Exhibit 12:

Manufacturers of Emission Controls Association,
Retrofitting Emission Controls on Diesel-Powered Vehicles

Case Studies of Construction Equipment Diesel Retrofit Projects

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1.0 Introduction

Diesel engines provide important fuel economy and durability advantages for large heavy-duty trucks, buses, and nonroad equipment. Although they are often the power plant of choice for heavy-duty applications, they have the disadvantage of emitting significant amounts of particulate matter (PM) and oxides of nitrogen (NOx), and lesser amounts of hydrocarbon (HC), carbon monoxide (CO) and toxic air pollutants.

Due to the lag in emission control regulations until 1996, diesel engines used in construction equipment are typically more polluting than those used for normal highway applications. It is estimated that 47 percent of mobile source diesel PM emissions nationwide comes from nonroad diesels and 25 percent of mobile source NOx comes from nonroad diesels. The reduction of diesel emissions from construction equipment has the potential to significantly improve air quality for those who live or work in or adjacent to construction sites. With the approval of the U.S. EPA Clean Air Nonroad Diesel Rule (see www.epa.gov/nonroad-diesel/2004fr.htm) that is scheduled for implementation in 2008-2015 timeframe, diesel emissions reduction from nonroad engines will occur through the use of advanced diesel engine technology, ultra-low sulfur diesel fuel (15 ppm S max.), and advanced diesel exhaust emission control technology such as diesel particulate filters (DPFs) for reducing PM emissions, and selective catalytic reduction (SCR) systems and NOx adsorber catalysts for reducing NOx emissions. These EPA Tier 4 emission standards for nonroad engines will apply to diesel engines used in most kinds of construction, agricultural, and industrial equipment. Technologies for complying with the Tier 4 nonroad diesel regulations will flow from the experience gained in complying with EPA's 2007-2010 heavy-duty highway diesel program (see www.epa.gov/OMSWWW/diesel.htm). However, due to the long operating lives of these diesel engines, it will take decades for older, "dirtier" nonroad diesel engines to be replaced with the mandated, newer "cleaner" engines. Given the health and environmental concerns associated with diesel engines and because the nonroad engines make up a significant percentage of diesel pollution emitted, there is an increasing interest in retrofitting the older nonroad diesel engines.

The case studies discussed in this paper focuses on those projects that have been completed, are in progress, or have received funding for retrofitting diesel-powered construction equipment with emission control technology. Many of the projects highlight the feasibility of installing verified onroad technologies on construction equipment and relate some of the lessons learned that may assist others in planning new construction equipment retrofit projects. The limited range of experience with retrofits on construction equipment summarized in this report also serves to point out the need for expanding the range of verified retrofit technology options for nonroad diesel applications in general, and construction equipment in particular. This paper focuses on technology-based strategies and, where available, provides information on the specific type of technology installed on the type of construction equipment and the emission reduction that was achieved. For more detailed descriptions of available emission control technologies that can be retrofit on existing onroad and nonroad diesel engines, please see MECA's white paper, *Retrofitting Emission Controls On Diesel-Powered Vehicles* (see www.meca.org or the MECA diesel retrofit web site: www.dieselretrofit.org).

2.0 Completed or Current Projects

2.1 The Central Artery/Tunnel (CA/T) Project, Boston, MA

The Central Artery/Tunnel (CA/T) Project, also known as the "Big Dig", is a major highway construction project designed to reduce traffic congestion and improve mobility in central Boston. The project requires the use of heavy-duty construction equipment in a concentrated area. Under a Clean Air Construction Initiative Program, 25 percent of long-term nonroad diesel equipment used in constructing the CA/T Project has been retrofitted with advanced pollution control devices, with more than 200 pieces of equipment retrofitted.

The construction equipments were retrofitted with diesel oxidation catalysts (DOCs) over diesel particulate filters (DPFs) because of the reduction in hydrocarbon (HC) associated with diesel odors and carbon monoxide (CO) and PM_{10} provided by DOC, the ease of installation and maintenance, and the cost of a DOC compared to DPF that allowed more pieces of equipment to be retrofitted with the available funds. In addition to retrofitting with emission control devices, the project included assigning staging zones for waiting trucks and limiting idling to not more than five minutes. The construction equipment was also refueled with ultra-low sulfur diesel (ULSD) and emulsified diesel fuels.

Equipment retrofitted with DOCs includes:

- Nichi, Caterpillar, SIC, Terex, and JLG lifts
- Mantis cranes
- John Deere and Caterpillar dozers
- Cradel excavators

The model years of the equipment ranged from 1994 to 2000, with most of the equipment being 1999 or 2000 model year. According to the contractors, the equipment retrofitted with DOCs has not experienced any adverse operational problems, such as loss of power or additional fuel consumption. During the pilot program, the Environment Canada used a portable emission-testing device and several DOCs will be removed and sent to Environment Canada for emission testing in subsequent evaluations.

To date, preliminary estimates from 2000-2004 of area-wide emission reductions from the retrofitted equipment indicate a reduction of approximately:

- 36 tons/year of CO,
- 12 tons/year of HC, and
- 3 tons/year of PM

More information on this project can be found at: www.massturnpike.com/bigdig/background/airpollution.html.

2.2 I-95 New Haven Harbor Crossing Corridor Improvement Program, New Haven, CT

As part of the Connecticut's Clean Air Construction Initiative, the I-95 New Haven Harbor Crossing Corridor Improvement Program, also known as the Q-Bridge Project, has successfully installed DOCs on approximately 70 pieces of construction equipment. The construction contractors have also volunteered to use low sulfur diesel (500 ppm sulfur) on all of their nonroad equipments. The Initiative was established to protect workers and residents from harmful construction emissions along a populated corridor. The contractors are required to implement the following:

- Install emissions control devices on nonroad diesel-powered construction equipment with engine horsepower ratings of 60 hp and above, that are on the project or assigned to the contract for more than 30 days;
- Truck staging zones will be established for diesel-powered vehicles to wait to load or unload;
- Idling is limited to three minutes for delivery and dump trucks and other diesel-powered equipment, with some exception;
- All work must be conducted to ensure that no harmful effects are caused to adjacent sensitive areas;
- Diesel-powered engines must be located away from fresh air intakes, air conditioners, and windows.

The construction began in 2003 and is scheduled to be completed in 2013. All contractors and sub-contractors are required to participate in the Connecticut Clean Air Construction Initiative by the ConnDOT. As bid by each contractor, the costs of purchasing DOCs and/or using clean fuels were included in the overall contract cost. Thus far, all the contractors have decided to install DOCs instead of using clean fuels, such as emulsified diesel fuel. More information on this project can be found at: www.i95newhaven.com/poverview/environ_init.asp.

2.3 Dan Ryan Expressway Road Construction Project

The Illinois Department of Transportation (IDOT) implemented a pollution reduction initiative on the reconstruction project of the Dan Ryan Expressway that runs through the middle of the south side of Chicago. Through this project, all heavy construction equipment on the Dan Ryan project will be either retrofitted with emissions control device or will use ULSD fuel (15 ppm sulfur). IDOT has also implemented idling limits and dust controls to reduce air emissions from construction activities. An estimated 290 pieces of construction equipment in use on the Dan Ryan project will have emissions control device or will use ULSD. Funded in part through a grant of $60,000 from U.S. EPA, these emissions control strategies are a contract requirement for equipment operating on the Dan Ryan project. The focus of this project is on reduced idling, with contractors required to establish truck staging areas while waiting to load or unload, and the idle time is limited to no more than 5 minutes. The Illinois Tollway Authority has also adopted IDOT's Initiative and is requiring the use of either ULSD fuel or retrofitting heavy construction equipment on the reconstruction and widening projects along several highways. The project is

estimated for completion in August 2007. More information on this project can be found at: www.danryanexpressway.com.

2.4 New York City Local Law No. 77

New York City Local Law No. 77 was signed into law on December 22, 2003 and requires the phase-in use of ULSD and best available technology (BAT) for emission control in all diesel-powered nonroad vehicles used in city construction projects. It applies to all diesel nonroad vehicles with an engine rated at 50 hp or greater that is owned by, operated by or on behalf of, or leased by a city agency. From December 19, 2005 on, any solicitation for a public works contract less than $2 million must specify that the contractors use Best Available Technology (BAT), but this schedule has been delayed. The Commissioner of the New York City Department of Environmental Protection will update the list of approved technology at least every six months, and includes those technologies verified by EPA or ARB. The requirements of Local Law No. 77 are enforced with penalties for those contractors that violate the provisions of the law, such as civil fine between $1,000 and 10,000 plus twice the amount of money saved by the contractor failing to comply with the requirements. More information on Local Law No. 77 can be found at: www.nyccouncil.info/pdf_files/bills/law03077.pdf.

2.5 WTC Diesel Emissions Reduction Project

The 7 WTC Diesel Emissions Reduction Project is a national model for demonstrating clean construction by using ULSD and retrofit nonroad, heavy-duty diesel construction equipment with DOCs or DPFs. The WTC Diesel Emissions Reduction Project is the first public/private initiative in New York construction market focused on reducing emissions from heavy-duty diesel construction equipment that was initiated by Clean Air Communities (CAC). The project plan calls for immediate use of ULSD fuel for selected equipment on-site and the phase-in of retrofit technologies on equipment owned by participating contractors or sub-contractors working at the 7 WTC site. CAC provides technical support and funding to construction contractors working at 7 WTC to implement ULSD fuel and to retrofit selected equipment. Funding has also been provided to construction corporations and transit fleets operating in the vicinity of 7 WTC in partnership with the Battery Park City Authority. The CAC project will retrofit 8 pieces of construction equipment at the WTC site and 10 pieces of equipment will use the ULSD fuel. More information on this project can be found at: www.cleanaircommunities.org/projects/wtc.html

In order to investigate diesel emission reduction from nonroad construction equipment at the World Trade Center, the Port of Authority of New York and New Jersey initiated a project designed to investigate the use of emission reduction strategies for several pieces of equipment with focus on PM reduction. The construction equipment selected for the project included two Caterpillar 966G wheel loaders and one Caterpillar 2,000 kW generator. First of the emission reduction strategy was to switch the fuel to ultra low sulfur diesel (ULSD) fuel and then the wheel loaders were retrofitted with DPFs. DPFs installed for the project utilized passive regeneration technology. Caterpillar, Inc. installed the DPF into the wheel loader exhaust system with a complete retrofit replacement kit that is a direct replacement for the original muffler. Because it was determined that the generator was unsuitable candidate for a DPF due to the lack of sufficient exhaust temperature, no emissions test was conducted on the generator. To quantify the emission reduction achieved with the ULSD and DPF, portable emission monitoring systems (PEMS) were installed on the wheel loaders. Two independent portable systems were installed simultaneously because no one system can provide the emission measurement metrics requested by the Port Authority: 1) the Clean Air Technologies International Montana system, and 2) the Environment Canada DOES2 system. Emission testing on the wheel loaders was performed to determine reduction efficiency performance of deploying ULSD and a DPF with ULSD against onroad diesel fuel. Emission testing was performed over a two-week period. The two loaders, TG-22 and TG-25 were exercised through a complete testing sequence one at a time. The following testing sequence was used:

- DPF and ULSD;
- OEM muffler and ULSD; and
- OEM muffler and on-road diesel fuel

The tests were run for each configuration until a minimum of three acceptable test runs were established. The test results are as follows:

PM Emissions Result

Significant PM emission reductions were documented as a result of implementing ULSD and installing DPFs. Both of the portable emissions monitoring systems found PM emission reduction in the 15 to 20 percent range when just ULSD was used and greater than 90 percent reduction when ULSD was combined with a DPF.

Table 1. PM Emission Test Results

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	3.964	---	1.551	---
ULSD	None	3.464	12.6	1.289	16.9
ULSD	DPF	0.100	97.5	0.011	99.3

CO Emissions Result

Significant CO emission reductions were observed during this program when the DPF was employed.

Table 2. CO Emission Test Results

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	25.64	---	25.23	---
ULSD	None	22.98	10.4	24.84	1.5
ULSD	DPF	3.43	86.6	2.15	91.5

HC Emissions Result

Results from switching from onroad diesel to ULSD alone indicate a net increase in HC emissions. However, a 97 percent reduction is achieved by switching to ULSD and using the DPF.

Table 3. HC Emission Test Results

Fuel	Retrofit Technology	Environment Canada PEMS	
		g/gal	% reduction
On-road diesel	None	1.26	---
ULSD	None	1.93	-52.7
ULSD	DPF	0.03	97.4

Note: Because the CATI Montana system is not equipped with a heated sample line, the HC total mass and real-time data is considered anecdotal and is not presented

NOx Emissions Result

The program as developed by the Port Authority did not target NOx reductions, and the emission test results indicate approximately 16 percent reduction as a result of switching fuels and between about 20 to 30 percent by using the DPF. Applications of DPFs is not expected to impact NOx emissions and the results reported here may be related to engine backpressure effects associated with operations utilizing a DPF.

Table 4. NOx Emission Test Result

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	100.0	---	123.0	---
ULSD	None	84.5	15.6	103.7	15.7
ULSD	DPF	80.4	19.7	87.93	28.5

CO_2 Emissions Result

The test results show that there was little difference in CO_2 results between fuel/retrofit technology configurations. The reductions shown are partially attributable to the differences in hydrogen and carbon content of the two fuels

Table 5. CO_2 Emission Test Result

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	10,275	---	11,808	---
ULSD	None	9,714	5.5	11,298	4.3
ULSD	DPF	9,749	5.1	11,340	4.0

More information on this project is available at:
www.mjbradley.com/documents/PANYNJ_WTC_Final_Report-09Aug04.pdf

2.6 LAX Master Plan Program: Community Benefits Agreement

As part of the LAX Master Plan Program, the Community Benefits Agreement provides a range of community benefits and impact mitigations that will be implemented by the Los Angeles World Airports (LAWA). Included in this Agreement is the requirement to retrofit all diesel construction equipment with best available emissions control devices to firstly reduce diesel PM and then NOx secondly. This requirement for retrofit applies to all diesel-powered nonroad equipment, onroad equipment, and stationary diesel engines. The emission control devices must be verified or certified by EPA or ARB for onroad or nonroad vehicles. Additionally, as part of a Demonstration Project, LAWA may allow diesel construction equipment used at a LAX Master Plan Program construction site to be retrofitted with a new emission control device that have not yet been certified or verified by ARB or EPA for use for onroad or nonroad vehicles or engines. LAWA, in consultation with the Coalition Representative and LAWA contractors, must develop processes to determine if a Demonstration Project using a new emission control device is needed, and how the project will be implemented. All emission control device installed on the diesel engines must achieve emission reduction no less than the reduction that could be achieved by an ARB Level 2 device (50-85% PM reduction efficiency). The emission reduction device may not increase the emission of any pollutant above the level that is standard for that engine. In order to determine the best available emission control devices for new technology that may become available in the future, the new emission control devices must meet a cost-effectiveness threshold of $13,600 per ton of NOx reduced. For $PM_{2.5}$ and PM_{10} reduction, any diesel particulate filter, diesel oxidation catalyst, or other technology on EPA or ARB verified list are considered to be cost-effective.

In addition to diesel construction equipment retrofit requirement, all construction equipment used for LAX Master Plan Program must use ultra-low sulfur diesel (ULSD) fuel, provided that there is an adequate supply in the Southern California area. If adequate supply of ULSD is not available, other fuels that do not emit greater emissions of fine PM or NOx than would using ULS, could be used.

Designation of the best available emission control devices will be reassessed annually and LAWA must establish processes to revise these designations and include them into construction bid documents before bidding of new construction phases of the LAX Master Plan Program. LAWA must also ensure that the requirements for installing diesel emission control devices and the use of ULSD are followed by all Airport Contractors, Airport Lessees, and Airport Licensees. Violation of these requirements is subject to a fine of $1,000 per day per violation. Compliance with these requirements will be monitored by an independent third party monitor. Diesel equipment manufactured before 1990 must be retrofitted with DOCs verified by ARB for use on nonroad diesel engines by December 31, 2005. If no verified DOC exists for the particular diesel equipment on or before June 30, 2003, the installation schedule is delayed until ARB can make the appropriate findings to support verification. If ARB verified DPFs are shown to be available and technically feasible, safe, reliable and cost effective for the pre-1990 diesel equipment, it must be retrofitted with the DPF by December 31, 2010. For diesel equipment that is manufactured in or after 1990, verified DPFs or verified DOCs must be installed within 36 months of ARB verification of the technology.

More information on the Community Benefits Agreement is available at: www.laane.org/lax/index.html.

