OTAY LANDFILL
ENGINE

of San Diego

R. J. Sommerville
Air Pollution Control Officer

HAP eff. and ≥ combustion products. Data Qual=C
also some CO, NOx
Back up data + calcs lacking

October 17, 1991

TO: Dave Byrnes
Associate Air Pollution Control Engineer

FROM: Lynn Kramer
Junior Air Pollution Control Engineer

SUBJECT: **EMISSION FACTORS FOR THE LANDFILL GAS FIRED INTERNAL COMBUSTION ENGINE AT OTAY LANDFILL, OPERATED BY PACIFIC ENERGY**

John Jackson of District Monitoring & Technical Services has reviewed and approved the source test results on the landfill gas (LFG) fired internal combustion engine at the Otay Landfill. Stack testing measured the exhaust rates of formaldehyde, hydrochloric acid, vinyl chloride, methylene chloride, and benzene. Landfill gas samples were collected and analyzed for vinyl chloride, methylene chloride, and benzene.

Destruction efficiencies were calculated for vinyl chloride, methylene chloride, and benzene. These DEs will be used to determine emissions of these three compounds, and will be averaged to determine the emissions of the remaining listed compounds found in LFG. The approved DEs are summarized:

Toxic Air Contaminant	Destruction Efficiency
Benzene	78.3%
Methylene Chloride	28.5%
Vinyl Chloride	100%
Ethylene Dibromide, Ethylene Dichloride, Perchloroethylene, Carbon Tetrachloride, Methyl Chloroform, Trichloroethylene, Chloroform	70%

It should be noted that the average destruction efficiency obtained from source testing is the same as the destruction efficiency assumed in permit evaluations for similar devices.

AIR POLLUTION CONTROL DISTRICT
9150 Chesapeake Drive, San Diego, California 92123-1095
(619) 694-3307 FAX (619) 694-2730

Stack samples were taken for formaldehyde and hydrochloric acid as combustion products. The approved emission factors for these TACs follow:

Toxic Air Contaminant	Emission Factor (lb/million SCF LFG burned)
Formaldehyde	6.94
Hydrochloric Acid	9.52

10/16/91

Substance	lb/MM cu ft gas	DE%	EF	Yearly Emissions	Hourly Emissions
Vinyl Chloride	1.5	100	0.0000	0.0000	0.0000
Benzene	1.2	78.3	0.2604	81.8854	0.0094
EDB	0.0004	70	0.0001	0.0377	0.0000
EDC	0.01	70	0.0030	0.9434	0.0001
Methylene Chloride	3.9	28.3	2.7963	879.3245	0.1007
Perc	1.4	70	0.4200	132.0732	0.0151
Carbon tetrachloride	0.0001	70	0.0000	0.0094	0.0000
Methyl Chloroform	0.03	70	0.0090	2.8301	0.0003
Trichloroethylene	0.9	70	0.2700	84.9042	0.0097
Chloroform	0.0003	70	0.0001	0.0283	0.0000
Formaldehyde	6.94			2182.3524	0.2498
HCl	9.52			2993.6592	0.3427

EMISSION TEST REPORT

SUPERIOR INTERNAL COMBUSTION ENGINES INSTALLED AT THE BONSALL AND OTAY LANDFILLS

Test Dates: October 20 and 22, 1987

Prepared for:

Pacific Lighting Energy Systems
6055 E. Washington Street
Commerce, California 90040

By:

VOC Testing, Inc.
P.O. Box 5892
114 E. Airport Dr., Suite 118
San Bernardino, CA 92412

EMISSION TEST REPORT

SUPERIOR INTERNAL COMBUSTION ENGINES INSTALLED AT THE BONSALL AND OTAY LANDFILLS

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114 E. Airport Dr., Suite 118
San Bernardino, CA 92412

Table of Contents

1.0 Introduction

On October 20 and 22, 1987 personnel of VOC Testing, Inc. performed emission testing of two natural gas fueled Superior "Clean Burn" engines installed at the Otay and Bonsal landfills. The testing consisted of continuous monitoring of the engine exhaust oxides of nitrogen, carbon monoxide, carbon dioxide, and oxygen. Three forty minute tests were performed on each of the two engines. Samples of the exhaust gas were taken during the tests in Tedlar bags and analyzed by gas chromatograph to determine the concentration of non-methane hydrocarbons present.

Participants and Observers

Ezra Abrahamy -- Pacific Lighting Energy Systems
Richard Sax -- Pacific Lighting Energy Systems
Clinton Cooney-- San Diego Air Pollution Control District
Craig Anderson-- San Diego Air Pollution Control District
Delbert Powell-- VOC Testing, Inc.

2.0 Summary of Results

Table 1 below presents the results of the first two-hour emission test performed on the sixteen cylinder Superior engine installed at the Otay Landfill on October 20, 1987 , and Table 2 presents the results of the two-hour test on the twelve cylinder Superior engine installed at the Bonsal Landfill on October 22, 1987. Each test consisted of three thirty minute subtests: twenty five minutes in NOx sampling mode, and five minutes in NO sampling mode.Table 3 presents the results of the gas chromatographic analysis of the bag sample of engine exhaust gas.

Table 1

Bonsall Landfill Test Results

Date: 10/20/87

Test Time : 10:30 a.m. to 12:17 p.m.

