PACIFIC LIGHTING ENERGY SYSTEMS
6055 EAST WASHINGTON BLVD.
COMMERCE, CALIFORNIA 90040

COMPLIANCE TESTS - ADDENDUM
PERMIT # 156443-47

FEBRUARY 3,4, & 5, 1988

PENROSE LANDFILL
SUN VALLEY, CALIFORNIA

Prepared By:

BTC ENVIRONMENTAL, INC.
1536 Eastman Avenue
Ventura, CA 93003

Job Number
88-4415

Laboratory Report Number
885203

Test Team Leader
Herb DeFriez

Results Verified By:

Tom Porter - Laboratory Supervisor
R. K. Sextro - Laboratory Manager

SAMPLING AND ANALYTICAL PROCEDURES

Source emission testing of five (5) Cooper-Superior engines driving 1972 KW generators. The engines were fired on a mixture of landfill gas and purchased gas at the Penrose site. The plant is located at the Penrose Landfill in Sun Valley, California.

On February 3, 4, & 5, 1988, BTC Laboratories performed source emission tests for total particulate matter, sulfur dioxide, particulate sulfate, oxides of nitrogen, carbon monoxide, methane and nonmethane hydrocarbons on the stack gases. The inlet fuel gas was sampled and tested for hydrocarbon composition, priority polluntants, hydrogen sulfide, mercaptan sulfur, and BTU content.

STACK GAS ANALYSIS: Samples of the stack gas were taken from the exhaust stack and analyzed for oxygen, oxides of nitrogren, carbon monoxide and carbon dioxide using SCAQMD 100.1. The oxygen was determined by a Taylor paramagnetic oxygen analyzer. The oxides of nitrogen were checked by a Monitor Labs chemiluminescent analyzer. The carbon monoxide and the carbon dioxide were checked using two Horiba non-dispersive infrared analyzers. Readings were obtained continuously during each run and then averaged together to obtain the stack gas composition.

STACK GAS FLOW RATE: The stack gas flow rate was calculated for each engine tested by using the Molal combustion of the fuel gas and standard EPA equations (carbon balance type calculations).

The stack temperature was determined using a thermocouple and an indicating pyrometer. The proportion of water was determined gravimetrically and the dry molecular weight of the stack gas determined by E.P.A. Method 3, equation 3-2.

PARTICULATE EMISSIONS: Particulates were collected using SCAQMD method 5.2 with a Lace Model 31 stack sampler system that conforms to E.P.A. requirements for particulate sampling. The system consists of a heated probe, an intermediate 10 cm heated filter, cooled impingers and a 47 mm preweighted backup filter (see E.P.A. Method 5/8). After the weight of the particulates in the probe is determined, the total solids in the impingers and the particulate material on the intermediate filter is determined and added to the particulate weight in order to comply with SCAQMD regulations. The particulate sulfate emissions were determined by the use of EPA Method 8. The samples of the probe rinse, the filter extract and the impingers were titrated for sulfate by the barium chloride titration using Thorin as an indicator. These results can be substracted from the total particulate values to obtain the net particulate emissions.

SULFUR DIOXIDE EMSSSIONS: The sulfur dioxide was sampled for using the EPA method 6 sampling train. The peroxide solutions were retrieved and titrated for SO2 by the barium chloride titration with Thorin indicator.

CONDENSABLE HYDROCARBONS: Condensable hydrocarbons were determined by extracting the probe water rinse and the impingers with Freon TF. The extracts were evaporated at room temperature and the resultant weight added to the total particulate weight.

METHANE AND NON-METHANE HYDROCARBONS: The non-methane hydrocarbons were sampled for using Tedlar bags by CARB method 106 on each engine tested. The analysis was done using a Finnegan GC/Mass Spectrometer. The methane and non-methane hydrocarbons were also sampled in duplicate also using stainless steel canisters and micro-condensers using ice water for cooling. The analysis conformed to SCAQMD method 25.1 and was performed by Truesdale Laboratory in Tustin. The results are reported as TCA in ppm as methane.