2.7 The Impact of Retrofit Exhaust Control Technologies on Emissions from Heavy-Duty Diesel Construction Equipment (SAE paper no. 1999-01-0110)

The testing program was conducted to study the in-use emissions and duty cycles from five heavy-duty construction vehicles and examine the emission reduction potential of retrofit control technologies on construction equipment, such as DOCs, passive DPF, and active DPF technologies. For this study, the following emissions reduction devices were installed:

- Backhoe was equipped with an active uncatalyzed particulate filter that was designed to operate a full shift and then at the end of the shift, regenerate using in-line electrical burners powered by 220 V shore power. The substrate was a 100 cells/inch^2 cell wall flow filter.
- Volvo front end loader was retrofitted with an oxidation catalyst with substrates in parallel 19 cm diameter and 13 cm length. The catalyst contained 300 cells/inch^2 and had a total volume of 7 liters. The catalyst washcoat contained a proprietary zeolite and the precious metal catalyst is platinum based. The unit was a direct replacement of the stock muffler.
- Caterpillar front end loader was retrofitted with a catalyzed particulate filter 100 cells/inch^2. The washcoat is a proprietary precious metal coating.
- Dump truck was retrofitted with an oxidation catalyst that is 3 cm in diameter. The catalyst contains 300 cells/inch^2 with a proprietary precious metal washcoat. The catalyst was a direct replacement of the stock muffler.
- Bulldozer was retrofitted with an oxidation catalyst specifically designed for this application. It contains 200 cells/inch^2 and has a proprietary precious metal coating.

After conducting the tests on each of the five construction equipments along with baseline emissions tests, it was concluded that:

- Dumptruck, equipped with DOC, showed PM reduction of 17%; however, the conversion of the gaseous emissions was low;
- Backhoe, equipped with active DPF, showed PM reduction of 81%;
- Bulldozer DOC system showed PM reduction of 24%, CO emissions were also significantly reduced while HCs were not reduced;
- Caterpillar wheeled loader, equipped with catalyzed DPF, showed a combination of 97% PM reduction and excellent gaseous control; and
- Volvo wheeled loader, equipped with DOC, showed PM reduction of 52% (during the tests a leak developed in the mass flow controller and made it difficult, if not impossible to determine the absolute emission rates).

This test program confirmed that retrofitting exhaust emission control technologies to nonroad construction equipment is feasible and that real in-use emission reductions can be achieved Based on the results of this study, retrofitting 200,000 diesel construction equipment with DOCs in the Northeast would reduce PM emissions up to 4,000 tons/year, CO up to 45,000 tons/year, and HCs up to 7,000 tons/year. Retrofitting 200,000 construction equipments with DPFs would reduce PM emissions up to 15,000 tons/year, CO up to 109,000 tons/year, and HCs up to 17,000 tons/year.

2.8 Demonstration Projects for Diesel Particulate Filter Technologies on Existing Off-Road Heavy-Duty Construction Equipment

The South Coast Air Quality Management District (SCAQMD) and California ARB jointly initiated a project to evaluate the durability and effectiveness of passive DPF technology installed on existing nonroad diesel construction equipment. The focus of the project was the installation of 21 PM filters onto 15 diesel engines that are used on 12 heavy-duty construction vehicles. The demonstration study comprised of engineering and retrofitting the construction equipment and monitoring their operation for a period of one year. The effectiveness and durability of the filters and their installation hardware were measured and laboratory dynamometer emission testing under various steady-state and transient conditions was also conducted. The Los Angeles County Sanitation District (LACSD) provided six vehicles (scrapers and dozers) that were fueled with ULSD fuel and two scrapers and two dozers were also operated as control vehicles to provide baseline information for fuel economy, oil consumption, and reliability performance against the vehicles retrofitted with the DPFs. C.W. Poss Construction, Inc. (Poss) also provided six vehicles (scrapers and dozers) as the study vehicles but did not operate any control vehicles. Two different manufacturers provided the DPFs for the construction equipment.

Vehicles and DPFs used:

- LACSD vehicles: 1996 vintage 657 E scrapers, and 2000 vintage D9 dozers
- Poss vehicles: Caterpillar 651 B scrapers and Caterpillar 824/825/834 series dozers manufactured between 1971 and 1983
- DPFs from supplier A: 20"x15" filters for all applications, except for one 15"x15" used on an 825C dozer with a Caterpillar 3406 engine
- DPFs from supplier B: 20"x15" filters on most applications

The final equipment selections are as follows:

- A total of 12 vehicles were retrofitted in the study: 6 with DPFs from supplier A and 6 with DPFs from supplier B; with 6 of the test vehicles located at LACSD and 6 at Poss
- A total of 15 engines were retrofitted: 8 with DPFs from supplier A and 7 with DPFs from supplier B; with 9 located at LACSD and 6 at Poss
- A total of 21 filters were involved in the program: 12 from supplier A and 9 from supplier B; with 12 located at LACSD and 9 located at Poss

After operating these construction equipments with DPFs for a period of one year, filters from suppliers A and B were tested at the West Virginia University (WVU) Engines and Emissions Research Laboratory. Dynamometer tests on a Caterpillar engine using both transient and 8-mode steady-state duty cycles were conducted. The test showed that DPFs from both suppliers were highly effective in reducing PM emission on the dynamometer tests. Both pre- and post-demonstration testing by WVU on the filter from supplier B showed more than 98 percent PM emissions reduction. Pre-demonstration test of the filter from supplier A showed greater than 98 percent PM emissions reduction, while the post-demonstration testing showed approximately 91 percent PM emission reduction. None of the filters from suppliers A and B affected the levels of total NOx significantly, while the traps greatly reduced the levels of HC and CO emissions (about 79 and 65 percent for the filter from supplier A, respectively, and 93 and 97 percent for the filter from supplier B, respectively).

Table 6. Post-Demonstration Dynamometer Emissions Test Results

Emission Type	Fuel Type	8-mode Weighted Average (g/bhp-hr)	Transient Cycle (g/bhp-hr)	% Reduction vs. ECD1 Baseline (Transient Test)
PM	ECD1 Baseline	0.17	0.33	0%
	EDC1-Supplier B	0.01	0.00	>99%
	EDC1-Supplier A	0.01	0.03	90.9%
NOx	ECD1 Baseline	6.52	6.40	0%
	EDC1-Supplier B	6.14	6.05	5.5%
	EDC1-Supplier A	5.96	5.96	6.9%
HC	ECD1 Baseline	0.12	0.30	0%
	EDC1-Supplier B	0	0	>99%
	EDC1-Supplier A	0	0	>99%
CO	ECD1 Baseline	1.31	2.10	0%
	EDC1-Supplier B	0.24	0.16	92.4%
	EDC1-Supplier A	0.03	0.21	90.0%

In evaluating the durability and reliability of the filters, filters from supplier B at LACSD initially performed well, but backpressure began to rise on all units equipped with the larger filters within 400 to 500 hours of operation. Inspection of the filter showed that the ceramic trap elements had "shifted" out of the canister on all of the larger units. These systems were replaced or re-canned. Since then, new filters with new banding design have accumulated approximately 1,000 hours of operation and the original filters that were re-canned using new banding design have accumulated approximately 2,500 hours. The filters from supplier B performed well on 1996 vintage and newer diesel engines, but were deemed incompatible with the 1970s vintage Poss diesel engines. The filters from supplier A showed excellent durability and reliability throughout the demonstration period with only one failure on a D9 dozer at LACSD. In this failure, the ceramic filter inside the canning shifted and was broken up, causing excessive backpressure and loss of power.

Although basic DPF performance was validated for use on heavy-duty diesel construction equipment, many challenges still remain with installing and mounting large DPFs on large construction equipment. These challenges are compounded by the fact that higher horsepower engines like those tested in this program required two very large filter sizes to handle the high-volume exhaust flow of the engines.

2.9 Reliability of DPF-Systems: Experience with 6000 Applications of the Swiss Retrofit Fleet (SAE paper no. 2004-01-0076)

In 2000, the occupational health agencies of Switzerland (Suva) declared that DPFs are essential for underground workplaces. The environmental agencies of the Swiss federal government (BUWAL) followed in mid-2002 with the Ordinance on Protecting Air Quality at Construction Sites (BauRLL) all over Switzerland. DPFs were first retrofitted onto large public construction sites, with emphasis on air quality in tunnel projects and their associated labor intensive activities. As of 2003, approximately 6,500 construction equipment have been retrofitted with DPFs. This study was conducted to evaluate the filtration quality of VERT-Test compliant traps in both their new state and after 2,000 operating hours. The report examined trap failures, their causes and prevention based on information from manufacturers, retrofitters, and independent inspections.

The first reliability test was conducted in October 2000, asking the manufacturers and retrofitters for feedback. Failure rates in this first survey were in the 5 to 6 percent range. A new survey was conducted in October 2003, based mainly on information provided by manufacturers and retrofitters on overall failure rates. This later survey showed an annual failure rate is below 2 percent. Causes of failure include: defective canning; material defects; faulty gluing of the segmented filters and other manufacturing defects causing functional deficiencies; customer's handling accidents; and operational errors such as using high sulfur fuels with catalyzed filters.

The experience with this large retrofitted fleet shows the applicability of DPFs for all types of diesel construction equipment. It also demonstrated that DPFs are technically, operationally, and economically feasible and that there are no major obstacles to large scale retrofitting of DPFs to existing diesel engines.

A database of DPFs verified by VERT for the Swiss diesel retrofit program is available at: www.akpf.org/index.html.

2.10 City of Houston Diesel Field Demonstration Project

In order to address the air pollution contribution from each City of Houston department, the City established a comprehensive Emission Reduction Plan (ERP) in June 2000. The main goal of the ERP is to reduce NOx emission by 50 to 75 percent and $PM_{2.5}$ by at least 25 to 33 percent. Under the Diesel Field Demonstration Project a number of diesel emissions control devices were evaluated in the field on various vehicles and equipment, including construction equipment, during the summer of 2000 through the fall of 2001. The goal of the project was to identify retrofit emission control systems that can achieve 75 percent NOx reductions and at least 25 to 33 percent reduction in fine particulates.

Environment Canada performed the gaseous and particulate exhaust emissions testing on the City of Houston fleet vehicles at Ellington Field, Houston, Texas. A total of 29 units were selected to be representative of the fleet, of which 26 were field tested with emissions control devices. In addition to demonstrating the effectiveness of emissions control devices, the program also evaluated various emulsified diesel fuel formulations. Several manufacturers provided various emissions control technologies to demonstrate the effectiveness of these devices to reduce exhaust emissions. Diesel retrofit technologies evaluated included DOCs, passively regenerated DPFs, and SCR systems. With respect to construction equipment, this project evaluated three different retrofit technology options on a 1992 MY Cummins Gradall G3WD 6BTA 5.9L 190 hp: DOC + emulsified diesel fuel, an SCR system, and a combined DPF + SCR system.

After installation, the vehicle was returned to regular service for a period of time advised by the manufacturer to degreen the device. At the end of this period, emissions testing were performed with the device installed. The following is the summary of results from emissions testing with emissions reduction devices installed:

Table 7. Summary of Emission Testing Results

Vehicle	Technology Installed	% NOx Reduction from baseline	% TPM Reduction from baseline
Gradall G3WD	DOC + Emulsified Diesel	34.8	76.3
Gradall G3WD	SCR	78.2	26.7
Gradall G3WD	DPF + SCR	84.0	91.9

More information on this project is available at: www.arb.ca.gov/msprog/ordiesel/Documents/houston_demo_project.pdf.

As a result of the field demonstration program described above, SCR was selected as one of the technologies to be used on City fleet equipment. This City of Houston Fleet Retrofit project involves retrofitting 33 rubber tire excavators with SCR and one SCR system was installed on a 2003 model year dump truck. In addition, the City has retrofitted about 30 to 40 nonroad engines such as backhoes and water pumps with DOCs. This program will include emission testing at the University of Houston's testing facility with chassis dynamometer to quantify the emission reductions achieved with the retrofit technologies. This project is funded by the Texas Council on Environmental Quality (TCEQ) with Texas Emission Reduction Program (TERP) funds and the Houston-Galveston Area Council with Congestion Mitigation and Air Quality (CMAQ) funds in the amount of $500,000 for the SCR systems.
The vehicles and equipments that were retrofitted include:

- Gradall rubber-tire excavators powered by 1994 to 2000 MY Cummins 5.9L 190 hp engines
- 2003 MY dump truck powered by a Cummins ISC 315 330 hp engine

As of February 18, 2005, all 33 ditch excavators were equipped with an initial design SCR system and the SCR system will be upgraded to increase the level of emission reduction. The SCR systems that were installed included a DOC and a warning signal to indicate when the ammonia supply was getting low. The SCR system was not verified at the time it was installed on the equipment. However, the Houston program helped to provide data for the eventual ARB verification of the SCR for application on nonroad 1991-1995 Cummins 5.9L from 150-200 hp engines. The SCR systems on the excavators will be upgraded with a SCR system that will include a hybrid DPF used with ULSD to achieve greater PM emission reduction. The SCR systems have been in operation for up to three years and have reported no major problems. For more information on this project, go to Appendix B of the Final Draft of *Diesel Retrofit Technology and Program Experience* report at: www.epa.gov/cleandiesel/publications.htm.

2.11 Port of Seattle, Sea-Tac International Airport Project

In order to meet conformity commitment to keep NOx emissions from construction projects to less than 100 tons per year, the Port of Seattle initiated a project to reduce NOx emissions from construction activities at Sea-Tac's Runway Three. In 2002, a pilot program was initiated fueling onroad and nonroad vehicles with ULSD. With the success of the program, all vehicles and equipment used in the construction of Runway Three started being fueled with ULSD in February 2004. The next phase of the project involves retrofitting up to 10 or more nonroad engines with DOCs. For this phase, muffler replacement DOCs, rather than DPFs, are planned because some of the equipments emit high levels of PM. Backpressure monitors will also be installed. For more information on this project, go to Appendix B of the Final Draft of *Diesel Retrofit Technology and Program Experience* report at: www.epa.gov/cleandiesel/publications.htm.

3.0 Funded Projects

3.1 2005 National Clean Diesel Campaign Demonstration Grant Construction Projects

On November 7, 2005, U.S. EPA announced grant awards of more than $1 million to ten grantees to implement projects to demonstrate effective emissions reduction strategies for nonroad equipment and vehicles. The purpose of the grants is to demonstrate a wide variety of technologies such as cleaner fuels, and diesel retrofit devices (DOC, DPF, and engine replacement) for nonroad sector. Below is the list of funded projects:

- *City and County of Denver, Colorado*: The City and County of Denver will install DOCs on diesel alley and street paving fleets operating in low-income and underserved communities. This project has been awarded $125,000.
- *American Lung Association of Hawaii*: The American Lung Association of Hawaii will replace older, dirtier diesel construction equipment engines with newer, cleaner engines to reduce air pollution on Oahu and Kauai. This project has been awarded $135,000.
- *Idaho Department of Environmental Quality (DEQ)*: The Idaho DEQ will install DOCs and closed crankcase ventilation systems on portable diesel generators that power rock crushers and hot mix asphalt plants. This project has been awarded $100,000.
- *Maryland Department of Environment*: The Maryland Department of Environment will install DPFs on front end loaders at landfills in the City of Baltimore. This project has been awarded $50,000.
- *Massachusetts Executive Office of Environmental Affairs*: The Massachusetts Executive Office of Environmental Affairs will retrofit construction equipment with diesel retrofit devices and use ULSD fuel. This project has been awarded $120,000.

- *New York State Energy Research and Development Authority (NYSERDA)*: NYSERDA will retrofit nonroad fleets as part of a research project to identify best available retrofit technologies. This project has been awarded $100,000.
- *Oregon-Columbia Chapter of Associated General Contractors (AGC)*: AGC will install retrofit technologies to diesel equipments used in highway bridge replacement projects and use ULSD fuel. This project has been awarded $120,000.
- *York Technical College*: York Technical College and several local municipalities will retrofit nonroad equipments with DOCs. This project has been awarded $95,040.
- *Wisconsin Department of Natural Resources (DNR)*: Wisconsin DNR will install DOCS on construction equipment and use ULSD fuel. This project has been awarded $100,000.

For more information on the National Clean Diesel Campaign 2005 grants, go to: www.epa.gov/cleandiesel/awarded-grants.htm.

