



Ultrafine Diesel Particles and Retrofit Technologies

With DPF



Without DPF



IN USE RETROFIT SECTION

JOHN KARIM, Manager



**PRESENTATION
OUTLINE**

**SHOWCASE
PROJECT**

**SUPPLEMENTAL
ENVIRONMENTAL
PROJECT
(SEP I,II,III)**

**SNOWCAT
PROJECT**

PEMS PROJECT

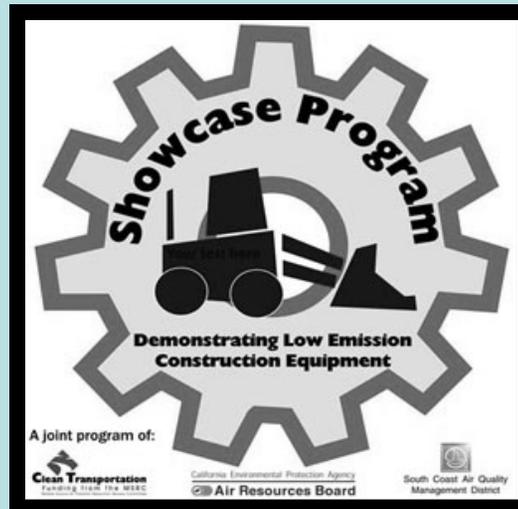




California Environmental Protection Agency



SHOWCASE PROGRAM





Objectives

- Reduce Diesel Emission from Off-Road Equipment (Level III Systems)
- Demonstrate Durability and Effectiveness of DPFs on Off-Road Construction Equipment
- Demonstrate New Emission Control Systems
- Increase Number of Verified Retrofit Devices
- Fill Gaps in Vehicle Matrix
- Update Board Meeting in December

	Target Vehicles		
	<175	<>	> 500
Bore/Drill Rigs	2	0	0
Cranes	2	1	0
Crawler Tractors	5	4	1
Excavators	4	7	1
Graders	1	3	0
Off-Highway Tractors	1	3	1
Off-Highway Trucks	0	2	1
Other Mobile Off-road	2	0	0
Paver	2	0	0
Rollers	3	2	0
Rough Terrain Forklifts	4	0	0
Rubber Tired Dozers	1	1	0
Rubber Tired Loaders	5	6	1
Scrapers	0	2	1
Skid Steer Loaders	10	1	0
Tractors/Loaders/Backhoes	10	4	1
Trenchers	5	0	0



Role of The Fleet Owner

- Submit Applications - Certification, EQ Information, Contracts with Device Manufacturers, Confirmation
- Ensure Vehicles Meet OEM Specifications
- Approve Retrofit Designs and Locations
- Make Vehicle(s) Available for Retrofitting
- Inform ARB of Any Issues
- Allow Access for Periodic Monitoring
- Allow On-site Emission Testing



18 Fleets

5 Public Fleets

13 Private Fleets

185 Total Vehicles

Private	Public
Community Recycling & Resource Recovery Inc.	CALTRANS Division of Equipment
Albert W. Davies, Inc.	City of Burbank Public Works Department
Recycled Materials Company of CA	City of Los Angeles, General Services Department
Dan Copp Crushing	County Sanitation Districts of L.A. County
ECCO Equipment Corp.	City of Culver City Transportation Department
Griffith Company	
PEED Equipment Company	
Altfillisch Contractors, Inc.	
Reed Thomas Company, Inc.	
Shimmick Construction Co.	
Skanska USA Civil West California District Inc.	
Tiger 4 Equipment Leasing	
Sukut Equipment Inc	

A joint program of:



Role of Device Manufacturers

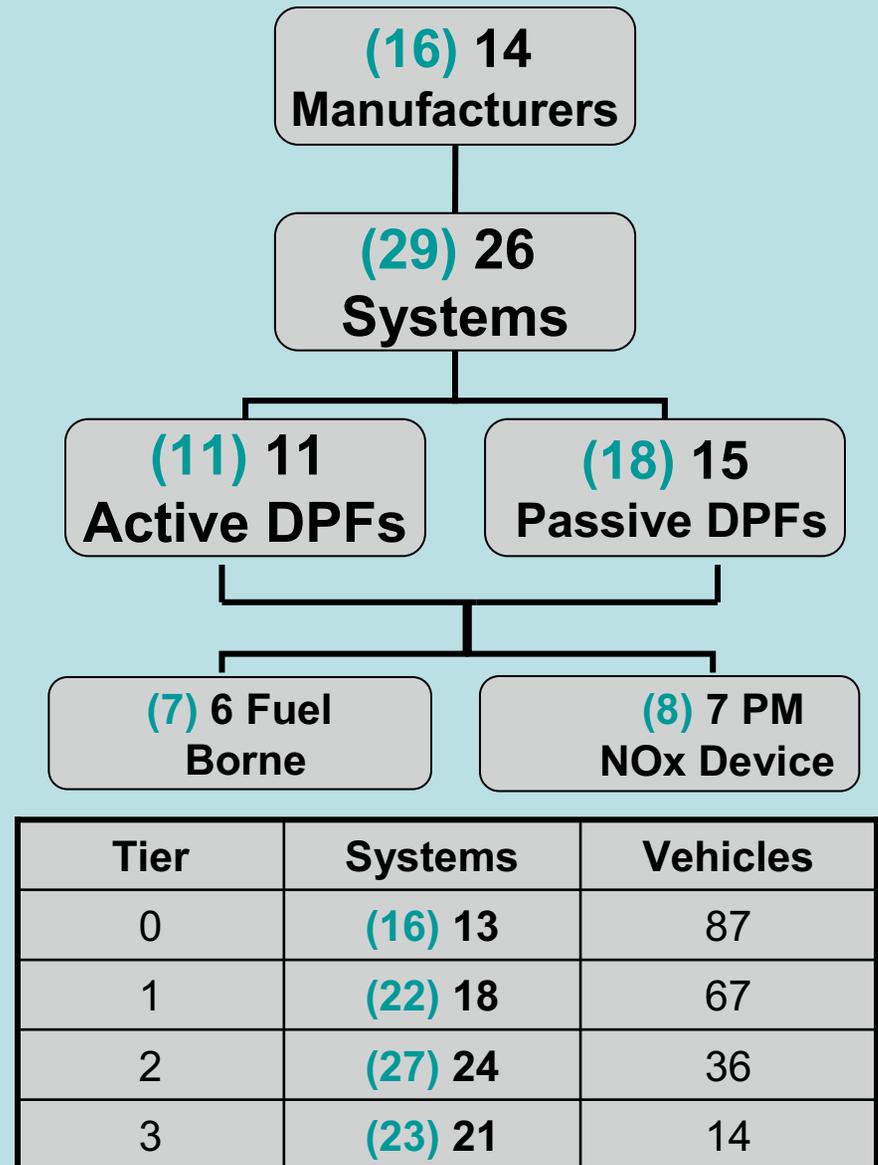
- Meet Mandatory Criteria
- Submit Proposal (s)
 - 1 YR Fuel Additive Supply
- Data Log EACH Vehicle
- Submit Design and Location to Fleet Owners and MSRC/SCAQMD/ARB
- Install DPF
- Install ARB Approved Data Loggers
- Respond within 24 hrs.
- Implement Warranty and Maintenance Agreement (2707)
- Provide Technical Support
- Obtain Experimental Permit

(626) 575-6848 rcastror@arb.ca.gov

EMISSION CONTROL MANUFACTURER PARTICIPANT LIST



MSRC(3.7M) AQMD (1.2M)





Showcase Project Status

Contracts:

Most of the
Contracts Between
MSRC and Fleet
Owners Have Been
Completed

50 Vehicles Data Logged

Fleet Owners and
Device
Manufacturers are
Determining Proper
Location for DPF
Installation

185 Vehicles are Participating

CDT

1 Engine Retrofit by End of Nov

DCL

5 Engine Retrofit by End of Nov

Dinex

5 Engine Retrofit by End of Nov

Donaldson

3 Engine Retrofit by End of Nov

Mann Hummel

6 Engine Retrofit by End Nov

Nett Tech

10 Engines Retrofit End Nov.

Expected Retrofits: 28 Vehicles



Retrofitted Vehicles

Vehicle Information 83N0670 Skanska	
Year	1995
Description	Rubber Tire Loaders
Horsepower	275
Hrs/Yr	1100
Proposed Device	CAT/EUG DPF
Tier	0



Vehicle Information 37006 Shimick	
Year	2004
Description	Tractors/Loaders/Backhoes
Horsepower	95
Hrs/Yr	880
Proposed Device	JM CRT
Tier	2



Vehicle Information 325B Community recycling	
Year	1994
Description	CAT 325B Excavator
Horsepower	168
Hrs/Yr	1953/per yr
Proposed Device	Sud Chemie ENIVCAT
Tier	0

Retrofitted Vehicles



Vehicle Information 330D Community Recycling	
Year	1999
Description	CAT 330B Excavator
Horsepower	222
Hrs/Yr	3200/per yr
Proposed Device	Sud Chemie ENIVCAT
Tier	1



Vehicle Information 5738 DCL	
Year	1997
Horsepower	Front 559, Rear 400
Description	Scraper
Hrs/Yr	1000
Proposed Device	DCL Mine X
Tier	0

Retrofitted Vehicles



DCL Installation CAP D6R Equipment 6503	
Year	2003
Horsepower	255
Description	Crawler Tractor
Hrs/Yr	1400
Proposed Device	DCL Mine X
Tier	2