INLET FUEL GAS ANALYSIS: Samples of the inlet fuel used by engines were sampled for composition using glass gas bombs, for sulfide and mercaptan compounds using ASTM D 2385 and for priority pollutants using tedlar bags with travel blank and standard. The analyses were done using the Carle GC equipped with an FID and TCD, the iodometric titration for sulfide and GC with mass spectrometer detection. The TCA method 25.1 was also used on the inlet fuel gas and the analysis done by by Truesdale also.

LEAK CHECKS: Leak rates were conducted on the sampling train and the pitot tubes before and after each test. The leak check for the sampling train was done at the nozzle. Any leak rate greater than 0.02 cfm was corrected for in the volume calculations.

All calculations for lbs/hr were done by using the flow rate of the stack gas by calculation. All values were calculated by using SCAQMD Standard conditions (60°F).

If you have any questions concerning this test or if we can be of further assistance, please feel free in calling any time at (805) 656-6074.

Respectfully submitted,

BTC LABORATORIES, INC.

R.K. Sextro
Environmental Division Manager

EMISSION SUMMARY

CONSTITUENT	RUN #1 (Engine 2)	RUN #2 (Engine 1)	RUN #3 (Engine 4)	RUN #4 (Engine 3)	RUN #5 (Engine 5)	ALLOWABLE
Total Particulate						
gr/DSCF	0.0172	0.0376	0.0152	0.0211	0.0201	
gr/DSCF @ 12% CO_2 (dry)	0.0194	0.0407	0.0165	0.0222	0.0213	
lbs/hr	0.81	1.71	0.68	0.94	0.87	2.0
lbs/millian BTU	0.040	0.087	0.035	0.048	0.046	
Sulfur Dioxide						
ppm by volume	19	28	22	25	25	
ppm by volume @ 3% O_2	29	40	31	35	36	
gr/DSCF	-	-	-	-	-	
lbs/hr	1.06	1.46	1.14	1.29	1.27	1.50
lbs/million BTU	0.053	0.074	0.058	0.066	0.067	
Total Sulfate						
gr/DSCF	0.0037	0.0036	0.0037	0.0039	0.0040	
gr/DSCF @ 12% CO_2 (dry)	0.0042	0.0039	0.0041	0.0041	0.0042	
lbs/hr	0.17	0.16	0.17	0.17	0.17	
lbs/million BTU	0.009	0.008	0.009	0.009	0.009	
Oxides of Nitrogen						
ppm by volume	132	104	110	148	162	
ppm by volume @ 15% O_2	64	50	52	69	76	
gr/DSCF	-	-	-	-	-	
lbs/hr	5.17	3.96	4.11	5.49	5.87	9.0
lbs/million BTU	0.258	0.201	0.209	0.280	0.308	
Carbon Monoxide						
ppm by volume	559	474	460	550	509	
lbs/hr	13.33	10.96	10.46	12.43	11.25	15.0
TCA (Organics)						
ppm by volume	201	266	305	175	216	
lbs/hr	2.69	3.67	4.0	2.31	2.77	0.38

PACIFIC LIGHTING ENERGY SYSTEMS

Penrose Mixed Purchased and Landfill Gas

ANALYTICAL RESULTS (ppm by volume)

