PROPOSED MODIFICATIONS TO THE DRAFT 2007 AQMP: APPENDIX IV-B-2

DISTRICT STAFF'S PROPOSED POLICY OPTIONS TO SUPPLEMENT CARB'S CONTROL STRATEGY

FEBRUARY 2007

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SECTION 1

DISTRICT STAFF'S PROPOSED POLICY OPTIONS TO SUPPLEMENT CARB'S CONTROL STRATEGY

INTRODUCTION

Additional reductions in mobile source emissions beyond the reductions identified in CARB's mobile source control strategy are needed in order for the South Coast Air Basin to attain the federal PM2.5 ambient air quality standard by 2015. To achieve the necessary reductions poses several challenges. The most significant challenge is the short timeframe to achieve the necessary reductions. This challenge can be partially overcome with early actions to affect mobile source cleanup through voluntary incentive programs such as the Carl Moyer Program. However, additional public funds are needed to accelerate such efforts. Regulatory actions to mandate mobile source cleanup are also needed beyond those identified by CARB to date.

The District staff believes that a combination of regulatory actions and public funding is the most effective means of achieving emission reductions. As such, the 2007 AQMP proposes three policy options for the decision makers to consider in achieving additional reductions. The rate of progress for NOx under the three policy options is shown in Figure 1. The first option is the District staff's proposed additional control measures as a menu of selections to further reduce emissions from sources primarily under State and federal jurisdiction. The proposed additional control measures represent a menu of measures that the State could implement and are intended to complement CARB's mobile source control strategy with defined short-term and mid-term control measures needed for reaching attainment by 2015 and to meet legal requirements. The proposed additional control measures are also intended to highlight the level of stringency and reductions needed from State and federal sources for attainment. These measures can be modified or substitutes developed by the implementing agencies to achieve equivalent or greater reductions in the time frame needed for PM2.5 attainment. It should be noted that full implementation of the proposed measures will result in significant reductions in air toxic contaminants.

The second option is to have the state fulfill its NOx emission reduction obligations under the 2003 AQMP by 2010 for its short-term defined control measures plus additional reductions needed to meet the NOx emission target between 2010 and 2014. Under this option the state could include some of the proposed measures under the first option or other measures that the state identifies as part of the SIP public process.

The third option is based on the same rate of progress under Policy Option 1, but relies heavily on public funding assistance to achieve the needed NOx reductions via accelerated fleet turnover to post-2010 on-road emission standards or the cleanest off-road engine standards in effect today or after 2010. Under Policy Option 3, CARB or the District would assume the responsibility of implementing the incentive programs based on specific funding designated for this purpose. Based on the analysis performed for the Carl Moyer program, up to an estimated $600 million per year is needed between 2009 and 2014. Section 4 of this Appendix illustrates possible funding sources that have

been suggested in the past by various parties and the District staff has included these as a matter of perspective and is seeking comments and suggestions on appropriate funding sources.

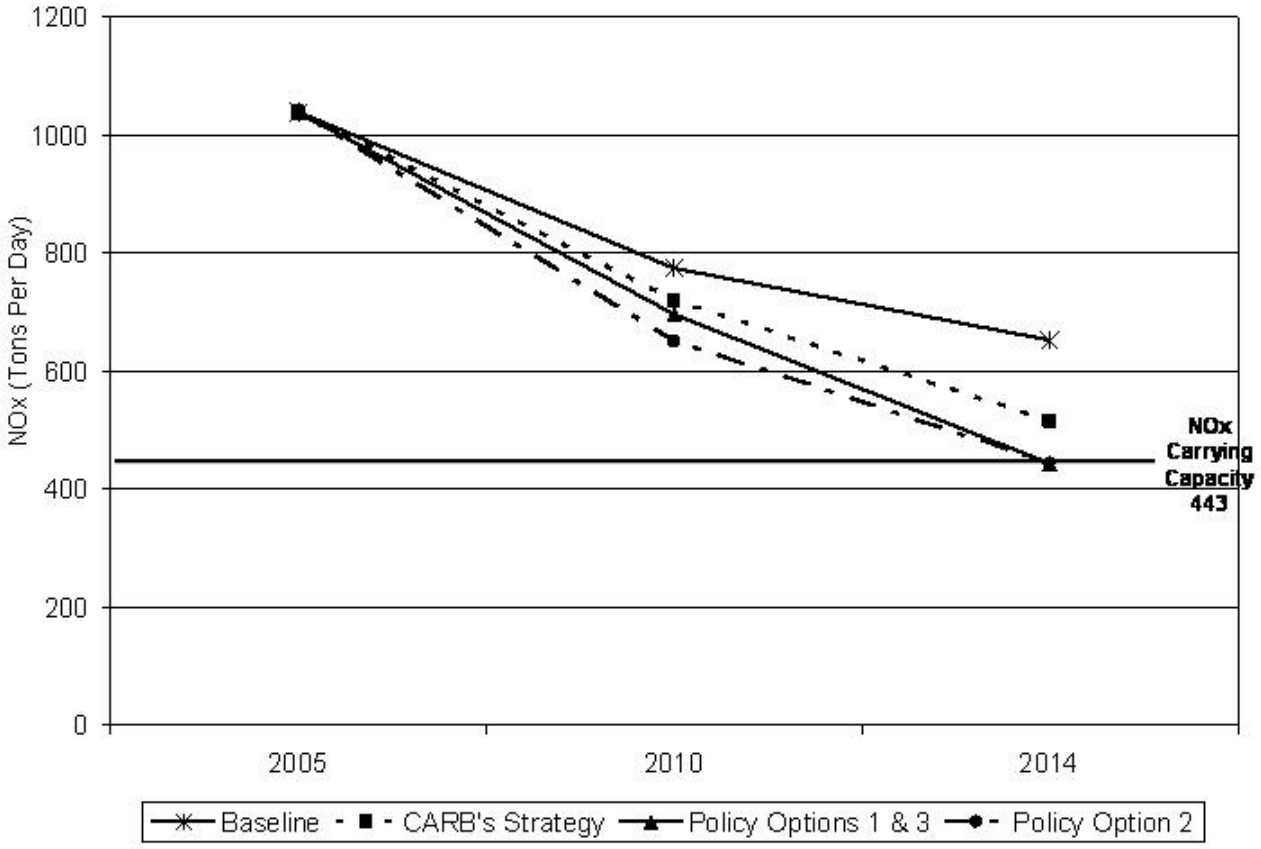

Figure 1. NOx Rate-of-Progress for the Three Policy Options

Relative to total emission reductions, each policy option would reach the same NOx emissions levels as identified in the PM2.5 attainment demonstration (i.e., 443 tons/day of remaining NOx emissions). CARB has identified 125 tons/day of NOx emission reductions from its proposed control strategy. An additional 71 tons/day of NOx emission reductions would be needed to demonstrate attainment. As such, all three policy options would achieve the additional 71 tons/day of reductions, but through different implementation mechanisms and on different implementation schedules.

The District staff recognizes these are very difficult policy choices the Basin is facing, but not meeting the PM2.5 standard by 2015 is not an acceptable public policy in light of recent health studies on particulate matter, not to mention the potential adverse economic impacts on the region due to potential federal sanctions. The following sections further describe the three policy options.

SECTION 2

POLICY OPTION 1 – DISTRICT STAFF'S PROPOSED ADDITIONAL MOBILE SOURCE AND CONSUMER PRODUCTS CONTROL MEASURES

INTRODUCTION

Based on CARB's proposed mobile source control strategy, District staff refined its evaluation of the control measures recommended in the Draft AQMP. Depending on the mobile source sector and the proposed control approach, District staff analyzed the need to accelerate the penetration of cleaner engine technologies. This Section describes the District staff's proposals for additional mobile source control measures to be included in the 2007 AQMP. Control measures presented in this appendix for ozone and $PM_{2.5}$ attainment demonstrations are based upon a variety of control technologies that are commercially available and/or technologically feasible in the next several years. The focus of these measures includes accelerated retrofits or replacement of existing vehicles or equipment, acceleration of vehicle turnover through high-emitter identification programs, and greater use of cleaner fuels in the near-term. In the longer-term, in order to attain the federal ozone ambient air quality standard, there is a need to increase the penetration of near-zero and zero emissions vehicles such as plug-in hybrids, even further use of cleaner fuels (either alternative or new formulations of gasoline and diesel fuels), and additional emission reductions from aircraft engines.

PROPOSED CONTROL MEASURES

Twelve additional control measures are proposed by the District staff for mobile sources and four long-term measures, which call for additional reductions from mobile sources and consumer products. The mobile source control measures call for greater emission reductions beyond the measures proposed by the state (as provided in Appendix IV-B-1) in order to achieve the necessary emission reductions to demonstrate attainment of the fine particulate air quality standards by 2015 and the 8-hour ozone air quality standard by no later than 2023. A summary of the 16 control measures is provided in Table 1.

TABLE 1
List of District Staff's Proposed Additional Mobile Source Control Measures Categorized by Control Strategy

On-Road Mobile Source Control Measures	
Number	**Title**
SCONRD-01	Accelerated Penetration of Advanced Technology Partial Zero-Emission and Zero Emission Vehicles [VOC, NOx, PM]
SCONRD-02	Deployment of On-Board Diagnostics (Phase III) in Light- and Medium-Duty Vehicles [VOC, NOx, PM]
SCONRD-03	Further Emission Reductions from On-Road Heavy-Duty Vehicles [NOx, PM]
SCONRD-04	Further Emissions Reductions from Heavy-Duty Trucks Providing Freight Drayage Services [NOx, PM]

TABLE 1
Concluded

Off-Road Mobile Source Control Measures	
Number	**Title**
SCOFFRD-01	Construction/Industrial Equipment Fleet Modernization [VOC, NOx]
SCOFFRD-02	Further Emission Reductions from Cargo Handling Equipment [NOx, PM]
SCOFFRD-03	Further Emission Reductions from Locomotives [NOx, PM]
SCOFFRD-04	Further Emission Reductions from Airport Ground Support Equipment [NOx, PM]
SCOFFRD-05	Further Emission Reductions from Transport Refrigeration Units [NOx]
SCOFFRD-06	Accelerated Turnover and Catalyst Based Standards for Pleasure Craft [VOC, NOx, PM]
Cleaner Fuels Control Measures	
SCFUEL-01	Further Emission Reductions from Gasoline Fuels [NOX, PM]
SCFUEL-02	Further Emission Reductions from Diesel Fuels [NOX, PM]
Long-Term Control Measures	
SC-LTM-01A	Further Emission Reductions from On-Road Mobile Sources [NOX]
SC-LTM-01B	Further Emission Reductions from On-Road Heavy-Duty Vehicles [NOx]
SC-LTM-02	Further Emission Reductions from Off-Road Mobile Sources [NOx]
SC-LTM-03	Further Emission Reductions from Consumer Products [VOC]

On-Road Mobile Source Control Measures

The District staff is proposing four on-road mobile source control measures. The first two measures focus on on-road light- and medium-duty vehicles operating in the South Coast Air Basin. By 2014, it is estimated that about 12 million vehicles will be operating in the Basin. The first measure would implement programs to accelerate turnover of older light- and medium-duty vehicles to new vehicles certified to the advanced technology partial zero emissions vehicle (ATPZEV) exhaust emissions standard with an emphasis on an accelerated penetration of plug-in hybrid and other near-zero or zero vehicle technologies. The second control measure would seek greater deployment of advanced on-board diagnostics in light- and medium-duty vehicles.

The remaining two measures focus on heavy-duty vehicles. The first of these measures seeks additional emission reductions from pre-2010 model year on-road heavy-duty vehicles through accelerated retrofit or replacement programs that would achieve at a minimum, 30 percent reduction in NOx depending on the age of the vehicle and 85 percent reduction in particulate matter. The measure would go beyond CARB's proposal for heavy-duty vehicles to seek accelerated replacement or retrofit of pre-2006 model year on-road heavy-duty vehicles to meet 2010 on-road heavy-duty exhaust

emissions standards. Lastly, 2007 to 2009 vehicles would be retrofitted to reduce NOx emissions.

It is estimated that 38 percent of all of the on-road heavy-duty vehicle activities are associated with goods movement. Due to the unique nature of the types of trucks performing freight drayage services at the marine ports, a separate control measure is proposed for this category of sources. The fourth control measure calls for on-road trucks that provide freight drayage services to implement the measure provided in the recently adopted San Pedro Bay Ports Clean Air Action Plan.

Off-Road Mobile Source Control Measures

The District staff is proposing six control measures that seek further emission reductions from off-road mobile sources and industrial equipment. Transportation sources such as aircraft, locomotives, and marine vessels are associated with anticipated economic growth not only in the Basin, but also nationwide. These sources are principally regulated by the federal and state agencies. The state has provided proposed actions on these sources as discussed in Appendix IV-B-1. In addition, certain local actions can result in emission reductions beyond the emissions standard setting authority of the state and U.S. EPA. The first measure calls for the state to adopt tighter NOx fleet averages on construction and other mobile industrial equipment such that cleaner engines or retrofit devices would be deployed as soon as possible. The second control measure calls for additional emission reductions from cargo handling equipment that operate at marine ports, rail yards, and warehouse distribution centers. The third measure calls for U.S. EPA to adopt new locomotive emissions standards and require the retrofit of existing locomotives to further reduce NOx and particulate emissions. The fourth control measure would require additional emission reductions from aircraft ground support equipment. The fifth measure calls for additional reductions from transport refrigeration units. The sixth measure calls for accelerated turnover of pleasure craft.

Cleaner Fuels Control Measures

In addition to the additional mobile source control measure proposals, two fuels related measures are proposed that could result in additional NOx, SOx, and PM emission reductions. The first measure reflects CARB's efforts to mitigate the impacts of ethanol permeation. CARB staff is currently evaluating mechanisms to offset the greater use of ethanol in gasoline fuels. As part of this evaluation, CARB staff indicated that there are NOx disbenefits associated with greater use of oxygenates that must be offset. One approach is to lower the sulfur content of the gasoline formulation. This measure reflects the emissions benefits associated with a lower sulfur content in gasoline fuels and additional SOx and NOx emissions benefits associated with the lower sulfur content. The second fuels related control measure calls for a 10 percent replacement of conventional diesel fuel with diesel fuel alternatives.

Long-Term Control Measures

The District staff is also proposing four additional long-term or "black box" or "Section 182(e)(5)" measures that would seek additional emissions reductions from on-road and off-road mobile sources and consumer products. These measures would not be implemented until after 2015 with full implementation in the 2021 to 2023 timeframe. For on-road and off-road mobile sources, greater use of cleaner gasoline and alternative diesel fuels would be sought in addition to advancing near zero emissions technologies where possible and further retrofits or replacement of existing engines. In addition, an inspection and maintenance program is proposed for on-road heavy-duty vehicles. Lastly, there is a need for additional VOC emissions reductions that could be achieved in the consumer products sector by 2023.

In addition to the proposed long term measures described above, reductions from the following programs can be used to fulfill, in part, the "black-box" commitment:

- NSR: Any excess reductions from the NSR program due to BACT or offset ratio beyond the AQMP assumptions; and
- AQMD short-term measures: Any emission reductions achieved from these measures that are beyond the District's SIP commitment will be used to offset CARB's 'black-box" commitment. Furthermore, permanent reductions in emission estimates due to improvement in inventory methodology are SIP creditable if the changes are approved by the AQMD Governing Board at its regularly scheduled public meetings.

To facilitate the implementation of the proposed black box measures, the District will continue to fund research and development to commercialize new advanced technologies through its Clean Fuels Program and through other research programs.

FORMAT OF CONTROL MEASURES

Included in each control measure description is a title, summary table, description of source category (including background and regulatory history), proposed method of control, estimated emission reductions, rule compliance, test methods, cost effectiveness, and references. The type of information that can be found under each of these subheadings is described below.

Control Measure Number

Each control measure is identified by a control measure number such as "CM #2007SCONRD-04" located at the upper right hand corner of every page. "CM #" is the abbreviation for the "control measure number" and is immediately followed by the year of the AQMP revision.

The next five- to seven-letter designation represents the abbreviation for a source category or specific programs. For example, "SCONRD" is an abbreviation for "South

Coast On-Road Mobile Sources." The following provides a description of the abbreviations for each of the measures.

- SCONRD On-Road Mobile Sources for the South Coast Air Basin
- SCOFFRD Off-Road Mobile Sources for the South Coast Air Basin
- SCFUEL Cleaner Fuels Measures for the South Coast Air Basin
- SC-LTM Long-Term Measures for the South Coast Air Basin

Title

The title contains the control measure name and the major pollutant(s) controlled by the measure. Titles that state "Control of Emissions from..." indicate that the measure is regulating a new source category, not presently regulated by an existing source- specific District rule. Titles that state "Further Emission Reductions of" imply that the measure could result in an amendment to an existing rule or acceleration of new technologies through incentive programs.

Summary Table

Each measure contains a table that summarizes the measure and is designed to identify the key components of the control measure. The table contains a brief explanation of the source category, control method, emission reductions, control costs, and implementing agency.

Description of Source Category

This section provides an overall description of the source category and the intent of the control measure. The source category is presented in two sections, background and regulatory history. The background has basic information about the control measure such as the number of sources in the Basin, description of emission sources, and pollutants.

The regulatory history contains information regarding existing regulatory control of the source category such as applicable state or federal rules or regulations and if the source category was identified in the 2003 or prior AQMPs.

Proposed Method of Control

The purpose of this section is to identify potential control options for an emission source to achieve emission reductions. If an expected performance for a control option is provided, it is intended for informational purposes only and should not be interpreted as the targeted overall control efficiency for the proposed control measure. To the extent feasible, the overall control efficiency for a control measure should take into account

achievable controls in the field by various subcategories within the control measure. A more detailed type of this analysis is typically conducted during rulemaking, not in the planning stage. It has been the District's long standing policy not to exclude any control technology and to intentionally identify as many control options as possible to spur further technology development.

