

ATTACHMENT F

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Final Staff Report

Proposed Rule 1186.1 – Less-Polluting Sweepers

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Preface

This is the final staff report for PR1186.1, which has been prepared as part of the PR1186.1 Adopt Hearing item for the Governing Board's August 18, 2000 public meeting. A preliminary draft staff report for PR1186.1 was released on May 24, 2000 at the PR1186.1 public workshop. The close of comments on the preliminary draft staff report was June 23, 2000. Major additions or other changes to the preliminary draft staff report are noted with underline and strikeout in the text. PR1186.1 is scheduled to be considered for adoption by the AQMD Governing Board at a public hearing on August 18, 2000. The rule development process, including outreach efforts, is described in the Outreach and Rule Development Efforts section of this document.

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EXECUTIVE SUMMARY

The South Coast Air Quality Management District (AQMD) is proposing a series of rules, referred to as the Clean Fleets Program, to increase the use of cleaner-burning vehicles in public fleets and private fleets performing public services. The objective of these rules is to reduce exhaust emissions from on-road vehicles and the public's exposure to air toxic contaminants and criteria pollutants. Proposed Rule (PR) 1186.1 - Less-Polluting Sweepers is a part of this program and will require public and private fleet operators to purchase alternative-fuel sweepers when replacing or adding equipment to their fleets. Alternative-fuel sweepers are powered by alternative fuels such as compressed or liquefied natural gas (CNG/LNG), liquefied petroleum gas (LPG or propane), methanol, electricity, or fuel cells. PR1186.1 requirements would become effective for purchases, leases or contracts made after June 30, 2002. Appendix A includes the PR1186.1 text.

Under currently proposed PR1186.1 provisions, a jurisdiction may be able to purchase or contract for non-alternative fueled equipment between June 30, 2002 and July 1, 2005, if AQMD approves a Technical Infeasibility Certification request for that purchase. AQMD approval of a Technical Infeasibility Certification request can only be granted after the fleet operator demonstrates that no alternative-fuel sweepers are commercially available for those specific sweeping operations, or that an alternative fueling station is not within five miles of the applicable vehicle storage or maintenance yard. Additionally, approval of a Technical Infeasibility Certification request would require the fleet operator to procure a Rule 1186-certified street sweeper powered by ultra-low sulfur diesel fuel with all exhaust vented through California Air Resources Board (ARB)-approved control device(s) that meet PR1186.1 requirements. These control devices include particulate traps and NO_x control devices, when available.

Year 2010 PR1186.1 emission reductions were estimated in the preliminary draft staff report at 64 tons per year for oxides of nitrogen and 7.4 tons per year for PM, based on the Carl Moyer program fuel-usage emission reduction methodology. Based on information provided by PR1186.1 Working Group members, it is now estimated that 80 percent of existing street sweeper models have two engines (a truck engine and an auxiliary engine). The auxiliary engines are non-road engines that are certified to higher emission standards; therefore, the emission reductions estimates have increased over those reported in the preliminary draft staff report. Specifically, the PR1186.1 emission reductions estimate for complete fleet turnover increases to 109.8 tons per year for oxides of nitrogen and 10.7 tons per year for PM. Appendix C details the assumptions used in the emission reduction estimate.

The incremental increase in equipment costs associated with alternative-fuel sweepers ranges from \$35,000 to \$50,000. Additional costs may include mechanic and operator training, infrastructure improvements, and additional maintenance. PR1186.1 cost-effectiveness for an individual sweeper was previously estimated at \$85,000 per ton by 2010 (based on a simple analysis and the incremental purchase price differential of \$50,000). For this report, an incremental purchase price differential of \$40,000 was used, based on more recent information. Using this price differential and a more refined methodology (e.g., new

estimates for emission reductions, fuel cost savings, and increased maintenance costs for alternative-fuel sweepers), the PR1186.1 cost-effectiveness is estimated at approximately \$20,000 per ton. This cost-effectiveness estimate is based on a sweeper powered by compressed natural gas (CNG); using a propane-powered sweeper would result in a similar or lower cost-effectiveness estimate. Appendix G describes the assumptions used to estimate this cost-effectiveness value.

BACKGROUND

The AQMD is the local government agency responsible for air quality assessment and improvement. The South Coast Air Basin (Basin), which includes Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties, is designated as an extreme non-attainment area for ozone and a serious non-attainment area for PM10 (small particulate matter under 10 microns). The Basin also has PM2.5 (small particulate matter under 2.5 microns) levels almost twice the proposed PM2.5 annual standard level. The Air Quality Management Plan (AQMP) shows that mobile sources emit significant amounts of both PM2.5 and oxides of nitrogen (NO_x); NO_x is a precursor to ozone, PM10 and PM2.5. In August 1998, the ARB identified particulate matter from diesel engine exhaust as a toxic air contaminant (TAC). The AQMD's Multiple Air Toxics Exposure Study II (MATES II) conducted locally identified mobile sources, particularly diesel particulate, as the overwhelming contributor to local air toxic risk levels. Based on the results of the MATES II study, in March 2000 the AQMD Governing Board adopted the Air Toxic Control Plan (ATCP), which included an early action control measure now known as the Clean Fleets program. The development of the Clean Fleets program, including PR1186.1, is a result of these two very important research and regulatory efforts. This proposal is also being developed to achieve additional NO_x emission reductions. The following provides additional information on ARB's identification of diesel particulate as a TAC, the Mates II study, federal alternative-fuel policies for fleets, and the AQMD's Clean Fleets Program.

ARB Identification of Diesel Particulate as a Toxic Air Contaminant

In the early 1980's, the ARB established one of the nation's first comprehensive state air toxic programs – the California Air Toxics Program. Its goal was to protect public health by reducing air toxic emissions that pose the highest risk to residents. As part of the program's risk assessment, the ARB identifies the highest risk substances called TACs. In 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. After a near-decade long scientific investigation into the health effects of exposure to fine particles and other pollutants in diesel exhaust, the ARB on August 27, 1998 included particulate emissions from diesel engines as a TAC. ARB's identification of diesel exhaust particulate matter as a surrogate for all diesel exhaust emissions, and as a TAC, was incorporated in the analysis the AQMD conducted as part of its MATES II Study.

Street sweepers used in most sweeping operations are fueled by one or more diesel engines. The auxiliary engine, used in about 80% of the sweepers, is a non-road engine that is

certified at significantly higher emission levels. Many sweepers operate on neighborhood streets in populated areas. As such, sweepers are a local source of heavy-duty diesel emissions, including the TAC diesel particulate. Powering sweepers by alternative fuels will reduce these air toxic emissions.

MATES II

The AQMD's MATES II program began in 1998 with local air toxic monitoring and emission analysis. In March 2000, the AQMD issued the final report. The objectives of this study were to monitor and evaluate urban air toxics, as well as 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 TAC. As such, the study included an analysis of the potential air toxic impacts associated with diesel emissions. The study, one of the most comprehensive air toxics programs ever conducted in an urban environment, 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.

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 estimated cancer risk from toxic air pollution averages about 1,400 in a million in the region. The study found that 71 percent of this cancer risk is attributable to diesel particulate. Benzene and 1,3 butadiene, originating from both gasoline- and diesel-powered mobile sources as well as stationary sources, contribute an additional 7 and 8 percent, respectively. Based on the results of the MATES II study, the AQMD Governing Board adopted an Air Toxic Control Plan (ATCP) in March 2000. The ATCP includes AT-MBL-01, "Clean On-Road Vehicle Fleet Rules for Governments and Certain Private Fleets," as an early Action Control Strategy. One of the primary objectives of the proposed Clean Fleets program, including PR1186.1, is to reduce mobile source emissions, particularly diesel particulates, by accelerating the implementation of currently available alternative-fuel vehicle technology. As noted above, diesel-powered sweepers are generally used for sweeping operations in neighborhoods and in other populated areas. Moreover, many are equipped with non-road auxiliary diesel engines, which have a much greater emission rate than the on-road engines. Powering sweepers by alternative fuels, or eventually advanced add-on control devices, could be a part of reducing local air toxic emissions of diesel particulate.

U.S Energy Policy Act Fleet Requirements

The U.S. Energy Policy Act (EPAct) is administered by the U.S. Department of Energy (DOE) and is designed to reduce dependence on foreign oil supplies and increase the use of alternative-fuel vehicles. By passing this legislation, Congress recognized that fleets are uniquely suited for introducing new fuel and vehicle technologies. According to U.S. DOE, fleet vehicles typically accumulate higher mileage than private vehicles and are replaced more frequently. Beginning in 1997, federal, state, and alternative-fuel provider fleet operators in areas such as the Basin, must acquire new alternative-fuel vehicles as a percentage of new vehicle acquisitions. This percentage starts out at 10 to 33 percent

depending on fleet type, and gradually increases over time. By the year 2002, the EPAct alternative-fuel vehicle purchase requirement is 75 percent for federal and state fleets, and 90 percent for fuel provider fleets. Municipal and private fleet operator participation in EPAct is currently in unknown; U.S. DOE is due to rule on this issue soon.

EPAct set a regulatory precedent by requiring large-scale purchases of alternative-fuel vehicles by government and certain private fleets. The regulations have been in place since 1992, and thus EPAct-affected fleets, which constitute a significant proportion of vehicle fleets operating in the AQMD, have been preparing for and have been gaining significant experience in the operation of light- and medium-duty alternative-fuel vehicles. Most importantly for heavy-duty vehicle fleet rules, such as PR1186.1, EPAct has also increased the infrastructure for fueling of alternative-fuel fleets. Fueling availability has been identified by both affected agencies and staff as a key requirement for the success of the Clean Fleets program, including PR1186.1.

AQMD Clean Fleets Program

PR1186.1 is one of a series of proposed Clean Fleets rules being proposed that affect vehicle fleet operations in the AQMD. The AQMD's objective is to promote the application of less polluting vehicle technologies to as many vehicle fleets as possible, not just those directly affected by the current Clean Fleets program, to maximize the air quality benefits of cleaner vehicle technologies.

Despite the significant progress that has been made in reducing both mobile and stationary emissions over the past twenty years, the Basin 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. EPA as an extreme nonattainment area for ozone and is one of only five regions designated as a serious nonattainment area for PM10. 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.

PURPOSE AND LEGAL AUTHORITY

The California Clean Air Act requires air districts to develop attainment plans in consideration of “the full spectrum of emission sources and focus particular attention on reducing the emissions from transportation and area-wide emission sources.” (Health & Safety Code section 40910) In this respect, air districts with “serious,” “severe,” or “extreme” air pollution “shall, to the extent necessary to meet the requirements of the plan” include in their attainment plans “[m]easures to achieve the use of a significant number of low-emission motor vehicles by operators of motor vehicle fleets.” [Health & Safety Code sections 40919(a)(4) and 40920.5(a)]

In recognition of the substantial contribution of motor vehicles to the critical air pollution problem in the region, the AQMD is authorized to require operators of public and commercial fleet vehicles of 15 or more vehicles, when adding vehicles to or replacing vehicles in an existing fleet or purchasing vehicles to form a new fleet, to purchase vehicles which are capable of operating on clean burning alternative fuel and to require that these vehicles be operated, to the maximum extent feasible, on the alternative fuel. [Health & Safety Code section 40447.5(a)]

Street sweepers are suited towards the use of alternative-fuel technology since the fleets are typically centrally fueled, and the sweepers are primarily operated on known, fixed service areas. Several government agencies operating street sweepers have taken a leadership position in utilizing the cleanest vehicle technologies. For example, the City of Cypress has purchased sweepers that are operated on alternative-fuel (i.e., propane). Sunline Transit Agency has also instituted similar policies and has since purchased and is currently utilizing seven alternative-fuel sweepers in the Coachella Valley. The purpose of PR1186.1 is to increase the number of alternative-fuel sweepers used by fleet operators providing sweeping services in the AQMD's jurisdiction to reduce air toxic and criteria pollutant emissions.

CONTROL TECHNOLOGY

PR1186.1 identifies alternative-fuel street sweepers as equipment that is powered by compressed or liquefied natural gas (CNG/LNG), liquefied petroleum gas (propane), methanol, electricity, or fuel cells. For the purposes of this rule, hybrid-electric and dual-fuel sweepers that use diesel fuels are not considered at this time to be powered by alternative fuels. There are CNG- and propane-powered sweepers currently being used by local fleet operators. Because sweeper manufacturers must typically remove the existing diesel engine and fuel system that the chassis/engine manufacturers provide before they can install an alternative-fuel engine and fuel system, there is an increased incremental cost for fleet operators who purchase an alternative-fuel sweeper. Although this cost may decrease as the market for these types of sweepers increases, the increased cost is currently between \$30,000 to \$50,000, depending on the sweeper (a \$40,000 incremental purchase price differential is used in the cost analysis). Funding is available to help offset the additional incremental cost of purchasing alternative-fuel sweepers (see Funding section).

