class FL series Business Class FL series Heavy-Duty FLD series	PSA/Caterpillar 3126B Cummins C8.3G DDC Series 50, 60	190-250 275 275-400	550, 660 660-850 890-1450
Mack Trucks	MR Refuse Hauler LE Refuse Hauler CH Conventional Tractor	Mack E7G Mack E7G Mack E7G	325 325 350	1180 1180 1250
Peterbilt	330 Refuse Truck 320 Refuse Truck 320 Refuse Truck 357 Refuse Truck 385 Refuse Truck	PSA/Caterpillar 3126B PSA/Caterpillar 3126B PSA/Caterpillar C10 PSA/Caterpillar C12 PSA/Caterpillar C12	190 190, 250 305 410 410	520 520, 660 1050 1250 1250
Western Star Trucks	Constellation Series	Deere 8.1 L DDC Series 60 Cummins C8.3G	280 330, 400 275	900 1400, 1450 750
Aftermarket: NGV Ecotrans	Chassis: Volvo, Peterbilt, Freightliner, or Mack (Re-power, MY 1992-98)	Repowers: Cummins 8.3G H/O Deere 8.1L Deere 8.1L H/O PSA/Caterpillar 3126B	275 250 280 190, 250	850 800 900 550, 660

Engine Manufacturer	Engine Family	Engine Model	Horse-power	Torque lb-ft
Aftermarket: Alternative Fuel Technology (AFT)	(to be certified June 2000) (to be certified Aug. 2000)	AFT Navistar DT466 AFT Cummins L10	240 250	680 680
Cummins Engine Co	YCEXH0505CBG YCEXH0505CBI YCEXH0505CBJ (under Cert. Testing)	C8.3G (2.5 NOx) C8.3G (2.5 NOx) C8.3G C8.3G	250, 275 250, 275 250, 275 280	660, 750 660, 750 660, 750 850
Deere Power Systems Group	YJDXH06.8004 YJDXH08.1001 YJDXH08.1003 (certification due 6/00)	6068 HFN 6.8 L 6081 HFN 8.1 L 6081 HFN 8.1 L 6081 HFN 8.1 L	250 250 250 280	660 800 800 900
Detroit Diesel Corp	YDDXH08.5FJF YDDXH08.5FJG YDDXH12.7FGF YDDXH12.7FGG	Series 50 (2.0 NOx) Series 50 Series 60 (2.5 NOx) Series 60	275 275 330, 400 330, 400	890 890 1400, 1450 1400, 1450
Mack Trucks	YMKXH11.9G55	E7G	325, 350	1180, 1250
Power Systems Associates/Caterpillar	YPSXH0442EGJ YPSXH0629E6J YPSXH0729E6J	3126B Dual-Fuel (7.2L) C10 Dual-Fuel (10.3L) C12 Dual-Fuel (11.9L)	190, 250 305 410	550, 660 1050 1250

* All engines are dedicated natural gas, except for Power Systems Associates/Caterpillar engines, which are all dual-fuel, operating on natural gas and diesel fuel.

ATTACHMENT 4

**EMISSIONS DATA FOR NATURAL GAS ENGINES
FOR USE IN REFUSE TRUCKS**

ATTACHMENT 4
ENGINES FOR USE IN REFUSE TRUCKS (FOR INFORMATIONAL PURPOSES ONLY)
Model Year 2000

Mfr	ARB EO	Engine Family	MAX BHP	FUEL TYPE	THC	NMHC	CO	NOx	Opt NOx	PART	MODELS	HORSE-POWER	TORQUE
Cummins	A-21-287	YCEXH0505CBG	275	NG		1.1	7.1	2.19		0.07	C8.3-275G, C8.3-250G	250, 275	660, 750
Cummins	A-21-283	YCEXH0505CBI	275	NG		0.6	0.9	1.837	2.5	0.02	C8.3-275G, C8.3-250G	250, 275	660, 750
Cummins	A-21-280-1	YCEXH0505CBJ	275	NG		0.2	0.6	1.7	2.5	0.01	C8.3-275G	250, 275	660, 750
Cummins	In test for certification		280	NG							C8.3-280G	280	850
DDC	A-290-81	YDDXH12.7FGF	330	NG		0.8	2.0	2.0		0.02	CNG, LNG Series 60	330, 400	1400, 1450
DDC	A-290-84	YDDXH12.7FGG	330	NG		0.8	2.0	2.0	2.5	0.02	CNG, LNG Series 60	330, 400	1400, 1450
DDC	A-290-87	YDDXH12.7FGF	330	NG		0.6	1.87	1.99		0.019	CNG, LNG Series 60	330, 400	1400, 1450
DDC	A-290-85	YDDXH08.5FJF	275	NG		0.8	2.2	1.5		0.01	CNG, LNG Series 50	275	890
DDC	A-290-83	YDDXH08.5FJG	275	NG		0.8	2.2	1.5	2.0	0.01	CNG, LNG Series 50	275	890
Deere	A-118-19	YJDXH08.1001	247	NG		0.4	2.2	2.6		0.05	6081H	250	800
Deere	A-118-20	YJDXH06.8004	239	NG		0.3	1.9	2.4	2.5	0.04	T06068	250	660
Deere	A-118-21	YJDXH08.1003	253.5	NG		0.4	1.8	2.2	2.5	0.02	6081H	250	800
Deere	Certification due 6/2000		280	NG							6081H	280	900
Mack	A-27-77	YMKXH11.9G55	350	NG	2.9	0.3	1.3	2.3	2.5	0.03	E7G-350, E7G-325	325, 350	1180, 1250
Power Systems	A-326-15	YPSXH0442E6J	250	NG-DSL	---	1.2	6.0	2.2	2.5	0.08	DUAL-FUEL 3126B (7.2L)	190, 250	550, 660
				DSL	0.6	---	1.2	3.8	4.0	0.09			
Power Systems	A-326-13	YPSXH0629E6J	305	NG-DSL	---	1.1	7.4	2.4	2.5	0.06	C-10 Dual Fuel (10.3L)	305	1050
				DSL	0.2	---	1.1	3.7	4.0	0.08			
Power Systems	A-326-14	YPSXH0729E6J	410	NG-DSL	---	0.5	4.1	2.4	2.5	0.10	C-12 Dual Fuel (12.0L)	410	1250
				DSL	0.2	---	1.0	3.8	4.0	0.08			

As of 3/7/2000