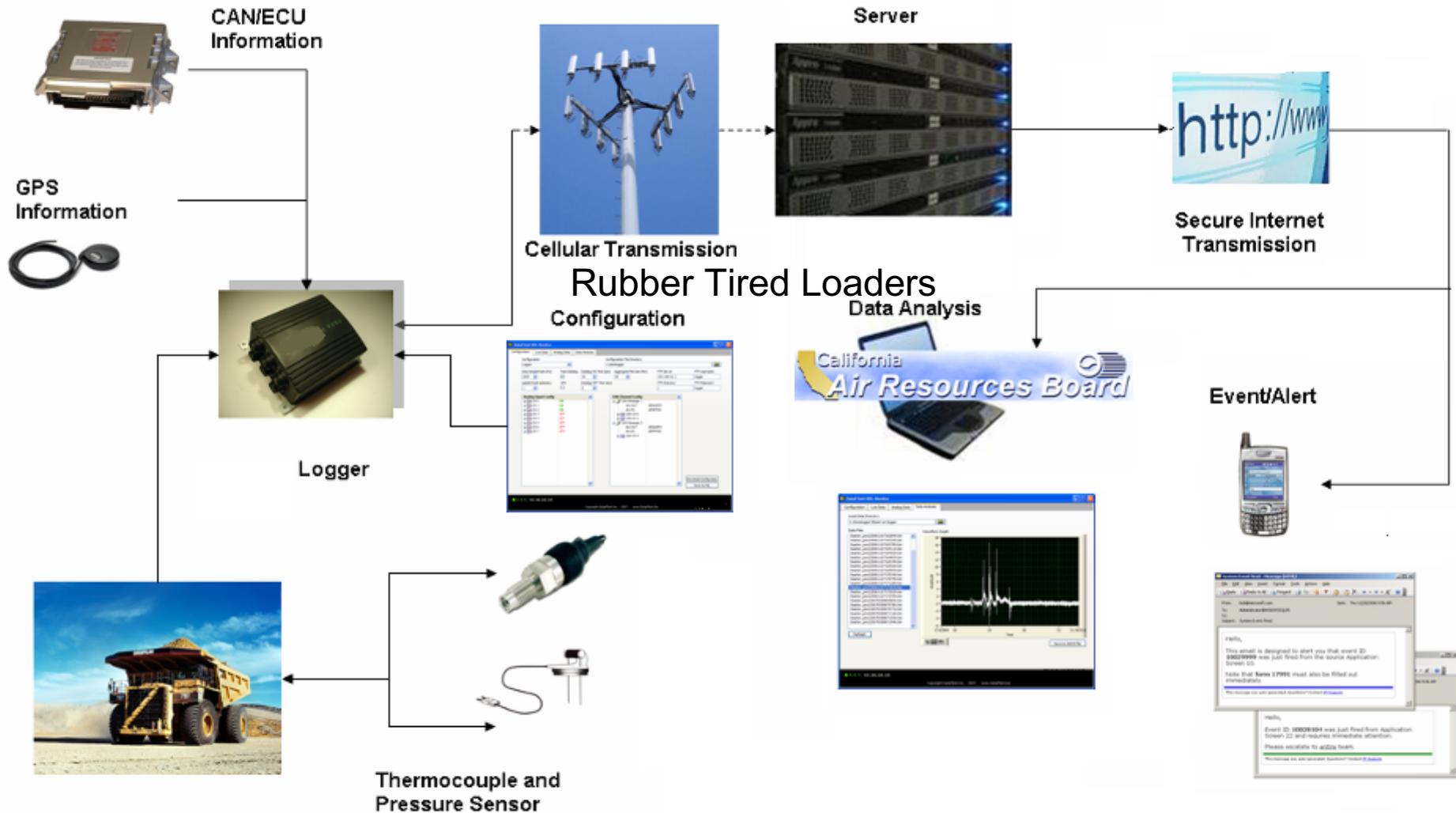


**Retrofitted
Vehicles**

Vehicle Information 5734 DCL Mine-X	
Year	1997
Horsepower	Front 559, Rear 400
Description	Scraper
Hrs/Yr	1000
Proposed Device	DCL Mine X
Tier	0



DATA LOGGER





California Environmental Protection Agency

Air Resources Board

**SUPPLEMENTAL
ENVIRONMENTAL
PROJECT I,II,III
PROGRAM**



SEP Objectives

- Reduce Diesel Emission from Off-Road Equipment (Level III Systems)
- Demonstrate Durability and Effectiveness of DPFs on Off-Road Construction Equipment
- **Demonstrate New Emission Control Systems**
- Increase Number of Verified Retrofit Devices
- Fill Gaps in Vehicle Matrix
- Update Board Meeting in December
- Spend \$200,000 in Valero Wilmington Refinery Area (25-mile radius)+

Role of Fleet Owner

- Same As Showcase

Role of Device Manufacturers

- Same As Showcase



SEP I RETROFITS





SEP I Vehicle Matrix

(Vehicle #)	YR	HP	Tier	Description	Hrs YR	Retrofit Device	Active/ Passive/ Nox Control
1182	2000	315	1	Wheel Loader	1500	Exengine ADECII	Active/ Nox
26701	1999	230	1	Excavator	1800	Rypos HDP	Active
6727A/B	2003	550 400	2	Scraper 657E	1700	DCL Mine X	Passive
6768	1998	105	1	Wheel Loader	2000	Nett Tech	Passive/ Nox
61620	2007	125	3	John Deere	1400	ECS Assisted	Active
61619	2007	125	3	John Deere	1400	ECS Assisted	Active
47121	2000	185	1	Motorgrader	620	Recat- ESW DC	Active
60654	2006	125	2	Tractor	2100	Sud Chemie	Passive
60656	2006	125	2	Tractor	1200	Recat ESW	Active
69061	2000	89	1	Wheel Loader	677	Mann Hummel	Active
69060	1999	80	1	Wheel Loader	500	Mann Hummel	Active
72204	1995	105	0	Wheel Loader	400	Huss FS-MD	Active
61621	2007	125	3	John Deere Tractor	1200	Sud Chemie	Passive
61623	2007	125	3	John Deere Tractor	1200	Sud Chemie	Passive



Vehicle Information 6727	
Year	2003
Horsepower	550/400
Tier	2
Description	657E Scrapper
Hrs/Yr	1700
Active/Passive/Nox	Passive
Proposed Device	DCL MINE-X