Average NOx Concentration (actual)	212 ppm
Average Oxygen Concentration	8.1 %
Average NOx Concentration (@3% O_2)	295 ppm
Average CO Concentration (actual)	450 ppm
Average CO Concentration (@3% O_2)	627 ppm
Average CO2 Concentration	11.6 %
Stack Gas Flow Rate	4450 DSCFM
NMHC Mass Emission Rate	0.0940 lbs/Bhp-hr

Table 2

Otay Landfill Test Results

Date: 10/22/87

Test Time : 9:10 a.m. to 10:55 a.m.

Average NOx Concentration (actual)	291 ppm
Average Oxygen Concentration	6.8 %

Table 2 (Cont.)

Average NOx Concentration (@3% O_2)	370 ppm
Average CO Concentration (actual)	448 ppm
Average CO Concentration (@3% O_2)	569 ppm
Average CO2 Concentration	13.4 %
Stack Gas Flow Rate	5680 DSCFM
NMHC Mass Emission Rate	0.0769 lbs/Bhp-hr

Need LFG - FR & CH_4 Content.

Otay LF : CH_4 = 47.7% Ref. 25.

3.0 Process Description

The sources tested were two Superior "Clean Burn" internal combustion engines incorporating stratified charge control technology fueled by natural gas. The engine at the Otay landfill is a Model 16SGTA (Serial # 307399) sixteen cylinder rated at 2650 horsepower at 900 rpm. The engine installed at the Bonsal Landfill is a Model 12SGTA (Serial # 307559) twelve cylinder rated at 2000 horsepower at 900 rpm. The engines ran at a steady load and constant speed during each test.

4.0 Testing Procedures

The exhaust of the Superior i.c. engines are discharged through an 18" i.d. stack. The stack was equipped with 3" capped pipe nipples for sampling ports. .

The gas sample for carbon monoxide,carbon dioxide, oxides of nitrogen, hydrocarbons, and oxygen was taken through a stainless steel probe located at the center of the stack. The sample was drawn through 25 feet of heated 1/4" teflon tubing to a condenser system to remove moisture from the sample. The condenser system consisted of a modified Greenburg-Smith impinger in an ice bath consisting of a 50% mixture of ethylene glycol and water with dry ice. This ice bath was kept below zero degrees fahrenheit to assure that the condenser contained ice rather than water. The sample leaving the drying system passed through 1/4" teflon tubing to a manifold from which a slipstream was drawn for each of the three continuous analyzers.

The NOx analyzer used was a Thermo Electron Model 10 AR chemiluminescence analyzer. The analyzer was calibrated at the beginning and end of each test with certified standard gas concentration of 104.8 ppm nitric oxide and 42.0 ppm nitrogen dioxide in nitrogen. This mixture was also used to check the converter efficiency. The converter efficiency was found to be 99%. The NOx concentration was recorded on a strip chart during the test. Five minute averages of the sample concentration were used to calculate the NOx results.

At the beginning and end of each test the effect of the condenser system on the nitrogen dioxide concentration was quantified by introducing a mixture of nitrogen dioxide in nitrogen (approximately 150 ppm) into the sampling system at the end of the probe and directly into the analyzer. The difference between these two readings was used to correct the NO2 results for the amount lost in the condenser. In addition a mixture of nitric oxide in nitrogen (529 ppm) was introduced at the probe end and directly into the analyzer at the beginning and end of the test to assure sampling system integrity.

The carbon dioxide analyzer used during the tests was an Anarad Model AR600 non-dispersive infrared analyzer. The analyzer was calibrated with a standard gas mixture of 10% carbon dioxide in nitrogen.

The carbon monoxide analyzer used was a Horiba PIR 2000 non-dispersive infrared analyzer. The analyzer was calibrated at the beginning and end of each test with certified standards of CO in air. The CO concentrations used were 783 ppm and 2007 ppm CO in nitrogen. The carbon monoxide concentration of the sample gas was recorded on the same strip chart as the carbon dioxide concentrations. The results were averaged over five minute intervals to calculate the results.

The oxygen concentration was determined continuously with a Teledyne Model 526A fuel cell analyzer. The analyzer was calibrated at the beginning and end of each test with a certified gas standards of 1.05% and 12.0% oxygen in nitrogen and with ambient air. The oxygen concentration was read and recorded at five minute intervals on the same strip chart as the oxides of nitrogen data.

A moisture test was run at the Otay engine on October 22 in accorcance with EPA Method 4. A sample of the stack gas was drawn through four impingers in an ice bath. The first two impingers contained water and the third impinger was left dry. The volume of stack gas sampled was measured with a calibrated dry gas meter. The pressure at the meter was measured with a barometer and magnehelic gauge, and the meter temperature was measured with a type K thermocouple. The volume of moisture condensed in the impingers was measured and from this data the stack gas moisture was calculated.