Emissions Reduction

The emission reductions are estimates based on the baseline inventories prepared for the 2007 AQMP and are provided in the Control Measure Summary Table. The emissions data are based on the annual average inventory for all five criteria pollutants. The planning inventory adjusts the emissions by taking into consideration a source category's seasonal variations. The emissions affecting ozone concentration (i.e., VOC and NO_X) are presented under the Summer Planning Inventory. The emissions section of the summary table includes the 2002, 2014, and 2023 inventory. The 2014 and 2023 emission projections reflect implementation of adopted rules. Based on the expected reductions associated with implementing the control measure, emission data are calculated for 2014 and 2023 assuming the implementation of the control measure in the absence of other competing control measures.

The emission reductions listed in the summary table represent the current best estimates, which are subject to change during rule development. As demonstrated in previous rulemaking, the District is always seeking maximum emission reductions when proven technically feasible and cost-effective. For emission accounting purposes, a weighted average control efficiency is calculated based on the targeted controls. The concept of weighted average acknowledges the fact that a control measure or rule consists of several subcategories, and the emission reduction potential for each subcategory is a function of proposed emission limitation and the associated emission inventory. Therefore, the use of control efficiency to estimate emission reductions does not represent a commitment by the District to require emission reductions uniformly across source categories. In addition, due to the current structure of emission inventory reporting system, a control measure may partially affect an inventory source category (e.g., certain size of equipment or certain level material usage). In this case, an impact factor is incorporated into the calculation of a control efficiency to account for the fraction of inventory affected. During the rule development, the most current inventory will be used. However, for tracking rate-of-progress on the SIP emission reduction commitment, the approved AQMP inventory will be used. More specifically, emission reductions due to mandatory or voluntary, but enforceable, actions will be credited under SIP obligations.

Rule Compliance

This section was designed to satisfy requirements in the 1990 Clean Air Act in which EPA has indicated that it is necessary to have a discussion of rule compliance with each

control measure. This section discusses the recordkeeping and monitoring requirements envisioned for the control measure. In general, the District would continue to verify rule compliance through site inspections and submittal of compliance plans.

Test Methods

In addition to requiring recordkeeping and monitoring requirements, EPA has stated that "An enforceable regulation must also contain test procedures in order to determine whether sources are in compliance." This section of the control measure write-up identifies appropriate approved District, ARB, and EPA source test methods.

Cost Effectiveness

The Discounted Cash Flow (DCF) method is used to calculate the cost-effectiveness of each control measure. As control measures undergo the rule making process, more detailed control costs will be developed.

The cost effectiveness values contained herein may overestimate actual levels because of a number of factors. As additional information on costs and more accurate numbers of affected facilities becomes available, the cost effectiveness will be revised and analyzed in the socioeconomic assessment report of the 2007 AQMP.

Implementing Agency

This section identifies the agency(ies) responsible for implementing the control measure. Also included in this section is a description of any jurisdictional issues that may affect the control measure's implementation.

References

This section identifies directly cited references, or those references used for general background information.

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GROUP 1
ON-ROAD MOBILE SOURCES

ACCELERATED PENETRATION OF ADVANCED TECHNOLOGY PARTIAL ZERO-EMISSION AND ZERO EMISSION VEHICLES [VOC, NOX, CO]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	GASOLINE- AND DIESEL-POWERED ON-ROAD VEHICLES WITH GROSS VEHICLE WEIGHT RATING UP TO 14,000 LBS		
CONTROL METHODS:	REQUIREMENTS FOR NEW VEHICLE SALES OF ADVANCED TECHNOLOGY PARTIAL ZERO EMISSIONS VEHICLES AND ZERO EMISSIONS VEHICLES		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
VOC INVENTORY	178.5	50.1	29.3
VOC REDUCTION		0.5	2.1
VOC REMAINING		49.6	27.1
NOX INVENTORY	147.6	37.3	17.4
NOX REDUCTION		1.0	5.2
NOX REMAINING		36.3	12.2
CO INVENTORY	1631.9	495.6	259.1
CO REDUCTION		11.9	54.9
CO REMAINING		483.7	204.2
PLANNING INVENTORY (SUMMER FOR VOC AND NOX; WINTER FOR CO)	**2002**	**2014**	**2023**
VOC INVENTORY	180.1	52.9	31.3
VOC REDUCTION		0.5	2.3
VOC REMAINING		52.4	29.0
NOX INVENTORY	140.8	35.6	16.6
NOX REDUCTION		1.0	5.0
NOX REMAINING		34.6	11.6
CO INVENTORY	1604.8	485.8	253.1
CO REDUCTION		11.7	53.7
CO REMAINING		474.2	199.4
CONTROL COST:	TBD		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

The purpose of this control measure is to seek emission reductions from existing passenger and medium duty vehicles through the use of advanced technology vehicles that would provide substantial improvements in emissions performance beyond currently available vehicle

technologies. This control measure would specifically facilitate the technological development and commercial deployment of vehicle platform(s) that satisfy normal consumer performance and drivability requirements with zero emissions capability approaching 100 percent of vehicle operational time. Control measure implementation would be primarily accomplished by new vehicle manufacturer production/sales requirements for vehicles providing these capabilities, such as hybrid-electric vehicles with extensive all electric driving range. In addition, control measure implementation could be augmented through the use of voluntary/incentive programs that would facilitate the commercial deployment of conversion kits for existing hybrid-electric vehicles to increase their all-electric driving range.

Background

Emissions from passenger vehicles continue to represent a significant and increasing portion of the emissions inventory in the South Coast Air Basin, adversely affecting regional air quality. The intent of this control measure is to specifically mitigate impacts associated with passenger car emissions.

Regulatory History

To address California's acute air quality problems, the federal Clean Air Act granted California the unique authority to adopt and enforce rules to control mobile source emissions within California. CARB is required to adopt State requirements that are as stringent or more stringent than federal requirements.

Significant strides have been made in reducing emissions from motor vehicles through CARB's mobile source regulations that apply predominately to new vehicles. As a result, a "new" vehicle today is approximately 99% less polluting compared to a vehicle manufactured a couple of decades ago. However, on-road and off-road mobile sources account for about 70 percent of ozone precursor emissions in the State. Because of the large emissions contribution, requiring the use of advanced technology such as plug-in hybrid electric vehicle technology capable of zero emission transportation is essential if clean air standards are to be realized, especially for in-use vehicles.

PROPOSED METHOD OF CONTROL

CARB's Low-Emission Vehicle regulation establishes various emission categories with associated emission requirements assigned to each category, and vehicle manufacturers have the flexibility to choose the appropriate emission category for each vehicle model intended for sale in California. Basically, this regulation achieves emission reductions by forcing vehicle manufacturers to gradually increase the proportion of vehicles sold over time that have been certified to emission categories with the lowest emission requirements. The cleanest emission categories defined in the Low-Emission Vehicle regulation are partial-zero emission vehicles (PZEV), advanced technology zero-emission vehicles (ATPZEV), and zero-emission vehicles (ZEV). PZEVs must meet very stringent tailpipe emission limits, zero evaporative emissions, and enhanced durability requirements. An ATPZEV is a PZEV that includes components common to ZEVs—e.g., an advanced battery that is integral to the operation of the power train or an electric power train.

This control measure proposes to strengthen the production/sales requirement provision of CARB's Low-Emission Vehicle Regulation, to require increased sales of ATPZEVs with nominal zero emissions miles beginning with the 2012 model-year. To meet this requirement, ATPZEVs would, at a minimum, meet an all electric driving range that would provide for the maximum feasible amount of zero-emission operational capability under normal driving conditions and may be equipped with plug-in recharging capability. This mandatory program could be supplemented with a voluntary program to be implemented by the District and/or CARB that would incentivize the development and deployment of conversion kits for existing ATPZEV certified hybrid-electric vehicles for the purpose of increasing their all electric range and providing for plug-in recharging capability. The goal for ATPZEV deployment in the District is 100,000 vehicles by the 2014/2015 timeframe and 1,000,000 vehicles by 2020. Cost impacts to consumers resulting from control measure implementation could be offset by tax credits; however, cost impacts would also be mitigated by overall improvements in fuel economy for ATPZEVs deployed as a result of this control measure.

Several automobile manufacturers have also announced plans to investigate the technology, with Daimler Chrysler currently developing a plug-in capable Sprinter Van. In addition, the District is conducting a program to demonstrate 30 plug-in hybrid vehicles in the South Coast Air Basin. This demonstration will facilitate the commercialization of plug-in hybrid technology and to spur conversion of existing hybrid vehicles to have plug-in capabilities. Plug-In Bay Area (PIBA), a local chapter of the national Plug-In Partners effort, is demonstrating that a growing network of consumers are asking for production of plug-in hybrid vehicles. Members are demonstrating plug-in hybrid vehicles by Energy CS and Daimler Chrysler.

EMISSIONS REDUCTION

Accelerated deployment of plug-in hybrid-electric vehicles with enhanced all-electric range can result in significant emission reductions. If the proposed control measure is fully implemented, estimated annual average emission reductions of VOC and NOx are 0.5 and 1.0 tons per day by 2014, and 2.1 and 5.2 tons per day by 2023.

RULE COMPLIANCE AND TEST METHODS

The existing CARB certification and verification programs would be used to administer those portions of the control measure that would require CARB approval of plug-in hybrid-electric vehicles and retrofit kit designs. It is anticipated that existing certification and verification test procedures, coupled with DMV data, would produce the data needed to document emission levels.

COST EFFECTIVENESS

This proposed control measure will affect light-duty vehicles with gross vehicle weight ratings up to 8,500 lbs. The current cost of the advanced batteries are high, but are expected to reduce significantly with enhanced manufacturing techniques and economies of scale.

The cost effectiveness of this control measure has not been estimated at this time.

IMPLEMENTING AGENCY

CARB, subject to existing agreements with U.S. EPA, has the authority to set emission standards and certification requirements for vehicles sold in California. In addition, other incentives such as direct funding assistance or tax credits may be developed to accelerate vehicle turnover to the newer technologies.

REFERENCES

SCAQMD, Plug-in Hybrid Electric Vehicle Forum & Technical Roundtable, See www.aqmd.gov/tao/ConferencesWorkshops/PHEV_Forum-07-12-06/Plug-in_Hybrid_Electric_Vehicle_Forum.htm.

DEPLOYMENT OF ON-BOARD DIAGNOSTICS (PHASE III) IN LIGHT- AND MEDIUM-DUTY VEHICLES [VOC, NOX, CO]

CONTROL MEASURE SUMMARY

SOURCE CATEGORY: GASOLINE- AND DIESEL-POWERED LIGHT & MEDIUM-DUTY VEHICLES UP TO 14,000 LBS GROSS VEHICLE WEIGHT

CONTROL METHODS: ON-BOARD DIAGNOSTICS III (COMPUTER CONTROL SYSTEM IDENTIFYING EMISSIONS RELATED PROBLEM AND CONSUMER REQUIRED TO FIX DEFECT)

EMISSIONS (TONS/DAY):

ANNUAL AVERAGE	2002	2014	2023
VOC INVENTORY	323.1	118.2	80.3
VOC REDUCTION		0.5	1.3
VOC REMAINING		117.7	79.0
NOX INVENTORY	366.3	129.7	72.5
NOX REDUCTION		3.3	6.1
NOX REMAINING		126.4	66.5
CO INVENTORY	3332.8	1186.1	691.6
CO REDUCTION		10.0	23.6
CO REMAINING		1176.1	668.0

SUMMER PLANNING INVENTORY	2002	2014	2023
VOC INVENTORY	323.2	122.0	83.9
VOC REDUCTION		0.5	1.3
VOC REMAINING		121.5	82.6
NOX INVENTORY	350.1	124.4	69.7
NOX REDUCTION		3.2	5.8
NOX REMAINING		121.2	63.9
CO INVENTORY	3284.0	1164.6	676.7
CO REDUCTION		9.8	23.1
CO REMAINING		1154.8	653.6

CONTROL COST: COST SAVINGS (CAPITAL COSTS FOR OBD III COULD BE OFFSET WITH THE ELIMINATION OF THE COSTS ASSOCIATED WITH SMOG CHECK TESTING)

IMPLEMENTING AGENCY: CARB, BUREAU OF AUTOMOTIVE REPAIR

DESCRIPTION OF SOURCE CATEGORY

The purpose of this control measure is to implement a strategy that will achieve continuous compliance for light- and medium-duty vehicles with in-use emission standards known as smog

check cut-points. This program will be applicable to all light- and medium-duty vehicles subject to the on-board diagnostics (OBD) requirements.

Background

Light- and medium-duty vehicles are major contributors of air pollutants in the South Coast Air Basin. While vehicle miles traveled increased more than 50% over the last 20 years, vehicle emissions have dropped by a factor of almost three due to increasingly stringent vehicle emission standards. Yet, the light and medium duty vehicle fleet continues to contribute more than a third of the Basin's total emissions of ozone and particulate matter forming pollutants in part due to high emitting vehicles. Studies show that the highest emitting 10% of the light duty fleet contribute well over 50% of the fleet's total emissions of ozone and particulate matter forming pollutants emphasizing the need to identify and repair these high emitting vehicles to ensure further emission reductions from the light duty vehicle fleet.

Even though new vehicles sold in California are the cleanest in the world, the millions of cars on the road and the ever increasing miles they travel each day make them our single greatest source of smog forming emissions. While new vehicles in California may start out with very low emissions, improper maintenance or faulty components can cause the vehicle emission levels to sharply increase. Studies estimate that approximately 50% of the total emissions from late-model vehicles are the result of emission-related malfunctions. All 1996 and newer gasoline and alternate fuel passenger cars and trucks are required to have OBD II systems. OBD II is an acronym for On-Board Diagnostics II, the second generation of on board self-diagnostic equipment requirements for California vehicles. On-board diagnostic capabilities are incorporated into the hardware and software of a vehicle's on-board computer to monitor virtually every component that can affect emission performance. If a problem or malfunction is detected, the OBD II system illuminates a warning light on the vehicle instrument panel to alert the driver. This warning light will typically display the phrase "Check Engine" or "Service Engine Soon." The system will also store important information about the detected malfunction so that a repair technician can accurately find and fix the problem.

Regulatory History

On-Board Diagnostics I (OBD I) was California's first OBD regulation which required manufacturers to monitor some of the emission control components on vehicles. Required on all 1991 and newer vehicles, OBD I systems were not as effective as possible because they were limited to monitoring only a few of the emission-related components and they were not calibrated to a specific level of emission performance. OBD II was developed to address these shortcomings and make the system more user-friendly for service technicians.

With several recent studies concluding that a small fraction of the fleet contributes a majority of the emissions for the vehicle source category and that repairs of such vehicles may not be lasting their full biennial two year cycle, this proposed control measure addresses such off-cycle excess emissions and ensure continuous compliance with smog check cutpoints.

PROPOSED METHODS OF CONTROL

The proposed control measure will include regulations requiring that all light- and medium-duty vehicles manufactured after 2012 and previously subject to California OBD requirements be equipped with a telematics device. Such telematics devices, when connected to the vehicle's computer controlled emission system, will notify a central dispatch when an emissions related defect has occurred and subsequently trigger a letter to the owner of the vehicle that a repair of said defect is required within an agreed to period of time.

For existing vehicles manufactured with OBD technology between MY1996 thru MY2012, vehicle owners will be required to install retrofit kits to include such telematics devices. Such kits will be installed by smog check repair shops phase in over time coinciding with their biennial smog test requirements. The cost of the retrofit program could be offset by the cost in subsequent years of not having to pay the cost of a biennial smog check test.

Specifically, this measure proposes that CARB adopt regulations which require that all vehicles manufactured after 2012 be equipped with a telematics device such that when connected to the vehicle's computer controlled emission system, will notify a central dispatch when an emissions related defect has occurred and subsequently trigger a letter to the owner of the vehicle that a repair of said defect is required within an agreed to period of time.

Beginning in MY 1996 and newer vehicles, all vehicles sold in California were equipped with on-board diagnostic capabilities having the ability to monitor virtually every component that can affect emission performance. In essence the on-board diagnosis system of a vehicle monitors the vehicles emissions on a real time basis and theoretically eliminates the need for biennial smog check tests. Consumers will be notified via mail of the noted detected malfunction and be required to fix such malfunction within a stated period.

In addition to the proposed regulatory action, this measure proposes that by 2020, all existing Model Year 1996 to 2012 vehicles equipped with OBD technologies be retrofitted with telematics devices. Specifically, beginning in 2012, Model Year 1996 through 2012 vehicles will be required to be retrofitted with telematics devices at a rate of one million vehicles per year. The vehicles will be randomly selected each year. Such kits will be installed by smog check repair shops upon receipt of their DMV notice requiring the installation of a telematics device at their next biannual smog check test. The cost of such retrofit kits is estimated to be between $100 to $150. Such costs could be offset by forgoing the cost of smog check testing every other year at an estimated cost of $65 per test.

EMISSIONS REDUCTIONS

Implementation of this measure would result in estimated annual average emission reductions of VOC and NOx are 0.5 and 3.3 tons per day by 2014, and 1.3 and 6.1 tons per day by 2023.

COST EFFECTIVENESS

This proposed control measure would result in a cost saving to consumers. Consumers participating in an OBD II program with telematics devices could potentially realize an overall cost savings if the State waived the cost of a biennial smog check test in lieu of the one time

estimated cost between $100 to $150 for a transponder unit to relay malfunction codes of the vehicle's emission control system device to a central dispatch. Overall cost savings of the program could result in additional off cycle emission reduction benefits to the existing smog check program.