Retrofitted Vehicles



Vehicle Information 26701	
Year	1999
Horsepower	230
Tier	1
Description	Excavator, MAT, HANDLING
Hrs/Yr	1800
Active/Passive/Nox	Active
Proposed Device	Rypos HDPF/C



Retrofitted Vehicles

Vehicle Information 6768	
Year	1998
Horsepower	105
Tier	1
Description	Wheel loader
Hrs/Yr	2000
Active/Passive/Nox	Passive, Nox Control
Proposed Device	Nett Tech Passive SCR



Vehicle Information 61619	
Year	2007
Horsepower	125
Tier	3
Description	John Deere 7520
Hrs/Yr	1400
Active/Passive/Nox	Active
Proposed Device	ECS Assisted Purifier



Retrofitted Vehicles

Vehicle Information 61620	
Year	2007
Horsepower	125
Tier	3
Description	John Deere 7520
Hrs/Yr	1400
Active/Passive/Nox	Active
Proposed Device	ECS Assisted Purifilter



Vehicle Information 47121	
Year	2000
Horsepower	185
Tier	1
Description	MotorGrader
Hrs/Yr	620
Active/Passive/Nox	Active
Proposed Device	Recat ESE DC-100



Retrofitted Vehicles

Vehicle Information 60656	
Year	2006
Horsepower	125
Tier	2
Description	Tractor
Hrs/Yr	1200
Active/Passive/Nox	Active
Proposed Device	Recat-ESW Therma Cat System ETI DC-202



Vehicle Information 60654	
Year	2006
Horsepower	125
Tier	2
Description	Tractor
Hrs/Yr	2100
Active/Passive/Nox	Passive
Proposed Device	Sud Chemie ENVICAT



Vehicle Information 69060	
Year	1999
Horsepower	80
Tier	1
Description	Wheel Loader/ Backhoe
Hrs/Yr	500
Active/Passive/Nox	Active
Proposed Device	Mann Hummel SMF-AR

Retrofitted Vehicles



Vehicle Information 69061	
Year	2000
Horsepower	89
Tier	1
Description	Wheel Loader
Hrs/Yr	677
Active/Passive/Nox	Active
Proposed Device	Mann Hummel SMF-AR



Retrofitted Vehicles

Vehicle Information 072204	
Year	1995
Horsepower	105
Tier	0
Description	Wheel Loader
Hrs/Yr	400
Active/Passive/Nox	Active
Proposed Device	Huss FS-MD



Vehicle Information 61621	
Year	2007
Horsepower	125
Tier	3
Description	John Deere Tractor
Hrs/Yr	1200
Active/Passive/Nox	Passive
Proposed Device	SUD CHEMIE





SEP II RETROFITS





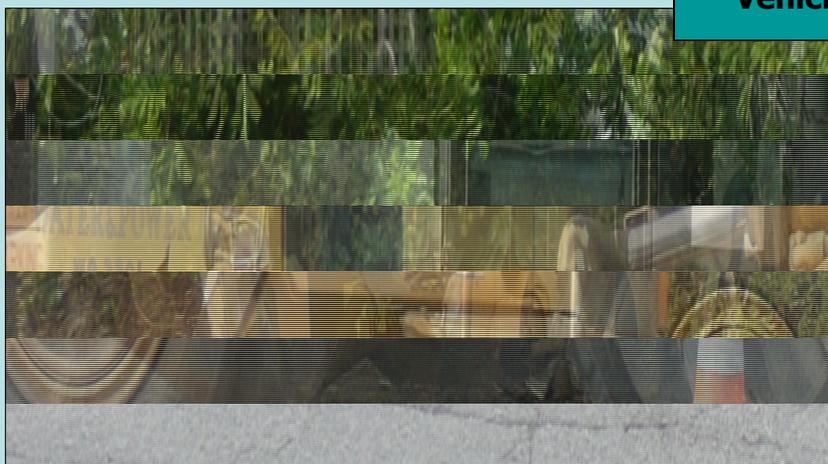
SEP II Vehicle Matrix

(Vehicle #)	YR	HP	Tier	Description	Hrs YR	Proposed Device	Active/ Passive/ Nox Control
14267	2000	86	1	Backhoe	29.9	Mann Hummel SMF-AR	Active
14339	2007	150	3	Tractor	104.5	Huss FS-MC	Passive
14337	2007	150	3	Tractor	123.0	ECS Purifilter	Passive
14336	2005	224	2	Wheel Loader	106	CAT - DPF	Passive
14338	2007	150	3	Tractor	248.4	Tehag	
W93301	2002	180	0	Articulate Wheel Loader	1440	Econix DPF-A	Active
W93518	2000	108	1	Articulate Wheel Loader	584.4	CDT Platinum Plus Purifilter	Passive
W93524	2004	95	2	Articulate Wheel Loader	567	CAT - DPF	Passive
W94677	2002	439	0	Excavator	700	CAT - DPF	Passive
844	2005	142	2	Fork Lift Truck	1920	Nett Tech Active DPF	Active
637	1999	185	1	Side Handler 6 High	1920	Extengine MaxTrap	Active/Nox



Retrofitted Vehicles

Vehicle Information 14338	
Year	2007
Horsepower	150
Tier	3
Description	Tractor
Hrs/Yr	20.7
Active/Passive/Nox	passive
Proposed Device	Tehag Passive DPF