Pacific Lighting Energy Systems — G.C. analysis

OTay + Bonsall

			Attenuation	Area/pk ht	Conc.
10/20	Stds	methane	4x10^-4	520 / 35.8	111
		ethane	4x10^-4	1120 / 66.5	107
		propane	~~1340~~ 4x10^-4	1340 / 85.5	109
		butane	~~2100~~ 4x10^-4	2100 / 72.0	112
		pentane	4x10^-4	2750 / 45.0	117
10/20	Bonsall ~~OTay~~ Sample	methane	—	— / 25.5	~~10.0~~ 10.3
		ethane	1x10^-4	28	0.6
		~~propane~~	1x10^-4	340	4.5
		butane	1x10^-6		
10/22	stds	methane	4x10^-4	~~[illegible]~~ 535/41	111
		ethane	4x10^-4	~~[illegible]~~ 950/72.3	107
		propane	4x10^-4	~~[illegible]~~ 1590/30.5	109
		butane	4x10^-4	~~2140/[illegible]~~ 2160/52.8	112
		pentane	4x10^-4		
10/22	OTay ~~Bonsall~~ Sample	methane	—	— / 39	14.2
		ethane	1x10^-4	30 / 1.5	0.5
		~~propane~~	1x10^-4	80	1.0
		butane	1x10^-4		

~~C_2 - 30.07/385 = 0.0781 #/ft³ = 35.46 gm/ft³~~

~~C_3 - 44.11/385 = 0.1146 #/ft³ = 52.03 gm/ft³~~

~~C_4 - 58.13/385 = 0.1510 #/ft³ = 68.5 gm/ft³~~

~~Bonsall - ethane - 10.3 ppm (10^-6)(35.46)(4445 dscfm)(60) = 97.7 gm/hr~~

~~propane - (0.6 ppm)(10^-6)(52.03)(4445)(60) = 8.3 gm/hr~~

~~butane - (4.5)(10^-6)(68.5)(4445)(60) = 82.2 gm/hr~~

~~NMHC MER = 185.2 gm/hr ÷ ~~[illegible]~~ 2000 Bhp = ~~[illegible]~~ 0.0926 gm/Bhphr~~

~~OTay ethane (14.2 ppm)(10^-6)(35.46)(5947)(60) = 179.7 gm/hr~~

~~propane (0.5 ppm)(10^-6)(52.03)(5947)(60) = 9.3 gm/hr~~

~~butane (1.0 ppm)(10^-6)(68.5)(5947)(60) = 24.4 gm/hr~~

~~NMHC MER = 213.4 gm/hr ÷ ~~[illegible]~~ 2650 Bhp = ~~[illegible]~~ 0.0805 gm/Bhphr~~

apcd
County of San Diego

R. J. Sommerville
Air Pollution Control Officer

September 19, 1991

TO: David Byrnes
Associate Air Pollution Control Engineer

FROM: John Jackson
Associate Air Pollution Chemist

SUBJECT: **AB2588 TOXIC HOT SPOT EMISSION TEST REPORT ON AN INTERNAL COMBUSTION ENGINE, LOCATED ON OTAY MESA LANDFILL, OPERATED BY PACIFIC ENERGIES.**

The Monitoring and Technical Services staff has reviewed the test report received on June 12, 1991. This report was prepared by South Coast Environmental Company (SCE) of La Verne, CA.

The scope of stack testing encompassed the testing for: Hydrogen chloride (HCl), formaldehyde, vinyl chloride, dichloromethane, and benzene. Additionally, digestion fuel samples were collected and analyzed for HCl, vinyl chloride, dichoromethane, benzene, total sulfur content, specific gravity and calorific value.

SCE used CARB methods to extract samples. The samples were sent to various laboratories for analysis. The formaldehyde samples were analyzed by Air Toxics LTD. Zalco Laboratories, Inc. and Atm AA, Inc. analyzed the fuel samples, and Enseco analyzed inlet and outlet samples for HCl.

The formaldehyde values reported initially in the SCE report were erroneous. SCE has submitted an addendum which included the correct values (see attached).

In conclusion, the data submitted in this report and the addendum are acceptable.

JJ:jl
Attachments

PACIFIC ENERGY
APRIL 2-5, 1991
PROJECT: T1265
UNIT: LANDFILL GAS-FIRED INTERNAL COMBUSTION ENGINES

I. SELECTED RESULTS - OTAY LANDFILL

A. FORMALDEHYDE RESULTS (EXHAUST)

RUN NO.	SAMPLE VOLUME (DSCF)	LB/SCF OF LFG		TOTAL FORMALDEHYDE (LB/HR)	
			Revised 9/17/91		Revised 9/17/91
1	2.12	1.13E-06	7.89×10^{-6}	3.98E-02	2.78×10^{-1}
2	1.99	8.23E-07	5.76×10^{-6}	2.90E-02	2.03×10^{-1}
3	1.90	1.02E-07	7.17×10^{-6}	3.61E-02	2.53×10^{-1}
	AVERAGE =	9.91E-07	6.94×10^{-6}	AVERAGE = 3.50E-02	0.245 #/hr

B. HYDROGEN CHLORIDE RESULTS

i. EXHAUST EMISSIONS

RUN NO.	SAMPLE VOLUME (DSCF)	LB/SCF OF LFG	TOTAL HCL LB/HR
1	72.92	1.10E-05	3.90E-01
2	67.66	8.74E-06	3.08E-01
3	68.98	8.78E-06	3.10E-01
	AVERAGE =	9.52E-06	3.36E-01

ii. INLET EMISSIONS

RUN NO.	SAMPLE VOLUME (DSCF)	TOTAL HCL LB/HR	TOTAL CL LB/HR
1	28.23	1.25E+00	1.53E-04

2

LFG FR = 591 SCFM.

