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EMISSION TESTS ON THE PUENTE HILLS ENERGY FROM LANDFILL GAS (PERG) FACILITY - UNIT 400, SEPTEMBER 1993

Prepared For:

COUNTY SANITATION DISTRICTS OF LOS ANGELES COUNTY
Whittier, California

For Submittal To:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Prepared By:

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NOVEMBER 1993

#41

MEMORANDUM

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To: STEVE ROE Date: 9/12/94

From: DAVID FREDIANI

Subject: PERC BOILER TEST RESULTS

HERE IS THE INFORMATION YOU REQUESTED. IF YOU HAVE ANY QUESTIONS OR NEED MORE INFORMATION, PLEASE CALL FRANK CAPONI. (310) 699-7411 EXT 2460

FORM 85

TABLE 3-2
PERG INLET TEST PROCEDURES

Parameter	Sample Medium	Analytical Technique	Reference Method
O_2, CO_2 and N_2	Tedlar Bag	GC/TCD	SCAQMD 10.1
Moisture	Impinger Train	Gravimetric	SCAQMD 4.1
Flow Rate		Plant Flow Meter	
Methane and Total Gaseous Non-Methane Organics	Tedlar Bag	GC/FID	SCAQMD 25.2
Trace Organics	Tedlar Bag	GC/PID/ELCD	EPA T03
H_2S	Tedlar Bag	GC/FPD/ELCD	EPA 15
Reduced Sulfur Compounds	Tedlar Bag	GC/FPD/ELCD	EPA 15

Duplicate emissions measurements were performed to determine O_2, CO_2, CO and NO_x concentrations. The average concentrations were determined during each test for a period of 70 minutes. This test average was then corrected for measured system bias and drift. Exhaust N_2 data was calculated by difference from the concentration of the other major exhaust gas components.

3.3.2 Moisture

Moisture was measured in both the inlet and outlet streams of the boiler. SCAQMD Method 4.1 was used for the determinations. Duplicate inlet measurements were made with a separate Method 4.1 train.

The moisture determinations of the boiler exhaust were made in combination with the particulate matter tests.

TABLE 3-3
PERG EXHAUST TEST PROCEDURES

Parameter	Sample Medium	Analytical Technique	Reference Method
O_2	CEM	Micro Fuel Cell	SCAQMD 100.1
CO_2	CEM	NDIR	SCAQMD 100.1
NO_x	CEM	Chemiluminescence	SCAQMD 100.1
CO	CEM	NDIR/GFC	SCAQMD 100.1
SO_x	Impinger Train	Barium Thorin Titration	SCAQMD 6.1
Moisture	Impinger Train	Gravimetric	SCAQMD 4.1
Flow Rate	Pitot Tube	Differential Pressure	SCAQMD 2.1
Methane and Total Gaseous Non-Methane Organics	Stainless steel tank w/H_2O knockout	GC/FID for tank fraction TOC analysis for H_2O fraction	Modified SCAQMD 25.1
Particulate Matter	Wet Impingement Train	Gravimetric	SCAQMD 5.1
Trace Organics	Tedlar Bag	GC/PID/ELCD	EPA T03

3.3.3 Flow Rate

Landfill gas flow rate into the boiler was set to specification using existing LACSD instrumentation on site, and was monitored and recorded throughout the test period. The inlet gas density is calculated using the concentrations of oxygen, carbon dioxide and methane. Outlet gas flow rate was determined in conjunction with all isokinetic tests using a combined pitot probe system.