3.2 West Coast Diesel Emissions Reduction Collaborative Construction Projects

East Side Combined Sewer Overflow Project

The City of Portland's Combined Sewer Overflow (CSO) program is the largest public works project in the history of the State of Oregon, comprising three "Big Pipe" projects: the Columbia Slough Consolidation Conduit; the West Side "Big Pipe"; and the East Side "Big Pipe". The East Side CSO Tunnel or "Big Pipe", to begin in 2006, is the final and largest of the projects in Portland's 20-year program. During this five year construction project, approximately 150 diesel powered vehicles will be used for construction. The proposed project plan will require the use of ULSD in all project vehicles, use equipment that comply with EPA Tier 2 requirements for nonroad engines at a minimum and install best available retrofit emission control devices, such as DPF, DOC or wire mesh flow-through filters. The funding for the fuel premium will be paid by the contractor and ultimately the ratepayers in the city, but funding for retrofitting is requested from other sources to realize the full environmental and public health benefits that are available. The project is scheduled to be completed in 2011. More information on this project is available at: www.portlandonline.com/cso.index.cfm?c=31727.

City of Fresno Wastewater Treatment Facility Retrofit Project

City of Fresno, Fleet Management Division has agreed to participate in a demonstration program to retrofit three pieces of nonroad equipment with a diesel retrofit technology currently verified by both EPA and ARB for onroad applications to reduce emissions of PM, NOx, VOC and CO. The equipment to be retrofitted is currently operated daily at a Wastewater Treatment Plant located in southwestern quadrant of the City of Fresno. The equipment will be retrofitted a combined lean NOx catalyst/DPF technology that is currently verified by ARB for PM and NOx reductions on a range of on-road diesel engines. This project will demonstrate the viability of a combined PM/NOx emission reduction technology in nonroad engines. The manufacturer of the retrofit technology will conduct all necessary field engineering work with Cummins West, Inc. and Cleaire will also be responsible for submitting the progress and final reports. The City of Fresno will make the equipments available as well as collect all necessary maintenance and operational data. More information on this project is available at: www.westcoastdiesel.org/projects.htm.

Washington Clean Construction: Feasibility Demonstration for Retrofit of Non-road Equipment Project

In order to reduce toxic air emissions, the Yakima Regional Clean Air Authority (YRCAA) is participating with six local air authorities, the Washington State Department of Ecology (Ecology), and the American Lung Association in a demonstration project to retrofit nonroad diesel equipments. In coordination with local air authorities, Ecology will implement a state-wide program to reduce emissions from diesel-powered construction equipment. The purpose of this demonstration project is to demonstrate to the public and private fleet owners of nonroad, diesel powered equipment, the feasibility of retrofitting these equipment with DOCs without disrupting fleet operations. Approximately 50 vehicles will be retrofitted with federal funding and in-kind contribution. More information on this project is available at: www.westcoastdiesel.org/projects.htm.

Construction Equipment Retrofit Demonstration Project

The Construction Equipment Retrofit Demonstration Project is a joint effort of the Collaborative, the Sacramento Metropolitan Air Quality Management District (SMAQMD), and a retrofit technology manufacturer to retrofit five pieces of heavy construction equipment with emission-reducing device. The demonstration project will then evaluate the viability of the retrofit technologies to reduce PM and, to the extent feasible, NOx, HC, and CO emissions. This project will be funded through a $211,000 grant from EPA and $14,000 from SMAQMD. The goal of the demonstration project is to install emission control devices to five pieces of construction equipment to reduce annual diesel emissions by more than 85 percent for PM, up to 25 percent for NOx, and up to 90 percent for CO. More information on this project is available at: www.westcoastdiesel.org/grants/files/Construction%20Equipment%20Retrofit%20Fact%20Sheet.pdf.

Oregon Construction Equipment Emissions Reduction Project

The Oregon Environmental Council (OEC) will work with builders, state environmental officials, the City of Portland, and other jurisdictions to reduce construction equipment diesel emissions. Through diesel engine retrofits, cleaner fuels, and idle reduction policies, the project aims to reduce diesel emissions from construction equipment used in the City of Portland by at least 20 percent. After the evaluation of the project results, the project's most efficient methods may be applied to reducing construction equipment emissions along the West Coast. This project will be funded through a $26,000 grant from EPA, and $27,000 from OEC. More information on this project is available at: www.westcoastdiesel.org/grants/files/OEC_Construction_Reduction_fact%20sheet.pdf.

4.0 Summary

As shown by the above case studies, experience with retrofitting construction equipment with emission control devices is growing. The majority of the retrofit experience in construction equipment projects has been focused on demonstrating the feasibility of applying verified, onroad retrofit emission control technology on construction equipment and quantifying the diesel emission reductions achieved. Many of the projects have been initiated by the state, local, and federal agencies to promote interest in retrofitting construction equipment and facilitate other retrofit projects that may build on the successes and challenges learned from previous projects. Much of the experience with construction equipment retrofit projects has been with DOCs. This stems, in part, from the more universal applicability of diesel oxidation catalysts on existing diesel engines compared to other retrofit technology options. Experience to date with DPFs on in-use construction equipment is more limited due to the fact that the application of DPFs involves more engineering constraints with respect to the duty cycles and engine out emission characteristics of diesel engines used in construction equipment applications. Retrofit DPFs also generally require the use of ultra-low sulfur diesel fuel (ULSD). The availability of ultra-low sulfur diesel fuel for nonroad diesel engines will expand significantly as the rollout of ULSD for highway applications expands nationwide in the second half of 2006. Emerging onroad verified retrofit technologies such as actively regenerated DPFs and flow-through particulate filters should also find application in nonroad diesel engines and provide more options for significant reductions in diesel particulate emissions from construction equipment. Similarly, verified retrofit technologies that provide reductions in NOx emissions, such as lean NOx catalysts and SCR systems, will also migrate into the nonroad sector and see greater attention on construction equipment in the future. The construction equipment segment requires an expanded range of verified retrofit technologies to provide broader application coverage for the range of engines and equipment that are currently a part of the existing fleet.

There is an increased interest in the U.S. for retrofitting diesel construction equipment, largely due to the availability of more federal, state, and local incentive funds that can be used for these projects. One such funding source is the federal DOT/EPA Congestion Mitigation and Air Quality (CMAQ) Program. Funds from the CMAQ program have been used to pay for onroad diesel retrofit projects and now can be used for retrofit projects on nonroad engines used in construction projects in nonattainment or maintenance areas with respect to air quality. The CMAQ funding provides priority for diesel retrofit and other cost-effective emission reduction activities, with funding for the overall program of about $1.4 billion per year through 2009. These CMAQ funds are typically controlled at the state and local level, most often by metropolitan planning organizations. Other significant state sources of funding for construction retrofit projects are available in California through ARB's Carl Moyer incentive funding program (see www.arb.ca.gov/msprog/moyer/moyer.htm) and in Texas through the Texas Emission Reduction Plan (see www.tceq.state.tx.us/implementation/air/terp/). Other states are considering similar funding schemes for incentivizing retrofit projects involving onroad and offroad diesel engines. Through utilization of the available funding sources and building on the lessons learned from previous projects, the retrofit of construction equipment with emission control technology will become more widespread and provide an important tool for reducing emissions from the large number of existing nonroad diesel engines operating in the U.S.

Exhibit 13:

Manufacturers of Emission Controls Association
Case Studies of Construction Equipment, Diesel Retrofit Projects

Case Studies of Construction Equipment Diesel Retrofit Projects

March 2006

Manufacturers of Emission Controls Association
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1.0 Introduction

Diesel engines provide important fuel economy and durability advantages for large heavy-duty trucks, buses, and nonroad equipment. Although they are often the power plant of choice for heavy-duty applications, they have the disadvantage of emitting significant amounts of particulate matter (PM) and oxides of nitrogen (NOx), and lesser amounts of hydrocarbon (HC), carbon monoxide (CO) and toxic air pollutants.

Due to the lag in emission control regulations until 1996, diesel engines used in construction equipment are typically more polluting than those used for normal highway applications. It is estimated that 47 percent of mobile source diesel PM emissions nationwide comes from nonroad diesels and 25 percent of mobile source NOx comes from nonroad diesels. The reduction of diesel emissions from construction equipment has the potential to significantly improve air quality for those who live or work in or adjacent to construction sites. With the approval of the U.S. EPA Clean Air Nonroad Diesel Rule (see www.epa.gov/nonroad-diesel/2004fr.htm) that is scheduled for implementation in 2008-2015 timeframe, diesel emissions reduction from nonroad engines will occur through the use of advanced diesel engine technology, ultra-low sulfur diesel fuel (15 ppm S max.), and advanced diesel exhaust emission control technology such as diesel particulate filters (DPFs) for reducing PM emissions, and selective catalytic reduction (SCR) systems and NOx adsorber catalysts for reducing NOx emissions. These EPA Tier 4 emission standards for nonroad engines will apply to diesel engines used in most kinds of construction, agricultural, and industrial equipment. Technologies for complying with the Tier 4 nonroad diesel regulations will flow from the experience gained in complying with EPA's 2007-2010 heavy-duty highway diesel program (see www.epa.gov/OMSWWW/diesel.htm). However, due to the long operating lives of these diesel engines, it will take decades for older, "dirtier" nonroad diesel engines to be replaced with the mandated, newer "cleaner" engines. Given the health and environmental concerns associated with diesel engines and because the nonroad engines make up a significant percentage of diesel pollution emitted, there is an increasing interest in retrofitting the older nonroad diesel engines.

The case studies discussed in this paper focuses on those projects that have been completed, are in progress, or have received funding for retrofitting diesel-powered construction equipment with emission control technology. Many of the projects highlight the feasibility of installing verified onroad technologies on construction equipment and relate some of the lessons learned that may assist others in planning new construction equipment retrofit projects. The limited range of experience with retrofits on construction equipment summarized in this report also serves to point out the need for expanding the range of verified retrofit technology options for nonroad diesel applications in general, and construction equipment in particular. This paper focuses on technology-based strategies and, where available, provides information on the specific type of technology installed on the type of construction equipment and the emission reduction that was achieved. For more detailed descriptions of available emission control technologies that can be retrofit on existing onroad and nonroad diesel engines, please see MECA's white paper, *Retrofitting Emission Controls On Diesel-Powered Vehicles* (see www.meca.org or the MECA diesel retrofit web site: www.dieselretrofit.org).

2.0 Completed or Current Projects

2.1 The Central Artery/Tunnel (CA/T) Project, Boston, MA

The Central Artery/Tunnel (CA/T) Project, also known as the "Big Dig", is a major highway construction project designed to reduce traffic congestion and improve mobility in central Boston. The project requires the use of heavy-duty construction equipment in a concentrated area. Under a Clean Air Construction Initiative Program, 25 percent of long-term nonroad diesel equipment used in constructing the CA/T Project has been retrofitted with advanced pollution control devices, with more than 200 pieces of equipment retrofitted.

The construction equipments were retrofitted with diesel oxidation catalysts (DOCs) over diesel particulate filters (DPFs) because of the reduction in hydrocarbon (HC) associated with diesel odors and carbon monoxide (CO) and PM_{10} provided by DOC, the ease of installation and maintenance, and the cost of a DOC compared to DPF that allowed more pieces of equipment to be retrofitted with the available funds. In addition to retrofitting with emission control devices, the project included assigning staging zones for waiting trucks and limiting idling to not more than five minutes. The construction equipment was also refueled with ultra-low sulfur diesel (ULSD) and emulsified diesel fuels.

Equipment retrofitted with DOCs includes:

- Nichi, Caterpillar, SIC, Terex, and JLG lifts
- Mantis cranes
- John Deere and Caterpillar dozers
- Cradel excavators

The model years of the equipment ranged from 1994 to 2000, with most of the equipment being 1999 or 2000 model year. According to the contractors, the equipment retrofitted with DOCs has not experienced any adverse operational problems, such as loss of power or additional fuel consumption. During the pilot program, the Environment Canada used a portable emission-testing device and several DOCs will be removed and sent to Environment Canada for emission testing in subsequent evaluations.

To date, preliminary estimates from 2000-2004 of area-wide emission reductions from the retrofitted equipment indicate a reduction of approximately:

- 36 tons/year of CO,
- 12 tons/year of HC, and
- 3 tons/year of PM

More information on this project can be found at: www.massturnpike.com/bigdig/background/airpollution.html.

2.2 I-95 New Haven Harbor Crossing Corridor Improvement Program, New Haven, CT

As part of the Connecticut's Clean Air Construction Initiative, the I-95 New Haven Harbor Crossing Corridor Improvement Program, also known as the Q-Bridge Project, has successfully installed DOCs on approximately 70 pieces of construction equipment. The construction contractors have also volunteered to use low sulfur diesel (500 ppm sulfur) on all of their nonroad equipments. The Initiative was established to protect workers and residents from harmful construction emissions along a populated corridor. The contractors are required to implement the following:

- Install emissions control devices on nonroad diesel-powered construction equipment with engine horsepower ratings of 60 hp and above, that are on the project or assigned to the contract for more than 30 days;
- Truck staging zones will be established for diesel-powered vehicles to wait to load or unload;
- Idling is limited to three minutes for delivery and dump trucks and other diesel-powered equipment, with some exception;
- All work must be conducted to ensure that no harmful effects are caused to adjacent sensitive areas;
- Diesel-powered engines must be located away from fresh air intakes, air conditioners, and windows.

The construction began in 2003 and is scheduled to be completed in 2013. All contractors and sub-contractors are required to participate in the Connecticut Clean Air Construction Initiative by the ConnDOT. As bid by each contractor, the costs of purchasing DOCs and/or using clean fuels were included in the overall contract cost. Thus far, all the contractors have decided to install DOCs instead of using clean fuels, such as emulsified diesel fuel. More information on this project can be found at: www.i95newhaven.com/poverview/environ_init.asp.

2.3 Dan Ryan Expressway Road Construction Project

The Illinois Department of Transportation (IDOT) implemented a pollution reduction initiative on the reconstruction project of the Dan Ryan Expressway that runs through the middle of the south side of Chicago. Through this project, all heavy construction equipment on the Dan Ryan project will be either retrofitted with emissions control device or will use ULSD fuel (15 ppm sulfur). IDOT has also implemented idling limits and dust controls to reduce air emissions from construction activities. An estimated 290 pieces of construction equipment in use on the Dan Ryan project will have emissions control device or will use ULSD. Funded in part through a grant of $60,000 from U.S. EPA, these emissions control strategies are a contract requirement for equipment operating on the Dan Ryan project. The focus of this project is on reduced idling, with contractors required to establish truck staging areas while waiting to load or unload, and the idle time is limited to no more than 5 minutes. The Illinois Tollway Authority has also adopted IDOT's Initiative and is requiring the use of either ULSD fuel or retrofitting heavy construction equipment on the reconstruction and widening projects along several highways. The project is estimated for completion in August 2007. More information on this project can be found at: www.danryanexpressway.com.

2.4 New York City Local Law No. 77

New York City Local Law No. 77 was signed into law on December 22, 2003 and requires the phase-in use of ULSD and best available technology (BAT) for emission control in all diesel-powered nonroad vehicles used in city construction projects. It applies to all diesel nonroad vehicles with an engine rated at 50 hp or greater that is owned by, operated by or on behalf of, or leased by a city agency. From December 19, 2005 on, any solicitation for a public works contract less than $2 million must specify that the contractors use Best Available Technology (BAT), but this schedule has been delayed. The Commissioner of the New York City Department of Environmental Protection will update the list of approved technology at least every six months, and includes those technologies verified by EPA or ARB. The requirements of Local Law No. 77 are enforced with penalties for those contractors that violate the provisions of the law, such as civil fine between $1,000 and 10,000 plus twice the amount of money saved by the contractor failing to comply with the requirements. More information on Local Law No. 77 can be found at: www.nyccouncil.info/pdf_files/bills/law03077.pdf.

2.5 WTC Diesel Emissions Reduction Project

The 7 WTC Diesel Emissions Reduction Project is a national model for demonstrating clean construction by using ULSD and retrofit nonroad, heavy-duty diesel construction equipment with DOCs or DPFs. The WTC Diesel Emissions Reduction Project is the first public/private initiative in New York construction market focused on reducing emissions from heavy-duty diesel construction equipment that was initiated by Clean Air Communities (CAC). The project plan calls for immediate use of ULSD fuel for selected equipment on-site and the phase-in of retrofit technologies on equipment owned by participating contractors or sub-contractors working at the 7 WTC site. CAC provides technical support and funding to construction contractors working at 7 WTC to implement ULSD fuel and to retrofit selected equipment. Funding has also been provided to construction corporations and transit fleets operating in the vicinity of 7 WTC in partnership with the Battery Park City Authority. The CAC project will retrofit 8 pieces of construction equipment at the WTC site and 10 pieces of equipment will use the ULSD fuel. More information on this project can be found at: www.cleanaircommunities.org/projects/wtc.html.