CNG-Powered Sweepers and Fuel Availability

Jurisdictions that are presently using CNG-powered sweepers include the cities of Placentia, Santa Monica, and Sunline Transit Agency. In addition, one private fleet operator also uses CNG-sweepers. Based on information provided by sweeper manufacturers, there currently are two manufacturers that presently offer alternative-fuel sweepers. Appendix B contains a listing of these models with some operational characteristics. As additional models become commercially available, AQMD staff will update this information and make it available to local jurisdictions and contract sweeping firms.

CNG is available at many stations throughout the AQMD's jurisdiction. Some agencies have dedicated CNG fueling stations and over 60 publicly-available CNG stations are currently

listed at www.cleancarmaps.com. (The web site www.cleancarmaps.com gives locations and status of a variety of alternative-fuel fueling stations, including driving directions to the nearest stations.) Alternative-fuel providers have indicated that they will be installing additional fueling stations in the near future. (Additional information on projected CNG fueling stations can be found in the Final Program Environmental Assessment, which can be viewed or downloaded at the AQMD's Clean Fleets home page (www.aqmd.gov/news1/Fleet_Rule_Home.html) or on the AQMD's CEQA home page at www.aqmd.gov/ceqa/1190ea.html.) Also, alternative-fuel provider companies currently offer capital lease packages where the provider installs and maintains fueling stations and the end user pays a small premium on the fuel price to pay for the station and accompanying maintenance costs. Funding is available for construction of alternative-fueling stations (see Funding section).

Propane-Powered Sweepers and Fuel Availability

The City of Cypress has been using propane-powered sweepers since 1979. Propane is a liquid fuel, and the fuel tank size is comparable to diesel fuel tanks, both of which are smaller than the CNG tanks that are necessary to ensure adequate range. Although the incremental cost differential for the propane-powered sweeper is comparable to CNG-powered sweepers, maintenance and fueling requirements, as well as fueling availability, are far more comparable to diesel. Propane fueling tanks are relatively simple to install, maintain and use. Some jurisdictions already have on-site propane tanks for other equipment or to power emergency generator systems. Additionally, propane is commercially available at many gas stations and home maintenance sites, which sell propane for recreational vehicles and barbecues. (Many of these sites are listed on www.cleancarmaps.com). Similar to CNG fuel providers, propane distribution companies will install and service a fueling station provided that a minimum number of dedicated propane vehicles are in the fleet. Maintenance training for the propane-powered sweepers has been straightforward, and the fleet operator has noted lower maintenance costs compared to diesel-powered sweepers. Propane may be especially suited to sweepers since they normally work at slow speeds and are not generally subject to heavy engine load. Appendix B contains a listing of the available propane-powered sweepers.

Minimal-Control Option If Alternative-Fuel Requirement Is Not Technically Feasible

Alternative-fuel technology to comply with the rule is currently commercially available for many sweeping operations. However, between June 30, 2002 and before July 1, 2005, if a fleet operator demonstrates to the AQMD that it is technically infeasible to acquire an alternative-fuel sweeper that meets the technical specifications of the fleet operator's sweeping operations (or if fueling is not available within 5 miles of their operation), the fleet operator may purchase or lease a Rule 1186-certified sweeper, powered by ultra-low sulfur diesel and outfitted with an ARB-approved control device(s) (e.g. particulate traps and NOx catalysts). Rule 1186, as amended in September 1999, provides for the certification of street sweepers that meet certain PM10-efficiency levels, related to material collection and entrained PM10, in their sweeping mode. Currently, six major sweeper manufacturers provide over twelve different types (and significantly greater sub-models) of sweepers that

have been certified under Rule 1186. These sweepers can be used in a variety of sweeping operations. In the development of PR1186.1, the goal is that fleet operators will be able to acquire Rule 1186-certified sweepers powered by alternative fuels by the PR1186.1 implementation date of July 1, 2002.

Before July 1, 2005, the fleet operator may purchase or lease a non-alternative fueled sweeper with approved exhaust control device(s), if and only if the AQMD certifies that it is technically infeasible for a fleet operator to purchase or lease an alternative-fuel sweeper. Control technology manufacturers have indicated that particulate traps are currently available and improved traps would be available well in advance of PR1186.1's July 2002 effective date. As ARB continues its implementation and equipment certification work, fleet operators would be required to purchase sweepers that include the latest control technology certified by ARB. While diesel sweepers with control devices have not demonstrated the emission benefits of alternative fuels, requiring particulate traps and NOx catalysts will help reduce emissions in the near term as the types of alternative-fuel sweeper models increase and alternative-fueling stations become more available. Eventually, alternative-fuel sweepers should be available for almost all sweeping operations.

Ultra-Low Sulfur Diesel Fuel

Ultra-low sulfur diesel fuel, defined as diesel fuel with a maximum sulfur content of 15 parts per million (ppm), is required by many of the current and proposed diesel exhaust control technologies. (The fuel also reduces SOx emissions in diesel exhaust, which are precursors to PM10). As such, PR1186.1 specifically requires the use of ultra-low sulfur diesel fuel if the fleet operator uses a Rule 1186-certified, controlled-diesel sweeper. Ultra-low sulfur diesel fuel is currently available from some local refineries. The ARB is considering ultra-low sulfur diesel fuel, as certified by the District, requirements and similarly, the AQMD is considering amendments to Rule 431.2, "Sulfur Content of Liquid Fuels," as part of its overall Clean Fleets program. U.S. EPA recently announced that it is proposing a national 15 ppm sulfur standard for diesel fuel beginning in 2006. Staff will continue to monitor these rulemaking efforts to assess ultra-low sulfur diesel fuel availability.

SUMMARY OF RULE REQUIREMENTS

The purpose of PR1186.1 is to reduce air toxic and criteria pollutant emissions from street sweeping equipment within the jurisdictional boundaries of the AQMD, which includes Orange county, the non-desert portions of Los Angeles and San Bernardino counties, and most of Riverside county (including Coachella Valley). The following is a brief summary of the PR1186.1 requirements. A complete version of the proposed rule is included in Appendix A.

- Applicable to public and private fleet operators undertaking sweeping operations by or for agencies with greater than 15 total vehicles (not just sweepers), excluding police, fire, and other emergency vehicles. [PR1186.1 (a)]

- Requires street sweeper purchases and leases beginning July 1, 2002 to be alternative-fuel vehicles. [PR1186.1 (d)(1)(A)]
- Requires street sweeper contracts beginning July 1, 2002 to be alternative-fuel vehicles. Only if alternative-fuel sweepers are not available from any contractor who bids, may the agency contract for non-alternative fueled sweepers. [PR1186.1 (d)(2)(A) and (d)(3)]
- Prior to July 1, 2005, a Technical Infeasibility Certification request may delay the procurement of an alternative-fuel sweeper and allow the purchase of a non-alternative fueled sweeper, which must be Rule 1186-certified, powered by AQMD-certified ultra-low sulfur diesel and outfitted with ARB-certified control device(s). [PR1186.1 (d)(1)(B) and (e)]
- AQMD approval of a Technical Infeasibility Certification request can only be issued before July 1, 2005 and must be based on a demonstration that no alternative-fuel sweeper is commercially available for the fleet operator's sweeping operations or that an alternative-fuel fueling station is not within five miles of the vehicle storage or maintenance yards. [PR1186.1 (e)(1) and (e)(3)]
- Approval of a Technical Infeasibility Certification request would require the fleet operator to procure a Rule 1186-certified sweeper, powered by AQMD-certified ultra-low sulfur diesel and outfitted with ARB-certified control device(s). [PR1186.1 (d)(1)(B)]
- Exemptions are provided for sweepers with a gross vehicle weight (GVW) of less than 14,000 pounds and for demonstration fleets. Certain sweeper purchases made by private fleet operators may be exempt. [PR1186.1 (b) and (f)]
- Agencies may be required to demonstrate compliance with PR1186.1 provisions by providing purchase, lease or contract records. [PR1186.1 (g)]

EXPECTED EMISSION REDUCTIONS

The PR1186.1 emission benefits are expected to result from reductions in diesel particulate matter, and the associated toxic risk, and oxides of nitrogen. An estimated 700 sweepers are used in the AQMD jurisdiction. The estimate of 700 sweepers in the AQMD's jurisdiction is based on a survey conducted in March 2000, which is described in the section on Outreach and Rule Development Efforts. (The draft Program Environmental Assessment (PEA) for the Clean Fleets Program assumed 540 sweepers in the Basin. The increased estimate of sweepers has been incorporated in the final PEA analysis.)

Unlike other heavy-duty equipment, as many as 80 percent of in-use sweepers have two engines; a truck engine to propel the vehicle and an auxiliary engine (~100 horsepower) to power the sweeping system (blowers, fans, conveyor systems). The truck engines are on-road engines that must meet the ARB certification standards of 2 grams of NO_x per brake horsepower hour (g/bhp-hr) and 0.1 g/bhp-hr for PM by 2002. Auxiliary engines with more than 100 horsepower, however, must meet non-road emissions standards of 4.9 g/bhp-hr for NO_x and 0.22 g/bhp-hr for PM. For non-road engines rated between 50 and 100 horsepower,

the applicable emission standards are 5.6 g/bhp-hr for NO_x and 0.3 g/bhp-hr for PM (40 CFR Part 89).

These non-road emission factors and the updated sweeper inventory have been incorporated into the revised PR1186.1 emission reductions estimate (see Appendix C). The following is a summary of the assumptions used in the PR1186.1 emissions reductions estimate:

- Equipment life (10 years)
- District sweeper inventory (700)
 - 540 are dual engine
 - 160 are single engine
- A diesel sweeper has the following emission standards:
 - truck engine (NO_x - 2.0 g/bhp-hr PM 0.1 - g/bhp-hr)
 - year 2003 - 2006 auxiliary engine (NO_x - 4.9 g/bhp-hr PM - 0.22 g/bhp-hr)
 - year 2007+ auxiliary engine (NO_x - 2.9 g/bhp-hr PM - 0.22 g/bhp-hr)
- An alternative-fuel sweeper has the following emission standards:
 - truck/auxiliary engine (NO_x - 1.4 g/bhp-hr PM - 0.03 g/bhp-hr)
- Years 2003 and later (100 percent alternative-fuel sweepers)
- Average annual vehicle miles traveled (15,000 miles)
- Annual average fuel consumption (7,500 gallons)

Based on the assumptions summarized above and detailed in Appendix C, the PR1186.1 emission reduction estimate would be 109.8 tons per year for oxides of nitrogen and 10.7 tons per year for particulate matter, after full fleet turnover.

COST ANALYSIS

Clean Fleets Program Economic Assessment

The AQMD has prepared a document entitled "Draft Economic Assessment, Assumptions, Funding Sources, and Socioeconomic Report Proposed Rule 1190 Series – Clean On-Road Vehicles" (dated April 25, 2000) that identifies the assumptions and analytical methods used to discern the cost/benefits, funding availability, and socioeconomic implications for the Clean Fleets program. (Copies of the document are available from the AQMD and can be reached at the AQMD's Clean Fleets Web page at www.aqmd.gov/news1/Fleet_Rule_Home.htm.) The document includes a preliminary cost effectiveness assessment of these rules based on direct and indirect costs and the anticipated emission reductions. Direct cost included vehicle miles traveled, size of vehicle fleets, type of vehicles used, fuel type and infrastructure development costs. The indirect costs, such as job impacts, were analyzed by application of the REMI model.

The Final Economic Assessment, Assumptions, Funding Sources, and Socioeconomic Report for the Proposed Rule 1190 Series – Clean On-Road Vehicles", based on public comments, was prepared and circulated on June 8, 2000. The revised economic assessment included information on total costs and available funding for each of the Clean Fleet rules. Based on the assumptions used in that document, the annualized cost of PR1186.1 from 2001 to 2015

is approximately \$1.9 million. In the best case funding scenario, \$5 million was allocated from the Clean Fuel Partnership fund and one million dollars was allocated from AB 2766 (vehicle registration) funding. In the worse case funding scenario, only one million in AB 2766 funding was allocated.

