ENCLOSURE 1

Los Angeles Department of Water and Power

Purchase of 56 Heavy-Duty CNG Vehicles
Contract No. ML09042

FINAL REPORT

February 13, 2013

**Prepared for the Mobile Source Air Pollution Committee (MSRC)
under the AB 2766 Discretionary Fund Work Program**

Clean Transportation
Funding from the MSRC

Acknowledgments

The following key personnel from the Los Angeles Department of Water and Power were involved with purchasing the CNG vehicles under this grant:

MSRC Grant Administrator:	Stephen B. Gallie
Manager of Fleet Procurement:	Fausto H. Cetina

This report was submitted in fulfillment of Contract No. ML08038 and the Purchase of 42 Heavy-Duty CNG Vehicles by the Los Angeles Department of Water and Power under the partial sponsorship of the MSRC. Work was completed as of September 7, 2012, when the last vehicle was received.

Disclaimer

Project Description and Work Performed

This grant helped to fund the replacement of existing diesel-powered vehicles with CNG powered ones, specifically fifty-six (56) two-axle dump trucks.

Engine Specification for the stake truck (see attached CARB Executive Order):

- Make: Cummins
- Model: ISL-G
- Engine Year: 2011
- Fuel Type: CNG/LNG
- Engine Size: 8.9 Liters

Vehicles Replaced and Retired Vehicles:

The older vehicles have either been sent to the salvage yard and are currently awaiting auction to be sold to a vendor for use outside California, or have already been sold. When a vehicle is sold, LADWP submits to the Department of Motor Vehicles a VIN stop and specifies that the vehicle can no longer be driven in California.

Procurement Schedule:

Ordered: Under LADWP Contract No.'s 7133-B, dated August 13, 2010

Received: Began receiving vehicles on December 27, 2011 and received the last vehicle on September 7, 2012

Deployment: Began on January 6, 2012 and ended October 2, 2012

Operational Experience and Problems Encourntered:

Some employees have complained of the supposed lag time once the foot is removed from the accelerator, claiming that the truck doesn't slow down quick enough. Fleet personnel took steps to compare the new CNG trucks side by side to existing diesel ones, and the time to slow down when releasing the accelerator is the same or better for the CNG. As a result, the engine manufacturer has come on site to provide training and an explanation of the different driving feel between CNG vs. diesel engines. Employees are still getting used to this difference and are slowly warming up to the new feel of the engine. This issue does not appear to be significant and it is anticipated that with ongoing training and awareness that over time there should be no long term problems.

Emission Benefits

The emission benefits of replacing older diesel-powered vehicles with cleaner CNG powered ones is calculated in the table below, using the appropriate model year values from the Carl Moyer Program Guidelines, Table B-4. Only forty-nine (49) were replaced and seven (7) of the fifty-six (56) were additions to the fleet.

The total emission reduction is as follows:

- PM (g/year) reduction from 88,419 to 6,630 (81,789 g/year)