In order to investigate diesel emission reduction from nonroad construction equipment at the World Trade Center, the Port of Authority of New York and New Jersey initiated a project designed to investigate the use of emission reduction strategies for several pieces of equipment with focus on PM reduction. The construction equipment selected for the project included two Caterpillar 966G wheel loaders and one Caterpillar 2,000 kW generator. First of the emission reduction strategy was to switch the fuel to ultra low sulfur diesel (ULSD) fuel and then the wheel loaders were retrofitted with DPFs. DPFs installed for the project utilized passive regeneration technology. Caterpillar, Inc. installed the DPF into the wheel loader exhaust system with a complete retrofit replacement kit that is a direct replacement for the original muffler. Because it was determined that the generator was unsuitable candidate for a DPF due to the lack of sufficient exhaust temperature, no emissions test was conducted on the generator. To quantify the emission reduction achieved with the ULSD and DPF, portable emission monitoring systems (PEMS) were installed on the wheel loaders. Two independent portable systems were installed simultaneously because no one system can provide the emission measurement metrics requested by the Port Authority: 1) the Clean Air Technologies International Montana system, and 2) the Environment Canada DOES2 system. Emission testing on the wheel loaders was performed to determine reduction efficiency performance of deploying ULSD and a DPF with ULSD against onroad diesel fuel. Emission testing was performed over a two-week period. The two loaders, TG-22 and TG-25 were exercised through a complete testing sequence one at a time. The following testing sequence was used:

- DPF and ULSD;
- OEM muffler and ULSD; and
- OEM muffler and on-road diesel fuel

The tests were run for each configuration until a minimum of three acceptable test runs were established. The test results are as follows:

PM Emissions Result

Significant PM emission reductions were documented as a result of implementing ULSD and installing DPFs. Both of the portable emissions monitoring systems found PM emission reduction in the 15 to 20 percent range when just ULSD was used and greater than 90 percent reduction when ULSD was combined with a DPF.

Table 1. PM Emission Test Results

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	3.964	---	1.551	---
ULSD	None	3.464	12.6	1.289	16.9
ULSD	DPF	0.100	97.5	0.011	99.3

CO Emissions Result

Significant CO emission reductions were observed during this program when the DPF was employed.

Table 2. CO Emission Test Results

Fuel	Retrofit Technology	Environment Canada PEMS		CATI PEMS	
		g/gal	% reduction	g/gal	% reduction
On-road diesel	None	25.64	---	25.23	---
ULSD	None	22.98	10.4	24.84	1.5
ULSD	DPF	3.43	86.6	2.15	91.5

and 8-mode steady-state duty cycles were conducted. The test showed that DPFs from both suppliers were highly effective in reducing PM emission on the dynamometer tests. Both pre- and post-demonstration testing by WVU on the filter from supplier B showed more than 98 percent PM emissions reduction. Pre-demonstration test of the filter from supplier A showed greater than 98 percent PM emissions reduction, while the post-demonstration testing showed approximately 91 percent PM emission reduction. None of the filters from suppliers A and B affected the levels of total NOx significantly, while the traps greatly reduced the levels of HC and CO emissions (about 79 and 65 percent for the filter from supplier A, respectively, and 93 and 97 percent for the filter from supplier B, respectively).

Table 6. Post-Demonstration Dynamometer Emissions Test Results

Emission Type	Fuel Type	8-mode Weighted Average (g/bhp-hr)	Transient Cycle (g/bhp-hr)	% Reduction vs. ECD1 Baseline (Transient Test)
PM	ECD1 Baseline	0.17	0.33	0%
	EDC1-Supplier B	0.01	0.00	>99%
	EDC1-Supplier A	0.01	0.03	90.9%
NOx	ECD1 Baseline	6.52	6.40	0%
	EDC1-Supplier B	6.14	6.05	5.5%
	EDC1-Supplier A	5.96	5.96	6.9%
HC	ECD1 Baseline	0.12	0.30	0%
	EDC1-Supplier B	0	0	>99%
	EDC1-Supplier A	0	0	>99%
CO	ECD1 Baseline	1.31	2.10	0%
	EDC1-Supplier B	0.24	0.16	92.4%
	EDC1-Supplier A	0.03	0.21	90.0%

In evaluating the durability and reliability of the filters, filters from supplier B at LACSD initially performed well, but backpressure began to rise on all units equipped with the larger filters within 400 to 500 hours of operation. Inspection of the filter showed that the ceramic trap elements had "shifted" out of the canister on all of the larger units. These systems were replaced or re-canned. Since then, new filters with new banding design have accumulated approximately 1,000 hours of operation and the original filters that were re-canned using new banding design have accumulated approximately 2,500 hours. The filters from supplier B performed well on 1996 vintage and newer diesel engines, but were deemed incompatible with the 1970s vintage Poss diesel engines. The filters from supplier A showed excellent durability and reliability throughout the demonstration period with only one failure on a D9 dozer at LACSD. In this failure, the ceramic filter inside the canning shifted and was broken up, causing excessive backpressure and loss of power.

Although basic DPF performance was validated for use on heavy-duty diesel construction equipment, many challenges still remain with installing and mounting large DPFs on large construction equipment. These challenges are compounded by the fact that higher horsepower engines like those tested in this program required two very large filter sizes to handle the high-volume exhaust flow of the engines.

2.9 Reliability of DPF-Systems: Experience with 6000 Applications of the Swiss Retrofit Fleet (SAE paper no. 2004-01-0076)

In 2000, the occupational health agencies of Switzerland (Suva) declared that DPFs are essential for underground workplaces. The environmental agencies of the Swiss federal government (BUWAL) followed in mid-2002 with the Ordinance on Protecting Air Quality at Construction Sites (BauRLL) all over Switzerland. DPFs were first retrofitted onto large public construction sites, with emphasis on air quality in tunnel projects and their associated labor intensive activities. As of 2003, approximately 6,500 construction equipment have been retrofitted with DPFs. This study was conducted to evaluate the filtration quality of VERT-Test compliant traps in both their new state and after 2,000 operating hours. The report examined trap failures, their causes and prevention based on information from manufacturers, retrofitters, and independent inspections.

The first reliability test was conducted in October 2000, asking the manufacturers and retrofitters for feedback. Failure rates in this first survey were in the 5 to 6 percent range. A new survey was conducted in October 2003, based mainly on information provided by manufacturers and retrofitters on overall failure rates. This later survey showed an annual failure rate is below 2 percent. Causes of failure include: defective canning; material defects; faulty gluing of the segmented filters and other manufacturing defects causing functional deficiencies; customer's handling accidents; and operational errors such as using high sulfur fuels with catalyzed filters.

The experience with this large retrofitted fleet shows the applicability of DPFs for all types of diesel construction equipment. It also demonstrated that DPFs are technically, operationally, and economically feasible and that there are no major obstacles to large scale retrofitting of DPFs to existing diesel engines.

A database of DPFs verified by VERT for the Swiss diesel retrofit program is available at: www.akpf.org/index.html.

2.10 City of Houston Diesel Field Demonstration Project

In order to address the air pollution contribution from each City of Houston department, the City established a comprehensive Emission Reduction Plan (ERP) in June 2000. The main goal of the ERP is to reduce NOx emission by 50 to 75 percent and $PM_{2.5}$ by at least 25 to 33 percent. Under the Diesel Field Demonstration Project a number of diesel emissions control devices were evaluated in the field on various vehicles and equipment, including construction equipment, during the summer of 2000 through the fall of 2001. The goal of the project was to identify retrofit emission control systems that can achieve 75 percent NOx reductions and at least 25 to 33 percent reduction in fine particulates.

Environment Canada performed the gaseous and particulate exhaust emissions testing on the City of Houston fleet vehicles at Ellington Field, Houston, Texas. A total of 29 units were selected to be representative of the fleet, of which 26 were field tested with emissions control devices. In addition to demonstrating the effectiveness of emissions control devices, the program also evaluated various emulsified diesel fuel formulations. Several manufacturers provided various emissions control technologies to demonstrate the effectiveness of these devices to reduce exhaust emissions. Diesel retrofit technologies evaluated included DOCs, passively regenerated DPFs, and SCR systems. With respect to construction equipment, this project evaluated three different retrofit technology options on a 1992 MY Cummins Gradall G3WD 6BTA 5.9L 190 hp: DOC + emulsified diesel fuel, an SCR system, and a combined DPF + SCR system.

After installation, the vehicle was returned to regular service for a period of time advised by the manufacturer to degreen the device. At the end of this period, emissions testing were performed with the device installed. The following is the summary of results from emissions testing with emissions reduction devices installed:

Table 7. Summary of Emission Testing Results

Vehicle	Technology Installed	% NOx Reduction from baseline	% TPM Reduction from baseline
Gradall G3WD	DOC + Emulsified Diesel	34.8	76.3
Gradall G3WD	SCR	78.2	26.7
Gradall G3WD	DPF + SCR	84.0	91.9

More information on this project is available at: www.arb.ca.gov/msprog/ordiesel/Documents/houston_demo_project.pdf.

As a result of the field demonstration program described above, SCR was selected as one of the technologies to be used on City fleet equipment. This City of Houston Fleet Retrofit project involves retrofitting 33 rubber tire excavators with SCR and one SCR system was installed on a 2003 model year dump truck. In addition, the City has retrofitted about 30 to 40 nonroad engines such as backhoes and water pumps with DOCs. This program will include emission testing at the University of Houston's testing facility with chassis dynamometer to quantify the emission reductions achieved with the retrofit technologies. This project is funded by the Texas Council on Environmental Quality (TCEQ) with Texas Emission Reduction Program (TERP) funds and the Houston-Galveston Area Council with Congestion Mitigation and Air Quality (CMAQ) funds in the amount of $500,000 for the SCR systems.
The vehicles and equipments that were retrofitted include:

- Gradall rubber-tire excavators powered by 1994 to 2000 MY Cummins 5.9L 190 hp engines
- 2003 MY dump truck powered by a Cummins ISC 315 330 hp engine

As of February 18, 2005, all 33 ditch excavators were equipped with an initial design SCR system and the SCR system will be upgraded to increase the level of emission reduction. The SCR systems that were installed included a DOC and a warning signal to indicate when the ammonia supply was getting low. The SCR system was not verified at the time it was installed on the equipment. However, the Houston program helped to provide data for the eventual ARB verification of the SCR for application on nonroad 1991-1995 Cummins 5.9L from 150-200 hp engines. The SCR systems on the excavators will be upgraded with a SCR system that will include a hybrid DPF used with ULSD to achieve greater PM emission reduction. The SCR systems have been in operation for up to three years and have reported no major problems. For more information on this project, go to Appendix B of the Final Draft of *Diesel Retrofit Technology and Program Experience* report at: www.epa.gov/cleandiesel/publications.htm.

2.11 Port of Seattle, Sea-Tac International Airport Project

In order to meet conformity commitment to keep NOx emissions from construction projects to less than 100 tons per year, the Port of Seattle initiated a project to reduce NOx emissions from construction activities at Sea-Tac's Runway Three. In 2002, a pilot program was initiated fueling onroad and nonroad vehicles with ULSD. With the success of the program, all vehicles and equipment used in the construction of Runway Three started being fueled with ULSD in February 2004. The next phase of the project involves retrofitting up to 10 or more nonroad engines with DOCs. For this phase, muffler replacement DOCs, rather than DPFs, are planned because some of the equipments emit high levels of PM. Backpressure monitors will also be installed. For more information on this project, go to Appendix B of the Final Draft of *Diesel Retrofit Technology and Program Experience* report at: www.epa.gov/cleandiesel/publications.htm.

3.0 Funded Projects

3.1 2005 National Clean Diesel Campaign Demonstration Grant Construction Projects

On November 7, 2005, U.S. EPA announced grant awards of more than $1 million to ten grantees to implement projects to demonstrate effective emissions reduction strategies for nonroad equipment and vehicles. The purpose of the grants is to demonstrate a wide variety of technologies such as cleaner fuels, and diesel retrofit devices (DOC, DPF, and engine replacement) for nonroad sector. Below is the list of funded projects:

- *City and County of Denver, Colorado*: The City and County of Denver will install DOCs on diesel alley and street paving fleets operating in low-income and underserved communities. This project has been awarded $125,000.
- *American Lung Association of Hawaii*: The American Lung Association of Hawaii will replace older, dirtier diesel construction equipment engines with newer, cleaner engines to reduce air pollution on Oahu and Kauai. This project has been awarded $135,000.
- *Idaho Department of Environmental Quality (DEQ)*: The Idaho DEQ will install DOCs and closed crankcase ventilation systems on portable diesel generators that power rock crushers and hot mix asphalt plants. This project has been awarded $100,000.
- *Maryland Department of Environment*: The Maryland Department of Environment will install DPFs on front end loaders at landfills in the City of Baltimore. This project has been awarded $50,000.
- *Massachusetts Executive Office of Environmental Affairs*: The Massachusetts Executive Office of Environmental Affairs will retrofit construction equipment with diesel retrofit devices and use ULSD fuel. This project has been awarded $120,000.

- *New York State Energy Research and Development Authority (NYSERDA)*: NYSERDA will retrofit nonroad fleets as part of a research project to identify best available retrofit technologies. This project has been awarded $100,000.
- *Oregon-Columbia Chapter of Associated General Contractors (AGC)*: AGC will install retrofit technologies to diesel equipments used in highway bridge replacement projects and use ULSD fuel. This project has been awarded $120,000.
- *York Technical College*: York Technical College and several local municipalities will retrofit nonroad equipments with DOCs. This project has been awarded $95,040.
- *Wisconsin Department of Natural Resources (DNR)*: Wisconsin DNR will install DOCS on construction equipment and use ULSD fuel. This project has been awarded $100,000.

For more information on the National Clean Diesel Campaign 2005 grants, go to: www.epa.gov/cleandiesel/awarded-grants.htm.

3.2 West Coast Diesel Emissions Reduction Collaborative Construction Projects

East Side Combined Sewer Overflow Project

The City of Portland's Combined Sewer Overflow (CSO) program is the largest public works project in the history of the State of Oregon, comprising three "Big Pipe" projects: the Columbia Slough Consolidation Conduit; the West Side "Big Pipe"; and the East Side "Big Pipe". The East Side CSO Tunnel or "Big Pipe", to begin in 2006, is the final and largest of the projects in Portland's 20-year program. During this five year construction project; approximately 150 diesel powered vehicles will be used for construction. The proposed project plan will require the use of ULSD in all project vehicles, use equipment that comply with EPA Tier 2 requirements for nonroad engines at a minimum and install best available retrofit emission control devices, such as DPF, DOC or wire mesh flow-through filters. The funding for the fuel premium will be paid by the contractor and ultimately the ratepayers in the city, but funding for retrofitting is requested from other sources to realize the full environmental and public health benefits that are available. The project is scheduled to be completed in 2011. More information on this project is available at: www.portlandonline.com/cso.index.cfm?c=31727.

City of Fresno Wastewater Treatment Facility Retrofit Project

City of Fresno, Fleet Management Division has agreed to participate in a demonstration program to retrofit three pieces of nonroad equipment with a diesel retrofit technology currently verified by both EPA and ARB for onroad applications to reduce emissions of PM, NOx, VOC and CO. The equipment to be retrofitted is currently operated daily at a Wastewater Treatment Plant located in southwestern quadrant of the City of Fresno. The equipment will be retrofitted a combined lean NOx catalyst/DPF technology that is currently verified by ARB for PM and NOx reductions on a range of on-road diesel engines. This project will demonstrate the viability of a combined PM/NOx emission reduction technology in nonroad engines. The manufacturer of the retrofit technology will conduct all necessary field engineering work with Cummins West, Inc. and Cleaire will also be responsible for submitting the progress and final reports. The City of Fresno will make the equipments available as well as collect all necessary maintenance and operational data. More information on this project is available at: www.westcoastdiesel.org/projects.htm.

Washington Clean Construction: Feasibility Demonstration for Retrofit of Non-road Equipment Project

In order to reduce toxic air emissions, the Yakima Regional Clean Air Authority (YRCAA) is participating with six local air authorities, the Washington State Department of Ecology (Ecology), and the American Lung Association in a demonstration project to retrofit nonroad diesel equipments. In coordination with local air authorities, Ecology will implement a state-wide program to reduce emissions from diesel-powered construction equipment. The purpose of this demonstration project is to demonstrate to the public and private fleet owners of nonroad, diesel powered equipment, the feasibility of retrofitting these equipment with DOCs without disrupting fleet operations. Approximately 50 vehicles will be retrofitted with federal funding and in-kind contribution. More information on this project is available at: www.westcoastdiesel.org/projects.htm.