Focused PR1186.1 Cost-Effectiveness Assessment

The revised economic assessment analyzed the entire Clean Fleets program. In that document it was assumed that there were 540 sweepers in the AQMD's jurisdiction, that costs were evenly distributed between private and public fleets, and that the incremental cost in purchasing an alternative-fuel sweeper was \$35,000. Updated information based on recent surveys and PR1186.1 Working Group comments (see Outreach and Rule Development section below) has been used to prepare a focused PR1186.1 economic assessment (see Appendix G). The following assumptions have been used in the focused PR1186.1 economic assessment:

- Equipment life (10 years)
- District sweeper inventory (700)
 - 75 percent are publicly-owned and 25 percent are privately-owned
 - 540 are dual engine
 - 160 are single engine
- Saving associated with alternative fuels (\$0.34 per gallon)
- Increased maintenance costs for alternative-fuel (CNG) sweeper (\$0.09 per gallon)
- Years 2003 on (100 percent alternative fuel sweepers)
- Average annual vehicle miles traveled (15,000 miles)
- Annual average fuel consumption (7,500 gallons)
- Incremental equipment purchase price differential (\$40,000)
- Cost-effectiveness is based on dividing the annualized cost by the annual emission reductions

Using these assumptions, the revised annual average costs for PR1186.1 are estimated at 1.7 million. Dividing these costs by the combined NOx and PM average annual PR1186.1 emission reductions between 2003 and 2015 results in a revised cost-effectiveness estimate of approximately \$20,000 per ton. This cost-effectiveness estimate is based on a sweeper powered by CNG; using a propane-powered sweeper would result in a similar or lower cost-effectiveness estimate. Despite modifications made to the cost assumptions, the revised cost of PR1186.1 is very close to that described in the Final Economic Assessment, Assumptions, Funding Sources, and Socioeconomic Report for the Proposed Rule 1190 Series – Clean On-Road Vehicles” (dated June 8, 2000). All of the conclusions in that assessment are not affected by this revised cost analysis.

Maintenance Cost Comparison

Information provided by fleet operators indicates a range of maintenance costs for diesel and alternative-fuel sweepers. For example, total maintenance costs (parts and labor) for a propane sweeper has been estimated at \$1.30 per mile. Information from a diesel sweeper fleet operator indicates a total maintenance range of \$0.60 to 2.37 per mile. A CNG-sweeper operator provided a budgeted total maintenance cost estimate of \$2.90 per mile. It should be

noted that it is difficult to compare these total maintenance costs because of the different recording methodologies and because some information is from actual usage and some is budgeted information. Qualitatively, the propane sweeper operator noted significant maintenance cost reductions associated with propane equipment compared with diesel equipment.

The Retrofit Strategy Analysis

As described elsewhere, before July 1, 2005, PR1186.1 allows the delay of an individual alternative-fuel sweeper purchase if the fleet operator obtains AQMD approval of a Technical Infeasibility Certification request. If a Technical Infeasibility Certification request is granted for an individual sweeper purchase, then the fleet operator may procure an ultra-low sulfur diesel-powered Rule 1186-certified sweeper that is outfitted with ARB-approved control devices. In the revised draft economic assessment, a similar scenario, without the sunset provision, is referred to as a retrofit strategy. The assumptions used in the retrofit strategy analysis include an estimate that half of the affected PR1186.1 fleets would use ultra-low sulfur diesel with particulate traps and that cost of each particulate trap is \$5,000 (ten-year life span). This analysis further presumed that the maintenance costs associated with the particulate traps would be minimal and that the incremental increase in ultra-low sulfur diesel costs is 5¢ per gallon. Using these assumptions, the retrofit strategy (50% controlled diesel) implementation costs were estimated at 1.1 million annually, based on a sweeper population of 540 sweepers and one trap per sweeper. Total costs would be higher based on the latest sweeper population of 700 sweepers and assuming that two particulate traps (at \$5,000 each) would be required for eighty percent of sweeper models.

Incremental Cost-Effectiveness Assessment

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.

PR1186.1 requires that diesel street sweepers be replaced with alternative-fuel street sweepers after July 1, 2002. Some sweeper purchases before July 1, 2005 could be controlled diesel sweepers, but only if it is technically infeasible to purchase an alternative-fuel sweeper. After July 1, 2005, any sweeper replacement must be an alternative-fuel sweeper. Thus, PR1186.1 requirements represent the most stringent control option currently. There is no other control option that can achieve the same emission reduction goal as PR1186.1. Therefore, the incremental cost effectiveness analysis does not apply to this rulemaking.

Funding Programs

Several agencies have commented that their support of the proposed Clean Fleets program depends on identifying funding that could be used to meet the rules' requirements. Various federal, state and local funding programs are available to assist agencies in the acquisition and operation of alternative-fuel sweepers. These are described generally below; however, a more detailed discussion of these funding sources is included in the Draft Economic Assessment, Assumptions, Funding Sources, and Socioeconomic Report Proposed Rule 1190 Series – Clean On-Road Vehicles document. It should be noted that policy, and in some cases, legislative changes would be necessary to make some of these funds available for use in complying with adopted regulations.

Local Government Subvention Funds: Forty percent of the funds collected from a \$4 surcharge on each vehicle registration (created by AB 2766 (Sher)) is allocated to local governments based on a pro-rated share of population and must be used to reduce mobile source emissions. Local governments can use these funds to purchase alternative-fuel vehicles or engines or to pay the incremental increase in contract sweeping costs. Funds not expended carry over from year to year. The AQMD staff contacts are Larry Rhinehart (AQMD) at 909-396-3780 and Oscar Abarca (AQMD) at 909-396-3242.

Mobile Source Air Pollution Reduction Review Committee's (MSRC) Discretionary Funds: Thirty percent of the funds collected each year from a \$4 surcharge on vehicle registration (created by AB 2766 (Sher)) is directed 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: heavy-duty vehicles; zero-emission/ultra-low emission vehicles; research, development and demonstration of advanced low-emission transportation technologies; transportation control measures; and intelligent transportation systems. The AQMD contact is Ray Gorski (MSRC Technical Advisor) at 909-396-2479.

Carl Moyer Memorial Air Quality Standards Attainment Program: The Carl Moyer Program was established in 1998 to reduce heavy-duty engine emissions and assist California to meet its air quality obligations under the State Implementation Plan. The Carl Moyer Program provides grants for the extra capital cost of vehicles and equipment that pollute less than the current minimum standards. The first two years of the Carl Moyer Program have been funded on a year-by-year basis. Assembly Bill 1571 (Villaraigosa, Brulte) codified the program criteria and created the Carl Moyer Program Advisory Board. The adopted legislation specifically prohibits the use of the Carl Moyer Program funds to meet regulatory mandates. However, ARB has stated that engines that exceed ARB's optional low emission standards would be eligible for Carl Moyer funds. The Advisory Board is responsible for recommending a source and amount of continued funding for the program. The Advisory Board has recommended annual funding of \$100 million through the year 2010.

The Moyer program is intended primarily to reduce emissions from vehicles and equipment that have traditionally been powered by heavy-duty diesel engines. The current program funds the incremental cost of cleaner heavy-duty vehicles and equipment from the following

categories: on-road motor vehicles over 14,000 pounds GVW rating; non-road equipment over 50 horsepower; marine vessels; locomotives; stationary agricultural pump engines; forklifts; and, airport ground support equipment. (Street sweepers are generally heavy-duty on-road vehicles over 14,000 pounds GVW.) The program is not intended to fund engine research and development, certification testing, training, or operational controls.

The state-wide FY 1998-99 appropriation for the Carl Moyer Program totaled \$25 million. ARB allocated \$11.3 million to the AQMD in April 1999. Governor Davis and the Legislature placed \$19 million in ARB's FY 1999-2000 budget to continue this incentive program for low-emission heavy-duty vehicles and \$2 million in the California Energy Commission's (CEC) budget to support fueling infrastructure specific to the Carl Moyer program. The AQMD received \$8.55 million from ARB and \$900,000 from CEC, for a total of \$9.45 million for the current fiscal year. The AQMD contact is Cindy Sullivan at (909) 396-3249.

Air Quality Investment Program (AQIP): The AQMD uses these AQIP funds to obtain emission reduction or air quality benefits that are equivalent to the sum Emission Reduction Target (ERT) for all participating employers in the AQIP. The AQMD accepts proposals for the disbursement of AQIP funds on an ongoing basis. The amount of emission reductions required to demonstrate equivalency and the amount achievable under each proposal is evaluated. The Executive Officer then recommends to the AQMD Governing Board, on a quarterly basis, the most cost-effective proposals that achieve equivalent emission reductions. Since its inception in July 1995, employers have invested over \$9.5 million in this program. The AQMD contact is the Transportation Programs office at (909) 396-3271.

Congestion Mitigation and Air Quality Improvement Fund: The federal Congestion Mitigation and Air Quality Improvement Program (CMAQ) authorizes \$8.1 billion for six years of Transportation Equity Act for the Twenty-First Century funding and provides a flexible funding source to state and local governments for transportation projects and programs that meet Clean Air Act requirements. CMAQ will fund programs that incorporate transit improvements, travel demand management strategies, traffic flow improvements, and public fleet conversions to cleaner fuels. Approximately \$1 billion over the six years of authorization has been allocated to the AQMD under CMAQ, specifically: Los Angeles County - \$110,040,981 per year; Orange County - \$30,696,885 per year; San Bernardino - \$14,473,885 per year; and, Riverside - \$115,111,211 per year.

California Energy Commission: The CEC has the following potential sources of funding available: \$6 million to establish a clean fuels infrastructure for public agencies, including cities, counties, school districts and transit districts; \$5 million to establish an incentive program for the lease or purchase of hybrid electric and fuel cell vehicles; and, \$1 million to develop a hydrogen fuel cell infrastructure.

Infrastructure Construction Funding Opportunities: Several fuel providers have stated that they would contract to build fueling stations at no cost to the users if a minimum level of throughput could be guaranteed. According to one CNG fuel provider, the minimum necessary throughput would be equivalent to 600 gallons of CNG daily. This amount of throughput equates to fill-up of: 10 transit buses, or 15 refuse collection vehicles, or 20 large

school buses, or 50 light-duty vehicles. If a facility is not able to guarantee the minimum throughput, construction costs may be offset by grants, or funding from other sources. For instance, if one million dollars of financing is available, a throughput of only 400 gallons daily may be sufficient for facility construction and operation by a private fuel provider.

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 program activities to increase transportation efficiency, including programs to accelerate the use of alternative transportation fuels for government vehicles. For more information, contact the State Energy Office or the DOE Regional Office for this region, listed under the Points of Contact section for California, or contact Ron Santoro at DOE Headquarters at (202) 586-8296.

Tax Incentives: The main federal incentives for the purchase or conversion of individual alternative-fuel vehicles are the federal income tax deductions/credits. A \$2,000 to \$50,000 federal income tax deduction is available for the purchase or conversion of qualified alternative-fuel vehicles. An income tax deduction is also available for the installation of refueling or recharging facilities for alternative-fuel vehicles. The agencies overseeing this program are the U.S. Department of Treasury and the Department of Energy (DOE).

Also allowed is a deduction for clean fuel vehicles and certain refueling properties. A tax deduction for the purchase of a new original equipment manufacturer (OEM) qualified clean fuel vehicle, or for the conversion of a vehicle to use a clean-burning fuel, is provided under the EPAct, Public Law-102-486, Title XIX-Revenue Provisions, Sec. 179A. The amount of tax deductions for qualified clean fuel vehicles is based on the gross vehicle weight (GVW) and type of vehicles as follows: truck or van, GVW of 10,000-26,000 pounds - \$5,000; truck or van, GVW greater than 26,000 pounds - \$50,000; buses, with seating capacity of 20+ adults - \$50,000; and, all other vehicles, non-road vehicles excluded - \$2,000. Additional information on this program is included in the Clean Fleets Economic Assessment.

PROGRAM ENVIRONMENTAL ASSESSMENT

A Draft Program Environmental Assessment (Draft PEA) for the AQMD Clean Fleets program was prepared and distributed to the public for a 45-day review and comment period beginning March 10 and ending April 25, 2000. A Final PEA was subsequently prepared and certified at the June 16, 2000 Public Hearing. The following is a summary of the Final PEA conclusions. The Final PEA can be viewed or downloaded at the AQMD's Clean Fleets home page (www.aqmd.gov/news1/Fleet_Rule_Home.htm) or on the AQMD's CEQA home page at www.aqmd.gov/ceqa/documents/aqmd/finalEA/1190/1190FEA.html.

The adoption and implementation of the proposed fleet vehicle rules, including PR1186.1 and proposed amendments to Rule 431.2, are expected to produce long-term TAC and criteria pollutant emission reductions from affected government, certain private, and commercial airport fleet vehicles. There are, however, short-term, significant adverse air

quality impacts from construction-related activities associated with the implementation of the proposed fleet vehicle rules and related amendments. In particular, the construction air quality impact analysis revealed that simultaneous construction of alternative clean-fuel fueling stations coupled with refinery modifications necessary to produce ultra-low sulfur diesel pursuant to PAR431.2 would result in significant adverse air quality impacts. However, these significant adverse air quality impacts are temporary. It is anticipated that construction activities related to refinery modifications will only last for two years. Once the refinery construction activities have ceased, the remaining construction activities associated with refueling stations result in insignificant air quality impacts, which are projected to last another three years, at which time construction activities are expected to cease. Accordingly, although the proposed project results in a permanent long-term emission reduction benefit, the proposed fleet vehicle rules and related amendments have the potential to generate short-term significant adverse air quality impacts associated with the construction activities. No other significant adverse environmental impacts were identified in the Final PEA.