IMPLEMENTING AGENCY

The implementing agencies would be the Bureau of Automotive Repair (BAR) under the Department of Consumer Affairs and the California Air Resources Board. BAR will likely have to adopt regulations to incorporate such requirements.

REFERENCES

Department of Consumer Affairs/Bureau of Automotive Repair, Report to the Legislature – April 2004 Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program, September, 2005.

Department of Consumer Affairs/Bureau of Automotive Repair, Technical Support Document for Evaluation of the California Enhanced Vehicle Inspection and Maintenance (Smog Check) Program, June 2004

CARB, Proposed 2003 State and Federal Strategy for California SIP - Section II Mobile Sources, August 25, 2003

Title 13, California Code of Regulations, Section 19685, Enforcement of Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium Duty Vehicles and Engines.

FURTHER EMISSION REDUCTIONS FROM ON-ROAD HEAVY-DUTY VEHICLES [NOX, PM]

SOURCE CATEGORY:	ON-ROAD HEAVY-DUTY DIESEL VEHICLES (14,001 LBS AND GREATER GVWR)		
CONTROL METHODS:	ACCELERATED REPLACEMENT OF EXISTING HEAVY-DUTY VEHICLES WITH VEHICLES MEETING 2010 STANDARDS AND RETROFITTING/REPOWERING EXISTING HEAVY-DUTY VEHICLES TO ACHIEVE LOWER EMISSION LEVELS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	218.9	133.6	70.3
NOX REDUCTION		35.7	8.2
NOX REMAINING		97.9	62.1
PM10 INVENTORY	9.8	5.7	3.0
PM10 REDUCTION		4.0	0.4
PM10 REMAINING		1.7	2.6
PM2.5 INVENTORY	9.0	5.3	2.8
PM2.5 REDUCTION		3.7	0.4
PM2.5 REMAINING		1.6	2.4
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	219.1	134.0	70.8
NOX REDUCTION		35.7	8.2
NOX REMAINING		98.3	62.6
CONTROL COST:	APPROXIMATELY $15,000 PER TON OF POLLUTANT REDUCED		
IMPLEMENTING AGENCY:	CARB AND SCAQMD		

DESCRIPTION OF SOURCE CATEGORY

Background

Emissions from heavy-duty diesel mobile sources continue to represent a significant and increasing portion of the emissions inventory in the South Coast Air Basin, adversely affecting regional air quality. The two primary pollutants resulting from diesel fuel combustion are particulate matter (PM) and oxides of nitrogen (NOx). PM typically constitutes the visible emissions from diesel engine exhaust, and it contains over 40 known cancer-causing substances. In 1998, California identified diesel PM as a toxic air contaminant based on its potential to cause cancer. In March 2000, the SCAQMD issued a report entitled "The Multiple Air Toxic Exposure Study in the South Coast Air Basin." This report concluded that about 70 percent of the carcinogenic risk associated with breathing ambient air can be attributed to diesel particulate emissions. Diesel engines also emit significant quantities of NOx, which is a precursor to ozone and secondary particulate matter formation. Additional control on diesel engine emissions is

essential for attainment of ozone and PM ambient air quality standards, as well as mitigating its toxic air quality impact.

The intent of this control measure is to seek emission reductions from existing heavy-duty vehicles except for port related trucks with gross vehicle weight ratings (GVWR) greater than 14,000 lbs through an accelerated vehicle replacement program with new 2010 and later model–year engines. In addition, for heavy-duty vehicles not replaced with new models, existing vehicle engines would be repowered with commercially available engines meeting 2010 emission standards or modified with retrofit kits to achieve lowest possible emission levels.

Regulatory History

The regulation of emissions from heavy-duty diesel mobile emission sources is the responsibility of CARB and U.S. EPA. Specifically, heavy-duty vehicle engines are subject to specific emission standards pursuant to state and/or federal requirements. Emission standards for new diesel engines powering heavy-duty vehicles were first established for the 1973 model-year and have gradually increased in stringency over time. The most stringent set of heavy-duty engine emission standards has been established by CARB and U.S. EPA for 2010 and subsequent model-years, which includes a 0.2 g/bhp-hr NO_x emission standard. Currently, heavy-duty diesel engine manufacturers (OEMs) are investigating NO_x control technologies to meet this NOx emission limit. For the model-years 2007 to 2009, the OEMs may phase in these technologies to meet a 1.2 g/bhp-hr NO_x emission standard. For PM emissions, all new heavy-duty engines must meet a 0.01 g/bhp-hr exhaust emissions standard beginning with the 2007 model-year. It is anticipated that currently developed diesel particulate trap technology would be used to comply with this PM emission standard.

PROPOSED METHOD OF CONTROL

This control measure seeks additional emission reductions from older, pre-2010 heavy-duty vehicles beyond the emission reductions targeted in CARB's proposed measure for heavy-duty vehicles. CARB's proposed measure for heavy-duty vehicles targets 30 percent of the oldest, pre-2010 heavy-duty vehicles and proposes to reduce excess emissions due to deterioration of emissions control equipment. Additional emission reductions could be achieved if an additional 15 percent of the oldest, pre-2010 heavy-duty vehicles are targeted.

CARB's proposed control measure target of 30 percent of the oldest, pre-2010 heavy-duty vehicles is equivalent to replacing or retrofitting pre-2001 model year heavy-duty vehicles with engines that meet 2010 heavy-duty exhaust emission standards. Targeting an additional 15 percent of the pre-2010 fleet is equivalent to replacing or retrofitting model year 2001 through 2004 with engines meeting 2010 emissions standards. The proposed targeted fleet is one scenario for heavy-duty vehicles. However, during the rule development process specific implementation approaches will be developed and most likely, will cover all pre-2010 vehicles in some manner as the regulation is implemented out to the 2020 timeframe.

Another scenario is proposed for this control measure that could achieve equivalent emission reductions to the additional 15 percent of the targeted pre-2010 heavy-duty vehicles. The scenario contains two elements: an expanded heavy-duty vehicle fleet modernization program and a NO_x and PM control retrofit program for in-use heavy-duty vehicles. This scenario

targets Model Years 2001 through 2009 heavy-duty vehicles that would be retrofitted or replaced at a rate of 15 percent per year, to meet 2010 on-road heavy-duty emissions standards. The two elements are further discussed below.

Expanded Heavy-Duty Fleet Modernization
This element calls for an accelerated modernization of the heavy-duty vehicle fleet through replacement or repower of 2001 to 2006 model-year heavy-duty vehicles with vehicles/engines meeting exhaust emissions standards of 0.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM at a rate of about 7.5 percent per year beginning in 2011. Resources would be directed to the replacement of older "captive" fleets used for short to medium distance hauling.

NOx Control Retrofit Program
This element calls for the retrofitting of 2001 to 2006 model-year heavy-duty vehicles to reduce NOx and PM emissions by at least 30 percent and 85 percent, respectively. In addition, all 2007 to 2009 model-year heavy-duty vehicles would be retrofitted by 2020 to reduce NOx emissions by 30 percent. Retrofitting would occur during the 2012 to 2020 time period at a rate of 7.5 percent per year. It is envisioned that currently verified retrofit technology and reasonable extensions of this technology would be sufficient to achieve the implementation goals of this control measure.

In order to meet the 2010 heavy-duty engine PM and NOx emission standards of 0.01 g/bhp-hr and 0.2 g/bhp-hr, respectively, heavy-duty engine manufacturers are currently investigating a variety of emission control technologies. For PM emission reductions, diesel particulate traps are expected to be employed, since this technology has been commercially available for a number of years and it still appears to be the best choice to reduce PM emissions to the 0.01 g/bhp-hr level for the post 2010 model year timeframe. For NOx emissions control, the use of exhaust gas recirculation, selective catalytic reduction using urea injection (SCR), lean NO_x absorbers, and lean-NO_x catalysts technologies are currently being investigated. Based on input from diesel-engine manufacturers, it appears that urea based SCR technologies will most likely be utilized to meet the 2010 NOx emission standard. As such, an additional issue that would need to be addressed relative to the widespread use of SCR in the heavy-duty truck sector is ammonia slippage emissions. In particular, the challenging nature of controlling on-highway heavy-duty engine NOx emissions using SCR under transient operating conditions could potentially lead to excess urea usage and subsequent ammonia emission generation under certain engine operating conditions. Ammonia emissions are a known precursor to PM formation in the basin as a secondary aerosol component.

EMISSIONS REDUCTION

The implementation of a heavy-duty vehicle emission reductions program that incorporates vehicle replacement, repower, and retrofit strategies can result in significant emission reductions. If the proposed control measure is fully implemented, estimated emission reductions of NOx and PM are 35.7 and 3.7 tons per day by 2014, and 8.2 and 0.4 tons per day by 2023.

RULE COMPLIANCE AND TEST METHODS

CARB, subject to existing agreements with U.S. EPA, has the authority to establish emission standards and certification requirements, and verify compliance with these requirements, for vehicles and engines sold in California. In addition, CARB has the authority to establish requirements for the verification of retrofit kits that would be used to modify heavy-duty diesel engines. Compliance with requirements of an incentive program(s) used to offset the costs of new heavy-duty vehicles, engines, or retrofit kits could be jointly or separately administered by SCAQMD or CARB.

COST EFFECTIVENESS

This proposed control measure will affect heavy-duty engine manufacturers, heavy-duty diesel truck owners, and heavy-duty diesel fleet operators. Costs of replacement engines vary depending on the specific model and vehicle application, and an evaluation would need to be conducted to determine the specific types of trucks and engine models that would be primarily affected by this control measure, as well as prioritizing vehicle applications on a cost-effectiveness basis for engine or vehicle replacement. Installation of the retrofit kit, both purchase price and labor, will cost an estimated $20,000 per truck. In addition, there will be an increase in operating costs due to either (1) a small increase in fuel consumption, or (2) a nominal cost for urea if SCR retrofits are used. These costs will need to be borne by the truck owners and operators. The cost effectiveness of this control measure is estimated to be approximately $15,000 per ton of pollutant reduced.

IMPLEMENTING AGENCY

CARB would implement those portions of this control measure regarding the approval of new heavy-duty engines and heavy-duty engine retrofit kits. In addition, CARB, SCAQMD or U.S. EPA could jointly or separately implement incentive programs that would help offset the costs associated with new truck purchase, engine repower, and/or retrofit kit installation. In particular, there is a need to incentivize emission reductions from interstate trucks registered outside of California.

REFERENCES

CARB, Staff Report for Public Hearing to Consider Amendments Adopting More Stringent Emission Standards for 2007 and Subsequent Model Year New Heavy-Duty Diesel Engines, September 7, 2001.

CARB, Summary of Adverse of Impacts of Diesel Particulate Matter, July 2005.

SCAQMD, Multiple Air Toxics Exposure Study in the South Coast Air Basin, March 2000.

CARB, Staff Report for Public Hearing to Consider Amendments Adopting More Stringent Emission Standards for 2007 and Subsequent Model Year New Heavy-Duty Diesel Engines, September 7, 2001.

FURTHER EMISSIONS REDUCTIONS FROM HEAVY-DUTY TRUCKS PROVIDING FREIGHT DRAYAGE SERVICES [NOx, PM]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	HEAVY-DUTY VEHICLES (33,000 AND GREATER GVWR)		
CONTROL METHODS:	ACCELERATED TRUCK REPLACEMENT PROGRAM WITH TRUCKS MEETING 2007 AND 2010 EXHAUST EMISSIONS STANDARDS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	28.1	19.4	10.6
NOX REDUCTION		11.4	0.0
NOX REMAINING		8.0	10.6
PM10 INVENTORY	1.6	0.89	0.42
PM10 REDUCTION		0.03	0.0
PM10 REMAINING		0.86	0.42
PM2.5 INVENTORY	1.4	0.82	0.38
PM2.5 REDUCTION		0.03	0.00
PM2.5 REMAINING		0.79	0.38
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	28.1	19.5	10.7
NOX REDUCTION		11.5	0.0
NOX REMAINING		8.0	10.7
CONTROL COST:	APPROXIMATELY $19,200 PER TON OF POLLUTANT REDUCED		
IMPLEMENTING AGENCY:	CARB, MARINE PORTS, SCAQMD		

DESCRIPTION OF SOURCE CATEGORY

Background

On-road heavy-duty diesel vehicle (truck) travel is an integral part of port operations moving containers from the port into the SoCAB and beyond. Almost all of these trucks are rated with a gross vehicle weight (GVW) greater than 33,000 pounds. It is not known exactly how many unique trucks service both Ports. During the development of the San Pedro Bay Clean Air Action Plan, baseline emissions inventory for both the Port of Los Angeles (2001 baseline) and the Port of Long Beach (2002 baseline), approximately 7,200 license plates of trucks visiting the Ports were analyzed which determined that the average age of the port specific fleet was 12.9 years (MY 1990) compared to the 2001 statewide fleet age of 12.2 years (MY 1991) in the state of California's emissions inventory model EMFAC2002. From the baseline emissions inventory data set, it was found that MY 1958 to 2002 trucks serviced the ports.

Regulatory History

The regulation of emissions from heavy-duty diesel mobile sources is the primary responsibility of CARB and U.S. EPA. Specifically, heavy-duty truck engines are subject to specific emission standards pursuant to state and/or federal requirements. The standards, primarily affecting new units, vary in stringency and compliance dates. Currently, heavy-duty diesel engine manufacturers (OEMs) are developing NO_x control technologies to meet a 0.2 g/bhp-hr NO_x exhaust emissions standard. For the model years 2007 to 2010, the OEMs may phase in this technology to meet NO_x emission standards and requirements. Beginning in 2007, all new heavy-duty engines must meet a 0.01 g/bhp-hr PM exhaust emissions standard.

Currently, both Ports are in the midst of updating their emissions inventory (EI) of port-related sources for 2005. As a part of this EI update, extensive truck visit/license plate information has been collected from seven terminals (three from POLA and four from POLB). To date, over one million (1,003,024) optical character recognition (OCR) truck visit data records have been received from the seven terminals and represent a time range of 45 to 208 days of records. From this preliminary data set, there were 35,291 unique California registered trucks identified which had an average model year age of 1994. The trucks range in age from 1941 to 2006. Efforts are still under way to try to fill in data for the remaining container terminals and estimate the entire 2005 record of truck calls for both Ports. For now however, this data represents the best data set available to analyze the trucks servicing the San Pedro Bay Ports.

In November 2006, the Ports of Los Angeles and Long Beach adopted the San Pedro Bay Ports Clean Air Action Plan (CAAP). One of the measures provided in the CAAP calls for the modernization of all on-road heavy-duty trucks providing drayage services at the Ports by the end of 2011. CARB is currently developing a statewide port truck regulation that calls for existing trucks to be retrofitted or replaced with newer trucks by 2014.

PROPOSED METHOD OF CONTROL

This control measure proposes to implement the heavy-duty truck measure provided in the San Pedro Bay Ports Clean Air Action Plan. To mitigate the costs impacts of this control measure, the Ports and AQMD would commit over $200 million over the next five years with a total investment from all funding sources of more than $1.8 billion. These strategies are further discussed below.

Port Truck Modernization

This strategy proposes the replacement/repower of older heavy-duty diesel trucks with alternative fuel trucks and clean diesel trucks. By 2012, half of all pre-1993 model-year heavy-duty trucks would be replaced with heavy-duty trucks powered by diesel engines meeting 2007 emission standards and the remaining half powered by alternative-fueled engines meeting 2010 emission standards. For 1993 through 2006 model-year trucks, 21 percent would be replaced with heavy-duty trucks powered by diesel engines meeting 2007 emission standards and an additional 21 percent would be replaced by heavy-duty trucks powered by alternative-fueled engines meeting 2010 emission standards. By 2012, 50 percent of pre-2007 model-year heavy-duty trucks would be powered by diesel engines meeting 2007 emission standards and the remaining 50 percent powered by alternative-fueled engines meeting 2010 emission standards.

NOx Retrofit Control Program

The strategy proposes to achieve specific penetration targets for the use of current diesel retrofit technologies on existing heavy-duty trucks servicing the Ports. By 2012, the targets consist of retrofitting 58 percent of 1993 to 2003 model-year heavy-duty trucks for 85 percent and 30 percent PM and NOx reductions, respectively. In addition, the 1993 to 1998 model-year heavy-duty trucks affected by this strategy would undergo chip reflash for additional emission reductions.

EMISSIONS REDUCTION

The accelerated deployment of newer-lower-emitting heavy-duty trucks powered by diesel fuel and alternative fuels, in combination with the implementation of a retrofit/repowered program can result in significant emission reductions. If the proposed control measure is fully implemented, estimated emission reductions of NOx and PM are 11.4 and 0.03 tons per day by 2014. The proposed control measure focuses on existing trucks servicing the ports. As such, there are no additional reductions beyond 2014. CARB has accounted for 2 tons per day of NOx emissions reductions from their proposed control strategy for port trucks. The emissions reductions associated with this control measure and CARB's targeted NOx emission reductions represent a total 10 tons per day of NOx reductions by 2014.

RULE COMPLIANCE AND TEST METHODS

The existing CARB certification and verification programs would administer those portions of the control measure that would require CARB approval of engine models and retrofit kits, respectively. It is anticipated that existing certification and verification test procedures would be used to generate and document emission levels. Compliance with requirements of an incentive program(s) used to offset the costs of new heavy-duty vehicles, engines, or retrofit kits could be jointly or separately administered by SCAQMD, CARB, or the Ports.

COST EFFECTIVENESS

The cost and cost-effectiveness of this measure is estimated to be approximately $19,200 per ton of pollutant reduced. The current state Carl Moyer fleet modernization program provides up to 80 percent of the cost of the replacement vehicle. Additionally, affected operators may access the historical Carl Moyer program, which provides for a $14,300/ton funding assistance.