Construction Equipment Retrofit Demonstration Project

The Construction Equipment Retrofit Demonstration Project is a joint effort of the Collaborative, the Sacramento Metropolitan Air Quality Management District (SMAQMD), and a retrofit technology manufacturer to retrofit five pieces of heavy construction equipment with emission-reducing device. The demonstration project will then evaluate the viability of the retrofit technologies to reduce PM and, to the extent feasible, NOx, HC, and CO emissions. This project will be funded through a $211,000 grant from EPA and $14,000 from SMAQMD. The goal of the demonstration project is to install emission control devices to five pieces of construction equipment to reduce annual diesel emissions by more than 85 percent for PM, up to 25 percent for NOx, and up to 90 percent for CO. More information on this project is available at:
www.westcoastdiesel.org/grants/files/Construction%20Equipment%20Retrofit%20Fact%20Sheet.pdf.

Oregon Construction Equipment Emissions Reduction Project

The Oregon Environmental Council (OEC) will work with builders, state environmental officials, the City of Portland, and other jurisdictions to reduce construction equipment diesel emissions. Through diesel engine retrofits, cleaner fuels, and idle reduction policies, the project aims to reduce diesel emissions from construction equipment used in the City of Portland by at least 20 percent. After the evaluation of the project results, the project's most efficient methods may be applied to reducing construction equipment emissions along the West Coast. This project will be funded through a $26,000 grant from EPA, and $27,000 from OEC. More information on this project is available at:
www.westcoastdiesel.org/grants/files/OEC_Construction_Reduction_fact%20sheet.pdf.

program (see www.arb.ca.gov/msprog/moyer/moyer.htm) and in Texas through the Texas Emission Reduction Plan (see www.tceq.state.tx.us/implementation/air/terp/). Other states are considering similar funding schemes for incentivizing retrofit projects involving onroad and offroad diesel engines. Through utilization of the available funding sources and building on the lessons learned from previous projects, the retrofit of construction equipment with emission control technology will become more widespread and provide an important tool for reducing emissions from the large number of existing nonroad diesel engines operating in the U.S.

California Home ARB: Home Search Site Map Links Software Contact Us AQD: Home

Welcome to California

iADAM

Highest 4 Daily PM2.5 Measurements

FAQs

Sacramento-T Street

Year:	2003		2004		2005	
	Date	Measurement	Date	Measurement	Date	Measurement
National:						
First High:	Jan 4	49.0	Nov 25	46.0	Dec 11	59.0
Second High:	Nov 24	41.0	Dec 4	43.0	Dec 14	56.0
Third High:	Dec 4	41.0	Jan 19	41.0	Dec 13	53.0
Fourth High:	Nov 6	39.0	Nov 7	41.0	Feb 3	50.0
California:						
First High:	Jan 4	49.0	Nov 25	52.5	Dec 11	63.8
Second High:	Nov 24	41.0	Dec 4	48.0	Dec 14	57.7
Third High:	Dec 4	41.0	Nov 18	43.3	Dec 13	56.3
Fourth High:	Nov 6	39.0	Dec 1	41.7	Feb 4	55.1
# Days Above Nat'l Standard:		0		0		0
3-Year Average 98th Percentile:		*		*		*
1-Year 98th Percentile:		*		*		47.0
National 3-Year Average:		*		*		*
National Annual Average:		*		*		10.9
State 3-Yr Maximum Average:		*		*		
State Annual Average:		*		*		

13
12.5

Go Backward One Year | New Top 4 Summary | Go Forward One Year

Notes: All concentrations are expressed in micrograms per cubic meter
State exceedances are shown in . National exceedances are shown in orange
An exceedance is not necessarily a violation.
State and national statistics may differ for the following reasons:
State statistics are based on California approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods.
State and national statistics may therefore be based on different samplers.
State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
3-Year statistics represent the listed year and the 2 years before the listed year.
* There was insufficient (or no) data available to determine the value.

Switch:	Hourly Ozone	8-Hour Ozone	PM10	Carbon Monoxide	Nitrogen Dioxide	Sulfur Dioxide	Hydrogen Sulfide

Go to: Data Statistics Home Page | Top 4 Summaries Start Page

Exhibit 15:

CEIDARS particulate matter speciation profiles

9/26/2002

CALIFORNIA EMISSION INVENTORY AND REPORTING SYSTEM (CEIDARS)
-- Particulate Matter (PM) Speciation Profiles --
SUMMARY OF OVERALL SIZE FRACTIONS AND REFERENCE DOCUMENTATION

PM PROFILE ID	PM_PROFILE_NAME	NEW FORMAT	SOURCE_REF	FRACTION < PM 10	FRACTION < PM 2.5
110	LIQUID MATERIAL COMBUSTION	N	KVB	0.976	0.967
111	FUEL COMBUSTION-RESIDUAL	N	KVB	0.87	0.76
112	FUEL COMBUSTION-DISTILLATE	N	KVB	0.976	0.967
113	UTILITY BOILERS-RESIDUAL	N	KVB	0.97	0.953
114	STAT I.C. ENGINE-DIST/DIESEL	N	KVB	0.976	0.967
115	STAT I.C. ENGINE-GASOLINE	N	KVB	0.994	0.992
116	STAT. I.C. ENGINE-DIESEL	N	KVB	0.96	0.937
119	MARINE VESSELS-LIQUID FUEL	N	KVB	0.96	0.937
120	GASEOUS MATERIAL COMBUSTION	N	KVB	1	1
121	RESIDENTIAL-NATURAL GAS	N	KVB	1	1
123	STAT. I.C.ENGINE-GAS	N	KVB	0.994	0.992
125	PETROLEUM HEATERS-GAS	N	KVB	0.95	0.93
131	COAL/COKE COMBUSTION	N		0.4	0.15
132	STAT. I.C. ENGINE-SOLID FUEL	N	KVB	0.997	0.927
133	WOOD WASTE COMBUSTION	N	KVB	0.997	0.927
137	UNPLANNED STRUCTURAL FIRES	N	KVB	0.98	0.914
141	AIRCRAFT-JET FUEL	N	KVB	0.976	0.967
151	ORCHARD HEATERS	N	KVB	0.976	0.967
161	INCINERATION-LIQUID FUEL	N	KVB	0.976	0.967
162	INCINERATION-GASEOUS FUEL	N	KVB	1	1
163	INCINERATION-SOLID FUEL	N		0.3	0.2
200	EVAPORATION	N	KVB	0.96	0.925
220	COATING MATERIAL EVAPORATION	N	KVB	0.96	0.925
222	PAINT APPLICATION-OIL BASED	N	KVB	0.96	0.925
223	PAINT APPLICATION-WATER BASED	N	KVB	0.68	0.62
311	CHEMICAL MANUFACTURING	N	KVB	0.9	0.89
312	CHEMICAL FERTILIZER-UREA	N	KVB	0.96	0.95
324	FEED AND GRAIN OPERATIONS	N	KVB	0.29	0.01
325	GRAIN DRYING	N	KVB	0.54	0.4
327	COFFEE ROASTING	N	KVB	0.62	0.61
331	PETROLEUM REFINING	N	KVB	0.61	0.555
341	ASPHALT ROOFING MANUFACTURE	N	KVB	0.98	0.945
342	ASPHALTIC CONCRETE BATCH PLANT	N	KVB	0.4	0.333
343	CEMENT PROD./CONCRETE BATCHING	N	KVB	0.92	0.62
344	LIME MANUFACTURING	N	KVB	0.3	0.117
345	CALCINATION OF GYPSUM	N	KVB	0.88	0.495
346	CLAY & RELATED PRODUCTS MFG	N	KVB	0.56	0.513
348	GLASS MELTING FURNACE	N	KVB	0.98	0.963
349	FIBERGLASS FORMING LINE	N	KVB	0.994	0.992
351	STEEL HEAT TREATNG-SALT QUENCH	N	KVB	0.96	0.86
353	STEEL ABRASIVE BLASTING	N	KVB	0.86	0.79
354	STEEL OPEN HEARTH FURNACE	N	KVB	0.98	0.93
356	ELECTRIC ARC FURNACE	N	KVB	0.83	0.6
358	ALUMINUM FOUNDRY	N	KVB	0.95	0.903
361	WOOD OPERATION-SANDING	N	KVB	0.92	0.885
362	WOOD OPERATION-RESAWING	N	KVB	0.4	0.283
371	MINERAL PROCESS LOSS	N	KVB	0.5	0.146
373	ROCK CRUSHERS	N	KVB	0.1	0.03
374	ROCK SCREENING & HANDLING	N	KVB	0.5	0.146
397	TIRE WEAR (REPLACED BY 472)	N		1	0.25
398	BRAKE WEAR (REPLACED BY 473)	N		0.98	0.42
399	GASOLINE VEHICLES-NO CATALYST	N	KVB	0.9	0.68
400	GASOLINE VEHICLES-CATALYST	N	KVB	0.97	0.9
401	CHROME: HEXAVALENT CHROMIUM	N	SINGLE COMPOUND	1	1
402	HEXAVALENT, TRIVALENT CHROMIUM	N	TWO SINGLE COMPOUNDS	1	1
403	CADMIUM	N	SINGLE COMPOUND	1	1
404	ASBESTOS	N	SINGLE COMPOUND	0.5	0.5
415	UNPAVED ROAD DUST (BEFORE 1997)	Y	OMNI	0.5943	0.126
416	WINDBLOWN DUST-UNPAVED RD/AREA	Y	OMNI	0.5943	0.126
417	AGRICULTURAL TILLING DUST	Y	OMNI	0.4543	0.1007

9/26/2002

CALIFORNIA EMISSION INVENTORY AND REPORTING SYSTEM (CEIDARS)
-- Particulate Matter (PM) Speciation Profiles --
SUMMARY OF OVERALL SIZE FRACTIONS AND REFERENCE DOCUMENTATION

PM PROFILE ID	PM_PROFILE_NAME	NEW FORMAT	SOURCE_REF	FRACTION < PM 10	FRACTION < PM 2.5
418	WINDBLOWN DUST - AGRIC. LANDS	Y	OMNI	0.4543	0.1007
420	CONSTRUCTION DUST	Y	OMNI	0.4893	0.1017
421	LANDFILL DUST	Y	OMNI	0.4893	0.1017
422	PAVED ROAD DUST (BEFORE 1997)	Y	OMNI	0.4572	0.0772
423	LIVESTOCK OPERATIONS DUST	Y	OMNI	0.4818	0.055
424	FIREPLACES AND WOODSTOVES	Y	OMNI	0.935	0.9001
425	DIESEL VEHICLE EXHAUST	Y	OMNI	1	0.92
430	AGRIC. BURNING - FIELD CROPS	Y	UCD	0.9835	0.9379
440	WEED ABATEMENT BURNING	Y	UCD	0.9835	0.9379
441	RANGE IMPROVEMENT BURNING	Y	UCD	0.9825	0.9316
450	ORCHARD PRUNINGS BURNING	Y	UCD	0.9814	0.9252
460	GRASS/WOODLAND FIRES	Y	UCD	0.9825	0.9316
461	OPEN BURNING	Y	UCD	0.9825	0.9316
462	WASTE BURNING	Y	UCD	0.9825	0.9316
463	FOREST MANAGEMENT BURNING	Y	UCD	0.961	0.8544
464	TIMBER AND BRUSH FIRES	Y	UCD	0.961	0.8544
470	UNPAVED ROAD DUST (1997 AND AFTER)	Y	CRPAQS	0.5943	0.126
471	PAVED ROAD DUST (1997 AND AFTER)	Y	CRPAQS	0.4572	0.0772
472	TIRE WEAR	N	HILDEMANN + NEA	1	0.25
473	BRAKE WEAR	N	HILDEMANN + NEA	0.98	0.42
900	UNSPECIFIED	N		0.7	0.42
90001	EPA AVG: SOLID WASTE	N	US EPA SPECIATE 3.0	0.19	0.13
90002	EPA AVG: CHEMICAL MANUFACTURNG	N	US EPA SPECIATE 3.0	0.505	0.279
90003	EPA AVG: FOOD AND AGRICULTURE	N	US EPA SPECIATE 3.0	0.49	0.14
90004	EPA AVG: STEEL PRODUCTION	N	US EPA SPECIATE 3.0	0.6	0.52
90006	EPA AVG: METAL MINING - GENRL	N	US EPA SPECIATE 3.0	0.51	0.15
90007	EPA AVG: PRIMARY METAL PRODCN	N	US EPA SPECIATE 3.0	0.644	0.464
90008	EPA AVG: SECONDARY METAL PRDCN	N	US EPA SPECIATE 3.0	0.633	0.474
90010	EPA AVG: GRAY IRON FOUNDRIES	N	US EPA SPECIATE 3.0	0.925	0.835
90011	EPA AVG: STEEL FOUNDRY - GENRL	N	US EPA SPECIATE 3.0	0.86	0.765
90013	EPA AVG: MINERAL PRODUCTS	N	US EPA SPECIATE 3.0	0.545	0.33
90014	EPA AVG: PETROLEUM INDUSTRY	N	US EPA SPECIATE 3.0	0.691	0.396
90015	EPA AVG: PULP AND PAPER INDUST	N	US EPA SPECIATE 3.0	0.608	0.486
90016	EPA AVG: INDUSTRIAL MANUFAC	N	US EPA SPECIATE 3.0	0.574	0.407

Exhibit 16:

Kern County Planning Department
Guidelines for Preparing an Air Quality Assessment
for Use in Environmental Impact Reports

PLANNING DEPARTMENT

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Engineering & Survey Services Department
Environmental Health Services Department
Planning Department
Roads Department

GUIDELINES FOR PREPARING AN AIR QUALITY ASSESSMENT FOR USE IN ENVIRONMENTAL IMPACT REPORTS

The Kern County Planning Department has developed the following guidelines to assist with the preparation of the air quality assessments for use as a technical document in Environmental Impact Reports prepared by the Department. These guidelines are intended to ensure that the assumptions and methodology used in the County's environmental documents are uniform from one project to the next to facilitate the comparison of air quality environmental effects. **All assumptions used are to be reasonably conservative and realistic.** The following is intended as minimum guidance and is to be augmented, as appropriate, by the professional judgment of the air quality preparer in consultation with planning staff. Air Quality Assessments that are submitted without this information, unless such deletions are approved by staff, may be required to be rewritten.

1. A complete project description including construction and operational aspects of the project, in addition to including traffic generation figures that are consistent with any submitted traffic studies.

2. Estimates of short-term construction emissions in tons per year. The estimates shall include both site grading and building construction emissions with comparison to the adopted Kern County California Environmental Quality Act (CEQA) thresholds (Attachment A) and the applicable Air District (San Joaquin Valley Air Pollution Control District and/or Kern County Air Pollution Control District) thresholds. The current version of URBEMIS 2002 (i.e Version 8.7) model or other documented approach, pre-reviewed and approved by Planning staff, shall be used. All assumptions are to be clearly presented, including length of each construction phase, equipment that will be used during each phase and the amount of soil disturbance, including any import or export of soil. The emission factors used to estimate emissions shall be clearly documented. The model output shall be included in the report.

3. Estimates of long term operational emissions in tons per year. The current version of URBEMIS 2002 (i.e. Version 8.7) model shall be used with comparison to the adopted Kern County CEQA thresholds and the applicable Air District (San Joaquin Valley Air Pollution Control District and/or Kern County Air Pollution Control District) thresholds. All assumptions are to be clearly presented, including any phasing, year of complete buildout, number of vehicle trips including, if applicable, residential, and commercial, employees, delivery, and other trucks. The emission factors used to estimate emissions

shall be clearly documented. All defaults used shall be clearly defined in the form of a project description. The model output shall be included in the report.

4. Estimates of existing onsite agricultural (or other) emissions in tons per year. These emission estimates shall be based on emission factors as developed by the California Air Resources Board, the U.S. EPA or other documented sources and clearly presented. The emissions estimated for existing operations should be shown as the baseline emissions in comparison to the project emissions.

5. CO Hotspot analysis using the CALINE4 Model for the following project conditions: a) Level of Service (LOS) of an intersection or roadway identified as Level of Service (LOS) E or worse; b) signalization and/or channelization is added to an intersection and c) sensitive receptors such as residences, schools, hospitals, etc are located in the vicinity of the affected intersection or signalization. If no such conditions exist, then the assessment shall include that information and note the reasons the CO Hotspot analysis was not required. The model output shall be included in the report.