CH4 Content? 47.7% from ref. 25

I. SELECTED RESULTS - OTAY LANDFILL (CONTINUED)

C. VINYL CHLORIDE RESULTS

i. INLET EMISSIONS

RUN NO.	PPB	LB/HR
1	5270	3.06E-02
2	5340	3.10E-02
3	5420	3.15E-02
	AVERAGE =	3.10E-02

ii. EXHAUST EMISSIONS

RUN NO.	PPB	LB/HR	LB/SCF OF LFG
1	0.00	0.00E+00	0.00E+00
2	0.00	0.00E+00	0.00E+00
3	0.00	0.00E+00	0.00E+00
	AVERAGE =	0.00E+00	0.00E+00

iii. PERCENT REDUCTION = 100%

I. SELECTED RESULTS - OTAY LANDFILL (CONTINUED)

D. DICHLOROMETHANE RESULTS

i. INLET EMISSIONS

RUN NO.	PPB	LB/HR
1	6180	4.88E-02
2	6010	4.75E-02
3	6200	4.90E-02
	AVERAGE =	4.84E-02

ii. EXHAUST EMISSIONS

RUN NO.	PPB	LB/HR	LB/SCF OF LFG
1	437.0	3.74E-02	1.06E-06
2	365.0	3.12E-02	8.85E-07
3	410.0	3.51E-02	9.94E-07
	AVERAGES =	3.46E-02	9.80E-07

iii. PERCENT REDUCTION = 28.5%

SELECTED RESULTS - OTAY LANDFILL (CONTINUED)

E. BENZENE RESULTS

i. INLET EMISSIONS

RUN NO.	PPB	LB/HR
1	1700	1.23E-02
2	1700	1.23E-02
3	1620	1.18E-02
	AVERAGE =	1.21E-02

ii. EXHAUST EMISSIONS

RUN NO.	PPB	LB/HR	LB/SCF OF LFG
1	36.10	2.84E-03	8.05E-08
2	33.70	2.65E-03	7.51E-07
3	30.20	2.37E-03	6.73E-08
	AVERAGE =	2.62E-03	3.00E-07

iii. PERCENT REDUCTION = 78.3%

I. SELECTED RESULTS - OTAY LANDFILL (CONTINUED)

F. TOTAL SULFUR COMPOUNDS RESULTS

i. INLET EMISSIONS

RUN NO.	PPM	LB/HR
1	51.41	1.74E-01
2	50.82	1.73E-01
3	50.48	1.71E-01
	AVERAGE =	1.73E-01

apcd
County of San Diego

R. J. Sommerville
Air Pollution Control Officer

August 30, 1991

Leslie Johnson
South Coast Environmental Company
1915 McKinley Avenue, Suite E
La Verne, CA 91750

INFORMATION REQUEST FOR PACIFIC ENERGY, OTAY MESA
AB2588 REPORT

The source test report, submitted by the South Coast Environmental Company (SCEC), is being reviewed by District staff. The following additional information is needed to complete the review process.

1. Air Toxic Ltd. reported the laboratory analysis in micrograms of formaldehyde. The SCEC should resubmit calculations which do not include a correction factor for formaldehyde hydrozone.

2. The SCEC used a Nutech dry gas meter in their sampling train. They used a meter correction factor associated with an Anderson dry gas meter in their computations. The error is relatively small. Therefore, correction is not mandatory.

3. The percent reduction efficiency addressed in the report compares output concentrations to input concentrations. The output values were measured in dry standard cubic feet and the input values were measured in wet standard cubic feet. This should be explained.

Please provide this information within 14 days. If any questions arise, please contact me at (619) 694-3345.

John D Jackson

JOHN JACKSON
Associate Air Pollution Chemist

JJ:jl
cc: Lynn Kramer

AIR POLLUTION CONTROL DISTRICT
9150 Chesapeake Drive, San Diego, California 92123-1095
(619) 694-3307 FAX (619) 694-2730

SOUTH
COAST
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COMPANY

JOHN J. ;
THIS WILL SATISFY THE AB2588 REQUIREMENTS. PLEASE MODIFY R.A.S. & ADVISE SITE WHEN PROTOCOL IS ACCEPTABLE.
THANKS
DAVE
3/19/91

March 15, 1991

Mr. Dave Burns
San Diego Air Pollution Control District
9150 Chesapeak Drive
San Diego, CA 92123

SUBJECT: Pacific Energy (PEn) Otay Landfill
AB2588 Testing Amendments
SCEC #T1265

Dear Mr. Burns:

This letter is to confirm our telephone conversation of March 13, 1991 regarding the subject testing.

The following is a list of compounds and testing locations that you requested to satisfy AB2588 requirements. All other compounds listed on the original protocol -- dated January 31, 1991 -- are omitted.

EXHAUST EMISSIONS	INLET GAS EMISSIONS
Methylene Chloride	Methylene Chloride
Benzene	Benzene
Vinyl Chloride	Vinyl Chloride
Formaldehyde	
Hydrogen Chloride	

Upon your approval, please send a confirmation letter to Mr. Terence Hee at PEn with a cc: to South Coast Environmental Company, attention Keith B. Shannon.

If you have any questions, comments, or require any further information, please feel free to contact me or Keith B. Shannon at (714) 596-6540.