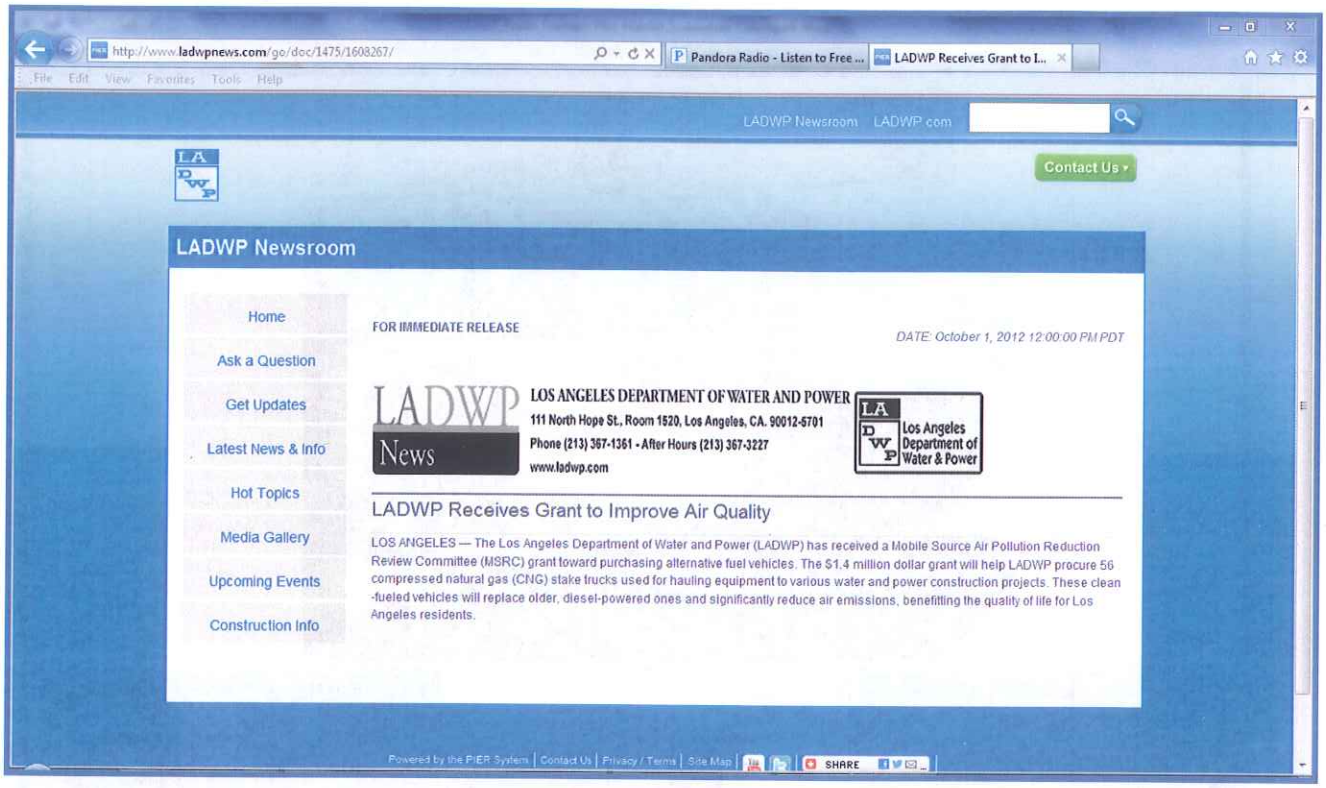
- NOx (g/year) reduction from 3.38 million to 140,890 (3,238,636.24 g/year)