CONSTITUENT	Engine #1	Engine #2	Engine #3	Engine #4	Engine #5
Chloromethane	<1	<1	<1	<1	<1
Vinyl Chloride	3.0	3.0	1.0	2.0	2.0
Methylene Chloride	<1	<1	<1	<1	<1
Acetone	<1	<1	<1	<1	<1
Dichloroethanes	<1	<1	<1	<1	<1
Tetrahydrofuran	<1	<1	<1	<1	<1
Freon T-F	<1	<1	<1	<1	<1
Ethylene Dibromide	<1	<1	<1	<1	<1
1,4-Dioxane	<1	<1	<1	<1	<1
Chloroform	<1	<1	<1	<1	<1
2-Butanone	7.0	6.0	<1	<1	<1
1,1,1-Trichloroethane	<1	<1	<1	<1	<1
Carbon Tetrachloride	<1	<1	<1	<1	<1
Trichloroethene	1.0	<1	<1	<1	<1
Benzene	3.0	2.0	3.0	3.0	4.0
Cis-1,2-Dichloroethylene	6.0	4.0	4.0	4.0	6.0
Bromoform	<1	<1	<1	<1	<1
Tetrachloroethene	3.0	3.0	1.0	1.0	1.0
Toluene	39	35	28	22	35
Chlorobenzenes	1.0	1.0	<1	<1	<1
Ethylbenzene	10	9.0	4.0	5.0	8.0
Total Xylenes	26	23	20	14	20
Styrene	1.0	<1	<1	<1	<1
Dichlorobenzenes	3.0	4.0	<1	<1	<1
Hydrogen Sulfide	20		122		59
Mercaptans (CH4S)	5		9		12
PENROSE MIXED FUEL SAMPLES (INLET TCA)					
Methane (%)	45.1	44.9	45.1	39.4	44.2
Volatile TCA as CH4	8453	8363	8611	9608	11,745
Duplicate	7693	8539	8997	8264	11,757
Condensible TCA as CH4	295	206	281	217	156
Duplicate	307	305	941	360	203
Total TCA-Avg.as CH4	8374	8707	9415	9225	11,931
in lbs/hr.	112.4	120.4	123.6	121.7	153.2
Carbon Dioxide (%)	35.0	35.4	33.2	30.5	35.3

PACIFIC LIGHTING ENERGY SYSTEMS

EXHAUST GAS OUTLETS FROM ENGINES

ANALYTICAL RESULTS (ppm by volume)

CONSTITUENT	Engine#1	Engine #2	Engine #3	Engine #4	Engine #5
Chloromethane	<0.005	<0.005	<0.005	<0.005	<0.005
Vinyl Chloride	<0.005	<0.005	<0.005	<0.005	<0.005
Methylene Chloride	<0.005	<0.005	<0.005	<0.005	<0.005
Acetone	<0.005	<0.005	<0.005	<0.005	<0.005
Dichloroethanes	<0.005	<0.005	<0.005	<0.005	<0.005
Tetrahydrofuran	<0.005	<0.005	<0.005	<0.005	<0.005
Freon T-F	<0.005	<0.005	<0.005	<0.005	<0.005
Ethylene Dibromide	<0.005	<0.005	<0.005	<0.005	<0.005
1,4-Dioxane	<0.005	<0.005	<0.005	<0.005	<0.005
Chloroform	<0.005	<0.005	<0.005	<0.005	<0.005
2-Butanone	<0.005	<0.005	<0.005	<0.005	<0.005
1,1,1-Trichloroethane	<0.005	<0.005	<0.005	<0.005	<0.005
Carbon Tetrachloride	<0.005	<0.005	<0.005	<0.005	<0.005
Trichloroethene	<0.005	<0.005	<0.005	<0.005	<0.005
Benzene	0.032	0.072	0.072	0.053	0.080
Cis-1,2-Dichloroethylene	<0.005	<0.005	<0.005	<0.005	<0.005
Bromoform	<0.005	<0.005	<0.005	<0.005	<0.005
Tetrachloroethene	<0.005	<0.005	<0.005	<0.005	<0.005
Toluene	<0.005	<0.005	0.018	0.028	<0.005
Chlorobenzenes	<0.005	<0.005	<0.005	<0.005	<0.005
Ethylbenzene	<0.005	<0.005	<0.005	<0.005	<0.005
Total Xylenes	<0.005	<0.005	<0.005	<0.005	<0.005
Styrene	<0.005	<0.005	<0.005	<0.005	<0.005
Dichlorobenzenes	<0.005	<0.005	<0.005	<0.005	<0.005