TABLE 4-1
GENERAL RESULTS - PERG UNIT NO. 400
SEPTEMBER 29, 1993

Parameter	INLET First Run	INLET Second Run	INLET Average	EXHAUST GAS First Run	EXHAUST GAS Second Run	EXHAUST GAS Average
O_2, % dry	4.03	3.79	3.91	5.22	5.12	5.17
CO_2, % dry	31.6	31.8	31.7	14.11	14.17	14.14
N_2, % dry	23.2	22.4	22.8	80.7	80.7	80.7
H_2O, %	6.0	7.4	6.7	15.9	16.1	16.0
Flow Rate, dscfm	11,000	10,740	10,870	69,460	70,080	69,770
Temperature, °F				319	326	323
NO_x:						
ppm				17.8	16.7	17.3
ppm @ 3% O_2				20.3	18.9	19.6
lb/hr (as NO_2)				8.99	8.51	8.75
CO:						
ppm				10.9	8.2	9.6
ppm @ 3% O_2				12.4	9.3	10.9
lb/hr				3.35	2.54	2.95
SO_2						
ppm				16.4	15.0	15.7
ppm @ 3% O_2				18.7	17.0	17.9
lb/hr (as SO_2)				11.5	10.6	11.1
HC: *						
CH_4 ppm	429,000	432,000	430,500	1.13	1.04	1.09
TGNMO ppm	5,940	6,450	6,195	ND<2	ND<2	ND<2
TGNMO @ 3% O_2	--	--	--	<2.3	<2.3	<2.3
TGNMO lb/hr (as CH_4)	165.29	175.24	170.26	<0.35	<0.35	<0.35
Destruction Eff. %	--	--	--	>99.8	>99.8	>99.8
Particulate:						
Organic Fraction gr/dscf				0.0001	0.0003	0.0002
Inorganic Fraction gr/dscf				0.0078	0.0044	0.0061
Total Particulate gr/dscf				0.0079	0.0047	0.0063
gr/dscf @ 3% O_2				0.0090	0.0053	0.0072
lb/hr				4.72	2.83	3.78
Sulfur Compounds:						
H_2S, ppm	64	63	64			
Methyl Mercaptan, ppm	1.7	1.8	1.8			
Ethyl Mercaptan, ppm	ND>0.96	ND>0.96	ND>0.96			
Dimethyl Sulfide, ppm	1.8	1.8	1.8			
Carbonyl Sulfide, ppm	ND<0.77	ND<0.77	ND<0.77			
Carbon Disulfide, ppm	ND<0.96	ND<0.96	ND<0.96			
Dimethyl Disulfide,ppm	ND<0.98	ND<0.98	ND<0.98			
Total Sulfur Compounds, ppm	<73.11	<72.21	<72.66			

* - TANK PORTION ONLY (EXHAUST).