					Old Diesel Engine				New CNG Engines			
	Description	Old LADWP No.	Model Year	Avg Miles per Year	PM (g/mile)	NOx (g/mile)	PM Emissions (g/year)	NOx Emissions (g/year)	PM (g/mile)	Nox (g/mile)	PM Emissions (g/year)	Nox Emissions (g/year)
1	2-AXLE DUMP TRUCK	P58573	1991	2,186	0.288	12.18	629.57	26625.48	0.024	0.51	52.464	1114.86
2	2-AXLE DUMP TRUCK	W58012	1985	3,614	0.72	16.65	2602.08	60173.10	0.024	0.51	86.736	1843.14
3	2-AXLE DUMP TRUCK	W58014	1985	4,369	0.72	16.65	3145.68	72743.85	0.024	0.51	104.856	2228.19
4	2-AXLE DUMP TRUCK	W58016	1985	4,705	0.72	16.65	3387.60	78338.25	0.024	0.51	112.92	2399.55
5	2-AXLE DUMP TRUCK	W58017	1985	3,812	0.72	16.65	2744.64	63469.80	0.024	0.51	91.488	1944.12
6	2-AXLE DUMP TRUCK	W58018	1985	2,907	0.72	16.65	2093.04	48401.55	0.024	0.51	69.768	1482.57
7	2-AXLE DUMP TRUCK	W58025	1985	4,183	0.72	16.65	3011.76	69646.95	0.024	0.51	100.392	2133.33
8	2-AXLE DUMP TRUCK	W58027	1985	3,201	0.72	16.65	2304.72	53296.65	0.024	0.51	76.824	1632.51
9	2-AXLE DUMP TRUCK	W58044	1988	3,208	0.504	14.6	1616.83	46836.80	0.024	0.51	76.992	1636.08
10	2-AXLE DUMP TRUCK	W58045	1988	4,776	0.504	14.6	2407.10	69729.60	0.024	0.51	114.624	2435.76
11	2-AXLE DUMP TRUCK	W58046	1988	3,110	0.504	14.6	1567.44	45406.00	0.024	0.51	74.64	1586.1
12	2-AXLE DUMP TRUCK	W58053	1988	3,541	0.504	14.6	1784.66	51698.60	0.024	0.51	84.984	1805.91
13	2-AXLE DUMP TRUCK	W58054	1988	4,409	0.504	14.6	2222.14	64371.40	0.024	0.51	105.816	2248.59
14	2-AXLE DUMP TRUCK	W58056	1988	4,540	0.504	14.6	2288.16	66284.00	0.024	0.51	108.96	2315.4
15	2-AXLE DUMP TRUCK	W58088	1988	4,697	0.504	14.6	2367.29	68576.20	0.024	0.51	112.728	2395.47
16	2-AXLE DUMP TRUCK	W58094	1988	4,280	0.504	14.6	2157.12	62488.00	0.024	0.51	102.72	2182.8
17	2-AXLE DUMP TRUCK	W58100	1988	2,678	0.504	14.6	1349.71	39098.80	0.024	0.51	64.272	1365.78
18	2-AXLE DUMP TRUCK	W58108	1988	3,927	0.504	14.6	1979.21	57334.20	0.024	0.51	94.248	2002.77
19	2-AXLE DUMP TRUCK	W58115	1988	2,356	0.504	14.6	1187.42	34397.60	0.024	0.51	56.544	1201.56
20	2-AXLE DUMP TRUCK	W58175	1994	10,048	0.216	10.7	2170.37	107513.60	0.024	0.51	241.152	5124.48
21	2-AXLE DUMP TRUCK	W58176	1994	6,871	0.216	10.7	1484.14	73519.70	0.024	0.51	164.904	3504.21
22	2-AXLE DUMP TRUCK	W58177	1994	8,193	0.216	10.7	1769.69	87665.10	0.024	0.51	196.632	4178.43
23	2-AXLE DUMP TRUCK	W58178	1994	10,988	0.216	10.7	2373.41	117571.60	0.024	0.51	263.712	5603.88
24	2-AXLE DUMP TRUCK	W58179	1999	7,047	0.144	9.77	1014.77	68849.19	0.024	0.51	169.128	3593.97
25	2-AXLE DUMP TRUCK	W58180	1999	8,389	0.144	9.77	1208.02	81960.53	0.024	0.51	201.336	4278.39
26	2-AXLE DUMP TRUCK	W58181	1999	9,832	0.144	9.77	1415.81	96058.64	0.024	0.51	235.968	5014.32
27	2-AXLE DUMP TRUCK	W58182	1999	7,110	0.144	9.77	1023.84	69464.70	0.024	0.51	170.64	3626.1
28	2-AXLE DUMP TRUCK	W58183	1999	10,796	0.144	9.77	1554.62	105476.92	0.024	0.51	259.104	5505.96
29	2-AXLE DUMP TRUCK	W58184	1999	10,798	0.144	9.77	1554.91	105496.46	0.024	0.51	259.152	5506.98
30	2-AXLE DUMP TRUCK	W58185	1999	9,123	0.144	9.77	1313.71	89131.71	0.024	0.51	218.952	4652.73
31	2-AXLE DUMP TRUCK	W58525	1991	4,268	0.288	12.18	1229.18	51984.24	0.024	0.51	102.432	2176.68
32	2-AXLE DUMP TRUCK	W58526	1991	10,294	0.288	12.18	2964.67	125380.92	0.024	0.51	247.056	5249.94
33	2-AXLE DUMP TRUCK	W58528	1991	4,146	0.288	12.18	1194.05	50498.28	0.024	0.51	99.504	2114.46
34	2-AXLE DUMP TRUCK	W58529	1991	4,932	0.288	12.18	1420.42	60071.76	0.024	0.51	118.368	2515.32
35	2-AXLE DUMP TRUCK	W58530	1991	2,586	0.288	12.18	744.77	31497.48	0.024	0.51	62.064	1318.86
36	2-AXLE DUMP TRUCK	W58532	1991	6,192	0.288	12.18	1783.30	75418.56	0.024	0.51	148.608	3157.92
37	2-AXLE DUMP TRUCK	W58536	1991	4,112	0.288	12.18	1184.26	50084.16	0.024	0.51	98.688	2097.12
38	2-AXLE DUMP TRUCK	W58537	1991	7,914	0.288	12.18	2279.23	96392.52	0.024	0.51	189.936	4036.14
39	2-AXLE DUMP TRUCK	W58540	1991	7,330	0.288	12.18	2111.04	89279.40	0.024	0.51	175.92	3738.3
40	2-AXLE DUMP TRUCK	W58541	1991	5,874	0.288	12.18	1691.71	71545.32	0.024	0.51	140.976	2995.74
41	2-AXLE DUMP TRUCK	W58542	1991	5,046	0.288	12.18	1453.25	61460.28	0.024	0.51	121.104	2573.46
42	2-AXLE DUMP TRUCK	W58543	1991	6,300	0.288	12.18	1814.40	76734.00	0.024	0.51	151.2	3213
43	2-AXLE DUMP TRUCK	W58544	1991	6,575	0.288	12.18	1893.60	80083.50	0.024	0.51	157.8	3353.25
44	2-AXLE DUMP TRUCK	W58546	1991	6,289	0.288	12.18	1811.23	76600.02	0.024	0.51	150.936	3207.39
45	2-AXLE DUMP TRUCK	W58547	1991	6,091	0.288	12.18	1754.21	74188.38	0.024	0.51	146.184	3106.41
46	2-AXLE DUMP TRUCK	W58550	1991	4,673	0.288	12.18	1345.82	56917.14	0.024	0.51	112.152	2383.23
47	2-AXLE DUMP TRUCK	W58551	1991	6,538	0.288	12.18	1882.94	79632.84	0.024	0.51	156.912	3334.38
48	2-AXLE DUMP TRUCK	W58552	1991	5,160	0.288	12.18	1486.08	62848.80	0.024	0.51	123.84	2631.6
49	2-AXLE DUMP TRUCK	W58574	1991	2,240	0.288	12.18	645.12	27283.20	0.024	0.51	53.76	1142.4
						Totals	88,418.74	3,379,525.78		Totals	6,630.10	140,889.54