Because the Final PEA identified short-term air quality impacts from infrastructure construction activities, a Statement of Findings and a Statement of Overriding Considerations (SOF/SOC) will be prepared for AQMD Governing Board consideration prior to the approval of PR1186.1. The SOF/SOC will address PR1186.1's insignificant contribution to the overall environmental impacts associated with the adoption and implementation of the proposed fleet vehicle rules and the related rule amendment.

COMPLIANCE

PR1186.1 would require that affected public agencies keep sufficient vehicle data records (e.g. purchase, lease, or contract records) to document rule compliance and that these records be presented to the Executive Officer upon request. 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 suggested data to be kept for each new vehicle would include the DMV Certificate of Title and registration, principal vehicle location, vehicle manufacturer, model-year, model, and fuel type. 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. To facilitate compliance by affected public agencies and private fleet operators, and to minimize AQMD compliance actions, AQMD staff suggests that any procurement materials, such as bid notices, requests for proposals or quotes, include language that requires PR1186.1-compliant sweepers.

OUTREACH AND RULE DEVELOPMENT EFFORTS

The Clean Fleets program has been in development since November 1999. There have been five public workshops and numerous working group meetings for the individual fleet rules. The focused AQMD PR1186.1 outreach program began with a conference call with six street sweeper manufacturers on February 29, 2000. (Manufacturer contacts were obtained through the Rule 1186 [PM10 Emissions from Paved and Unpaved Roads and Livestock Operations]

development process that began in 1997). The phone conference purpose was to inform the manufacturers of program goals and to provide the earliest opportunity to comment on the proposal. A PR1186.1 Working Group was then formed, comprised primarily of representatives from local governments, contract street sweeping firms, equipment manufacturers/dealers, and alternative-fuel providers. (Appendix D contains a listing of key contacts for PR1186.1, including PR1186.1 Working Group members.) Subsequently, four working group meetings were held at the AQMD headquarters on March 7th, April 11th, May 9th, and July 18th of 2000. Information presented at the working group meetings began with broad program goals that subsequently transitioned into draft rule language based on the comments received. Additional information presented at working group meetings included presentations on funding availability, case studies of successful local government alternative-fuel programs, and a preliminary evaluation of emission reductions. The outreach efforts are noted in the rule development summary presented in Appendix E.

With the assistance of the PR1186.1 Working Group, a sweeper survey, intended to refine the estimate of street sweepers and to inform agency staff of the proposal, was distributed on March 10, 2000 to each local government within the AQMD's jurisdictional boundaries. The survey was sent directly to the person who is responsible for street sweeping activities, which the staff had identified during the outreach program for AQMD Rule 1186. As of May 5, 2000, an eighty-percent survey response rate was achieved through use of this targeted local jurisdiction contract list. Based on the survey, about 40 percent of the jurisdictions and agencies own and operate their own sweepers, with an additional 10 percent that both own sweepers and contract for services. Private fleet operators provide contract street sweeping services for about 50 percent of the local jurisdictions. Eleven sweeping contractors were identified in the survey responses, but four or five major sweeping contractors provide the bulk of the sweeping services. Based on the survey results and a phone survey of the major private sweeping service contractors, there are approximately 610 sweepers in the AQMD. This estimate was increased to 700 to account for jurisdictions that did not respond to the request for information. The following is a summary of the survey results and the staff's working estimate of sweeper population.

	Survey Results	Estimated Total
Agency-Owned Equipment	483	550
Contractor-Owned Equipment	127	150
TOTAL	610	700

Public Comments

The following is a summary list of issues that arose from the discussions with the sweeper manufacturers and at working group meetings, followed by staff responses. For clarity, the comments and responses are differentiated between comments expressed by local governments, sweeper manufacturer/dealers, and contract sweeping firms. In addition to the oral comments, staff received several written comments specific to the PR1186.1 proposal. The written comments are included in Appendix F.

Local Government Comments

Comment 1: There are not a sufficient number of alternative-fuel street sweepers currently available. This could restrict a local government's ability to procure the type of equipment suited for the intended use.

Staff Response: Based on information provided by sweeper manufacturers, there are currently five alternative-fuel sweeper models provided by two manufacturers. Other manufacturers have expressed an interest in providing alternative-fuel sweepers, however, concerns have been expressed over alternative-fuel engine/chassis availability and a limited market. Staff continues to work with sweeper/engine manufacturers and engine conversion companies to facilitate the increase of alternative-fuel sweeper models. In order to facilitate program implementation, PR1186.1 requirements become applicable for new purchases or leases by fleet operators (public or private) executed after July 1, 2002. This time period is intended to allow local jurisdictions and contract sweeping companies to identify alternative-fuel sources, train employees, and conduct equipment evaluations. In the event that a fleet operator cannot resolve certain technical issues, PR1186.1 includes provisions that allow local jurisdictions to submit a Technical Infeasibility Certification request, but only for purchases prior to July 1, 2005. AQMD approval of a Technical Infeasibility Certification request would require the jurisdiction to procure a sweeper that is Rule 1186-certified, powered by ultra-low sulfur diesel, and outfitted with ARB-approved control device(s).

Comment 2: Many local governments have very limited resources and procurement of alternative-fuel sweepers may require the cancellation of other programs. Sufficient funding sources must be identified for Rule implementation.

Staff Response: Funding is a key issue for both local jurisdictions and contract street-sweeping companies. To assist with funding identification for local governments and contractors, the AQMD will prepare a document entitled, "Potential Funding Sources for PR1186.1" if there is additional information beyond that already provided here and in the AQMD's Economic Assessment for the Clean Fleets Program.

Comment 3: In addition to the incremental increase in purchase price for alternative-fuel sweepers, there would also be an incremental increase in maintenance costs to local governments (i.e., mechanic training).

Staff Response: As mentioned, PR1186.1 requirements become effective for new purchases, leases or contracts executed after July 1, 2002. This time period is intended to allow local jurisdictions to conduct staff training and to secure funding and fueling sources. Based on conversations with an alternative-fuel sweeper fleet operator, training to work on CNG engines typically involves a 40-hour course at a cost of approximately \$600. These courses are offered at many community colleges and private companies. Additionally, propane-powered sweepers require little additional mechanic training and a fleet operator has noted significantly reduced maintenance costs, even compared to diesel engines. To assist fleet operators, staff has provided all Working Group members with copies of the "Training Availability and Opportunity" document for the clean fleet rules.

Comment 4: Alternative-fuel sweepers are new to the market and there is limited information on equipment performance and durability. Additionally, there have been a variety of reported incidents involving explosions in compressed natural gas (CNG) vehicles.

Staff Response: Based on information provided by the manufacturers, the alternative-fuel sweepers offered today have warranties that are at least comparable to the warranties offered for diesel-powered equipment. Although it is acknowledged that there have been some problems with certain alternative-fuel equipment in the past, these problems were solved through improved employee training and fuel delivery technology. Potential PR1186.1 health and safety impacts are analyzed in the final PEA for the Proposed Fleet Vehicle Rules and Related Amendments. This document can be viewed or downloaded at the AQMD Clean Vehicle Fleet home page (http://www.aqmd.gov/news1/Fleet_Rule_Home.htm).

Comment 5: Alternative fuels are only available at a limited number of sites, some of which have limited hours of operation or are not available to the general public. Additionally, construction of an alternative-fueling station typically must be programmed as a capital improvement project. The timeframe for implementation of a capital improvement project is ordinarily five years or more.

Staff Response: Fuel availability is another key issue and alternative-fuel providers are attempting to ensure that local jurisdictions will have access to alternative fuels. For example, alternative-fuel provider companies currently offer capital lease packages where the provider installs and maintains fueling stations and the end user pays a small premium on the fuel price to pay for the station and accompanying maintenance costs. Concerns with this approach have been raised, however, because a minimum fuel usage rate guarantee is required prior to construction of an alternative-fuel station. As an alternative, one local jurisdiction presently uses two sweepers powered by LPG (propane), a fuel that is widely available. Also, propane fuel providers have indicated that a fueling station can be installed at no charge provided that at least three dedicated propane vehicles are in the fleet. Additional information on fuel providers and the minimum fuel usage requirements is included in the Economic Assessment for the Clean Fleets Program. Recognizing the importance of access to alternative fuels, PR1186.1 contains a provision that can delay the procurement of an individual alternative-fuel sweeper purchase, before July 1, 2005, if a Technical Infeasibility Certification request is submitted and approved by the AQMD. Approval of such a request can be based on a demonstration that an alternative-fueling station is not available within five miles of the maintenance or corporate yard. Jurisdictions with an approved Technical Infeasibility Certification request would be required to procure a Rule 1186-certified sweeper, powered by ultra-low sulfur diesel and outfitted with ARB-approved control device(s).

Comment 6: Local governments that decide to install an alternative-fueling station are required to meet various regulatory requirements that may be cost prohibitive. Additionally, some fire departments and/or other responsible agencies may not allow the installation of an alternative-fuel station due to perceived safety concerns.

Staff Response: The National Fire Protection Association (NFPA) part 52: Compressed Natural Gas (CNG) Vehicular Fuel Systems Code, 1998 Edition contains guidance on fire safety requirements for CNG fueling systems. NFPA documents also address other alternative fuels (i.e., gaseous hydrogen, liquid hydrogen, and liquefied petroleum gas). These documents, along with NFPA 70: National Electrical Code, contain specific guidance

on the establishment and operation of alternative-fueling stations. Adherence to the policies and procedures included in these documents should alleviate responsible agencies' concerns over the construction and operation of alternative-fueling stations. It should be noted that alternative fuels other than CNG have been used to power sweepers. Costs associated with fueling station construction have been factored into the Economic Assessment for the Clean Fleets Program.

Comment 7: Alternative-fuel street sweepers may have a reduced range when compared to diesel powered equipment. This reduction in range may require additional fueling stops that may require the purchase of additional equipment to maintain the existing level of service.

Staff Response: According to information provided by manufacturers, the currently available alternative-fuel sweepers have a range of between 5.5 to 10 hours based on a single fueling.¹ Subsequent to distribution of that information, manufacturers have indicated the goal of providing alternative-fuel sweepers with an equivalent range as diesel equipment. Before July 1, 2005, if alternative-fuel sweepers with sufficient range cannot be identified, a jurisdiction may submit a Technical Infeasibility Certification request to the AQMD. If such a request is approved by the AQMD, then the jurisdiction can procure diesel-powered equipment provided that the sweeper is Rule 1186-certified, powered by ultra-low sulfur diesel and outfitted with ARB-approved control device(s).

Comment 8: All of the currently available alternative-fuel sweepers have a gross vehicle weight (GVW) greater than 26,000 pounds. Operators of this equipment must have a Class B commercial drivers license. Local jurisdictions that currently operate sweepers with a GVW of less than 26,000 pounds would need to retrain drivers to obtain a Class B license. This would have significant economic impacts and may affect labor contract negotiations.

Staff Response: Some alternative-fuel street sweepers would have a GVW in excess of 26,000 pounds. Based on AQMD survey results, many local jurisdictions presently use sweepers with a GVW greater than 26,000 pounds, and the operator's meet Department of Motor Vehicle (DMV) licensure requirements. Training for a Class B commercial drivers license is available at a variety of facilities for approximately \$750 - 1000. Under current DMV procedures, the steps involved in obtaining a Class B commercial license include a payment of a \$57 application fee for a four-year license, and successful completion of the following three examinations: 1) traffic laws and signs, 2) pre-trip inspection, and 3) driving skills. In addition, a medical certificate, valid for 24 months, is required.

Street Sweeper Manufacturer/Dealer Comments

Comment 9: Local manufacturer representatives may or may not have the experience and expertise to maintain alternative-fuel sweepers. Also, the majority of alternative-fuel sweepers are conversions from diesel equipment and the original engine manufacturer will not provide service for these engines.

¹ CNG Vehicle Fact Sheet, Southern California Gas Company, March 7, 2000.

Staff Response: Based on information from an alternative-fuel sweeper manufacturer, local dealers can provide parts and maintenance for the sweeping system (i.e., blowers, conveyors, brooms, etc.), but the original equipment manufacturer (OEM) is responsible for design and warranty of fueling systems and alternative-fuel engines. Another alternative-fuel sweeper manufacturer added that in addition to the OEM, firms that convert engines to alternative fuels are also able to service these engines.

Comment 10: Many street sweepers contain two engines: one to propel the vehicle (typically >200 hp) and an auxiliary engine for the sweeping equipment (typically <100 hp). While there are a limited number of alternative-fuel engines and chassis in the >200 hp range, currently there are no OEMs of alternative-fuel engines in the <100 hp range. Currently, the auxiliary engines in alternative-fuel sweepers are either oversized engines or gasoline engines converted to CNG/LPG.