TABLE 4-3
TRACE ORGANIC SPECIES DESTRUCTION EFFICIENCY RESULTS
PERG UNIT NO. 400, TEST NO. 1
SEPTEMBER 29, 1993

Flow rate, Inlet dscfm	11,000
Flow rate, Exhaust dscfm	69,640

Species	Inlet	Exhaust	Destruction Efficiency, %
Methylene Chloride:	5400 ppb	0.3 ppb	
lb/hr	7.98×10^{-1}	2.81×10^{-4}	99.96
Chloroform:	ND < 100 ppb	ND < 0.1 ppb	
lb/hr	$< 2.08 \times 10^{-2}$	$< 1.31 \times 10^{-4}$	NA
1,1,1-Trichloroethane:	340 ppb	ND < 0.1 ppb	
lb/hr	7.89×10^{-2}	$< 1.47 \times 10^{-4}$	> 99.81
Carbon Tetrachloride:	ND < 100 ppb	ND < 0.1 ppb	
lb/hr	$< 2.68 \times 10^{-2}$	$< 1.69 \times 10^{-4}$	NA
1,1-Dichloroethene:	ND < 210 ppb	ND < 0.2 ppb	
lb/hr	$< 3.54 \times 10^{-2}$	$< 2.13 \times 10^{-4}$	NA
Trichloroethylene:	700 ppb	ND < 0.1 ppb	
lb/hr	1.60×10^{-1}	$< 1.45 \times 10^{-4}$	> 99.91
Tetrachloroethylene:	1700 ppb	ND < 0.2 ppb	
lb/hr	4.90×10^{-1}	$< 3.65 \times 10^{-4}$	> 99.93
Chlorobenzene:	ND < 220 ppb	ND < 0.2 ppb	
lb/hr	$< 4.31 \times 10^{-2}$	$< 2.48 \times 10^{-4}$	NA
Vinyl Chloride:	ND < 500 ppb	ND < 0.4 ppb	
lb/hr	$< 5.43 \times 10^{-2}$	$< 2.75 \times 10^{-4}$	>99.49
m-Dichlorobenzene:	ND < 230 ppb	ND < 0.2 ppb	
lb/hr	$< 5.88 \times 10^{-2}$	$< 3.24 \times 10^{-4}$	NA
o+p Dichlorobenzene:	500 ppb	ND < 0.2 ppb	
lb/hr	1.28×10^{-1}	$< 3.24 \times 10^{-4}$	> 99.75
1,1-Dichloroethane:	1300 ppb	ND < 0.1 ppb	
lb/hr	2.24×10^{-1}	$< 1.09 \times 10^{-4}$	> 99.95
1,2-Dichloroethane:	ND < 110 ppb	ND < 0.1 ppb	
lb/hr	$< 1.89 \times 10^{-2}$	$< 1.09 \times 10^{-4}$	NA
Benzene:	4600 ppb	1.5 ppb	
lb/hr	6.25×10^{-1}	1.29×10^{-3}	99.79

ND< indicates that the species was not detected. Values indicate the detection limit for this species and the concentration is less than the presented value. (continued)

NA - indicates that the destruction efficiency cannot be calculated because the concentration is below detection limits.

TABLE 4-3 (continued)
TRACE ORGANIC SPECIES DESTRUCTION EFFICIENCY RESULTS
PERG UNIT NO. 400, TEST NO. 1
SEPTEMBER 29, 1993

Flow rate, Inlet dscfm	11,000			
Flow rate, Exhaust dscfm	69,640			
Species		Inlet	Exhaust	Destruction Efficiency, %
Toluene:		33000 ppb	3.7 ppb	
	lb/hr	5.29×10	3.75×10^{-3}	99.93
Acetonitrile:		ND < 2300 ppb	ND < 2.3 ppb	
	lb/hr	$< 1.64 \times 10^{-1}$	$< 1.04 \times 10^{-3}$	NA
m-Xylenes:		15000 ppb	0.9 ppb	
	lb/hr	2.77×10	1.05×10^{-3}	99.96
o+p Xylenes:		12000 ppb	0.9 ppb	
	lb/hr	2.22×10	1.05×10^{-3}	99.95
1,2-Dibromoethane:		ND < 2900 ppb	ND < 2.9 ppb	
	lb/hr	$< 9.48 \times 10^{-1}$	$< 6.00 \times 10^{-3}$	NA
Benzyl Chloride:		ND < 1000 ppb	ND < 1.0 ppb	
	lb/hr	$< 2.20 \times 10^{-1}$	$< 1.39 \times 10^{-3}$	NA

ND< indicates that the species was not detected. Values indicate the detection limit for this species and the concentration is less than the presented value.
NA - indicates that the destruction efficiency cannot be calculated because the concentration is below detection limits.