Sincerely,
SOUTH COAST ENVIRONMENTAL COMPANY

Leslie A. Johnson
Source Test Manager

LAJ/KBS:mmn

cc: Terence Hee - PEn
John Jackson - SDAPCD

1415 McKinley Ave
Suite E
La Verne, CA 91750
714-596-6540
714-596-5619 (FAX)

1265c

SOUTH
COAST
ENVIRONMENTAL
COMPANY

SOURCE TEST PROTOCOL

AB2588 COMPLIANCE

Prepared for

Pacific Energy
6085 East Washington Blvd.
Commerce, CA 90040

Submitted to

San Diego Air Pollution Control District
9150 Chesapeake Drive
San Diego, CA 92123

Prepared by

South Coast Environmental Company
1915 McKinley Ave., Suite E
La Verne, CA 91750

January 31, 1991

TEST PROTOCOL
AB2588

(a) Test date: March 5, 1991

(b) Testing Company:
South Coast Environmental Company (SCEC)
1915 McKinley Ave.
LaVerne, CA 91750

Analytical Laboratory:
Enseco -CRL
7440 Lincoln Way
Garden Grove, CA 92641

Zalco Laboratories
4309 Armour Avenue
Bakersfield, CA 93308
and
Air Toxics
11325 Sunrise Gold Circle
Suite E
Rancho Cordova, CA 95742

(c) Name of Contractor:
Pacific Energy
6085 East Washington Blvd.
Commerce, CA 90040

(d) Units to be tested: Internal Combustion Engine, landfill gas-fired, 650 BHP, 900 rpm, clean burn, model #165 GTA.

(e) Process reactant composition and rates: To be determined as part of the source test.

(f) Fuel analysis and flow rates: Landfill gas will be analyzed as part of the source test being performed in March. These results will be included in the final report.

(g) Proposed Test Methodology

This test plan defines the methodology proposed for the compliance testing as specified by AB2588 Emissions Inventory Criteria and Guidelines. Included within this test plan are the test protocol and guidelines, the sampling and analytical procedures, the quality assurance.

Parameter	# And Location	Test Method
Flow, Velocity and Temperature	Triplicate, Exhaust only	CARB Methods #1 and #2
Multiple Metals: Ar, Be, Br, Ca, Cr, Cu, Fl, Pb, Mn, Hg, Ni, P, Se, and Zn.	Single, Fuel Analysis	EPA Method 6010, in SW-846

Parameter	# And Location	Test Method
Sulfur	Single, Fuel Analysis	ASTM Method D129-64
Chlorine	Single, Fuel Analysis	ASTM Method 0808-87
Hydrogen Chloride	Triplicate, Exhaust and Fuel Analysis	CARB Method 421 CARB Method 106
Formaldehyde	Triplicate, Exhaust	CARB Method 430
Benzene	Triplicate, Fuel Analysis and Exhaust	CARB Method 410A
Vinyl Chloride	Triplicate, Fuel Analysis and Exhaust	CARB Method 106
Methylene Chloride	Triplicate, Fuel Analysis and Exhaust	CARB Method 422
Acetonitrile Benzyl Chloride Chlorobenzene 1,1 Dichloroethane 1,2 Dichloroethane 1,1 Dichloroethene Tetrachloroethylene Tetrachloromethane Toloene 1,1,1 Trichloroethane Trichloroethylene Trichloromethane Xylene	Triplicate Fuel, Only	CARB Method 422
H2S	Triplicate, Fuel only	CARB Method 16
CO2, O2, N2	Triplicate, Exhaust only	CARB Method 3

(h) Equipment specifications and drawings: See Attachment A.

(i) Independent tester Executive Order: See Attachment B for CARB Testing Certification.

(j) Typical values and allowable ranges of operating parameters: To be determined as part of the source test.

(k) Process operating conditions during test: Engine operating at maximum capacity.

(l) Stack temperature: Approximately 900 F

(m) Concentration of any listed substances in the exhaust stream: To be determine as part of the source test.

(n) Mass emission rate of any listed substance: To be determined as part of the source test.

(o) Composition and rate waste streams: Not applicable.

(p) Oxygen, Carbon dioxide, and moisture content of exhaust gas:

O2 = 8-9%
CO2 = 9-10%

(q) Gas velocity and volumetric flow rate:

Velocity = 180-200 fps
DSCFM = 6800-7300

(r) Sample points and number of samples: A total of 24 sampling point locations will be used for the traverses. Please see Attachment C for sample point locations.

(s) Calibration Data: See Attachment D.

(t) Quality assurance and quality control data:

1. Testing Company-SCEC will adhere to all QA/QC set forth in referenced source test methods as stated in this protocol. See Attachment E for applicable forms.

2. Analytical Laboratories Enseco CRL,Zalco and Air Toxics have a formal QA/QC program which governs data quality for the entire laboratory. The QA/QC procedures are designed to monitor and control the basic elements of quality assurance-instrumentation, glassware, reagents, solvents, gases, and to generate valid precision and accuracy for each method and analysis. Other activities include matrix spikes/spike duplicate analysis, and reagent blank analysis.

(u) Chain of custody document: See Attachment F.

(v) Applicable emission standards: Not applicable.

If there are any questions regarding this Test Protocol, please call Leslie Johnson or Keith Shannon at (714) 596-6540.