Staff Response: Although there may be an increase in the number of smaller horsepower alternative-fuel engines in the future, it is acknowledged that the available engines may not meet the specific requirements of sweeper manufacturers. Before July 1, 2005, PR1186.1 does contain provisions that would allow local governments or contract sweeping firms to submit a Technical Infeasibility Certification request to the AQMD for consideration if suitable engine/chassis combinations are not available. As mentioned, AQMD approval of a Technical Infeasibility Certification request would require the jurisdiction to procure a Rule 1186-certified sweeper, powered by ultra-low sulfur diesel and outfitted with ARB-approved control device(s).

Comment 11: The development cost for an alternative-fuel sweeper is high and given the region's relatively small sweeper market, it is difficult for manufacturers to recoup money invested into a new product line. Additionally, manufacturers must guarantee part availability for a minimum of ten years after the last equipment production date (see attached comment letters regarding manufacturers previous alternative-fuel experiences - Appendix F).

Staff Response: Staff concurs that street sweepers have a relatively small vehicle population when compared to other heavy-duty vehicles. The AQMD has conducted a street sweeper survey using information provided by local governments and contract sweeping firms. Based on the initial results of this survey, the estimate of sweepers in the AQMD has been increased to 700. In addition to PR1186.1, programs from other states and the federal government may increase the demand nationally for alternative-fuel sweepers. As mentioned, two manufacturers presently offer alternative-fuel sweepers. As part of the PR1186.1 adoption resolution, staff will include a commitment to conduct a technology assessment with the goal of evaluating the availability of alternative-fuel sweepers and the possibility that conventionally fueled sweepers that achieve equivalent emissions and toxic risk could be an acceptable alternative to existing PR1186.1 requirements.

Comment 12: During street cleaning operations, sweepers typically operate at a steady speed of 5 to 7 miles per hour. Traveling at this slow speed does not involve the "stops and starts" that can result in the black exhaust plume associated with some heavy-duty vehicles. Because of these characteristics, exhaust emissions from sweepers are negligible and should not be regulated.

Staff Response: While it is acknowledged that sweepers may have fewer stops and starts than other heavy-duty equipment, studies have shown that NO_x and PM reductions can be achieved by powering equipment with alternative fuels. The estimated PR1186.1 emission reductions are documented elsewhere in this final staff report.

Contract Street Sweeping Company Comments

Comment 13: The majority of identified funding sources are only available to local government entities. Contract sweeping companies are private organizations that have limited resources to purchase alternative-fuel sweepers. Sufficient funding sources for private entities must be identified for Rule implementation.

Staff Response: As mentioned, if there is additional information beyond that already provided in the District's funding report and summarized in this report, the AQMD will prepare a document entitled, "Potential Funding Sources for PR1186.1". As detailed in the District's funding report, contract-sweeping firms are eligible for Mobile Source Air Pollution Reduction Committee (MSRC) and Carl Moyer grant programs. Also, unlike governmental agencies, private contract sweeping firms are eligible for up to \$50,000 in tax credits for each alternative-fuel vehicle with a GVW in excess of 26,000. Moreover, local governments may be able to use a portion of AB 2766 funding to offset the incremental increase in sweeping costs associated with PR1186.1 requirements.

Comment 14: Contract sweeping companies typically have one corporate yard and service accounts throughout the region. If alternative-fuel stations are not readily available, a contractor may no longer be able to provide service to jurisdictions outside of a given area.

Staff Response: The manufacturers' goal is that the alternative-fuel sweepers have ranges that are comparable to diesel equipment. Additionally, the number of alternative-fuel stations is anticipated to increase before the PR1186.1 effective date of July 1, 2002. Recognizing the importance of access to alternative fuels, PR1186.1 contains a provision that can delay the procurement of an individual alternative-fuel sweeper purchase that occurs before July 1, 2005 if a Technical Infeasibility Certification request is submitted and approved by the AQMD. Approval of such a request can be based on a demonstration that an alternative-fueling station is not available within five miles of the maintenance or corporate yard. Jurisdictions with an approved Technical Infeasibility Certification request would be required to procure a Rule 1186-certified sweeper, powered by ultra-low sulfur diesel and outfitted with ARB-approved control device(s).

Public Workshop

In addition to the outreach activities described above, a formal PR1186.1 Public Workshop was held on May 24, 2000 at the AQMD headquarters in Diamond Bar. The following is a summary of comments made at the meeting followed by staff's response.

PWS Comment 1: In addition to the funding sources listed in the PR1186.1 preliminary draft staff report, private organizations are eligible for a one-time tax credit of \$50,000 per alternative-fuel vehicle with a GVW in excess of 26,000 pounds.

Staff Response: Staff concurs that contract sweeping firms that purchase an alternative-fuel sweeper with a GVW in excess of 26,000 pounds may be eligible to a \$50,000 tax credit.

Additional information on federal tax incentive programs is included in the Economic Assessment for the Clean Fleets Program. Because of the applicability of tax incentives to contract sweeping firms, a summary of the Economic Assessment tax incentive discussion has been added to the funding section of this document.

PWS Comment 2: During the staff presentation, a slide showed a preliminary cost-effectiveness estimate of \$85,000 dollars per ton NOx reduced. How does this value correspond with the estimated incremental purchase price differential of \$50,000 for an alternative-fuel sweeper?

Staff Response: As mentioned elsewhere in this staff report, the estimated PR 1186.1 cost-effectiveness of \$85,000 per ton of NOx reduced represented a simplified cost-effectiveness analysis based solely on the annualized incremental purchase price differential (\$8,500) divided by the estimated annual emissions reductions (.1 ton) for a single vehicle. As mentioned in the workshop, this methodology does not account for the emissions reductions associated with alternative-fuel auxiliary engines versus a non-road diesel auxiliary engine. Additionally, this methodology does not account for the anticipated fuel cost savings or the potential impact of funding availability. A refined cost-effectiveness estimation that includes the above-mentioned inputs has been completed and is included in this report. Based on this refined analysis, PR1186.1 cost-effectiveness is estimated at approximately \$20,000 per ton.

PWS Comment 3: Have there been any discussions with engine manufacturers regarding their plans to provide alternative-fuel engines? This is especially important for the auxiliary engines in the ~100 HP class, where there has traditionally been limited alternative-fuel engine availability.

Staff Response: Throughout the Clean Fleets program (PRs 1191-96, 1186.1 and PAR 431.2), there has been extensive involvement with alternative-fuel engine manufacturers. This has included the Clean Fleets working group meetings as well as special meetings with individual engine manufacturers. One recent letter from an engine manufacturer outlined their current efforts for certifying engines that meet the ARB low-NOx emission standards. In that letter, a statement is made that the ongoing certification efforts should result in a complete line of alternative-fuel engines that are suitable for centrally-fueled fleet vehicles as specified in the AQMD Clean Fleets program. Recognizing the importance of alternative-fuel engine availability, the AQMD will continue to facilitate communication between engine manufacturers/engine conversion companies and sweeper manufacturers. Additionally, the PR1186.1 adoption resolution will include a staff commitment to conduct a technology assessment that analyzes the availability of alternative-fuel sweepers and the potential for conventionally fueled sweepers with control devices to achieve equivalent emission reductions and associated toxic risk values.

PWS Comment 4: To comply with State water quality regulations, our jurisdiction recently spent a significant amount of money to upgrade the underground storage tanks used to fuel our equipment. Now the AQMD is asking us to transition to alternative fuels that would require the installation of separate fueling facilities. Our jurisdiction does not have sufficient funds to comply with all of these mandated programs.

Staff Response: Supplemental funding resources may help facilitate local government compliance with the proposed Clean Fleets program. This staff report contains a summary of available funding programs and a complete funding discussion is contained in the Economic

Assessment for the Clean Fleets program (available from the AQMD or can be viewed or downloaded at the AQMD's Clean Fleets home page: www.aqmd.gov/news1/Fleet_Rule_Home.html). PR1186.1 requirements may not require construction of an alternative-fueling station. An existing public station may be within a suitable range or several adjoining agencies may be able to partner to reduce the alternative-fueling station construction costs. It should also be noted that prior to July 1, 2005, AQMD approval of a Technical Infeasibility Certification (based on a demonstration that an alternative-fueling station is not available within five miles) can delay procurement of an alternative-fuel sweeper. However, jurisdictions with an approved Technical Infeasibility Certification request would be required to procure a Rule 1186-certified sweeper, powered by ultra-low sulfur diesel and outfitted with ARB-approved control device(s).

PWS Comment 5: Local jurisdictions typically must accumulate funds for a number of years to cover the costs of complying with mandated programs. The PR 1186.1 July 1, 2002 implementation date does not afford a jurisdiction enough time to accumulate funds. Additionally, there is strong competition for funding programs (Carl Moyer, MSRC, AQIP, etc.) and a jurisdiction may not receive funding even if they apply to all sources. Would it be possible to designate a certain percentage of these funds to only be eligible to local jurisdictions that are attempting to comply with the Clean Fleets program?

Staff Response: PR1186.1 requirements become effective for new purchases or contracts made after June 30, 2002; there are no retrofit requirements. The delayed PR1186.1 implementation date is intended to allow local jurisdictions and their contractors to evaluate equipment, identify alternative fuel sources, and obtain grant funding, if available. The majority of funding sources described in the Economic Assessment are not under the direct control of the AQMD and, as such, it would not be possible to place restrictions on those programs. A proposal could be made; however, to prioritize Clean Fleet projects for those funding sources that AQMD has direct control (i.e., AQIP).

Additional Manufacturer Comments

Staff has also solicited specific comments from eight street sweeper manufacturers on future plans to provide alternative-fuel sweepers, obstacles to entering the alternative-fuel sweeper market and the use of ultra-low sulfur diesel with particulate traps. In most cases the information provided was identified as confidential, however, there were also general comments. The following is a summary of these general manufacturer comments followed by staff's response.

Manufacturer Comment 1: Reducing the sulfur content from the 500 to 2000-ppm range currently utilized in diesel engines, will harm those engines due to the lubricity of the sulfur. Most engine components, especially in the high-pressure injection system will experience rapid wear and increased maintenance. This problem was pronounced when sulfur was dropped from 2000 to 3000-ppm range for the on-road engines. Decreasing the sulfur from 500 to 15-ppm could have more severe effect on engines wear.

Staff Response: Information from engine manufacturers and providers of ultra-low sulfur diesel indicates that lowering the diesel fuel sulfur content will not adversely affect engine performance. As mentioned elsewhere, procurement of an ultra-low sulfur diesel sweeper outfitted with particulate traps represents an alternative method of compliance and can only be implemented if the District approves a Technical Infeasibility Certification request before

July 1, 2005. The potential impact of using ultra-low sulfur diesel is one consideration for a fleet operator that submits a Technical Infeasibility Certification request.

Manufacturer Comment 2: Using active catalyst in a ceramic trap to accomplish continuous regeneration is effective in burning accumulated soot in the trap provided that the exhaust gas temperature reaches soot ignition temperature. Such condition is detrimental to ensure successful and reliable operation in real life conditions. Exhaust temperature is primarily a function of engine loads. At full load, exhaust temperatures are usually high enough to provide regeneration. At idle and low engine loads, exhaust temperatures are low and do not lend themselves to initiate regeneration. Therefore, the reliability and successful operation of a continuously regenerated trap system is a function of engine operating cycle. Should the engine operate in the low-load range for a period of, say one hour, the trap would not regenerate plugs up and ultimately shuts off the engine. One engine manufacturer experienced similar problems in California in the 1980's and the problem was corrected by running the cars on chassis dynamometer at full load. Most Sweeper engines have a tendency to operate in the low power range and, therefore, this potential problem could be significant in this application.

Staff Response: Information from particulate trap manufacturers indicates that four-cycle diesel engines provide sufficient exhaust temperatures, even at engine idle, to regenerate particulate traps. There may not be sufficient exhaust heat with a standard two-cycle diesel engine, however, information from particulate trap manufacturers indicates that this can be addressed by insulating the exhaust system. While use of ultra-low sulfur diesel with particulate traps represents a promising technology, it is an alternative to PR1186.1 requirements and is it the responsibility of fleet operators to consider potential implementation problems prior to submitting a Technical Infeasibility Certification request.

Manufacturer Comment 3: Ultra low-sulfur diesel fuel is not readily available through fuel distribution systems. As such, it would require construction of dedicated tanks and special delivery from the refineries. Any contamination of this fuel with high sulfur will poison and deteriorate the soot trap system causing plug ups. Measures to avoid contamination as well as others will result in added capital and operating costs. This is in addition to the higher costs of the ultra-low sulfur diesel fuel.

Staff Response: Information obtained from fuel providers and included in the Clean Fleets Economic Assessment indicates a five-cent cost increase for ultra-low sulfur diesel fuel. There is significant interest in the use of ultra-low sulfur diesel with particulate traps and this interest may generate sufficient demand to warrant a dedicated fleet of ultra-low sulfur diesel delivery trucks. Again, use of ultra-low sulfur diesel with particulate traps represents an alternative to PR1186.1 requirements and the fleet operator needs to consider all potential implementation impacts prior to submitting a Technical Infeasibility Certification request.