Vehicle Information W93301	
Year	2002
Horsepower	180
Tier	0
Description	Articulate Wheel Loader
Hrs/Yr	960
Active/Passive/Nox	Active
Proposed Device	Econix DPF -A



Retrofitted Vehicles

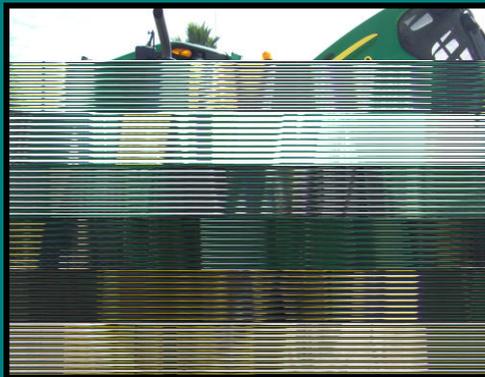
Vehicle Information 14339	
Year	2007
Horsepower	150
Tier	3
Description	Tractor
Hrs/Yr	104.5
Active/Passive/Nox	passive
Proposed Device	Huss FS-MC



Vehicle Information 14337	
Year	2007
Horsepower	150
Tier	3
Description	Tractor
Hrs/Yr	123
Active/Passive/Nox	Passive
Proposed Device	ECS Purifier



SEP III RETROFITS





SEP III Vehicle Matrix

(Vehicle #)	YR	HP	Tier	Description	Hrs YR	Proposed Device	Active/ Passive/ Nox Control
7613	2006	75	2	Rubber Tire Loader	401	Huss	Huss MD Passive
7308	1998	75	1	Rubber Tire Loader	392	Nett Tech	Nett Vorteq Active DPF
7601	1997	150	1	Motor grader	290	Nett Tech	Nett Vorteq Active DPF
C594	2004	113	2	Tractor-Rotary Boom Mower	250	Huss	Huss MD Passive
C440	1999	225	1	Motor grader	625	CAT	CAT - DPF
S84A	2006	80	2	Broom	755.5	CDT	CDT DPF Passive
R85B	2004	119	2	Wheel Loader	725.5	CDT	CDT DPF Passive
R82A	1999	240	1	Excavator	671	CAT	CAT - DPF
TC55DA	2005	~55	2	Tractor (Spreader)	400	ECS	Purifilter Plus (Hybrid device)
30582	2005	~81	2	Mower	333	ECS	Purifilter Plus (Hybrid device)
30581	2004	~82	2	Mower	333	Mann Hummel	SMF- AR Active
420D	2001	~95	1	Backhoe	1000	Mann Hummel	SMF- AR Active



FLEET VEHICLE LIST

Monday, November 10, 2008

This page last reviewed: November 10, 2008

UP LINKS

- ARB Programs
- Diesel Programs
 - Mobile Vehicles and Equipment
 - **Showcase Off-Road Diesel Retrofit**

LOCAL LINKS

- Announcements
- Application Information
- Background
- Contacts
- Equipment Temperature Profiles
- FAQs
- Fleet List
- Join Email List
- SEP
- SEP II
- SEP III
- Site Visit Sign-Up
- Snowcat Reports
- Verification Strategies

ShowCase / SEP Fleet

- Login
- Change Password
- Fleet Vehicle List

Showcase:

SEP:

SEP II:

SEP III:

FLEET/BUSINESS: COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY

Showcase Vehicles

Equipment ID	Year	HP	Tier	Description	S/N	HRs/YR	Device	Data Logged	DataLogger Installed	Device Installed
5002 E	2006	577	--	Front Engine	80M05737	1,400 per year	CDT Permit-FBC	-	-	-
5002 R	2006	418	--	Rear Engine	99C07656	1,400 per year	CDT Permit-FBC	-	-	-
5003 F	2006	577	--	Front Engine, used to be with Purem (10)	80M08550	1,300 per year	CAT - DPF	-	-	-
5003 R	2006	418	--	Rear Engine, used to be with Purem (10)	99C07705	1,300 per year	CAT - DPF	-	-	-
5004 F	2006	577	--	Front Engine	80M05697	1,500 per year	CDT Platinum Plus Purifier Filter	-	-	-
5004 R	2006	418	--	Rear Engine	99C09907	1,500 per year	CDT Platinum Plus	-	-	-



Vehicle Information Page

SEP II VEHICLE INFORMATION

Monday, November 10, 2008

This Page Last Reviewed: November 3, 2008

UP LINKS

- > ARB Programs
- > Diesel Programs
 - > Mobile Vehicles and Equipment
 - > **Showcase Off-Road Diesel Retrofit**

LOCAL LINKS

- > Announcements
- > Application Information
- > Background
- > Contacts
- > Equipment Temperature Profiles
- > FAQs
- > Fleet List
- > Join Email List
- > SEP
- > SEP II
- > SEP III
- > Site Visit Sign-Up
- > Snowcat Reports
- > Verification Strategies

ShowCase / SEP Fleet

- > Login
- > Change Password
- > Fleet Vehicle List



[View More Pictures](#)

Equipment ID: 14267

Equipment Details

Make: CAT **Model:** 416
Year: 2000 **S/N:** 4ZN21522
Description: BACKHOE

Engine Details

Make: CAT **Model:** CAT 3204
Year: 2000 **Size:** 4.0 **HP:** 86
Family: YPKXL03.9AK1