1265b

LIST OF ATTACHMENTS

SOUTH
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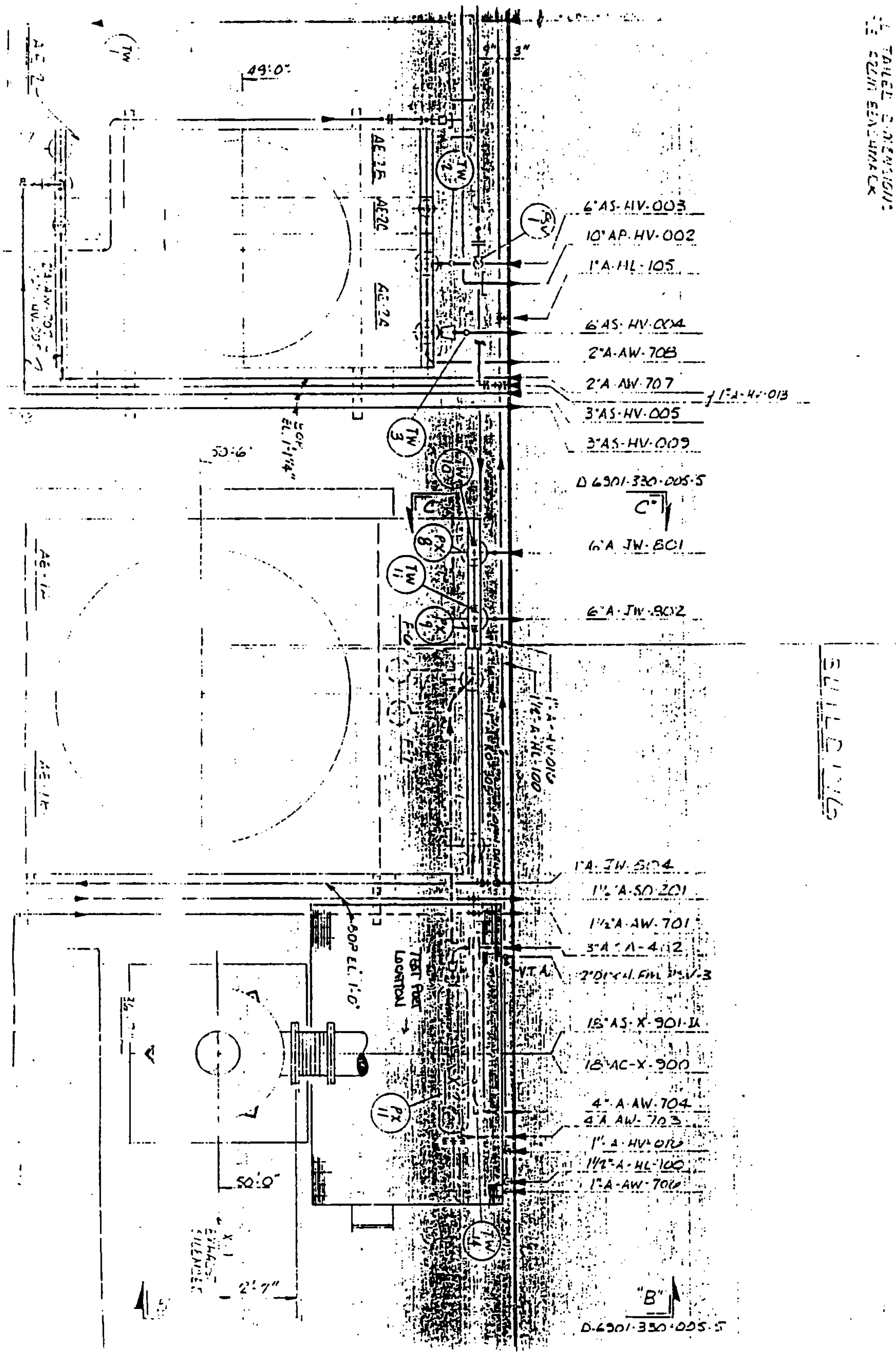
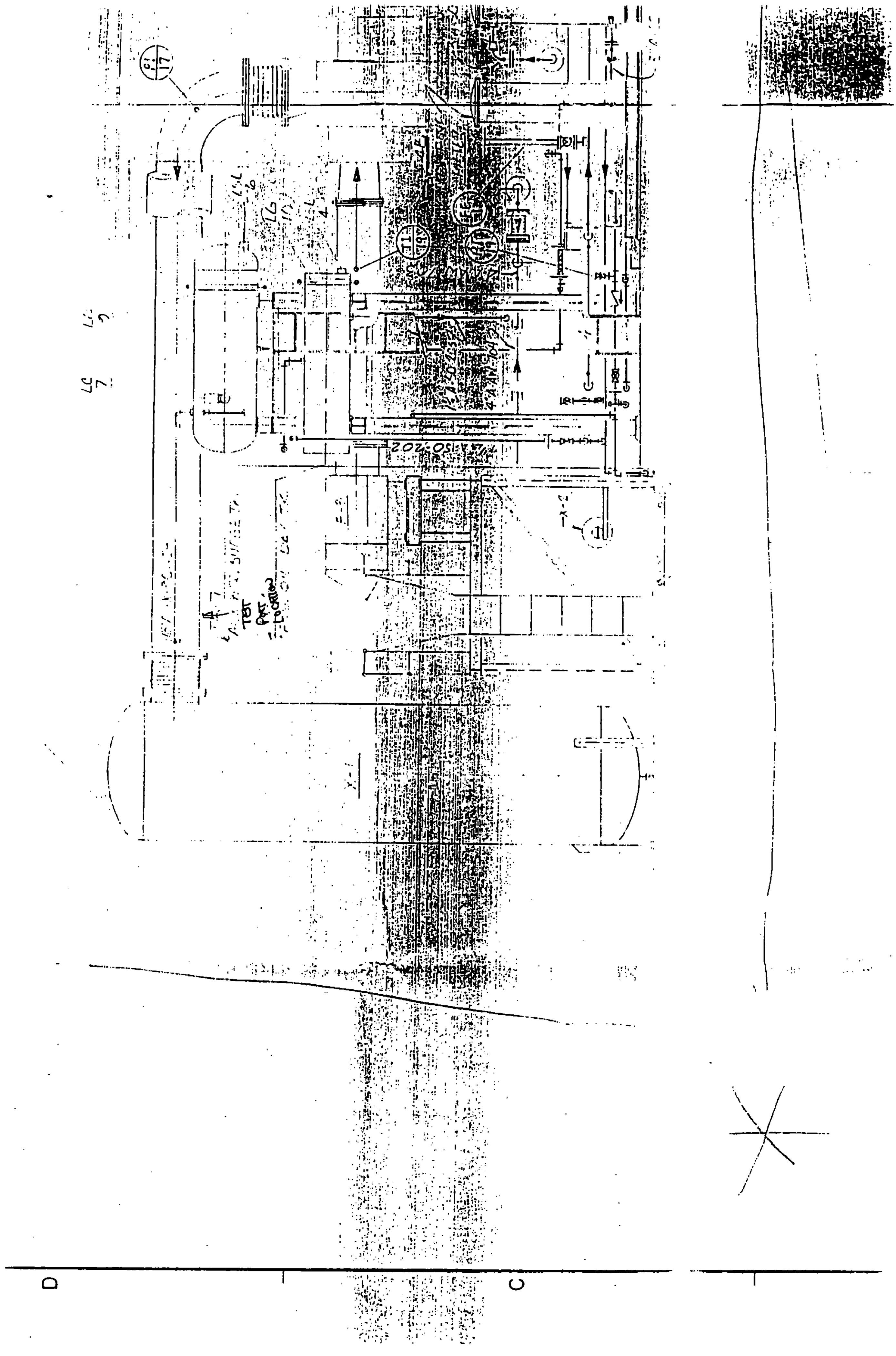
ATTACHMENT A