6. SCREEN3 or ISCST3 modeling of maximum 24 –hour average concentration of Primary PM10 and PM2.5 at the project boundary, with comparison to National Ambient Air Quality Standards (NAAQS) ,Kern County CEQA thresholds and the applicable Air District (San Joaquin Valley Air Pollution Control District and/or Kern County Air Pollution Control District) thresholds. The model output shall be included in the report.

7. SCREEN3 or ISCST3 modeling of maximum 24 –hour average concentrations of odorous compounds at the project boundary and within a six mile limit identifying the location of any residences, schools, or other sensitive receptors, including approved, but not constructed sensitive receptors, with comparison to odor thresholds and CEQA impact thresholds. The model output shall be included in the report.

8. Impacts to visibility are to be evaluated for all industrial projects and any other projects, such as mining projects, that have components that could generate dust or emissions related to visibility. All Class 1 areas located within 100 kilometers of the project site, Edwards Air Force Base, China Lake Naval Weapons Station and the entire R-2508 Airspace Complex shall be included in the analysis.

9. Estimates of all stationary source equipment and whether it is subject to the applicable air district registration or permitting. Include fuel type, maximum rated horsepower, and annual fuel usage and emission estimates for NOx, CO, ROG, PM10, PM2.5 and SOx. The emission factors used shall be based on US EPA AP 42-emission factors and/or vendor guarantees. If EPA emission factors are used, then specific

emission factor (chapter of AP-42 and the date of the publication) shall be included in documentation. If vendor guarantees are used, a copy of these guarantees shall be included. The model output shall be included in the report.

10. As part of the preparation of the Air Qualtiy Assessment, a determination as to the need for a health risk assessment (HRA), analyzing the acute, chronic, and carcinogenic health risks of pollutants, including Toxic Air Contaminants (TAC),that would be emitted during project operations shall be made in consultation with staff. The HRA shall evaluate the risks of pollutants such as diesel exhaust and any other pollutants emitted by the project that have been identified as acute, chronic, or carcinogenic substances by the California Office of Environmental Health Hazard Assessment. The model output shall be included in the report. The most recent version of the California Air Resources Board's HARP model shall be used to conduct the HRA. Use of the ISC-3 Dispersion Model or other documented approach instead of the HARP model must be discussed and approved by Planning staff prior to completion of the report. The model output shall be included in the report.

11. Tables showing all construction and all operational emissions in tons per year, with a comparison to Kern County CEQA thresholds shall be included. Tables shall be shown with unmitigated emissions and mitigated emissions.

12. The San Joaquin Valley Air Pollution Control District Air Quality Mitigation Checklist, which has been developed for use with Rule 9510(Indirect Source Rule) , (Attachment B) along with any other recommendations from the applicable air district, shall be consulted for feasible and reasonable mitigation, regardless of the air basin. Mitigation that is not being recommended for inclusion from the checklist or from the air district shall be discussed with staff before completion of the assessment. A summary section shall be included that details all design features used in the modeling as well as all recommended mitigation measures.

13. Projects that choose to enter into a Voluntary Emission Reduction Program (VERP) with the San Joaquin Valley Air Pollution Control District may discuss the program as a design feature. It is not to be discussed or labeled as a mitigation measure. Use of this program shall not substitute for any of the emission estimates required by these guidelines.

14. The most recent air quality guidance documents from the Kern County Air Pollution Control District and the SJVAPCD, such as the Guide For Assessing and Mitigation Air Quality Impacts (GAMAQI) shall be used and referenced in the preparation of this assessment. However, where the Planning Department guidelines require quantification and the air district does not, for purposes of CEQA, the Planning Department guidelines shall be followed. Discussion and consultation with the appropriate air district and Planning staff is recommended.

15. A complete description of all air pollutants and their associated health effects shall be included. All pollutants should be included, even if the project does not generate those pollutants. An example of the typical scope of discussion required is attached.(Attachment C)

16. The cumulative impact assessment shall include all of the following. Certain specialized projects may require a modification of this approach in consultation with planning staff.
    A. Localized Impacts. Using a list of projects within a one mile and six mile radius of the project boundaries estimate impacts. Depending on the type of project, the impacts may include odors, Toxic Air Contaminants, NOx, ROG, CO, PM 10 and PM 2.5.
    B. Consistency with Existing Air Quality Plans
        1. Discuss project in relation to KernCog conformity and Traffic Analysis Zones.
        2. Quantify the emissions from similar projects in the Ozone Attainment plan for the applicable basin. Discuss the Ozone Attainment plan for the applicable air district, development and relation to regional basin, Triennial Plan and State Implementation Plan.

    C. CARB Air Basin Emissions
    Download the Air Basin Emissions from the CARB website. Create tables showing the following:
        1. Current year Kern County portion of the air basin
        2. Current year for the entire air basin.
        3. Year 2020 – Kern County portion of the air basin
        4. Year 2020- entire air basin
        5. Composite Table showing total of all results and Project results
        An example of presentation is attached (Attachment D)

Exhibit 17:

South Coast Air Quality Management District

Final—Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Final –Methodology to Calculate Particulate Matter (PM) 2.5 and PM 2.5 Significance Thresholds

October 2006

Executive Officer
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Introduction

In the last few years, both California and the federal governments have established ambient air quality standards for fine particulate matter (PM) less than or equal to 2.5 microns in diameter (PM2.5). As a result, there is a need to establish a methodology for calculating PM2.5 and appropriate PM2.5 significance thresholds for the purpose of analyzing local and regional PM2.5 air quality impacts in California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) air quality analyses. This document provides a methodology for calculating PM2.5 and recommendations for localized and regional PM2.5 significance thresholds.

Background

PM larger than 2.5 microns and less than 10 microns, often referred to as the coarse PM fraction (or PM10), is mostly produced by mechanical processes. These include automobile tire wear, industrial processes such as cutting and grinding, and re-suspension of particles from the ground or road surfaces by wind and human activities such as construction or agriculture. In contrast, PM less than or equal to PM2.5 is mostly derived from combustion sources, such as automobiles, trucks, and other vehicle exhaust, as well as from stationary combustion sources. The particles are either directly emitted or are formed in the atmosphere from the combustion of gases, such as NOx and SOx combining with ammonia. PM2.5 components from material in the earth's crust, such as dust, are also present, with the amount varying in different locations. Staff's recommendation for calculating PM2.5 focuses only on directly emitted PM2.5.

In 1997, U.S. EPA established an annual and a 24-hour standard for the finest fraction of particulates, PM2.5, to complement the existing PM10 standards. However, U.S. EPA recently modified the 24-hr PM2.5 standard and revoked the annual PM10 standard. (Table 1). The annual component of the standard was established to provide protection against typical day-to-day exposures as well as longer-term exposures, while the daily component protects against more extreme short-term events.

TABLE 1

Federal Standards for Particulate Matter

Federal Standards	PM 10	PM 2.5
Annual	Revoked[a]	15 μg/m^3
24-Hour	150 μg/m^3	35 μg/m^3 [b]

In June 2002, the California Air Resources Board (CARB) adopted new, stricter standards for particulate matter that would affect both the coarse as well as fine particulate fraction (Table 2). CARB delayed action on the proposed 24-hour PM2.5 standard in light of the

[a] U.S EPA final rulemaking for CFR 40 Part 50.7 National Primary and Secondary Ambient Air Quality Standards at http://epa.gov/pm/pdfs/20060921_rule pdf
[b] U.S EPA final rulemaking for CFR 40 Part 50.13 National Primary and Secondary Ambient Air Quality Standards at http://epa.gov/pm/pdfs/20060921_rule pdf

findings related to statistical issues in several key short-term exposure health effects studies.

TABLE 2

California Standards for Particulate Matter

California Standards	PM 10	PM 2.5
Annual	20 µg/m³	12 µg/m³
24-Hour	50 µg/m³	n/a

Methodology to Calculate PM 2.5

Because there are currently few or no PM2.5 emission factors for mechanical or combustion processes, staff is recommending an indirect approach to calculating PM2.5 emissions until such time as PM2.5 factors are developed. Since PM2.5 is a subset of PM10, the current methodology for calculating PM10 from fugitive dust sources (grading, demolition, unpaved roads, open storage piles, etc.) and combustion sources (stationary combustion sources, vehicle exhaust) will continue to be used to calculate PM10 and can also be used to calculate PM2.5. Total suspended PM (TSP) emissions typically contain specific fractions of PM10 and PM2.5 that can be measured. In general, PM from fugitive dust generating sources is primarily composed of PM10 with a relatively small fraction of the fugitive PM consisting of PM2.5. Alternatively, PM from combustion sources is primarily composed of PM2.5 with a small fraction consisting of PM10.

To calculate both PM10 and PM2.5, existing PM10 calculation methodologies for both fugitive dust PM10 and combustion PM10 can be used. To determine the PM2.5 fractions of the PM10 emission results, staff is recommending that the PM10 emissions be calculated using standard PM10 calculation methodologies. The PM10 emission results for each emission source or operation would then be multiplied by the applicable PM2.5 fraction, derived by emissions source, using PM profiles in the California Emission Inventory Data and Reporting System (CEIDARS) developed by the California Air Resources Board (CARB). The CEIDARS PM profiles are used to develop emission inventories for a variety of sources and operations in the Air Quality Management Plan (AQMP). The CEIDARS PM profiles have been streamlined to be used for most types of processes that would be encountered in a CEQA or NEPA document In addition, AQMD staff has identified the PM2.5 fraction of PM10. The streamlined CEIDARS PM profiles can be found in Appendix A. The CEIDARS PM profiles may be updated as necessary to reflect updates prepared by CARB.

If the project being evaluated is not listed among the categories in Appendix A, then the closest related type of operation/process should be used. For example in analyzing construction activities, e.g., grading, earth moving, etc., if the specific activity is not located in the tables the CEQA practitioner can use the following default factors derived from the 2003 AQMP annual inventories (see Tables 3 and 4 below under the "Localized Significance Thresholds for PM2.5 Emissions" discussion). For mechanical dust generating sources, e.g., construction, the PM2.5 fraction of PM10 is 21 percent and for combustion sources the PM2.5 fraction of PM10 is 99 percent. For off-road combustions sources, the PM2.5 fraction default would be 89 percent (Table 5). Other publicly available and peer reviewed sources of PM10 and PM2.5 emission factors can also be used if they more closely match the type of emission source than the sources identified in Appendix A. In addition, site-specific or project-specific information can be used.

Once the PM10 fractions from all emissions sources are calculated, these are summed and compared to the appropriate PM10 significance thresholds to determine whether or not a project is significant. Similarly, once the PM2.5 fractions from all emissions sources have been calculated, these are also summed (separate from the PM10 fractions) and compared to the appropriate PM2.5 significance threshold (see following discussion) to determine project significance.

The PM2.5 fraction of PM10 can be easily calculated as follows.

Step 1: Calculate PM10 emissions for each emissions source category.

Step 2: Look up the PM2.5 fraction of PM10 for the applicable source category by year that construction will occur or operation of the project will begin (Appendix A, column 6 of the appropriate table).

Step 3: Multiply the PM2.5 fraction by the PM10 emissions for each source category (PM2.5 emissions = PM10 emissions x [PM2.5 fraction])

Step 4: Sum the PM2.5 emissions from each emissions source.

Step 5: Compare PM2.5 emissions to the appropriate significance threshold.

Example:

A project is estimated to generate 8 pounds per day of PM10 from one piece of construction equipment. The PM2.5 emissions are as follows:
PM2.5 emissions = 8 pounds of PM10 per day x 0.89 = 7.12 pounds of PM2.5 per day.

In conjunction with establishing a methodology for calculating PM2.5, staff has developed the following recommended PM2.5 significance thresholds for both localized and regional significance for both construction and operation.

Localized Significance Thresholds for PM 2.5 Emissions

Localized significance thresholds (LSTs) were developed in response to the SCAQMD Governing Board's environmental justice (EJ) initiatives (EJ initiative I-4) in recognition of the fact that criteria pollutants, carbon monoxide (CO), oxides of nitrogen (NOx), and PM10 in particular, can have local impacts as well as regional impacts. The LST proposal went through extensive public outreach and was adopted by the Governing Board in October 2003. At the time the LST was adopted by the Governing Board, staff had not yet developed proposed LSTs for PM2.5.

Determining localized air quality impacts requires dispersion modeling. Because local lead agencies may not have the expertise or resources to perform dispersion modeling, SCAQMD created a series of look-up tables for CO, NOx, and PM10 in which staff back-calculated the mass emissions necessary to equal or exceed the construction or operation LST. The look-up tables were created for projects one to five acres in size and take into consideration location (source receptor area) and distance to the sensitive receptor. To use the look-up tables, the lead agency calculates daily emission as it normally would and then compares the results to the emissions in the applicable look-up table.

In general, the LSTs will apply primarily to construction because emissions from construction equipment occur at a fixed location compared to operation, which, for most land use projects, consists of emissions from vehicles traveling over the roadways, which, therefore, do not create impacts to a single location. To further assist lead agencies with calculating construction emissions, the SCAQMD conducted construction site surveys for each phase of construction to develop standard construction scenarios relative to construction equipment and hours of operation. Spreadsheets were developed to calculate emissions for the construction scenarios in an effort to create scenarios that would not exceed any applicable LSTs. When preparing a CEQA analysis, lead agencies could use the sample construction projects for their construction analyses, use the spreadsheets to tailor the analysis to their individual projects, or use a combination of the two.

The following subsections describe the proposed PM2.5 LSTs for both operation and construction.

Establishing LSTs

To determine the effects of PM2.5 on local (nearby) receptors, such as residents, hospitals, schools, etc., a PM2.5 localized significance threshold (LST) needs to be established. Since the Basin exceeds one or more of the state or federal ambient air quality standards for PM2.5, the process used to determine significance for attainment pollutants, i.e., NO2 and CO, developed for the LST program cannot be used[c]. Under the LST program, since PM10 is a nonattainment pollutant, the LST methodology uses a different process for determining whether localized PM10 air quality impacts are significant. To determine localized PM10 air quality impacts during operation, the LST methodology uses as a significance threshold the allowable change in concentration threshold for PM10 listed in Rule 1303, Table A-2, which is 2.5 micrograms per cubic meter ($\mu g/m^3$). The allowable change in concentration threshold is a modeled concentration that cannot be exceeded at the sensitive receptor, and determines whether or not a permit applicant will receive a permit from the SCAQMD. For the LST program staff used a dispersion model (ISCST3) to convert the 2.5 $\mu g/m^3$ concentration into mass daily PM10 emissions numbers based on the size of the project, location of the project, and distance to the sensitive receptor. The

[c] Under the LST program, to determine significance for attainment pollutants, the emissions contribution from the project expressed as a concentration is added to the highest local ambient concentration from the last three years where data are available. If the sum is equal to or greater than any applicable state or federal ambient air quality standard, the project is considered to have significant localized air quality impacts for that pollutant. More information on the LST program can be found at the following URL: http://www.aqmd.gov/ceqa/handbook/LST/LST.html

results were then incorporated into an LST look-up table. If the mass emissions from a project exceed the applicable LST look-up tables' mass emission numbers (which are based on the 2.5 $\mu g/m^3$ concentration), then localized PM10 air quality impacts are considered to be significant.

Operational Localized Significance Thresholds

To establish operational PM2.5 localized significance thresholds, staff first reviewed the PM inventories in Appendix III of the 2003 AQMP. In particular, staff evaluated the composition of PM10 and PM2.5 from combustion processes in the 2003 AQMP to establish a general ratio of PM2.5 to PM10. Combustion processes were evaluated because, for most land use projects, mobile source combustion emissions comprise the majority of emissions. Table 3 shows the total PM10 and PM2.5 inventories for total fuel combustion process for the years 2005 through 2010. As can be seen in Table 3, over the five-year timeframe considered, the fraction of combustion PM10 that consists of PM2.5 is consistently 99 percent. Since combustion PM10 and PM2.5 fractions are essentially equivalent, staff is recommending that the operational localized significance threshold for PM2.5 be the same as the current operational localized significance threshold for PM10, i.e., 2.5 $\mu g/m^3$.

TABLE 3

Total Stationary Source Fuel Combustion Inventory (Tons/Day)

Year	PM 10	PM 2.5	Percent of PM 10 which is PM 2.5
2005	8.13	8.01	99
2006	8.21	8.10	99
2007	8.30	8.18	99
2008	8.38	8.26	99
2010	8.54	8.42	99

Source: Appendix III, 2003 AQMP. Annual Average Emission Inventory

Construction Localized Significance Thresholds

Similarly, to develop a PM2.5 construction significance threshold for localized impacts, staff considered the PM2.5 contribution from fugitive sources and the PM2.5 contribution from combustion sources (construction equipment). As discussed in more detail in the following paragraphs, combustion emissions from the construction equipment contribute a larger portion of the total PM2.5 emissions from construction operations than fugitive sources.