TABLE 4-4
TRACE ORGANIC SPECIES DESTRUCTION EFFICIENCY RESULTS
PERG UNIT NO. 400, TEST NO. 2
SEPTEMBER 29, 1993

Flow rate, Inlet dscfm	11,000
Flow rate, Exhaust dscfm	69,640

Species	Inlet	Exhaust	Destruction Efficiency, %
Methylene Chloride:	5800 ppb	0.3 ppb	
lb/hr	8.57×10^{-1}	2.81×10^{-4}	99.97
Chloroform:	ND < 100 ppb	ND < 0.1 ppb	
lb/hr	$< 2.08 \times 10^{-2}$	$< 1.31 \times 10^{-4}$	NA
1,1,1-trichloroethane:	360 ppb	ND < 0.1 ppb	
lb/hr	8.35×10^{-2}	$< 1.47 \times 10^{-4}$	> 99.82
Carbon Tetrachloride:	ND < 100 ppb	ND < x 0.1 ppb	
lb/hr	$< 2.68 \times 10^{-2}$	$< 1.69 \times 10^{-4}$	NA
1,1-dichloroethene:	ND < 210 ppb	ND < 0.2 ppb	
lb/hr	$< 3.54 \times 10^{-2}$	$< 2.13 \times 10^{-4}$	NA
Trichloroethylene:	670 ppb	ND < 0.1 ppb	
lb/hr	1.53×10^{-1}	$< 1.45 \times 10^{-4}$	> 99.91
Tetrachloroethylene:	1600 ppb	ND < 0.2 ppb	
lb/hr	4.61×10^{-1}	$< 3.65 \times 10^{-4}$	> 99.92
Chlorobenzene:	ND < 220 ppb	ND < 0.2 ppb	
lb/hr	$< 4.31 \times 10^{-2}$	$< 2.48 \times 10^{-4}$	NA
Vinyl Chloride:	560 ppb	ND < 0.4 ppb	
lb/hr	6.09×10^{-2}	$< 2.75 \times 10^{-4}$	> 99.55
m-dichlorobenzene:	ND < 230 ppb	ND < 0.2 ppb	
lb/hr	$< 5.88 \times 10^{-2}$	$< 3.24 \times 10^{-4}$	NA
o+p dichlorobenzene:	ND < 220 ppb	ND < 0.2 ppb	
lb/hr	$< 5.62 \times 10^{-2}$	$< 3.24 \times 10^{-4}$	NA
1,1-dichloroethane:	1300 ppb	ND < 0.1 ppb	
lb/hr	2.24×10^{-1}	$< 1.09 \times 10^{-4}$	> 99.95
1,2-dichloroethane:	ND < 110 ppb	ND < 0.1 ppb	
lb/hr	$< 1.89 \times 10^{-2}$	$< 1.09 \times 10^{-4}$	NA
Benzene:	4200 ppb	2.0 ppb	
lb/hr	5.71×10^{-1}	1.72×10^{-3}	99.70

ND< indicates that the species was not detected. Values indicate the detection limit for this species and the concentration is less than the presented value. (continued)

NA - indicates that the destruction efficiency cannot be calculated because the concentration is below detection limits.

TABLE 4-4 (continued)
TRACE ORGANIC SPECIES DESTRUCTION EFFICIENCY RESULTS
PERG UNIT NO. 400, TEST NO. 2
SEPTEMBER 29, 1993

Flow rate, Inlet dscfm	11,000
Flow rate, Exhaust dscfm	69,640

Species	Inlet	Exhaust	Destruction Efficiency, %
Toluene:	30000 ppb	3.9 ppb	
lb/hr	4.81 x 10	3.96×10^{-3}	99.92
Acetonitrile:	ND < 2300 ppb	ND < 2.3 ppb	
lb/hr	$< 1.64 \times 10^{-1}$	$< 1.04 \times 10^{-3}$	NA
m-xylenes:	13000 ppb	ND < 0.2 ppb	
lb/hr	2.40 x 10	$< 2.34 \times 10^{-4}$	> 99.99
o+p xylenes:	11000 ppb	0.7 ppb	
lb/hr	2.03 x 10	8.18×10^{-4}	99.96
1,2-dibromoethane:	ND < 2900 ppb	ND < 2.9 ppb	
lb/hr	$< 9.48 \times 10^{-1}$	$< 6.00 \times 10^{-3}$	NA
Benzyl Chloride:	ND < 1000 ppb	ND < 1.0 ppb	
lb/hr	$< 2.20 \times 10^{-1}$	$< 1.39 \times 10^{-3}$	NA

ND< indicates that the species was not detected. Values indicate the detection limit for this species and the concentration is less than the presented value.
NA - indicates that the destruction efficiency cannot be calculated because the concentration is below detection limits.