PENROSE ENGINE EMISSIONS (OUTLET TCA)

Methane (ppmv)	1885	1620	1570	2064	1362
Volatile TCA as CH4	41	30	23	53	47
Duplicate	112	36	32	73	67
Condensible TCA as CH4	126	331	457	113	238
Duplicate	122	134	97	111	79
Total TCA-Avg.as CH4	201	266	305	175	216
in lbs/hr	2.69	3.67	4.0	2.31	2.77
Moisture (%)	7.3	5.0	2.5	2.1	4.2

TCA ANALYSIS and CARBON BALANCE

Client : PLES
Site : Penrose
Unit : engine#1

Date : 2/3/88
Job #: 88-4415-C01
Lab #: 885203

Exhaust Flow Rate: 5305 sdcfm
Fuel Rate: 699 scfm

	TCA Inlet		TCA Outlet	
	ppm by vol.	lbs./hr.	ppm by vol.	lbs./hr.
Run #1	8748.0		167.0	
Run #2	8000.0		234.0	
Average				
Total TCA as CH4	8374	112.38	201	2.69
Methane, CO2 & TCA	0	0.00	0	0.00
			CH4, CO2, CO, & TCA	

formulae:
lbs./hr. = (1.581 * 10**-7) * Flow Rate * ppm by vol.* MW

TCA ANALYSIS and CARBON BALANCE

Client : PLES
Site : Penrose
Unit : engine#2

Date : 2/3/88
Job #: 88-4415-C01
Lab #: 885203

Exhaust Flow Rate: 5468 sdcfm
Fuel Rate: 699 scfm

	TCA Inlet		TCA Outlet	
Run #1	8569.0		361.0	
Run #2	8844.0		170.0	
	ppm by vol. Average	lbs./hr.	ppm by vol. Average	lbs./hr.
Total TCA as CH4	8707	120.43	266	3.67
Methane, CO2 & TCA	0	0.00	0	0.00
			CH4, CO2, CO, & TCA	

formulae:
lbs./hr. = (1.581 * 10**-7) * Flow Rate * ppm by vol.* MW

TCA ANALYSIS and CARBON BALANCE

Client : PLES
Site : Penrose
Unit : engine#3

Date : 2/4/88
Job #: 88-4415-C01
Lab #: 885203

Exhaust Flow Rate: 5189 sdcfm
Fuel Rate: 696 scfm

	TCA Inlet			TCA Outlet	
Run #1	8892.0			480.0	
Run #2	9938.0			129.0	
	ppm by vol. Average	lbs./hr.		ppm by vol. Average	lbs./hr.
Total TCA as CH4	9415	123.58		305	4.00
Methane, CO2 & TCA	0	0.00	CH4, CO2, CO, & TCA	0	0.00

formulae:
lbs./hr. = (1.581 * 10**-7) * Flow Rate * ppm by vol.* MW

TCA ANALYSIS and CARBON BALANCE

Client : PLES
Site : Penrose
Unit : engine#4

Date : 2/4/88
Job #: 88-4415-C01
Lab #: 885203

Exhaust Flow Rate: 5215 sdcfm
Fuel Rate: 694 scfm

	TCA Inlet		TCA Outlet	
Run #1	9825.0		166.0	
Run #2	8624.0		184.0	
	ppm by vol. Average	lbs./hr.	ppm by vol. Average	lbs./hr.
Total TCA as CH4	9225	121.69	175	2.31
Methane, CO2 & TCA	0	0.00	0	0.00