Retrofit Details

Tier: 1 **Hrs/Month:** 29.9 **Install Date:**
Data Logging: Mann Hummel
Selected Device:

Temperature Profiles For Equipment -- 14267

Temperature Profile	Profile Date	Date Posted
vehicle#14267	2008-09-11 00:00:00	2008-09-11 00:00:00

Current Equipment Log Information

This Equipment Has No Log Entries At This Time



Equipment Image Gallery

CA.GOV California Environmental Protection Agency AIR RESOURCES BOARD

Skip to: [Content](#) | [Footer](#) | [Accessibility](#) | [A-Z Index](#)

Search ARB
 Google Advanced

[Home](#) [Programs](#) [Rulemaking](#) [Board Meetings](#) [Laws & Regulations](#) [Data & Statistics](#) [Permits, Etc.](#) [Events](#)

EQUIPMENT IMAGE GALLERY

Wednesday, October 29, 2008

This Page Last Reviewed: October 6, 2008

UP LINKS

- ARB Programs
 - Diesel Programs
 - Mobile Vehicles and Equipment
 - **Showcase Off-Road Diesel Retrofit**

LOCAL LINKS

- Announcements
- Application Information
- Background
- Contacts
- Equipment Temperature Profiles
- FAQs
- Fleet List
- Join Email List
- SEP
- SEP II
- SEP III
- Site Visit Sign-Up
- Snowcat Reports
- Verification Strategies

ShowCase / SEP Fleet

- Login

Image_3



SNOWCATS PROJECT

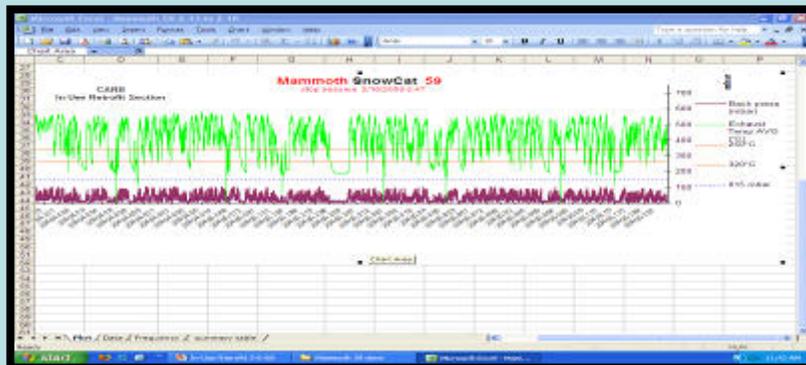




Snowcat Project

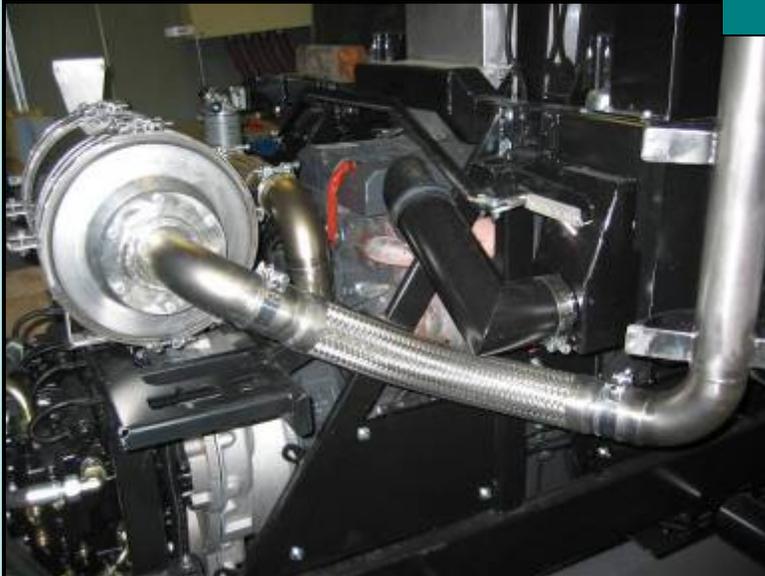
- **Three Locations:**
 - Northstar : 5 vehicles
 - Mammoth: 5 vehicles
 - Sugarbowl: 2 vehicles
- **Temperature Profiles**
 - Generated, analyzed and posted on the ARB website for all vehicles
- **Preliminary Results** of the temperature profile analysis indicate that vehicles were operating at 400°C or above for 40% of the time regardless of vehicle type.
- **Recommendation:** All vehicles be retrofitted with passive DPFs.
- **Outcome:** Northstar is already retrofitting its vehicles with passive DPFs.

<http://www.arb.ca.gov/diesel/showcase/showcase.htm>





**Retrofitted
Vehicles**





Portable Emissions Monitoring System



PEMS



PEMS Description

Purpose:

- To Evaluate Performance of DPF On Off-Road / On-Road Equipment.
- To Compare On Road Measurement with Engine Dyno Measurements
- To Evaluate Possibility of Measuring PM Using Low Cost Instruments
- To Evaluate Different Techniques of Particulate Measurements
- To Establish a Test Cycle in Order to Evaluate Retrofit Device Performance

Parameters:

- Temperature, backpressure, RPM, throttle position, manifold pressure, EGR, atmospheric conditions
- Monitor engine parameters using the vehicles ECM (When applicable)

Measurement:

- Accurately Measures Vehicle Exhaust flow rate from either the engine electronic control module and/or the vehicle exhaust tail pipe
- NO, NO₂, CO, CO₂, THC, PM