IMPLEMENTING AGENCY

CARB, Marine Ports, SCAQMD

REFERENCES

CARB. Emissions Reduction Plan for Ports and Goods Movement in California (April 2006)

Final San Pedro Bay Ports Clean Air Action Plan (November 2006).

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GROUP 2

OFF-ROAD MOBILE SOURCES

CONSTRUCTION/INDUSTRIAL FLEET MODERNIZATION [VOC, NOx]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	OFF-ROAD CONSTRUCTION, INDUSTRIAL ENGINES AND TRANSPORTATION REFRIGERATION UNTIS		
CONTROL METHODS:	ESTABLISH MORE STRINGENT FLEET AVERAGE REQUIREMENTS TO REPLACE OR RETROFIT OLDER ENGINES WITH NEW, CLEANER ENGINES		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
VOC INVENTORY	23.5	13.4	8.2
VOC REDUCTION		3.6	1.7
VOC REMAINING		9.8	6.5
NOX INVENTORY	158.9	97.3	47.2
NOX REDUCTION		18.5	22.2
NOX REMAINING		78.8	25.0
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
VOC INVENTORY	23.3	13.3	8.1
VOC REDUCTION		3.6	1.7
VOC REMAINING		9.7	6.4
NOX INVENTORY	157.5	96.4	46.8
NOX REDUCTION		18.3	22.0
NOX REMAINING		78.1	24.8
CONTROL COST:	APPROXIMATELY $2 BILLION THROUGH 2023 WITH A COST EFFECTIVENESS RANGING BETWEEN $13,000 TO $15,000 PER TON OF NOX + VOC CONTROLLED		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

The purpose of this control measure is to promote faster turn-over of older in-use construction and industrial diesel engines.

Background

Off-road heavy-duty construction and industrial equipment account for 19% and 6.9% of the total NO_x and PM emissions, respectively, in 2014. However, these equipment emissions are projected to steadily increase over other mobile sources. At least 60% of today's heavy-duty construction equipment fleets were manufactured before 1988, with higher levels of emissions than later models. Through its Diesel Risk Reduction Plan CARB is focusing on off-road fleet rules reducing primarily PM and secondarily NOx emissions through retrofits controls, engine

repowers, and equipment replacement. While CARB expects to see close to 90% reduction of PM by 2020, NOx reductions will be substantially less – approximately 20%.

Regulatory History

The Federal Clean Air Act prohibits states from setting emission standards for new engines used in construction and farming equipment less than 175 horsepower. Diesel engines greater than 175 horsepower are regulated by CARB. In September 1996, CARB, U.S. EPA, and the diesel engine manufacturers signed a statement of principles, which called for a cooperative effort to reduce NO_x, VOC, and PM emissions by more than 60%. In August 1998, U.S. EPA adopted new emission standards pertaining to off-road diesel engines. Subsequently, in January 2000 and in December 2004, CARB adopted amendments to existing California emission standards to harmonize with the federal requirement. These amendments included a tiered approach starting from 1996 for Tier 1 to 2011-2014 for Tier 4.

CARB is in the process of developing an Off-Road Equipment In-Use Rule which is expected to be adopted early 2007, which will reduce PM emissions by close to 90% and NOx by close to 20% through retrofit controls, engine repowers, and equipment replacement. CARB has proposed that off-road equipment fleets meet a declining fleet average emissions level or alternatively turnover 10 percent of the existing fleet to new Tier 3 models.

PROPOSED METHOD OF CONTROL

New off-road diesel engines are required to meet Tier 2 or Tier 3 emission standards ranging between 6.0 and 2.6 g/bhp-hr NO_x and 0.6 and 0.15 g/bhp-hr PM. To comply with these standards, newer off-road diesel engines are equipped with modern and better technologies resulting in 72 % less NO_x or PM than the pre-1988 engines, and will potentially emit 85% less NO_x in 2007. While substantially improved over the pre-Tier 0 and Tier 0 emission rates the new off-road standards remain significantly higher than the same model year on-road engines. On-road engine standards for the year 2010 will meet emission levels 10 to 100 times cleaner than the oldest off-road engines resulting in 90 to 99% control of emissions.

This measure calls for more stringent NOx fleet average requirements beginning in the 2014 time frame than that proposed by CARB. Essentially, this measure proposes that CARB proposed NOx fleet average for 2018, be moved up to 2014. This would have an effect of accelerating fleet turnover and engine re-powering to ensure that most pre-Tier 2 engines are replaced by Tier 3 engines or better (including engines meeting on-road standards for categories where it is feasible). Reductions expected would be equivalent to those that would be achieved by replacing pre-Tier 2 engines with Tier 3 engines or better (assume 25% of the engines can meet 2010 on-road emission standards and 75% will meet Tier 3 standards) by 2014. 2020 emission reductions are estimated as equivalent to what would be achieved by replacing Tier 2 engines with Tier 4 engines or better and retrofitting Tier 3 engines with NOx and PM controls that achieve at least 80% and 85% respectively (reductions are determined by assuming 50% of the engines meet the 2010 on-road engine emission levels, and 50% meet the Tier 4 engine emission levels). Currently there are CARB verified control technologies that achieve 80% NOx control and 85% PM control on some off-road engines and it is expected that the technology will improve to include many of the off-road diesel engine categories. In addition, some off-road equipment are operating with diesel engines that meet on-road exhaust emission

standards (e.g., yard hostlers). Many other off-road equipment categories may operate in a manner where the use of engines or retrofits meeting on-road standards is feasible, and as engine technology improves more off-road engines will meet the on-road emission standards.

EMISSIONS REDUCTION

Emission reductions beyond those anticipated from the proposed CARB In-use Off-road Diesel Vehicles regulation are estimated to be 18.5 tons/day (tpd) for NO_x, and 3.6 tpd for VOC in 2014, and 22.2 tpd for NOx and 1.7 tpd for VOC in 2023.

COST EFFECTIVENESS

The cost associated with this control measure is expected to be approximately $750 million by 2014. This is based on estimated costs for repowering all Tier 1 equipment to Tier 3 or better by 2014 and represents the high end of the range. It is expected that retrofit technology will play an important role at a much lower cost when the technology becomes verified in the near future. In 2020, the costs are expected to be approximately $1.3 billion and are estimated based on repowering all Tier 2 engines to Tier 4 or better and retrofitting all Tier 3 engines. These costs correspond to a cost effectiveness of approximately $13,000 to $15,000 per ton of NOx and VOC controlled. To offset the cost of this control measure, a financial support program, similar to the Carl Moyer Program, may be necessary.

IMPLEMENTING AGENCY AND ISSUES

CARB has the authority to require retrofit or replacement of in-use off-road engines. In addition, this control measure could be implemented through incentive programs.

REFERENCES

1. CARB Presentation: Diesel Off-Road Equipment Rule Working Group Meeting: New Regulatory Concepts and Inventory Updates, July 21, 2006.
2. CARB, Proposed Regulation for, 12/4/2006 draft

FURTHER EMISSION REDUCTIONS FROM CARGO HANDLING EQUIPMENT [ALL POLLUTANTS]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	OFF-ROAD EQUIPMENT OPERATING USED TO MOVE FREIGHT CONTAINERS		
CONTROL METHODS:	ACCELERATED REPLACEMENT/RETROFIT PROGRAM		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	4.6	3.6	1.8
NOX REDUCTION		1.1	0.5
NOX REMAINING		2.5	1.3
PM10 INVENTORY	0.2	0.10	0.10
PM10 REDUCTION		0.03	0.03
PM10 REMAINING		0.07	0.07
PM2.5 INVENTORY	0.2	0.10	0.10
PM2.5 REDUCTION		0.03	0.03
PM2.5 REMAINING		0.07	0.07
SUMMER PLANNING INVENTORY			
NOX INVENTORY	4.6	3.6	1.8
NOX REDUCTION		1.1	0.5
NOX REMAINING		2.5	1.3
CONTROL COST:	TBD		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

Background

Emissions from goods movement related mobile sources (e.g., ships, trains, trucks, and off-road equipment) continue to represent a significant and increasing portion of the emissions inventory in the South Coast Air Basin, adversely affecting not only the local port area, but also the regional air quality of the Basin. The purpose of this control measure is to implement programs to further reduce emissions from cargo handling equipment operated at marine ports, intermodal freight facilities, and warehouse distribution centers.

Regulatory History

The U.S. EPA's and CARB's Tier 1, Tier 2, Tier 3, and Tier 4 emissions standards for non-road diesel engines require compliance with progressively more stringent standards for hydrocarbon, CO, NOx, and PM. Tier 4 standards for non-road diesel powered equipment complement the

latest 2007 and later on-road heavy-duty engine standards requiring 90 percent reduction in NOx and PM when compared against the current level. To meet these standards, engine manufacturers will produce new engines with advanced emissions control technologies similar to those already expected for on-road heavy-duty diesel vehicles. These standards for new engines will be phased in starting with smaller engines in 2008 until all but the very largest diesel engine meet NOx and PM standards in 2015.

In December 2005, CARB adopted a regulation to reduce emissions from CHE such as yard tractors and forklifts starting in 2007. The regulation calls for the replacement or retrofit of existing engines with engines that use Best Available Control Technology (BACT). Beginning January 1, 2007 the regulation will require that newly purchased, leased, or rented CHE be equipped with either a 2007 or later on-road engine, a Tier 4 off-road engine or the cleanest verified diesel PM emissions control system which reduces PM by 90% and NOx by at least 70% for yard tractors. For non-yard tractors cargo handling equipment currently verified technologies reduce PM by 85%.

In November 2006, the Ports of Los Angeles and Long Beach adopted the San Pedro Bay Ports Clean Air Action Plan (CAAP). One of the measures provided in the CAAP calls for terminal operators to use cargo handling equipment with the cleanest engines meeting 2007 on-road heavy-duty engine emission standards or Tier 4 off-road engine standards.

PROPOSED METHOD OF CONTROL

This measure calls for CARB to amend its current regulations on cargo handling equipment to include those categories of equipment not currently covered under the existing regulation but are identified in the San Pedro Bay Ports Clean Air Action Plan, primarily non-yard tractors. The San Pedro Bay Ports Clean Air Action Plan (CAAP) includes a strategy which accelerates the implementation of CARB's rule requirements through lease requirements or other mechanisms. The CAAP measure provides an additional 15% NOx and 19% PM reductions by 2011 beyond CARB's regulation based on the replacement of existing cargo handling equipment with equipment meeting Tier IV off-road or 2007 on-road engine standards (for port tenants with lease openings by 2011). This measure incorporates the reductions associated with this strategy and projects these reductions to be about 30% by 2014 based on the continuation of this strategy beyond 2011.

This measure would require replacement of existing cargo handling equipment with the cleanest engines or implementation of commercially available NO_x and PM retrofit technologies—diesel oxidation catalyst, emulsified diesel fuel, and combination of NO_x reduction catalysts with particulate traps—for cargo handling equipment. A variety of commercially available NO_x emission control technologies can reduce emissions from passenger cars, light-duty trucks, and medium-duty vehicles to very low levels, and yield significant emission reductions from buses, trucks, and heavy-duty highway vehicles. The same retrofit technologies and cleaner alternative diesel fuels have been verified by CARB, and are increasingly being used to reduce NO_x and PM emissions from in-use off-road heavy-duty diesel equipment. These technologies are capable of reducing NO_x emissions by at least 25%, and include diesel oxidation catalysts, combination of NO_x reduction catalyst with particulate traps, and emulsified diesel fuels. Recent technological advancements in flywheel design have been demonstrated on a rubber tire

gantry crane that resulted in about a 30 percent reduction in NOx emissions. In addition, electrification is a feasible control option for a variety of these types of equipment. Implementation of this measure would require the replacement or retrofit of cargo handling equipment, particularly non-yard tractors.

EMISSIONS REDUCTION

The estimated emission reductions shown in the table at the beginning of this section reflect the reductions achieved through the implementation of this measure only for non-yard tractors (i.e., 30 percent reduction in NOx and particulate matter emissions by 2014). Additional emission reductions would occur with an accelerated replacement of existing yard tractors with the cleanest on-road engines, beyond the requirements of the existing state regulation.

COST EFFECTIVENESS

The cost and cost effectiveness will vary depending on the type of control technologies implemented. The cost-effectiveness has not been estimated at this time.

IMPLEMENTING AGENCY

CARB has the authority to adopt regulations for this category of equipment. In addition, the marine ports through their leasing authority will require terminal operators to acquire the cleanest cargo handling equipment.

REFERENCES

CARB. Emissions Reduction Plan for Ports and Goods Movement in California (April 2006)

Final San Pedro Bay Ports Clean Air Action Plan (November 2006).

FURTHER EMISSION REDUCTIONS FROM LOCOMOTIVES [NOX, PM]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	LOCOMOTIVE ENGINES (ALL CLASSES)		
CONTROL METHODS:	ACCELERATED REPLACEMENT OF EXISTING LOCOMOTIVE ENGINES MEETING TIER 3 OR CLEANER EXHAUST STANDARDS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	33.8	18.3	22.6
NOX REDUCTION		14.3	10.5
NOX REMAINING		4.0	12.1
PM10 INVENTORY	0.8	0.8	0.8
PM10 REDUCTION		0.6	0.4
PM10 REMAINING		0.2	0.4
PM2.5 INVENTORY	0.8	0.7	0.8
PM2.5 REDUCTION		0.6	0.4
PM2.5 REMAINING		0.1	0.4
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	33.8	18.3	22.6
NOX REDUCTION		14.3	10.5
NOX REMAINING		4.0	12.1
CONTROL COST:	THE COST-EFFECTIVENESS OF THIS CONTROL MEASURE WILL VARY DEPENDING ON THE TYPE OF CONTROL EQUIPMENT. THE AVERAGE COST-EFFECTIVENESS IS ESTIMATED TO BE AROUND $5,100/TON.		
IMPLEMENTING AGENCY:	U.S. EPA		

DESCRIPTION OF SOURCE CATEGORY

Background

Diesel-electric locomotives have a large diesel engine (main traction engine) for generating electric power which in turn drives electric motors in each axle. Modern line-haul or freight locomotives have 4400-horsepower diesel engines with six drive axles. Passenger locomotives have similar engines with about 3800 horsepower and four drive axles. Switch locomotives are smaller, and usually older, four-axle locomotives, with 1200-2500 horsepower engines. EPA emission standards affect 1973-2001 locomotives upon engine rebuild and new 2002 and later locomotives. Locomotives remain in commercial service from 25 to 40 years.

Regulatory History

In December 1997, the U.S. EPA published emission standards for diesel locomotives. These standards included Tier-0 standards for 1973-2001 uncontrolled locomotives upon rebuilding of their diesel engines; more stringent Tier-1 standards for new 2002-2004 locomotives; and modestly stringent Tier-2 standards for 2005 and newer locomotives. However, these standards did not match the stringency of adopted emission standards for on-road diesel engines. As a result, in June 2004, the U.S. EPA announced it intended to adopt more stringent Tier-3 standards for new diesel locomotives, possibly starting with 2011 models. The U.S. EPA indicated that the new locomotive standards would consider emission control technologies proposed for heavy-duty on-road diesel vehicles, including selective catalytic reduction (SCR), diesel particulate filters (DPFs), and lean-NOx absorber technology.

Beside the federal emission requirements for locomotives, CARB has signed two agreements with the two Class-1 railroads operating in California, Burlington Northern Santa Fe Railway (BNSF) and Union Pacific Railroad (UP). The first agreement, the South Coast Memorandum of Understanding (MOU), was signed in 1998. Among other features, it commits these railroads to meeting Tier-2 NOx standards, on average, starting in 2010 with their locomotives operating in the South Coast Air Basin. The second CARB agreement, the Rail Yard Agreement, was published in 2005. It calls upon these railroads to reduce diesel emissions in and around rail yards in California including a statewide locomotive idling limitation program, increase use of low-sulfur diesel for locomotives fueled in California, and a visible-emissions detection and repair program. The District has also adopted a rule which requires the railroads to reduce unnecessary idling, but the rule is currently in litigation.

In April 2006, CARB adopted the Emission Reduction Plan for Ports and Goods Movement in California (GMERP). This plan proposes several control measures including a call for U.S. EPA to adopt Tier-3 locomotive emission standards which would reduce Tier-2 NOx and PM by 90 percent starting with 2011 locomotives. California fleet penetration of Tier-3 locomotives is projected for 40 percent in 2015 and 90 percent in 2020. Another measure includes remanufacturing Tier-2 locomotives to Tier-2.5 standards with a 25-percent NOx reduction and 60-percent PM reduction over Tier-2 standards. Finally, one measure proposes the replacement of all switch locomotives in California by hybrids by 2010.

In November 2006, the Ports of Los Angeles and Long Beach adopted the San Pedro Bay Ports Clean Air Action Plan. One of the measures in the Plan calls for switchers operating at the ports to be 90 percent cleaner than current Tier-2 standards by 2011. In addition, line-haul locomotives entering the ports must be Tier-3 equivalent by 2014.

U.S. EPA has adopted a series of non-road-engine emission standards beginning with Tier-1 standards with 1996 engines and culminating with Tier-4 standards beginning in 2014. These standards also vary by maximum power rating of these essentially portable engines. Compliance with Tier-4 interim standards is required starting in 2011 and will necessitate the use of DPFs. Full Tier-4 standards start in 2014 and will require the use of both DPF's and NOx after-treatment, most likely SCR. Non-propulsion engines used on locomotives are required to be emission-controlled non-road engines.