FINDINGS AND COMPARATIVE ANALYSIS

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 PR1186.1 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 oxide emissions from diesel powered vehicles from PR1186.1 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. PR1186.1 makes progress toward that goal. Section 40919 requires air districts to include measures in their plans to achieve the use of a significant number of low-emission vehicles in fleets.
- e) Approximately 71 percent of the 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, 40447.5, 40463, 40702, 40725 through 40728, and 40910 through 40920.5, inclusive.

Clarity - The AQMD Board determines that PR 1186.1 is written or displayed so that persons directly affected by it can easily understand its meaning.

Consistency - The AQMD Board determines that PR1186.1 is in harmony with, and not in conflict with or contradictory to, existing federal or state statutes, court decisions, or regulations.

Non-Duplication - PR1186.1 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), and 40919(a)(4)/40920.5(a) (measures to achieve the use of a significant number of low-emission motor vehicles by operators of motor vehicle fleets).

Incremental Cost-Effectiveness Assessment - 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 the most stringent option compared with the next less costly control option. PR1186.1 requirements represent the most stringent control option currently and there is no other control option that can achieve the same emission reduction goal. Therefore, an incremental cost-effectiveness assessment has not been prepared for this rulemaking effort.

Comparative Analysis

Health and Safety Code §§40727.2 requires a written comparison of a proposed rule with existing federal and local regulations imposed on the same source. Based on available information, there are no federal, State, or local air pollution regulations or monitoring/recordkeeping/reporting requirements regarding jurisdiction procurement of alternative-fuel street sweeping equipment.

APPENDIX A:
PR1186.1 RULE TEXT

**PROPOSED RULE 1186.1 IS PROVIDED IN AN EARLIER PART OF THE
BOARD PACKAGE AND FINAL RULE LANGUAGE WILL BE INSERTED
HERE UPON ADOPTION BY THE AQMD GOVERNING BOARD**

**APPENDIX B:
ALTERNATIVE-FUEL SWEEPERS CURRENTLY AVAILABLE**

Original Equipment Manufacturer (OEM) Compressed Natural Gas Sweepers

Manufacturer	Model	Truck Engine	Auxiliary (Sweeper) Engine	Gross Vehicle Weight (lbs.)
Elgin Company	Eagle	Cummins (5.9L)	Ford (2.5L)	32,000
	Crosswind	Cummins (5.9L)	Ford (4.2L)	32,000
TYMCO	600	Cummins (5.9L)	GM (5.7L)	31 - 33,000
	350	Cummins (5.9L)	GM (5.7L)	26,000
	210	GM (5.7L)	Ford (300ci)	14,500

Original Equipment Manufacturer (OEM) Liquefied Petroleum Gas (Propane) Sweepers

Manufacturer	Model	Truck Engine	Auxiliary (Sweeper) Engine	Gross Vehicle Weight (lbs.)
Elgin Company	Eagle	Cummins (5.9L)	Ford (2.5L)	32,000
	Crosswind	Cummins (5.9L)	Ford (4.2L)	32,000
TYMCO	600	Cummins (5.9L)	GM (5.7L)	31 - 33,000

Appendix C: Emission Reductions Methodology

Introduction:

Unlike other heavy-duty equipment, many existing street sweeper models have two engines; a truck engine to propel the vehicle and an auxiliary engine to power the sweeping system (blowers, fans, conveyor systems). The truck engines are on-road engines that must meet ARB certification standards, however, the auxiliary engines are non-road engines that are subject to less stringent emission standards. The following analysis includes the higher emission standards for non-road auxiliary engines and assumptions regarding the percentage of sweepers that have two engines and the amount of fuel utilized by each engine.

Inputs for Alternative-Fuel Emission Reduction Calculations:

Input	Explanation
Baseline NOx emissions rate (on-road [truck] engine used in diesel sweepers) = 2.0 g/bhp-hr	The nominal NOx emission level assumed by ARB as the NOx portion of the mandatory 2.5 g/bhp-hr NMHC+NOx emission standard for heavy-duty engines is 2.0 g/bhp-hr, based on ARB staff input and as specified in ARB's Urban Bus Fleet Rule.
Baseline NOx emissions rate (non-road [auxiliary] engine used in diesel sweepers) = 4.8 ² g/bhp-hr (2003 - 2006) = 2.8 g/bhp-hr (2007 +)	Based on 40 Code of Federal Regulations Part 89, Section 89.112 (Standards for non-road engines). Tier 2 standards become effective for model year 2003 engines. Tier 3 standards become effective for model year 2007 engines. (Emission standards are for non-road engines with a rated power of 100 - 175 HP).
Baseline PM emissions rate (on-road [truck] engine used in diesel sweepers) = 0.1 g/bhp-hr	The PM emission rate for diesel heavy-duty engines is based on the 0.1 g/bhp-hr emission standard.
Baseline PM emissions rate (non-road [auxiliary] engine used in diesel sweepers) = 0.22 g/bhp-hr	Based on 40 Code of Federal Regulations Part 89, Section 89.112 (Standards for non-road engines). (Emission standards are for non-road engines with a rated power of 100 - 175 HP)
NOx emission rate for alternative-fuel sweepers (heavy-duty on-road/non-road engines) = 1.4 g/bhp-hr	Based on discussions with and input from ARB technical staff regarding the appropriate nominal NOx emission level that corresponds with the expected certification level of 1.8 g/bhp-hr NMHC+NOx for alternative-fuel heavy-duty engines for the year 2002 and later. This is consistent with ARB's Urban Bus Fleet Rule documentation.

² The 40 CFR Part 89 standards include NOx and NMHC. Based on suggestions by ARB staff, the reported baseline standards have been reduced by 0.1 to remove the NMHC emissions.

Inputs for Alternative-Fuel Emissions Reductions Calculations (Continued):

Input	Explanation
PM emission rate for alternative-fuel sweepers (heavy-duty on-road vehicles) = 0.03 g/bhp-hr	For alternative fuels (e.g. natural gas), the PM level is 0.03 g/bp-hr, based on ARB staff input and certification data for heavy-duty engines. This emission level is also consistent with the PM standard for the alternative-fuel path in the recently adopted ARB Urban Bus Fleet Rule.
Conversion factor based on fuel usage = 18.5 bhp-hr/gallon of fuel used	Based on Carl-Moyer emission reduction calculation methodology for other heavy-duty vehicles.
Fuel usage (single engine sweeper) = 30 gallons/day	Based on comments by PR1186.1 Working Group members. Range was from 25 to 35 gallons/day.
Fuel usage (dual engine sweeper) = 20 gallons/day/truck engine, 10 gallons/day/auxiliary engine	Based on comments by PR1186.1 Working Group members. Fuel usage split between truck and auxiliary engine accounts for the greater fuel usage associated with the larger truck engine and lower torque required for the lower horsepower auxiliary engine.

NOTE: All standards and emission levels are for the year 2002 and later, consistent with the PR1186.1 implementation date. Also, emissions reductions are based on annual fuel usage.

Alternative-Fuel Sweeper Emission Benefits:**NO_x (On-Road Truck Engine)**

Baseline NO _x	– Alternative-Fuel Level	= Emissions Benefit
2 g/bhp-hr	– 1.4 g/bhp-hr	= 0.6 g/bhp-hr

NO_x (Non-Road Auxiliary Engine)

Baseline NO _x	– Alternative-Fuel Level	= Emissions Benefit
4.8 g/bhp-hr	– 1.4 g/bhp-hr	= 3.4 g/bhp-hr (Year 2003-2006)
2.8 g/bhp-hr	– 1.4 g/bhp-hr	= 1.4 g/bhp-hr (Year 2007 +)

PM (On-Road Truck Engine)

Baseline PM	– Alternative-Fuel Level	= Emissions Benefit
0.1 g/bhp-hr	– 0.03 g/bhp-hr	= 0.07 g/bhp-hr

PM (Non-Road Auxiliary Engine)

Baseline PM	– Alternative-Fuel Level	= Emissions Benefit
0.22 g/bhp-hr	– 0.03 g/bhp-hr	= 0.19 g/bhp-hr

Alternative Fuel Emission Reductions Estimates:

Emission Reductions = [Baseline emission rate – Alternative-Fuel emission rate)]*(conversion factor for fuel usage calculations)*(Fuel usage per day)*(Working days per year)*(conversion from grams to pounds)

Single Engine Alternative-Fuel Sweeper

NOx Emission Reductions for Single (On-Road) Engine Street Sweeper:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (30 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
0.6	x 18.5	x 30	x 250	x 0.002203	= 183

PM Emission Reductions for Single (On-Road) Engine Street Sweeper:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (30 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
0.07	x 18.5	x 30	x 250	x 0.002203	= 21

Dual-Engine Alternative-Fuel Sweeper

NOx Emission Reductions for Street Sweeper Truck (On-Road) Engine:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (20 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
0.6	x 18.5	x 20	x 250	x 0.002203	= 122

NOx Emission Reductions for Street Sweeper Auxiliary (Non-Road) Engine:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (10 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
3.4 (Year 03-06)	x 18.5	x 10	x 250	x 0.002203	= 346
1.4	x 18.5	x 10	x 250	x 0.002203	= 143

(Year 07+)

Total NOx Emission Reductions for Dual-Engine Alternative-Fuel Sweeper

= 468 pounds/vehicle/year (Year 2003 - 2006)
 = 265 pounds/vehicle/year (Year 2007+)

PM Emission Reductions for Street Sweeper Truck (On-Road) Engine:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (20 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
0.07	x 18.5	x 20	x 250	x 0.002203	= 14

PM Emission Reductions for Street Sweeper Auxiliary (Non-Road) Engine:

Emission Benefit (g/bhp-hr)	Conversion Factor (bhp-hr/gal.)	Fuel Usage (10 gal/day)	250 Working Days / Year	0.002203 lbs/g	Lbs/vehicle/yr
0.19	x 18.5	x 10	x 250	x 0.002203	= 19

Total PM Emission Reductions for Dual-Engine Alternative-Fuel Sweeper

= 33 pounds/vehicle/year

EMISSION REDUCTIONS SUMMARY

Emission Reductions from an Individual Street Sweeper (pounds/vehicle/year)

Sweeper Type	NOx	PM
Single-Engine Alternative-Fuel Sweeper	183	21
Dual-Engine Alternative-Fuel Sweeper	468 (year 2003- 2006) 265 (year 2007 +)	33

PR1186.1 Future Year Emission Reductions (tons/year)

Assumptions:

- 700 sweepers in the District (80% are dual engine)
- 10 year equipment life
- Emission reductions begin in year 2003
- Entire District sweeper fleet converts to alternative fuels

Calculations: This table reports cumulative sweeper replacements, and the cumulative NOx and PM emission reductions (tons/year).

Year	Single Engine Sweepers	NOx Emissions	PM Emissions	Year	Dual Engine Sweepers	NOx Emissions	PM Emissions
2002	-	-	-	2002	-	-	-
2003	14	1.28	0.15	2003	56	13.10	0.92
2004	28	2.56	0.29	2004	112	26.21	1.85
2005	42	3.84	0.44	2005	168	39.31	2.77
2006	56	5.12	0.59	2006	224	52.42	3.70
2007	70	6.41	0.74	2007	280	59.84	4.62
2008	84	7.69	0.88	2008	336	67.26	5.54
2009	98	8.97	1.03	2009	392	74.68	6.47
2010	112	10.25	1.18	2010	448	82.10	7.39
2011	126	11.53	1.32	2011	504	89.52	8.32
2012	140	12.81	1.47	2012	560	96.94	9.24
2013	140	12.81	1.47	2013	560	96.94	9.24
2014	140	12.81	1.47	2014	560	96.94	9.24
2015	140	12.81	1.47	2015	560	96.94	9.24

At Full Fleet Turnover (for year 2012 and later)

NOx = 109.75

PM = 10.71

APPENDIX D

KEY CONTACT LIST

Local Jurisdictions

City of Commerce
City of Cypress
City of Fullerton
City of Glendale
City of Huntington Beach
City of La Habra
City of Long Beach
City of Los Angeles
City of Moreno Valley
City of Pasadena
City of Torrance
County of Orange
County Los Angeles
County of Riverside
County of San Bernardino
Los Angeles League of Cities
Orange County
 Council of Governments
San Bernardino County
 Association of Governments
Western Riverside
 Council of Governments

Street Sweeper Manufacturers/Dealers

Athey Products Corporation
Elgin Sweeper Company
GCS Western Power and Equipment
Haaker Equipment
Johnston Sweeper Company
Kelly Equipment

Street Sweeper Manufacturers/Dealers (Continued)

Nixon-Egli Equipment Company
Schwarze Industries
Tennant Sweeper Company
Tymco Sweeper Company
Wittke Company
Leach Company

Fuel Providers

ARCO
Western States Petroleum Association
Pinnacle
Southern California Gas Company

Contract Street Sweepers

Nationwide Environmental
Interstate Sweeping
R.F. Dickson Co.
California Street Maintenance
Sunset Property Services