CH4, CO2, CO, & TCA

formulae:
lbs./hr. = (1.581 * 10**-7) * Flow Rate * ppm by vol.* MW

TCA ANALYSIS and CARBON BALANCE

Client : PLES
Site : Penrose
Unit : engine#5

Date : 2/5/88
Job #: 88-4415-C01
Lab #: 885203

Exhaust Flow Rate: 5078 sdcfm
Fuel Rate: 694 scfm

	TCA Inlet		TCA Outlet	
Run #1	11901.0		285.0	
Run #2	11960.0		146.0	
	ppm by vol. Average	lbs./hr.	ppm by vol. Average	lbs./hr.
Total TCA as CH4	11931	153.25	216	2.77
Methane, CO2 & TCA	0	0.00	0	0.00
			CH4, CO2, CO, & TCA	

formulae:
lbs./hr. = (1.581 * 10**-7) * Flow Rate * ppm by vol.* MW

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT BTC Laboratories, Inc.
2978 Seaborg Avenue
Ventura, CA 93003
Attention: Robert Sextro

DATE March 1, 1988

RECEIVED Feb. 4, 1988

LABORATORY NO. 25839

SAMPLE

Preparation of 20 TCA Sampling Trains

INVESTIGATION

Total Hydrocarbons

RESULTS

The submitted samples were analyzed for total hydrocarbons (as C_1) by the Total Carbon Analysis (TCA) method. The inlet samples were analyzed for CH_4, H_2, and O_2 by gas chromatography utilizing thermal conductivity detection.

The results are as follows:

DATE RECD MAR 04 1988
- ☐ DON
- ☐ LIN
- ☐ DIVN 1
- ☒ DIVN 5
- ☐ PHYS. LAB
- ☐ ENG.
- ☐ DISP
- ☐ OFF MGR
- ☐ _____
- ☐ _____
- ☐ FILE
- ☐ RETURN TO
- ☐ DISCARD

Outlets:

Sample	Engine	CO,ppm	CH_4,ppm	CO_2,%	Nonmethane Hydrocarbons (as C_1) Volatile	Condensable	Total
1A(BG)	2	538	1861	10.4	41	126	167
1B(JJ)	2	530	1909	10.2	112	122	234
2A(HH)	1	459	1608	10.5	30	331	361
2B(CC)	1	461	1631	10.6	36	134	170
3A(EE)	4	433	1600	10.6	23	457	480
3B(FFX)	4	408	1540	10.4	32	97	129
4A(102)	3	503	1946	9.7	53	113	166
4B(KK)	3	557	2182	10.9	73	111	184
5A(BA)**	5	482	1336	9.1	47	238	285
5B(BC)*	5	516	1388	10.9	67	79	146

Inlets:

Sample	Engine	CO,%	CH_4	CO_2,%	H_2,%	O_2,%	Nonmethane Hydrocarbons (as C_1) Volatile	Condensable	Total
1C(XX)*	2	<1	45.3	34.5	<0.1	0.3	8,453	295	8,748
1D(BB)*	2	<1	44.8	35.4	<0.1	0.2	7,693	307	8,000
2C(MD4)***	1	<1	45.2	35.3	<0.1	0.3	8,539	206	8,745
2D(SS)	1	<1	44.6	35.6	<0.1	0.3	8,363	305	8,668
3C(AE)	4	<1	44.4	34.1	<0.1	0.4	8,611	281	8,892
3D(AF)	4	<1	45.8	32.2	<0.1	0.4	8,997	941	9,938
4C(MD5)	3	<1	44.9	35.6	<0.1	0.2	9,608	217	9,825
4D(BP)**	3	<1	33.9	25.4	<0.1	5.8	8,264	360	8,624
5C(MD7)	5	<1	44.3	35.4	<0.1	0.4	11,745	156	11,901
5D(BE)	5	<1	44.5	35.2	<0.1	0.3	11,757	203	11,960

* Loose Probe Cap
** Tank Valve Open
*** No Trap Cap

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Andrew Keller

Andrew Keller, Assistant Manager
Air Pollution Testing