PROPOSED METHOD OF CONTROL

The GMERP proposes a 40-percent penetration of Tier-3 locomotives in California by 2015. This measure proposes that all locomotives operating in the Basin by 2014 have Tier-3-equivalent emissions, either new Tier-3 locomotives or older Tier-2 locomotives retrofitted with aftertreatment systems to reduce NOx and PM by 90 percent. The proposal is consistent with the San Pedro Bay Ports Clean Air Action Plan. In addition, the region has been discussing the potential for building near-zero or zero-emission advanced transportation systems such as maglev or linear induction systems. These systems would offset a large portion of the locomotive activity in the Basin and would represent an alternative means of achieving the emission reductions associated with this measure.

CONTROL TECHNOLOGY AVAILABILITY

Three technologies are currently available for controlling locomotive diesel engines: SCR, DPFs and DOCs.

SCR has been used for many years on large stationary engines for NOx control. Locomotives are propelled by engines similar to such stationary engines. By increasing the ruggedness and durability of the current SCR systems, NOx emissions can be reduced by at least 85 percent. In addition, SCR reduces PM by about 50 percent in a locomotive environment. Besides the special catalytic converter, these systems inject ammonia into the exhaust stream to enable the SCR catalyst to reduce NOx to nitrogen and water. For mobile applications, urea solution, which breaks down to form ammonia in the exhaust, is used because it is safer than ammonia in terms of maintenance and accident scenarios.

DPFs have been introduced in recent years on heavy-duty on-road trucks and buses for PM control and will be used on all 2007 model heavy-duty engines. Also, retrofit DPFs have been verified by CARB for 1994 and newer diesel engines up to 500 horsepower. DPFs generally reduce PM by at least 85 percent. Hug Engineering of Switzerland has recently developed and introduced a DPF system for switch locomotives with four-cycle engines. The American Association of Railroads (AAR) is also demonstrating these DPFs on switch locomotives with EMD two-cycle engines. Switch locomotives spend much time idling and generally have cooler diesel exhaust which does not self-initiate regeneration of the collected soot. As such, DPF systems on switch locomotives use a fuel-fired burner to assist in regeneration of collected PM. However, line-haul locomotives frequently have high exhaust temperatures which can facilitate such regeneration without burners.

Combination SCR-DPF systems are being developed and verified for on-road trucks and are expected to become commercially available within the next one to two years. Such systems would be compatible with the smaller diesel engines of hybrid switch locomotives. A minimum control efficiency of 85 percent is expected for both NOx and PM.

In recent years, DOCs have been introduced on certain heavy-duty on-road diesel engines. These DOCs oxidize a portion of the PM in the exhaust stream, usually by at least 30 percent. Recently, EPA has demonstrated retrofit DOCs on a line-haul locomotive. Such DOCs require that higher exhaust temperatures be achieved in order to burn-off collected soot from idling. DOCs, without burners or other technology, are not appropriate for switch locomotives due to low exhaust temperatures and extended idling.

CONTROL TECHNOLOGY APPLICABILITY

Tier-3 Locomotive Penetration

CARB is proposing in the GMERP a 40-percent penetration rate of Tier-3 locomotives in California in 2015. CARB's proposal could be enhanced through the retrofitting of Tier-2 locomotives with DPF and SCR technology to bring them to Tier-3 emission levels. Essentially by 2010, all locomotives being operated by BNSF and UP in the Basin will be Tier-2 due to the 1998 MOU. DPF technology is now being investigated by the US locomotive manufacturers, has been used on locomotives in Europe, and is being demonstrated on switch locomotives here in the U.S. This technology on a full-size locomotive has not been publicly demonstrated in the U.S., but such commercial DPF systems do exist in Europe. With regard to SCR systems, such a system demonstration on a full-size Metrolink locomotive will be conducted in 2007.

Hybrid Switch Locomotives with Tier-4 Controls

Hybrid-electric and multi-engine hybrid locomotives use smaller diesel engines to provide either battery or traction power. As such, these engines run at nearly full power and have high-temperature exhaust. Such operation is compatible with SCR and DPF systems. There are truck-engine-sized SCR and DPF combinations in the process of being verified by CARB, and these are expected to become commercially available in the next one to two years. Such after-treatment systems would be applicable to these locomotives and will provide maximum NOx and PM control.

The replacement of conventional switch locomotives with hybrid switchers results in the use of EPA non-road engines to generate electric power. Depending upon the rated horsepower this will result in a mix of Tier-2, Tier-3, and Tier-4 Interim standard engines on these hybrid locomotives by 2014. All such engines should be retrofitted with after-treatment DPF and SCR systems to bring them in compliance with Tier-4 non-road engine emissions. Such retrofit systems are in the process of being verified by CARB for on-road truck engines similar in power and will facilitate lowering these non-road engines to Tier-4 emission levels.

EMISSIONS REDUCTION

Full implementation of the proposed control measure would result in a 14.3 tons/day reduction in NOx and 0.6 tons/day reduction in particulate matter emissions by 2014. Further reductions are achieved by 2023 with greater penetration of retrofits as described above. Other actions such as advanced cargo transportation systems that have near-zero to zero-emissions may provide emission reduction equivalency to this measure.

COST EFFECTIVENESS

It is estimated that the additional cost for SCR and a DPF on new line-haul locomotives would cost about $200,000 to install. The annualized cost for such a unit would be approximately $42,000. This includes a 10 year housing life, a 5 year DPF and SCR element life and $8,000 per year for urea. The estimated cost to equip existing smaller switcher locomotives with diesel oxidation catalyst devices is about $50,000. The estimated cost to equip existing locomotives with a DPF is about $150,000 per locomotive.

IMPLEMENTING AGENCY

U.S. EPA has the legal authority to adopt emission standards for locomotives. In addition, the Ports of Los Angeles and Long Beach have authority as landlords to impose certain conditions on leases and other contractual arrangements, potentially including port-wide conditions.

REFERENCES

CARB. Emissions Reduction Plan for Ports and Goods Movement in California (April 2006)

Miratech, Inc., Personal Communications. (August 2006)

Final San Pedro Bay Ports Clean Air Action Plan (November 2006).

EMISSION REDUCTIONS FROM AIRPORT GROUND SUPPORT EQUIPMENT [VOC, NOx, PM]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	AIRPORT GROUND SUPPORT EQUIPMENT		
CONTROL METHODS:	REQUIRE ADDITIONAL FLEET ZEV MANDATES AND STRICTER FLEET AVERAGE EMISSION STANDARDS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
VOC INVENTORY	1.0	0.5	0.4
VOC REDUCTION		0.3	0.3
VOC REMAINING		0.2	0.1
NOX INVENTORY	2.8	1.2	2.1
NOX REDUCTION		0.8	1.6
NOX REMAINING		0.4	0.5
PM10 INVENTORY	>0.1	>0.1	>0.1
PM10 REDUCTION		>0.1	>0.1
PM10 REMAINING		>0.1	>0.1
$PM_{2.5}$ INVENTORY	>0.1	>0.1	>0.1
$PM_{2.5}$ REDUCTION		>0.1	>0.1
$PM_{2.5}$ REMAINING		>0.1	>0.1
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
VOC INVENTORY	0.9	0.5	0.4
VOC REDUCTION		0.3	0.3
VOC REMAINING		0.2	0.1
NOX INVENTORY	2.6	1.1	0.9
NOX REDUCTION		0.7	0.6
NOX REMAINING		0.4	0.3
CONTROL COST:	$1,200 PER TON		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

Require additional electrification of airport ground support equipment (GSE) through fleet zero emission requirements and lower VOC + NOx fleet average emissions limits applicable to spark-ignited equipment.

Background

GSE perform a variety of functions at airports including, but not limited to starting aircraft, transporting fuel and cargo, loading cargo, transporting passengers, baggage handling, etc. The types of equipment include, but are not limited to: air starts, air conditioners, belt loaders, fuel trucks, service trucks, and aircraft tow tractors. GSE is critical to the efficient functioning of airports. A study indicates that there were an estimated 2,065 GSE in the Basin in 1995. According to CARB's estimate, there are 3,600 GSE in various categories in the South Coast Air Basin.

Regulatory History

In November 2002, CARB and the airlines executed a memorandum of understanding (MOU) to implement programs and cleaner technologies to reduce emissions from GSE. The MOU includes 17 airlines at Los Angeles International Airport, Burbank Glendale Pasadena Airport, Ontario Airport, Long Beach Airport, and John Wayne Airport. The MOU includes the electrification of existing and new GSE by using zero emission vehicles (ZEV) by 2010. Specifically, the MOU established a 30% and 45% ZEV target for existing and new GSE fleet, respectively, and a fleet average emission rate for VOC and NOx combined. The MOU is voluntary in nature since it does not assure emission reductions by 2010 without a backstop measure. However, as of this date, the MOU is no longer in effect since the airline industry walked away from the agreement. In 2006, CARB adopted a regulation for large spark-ignited (LSI) equipment including ground support equipment which required GSE to meet a 30% ZEV target and fleet average emission rate (2.6 g/bhp-hr VOC and NOx).

PROPOSED METHOD OF CONTROL

In 2014 and 2020, consistent with the original MOU requirement, an additional 15% of GSE in the South Coast Air Basin could be electrified by charging on-board battery packs using grid power and some categories of GSE can potentially be powered using electrical hookups to grid power. Combined with the LSI regulation, this requirement will achieve the MOU's overall 45% ZEV target. In addition, since the LSI fleet-wide average for GSE is less stringent than the one required for other LSI categories (e.g., forklifts), this measure proposes that emissions from the remaining GSE fleet can be reduced by lowering the combined VOC + NOx emissions to 1.0 g/bhp-hr (2006 LSI VOC + NOx emission limit is 2.6 g/bhp-hr).

EMISSIONS REDUCTION

Implementation of this measure will result in about 0.8 and 0.3 tons per day of NOx and VOC reductions from aircraft ground support equipment in 2014.

COST EFFECTIVENESS

The cost-effectiveness is estimated to be around $1,200 per ton based on the categories of ground service equipment to be electrified.

IMPLEMENTING AGENCY

This proposed strategy can be implemented by CARB.

REFERENCES

November 2002 CARB South Coast Ground Support Service Equipment Memorandum of Understanding.

FURTHER EMISSION REDUCTIONS FROM TRANSPORT REFRIGERATION UNITS [NOX]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	TRANSPORT REFRIGERATION UNITS		
CONTROL METHODS:	PROMULGATE MORE STINGENT EXHAUST AND OPERATIONS STANDARDS, AND ACCELERATE FLEET TURNOVER		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	7.2	9.3	10.1
NOX REDUCTION		1.1	5.3
NOX REMAINING		8.2	4.8
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	7.1	9.2	10.0
NOX REDUCTION		1.1	5.3
NOX REMAINING		8.1	4.7
CONTROL COST:	APPROXIMATELY $10,000 PER TON		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

The purpose of this control measure is to reduce NOx emissions through retrofits and electrification.

Background

A transport refrigeration unit (TRU) is a small diesel engine (7-36 hp) powered unit where either the engine powers the refrigeration unit directly or powers a generator that in turn supplies electrical power to the refrigeration unit. There will be approximately 25,000 TRUs operating in the South Coast Air Basin on insulated semi-trailers, trucks vans, shipping containers and railcars in 2014. By 2020 the number of TRU is expected to grow to 35,000. NOx Emissions are estimated at 9 tons/day in both 2014 and 2020.

Regulatory History

In August 1998, U.S. EPA adopted new emission standards pertaining to off-road diesel engines. Subsequently, in January 2000 and in December 2004, CARB adopted amendments to existing California emission standards to harmonize with the federal requirement. These amendments include a tiered approach starting from 1996 for Tier 1 to 2008-2012 for Tier 4. New TRU engines must meet the EPA off-road diesel engine exhaust limits. In addition to the EPA new engine emissions requirements, CARB has promulgated regulations in 2004 that require in-use PM emission limits for TRU engines as well as accelerated turnover requirements.

PROPOSED METHOD OF CONTROL

Implementation of a program of regulation and incentives to further increase the fleet turnover and either replace or retrofit TRU engines that achieve 80% NOx control is proposed. It is assumed that the fleet average is equivalent to approximately 10% of the fleet being retrofitted by 2014 and 75% of the fleet is retrofitted by 2020 with NOx controls achieving 80% control. SCR NOx control technology exists for the off-road diesel engine that can achieve upwards of 80% control, and has been verified for larger engines. It is expected that the technology will achieve similar reductions for the smaller TRU size category.

EMISSIONS REDUCTION

Emission reductions of 1.1 tons/day of NOx in 2014 and 5.3 tons/day of NOx in 2023 will be achieved.

COST EFFECTIVENESS

The ARB in their rule development for in-use off-road diesel equipment has estimated that the cost impacts will be approximately $10,000 per ton of NOx reduced. SCAQMD staff expects that the costs associated with this control strategy will be similar. To offset the cost of this control measure, a financial support program, similar to the Carl Moyer Program, may be necessary.

IMPLEMENTING AGENCY

CARB has the legal authority to require accelerated engine and equipment retrofit programs. This strategy may need to be implemented with incentive programs.

REFERENCES

CARB staff report – Initial Statement of Reasons for Proposed Rule Making, "Airborne Toxic Control Measure for In-use Diesel Fueled Transport Refrigeration Units (TRU), and TRU Generator Sets, and Facilities Where TRUs Operate, October 28, 2003.

ACCELERATED TURNOVER AND CATALYST BASED STANDARDS FOR PLEASURE CRAFT [VOC, NOx, PM]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	PLEASURE CRAFT		
CONTROL METHODS:	ACCELERATE TURNOVER OF PLEASURE CRAFT FLEET TO MEET MOST STRINGENT EXISTING STANDARD BY 2014 AND MEET NEW MORE STRINGENT STANDARDS IN 2021		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
VOC INVENTORY	35.5	21.6	17.4
VOC REDUCTION		3.1	11.8
VOC REMAINING		18.5	5.6
NOX INVENTORY	6.7	9.7	10.1
NOX REDUCTION		1.1	6.8
NOX REMAINING		8.6	3.3
PM10 INVENTORY	2.2	3.8	6.0
PM10 REDUCTION		0.8	5.3
PM10 REMAINING		3.0	0.7
PM2.5 INVENTORY	1.6	2.9	4.5
PM2.5 REDUCTION		0.6	4.0
PM2.5 REMAINING		2.3	0.5
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
VOC INVENTORY	57.7	34.9	28.2
VOC REDUCTION		5.1	19.2
VOC REMAINING		29.8	9.0
NOX INVENTORY	10.5	15.3	16.0
NOX REDUCTION		1.7	10.7
NOX REMAINING		13.6	5.3
CONTROL COST:	APPROXIMATELY $525 MILLION THROUGH 2020 AT A COST EFFECTIVENESS RANGE BETWEEN $850 TO $2,500 PER TON OF (VOC+NOX+20XPM2.5) CONTROLLED		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

The purpose of this control measure is to promote faster turnover of the pleasure craft fleet and development of more stringent catalyst based standards for pleasure craft.

Background

It is estimated that currently there are 250,000 two-stroke gasoline engines and 115,000 four-stroke gasoline engines in the Basin that are used for recreational marine activities. The emission inventory for the exhaust emissions in the Basin from the two- and four-stroke gasoline engines is about 35 tons/day of VOC and 15 tons/day of NOx in 2014 and 29 and 16 tons/day for VOC and NOx respectively in 2023. The purpose of this control measure is to increase the turnover of existing two-stroke carbureted gasoline engines and older 4 stroke engines to significantly cleaner engines, and develop more stringent catalyst based standards for all pleasure craft gasoline categories.

Regulatory History

The regulation of emissions from mobile sources is primarily accomplished through CARB and U.S. EPA regulations. EPA's 40CFR Part 91, Control of Emissions from Marine Spark Ignition Engines, requires all spark ignited outboard marine engines to meet certain hydrocarbon and NO_x emissions standards starting with model year 1998. Also, CARB's Title 13 requires all pleasure craft spark ignited engines to meet certain hydrocarbon and NO_x emission standards. These standards are implemented in phases with the last phases to be completed in 2008 or 2009. Personal water craft and outboard motors will be required to meet an average emission of approximately 17 g/kw-hr of NOx+VOC. Inboard and stern drive engines will be required to meet a standard of 5 g/kw-hr. The standards will result in engines being up to 10 times cleaner than the oldest engines in the fleet. However, the emission standards remain far above the standards for other spark ignited engine categories. For example, CARB's most recent regulation for Large Spark Ignited (LSI) engines requires engines to soon meet a 0.8 g/kw-hr emission standard (10 to 20 times lower than the most stringent pleasure craft standards) and states that with advanced technology even lower levels are achievable. While the duty cycle and operational environment (in or on the water) provide different challenges than those for land based spark ignited engines in achieving the lowest emission levels, there certainly appears to be opportunity for additional reductions through further engine modifications and the addition of exhaust catalysts.

PROPOSED METHOD OF CONTROL

CARB would implement programs to accelerate retirement or retrofit approximately 20% more than would be achieved with natural turnover of the pleasure craft engines not meeting the most stringent emission standards by 2014, and (2) develop new emission standards and regulations that ensure that the entire pleasure craft fleet meet the new standards by 2020.

EMISSIONS REDUCTION

If through an accelerated retirement or retrofit program approximately 20% more than would be achieved through natural turnover of the personal water craft and outboard motors meet the 17 gm/kw-hr standard and inboard and stern drive engines meet the 5 g/kW-hr standard by 2014, the reductions are estimated at 3.1 tons/day VOC, 1.1 ton/day NOx, and 0.6 tons/day of PM2.5. Developing and implementing more stringent standards (assumed to be 5 g/kW-hr for personal water craft and outboard motors and 0.5 g/kw-hr for inboard and stern drive engines based on better catalyst and engine performance) and increasing natural turnover so that the entire pleasure craft fleet to meet these standards by 2023 would result in VOC reduction of

approximately 11.8 tons/day, NOx reductions of 6.8 tons/day, and PM2.5 reductions of 4.0 tons/day.