Data:

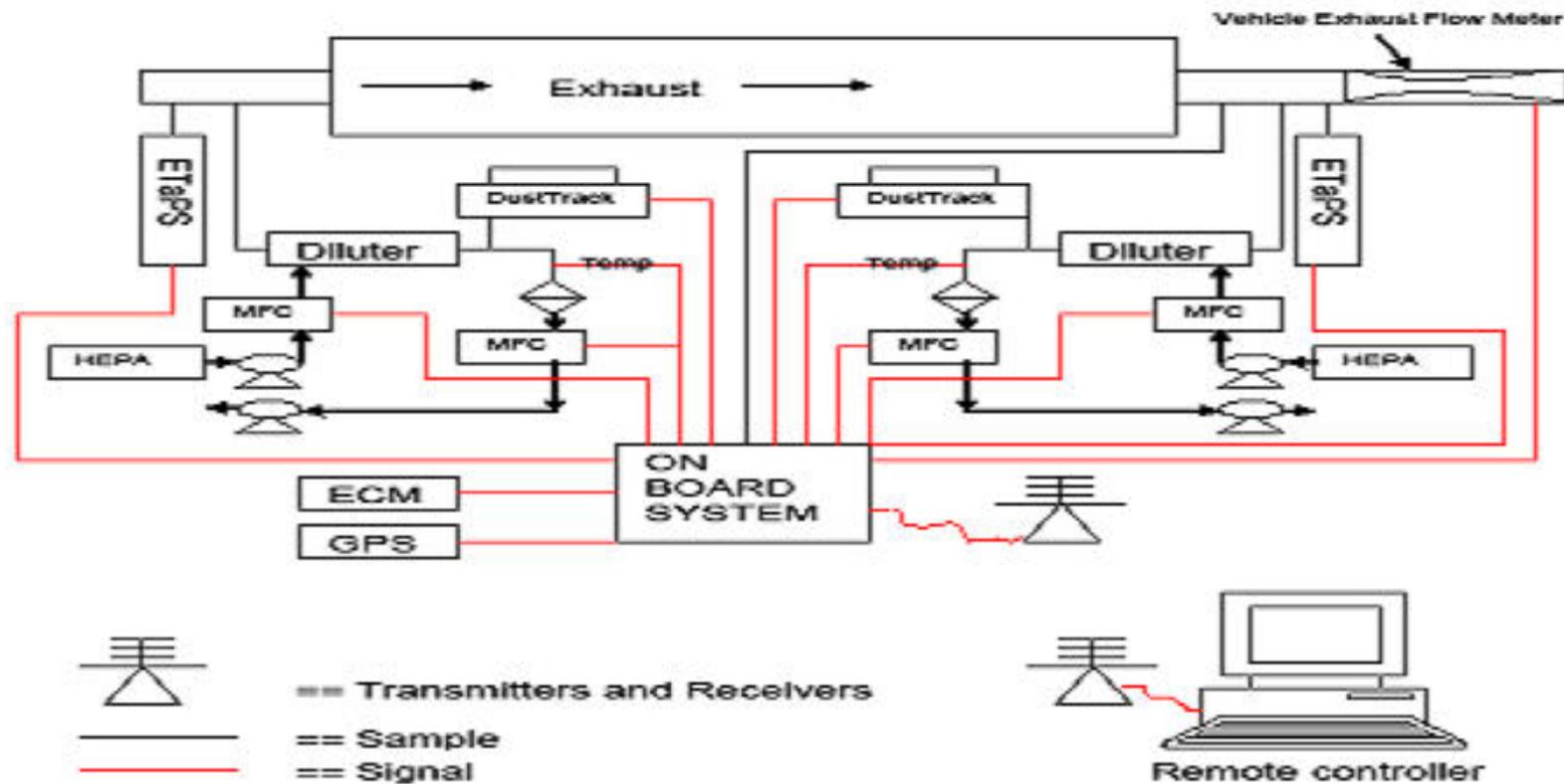
- Real time vehicle emission data in engineering units
- Report vehicle trap efficiency before/after measurement of ETaPS and Dust Track,





PEMS Diagram Overview

ON BOARD SYSTEM CONCEPT





PEMS System



Gaseous Emissions:
THC, NO_x, NO,
NO₂, CO, CO₂

Exhaust Flow Measurement
CFV, ECU

PM by:

Mass

Soot

Electric Mobility

QCM

Received Aug,
2008.

Planned to Add:

EAD

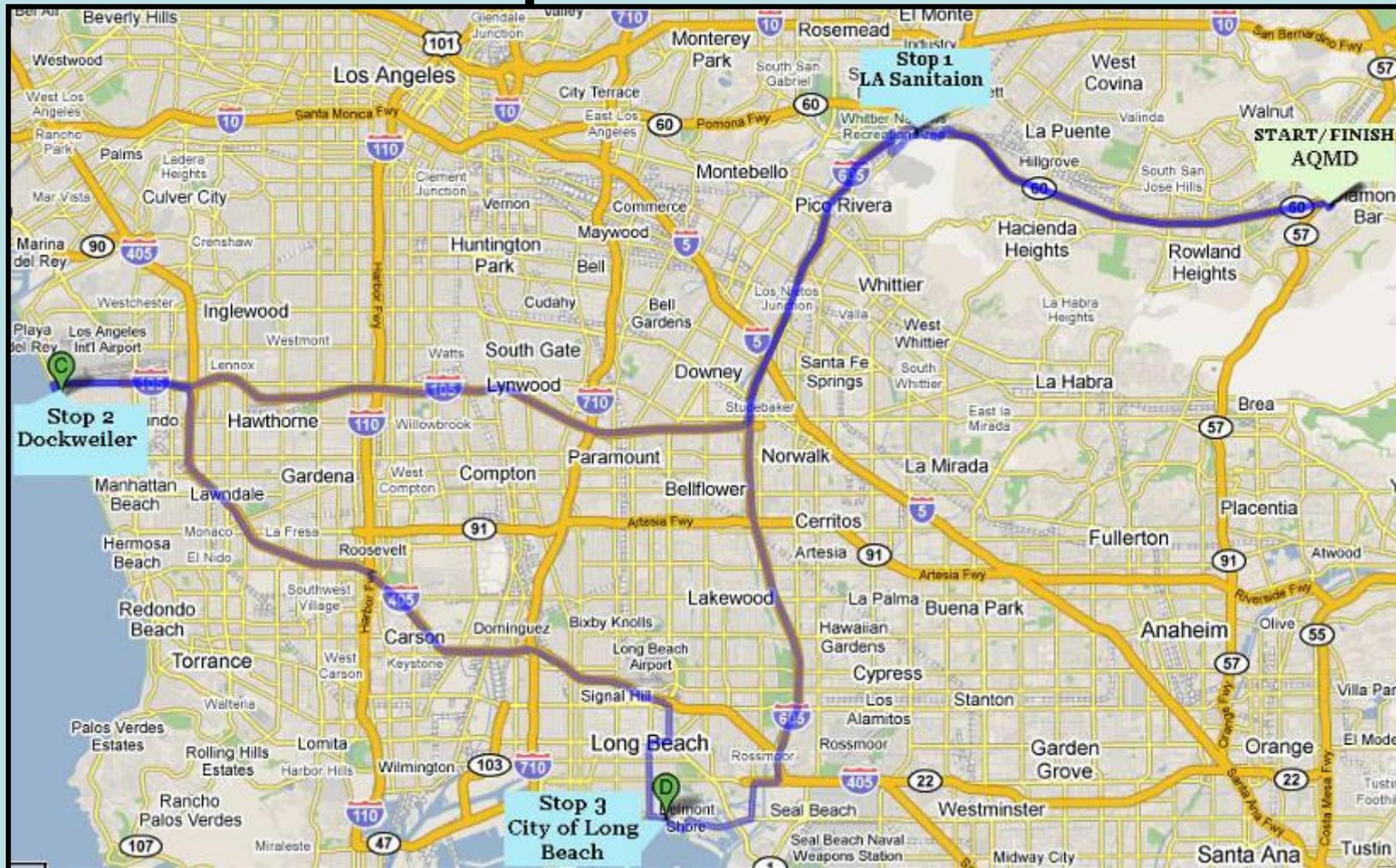
CPC

DMM





Map Locations





SITE VISIT AGENDA



California Environmental Protection Agency

Conference: Course on Ultrafine Diesel Particles and Retrofit Technologies for Diesel Engines

Scheduled Site Visits: November 14, 2008

AGENDA

TIME	DESCRIPTION	LOCATION
8:00	Leave AQMD Site	South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, California 91765
9:00	Arrive on Site: LA County of Sanitation	1955 Workman Mill rd. City of Industry, CA
10:00	Leave Site: LA County of Sanitation	
11:00	Arrive on Site: Dockweiler Beach Lunch	12503 Vista Del Mar Playa Del Rey, CA 90293
1:00	Leave Site: Dockweiler Beach	
2:00	Arrive on Site: City of Long Beach	4320 E Olympic Plaza Long Beach, CA 90804
3:00	Leave Site: City of Long Beach	
5:30	Arrive Back at AQMD	South Coast Air Quality Management District, 21865 Copley Drive, Diamond Bar, California 91765



Site Visit

<http://www.arb.ca.gov/diesel/showcase/signup.php>

Please be aware of the following:

- Due to space limitations personal vehicles will not be allowed on-site at any of the locations we will be visiting.
- The ARB will not provide pick up for those who wish to leave the trip early. (i.e. you must visit all 3 site or arrange for someone to pick you up at one of the sites.)
- The ARB is not responsible for the loss or theft of any personal items on this trip.
- Please keep in mind that these sites are off road and you may be climbing up on equipment. Please dress accordingly.
- You may be asked to sign a release of liability.



SPECIAL THANKS

The Air Resources Board's In-Use Retrofit section would like to extend our deepest gratitude to:

Rick Teebay (L.A. Department of Water and Power)

Wayne Schumaker

Pamela Manning (L.A. Department of Public Works)

Don Knabe (County of Los Angeles' 4th district)

Roberta Tilles (L.A. Beaches & Harbors)

Silverster Townsend (L.A. Beaches & Harbors)

Monet Wong (LA Sanitation)

Larry Eisenberg (LA Sanitation)

Ray Ontiveros

Vern HelBig (City of Long Beach)



Contacts

Johnny Karim, Manager

- **In-Use Retrofit Section**
- **(626) 459-4303, jkarim@arb.ca.gov**

- **Website:**

- **<http://www.arb.ca.gov/diesel/showcase/showcase.htm>**