Photographs and Outreach

Below are pictures of the two-axle dump trucks purchased under this grant:

In accordance with the Public Outreach Plan approved by your office, the following news bulleting was posted on the LADWP website.



Summary and Conclusions

In closing, this grant allowed for the purchase of fifty-six (56) two-axle dump trucks to replace older, diesel-powered ones. As a result the estimated total emission reduction for PM is 81,789 grams per year and for NOx around 3.2 million grams per year. This grant was very beneficial in helping to offset the additional cost of purchasing CNG powered vehicles, and has allowed LADWP to reduce its fleet emissions.

California Environmental Protection Agency AIR RESOURCES BOARD	CUMMINS INC.	EXECUTIVE ORDER A-021-0537 New On-Road Heavy-Duty Engines Page 1 of 1 Pages

Pursuant to the authority vested in the Air Resources Board by Health and Safety Code Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Sections 39515 and 39516 and Executive Order G-02-003;

IT IS ORDERED AND RESOLVED: The engine and emission control systems produced by the manufacturer are certified as described below for use in on-road motor vehicles with a manufacturer's GVWR over 14,000 pounds. Production engines shall be in all material respects the same as those for which certification is granted.

MODEL YEAR	ENGINE FAMILY	ENGINE SIZES (L)	FUEL TYPE [1]	STANDARDS & TEST PROCEDURE	INTENDED SERVICE CLASS [2]	ECS & SPECIAL FEATURES [3]	DIAGNOSTIC [6]
2011	BCEXH0540LBH	8.9	CNG/LNG	Diesel	HHDD	TBI, TC, CAC, ECM, EGR, TWC, HO2S	N/A

PRIMARY ENGINE'S IDLE EMISSIONS CONTROL [5]	ADDITIONAL IDLE EMISSIONS CONTROL [5]
EXEMPT	N/A

ENGINE (L)	ENGINE MODELS / CODES (rated power, in hp)
8.9	ISL G 280 / 3517;FR93282 (280), ISL G 260 / 3517;FR93284 (260), ISL G 250 / 3517;FR93287 (250) ISL G 320 / 3517;FR93276 (320), ISL G 300 / 3517;FR93279 (300)

* =not applicable; GVWR=gross vehicle weight rating; 13 CCR xyz=Title 13, California Code of Regulations, Section xyz; 40 CFR 86.abc=Title 40, Code of Federal Regulations, Section 86.abc; L=liter; hp=horsepower; kw=kilowatt; hr=hour;

[1] CNG/LNG=compressed/liquefied natural gas; LPG=liquefied petroleum gas; E85=85% ethanol fuel; MF=multi fuel a.k.a. BF=bi fuel; DF=dual fuel; FF=flexible fuel;