COST EFFECTIVENESS

Analysis of the costs associated with accelerated fleet turnover (i.e. replacement of older engines with the cleanest engines) show the cost of this measure in 2014 at approximately $52 million and is based on an average incentive of $1,000 for pleasure craft owners to scrap their old vessel and purchase a newer cleaner one. The cost effectiveness of the measure in 2014 will be close to $850 per ton of (NOx+VOC+20xPM2.5) controlled. CARB, during its development of the most recent LSI regulation, calculated that the average additional cost of modifying the engine and adding a catalyst to meet more stringent standards would be approximately $600. Assuming this is the additional cost of a new pleasure craft meeting the proposed new more stringent standards and allowing for up to an average of $600 to incentivize the needed enhanced turnover so that all pleasure craft would meet the new more stringent standards by 2023 results in a cost of approximately $525 million. The cost effectiveness of this measure would be about $2,500 per ton of (VOC+NOx+20xPM2.5) controlled in 2023.

IMPLEMENTING AGENCY AND ISSUES

CARB has the legal authority to require in-use retrofit controls and accelerated engine replacement programs. This strategy can be implemented as a phased, command-and-control regulation, complimented with market incentive programs.

REFERENCES

1. Emissions from Two Outboard Engines Operating on Reformulated Gasoline Containing MTBE; Peter A. Gable, U.S. EPA, and Steven M. Pyle, U.S. EPA
2. 40 CFR Part 91
3. CARB, Title 13
4. CARB, Staff Report: New Emission Standards, Fleet Requirements, and Test Procedures for Forklifts and Other Industrial Equipment, March 3, 2006.

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GROUP 3

CLEANER FUELS CONTROL MEASURES

FURTHER EMISSION REDUCTIONS FROM GASOLINE FUELS [NOX, SOX]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	ON- AND OFF-ROAD MOBILE SOURCE CATEGORIES		
CONTROL METHODS:	LOWER SULFUR CONTENT IN GASOLINE FUELS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	402.9	149.5	92.6
NOX REDUCTION		6.0	3.7
NOX REMAINING		143.5	88.9
SOX INVENTORY	2,5	2.0	2.2
SOX REDUCTION		1.4	1.5
SOX REMAINING		0.6	0.7
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	389.2	9.2	95.5
NOX REDUCTION		1.1	3.8
NOX REMAINING		8.1	91.6
CONTROL COST:	$10,041/TON		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

Background

Automotive exhaust and evaporative emissions are very sensitive to the quality of fuel being combusted, as well as the sophistication of emission control hardware. CARB has adopted Phase 3 reformulated gasoline (RFG3) specifications for gasoline which set limits on fuel sulfur, vapor pressure, benzene, aromatics, distillation temperature, and other parameters [1]. The Alliance of Auto Manufacturers has proposed a World Fuel Charter which recommends that tighter gasoline specifications be adopted. In 2006, the Alliance proposed specifications which were tighter than RFG3 caps for sulfur, among other parameters related to exhaust and evaporative emissions; the Alliance also recommended that the specification be amended to include a new Distillation Index criterion to address drivability issues. Based in part on this Charter, this control measure would establish tighter specifications compared to current Phase 3 gasoline requirements.

Regulatory History

CARB initially updated its RFG3 requirements in December 1999 to accommodate the blending of ethanol into gasoline and to delay the final deadline for the phase-out of methyl tertiary-butyl ether (MTBE). Major amendments including a prohibition of the use of MTBE in gasoline

starting December 31, 2002 (§ 2262.6), establishment of the Phase 3 RFG standards (§ 2262), and establishment of a Phase 3 CaRFG Predictive Model [§ 2265(a)] were adopted June 16, 2000. Other amendments made numerous changes, including establishing specifications for denatured ethanol intended for blending into gasoline, establishing a CARBOB model and downstream CARBOB cap limits, making other changes regarding blending ethanol into gasoline, and establishing a mechanism for a small refiner to offset excess emissions from small refiner producing Phase 3 RFG.

At the April 24, 2002 CARB workshop on RFG3, the Alliance of Auto Manufacturers presented information on the potential for enhancements to current gasoline specifications [2]. They noted that the European Union is moving aggressively to adopt stricter sulfur standards, and that an opportunity exists to leverage international efforts to enhance gasoline fuel quality beyond those reflected in RFG3. The Alliance proposed that stricter standards be pursued on an expedited basis. CARB has recently issued a draft updated version of the Predictive Model used to qualify California gasoline formulations, and expects to finalize this model by the end of the year.

CARB is currently developing approaches to mitigate the ethanol permeation affects and to allow greater use of ethanol in gasoline fuels. The proposal includes lowering the current sulfur content limit from 30 ppm to 20 ppm to offset NOx disbenefits associated with the increased use of oxygenates. At the January 26, 2007 ARB fuels workshop, the Auto Alliance proposed that the sulfur level be reduced further, down to 10 ppm, to provide additional opportunities to reduce emissions concurrent with higher fuel efficiency. Specifically, auto manufacturers consider such lower sulfur fuel to have a major enabling effect in helping to optimize and commercialize direct injection gasoline technology. The emissions benefits associated with the proposed lower sulfur content limit has not been included in the AQMP. In addition, more stringent sulfur content limits can result in additional NOx emissions reductions.

PROPOSED METHOD OF CONTROL

This measure calls on CARB to adopt a sulfur content limit (i.e., "cap") of 10 ppm for future gasoline fuels, which in practical terms is nearly equivalent to a 5 ppm "flat limit". Sulfur levels in gasoline have been consistently shown to have a significant adverse effect on in-use emissions, although this effect diminishes at lower sulfur levels. The Alliance of Auto Manufacturers has stated that tighter specifications should be adopted for "markets with additional advanced requirements for emission controls, to enable sophisticated NO_x after-treatment technologies." [3] Data compiled by the Alliance demonstrates that further emission reductions are possible with cleaner gasoline specifications. In Europe and Japan, starting in 2009, the sulfur requirements for gasoline drop to 10 ppm.

EMISSIONS REDUCTION

The implementation of a lower sulfur content limit can result in significant emission reductions. If the proposed control measure is fully implemented, estimated emission reductions of NOx and SOx are 6 and 1.4 tons per day by 2014, and 3.7 and 1.5 tons per day by 2023.

COST EFFECTIVENESS

The cost of refinery upgrades to accommodate the proposed cleaner gasoline specifications is estimated to be much lower than the control costs imposed when RFG 2 was introduced in 1996. Cost estimates before RFG2 modifications were made ranged from 6 to 11¢ per gallon, while actual costs were found to be much lower, approximately 4¢ per gallon. Refinery modifications for the proposed cleaner gasoline could include added hydrotreating, broader fluid catalytic cracker (FCC) naptha processing and other desulfurization technology which is readily available to refiners on a commercial basis. In some cases, refiners may be able to increase the severity of processing using existing equipment through higher catalyst loadings and operating pressures. Such steps could be expected to require more frequent equipment maintenance and catalyst changes. The Energy Information Administration estimates that the marginal capital cost of new desulfurization capacity is approximately 1.1 ¢ per gallon. Staff estimates that approximately 50% of refineries will require additional desulfurization capacity, while the remainder will be able to expand the severity and residence time of existing capacity. A 15 year project life was assumed in this analysis. By comparison, the long term AQMP control measure for gasoline calls on more severe refining modifications involving additional refining modifications, such as C4 and C5 alkylate production, to accommodate a zero summertime ethanol specification, at least for the South Coast Air Basin, commencing after 2017 or earlier if feasible. Although a zero ethanol fuel specification would completely eliminate the excess permeation emissions resulting from the switch from Phase II to Phase III gasoline as called for in SB 989, the proposed short term control measure focuses on sulfur reduction alone; it is recognized that there are near term infrastructure constraints, market pressures and greenhouse gas policy objectives which underlie current plans to continue and possibly expand the degree of ethanol blending in gasoline. On balance, a first order estimate of the cost of the proposed short-term cleaner gasoline control measure is shown in Table 1.

The cost burden for reformulating gasoline will fall disproportionately on lower income gasoline purchasers, and those with higher fuel consumption rates, such as SUV owners. The magnitude of these cost increases would not likely be greater than 1% of operating costs for the vehicle. Furthermore, the full cost impacts of these proposed cleaner gasoline specifications are expected to diminish significantly once the capital costs of refinery modification are recovered after the first four years.

Table 1. Assumptions Used to Estimate the Cost of 10 ppm Sulfur Content Gasoline Fuel

Statewide gallons	15,700,000,000
Desulfurization capital cost per gallon	0.01
Gallons requiring new de-S capacity	7,850,000,000
Desulfurization capital cost	78,500,000
Cost components for Increased utilization of existing capacity:	
a) enhanced catalyst loading, cost per gallon	0.002
b) catalyst replacement frequency, cost per gallon	0.003
c) increased maintenance due to higher pressures, cost per gallon	0.002
Total incremental desulfurization cost from expanded capacity changes, per gallon	0.007
Gallons requiring incremental S capacity expansion	7,850,000,000
Total incremental desulfurization cost from expanded capacity changes	54,950,000
Capital costs:	
a) New capacity	78,500,000
b) Increased severity with existing equipment	15,700,000
Total Capital Cost	94,200,000
Internal Discount Rate (internal cost of funds)	4.0%
Project Life, years	15
Capital Recovery Factor	0.09
Annualized Capital Cost	8,478,000
Annual Maintenance Cost	39,250,000
Total Statewide Annualized Cost	**47,728,000**
Wholesale price per gallon increase	.003
NOx reduction, tpd	4.51
SOx reduction, tpd	1.35
Total Reduction, tpd	5.86
Total Reduction, tons per year	2,139
South Coast portion of Annualized Cost (45% of state fuel use)	21,477,600
Cost per ton reduced	**$10,041**

IMPLEMENTING AGENCY

CARB has the authority to establish stricter gasoline specifications.

REFERENCES

1. California Reformulated Gasoline Regulations, Title 13, California Code of Regulations, Sections 2250-2273.5 As of May 1, 2003, http://www.arb.ca.gov/fuels/gasoline/050103rfg3regheader.doc
2. Alliance of Auto Manufacturers, "CARFG3 – Unfinished Business", CARB Workshop, April 24, 2002, http://www.arb.ca.gov/fuels/gasoline/meeting/2002/042402AAMPrstn.pdf

3. Alliance of Auto Manufacturers, World Wide Fuel Charter, issued jointly with European Auto Manufacturers Association, Engine Manufacturers Association, and the Japan Auto Manufacturers Association, December, 2002. http://www.autoalliance.org/fuel_charter.htm
4. UOP, The Role of the Merox Process in an Era of Ultra Low Sulfur Transportation Fuels, EMEA Catalyst Technology Conference, March 3 + 4, 2004, , http://www.uop.com/objects/emea%20the%20role%20of%20ultra%20low.pdf
5. Energy Information Administration, 1993, http://www.eia.doe.gov/pub/pdf/feature/lidder2.pdf , pg. 11.

FURTHER EMISSION REDUCTIONS FROM DIESEL FUELS [NOX, PM]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	OFF-ROAD MOBILE SOURCE CATEGORIES		
CONTROL METHODS:	DISPLACEMENT OF CONVENTIONAL DIESEL FUELS WITH DIESEL FUEL ALTERNATIVES		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	462.3	288.8	160.3
NOX REDUCTION		6.4	7.1
NOX REMAINING		282.4	153.2
PM10 INVENTORY	23.6	12.8	5.9
PM10 REDUCTION		0.6	0.6
PM10 REMAINING		12.2	5.3
PM2.5 INVENTORY	21.7	11.8	5.4
PM2.5 REDUCTION		0.6	0.5
PM2.5 REMAINING		11.2	4.9
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	465.3	290.9	162.2
NOX REDUCTION		6.4	7.1
NOX REMAINING		284.5	155.1
CONTROL COST:	$10,468/TON OF NOX AND PM REDUCED		
IMPLEMENTING AGENCY:	CARB, SCAQMD		

DESCRIPTION OF SOURCE CATEGORY

Background

CARB has adopted minimum specifications for diesel fuel. These specifications currently allow alternative formulations which are equivalent to a base formulation with a maximum of 10% aromatic content. However, in practice, such a fuel specification is not actually provided by refiners, who chose to offer higher aromatic-containing diesel fuel through their exercise of ARB's discretion to authorize alternative "equivalent" formulations.

The specifications proposed here reflect a different approach to regulating diesel fuel. There are two aspects to this proposed measure. In the aggregate, the goal of this measure is to displace 10% of conventional diesel by 2014 through a combination of actions that could include greater use of diesel fuel alternatives such as CNG, LNG, di-methyl ether (DME), propane, and Fisher Tropsch diesel (i.e. gas-to-liquids or GTL). A combination of user and supplier incentives would be implemented to achieve the displacement of conventional diesel fuel with some combination of the listed diesel alternatives. The overall objective of this measure is to contribute to the achievement of a additional emission reductions from diesel fuel use.

Regulatory History

After CARB adopted its aromatic content requirements for on-road diesel fuel, in 2003 they adopted more stringent requirements which reduced sulfur levels from 500 ppm to 15 ppm. Other diesel fuel modifications have been made more recently, including the addition of lubricity requirements to address concerns of pipeline operators. Current CARB diesel requirements allow the use of alternative formulations which can greatly exceed the nominal 10% aromatic limit, as refiners are allowed the flexibility to refine diesel fuel up to 21% aromatic content.

More recently, California has been evaluating ways to reduce petroleum dependence. The California Energy Commission (CEC) AB2076 Report envisions that by 2020, 20 percent of the conventional fuel usage could be displaced with alternatives such as natural gas, gas-to-liquids, and other diesel fuel alternatives. In January 2007, the Governor announced a vision to have greater use of alternative fuels and lower carbon fuels.

PROPOSED METHOD OF CONTROL

This measure calls on CARB to develop new regulations requiring the use of diesel fuel alternatives as a blending agent or to reformulate current diesel fuels to achieve equivalent emissions reduction benefits. In addition, incentive programs need to be developed to ensure that at least 10% of current volume of conventional diesel fuel – approximately 0.27 billion gallons statewide annually – would be displaced with diesel alternatives. Incentives of approximately 15¢ per gallon or equivalent are estimated to be needed to achieve full market saturation of these cleaner formulations, based on CEC incremental cost estimates performed as part of their AB 2076 Petroleum Displacement proceeding analysis. As a result, approximately 300 million gallons of the California diesel fuel pool (or possibly less, depending on refiner optimization) would be diverted to diesel fuel alternatives.

While this measure calls for the use of a wide variety of diesel fuel alternatives, it is expected that the largest portion of this diverted demand would be met through the use of gas-to-liquid (GTL or Fischer-Tropsch) diesel, which has zero sulfur, <1% aromatics, and cetane $\geq$ 70. Sasol, the world's largest producer of Fischer-Tropsch GTL fuels, estimates that a natural gas reserve of 20 trillion cubic feet (TCF) could supply the entire California diesel market with GTL for 30 years, and that uncommitted global stranded gas reserves exceed 2,000 TCF. The CEC estimates that the average long-term wholesale incremental cost from GTL diesel would be approximately 10¢ per gallon higher than conventional diesel fuel prices, while additional controls on diesel fuel could lower this to approximately 7¢ per gallon over reformulated diesel over the longer term. In order to achieve the high penetration rates assumed in this measure, retail incentives in the range of 15¢ per gallon are projected as necessary.

GTL makes a high quality diesel blend component as well as a neat fuel option; similar to DME, it contains no sulfur or aromatic compounds. The miscibility of GTL with conventional diesel helps ensure the cost-effectiveness of the proposed regulation. The miscibility of DME with propane can also help rationalize the economics of its application to higher-volume niche propane markets with centralized fueling.

EMISSIONS REDUCTION

Based on the penetration rate of diesel fuel alternatives for the current diesel fuel, 6.4 tons/day of NOx and 0.6 tons/day of particulate matter emission reductions are expected by 2014 and 7.1 and 0.5 tons/day of NOx and particulate matter, respectively, by 2023.

COST EFFECTIVENESS

During the initial stages of diesel alternative commercialization, the substitution of GTL, DME and other options is likely to commercialized first at specified card-lock and other fleet operations. Improved cetane requirements will tend to improve diesel engine operational efficiency slightly. A first order estimate of the cost effectiveness of proposed cleaner alternative diesel formulation is shown below:

Statewide diesel annual demand, gallons	2,700,000,000
10% portion as GTL or equivalent	270,000,000
cost per gallon of GTL or equivalent	$0.15
Cost for 10% portion as GTL or eq.	40,500,000
South Coast portion of state diesel demand	40%
Annualized cost in South Coast	$16,200,000
Emission reductions of NOx, SOx & PM, tpd	4.24
Annual Emission Reductions, NOx SOx and PM	1,548
Cost per ton	$10,468

There will be some degree of stranded capital investment designed to accommodate the unique blending and transport requirements of DME during the early years of its introduction. However, these costs are a relatively small portion of the total costs of compliance. Furthermore, future on-road heavy-duty engines certified to run on DME and/or GTL diesel are expected to have lower risks of in-use emission compliance issues, as these fuels are inherently cleaner than conventional diesel fuel as defined under current CARB regulations and used as the basis for U.S. EPA and CARB on-road heavy-duty engine certification.

There are also reasonable concerns about additional market isolation for California diesel. However, the fungibility of this proposed diesel, including the miscibility of GTL diesel (sometimes referred to as Fisher-Tropsch Diesel) with the current distribution system, helps reduce the incremental cost of this proposal.