EQUIPMENT SPECIFICATION AND DRAWING



6"AS-HV-003
10"AP-HV-002
1"A-HL-105
6"AS-HV-004
2"A-AW-708
2"A-AW-707
3"AS-HV-005
3"AS-HV-009
D 6301-330-005-5
"C"
6"A-JW-801
6"A-JW-802
1"A-JW-804
1½"A-SO-201
1½"A-AW-701
18"AS-X-901-1A
18"AC-X-900
4"-A-AW-704
4"A-AW-703
1½"A-HL-100
1"A-AW-706
"B"
D-6301-330-005-5
49'-0"
50'-6"
50'-0"
2'-7"
TEST PORT LOCATION
V.T.A.



SOUTH
COAST
ENVIRONMENTAL
COMPANY

ATTACHMENT B

CARB INDEPENDENT TESTERS CERTIFICATE

State of California
AIR RESOURCES BOARD

Executive Order G-591

Approval to South Coast Environmental Company
To Conduct Testing as an Independent Contractor

WHEREAS, the Air Resources Board ("Board"), pursuant to Section 41512 of the California Health and Safety Code, has established the procedures contained in Section 91200-91220, Title 17, California Code of Regulations, to allow the use of independent testers for compliance tests required by the Board; and

WHEREAS, pursuant to Sections 91200-91220, Title 17, California Code of Regulations, the Executive Officer has determined that South Coast Environmental Company meets the requirements of the Board for conducting ARB Test Method 1-5.

NOW, THEREFORE, BE IT ORDERED that South Coast Environmental Company is granted an approval, from the date of execution of this order, until June 30, 1992 to conduct the tests listed above, subject to compliance with Section 91200-91220, Title 17, California Code of Regulations.

BE IT FURTHER ORDERED that during the approved period the Executive Officer or his or her authorized representative may field audit one or more tests conducted pursuant to this order for each type of testing listed above.

Executed this 21ST day of December 1990, at Sacramento, California.