Others

Caltrans
Engelhard Corporation
General Motors

**APPENDIX E
RULE DEVELOPMENT PROCESS**

Proposed Rule 1186.1 – Less-Polluting Sweepers

AQMD Governing Board Environmental Justice Initiatives (October 10, 1997) AQMD Governing Board Direction to Develop Fleet Rules (September 1999) First Draft Fleet Rule Proposal Release - PR1190 (November 1999) First Draft PR1186.1 Proposal Release (April 11, 2000)

**Public Meetings and Public Workshops, Site Visits,
Surveys, and Board Committee Meetings:**

Fleet Rule Public Workshops: December 21, 1999; January 12, 2000; February 16, 2000; March 10, 2000; May 10, 2000 (over 20,000 notices mailed) Street Sweeper Manufacturer Conference Call: February 29, 2000 Rule 1186.1 Survey Mailed to each AQMD Jurisdiction: March 10, 2000 Fleet Rule Public Consultation Meeting: March 28, 2000 Site Visits to City of Cypress and Local Sweeping Contractor: April 2000 Rule 1186.1 Working Group Meetings: March 7, April 11, May 9, July 18, 2000 Rule 1186.1 Public Workshop: May 24, 2000 (over 950 notices mailed) Mobile Source Committee Briefing: June 23, 2000
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CEQA and Socioeconomic Reports

<p><u>CEQA Document</u> Release Notice of Preparation/Initial Study for 30-day Public Comment Period: November 12, 1999 to December 14, 1999 Release Draft Program Environmental Assessment for 45-day Public Comment Period: March 10, 2000 to April 25, 2000 Final Program Environmental Assessment Certified: June 16, 2000</p> <p><u>Socioeconomic Assessment</u> Identification of Impacts to Industry and Control Costs Draft Socioeconomic Assessment Released for Comment: April 25, 2000 to May 26, 2000 Final Socioeconomic Assessment Approved by Governing Board: June 16, 2000</p>

Set Hearing: July 21, 2000 Public Hearing: August 18, 2000

Nine months spent in rule development

APPENDIX F
WRITTEN COMMENTS

January 17, 2000

Mr. David Coel
Mobile Source Strategies Section
Planning, Rule Development & Area Sources
SCAQMD
21865 E. Copley Drive
Diamond Bar, CA 91765



Dear Mr. Coel,

TENNANT CO. has been producing the Model 830II, a specialized sweeper since 1993. It was designed for use in dusty, severe environment industrial applications. This capability lent itself for use in high profile municipal applications requiring a degree of sweeping performance and dust control not available in conventional street sweepers. It was the only commercially viable sweeper with dry dust control that was certified under the 1186 Certification program.

The standard engine in the sweeper is a 4 cylinder, 108hp Perkins diesel model. In order to license the unit for municipal use as a motor vehicle, a 6cyl, 185hp Cummins engine was made available. This is the smallest available engine with CARB/EPA on-road, out of vehicle certification. As you can well guess, packaging a 6 cyl. engine into a machine designed around a 4 cylinder engine was a challenge. It would not be possible to convert that engine to an alternate fuel and achieve an operating time longer than perhaps an hour or two.

While TENNANT CO. feels this sweeper can be of benefit in the LA basins quest for cleaner air, the cost penalty of \$17,000 associated with the certified engine has limited its sales to less than 5 units for municipal use in the SQAQMD area. With the increased emphasis on PM10 reduction, we feel the usage will increase to approximately 10 units per year.

Please review the attached literature, consider the gains to be made with PM10 reduction and consider the Model 830II for an exemption from the SCAQMD requirements for alternate fuels in Rule 1190.

Sincerely

A handwritten signature in black ink, appearing to read "Mark Kinter".

Mark Kinter
Principal Engineer
TENNANT CO.



March 7, 2000

Dr. Julia Lester
PM10 Program Supervisor
SCAQMD
21865 East Copley Drive
Diamond Bar, CA 91765-4182

Dear Dr. Lester,

On behalf of Athey Products Corporation, I would like to thank you for including the street sweeper industry in your Diesel engine emissions exploration; without the input of industries potentially affected by a rule as far reaching as the proposed 1190, the true meaning of a democracy would be jeopardized.

As you are aware, Athey Products is a public corporation and a manufacturer of mechanical, vacuum, and regenerative air sweepers in both single and twin engine (propulsion and auxiliary engine) models. Our customers include private contractors, municipalities, the military, airport authorities, and international users.

We have several concerns we would like to raise regarding the currently proposed rule 1190:

- End product sale price for "alternative fuel" sweepers
- Warranty effect on end product sale price due to new technology
- Availability of suitable engines for both propulsion and auxiliary use
- Availability of space and tanks for on-board storage, fuel economy and range
- Refueling infrastructure
- Language of an adopted Rule 1190

Preliminary investigations show the additional costs of an alternative fuel sweeper range from \$15,000 to \$30,000 per sweeper depending on the sweeper model. This does not include the engineering, manufacturing, and training expenses that would probably be amortized over a relatively small number of units. Without "economy of scale", sweeper manufacturers will have to forward a disproportionate amount of the design and development costs to the customer. This in turn will affect sweeper marketability.

Because the technology for alternative fuel engines is relatively new and unproven, the final manufacturer will have to bear the additional service/warranty expenses until the



new engines become as reliable as the ones with proven technology. These expenses would have to be estimated and amortized over a relatively small number of units. The customer would again be subjected to an increase in sale price.

Twin engine sweepers use a larger engine for propulsion and a smaller engine for powering the sweeping functions. The larger propulsion engine has been more commercially available in alternative fuel versions (e.g., compressed natural gas) because there has been more demand for the size range. Alternative fuel engines in the size range suitable for the auxiliary engines more commonly used in sweepers are more limited. It is doubtful the relatively small demand from sweeper manufacturers for certain alternative fuel engines would stimulate many engine manufacturers to invest in the design and development programs necessary to bring new engines to the market place. It is possible that the cost of a smaller horsepower unit could rival that of larger horsepower units due to the engine manufacturer's limited economy of scale. This expense would probably be amortized over a relatively small number of units and the customer would again bear an increase in sale price.

Current alternative fuel storage and delivery systems are more successful in stationary applications than in mobile ones. The range of environments and subsequent stresses present the designer of mobile equipment with unique challenges in the design of fuel storage and delivery systems. Furthermore, the size of fuel storage tanks required to maintain current fuel range standards makes it difficult to locate them on an already crowded sweeper chassis. In many cases, enlarging the chassis is not an acceptable solution because of the obvious need to maintain maneuverability. Custom size and shape tanks would probably not be readily available and would have to be manufactured for a limited number of sweepers. Again, this added expense would probably have to be passed on to the customer.

The infrastructure for alternative fuels is currently non-existent or extremely limited at best. Because the range of alternative fuel street sweepers would likely be less than that of their traditional fuel counterparts, they would require more frequent refueling. Going to remote or out of the way refueling stations will increase the cost of sweeping.

The language of an adopted Rule 1190 would have to be carefully chosen. Currently, the Preliminary Draft seems to emphasize "alternative fuel" as the requirement for compliance. It seems the goal of the rule should be to reduce harmful emissions and should thus focus on an emissions standard rather than the means of achieving that standard. Furthermore, the emissions standard would need to be clearly defined and regulated by a recognized authority. There are on going efforts to design synthetic fuels, which may or may not fit under an "alternative fuel" definition. Synthetic liquid fuels and hybrid fuels could potentially all but eliminate harmful emissions yet require little or



no modifications to current engine designs and fuel delivery systems and infrastructure. There are also on-going efforts to redesign and refine current engine designs which could reduce emissions to an acceptable level but still burn traditional fuels.

In closing, I would like to summarize and point out what is probably obvious to you and your colleagues: An adopted Rule 1190 will likely have noble intentions and a positive environmental impact; but due to its complexity and far reaching implications, it could also have some profoundly negative impacts on a wide range of industries as well as the economy.

Nick Schlessinger
Regenerative Air Products Manager
Athey Products Corporation

cc: Mike Adams - Sales Manager, Blue Ridge Diesel Injection
Greg Berry - Territory Manager, Cummins Atlantic
Wes Brant - VP Operations, Athey Products
Larry Fetter - Manufacturing Engineer, Athey Products
David Hancock - Engineering Manager, Athey Products
Cecil Hill - General Sales Manager, Covington Detroit Diesel - Allison
Tom Nelson - President, Athey Products
John Stranahan - Truck Engine Account Manager, Gregory Poole Caterpillar

JOHNSTON SWEEPER COMPANY
4651 Schaefer Avenue
Chino, California 91710



FACSIMILE TRANSMISSION

Date: 3/8/00
To: Julia Lester
Fax:
From: Stephen Walsh
Fax: (909) 613-5736
Phone: (909) 613-5768
C.O.
No. Pages: (2)

Subject: Alternate Fuel sweepers

Dear Julia

I am responding to your request for comments regarding alternate fuel sweepers.

Johnston has had considerable experience in adapting our sweeper range to alternate fuels, primarily CNG but also LNG. Regrettably the experience so far has been a costly one given the small amount of units sold and the lack of stability from proprietary suppliers in the alternate fuel market. In volume terms the sweeper market is small and the opportunity to re-coup expensive development costs is limited. I thought you would be interested to learn of our experiences to date.

In 1994 we were requested by Caltrans to manufacture 4 of our model 4000 mechanical sweepers to be powered by the Hercules CNG engine. Subsequently the Hercules engine was discontinued and we were asked by Caltrans to change one unit to a Perkins diesel engine at Caltrans expense. On a production run of four units our development costs were considerable.

In 1995 we were approached by our major customer New York City to manufacture five units fuelled by CNG. NYC runs a fleet of over 400 of our 4000 series mechanical sweepers. Given that we had already lost money on the previous development for Caltrans we were reluctant to develop a CNG unit. However New York's buying power overcame our objections and we agreed to develop a unit that met their operating requirement of eight hours continuous sweeping range. By this stage the Hercules

engine was no longer available so NYC specified the Detroit Diesel engine. The units were delivered in 1987 and although working successfully NYC subsequently changed their purchasing policy and reverted to specifying LEV diesel engines, which we achieve by using the Cummins ISB 190 engine in conjunction with a catalytic converter.

With no opportunity to amortize the development cost over a 50-60 unit order for NYC we offered the design to other cities, in short order the manufacturer of the Carbon fibre gas tanks went into liquidation, followed by Detroit Diesel withdrawing the CNG engine due to lack of demand. Currently the only engine manufacturer that makes a CNG engine suitable for the Johnston 4000 series is Cummins. This was a costly development program for our company that once again produced no payback.

On the vacuum sweeper side we have some novel and ingenious designs currently working in Europe that could be adapted to suit the AQMD customer-selling base. The design utilizes a commercially available alternate fuel truck chassis, however the additional cost for an alternate fuel chassis moves from \$45,000 at present to \$75,000 for the alternate fuel chassis.

We need to be certain that both legislation and customer funds are in place before we commit to producing this design in the US. Legislators often forget the infrastructure cost of new parts manuals, technical manuals, additional parts inventory. Plus as a manufacturer we must guarantee parts for a minimum of Ten years after the last production date which is a cost that must be included in any development program for a new or additional model.

Other points for consideration

In manufacturing terms the potential sweeper volume in the LA Basin is small and competition from manufacturers striving to re-coup design and development costs can drive prices to uneconomic levels.

There is a lack of competition from engine manufacturers in our size range requirement of 100 to 200HP.

Converted gasoline engines do not perform well on the continuous duty cycle necessary for a sweeper, maintenance cost will be higher.

It appears from the workshop briefing that City funding for alternate fuel capital equipment purchases and maintenance infrastructure is not available to meet AQMD proposed timetables.

The Gas Company

Michael L. Eaves
NGV Program Manager



May 1, 2000



Mr. Jack P. Broadbent
Deputy Executive Officer
South Coast Air Quality Management District
21865 East Copley Drive
Diamond Bar, CA 91765

Dear Mr. Broadbent:

This letter is in response to your request for comments regarding emission reduction analyses and calculations in the South Coast Air Quality Management District's (AQMD's) proposed fleet rules. Southern California Gas Company has reviewed the available proposed rule language as well as the associated Environmental Assessment (EA) document, and offers the following general comments for your consideration. A more comprehensive discussion of recommendations can be found in Attachment A.

General Recommendations:

1. Emission reductions should be analyzed separately for each rule.

Currently, emission reductions are estimated in the EA using common assumptions across vehicle classes (except for some high level distinctions between urban and school buses and all other HDVs). It is likely that overall emission reduction benefits will increase if reductions are analyzed separately for each rule. For example, in the case of refuse trucks, the "other heavy-duty" assumptions could be better tailored to meet the refuse duty cycle. The same will apply to street sweepers and airport service vehicles as shown in Attachment A.