IMPLEMENTING AGENCY

CARB has the authority to establish stricter diesel specifications that would allow for blending of conventional diesel fuel with diesel fuel alternatives. Current refinery capabilities vary in the degree of modifications necessary to accommodate these proposed standards. The implementation date needs to reflect the reasonable time requirements for refiner capital modifications to their facilities. Because the diesel specified in this proposal is inherently fungible in pipelines, logistic constraints which inhibit product exchange agreements are not expected.

The lead time for full implementation of these specifications is expected to be approximately 4-5 years after CARB adoption.

REFERENCES

1. ARB Reformulated Diesel Fact Sheet *(Original issued in August, 1993)*
2. ARB Reformulated Diesel Fact Sheet *Updated October 6, 2000*
3. Diesel Fuel Effects on Locomotive Exhaust Emissions, SWRI, 2000
4. Summary of Diesel Fuel Alternative Formulation Certificates, 1992 through 2001
5. Durbin, T.D, et. al., Evaluation of the Effects of Alternative Diesel Fuel Formulation on Exhaust Emission Rates and Reactivity, Final Report, CE-CERT, April 1999.
6. Sasol Limited, "Gas to Liquids – Global Prospects", Pat Davies, to Deutche Bank Oil & Gas Conference, September 2003
7. CEC, AB 2076, Petroleum Displacement Report, Appendix B, Staff Paper on Option 2I, Fischer Tropsch Diesel
8. Rudolf Maly, DaimlerChrysler, "Effects of GTL Diesel Fuels on Emissions and Engine Performance", 10th Diesel Engine Emissions Reduction Conference, Coronado, California, September, 2004.

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GROUP 4

LONG-TERM MOBILE SOURCE CONTROL MEASURES

FURTHER EMISSION REDUCTIONS FROM ON-ROAD MOBILE SOURCES [NOX]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	ON-ROAD MOBILE SOURCE CATEGORIES		
CONTROL METHODS:	ACCELERATED FLEET TURN-OVER, RETROFITS, ENGINE STANDARDS; ADVANCED CARGO TRANSPORTATION SYSTEMS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	630.0	292.2	164.1
NOX REDUCTION			67.9
NOX REMAINING			96.2
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	612.9	286.8	161.3
NOX REDUCTION			68.2
NOX REMAINING			93.1
CONTROL COST:	NOT DETERMINED		
IMPLEMENTING AGENCY:	CARB		

DESCRIPTION OF SOURCE CATEGORY

Background

The emission sources targeted under this control measure include on-road mobile sources such as passenger cars and light-, medium-, and heavy-duty vehicles. The objective of this long-term control measure is to achieve further NOx reductions from these vehicles beyond those achieved through CARB's and AQMD's proposed short-term strategies in order to attain the federal 8-hour ozone standard by 2023. These reductions are expected to be achieved through implementation of new and advanced control technologies as well as improvement of existing control technologies. Control techniques requiring substantial levels of committed funding for implementation would also fall under this category of long-term measures.

Regulatory History

CARB and U.S. EPA have adopted a number of regulations affecting on-road mobile sources. For the most part, these regulations have established new engine standards or fuel requirements for various source categories. However, additional regulations and programs need to be developed to accelerate the turn-over and modernization of existing vehicles in order to achieve the level of reductions needed for attainment.

PROPOSED METHOD OF CONTROL

This control measure proposes to achieve further NOx reductions from on-road mobile source categories beyond the reductions achieved from the short-term measures through 1) accelerated turn-over of high-emitting vehicles and penetration of ATPZEVs and ZEVs; 2) modernization of heavy-duty vehicles through replacements or retrofits; 3) more stringent fuel specifications and use of diesel alternatives; and 4) advanced near-zero and zero emitting cargo transportation systems.

The following table provides a potential listing of advanced technologies and innovative control approaches for achieving long-term reductions from on-road mobile sources.

TABLE 1
Possible Long-Term Control Measures for On-Road Mobile Sources

Light and Med. Duty Vehicles	▪ Extensive retirement of high-emitting vehicles and accelerated penetration of ATPZEVs and ZEVs
Heavy Duty Vehicles	▪ Expanded modernization and retrofit of heavy-duty trucks and buses ▪ Advanced Near-Zero and Zero Emitting Cargo Transportation Technologies
Fuels	▪ More stringent gasoline and diesel specifications; Extensive use of diesel alternatives
Non-Polluting Energy	▪ Accelerated use of renewable energy and development of hydrogen technology and infrastructure
AB32 Implementation	▪ Concurrent criteria pollutant reduction technologies

For light-duty vehicles, an extensive retirement and replacement of high-emitting vehicles would be required through either mandatory or incentive-based programs. Furthermore, achieving further reductions from this source category will require an even more accelerated penetration of ATPZEVs (and ZEVs) beyond the 1 million target in 2020 currently proposed under short-term measures and could be as high as 4 to 5 million in 2020.

For heavy duty vehicles, a more extensive modernization program could be instituted to require the replacement of the remaining trucks not meeting the 2010 model year standard in 2020 after implementation of short-term measures. Reformulation of gasoline and diesel fuels coupled with requirements for greater use of diesel alternatives (e.g., gas-to-liquid, alternative fuels, etc.) would also provide an opportunity for additional long-term NOx, VOC, and PM reductions from on-road mobile sources.

Advanced cargo transportation technologies such as Maglev and other types of linear induction motor technologies could also be used to transport containers to and from ports thereby significantly reducing emissions from heavy-duty trucks. Such alternative electric propulsion systems would have the added benefit of reducing congestion and reliance on fossil fuels. Accelerated development and implementation of these advanced technologies would provide a tremendous opportunity for achieving the emission reductions needed for ozone attainment. Finally, the accelerated use of renewable energy and implementation of AB32 strategies provide

the potential for achieving long-term emission reductions. Implementation of the long-term measures will require significant technology development and commercialization as well as considerable amount of funding.

EMISSIONS REDUCTION

The emission reduction target for this measure is 68 tons of NOx by 2023.

RULE COMPLIANCEAND TEST METHODS

Compliance for this control measure would be primarily based on CARB's regulation(s) and incentive-based programs affecting existing on-road mobile sources.

COST EFFECTIVENESS

Cost-effectiveness has not yet been determined for this control measure and would depend on the type of source category and control strategy selected.

IMPLEMENTING AGENCY/SCHEDULE

CARB has the authority to regulate emissions for the majority of the targeted sources. U.S. EPA has the authority to adopt aircraft engine standards. The District will work closely with CARB and U.S. EPA in developing and implementing these strategies. The following table outlines the proposed implementation schedule and associated milestones. Implementation of these control strategies and technologies would require continued research, development, demonstration, commercialization, and funding.

Table 2
Implementation Milestones/Schedule

Category	Proposed Strategy	Tech Assessment	Strategy Development & Funding	Rule Adoption	Rule Implementation
PCs, LDTs, MDTs	Accelerated Retirement; Penetration of ATPZEVs	2008-2009	2009-2010	2011	2015-2023
Heavy-Duty Vehicles	Expanded Fleet Modernization	2008-2009	2009-2010	2011	2015-2023
Heavy-Duty Vehicles	Advanced Cargo Transportation Technologies	2009-2012	2012-2013	2014	2018-2023
Fuels	Reformulated Fuels; Diesel Alternatives	2008-2009	2009-2010	2010	2010-2023

FURTHER EMISSION REDUCTIONS FROM ON-ROAD HEAVY-DUTY VEHICLES [NOX]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	HEAVY-DUTY VEHICLES (14,001 AND GREATER GVWR)		
CONTROL METHODS:	INSPECTION AND MAINTENANCE PROGRAM FOR HEAVY-DUTY VEHICLES USING VISUAL INSPECTIONS AND ON-BOARD DIAGNOSTICS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY			*
NOX REDUCTION			*
NOX REMAINING			*
PM10 INVENTORY			*
PM10 REDUCTION			*
PM10 REMAINING			*
PM2.5 INVENTORY			*
PM2.5 REDUCTION			*
PM2.5 REMAINING			*
SUMMER PLANNING INVENTORY			
NOX INVENTORY			*
NOX REDUCTION			*
NOX REMAINING			*
CONTROL COST:	NOT DETERMINED		
IMPLEMENTING AGENCY:	CARB AND BUREAU OF AUTOMOTIVE REPAIR		

* The emission reductions associated with this measure are part of the total on-road emission reductions provided in SC-LTM-01A.

DESCRIPTION OF SOURCE CATEGORY

Heavy duty vehicles are defined as on-road vehicles weighing more than 14,000 lbs Gross Vehicle Weight Rating (GVWR), and are used in a variety of applications such as large trucks and school buses. Heavy-duty vehicles are powered with either otto-cycle (spark-ignited) or diesel-cycle (compression ignition) engines. Diesel-powered heavy-duty vehicles are the primary choice for transport of goods and material throughout the United States. Currently, about 190,000 heavy-duty vehicles operate in the SCAQMD, and this number is projected to increase to 240,000 by 2020. The oxides of nitrogen (NOx) and particulate matter (PM) emissions from heavy-duty vehicles are of great concern. For example, the in-use heavy-duty diesel truck fleet currently contributes approximately 28 percent and 16 percent to the total statewide mobile source NO_x and PM emissions inventory, respectively.

Background

Emissions from motor vehicles are generally lowest when they are new and progressively increase as the vehicles age and accumulate mileage. The causes of these emissions increases are numerous, but can be broadly categorized in terms of normal deterioration of properly functioning on-board emission control system components, malfunctioning emission control system components due to design flaws and/or lack of proper maintenance, or tampered emission control system components. In recognition that potential substantial emission reductions could be generated by programs that would regularly emission test in-use vehicles, smog check programs have been established to systematically inspect and emission test in-use vehicles for the purpose of identifying and repairing vehicles with malfunctioning and tampered emission control system components.

In California, the Smog Check program was first established in 1982, and it includes all gasoline-powered passenger cars and trucks up to 10,000 lbs GVWR to be inspected at various times (typically biennially) throughout the vehicle life. Unlike the established Smog Check program for light-duty passenger vehicles and trucks, there has been no similar program adopted in California to periodically check emissions from heavy-duty vehicles. It should be noted, however, that two programs have been implemented by CARB that begin to address the problem of excess emissions coming from heavy-duty vehicles. The first program is the Heavy-Duty Vehicle Inspection Program, which requires heavy-duty trucks and buses to be inspected for tampering and excessive smoke through the use of a snap-idle test to determine compliance with tailpipe opacity requirements, with inspections/emission testing conducted at random roadside checkpoints and border crossings. The second program is the Periodic Smoke Inspection Program, which requires diesel vehicle and bus fleet owners to conduct annual inspections of their vehicles and repair those vehicles with excessive smoke emissions.

Regulatory History

In recognition of the on-road heavy-duty vehicle fleet's significant contribution to ozone and particulate matter formation in the South Coast Air Basin and its contribution to toxic air contaminants, much more stringent NO_x and PM standards have been adopted for new heavy-duty engines. In 2004, the NO_x emission standard was reduced by over 60 percent and PM emissions standard by over 80 percent compared to the emission standards of 1990. Complying with the 2004 standard required improved engine designs and emission control technologies, such as exhaust gas recirculation, or EGR.

In 2007, the NO_x standard was effectively reduced by 50 percent and the PM standard reduced by another 90 percent compared to the 2004 standards. Complying with the 2007 NOx and PM standards will require additional emission control system improvements including the use of more advanced EGR strategies. The most advanced engine designs, coupled with exhaust aftertreatment will be needed to comply with 2010 emission standards, primarily driven by the 0.2 g/bhp-hr NOx emission standard, representing an additional 83 percent reduction in NOx compared to the 2007 standard.

PROPOSED METHOD OF CONTROL

This measure would call on the State of California to develop an expanded inspection and maintenance (I/M) program for heavy-duty diesel trucks by 2015. Specifically, the current smoke inspection program should be expanded to include (1) a visual under-the-hood inspection of the emission control devices, (2) an electronic check of the truck's on-board computer, and (3) use of remote sensing technology to assess in-use heavy-duty diesel truck emissions.

As mentioned previously, CARB currently has the authority to conduct roadside inspections of heavy-duty diesel trucks for the purpose of determining compliance with tampering and tailpipe opacity requirements. With the advent and requirement of on-board-diagnostic (OBD) instrumentation for heavy-duty diesel engines beginning in 2010, a program can be developed to periodically monitor the operating parameters of the engine and the resultant emissions. The implementation of an expanded I/M programs for in-use heavy-duty vehicles is particularly needed in order to track the expected increased rates of emissions deterioration caused by tampering and malmaintenance of exhaust aftertreatment devices and other emission control components expected to be used in 2007 and later model-year diesel-powered heavy-duty vehicles. In addition, an expanded I/M program would help avoid a situation identified several years ago where heavy-duty diesel engines were identified with NOx defeat devices for the purposes of fuel savings at the expense of excess pollution. In an effort to address this situation the United States Environmental Protection Agency and the California Air Resources Board entered into a consent decree agreement with engine manufacturers in 1998. One requirement of this agreement was a not-to-exceed (NTE) component for 1998 and later model year engines. The NTE limits have been introduced as an additional instrument to make sure that heavy-duty engine emissions are controlled over the full range of speed and load combinations commonly experienced in use. This proposed control measure would have CARB develop NTE limits for heavy duty diesel engines prior to the 1998 model year to ensure in-use emissions are kept in check for such engines not covered by the prior consent decree order. As an additional tool to monitor compliance with NTE limits, these proposed control measures call for the implementation of a remote sensing program for purposes of measuring in-use emissions from heavy-duty trucks.

EMISSIONS REDUCTION

The emission reductions associated with this control measure depend on program design and require further study. It is expected that these emission reductions would be similar to those achieved under the current Inspection and Maintenance Program applicable to light- and medium-duty vehicles.

RULE COMPLIANCE AND TEST METHODS

As more heavy-duty diesel engine trucks become equipped with on-board diagnostic devices, the opportunity exists to develop a program requiring the periodic check of these devices to facilitate the identification and repair of malfunctioning heavy-duty engine emission control systems. Similar to the check of a light-duty vehicle OBD system, it is anticipated that test technicians in an expanded heavy-duty vehicle I/M program would check for an illuminated MIL light and/or connect a diagnostic tool into the heavy-duty vehicle's OBD system for the purpose of downloading fault codes and related information that would assist the technician in

identifying emission control system malfunctions. For older existing heavy-duty vehicles not equipped with OBD technology, a remote sensing component should be developed in order to identify vehicles with potentially excessive emissions for NO_x and particulate matter.

Establishment of NTE test procedures for 1998 and older heavy-duty diesel engines could be similar to those test procedures established for 1998 and newer heavy-duty diesel engines.

COST EFFECTIVENESS

Overall cost-effectiveness values for this control measure would require additional study. As a guide, the cost-effectiveness value for the current Inspection and Maintenance Program is estimated to be approximately $5,000 per ton of pollution (ROG + NOx) reduced. In addition, the cost-effectiveness of the combined CARB Heavy-Duty Vehicle Inspection program and Periodic Smoke Inspection Program is estimated to be approximately $2,000 per ton of pollution (hydrocarbons + NOx + PM) reduced. It is expected that the cost-effectiveness for this control measure would result in similar values.

IMPLEMENTING AGENCY

The implementing agency would be the California Air Resources Board and the Bureau of Automotive Repair. These agencies currently implement the Inspection and Maintenance Program for light- and medium-duty vehicles.

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FURTHER EMISSION REDUCTIONS FROM OFF-ROAD MOBILE SOURCES [NOX]

CONTROL MEASURE SUMMARY			
SOURCE CATEGORY:	OFF-ROAD MOBILE SOURCE CATEGORIES		
CONTROL METHODS:	ACCELERATED FLEET TURN-OVER, RETROFITS, ENGINE STANDARDS		
EMISSIONS (TONS/DAY):			
ANNUAL AVERAGE	**2002**	**2014**	**2023**
NOX INVENTORY	373.3	285.0	267.9
NOX REDUCTION			115.6
NOX REMAINING			152.3
SUMMER PLANNING INVENTORY	**2002**	**2014**	**2023**
NOX INVENTORY	379.1	292.3	275.3
NOX REDUCTION			116.3
NOX REMAINING			159.0
CONTROL COST:	NOT DETERMINED		
IMPLEMENTING AGENCY:	CARB, U.S. EPA		

DESCRIPTION OF SOURCE CATEGORY

Background

The emission sources targeted under this control measure include off-road mobile sources such as off-road diesel equipment (e.g., construction and industrial equipment), marine vessels, trains, pleasure craft, and aircraft. The objective of this long-term control measure is to achieve further NOx reductions from off-road mobile sources beyond those achieved through CARB's and AQMD's proposed short-term strategies in order to attain the federal 8-hour ozone standard by 2023. These reductions are expected to be achieved through implementation of new and advanced control technologies as well as improvement of existing control technologies. Control techniques requiring substantial levels of committed funding for implementation would also fall under this category of long-term measures.

Regulatory History

CARB and U.S. EPA have adopted a number of regulations affecting off-road mobile sources. For the most part, these regulations have established new engine standards or fuel requirements for various source categories. However, additional regulations and programs need to be developed to accelerate the turn-over and retrofit of existing vehicles and equipment in order to achieve the level of reductions needed for attainment.

PROPOSED METHOD OF CONTROL

This control measure proposes to achieve further NOx reductions from various off-road mobile source categories beyond the reductions achieved from the short-term measures through 1) accelerated turn-over of existing equipment and vehicles and replacement with new equipment meeting the new engine standards; 2) retrofit of existing vehicles and equipment with add-on controls such as SCR; and 3) develop new engine standards (e.g., aircraft, ships).