Staff then reviewed the 2003 AQMP, Appendix III fugitive PM inventory for construction and demolition to obtain the PM10 and PM2.5 compositions. Table 4 shows the total PM10 and PM2.5 inventories for construction activities for the years 2005 through 2010. As can be seen in Table 4, over the five-year timeframe, the fraction of PM10 that consists of PM2.5 is consistently 21 percent. Multiplying the fugitive PM2.5 percent fraction of

PM10 by the existing construction PM10 LST, 10.4 μg/m^3, produces a result of approximately 2.2 μg/m^3.

TABLE 4

Total Fugitive PM Inventory (Tons/Day)

Year	PM 10	PM 2.5	Percent of PM 10 which is PM 2.5
2005	42.7	8.91	21
2006	43.66	9.11	21
2007	44.6	9.3	21
2008	45.54	9.5	21
2010	47.44	9.9	21

Source: Appendix III, 2003 AQMP, Annual Average Emission Inventory

Off-road construction equipment, however, also contributes combustion PM as well as fugitive PM. To determine the contribution of PM2.5 from construction equipment combustion emissions, staff performed dispersion modeling using the ISCST3 dispersion model for one-, two-, and five-acre construction scenarios. The construction scenarios were developed from construction site surveys conducted in connection with staff's original LST proposal. Combustion sources were modeled as adjacent five-meter volume sources and fugitive sources were modeled as adjacent one-meter area sources. Worst-case meteorological data from the West Los Angeles source receptor area were used and receptors were placed at 25, 50, 100, 200, and 500 meter distances from the construction site. Using CARB speciation data, it was assumed that 21 percent of fugitive dust PM10 is comprised of PM2.5 and 89 percent of off-road equipment combustion PM10 emissions are comprised of PM2.5 (based 2003 AQMP inventories, see Table 5).

TABLE 5

Combustion PM Inventory from Off-Road Equipment (Tons/Day)

Year	PM 10	PM 2.5	Percent of PM 10 which is PM 2.5
2005	11.95	10.64	89
2006	11.61	10.33	89
2007	11.2	9.97	89
2008	10.93	9.71	89
2010	10.26	9.09	89

Source: Appendix III, 2003 AQMP, Annual Average Emission Inventory

The modeling results showed that combustion PM2.5 from off-road equipment comprise approximately 75 to 100 percent of the total PM2.5 emissions from construction activities Further, the PM2.5 contribution from fugitive sources is dependant on the construction phase. For example, the modeling showed that the demolition and site preparation phases have the highest fugitive PM2.5 contribution to the overall results, whereas, the building and asphalt paving phases contribute the most combustion PM2.5 to the overall results.

The modeling results indicate that the contribution of off-road combustion PM2.5 emissions can be three to four times higher than the contribution of PM2.5 from fugitive sources. Based on this result, staff recommends that the PM2.5 fugitive dust component be adjusted upward by approximately four times to account for the PM2.5 emissions from the construction equipment. As a result, staff is recommending a PM2.5 construction LST of 10.4 $\mu g/m^3$, the same as the construction LST for PM10. Finally, an exceedance of either the PM10 construction LST or the PM2.5 construction LST is a significant adverse localized air quality impact.

Regional Emission Threshold of Significance for PM 2.5

Emissions that exceed the regional significance thresholds are mass daily emissions that may have significant adverse regional effects and are the air quality significance thresholds with which most CEQA practitioners are familiar.

Table 6
Regional Air Quality Significance Thresholds

Mass Daily Thresholds[a]		
Pollutant	**Construction**[b]	Operation[c]
NOx	100 lbs/day	55 lbs/day
VOC	75 lbs/day	55 lbs/day
PM10	150 lbs/day	150 lbs/day
SOx	150 lbs/day	150 lbs/day
CO	550 lbs/day	550 lbs/day
Lead	3 lbs/day	3 lbs/day

The following subsection describes the proposed PM2.5 regional significance thresholds for both operation and construction.

Establishing Regional Significance Thresholds

PM emissions also affect air quality on a regional basis. When fugitive dust enters the atmosphere, the larger particles of dust typically fall quickly to the ground, but smaller particles less than 10 microns in diameter may remain suspended for longer periods, giving the particles time to travel across a regional area and affecting receptors at some distance from the original emissions source. Fine PM2.5 particles have even longer atmospheric residency times. Staff is recommending a PM2.5 regional significance threshold based on a recent EPA proposal, as explained in the following paragraphs.

On September 8, 2005, EPA published in the Federal Register "Proposed Rule to Implement the Fine Particle National Ambient Air Quality Standards," which proposed a significant emission rate for PM2.5 of 10 tons per year. Staff is proposing to use EPA's significant emission rate for PM2.5 to develop the daily mass emission regional significance threshold for PM2.5. Converting the annual rate, 10 tons, into a daily rate produces a daily rate of approximately 55 pounds per day. A similar approach was used to derive the operational regional significance thresholds for NO2 and VOC. NO2 and VOC operational regional significance thresholds were derived by using the NOx/VOC emission rate that defined a major source in the South Coast Air Basin, 10 tons per year. Converting the annual emissions rate into a daily rate resulted in a regional operational significance threshold of 55 pounds per day for each pollutant. Similar to the regional significance threshold for PM10 of 150 pounds per day, the proposed PM2.5 regional significance threshold of 55 pounds per day would apply to both construction and operation.

Conclusion

In this document staff identified a methodology to indirectly calculate PM2.5 emissions for a CEQA or NEPA air quality analysis, to be used until such time as PM2.5 emission factors are available, which will allow the CEQA practitioner to calculate PM2.5 emissions directly. In addition, PM2.5 construction and operation LSTs have been identified to address localized impacts. The PM2.5 LSTs will be used to develop look-up tables for projects five acres in size or smaller, similar to those prepared for PM10, nitrogen dioxide (NO2), and carbon monoxide (CO). As with the other pollutants, the PM2.5 look-up tables can be used as a screening procedure to determine whether or not small projects (less than or equal to five acres) will generate significant adverse localized air quality impacts. Screening procedures are by design conservative, that is, the predicted impacts tend to overestimate the actual impacts. If the predicted impacts are acceptable using the LST look-up tables, then a more detailed evaluation is not necessary. However, if the predicted impacts are significant, then the project proponent may wish to perform a more detailed emission and/or modeling analysis before concluding that the impacts are significant. Project proponents are not required to use this LST procedure; and may complete site specific modeling instead. Site-specific modeling is required for projects larger than five acres.

SMITH ENGINEERING & MANAGEMENT

November 3, 2006

Mr. Donald B. Mooney
129 C. Street
Suite 2
Davis, CA 95616

Subject: Sutter Medical Center Sacramento & Trinity Cathedral Project Revised Draft Environmental Impact Report

Dear Mr. Mooney:

Per your request, I have reviewed the Revised Draft Environmental Impact Report (hereinafter the RDEIR) for the Sutter Medical Center Sacramento (hereinafter SMCS) and Trinity Cathedral Projects with specific focus on traffic and parking matters described in the Transportation and Circulation sections of the document. My qualifications to perform this review include registration as a Civil and Traffic Engineer in California, 38 years of professional transportation/traffic engineering consulting practice in California including preparation and review of transportation/traffic components of environmental documents. I have previously formally commented on the original 2005 Draft Environmental Impact Report (DEIR) on the subject project and provided testimony on the environmental documentation at the Sacramento City Planning Commission and City Council hearings on this matter in November and December 2005 respectively. My resume is attached herewith. This letter documents comments and conclusions resultant from my review.

PARKING

The revised Sutter DEIR document circulated in September '06 does not make any change in the parking generation rate and estimated total parking demand for the project from what was contained in the original draft and final EIR on the project. It merely discloses and integrates some backup data materials in an effort to explain how the parking generation rate and estimate of parking demand for the SMCS project was compiled. There are serious flaws in the parking data that was used to estimate parking demand and parking impacts of the proposed project.[1] These include:

Sutter Memorial Parking Survey Does Not Measure Portion of Parking Generation Met by Use of On-Street or Off-Site Parking

As described in the RDEIR, the EIR parking analysis utilized an occupancy count survey of parking at Sutter Memorial Hospital to estimate the parking demand of the new hospital component of the SMCS project. The parking survey at Sutter Memorial, the basis of the EIR's parking generation rate used to estimate parking demand at the *Women's and Children's Center* at SMCS surveyed parking only in the formal lots managed by Sutter Memorial. Hence, any of the Sutter Memorial parking demand that was met by parking on-street or off-street in lots not formally controlled by Sutter Memorial is not reflected in the parking survey or in the parking generation rates derived therefrom that were then used to compile the 833 space demand estimate for the *Women's and Children's Center* at SMCS. Both the aerial photos of Sutter Memorial included in the RDEIR and others commonly available on the internet evidence heavy on-street parking along the Sutter Memorial frontage on F Street. In the aerial photo of this frontage currently available on *Google Earth*, there are 28 vehicles visible (and possibly more actually present because foliage obscures the aerial view of a portion of the frontage) parked on-street along Sutter Memorial's frontage on F Street. In the aerial view of this same frontage included in the RDEIR, there are 34 vehicles parked on-street along the Sutter Memorial frontage. Hence, the parking demand estimated for the project is low by whatever portion of the demand for Sutter Memorial is met on-street or off-site. 2-44

The Occupancy Survey of Sutter Memorial Parking Was Conducted On an Anomalous Day

The subject parking survey at Sutter Memorial was conducted during normal midday lunch period (11:30 am to 12:30 pm) on March 17, 2005. March 17 is St. Patrick's Day, an informal but widely celebrated holiday on which anyone with common sense would recognize that lunchtime parking occupancy would tend to be abnormal. Hence, the parking demand estimated for the project is low by whatever portion of normal mid-day parking demand was absent due to normally present staff and visitors celebrating St. Patrick's Day lunch elsewhere. 2-45

[1] Although the City claims on page 56.7R-1 that "the transportation and circulation (including parking) analyses contained in Section 6.7 (Transportation and Circulation) of the EIR are adequate, in fact, the flaws in the parking generation (and trip generation) data collection and rate estimates disclosed in this RDEIR and in the Supplemental Administrative Record disclosed in Court proceedings open the entire analyses and conclusions of the transportation and circulation component of the EIR to further scrutiny and comment. 2-45a

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The Occupancy Survey of Sutter Memorial Parking Was Conducted At a Time of Day Other Than That Of Peak Parking Occupancy

The EIR traffic and parking consultants knew or should have known based on traffic counts at Sutter parking entries and exits already in their possession that peak parking occupancy in Sutter parking could occur before 11 AM or after 1 PM instead of in the sole 11:30 AM to 12:30 PM hour in which they chose to count parking accumulation. This is disclosed in Supplemental Record Bate 027 (also disclosed as Bate 002 and 100). If the analyst accepts whatever parking is already in the parking facilities at 7 am as a fixed starting point, and compiles the cumulative differential between the entry counts and exit counts at the end of each hour (the differential being the accumulated parking taking place inside), bate 027 shows the peak parking accumulation at the visitor garage at Sutter General occurring between10 and 11 AM. For the visitor lot at Sutter Memorial, the peak parking accumulation is shown to be between 2 and 3 PM. Hence, the evidence already in the EIR consultants' possession demonstrated it would be insufficient to count parking occupancy for just one hour of the day and that the 11:30 to 12:30 hour counted might not be the peak hour of occupancy. 2-46

The EIR parking consultants also should have known that it would be insufficient to measure peak parking demand by counting only the 11:30 am to 12:30 pm hour based on authoritative parking reference source information indicating hospital parking tends to peak at mid-morning, slacken somewhat at mid-day and then reach a greater peak at mid-afternoon.[2] 2-47

Data Available To the EIR Parking Consultants Indicates More Parking at Sutter Memorial Than Was Observed in the Subject Parking Survey

The Supplementary Record disclosed by the City in connection with this matter demonstrates that the consultants preparing the DEIR had knowledge of prior parking studies at Sutter Memorial that showed considerably higher parking occupancy on the Sutter Memorial parking facilities than was counted in the subject Saint Patrick's Day survey. In a memo dated April 13, 2005 from Pelle Clarke and Vic Maslanka (DKS) to Christine Kronenberg (EIP), the consultants who prepared the traffic and parking sections of the subject EIR indicate that a May 2003 parking study of the same Sutter Memorial parking facilities by the Hoyt Company observed that parking demand often exceeded the available 960 parking spaces – in other words, that the parking occupancy often *exceeded* the 898 level observed in the St. Patrick's Day survey by 62 spaces and that the demand could be yet more than that. 2-48

The report that parking demand often *exceeded* the 960 space capacity of the parking supply under Sutter Memorial's direct control supports our observation that there probably is Sutter Memorial-generated parking that takes place on- 2-49

[2] See *Parking*, Weant, Robert A., and Levinson, Herbert S., Eno Foundation, 1990, pages 114-116.

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street or in nearby off-site, off-street locations and that the procedures used in surveying the parking demand failed to account for the portion of Sutter Memorial's demand that is met on-street or in non-Sutter-controlled off-street sites. 2-49 (con't

The failure to acknowledge and incorporate the Hoyt data in the actual EIR analysis (as opposed to only disclosing it obliquely in the supplemental record) appears to be of itself an improper action with regard to CEQA obligations. 2-50

Had the Hoyt data been relied on as it should have, given the questionable reliability of a parking survey taken for one hour at midday on St. Patrick's Day, the parking demand rate for the Sutter Memorial lots surveyed, according to the analysis procedures followed would have been 2.23 spaces per thousand square feet instead of the 2.09 rate used. If the on-street parking demand from Sutter Memorial evident in the aerial photos as described above were also factored into the analysis, the correct parking demand rate for Sutter Memorial would have been compiled at 2.30 spaces per thousand square feet of hospital floor area. Had this latter rate accounting for all the actual parking generation at Sutter Memorial been used in estimating the parking demand for the *Women's and Children's Center* component at SMCS, the demand would have been stated as 916 spaces instead of 833, a difference of 83 stalls. This would consequently increase the net parking deficit ultimately disclosed in the analysis of parking impacts by another 83 spaces. 2-51

The RDEIR Analysis Fails To Account For The Parking Reservoir Needed At Shift-change Time When the Parking Demands Of Both Shifts Overlap

The entire parking analysis fails to take into account need for shift-change parking reservoir to respond to overlapping parking demands at shift-change time despite the obvious evidence of such a reservoir in the data from the subject survey at Sutter Memorial. The need for such a reservoir is obvious. The incoming shift must be able to park before coming into their work stations to relieve the personnel of the shift that is departing. Members of the departing shift can only then depart and remove their vehicles from the parking areas. The incoming shift cannot be left to hunt for potentially rare parking spaces at times of peak occupancy. So there must be a reservoir of readily available employee parking to meet the simultaneous parking demands of the incoming and outgoing shifts.[3] The detailed field documents from the subject parking survey and the Clarke memo of 9-20-06 disclosed in the RDEIR show that the vacant reservoir designated "A Lot" and observed "chained off" and "not occupied" and signed "Lot A PM Staff" in the DKS parking survey, but its implication is unrecognized in the analysis. 2-52

[3] This is not so much of a problem at the late evening and early morning shift-changes, times when there is very little visitor or out-patient parking demand, but it is a clear need at the mid-to-late afternoon shift change when visitor and out-patient parking demand is heavy.

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9-20-06 Memo in RDEIR Inaccurately Describes Parking Data Analysis

The 9-20-06 Pelle Clarke (DKS) memo incorporated in the RDEIR parking
analysis references the Center City Parking Master Plan study and 158 pages of
parking inventory/occupancy data sheets on aerial photo maps are appended in
the RDEIR. The subject memo states that the data from that study *"(specifically
parking counts conducted in the garages and on-street adjacent to the SMH)
were used to establish existing parking conditions for both on-street and off-
street parking."* However, the analysis shows no evidence that any adjustment 2-53
for on street or non-Sutter off-street parking was incorporated into the estimate of
the SMH parking generation rate that was subsequently employed to estimate
the parking demand for the *Women's and Children's Center* component at
SMCS. The parking generation rate estimated at 2.09 spaces per thousand
square feet of hospital use was purely based on the DKS St. Patrick's Day
survey counts of vehicles parked in the midday hour in SMH-controlled off-street
lots.