2. Use Carl Moyer Memorial Program calculation methodologies.

As detailed in Attachment A, the more recently developed emission reduction calculation methodologies provided in the Carl Moyer Program provide additional benefits for many of your proposed fleet rules.

3. Minimizing rule extensions will increase emissions reductions.

In October 2002, there is the biggest drop in emission standards for heavy-duty vehicles. Thus, maximizing the number of vehicles that come on-line within this period will maximize emission reductions of the applicable rule. Rules that do not become effective until mid-2001 provide only one year of meaningful emissions reduction benefit.

4. Need to develop a useful metric for communicating toxic emission reductions.

As standards for criteria pollutants become more stringent, consideration of toxic emission reductions from reduced diesel combustion will be increasingly important. I realize this is very difficult in the absence of a good database, but it might be worth investigating.

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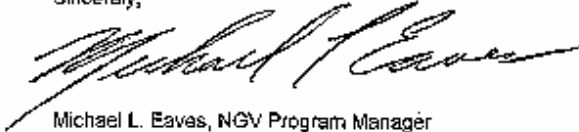
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C-217

In addition to these general comments, specific recommendations for individual rules can be found in Attachment A. These recommendations significantly improve the emission reduction calculations.

Thank you for this opportunity to provide constructive input to this important effort. Please call me at (213) 244-5320 if you have any questions regarding the above comments/suggestions.

Sincerely,

A handwritten signature in black ink, appearing to read "Michael L. Eaves". The signature is fluid and cursive, with a long horizontal stroke at the end.

Michael L. Eaves, NGV Program Manager

cc: Dave Coel (SCAQMD)
Mitch Pratt
Howard Levin
Bob Nicksin
Lee Wallace
Lauren Dunlap

Attachment A
Specific Rule Recommendations

(Page 1 of 3)

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

Refuse trucks are analyzed by AQMD as part of the "other heavy-duty vehicles" (HDVs) category. The basic approach that AQMD staff currently takes on the HDV emission reduction calculations is consistent with the calculation of mobile source emission reduction credits (MSERCs). However, MSERC calculation methodologies were developed several years ago, and the more recent Carl Moyer Memorial Program includes improved approaches to emission reduction calculations.

Due to the unique operating conditions of refuse haulers (many hours of operation without significant mileage), it is preferred to consider the calculation methodology required by the Carl Moyer Program Guidelines. An example is provided below:

AQMD Calculation based on mileage:

$$(4 - 2.5 \text{ gm/bhp-hr NOx}) * (2.6 \text{ bhp-hr/mi}) * 10,000 \text{ mi} / 907200 \text{ ton/gm} = 0.04299 \text{ tons/yr}$$

Moyer Calculation based on fuel use (45 gal per day, 260 days per year):

$$(4 - 2.5 \text{ gm/bhp-hr NOx}) * (18.5 \text{ bhp-hr/gal}) * (11700 \text{ gal}) / 907200 \text{ ton/gm} = 0.35789 \text{ tons/yr}$$

Comparison: $0.35789 \text{ tons/yr} - 0.04299 \text{ tons/yr} = 0.3149 \text{ tons/yr}$ more reductions.

Recommendation: Use the Moyer calculation methodology - it provides a seven-fold increase in emission reductions for the refuse fleet rule.

Proposed Rule 1194 - Commercial Airport Ground Access

PR 1194 applies to ground transportation services such as taxis and airport limousines; van services; and airport shuttle bus services. Many of these applications are served by extremely high mileage vehicles; specifically taxis, which operate approximately 50,000 miles per year, and Super Shuttle-type medium-duty vans which operate approximately 100,000 miles per year (compared to AQMD's 10,000 annual mileage assumption). AQMD calculates the emission reductions for these vehicles as part of the general LDV/MDV calculations using the assumption of 10,000 miles per year. For this proposed rule, such an assumption is very low.

Recommendation: Ensure that real-life fleet mileages are used for specialty airport applications. This should significantly increase (a factor of 5 or 10, depending on application) the emissions reductions for these vehicles.

Attachment A
Specific Rule Recommendations
(Page 2 of 3)

Proposed Rule 1186 – Clean On-Road Heavy-Duty Public Fleet Vehicles

There is a good opportunity to improve emission reductions for the class-8 heavy-duty truck engines that are included in this rule. According to the Carl Moyer Program Guidelines, the baseline NOx emission level is set in accordance with the settlement agreement between the ARB and the diesel engine manufacturers regarding excess emissions from the use of alternative injection timing strategies. According to this agreement, the baseline NOx emission rate of 6.0 gm/bhp-hr is used for class-8 heavy-duty trucks. Currently, AQMD is using 4.0 gm/bhp-hr.

For this proposed rule, AQMD assumes that all trucks subject to the rule operate with a 10-year life and 10,000 miles per year. If real-life data on the fleet vehicles that would be subject to this rule are available, then it is likely that some emission benefits will improve.

Recommendation: Ensure that AQMD follows the Moyer Guidelines for the class-8 heavy-duty truck engine baseline emissions (6.0 gm/bhp-hr NOx) and try to use real life fleet data for each key market segment, in order to facilitate more accurate emission reduction estimates.

Proposed Rule 1186.1 – Alternative Fuel Street Sweepers

Like refuse trucks, street sweepers have unique operating profiles that do not fit AQMD's assumptions for heavy-duty vehicles. In fact, vehicle mileage is not even tracked by most fleets. Instead, operating hours and fuel consumption are used to manage fleet operations. As such, AQMD's calculation based on annual mileage is not appropriate for this application.

Street sweepers are commonly equipped with two engines: a propulsion engine to move the truck, and an auxiliary power unit (APU) to operate the non-propulsion sweeper operations. The emission requirements applicable to this vehicle only address the propulsion engine, and do not consider the APU emission levels. For most, if not all, sweeper vehicles, this APU is an off-road, uncontrolled diesel engine, with baseline NOx emissions of 13 gm/bhp-hr.

The following APU emission reduction calculation is based on the off-road calculation methodology provided in the Moyer Program guidelines. Note that baseline NOx emissions are 13 gm/bhp-hr and replacement engine NOx emissions are 1.5 gm/bhp-hr, based on available certified natural gas technology for this engine size (Baytech).

AQMD APU calculation: zero emission reduction opportunity

Proposed APU calculation example based on Moyer off-road methodology:

$$(13 - 1.5 \text{ gm/bhp-hr}) * (100 \text{ hp}) * (1500 \text{ hrs/yr}) * 0.68 \text{ load factor} / 907200 \text{ ton/gm} = 1.29 \text{ ton/year}$$

Attachment A
Specific Rule Recommendations
(page 3 of 3)

Proposed Rule 1186.1 – Alternative Fuel Street Sweepers (cont.)

Note that a load factor of 0.9 (90 percent) could be easily justified and would increase the emission reductions to 1.7 tons/year. Also, a new natural gas technology sweeper truck that combines the APU and propulsion engine into one unit eliminates the APU emissions entirely, resulting in a reduction of 1.46 at a 68 percent load.

AQMD Propulsion Engine Calculation based on mileage:

$$(4 - 2.5 \text{ gm/bhp-hr NO}_x) * (2.6 \text{ bhp-hr/mi}) * 10,000 \text{ mi} / 907200 \text{ ton/gm} = 0.04299 \text{ tons/yr}$$

Moyer Propulsion Engine Calculation based on fuel use (about 4,000 gal/year):

$$(4 - 2.5 \text{ gm/bhp-hr NO}_x) * (18.5 \text{ bhp-hr/gal}) * (4000 \text{ gal}) / 907200 \text{ ton/gm} = 0.12235 \text{ tons/yr}$$

Comparison: $0.12235 \text{ tons/yr} - 0.04299 \text{ tons/yr} = 0.07936 \text{ more tons/year reduced}$

Recommendation: Adopt Moyer Program calculation methodologies and consider the off-road classification of the APU. This will significantly increase emission reductions for this vehicle class. Again, the repower/retrofit discussion for refuse trucks applies to sweeper trucks as well.

ADDENDUM TO FINAL STAFF REPORT

**FINAL
SOCIOECONOMIC IMPACT ASSESSMENT**

**PROPOSED RULE 1186.1
LESS-POLLUTING SWEEPERS**

AUGUST 2000

Prepared by: Shah Dabirian, Ph.D.
Air Quality Specialist

Reviewed by: Sue Lieu, Ph.D.
Program Supervisor

Reviewed by: Alene Taber, AICP
Planning Manager

Jack P. Broadbent
Deputy Executive Officer
Planning, Rule Development and Area Sources

Socioeconomic Assessment

The proposed rule requires public fleet operators with 15 or more total vehicles (not only street sweepers) to acquire alternative-fueled street sweepers when purchasing new or replacing existing sweepers after July 1, 2002. The proposed rule also requires private fleet operators that provide service to governmental agencies with more than 15 total vehicles to provide alternative-fuel sweepers for contracts made after July 1, 2002. Prior to July 1, 2005, the proposed rule also provides an alternative compliance option to address situations in which the use of an alternative-fueled sweeper is technologically infeasible.

Affected Industries

Based on the recent AQMD survey and information provided by fleet operators, there are about 700 street sweepers in the four county area. Seventy-five percent (550 sweepers) are owned and operated by cities, counties, and governmental agencies (SIC 91-97). The remaining twenty-five percent (150 sweepers) are privately owned and belong to eleven street sweeping contractors (SIC 4953). Based on the survey, six major sweeping contractors provide the bulk of the sweeping services with each having more than 15 sweepers. Two contractors have more than 10 sweepers and the remaining 3 have fewer than 5 sweepers. Under the proposed rule, the small private operators (with fewer than 15 sweepers) could potentially be affected if they contract with cities or counties, which have more than a total of 15 vehicles.

Compliance Costs

For the purpose of this analysis, it is assumed that all the replaced street sweepers will be CNG-powered. The total average annual cost of the replacement is comprised of one-time capital and annual operating and maintenance cost. The incremental cost of converting a diesel street sweeper to a CNG-powered one is estimated at \$40,000, which is annualized based on a four-percent real interest rate. It is assumed that one-tenth of the affected vehicles will be replaced every year. The operating and maintenance cost differential between a CNG-powered and a diesel-powered street sweepers is comprised of two components: fuel and maintenance costs. The fuel costs per gallon for diesel and CNG are assumed to be \$0.70 and \$0.36, respectively. The additional maintenance cost of operating a CNG vehicle versus a diesel one is estimated at \$0.09 per mile. The average annual vehicle miles traveled is assumed to be 15,000 miles. Furthermore, fuel efficiency of two miles per gallon for both diesel and CNG-powered street sweepers is assumed.

All the CNG-powered street sweepers are assumed to use (share) the CNG refueling stations that will be built under other (proposed) fleet rules. Therefore, no infrastructure cost is assumed here.

Based on the above assumptions, the total annual compliance cost from implementing the proposed rule is estimated at \$1.70 million, on average, from 2003 to 2015. The public fleet

operators incur seventy-five percent of the cost (\$1.27 million) while the private contractors incur the remaining twenty-five percent (\$0.43 million).

Based on the emission reductions estimates included in Appendix C to the Staff Report, the proposed rule will result in an average total of 84 tons of combined NOx and PM emission reductions per year during the period 2003 to 2015. The resulting cost-effectiveness of the proposed rule is estimated at \$20,474 per ton, assuming no funding is available to defray the cost.

Small Business Impacts

There are several conflicting definitions of a small business. The SCAQMD defines a "small business" in Rule 102 as one which employs 10 or fewer persons and which earns less than \$500,000 in gross annual receipts. However, for qualifying for assistance offered by the SCAQMD's small Business Assistance Office only, a small business means a business with total gross annual receipts of \$5,000,000 or less, or a total number of employees of 100 or fewer. In addition to the SCAQMD's definition of a small business, the federal Small Business Administration (SBA), the federal Clean Air Act Amendments (CAAA) of 1990, and the California Department of Health Services (DHS) also provide their own definitions of a small business. Two common characteristics of the SBA's, CAAA's, and DHS's definitions are the following: (1) standards are unique to each industry type, and (2) the businesses have to be independently owned and operated and cannot be dominant in their field.

The SBA's definition of a small business uses the criterion of either gross annual receipts (ranging from \$0.5 million to \$17 million, depending on industry type) or number of employees (ranging from 100 to 1,500). The CAAA classifies a facility as a "small business stationary source" if it: (1) employs 100 or fewer employees, (2) does not emit more than 10 tons per year of either VOC or NOx, and (3) is a small business as defined by SBA. The DHS definition of a small business uses an annual gross receipts criterion (ranging from \$1 million to \$9.5 million, depending on industry type) for non-manufacturing industries and an employment criterion of fewer than 250 employees for manufacturing industries.

Based on the SBA's, CAAA's, and DHS's definitions of small businesses, five of the small private sweeping contractors could potentially be small businesses. However, under the AQMD's definition, fewer of these operators would be considered small businesses. All of the cost assumptions discussed above apply to the small private contractors also.