The following table provides a potential listing of advanced technologies and innovative control approaches for achieving long-term reductions from off-road mobile sources.

TABLE 1
Possible Long-Term Control Measures for Off-Road Mobile Sources

Off-Road Diesel Vehicles	▪ Expanded modernization and retrofit of off-road equipment
Fuels	▪ More stringent gasoline and diesel specifications; Extensive use of diesel alternatives
Marine Vessels	▪ More stringent emission standards and programs for new and existing ocean-going vessels and harbor craft
Locomotives	▪ Advanced Near Zero and Zero Cargo Transportation Technologies (e.g., linear induction motor technologies, automated rail vehicles)
Pleasure Craft	▪ Accelerated replacement and retrofit of high-emitting engines
Aircraft	▪ More stringent emission requirements for jet aircraft (engine standards, clean fuels, operational controls, retrofit controls)

For off-road heavy diesel equipment, opportunities would still exist to achieve additional long-term reductions by requiring that all of these equipment meet Tier 4 off-road engine standards and better through replacements or retrofits by 2023. Within this timeframe, retrofit technologies are expected to be developed providing 90% and higher NOx reduction benefits for Tier 2, Tier 3, and even Tier 4 engines. Reformulation of gasoline and diesel fuels coupled with requirements for using diesel alternatives (e.g., CNG, LNG, gas-to-liquid) would also provide an opportunity for additional long-term NOx, VOC, and PM reductions from off-road mobile sources.

Advanced cargo transportation technologies such as Maglev and other types of linear induction motor technologies could also be used to transport containers to and from ports thereby significantly reducing emissions from locomotives. Such alternative electric propulsion systems would have the added benefit of reducing congestion and reliance on fossil fuels. Accelerated development and implementation of these advanced technologies would provide a tremendous opportunity for achieving the emission reductions needed for ozone attainment.

Further emission reductions from ocean-going vessels beyond those considered under CARB's goods movement plan could also be achieved through a more expanded main engine retrofit

program (i.e., SCR or equivalent technologies) which would target all vessels calling on the San Pedro Bay ports (i.e., including those making non-frequent or less frequent calls) to achieve higher levels of NOx reductions from existing vessels. CARB or the Ports have the ability to adopt and implement such programs.

Accelerated replacement of existing pleasure craft with new models meeting the most stringent engine standards and application of potential retrofit technologies provides another strategy for achieving long-term reductions. In addition, aircraft emissions could be further reduced through strategies such as lower engine emission standards, reformulation of jet fuel, operational controls (e.g., reduced idling) and installation of retrofit kits which would require extensive technology development.

Implementation of these measures will require significant technology development and commercialization as well as considerable amount of funding.

EMISSIONS REDUCTION

The emission reduction target for this measure is 116 tons of NOx by 2023.

RULE COMPLIANCE AND TEST METHODS

Compliance for this control measure would be primarily based on CARB's regulation(s) and incentive-based programs affecting existing off-road mobile sources. In addition, U.S. EPA could adopt regulations for new and existing sources under its jurisdiction such as aircraft, trains, and ships:

COST EFFECTIVENESS

Cost-effectiveness has not yet been determined for this control measure and would depend on the type of source category and control strategy selected.

IMPLEMENTING AGENCY/SCHEDULE

CARB has the authority to regulate emissions for the majority of the targeted sources. U.S. EPA has the authority to adopt aircraft engine standards. The District will work closely with CARB and U.S. EPA in developing and implementing these strategies. The following table outlines the proposed implementation schedule and associated milestones. Implementation of these control strategies and technologies would require continued research, development, demonstration, commercialization, and funding.

Table 2
Implementation Milestones/Schedule

Category	Proposed Strategy	Tech Assessment	Strategy Development & Funding	Rule Adoption	Rule Implementation
OGVs (main engines)	SCR or Equivalent Technologies (90%+)	2008-2010	2009-2011	2012	2015-2023
Off-Road Diesel Equipment	Tier 4 & Level 3+ Retrofits (90% +)	2008-2010	2009-2011	2012	2015-2023
Trains	Advanced Cargo Transportation Technologies	2009-2012	2012-2013	2014	2018-2023
Pleasure Craft	Accelerated Turn-over; Retrofit Technologies	2008-2009	2009-2010	2010	2010-2023
Aircraft	New Engine Standards; Operational Controls; Fuel Reformulation	2008-2010	2010-2011	2012	2015-2023

FURTHER EMISSION REDUCTIONS FROM CONSUMER PRODUCTS [VOC]

CONTROL MEASURE SUMMARY

SOURCE CATEGORY: CONSUMER PRODUCT

CONTROL METHOD: REQUIRE ULTRA LOW VOC PRODUCTS

THIS CONTROL MEASURE WILL SEEK ADDITIONAL REDUCTIONS FROM CONSUMER PRODUCTS BY TRANSFERRING LOW- AND ULTRA-LOW VOC STATIONARY SOURCE TECHNOLOGIES TO CONSUMER PRODUCTS

EMISSIONS (TONS/DAY):

ANNUAL AVERAGE	**2002**	**2014**	**2023**
VOC INVENTORY	110.4	102.6	109.5
VOC REDUCTION			20.0
VOC REMAINING			89.5
SUMMER PLANNING INVENTORY			
VOC INVENTORY	110.4	102.6	109.5
VOC REDUCTION			20.0
VOC REMAINING			89.5

CONTROL COST: THE COST-EFFECTIVENESS OF EMISSION REDUCTIONS FROM ADHESIVES AND CLEAN-UP SOLVENTS WERE ESTIMATED AT LESS THAN $1,000 PER TON AND LESS THAN $2,000 PER TON, RESPECTIVELY FOR STATIONARY SOURCE APPLICATIONS. OTHER CONSUMER PRODUCT CATEGORIES WERE ESTIMATED AT LESS THAN $5,000 PER TON. REFORMULATION OF CONSUMER PRODUCTS MAY IMPACT MANUFACTURERS BY INCREASING THEIR PRODUCTION COSTS. THE INCREMENTAL COSTS WOULD BE PASSED ON TO CONSUMERS THROUGH INCREASED PRICES FOR AFFECTED CONSUMER PRODUCTS.

IMPLEMENTING AGENCY: CARB

DESCRIPTION OF SOURCE CATEGORY

A consumer product is defined as a chemically formulated product used by household and institutional consumers. Consumer products include, but are not limited to, detergents, cleaning compounds, polishes, floor finishes, cosmetics, personal care products such as antiperspirants and hairsprays, disinfectants, and sanitizers. Despite the implementation of short-term control measure proposed by CARB, consumer products would still remain a significant source of VOC emissions in the Basin contributing to the formation of both ozone and particulate matter. Particularly, additional long-term reductions are necessary from this source category for attainment of the 8-hour ozone standard by 2023.

Background

Consumer Products are currently the second largest source category of VOC emissions following the light- and medium-duty vehicle source category but will surpass this category by 2014. VOC emissions from this source category are estimated at 107.1 and 112.1 tons per day in 2014 and 2020, respectively. Short-term control measures in the 2003 AQMP were expected to reduce these emissions by up to 17 tons per day of VOC in 2010. This measure has yet to be fully implemented by CARB. However, emissions from this source category can be further reduced by transferring low-VOC technology developed for stationary sources.

Regulatory History

CARB has primary authority over consumer products and has taken several regulatory actions over the past several years to reduce the VOC emissions form consumer products. Since 1989, CARB has adopted five regulations affecting consumer products. The regulations have been amended several times and contain a total of 200 emission limits affecting 82 categories. While the 1994 SIP and the 1997 AQMP had an emission reduction commitment of 89 tons per day and 77 tons per day, respectively, for the South Coast Air Basin (Basin) in 2010, CARB has scaled back its 2014 emission reduction commitment to 9 tons per day of VOC for the 2007 draft AQMP. Although CARB has adopted CONS1 from the 2003 Plan, CONS2 has yet to by fully developed and implemented.

PROPOSED METHOD OF CONTROL

This measure proposes to implement low-VOC technologies developed for stationary sources into categories with similar uses in consumer products. In addition, the use of lower reactive VOC compounds could offer the potential for achieving equivalent reductions.

SCAQMD's aggressive stationary source regulatory program has resulted in the development of remarkably less polluting coating, adhesive and solvent technologies with exceptional performance characteristics. This proposed strategy seeks further emission reductions from consumer products by transferring the low-VOC technology developed for stationary sources to comply with rules in Regulation XI, such as Rule 1171 – Solvent Cleaning Operations, Rule 1168 – Adhesives, Rule 1122 – Solvent Degreasers and others to categories of consumer products used in similar applications. These technologies include advances in aqueous, low-VOC and non-VOC (exempt) cleanup solvents, adhesive and coating technologies. This approach is most suitable for cross-over products used in both stationary source applications and as consumer products. The following is a listing of some categories from consumer products that have the potential for significant emission reductions (50% - 75%):

- Paint Thinner – carryover technology from Rule 1171. Low- and zero-VOC technology available and effective for clean-up operations can replace high-VOC (> 700 g/l) counterparts (non-architectural paint thinners)
- Paint Stripper – carryover technology from Rule 1124 – Aerospace Operations. Waterborne strippers (VOC < 200 g/l) commonly used.

- Brake Cleaners – carryover technology from Rule 1171. Low- and zero-VOC technology available, with aerosol cleaners using CO2 or N2 as alternative propellants to hexane and other VOCs.
- Multi-Purpose Cleaning - carryover technology from Rule 1171. Low- and zero-VOC technology available
- General Purpose Cleaning - carryover technology from Rule 1171. Low- and zero-VOC technology available
- Carburetor/Choke Cleaners - carryover technology from Rule 1171. Low- and zero-VOC technology available
- Contact Adhesive – carryover technology from Rule 1168 – Adhesives
- Construction and Panel Adhesives - carryover technology from Rule 1168 – Adhesives
- Lubricants (Total of four Consumer Products Categories) – Waterborne and synthetic lubricants available and in use
- Hairspray – Non-VOC propellant and delivery by pump readily available

There is currently significant discrepancy in the level of stringency between stationary source and consumer products regulations that is not warranted in many cases. For instance, there are cleaners which when used in industrial/commercial applications and subject to Rule 1171 have to meet a VOC limit of 25 g/l, but when sold as a consumer product the same cleaner must meet a 45 percent by weight VOC limit (equivalent to approximately 400 g/l assuming an average cleaner density of 7.5 lb/gal). The cleaners meeting the Rule 1171 VOC limit the use of low- and non-VOC alternatives based on exempt solvents (e.g. acetone). These products are subject to highly demanding performance standards dictated by a highly competitive market and many of the technologies are directly applicable to consumer products. Consistency between industrial applications and consumer products can also assist rule effectiveness of existing source-specific rules.

Consumer products can come in different product forms such as aerosol, gel, liquid or solid. Current state law prohibits CARB from regulating so as to eliminate a product form. If the current state legislation can be modified, emissions from consumer products can be further reduced by phasing out certain product forms where low-VOC alternatives are available. Functioning equivalent, yet low-emitting products, do exist in many instances.

Although this measure focuses on certain categories of consumer products with a large inventory, the lower-VOC technology can be further implemented into other smaller emission categories found within Consumer Products. In addition, the use of lower reactive VOC compounds could offer the potential for achieving equivalent reductions

EMISSIONS REDUCTION

The emission reductions from this long-term measure are estimated at 20 tons per day of VOC by 2023.

COST EFFECTIVENESS

The cost-effectiveness of emission reductions from adhesives and clean-up solvents were estimated at less than $1,000 per ton and less than $2,000 per ton, respectively for stationary source applications. CARB estimated the cost-effectiveness of recent VOC emission reductions from consumer product categories at less than $5,000 per ton. Their estimates included nonrecurring costs including research and development and capital equipment purchases as well as recurring raw material costs. Reformulation of consumer products may impact manufacturers by increasing their production costs. The incremental costs would be passed on to consumers through increased prices for affected consumer products. This strategy is not expected to impact competitiveness of California business compared with those outside of California because all companies that sell these products in California would have to meet the proposed requirements.

IMPLEMENTING AGENCY/SCHEDULE

CARB has primary authority over consumer products and would be responsible for regulating these categories where possible or implementing this strategy. As an alternative to CARB implementing this strategy, the AQMD would regulate these categories where possible or seek additional authority under the Health and Safety Code or request CARB to delegate its authority over consumer products to the AQMD. If the current state legislation can be modified, emissions from consumer products can be further reduced by setting the lowest achievable VOC limits (or equivalent reductions) regardless of product types. The implementation schedule and associated rulemaking activities are outlined below:

Table 2
Implementation Milestones/Schedule

Category	Proposed Strategy	Tech Assessment	Strategy Development	Rule Adoption	Rule Implementation
Consumer Products	Reformulation; Product Replacement	2008-2010	2009-2010	2011	2015-2023

REFERENCES

1. CARB, California Consumer Products Regulation, Title 17 California Code of Regulations, Sections 94508, 94509, and 94513.
2. SCAQMD, Staff Report, Proposed Amended Rule 1168 – Adhesives and Sealant Applications, October 2003
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8. Institute for Research & Technical Assistance, Draft Report, Assessment, Development, and Demonstration of Low-VOC Cleaning Systems for South Coast Air Quality Management District Rule 1171, June 2003
9. SCAQMD, Staff Report, Proposed Amended Rule 1122 – Solvent Degreaser, October 2004
10. CARB, Proposed Amendments to the California Consumer Products Regulation and the Aerosol Coatings Regulation, September 29, 2006

SECTION 3

MOBILE SOURCE CONTROL OPTION 2 – MOBILE SOURCE EMISSION REDUCTIONS TO MEET RATE-OF-PROGRESS

INTRODUCTION

Under this option the state would fulfill its NOx emission reduction obligations under the 2003 AQMP by 2010. An additional 208 tons per day would be needed to meet the NOx emission target between 2010 and 2014. Under this option the state could include some of the proposed measures under the first option or other measures that the state identifies as part of the SIP public process. The rate of progress for NOx under Policy Option 2 is shown in Figure 1 (Section 1).

As shown in Figure 1, the projected 2010 base year emissions for NOx is estimated to be at 775 tons/day. When the state submitted the 2003 AQMP to the U.S. EPA, the State provided as its obligation to reduce NOx emissions by 156 tons/day in order to meet the 1-hour ozone ambient air quality standard by 2010. Based on the state's actions since the submittal of the 2003 AQMP, 32 tons/day of NOx emission reductions have been achieved, leaving another 124 tons/day to be achieved by 2010. After 2010, an additional 208 tons/days of NOx emission reductions are needed to meet the federal PM2.5 ambient air quality standard by 2014.

The state may choose to meet the 2010 obligation through a combination of the remaining commitments under the 2003 AQMP (shown in Table 1-3 of the AQMP Main document), its proposed control strategy plus the measures provided under Option 1, or any other measures the state may identify. In addition, the state would need to identify additional reductions to be implemented by 2014 to meet the NOx emissions reduction levels needed to attain the federal PM2.5 ambient air quality standard. Again, this can be any set of measures the state identifies for this option, which could be a combination of its proposed control strategy, measures identified under Option 1, or any other measure not identified at this time.

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SECTION 4

POLICY OPTION 3 – PUBLIC FUNDING ASSISTANCE TO ACHIEVE NEEDED ADDITIONAL EMISSION REDUCTIONS

INTRODUCTION

The third option is based on the same rate of progress under Policy Option 1, but relies heavily on public funding assistance to achieve the needed NOx reductions via accelerated fleet turnover to post-2010 on-road emission standards or the cleanest off-road engine standards in effect today or after 2010. This would include funding for the replacement of on-road heavy-duty vehicles, off-road mobile equipment, pleasure craft, and off-road vehicles.

Under Policy Option 3, CARB or the District would assume the responsibility of implementing the incentive programs based on specific funding levels designated for this purpose. Based on the analysis performed for the Carl Moyer program, up to an estimated $600 million per year, which represents funding over a five year period, is needed between 2009 and 2014. In addition, significant funding would be made available beginning in mid-2008 through 2014. The total public funding estimated to achieve the additional NOx emission reductions of 71 tons/day as identified in Table 2-11, is about $3 billion based on the current Carl Moyer Program cost-effectiveness criteria of $14,300/ton with a 10-year project life. This is a conservative estimate since many of the projects would be more cost-effective than the $14,300/ton criteria.

The total public funding needed of about $600 million per year would need to begin in mid-2008. Table 2 illustrates funding sources that have been suggested in the past by various parties and the District staff has included these as a matter of perspective and is seeking comments and suggestions on appropriate funding sources. Currently, the District receives about $55 million per year, which a significant portion has been allocated by the District Governing Board to accelerate vehicle turnover including urban buses, school buses, and agricultural equipment. In addition, the Mobile Source Emissions Reduction Review Committee (MSRC) allocates a significant amount of funds to cleaner vehicles. The MSRC is currently allocating funding assistance for on-road engines meeting 2010 emissions standards and replacement of off-road equipment with current commercially available Tier 3 engines. In order to implement this option, additional funding must be identified within the next year and a half. Funding proposals such as marine port user fees, surplus fuel tax, or other mechanisms such as port tariff fees (which would facilitate cleanup of goods movement related sources) are examples of funds that could be made available to cover the implementation of this option.

TABLE 2
Example List of Past Suggested Funding Sources by Various Parties*

Potential Funding Sources	Potential Funding Levels
Carl Moyer Program	~$35 - $50 million/yr
MSRC Program	~ $8 - $10 million/yr
Marine Port User Fee Proposals	~$250 million/yr
1-cent Increase in Fuel Tax	~$70 - $80 million/yr

* Sources listed in Table 2 are provided for discussion purposes only