Moreover, the study limits of the Center City Parking Master Plan extend only as
far east as Alhambra Boulevard. Sutter Memorial Hospital is located between 51st
Street and Lagomarsino Way, some 21 blocks (1.33 miles) outside (east of) the
east limits of the Center City Parking Master Plan study. Clearly, DKS did have
a large bundle of Center City Parking Master Plan data gathered sometime in
April 2005. However, it is quite obvious that there is no Center City Parking
Master Plan data adjacent to SMH to establish existing parking conditions for 2-54
both on-street and off-street parking as claimed in the subject Clarke memo.
Hence, the statement in the 9-20-06 Clarke parking memo disclosed in the
RDEIR that Center City Parking Master Plan data was relied upon in deriving the
parking generation rate is not only quite evidently factually incorrect; it also
appears to be an improper effort to mislead the public as to the nature of parking
data considered to derive the parking generation rates that were applied to
estimate the Women's and Children's Center component of the future parking
demand at SMCS.

Combined Effect of Errors In Parking Data Analysis Understates Parking Impacts

The flaw in the estimated parking generation described above, including the
underestimate due to on-street and off-site parking, result in understatement of
the parking demand at the proposed Womens' and Children's Center and the 2-55
overall SMCS of 83 stalls. In addition, the failure to reflect the need for a shift-
change parking reservoir for the Womens' and Children's Center component
results, if one estimates this reservoir proportionate to the shift change reservoir
stalls per square foot of hospital at Sutter Memorial[4], in an understatement of 50

[4] Sutter Memorial has 430,627 square feet and has approximately 54 spaces in the shift change parking reservoir (Lot A), or about 125 spaces per thousand square feet. At this same shift change parking

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stalls in additional parking space demand related to the Women's and Children's Center. 2-55 (con't

The original DEIR's estimate of incremental parking demand for the SCMS project is 1427 parking spaces[5], a total which remains unchanged in the RDEIR. The DEIR states that the additional parking supply to be provided by the SMCS project (reflecting deductions for existing spaces to be removed by the project) is 890 spaces. Hence, according to the RDEIR, the project could result in a parking deficit of 537 spaces for SMCS. However, that is all based on the flawed, one-hour St. Patrick's Day survey that didn't observe Sutter Memorial parking at a peak time, didn't measure the portion of Sutter Memorial demand met by on-street parking, and missed accounting for the shift-change reservoir. 2-56

If the parking generation for the Women's and Children's Center component is computed based on the Hoyt Company data for Sutter Memorial and also adjusted for the portion of Sutter Memorial parking demand met on-street, and the need for a shift change parking reservoir is factored in, the SMCS project parking demand becomes 1560 spaces (1427 +83 +50) and the potential deficit becomes 670 spaces. This is a significant difference (133 spaces, approximately 25 percent) from the parking space deficit that has been reported to the public and public policy makers in the DEIR (and that remains unchanged in the RDEIR). 2-57

Parking Surplus in Existing Facilities Overstated

Among the factors the DEIR (unchanged in the RDEIR) cites as potentially mitigating the impact of the parking deficit inherent in the SMCS project is availability of underutilized space in existing SCMS parking facilities. However, this assessment is flawed in that it overestimates the available space in existing facilities that could be available to the subject SMCS project because it estimates the parking demand for a previously entitled 71,300 square foot expansion of Sutter General at the understated rates of the St. Patrick's Day survey at Sacramento Memorial and because it fails to consider the shift change parking reservoir needs of Sutter General. If the estimate for the parking demand of the 71,300 square foot addition used Sutter Memorial rates that considered the Hoyt data, on-street use and the shift change reservoir, there would be 58 fewer vacant spaces in existing parking facilities available to offset the project's parking deficit (213 instead of 271). However, if 'practical capacity' of parking facilities (described below) is considered, as few as 25 stalls in existing facilities may be available to offset the parking deficits of the project. 2-58

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reservoir rate, the 398,362 square feet, the Women's and Children's Center component of the SMCS project would require a shift change reservoir of about 50 parking spaces (398.652 x 0.125). Sutter General Hospital at 351,000 square feet plus 71,300 square feet of previously entitled expansion would require a shift change reservoir of about 53 parking spaces (422.300 x 0.125).

[5] This total is for the SMCS project alone, excluding the parking demand contributions of the adjacent Trinity Cathedral project and the Children's Theater project.

EIR Analysis Failed to Consider Practical Capacity of Parking Facilities

In addition, documents in the Supplemental Record disclosed by the City in the course of proceedings, specifically the previously cited memo from Pelle Clarke and Vic Maslanka (DKS) to Christine Kronenberg (EIP) dated June 7, 2005, makes evident that the DEIR and the RDEIR did not disclose how much additional parking would actually have to be provided to actually offset the projected parking deficits and did not consider the 'practical capacity' of parking facilities in defining the deficits. The memo correctly identifies the fact that when, in its terms, *"parking facilities are occupied at 90 percent or more of their capacities, it is difficult to find spaces. Therefore, facilities are often planned with a buffer to minimize these effects."* What the memo is addressing is the conventional practice among parking design and evaluation professionals of regarding the 'practical capacity' of a parking facility as being 90 percent of the stall total, because of operational considerations involving the difficulty for drivers in finding the last available spaces and because of the congestion in the circulation aisles caused by drivers hunting for those scarce available spaces. However, the cited memo notes that in the parking analysis of the original DEIR (unchanged in the RDEIR) that impacts have been defined purely on the basis of differential between parking demand and spaces provided with "no such buffers" (or, in our terms, no consideration of practical capacity of the parking facilities) included in the calculations. This has several key implications: 2-59

The 890 additional parking spaces provided by the SMCS project would have a practical capacity of about 801 spaces (a difference of 89 spaces). Therefore, the potential parking deficit of the project would be 626 based on the DEIR's original estimate of demand (537) or 731 based on our revised estimate of demand described above (642). 2-60

If conventional parking industry practice with regard to 'practical capacity' were considered, it would take creation of an additional 696 parking spaces additional spaces to offset or fully mitigate the parking deficit based on the DEIR's original computation of demand or 812 additional spaces to fully offset the parking deficit based on our computation of demand above. 2-61

Instead of there being a surplus of 420 stalls in the existing SMCS facilities to partly offset the proposed project's deficit, there would be only 25 stalls available in those facilities to offset project parking deficits, considering our computation of demand in them (with the previously approved expansion to Sutter General, the need for a shift change reservoir for Sutter General and 'practical capacity' of the parking facilities). 2-62

Hence, in addition to the RDEIR disclosing a flawed and understated total parking demand of the SCMS project, there is also a substantial gap between what has been disclosed to the public and public policy makers as the Project's parking deficit (the impact) and the amount of parking that ordinarily would need 2-63

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to be provided to mitigate the impact (the added spaces including consideration of "practical capacity". 2-63 (con'

Entire Parking Analysis Must Be Recompiled and Recirculated in Draft

In leaving the actual quantification of SCMS project parking demand and parking impacts unchanged, the RDEIR fails to remedy the obvious defects noted above in the parking analysis contained in the original EIR and DEIR. These are defects that, had the information now disclosed with the RDEIR and with the City's earlier disclosure of the Supplemental Record on this matter been properly disclosed with the circulation of the original DEIR been the subject of comments of the same nature as above, which the City would have been required to respond to at that time. 2-64

Considering the flaws in the parking analysis described above and the incorrect, incomplete and misleading information provided to the public and public policy makers, the entire parking analysis contained in the original DEIR and RDEIR must be recomputed and the revised document must be recirculated in "draft" status.

TRIP GENERATION

The RDEIR discloses additional details of the trip generation data that supported the original EIR analysis, but does nothing to correct the obvious flaws in the data and consequent flaws in the DEIR traffic analysis.

Sutter Memorial Trip Generation Survey Failed to Count Trips Involving On-street Pick-ups or Drop-offs, and Trips That Parked On-street or Off-site

In our comments on the original DEIR in this matter, we pointed out that the trip generation estimated for the hospital components of the project, reportedly based on a survey of trip generation at Sutter Memorial hospital appeared very low relative to authoritative trip generation rates for this use published in *Trip Generation, 7th Edition*, identified the fact that the differences between the trip generation rate used in the original DEIR and that in *Trip Generation, 7th Edition* resulted in differences in significant numbers of estimated project trips that could alter the findings regarding significant traffic impacts of the project and, knowing that reasonably accurate measurement of trip generation of a land use like a hospital set within an urban environment requires very thorough traffic survey techniques to avoid missing significant components of the trip generation, asked for details of the Sutter Memorial trip generation survey the DEIR relied upon. 2-65

The City's response to these comments was to assert that the trip generation rates derived from the survey at Sutter Memorial were correct and appropriate for use in the analysis. But the response failed to provide any clarifying details regarding the trip generation survey procedures and data at Sutter Memorial. 2-66

Now that the RDEIR has provided the details of the Sutter Memorial trip generation survey in response to the order of the Court, those details prove that our concern that the survey missed a portion of Sutter Memorial's trip generation was well founded. The RDEIR information reveals that the Sutter Memorial trip generation survey was structured to measure only that portion of Sutter Memorial's trip generation that involved use of parking fields under Sutter Memorial's direct control or pick-ups and drop-offs in formally designated pick-up/drop-off zones normally used for patient transfers during admissions and discharges. Only the entries and exits to Sutter's parking areas and the patient transfer pick-up/drop-off zone were counted. Any of the trip generation of Sutter Memorial that involved people parking in on-street locations or in off-street locations not controlled by Sutter were *not measured* in the subject survey. Nor were people who were picked-up or dropped off at curbside locations other than the formal patient transfer pick-up/drop-off areas. Because it is commonplace for workers who carpool with others not destined for the same location, or hospital visitors or even out-patients who ride with someone not destined for the same location to be dropped by curbside, and because recent aerial photos commonly available on the internet show heavy curb parking on the F Street frontage of Sutter Memorial, there is good reason to conclude that the trip generation studies conducted at Sutter Memorial for the purposes of the subject EIR *did fail to count* a meaningful portion of that hospital's trip generation. 2-67

The EIR parking consultants should have been aware that a portion of Sutter Memorial's parking generation was being served on-street just by observation. Moreover, in a 4-13-05 memo to Christine Kronenberg (EIP) disclosed as part of the City's Supplemental Administrative Record in the matter, Pelle Clarke and Vic Maslanka (DKS), the EIR parking consultants, indicate they are aware that a portion of Sutter General Hospital's parking demand was being met on-street. If they knew that, they obviously should have been aware that the same thing was taking place at Sutter Memorial and counted it in the parking generation study. 2-68

The assertions made by the City in response to comment on the original environmental documents and reiterated again in the RDEIR (as part of its' appended Clarke 9-20-06 memo on Sutter Medical Center Trip Generation) regarding appropriateness of the trip generation surveys at Sutter Memorial as the basis of trip generation estimates for the new hospital components at SMCS are unconvincing and completely miss the point. The statement in the Clarke memo that both the Institute of Transportation Engineers *Trip Generation Handbook* and the City of Sacramento Traffic Study Guidelines allow substitution of trip generation information specific to a project or from sites representative of a project has never been disputed. *The issue is that the trip generation data utilized is understated because, as described previously and as the RDEIR details show, the consultants counted only a part of the trip generation at the purportedly representative site, Sutter Memorial.* Neither the *Trip Generation* 2-69

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Handbook nor the City Traffic Study Guidelines encourage use of incomplete counts to represent the entire trip generation of the representative site. 2-69 (con't)

RDEIR Fails To Remedy Serious Flaws in Trip Generation Analysis That City Is Now Aware Of

In testimony at the Planning Commission and City Council hearings on the original DEIR/FEIR, in response to our comments questioning the trip generation rates based on the Sutter Memorial survey, City staff stated that the EIR analysis also considered data collected from Kaiser Roseville hospital that corroborated the Sutter Memorial trip generation rates. When the Kaiser Roseville data was finally made available in a late supplemental disclosure of the administrative record, we found, and disclosed in Court proceedings, that the City's EIR consultants interpretation of the Kaiser data contained an obvious computational blunder and that the Kaiser data did not corroborate the Sacramento Memorial trip generation data at all; instead it supported use of the ITE trip generation data that we had suggested in our original comments. Despite that revelation, in this RDEIR the City has not taken the opportunity to correct the trip generation analysis, but has persisted in proceeding with the flawed trip generation data based on the partial Sutter Memorial survey. 2-70

RDEIR Inconsistent In Describing Sutter Memorial Trip Generation Data Collection

RDEIR Table 6.7-13R states in footnote that trip generation survey estimates are based on counts taken on June 8th through 10th in 2004 plus ones on March 17, 2005. This suggests that the trip generation rates may be tainted by anomalous data collected on St. Patrick's Day. The 9-20-06 Clarke memo on trip generation included in the RDEIR states that the data used in the computation of trip generation rates were collected only on the June 8th through 10th, 2004 dates. This discrepancy must be resolved, because use of the anomalous St. Patrick's Day data would be a concern. 2-71

RDEIR Fails to Account For Traffic Impacts of Trips Between Patient Pick-up/Drop-off Areas and Parking Facilities

The RDEIR provides a specific accounting of trip generation at the project's patient pick-up/drop-off areas but asserts that valet-park or self-park movements between the project's pick-up/drop-off areas and its' parking facilities are "internal trips" that do not need to be accounted for in the traffic impact analysis. While this is true in the case of trips between the pick-up/drop-off zones and some of the parking facilities mentioned in the RDEIR, it is also clear that given the location of some of the parking facilities involved, secondary trips to those facilities would pass through key street intersections in the project vicinity that are the subject of traffic level-of-service analysis and would be additive to traffic there. Hence, those trips are not purely "internal" to the project and therefore 2-72 that portion of the trips between the pick-up/drop-off zones and parking must be taken into consideration in the LOS analysis for those intersections. 2-72 (con't)

RDEIR Reveals Details of Two-Way Conversion Traffic Known

In our prior comments, we indicated that the original DEIR should have included a short range traffic analysis of the project's impacts on the feasibility of the two-way street conversion project that the City was concurrently considering. City staff responded at the City Planning Commission or City Council hearing on the matter that such an analysis was not possible because the City did not know how to define a "short-term no-project scenario" as the baseline for such an analysis. 2-73

However, by including the resume Mr. Pelle Clarke of DKS Associates, the RDEIR now reveals that he was a principal directly involved in preparing the City's two-way streets conversion evaluation study concurrently with his work on the original DEIR traffic studies. In addition, documents disclosed by the City as part of the Supplemental Administrative Record in these proceedings appear to indicate that at an early stage of the EIR analysis Clarke and DKS representatives suggested consideration of just such a scenario. These current disclosures appear to indicate that the City's response on the issue was improper and that the EIR should be revised to include consideration of such a scenario. 2-74

Conclusion

Given all of the foregoing, we believe that the RDEIR and earlier EIR analysis must be revised extensively to address all of the issues raised herein, and that the document(s) must be recirculated in draft status. 2-75

Sincerely,

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supra, 133 Cal.App.3d at p. 417; see also *Sequoyah Hills*, *supra*, 23 Cal.App.4th at p. 715.)

In short, CEQA requires that the lead agency adopt mitigation measures or alternatives, where feasible, to substantially lessen or avoid significant environmental impacts that would otherwise occur. Project modifications or alternatives are not required, however, where such changes are infeasible or where the responsibility of modifying the project lies with some other agency. (CEQA Guidelines, § 15091, subds. (a), (b).)

The detailed discussion in Section VIII demonstrates that nearly every significant effect identified in the EIR has been at least substantially lessened, if not fully avoided, by the adoption of feasible mitigation measures. The Project would nevertheless result in significant and unavoidable direct and cumulative impacts. Specifically, the Project would result in significant and unavoidable impacts on the following:

The SMCS Project would result in the following significant and unavoidable cumulative impacts:

- Construction of the SMCS Project would increase emissions of nitrogen oxide (NO_X) generated by construction on a short-term basis (6.2-3.)
- Operation of the SMCS Project would general an increase in ROG and NO_X (criteria pollutants) (6.2-4.)
- Construction activities of the SMCS Project would intermittently generate noise levels above existing ambient levels in the project vicinity on a short-term basis (6.6-1.)
- The SMCS Project and the Children's Theatre would increase traffic volumes on the freeway system (6.7-2.)
- The SMCS Project and the Children's Theatre would increase demand for parking (6.7-6.)

- The SMCS Project would generate more than 500 tons of solid waste per year. (6.8-11.)

(DEIR, pp. 3-3 – 3.4.)

The SMCS Project would result in the following significant and unavoidable cumulative impacts:

- The SMCS Project, in combination with other projects in the Sacramento Valley Air Basin, could result in a cumulative impact on criteria pollutants associated with project operation (6.2-8);