[2] L/M/H HDD=light/medium/heavy heavy-duty diesel; UB=urban bus; HDO=heavy duty Otto;

[3] ECS=emission control system; TWC/OC=three-way/oxidizing catalyst; NAC=NOx adsorption catalyst; SCR-U / SCR-N=selective catalytic reduction – urea / – ammonia; WU (prefix) =warm-up catalyst; DPF=diesel particulate filter; PTOX=periodic trap oxidizer; HO2S/O2S=heated/oxygen sensor; HAFS/AFS=heated/air-fuel-ratio sensor (a.k.a., universal or linear oxygen sensor); TBI=throttle body fuel injection; SFI/MFI=sequential/multi port fuel injection; DGI=direct gasoline injection; GCARB=gaseous carburetor; IDI/DDI=indirect/direct diesel injection; TC/SC=turbo/super charger; CAC=charge air cooler; EGR / EGR-C=exhaust gas recirculation / cooled EGR; PAIR/AIR=pulsed/secondary air injection; SPL=smoke puff limiter; ECM/PCM=engine/powertrain control module; EM=engine modification; 2 (prefix)=parallel; (2) (suffix)=in series;

[5] ESS=engine shutdown system (per 13 CCR 1956.8(a)(6)(A)(1); 30g=30 g/hr NOx (per 13 CCR 1956.8(a)(6)(C); APS =interrial combustion auxiliary power system; ALT=alternative method (per 13 CCR 1956.8(a)(6)(D); Exempt=exempted per 13 CCR 1956.8(a)(6)(B) or for CNG/LNG fuel systems; N/A=not applicable (e.g., Otto engines and vehicles);

[6] EMD=engine manufacturer diagnostic system (13 CCR 1971); OBD=on-board diagnostic system (13 CCR 1971.1);

Following are: 1) the FTP exhaust emission standards, or family emission limit(s) as applicable, under 13 CCR 1956.8; 2) the EURO and NTE limits under the applicable California exhaust emission standards and test procedures for heavy-duty diesel engines and vehicles (Test Procedures); and 3) the corresponding certification levels, for this engine family. "Diesel" CO, EURO and NTE certification compliance may have been demonstrated by the manufacturer as provided under the applicable Test Procedures in lieu of testing. (For flexible- and dual-fueled engines, the CERT values in brackets [ ] are those when tested on conventional test fuel. For multi-fueled engines, the STD and CERT values for default operation permitted in 13 CCR 1956.8 are in parentheses.).

in g/bhp-hr	NMHC		NOx		NMHC+NOx		CO		PM		HCHO	
	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO
STD	0.14	0.14	0.20	0.20	*	*	15.5	15.5	0.01	0.01	*	*
FEL	*	*			*	*	*	*	*	*	*	*
CERT	0.08	0.08	0.13	0.01	*	*	14.2	11.6	0.002	0.001	*	*
NTE	0.21		0.30		*		19.4		0.02		*	

[4] g/bhp-hr=grams per brake horsepower-hour; FTP=Federal Test Procedure; EURO=Euro III European Steady-State Cycle, including RMCSET=ram mode cycle supplemental emissions testing; NTE=Not-to-Exceed; STD=standard or emission test cap; FEL=family emission limit; CERT=certification level; NMHC/HC=non-methane/hydrocarbon; NOx=oxides of nitrogen; CO=carbon monoxide; PM=particulate matter; HCHO=formaldehyde; (Rev.: 2007-02-26)

BE IT FURTHER RESOLVED: Certification to the FEL(s) listed above, as applicable, is subject to the following terms, limitations and conditions. The FEL(s) is the emission level declared by the manufacturer and serves in lieu of an emission standard for certification purposes in any averaging, banking, or trading (ABT) programs. It will be used for determining compliance of any engine in this family and compliance with such ABT programs.

BE IT FURTHER RESOLVED: For the listed engine models the manufacturer has submitted the materials to demonstrate certification compliance with 13 CCR 1965 (emission control labels) and 13 CCR 2035 et seq. (emission control warranty).

Engines certified under this Executive Order must conform to all applicable California emission regulations.

The Bureau of Automotive Repair will be notified by copy of this Executive Order.

Executed at El Monte, California on this 23 day of December 2010.

Annette Hebert, Chief
Mobile Source Operations Division