James J. Morgester, Chief
Compliance Division

AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

September 12, 1990

South Coast Environmental Company
1915 McKinley Ave., Suite E
La Verne, CA 91750

Ms. Leslie Johnson
(714) 596-6540

TEST	EXPIRES
Method 1-1	6/30/91
Method 1-2	6/30/91
Method 1-3	6/30/91
Method 1-4	6/30/91
Method 1-100	
CO2	6/30/91
NOx	6/30/91
O2	6/30/91
Visible Emissions Evaluation	6/30/91

SOUTH
COAST
ENVIRONMENTAL
COMPANY

ATTACHMENT C

SAMPLE POINT LOCATIONS

SOUTH
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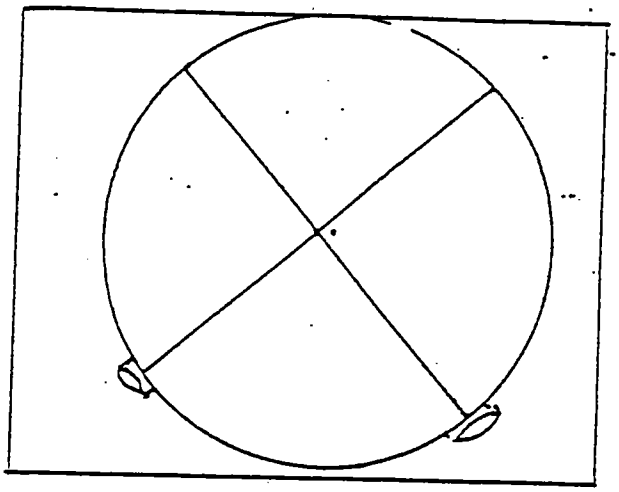
1915 MCKINLEY AVENUE
SUITE E
LA VERNE, CA 91750
(714) 596-6540

FILE REF: ST12

SAMPLE POINT LOCATION DATA SHEET

FACILITY: Pacific Energy: Otay
PROJECT #: - 00
DATE: -
STACK DIMENSIONS: L= _____
W= _____
H= _____
UPSTREAM DIST./
EQUIVALENT DIAMETERS min 2
DOWNSTREAM DIST./
EQUIVALENT DIAMETERS min 1
NO. OF SAMPLING POINTS
SAMPLING PORT DIMENSIONS:
DIA.= 12
PROTRUSION DIST.= 4



SAMPLE POINT	% OF STACK DIAMETER	DISTANCE FROM STACK WALL (IN.)	DISTANCE FROM SAMPLE PORT (IN.)
1	2.1	0.3	
2	6.7	0.8	
3	11.8	9.3	
4	17.7	2.1	
5	25.0	3.0	
6	35.6	4.3	
7	64.4	7.7	
8	75.0	9.0	
9	82.3	9.9	
10	88.2	10.6	
11	93.3	11.2	
12	97.9	11.8	

5 McKinley Ave.
e E
rne, CA 91750
596-6540
596-5619 (FAX)

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ATTACHMENT D

CALIBRATION DATA FORMS

SOUTH
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COMPANY

La Verne, CA 91750
714-596-6540
714-596-5619 (FAX)

DATA SHEET FOR MAGNEHELIC GAUGE

Magnehelic Gauge I.D.:_____ Date:_____

Reference Gauge I.D. :_____ Calibrated by:_____

Full Scale of Magnehelic Gauge:_____ "H2O

System Leak Check @ _____ "H2O pres _____ "H2O vacuum

Magnehelic "H2O (H1)	Incline Manometer "H2O (H2)	Difference ΔH H1 - H2	Deviation 100 * ΔH/H2	COMMENTS

ST38

DATA SHEET FOR CALIBRATION OF PITOT TUBES

Run No	Date	S-Type Pitot Tube I.D.	Can. Config. OK/NO	Side A/B	Std. (Ref.) Pitot Tube I.D.	Cal. Manif. I.D.	Manif. Leak Ck. L	Manif. Leak Ck. R	S-Type $\Delta P(s)$	Std. (Ref.) $\Delta P(std)$	C_p	$C_p - \bar{C}_p$	Remarks

$$\sigma(A \text{ or } B) = \frac{\sum_{1}^{3} \left| C_p - \bar{C}_p (A \text{ or } B) \right|}{3}$$

Example Data Sheet for Calibration of Pitot Tubes

Orifice Calibration Data and Calculation Form

DATE_____ ORIFICE #_____

BAREMETRIC PRESSURE, P_{bar} = _____in.Hg CALIBRATED BY_____

Q (CFM)	Orifice Manometer Setting (ΔH) in. H_2O	Volume	Temperature				
		Dry Gas Meter (V_m), dcf	Dry Gas Meter			Time (θ), min	$\Delta H@_i$** in. H_2O
			Inlet (t_{in}), °F	Outlet (t_{out}), °F	Avg.* (t_m), °F		
0.25							
0.50							
0.75							
1.00							
						Avg.	

Q (CFM)	ΔH in. H_2O	$\Delta H@_i = \frac{0.319 x t_m x \Delta H}{P_{bar}} \left[\frac{\theta}{Y x V x A}\right]^2$
0.25		
0.50		
0.75		
1.00		

*If there is only one thermometer on the dry gas meter, record temperature under T_m.

**Acceptable if the four values obtained differ by no more than 3.0 mm H_2O (0.15 in. H_2O) from the average.

Orifice Calibration Data and Calibration Form (English Units)

Nozzle Calibration

Date _____ *Calibrated by* _____

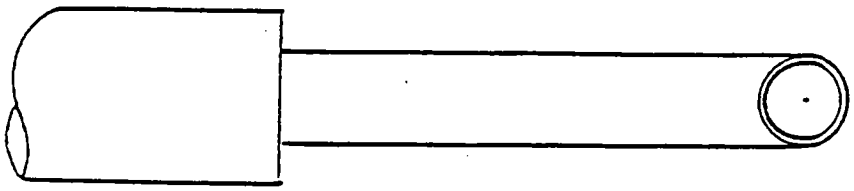
Nozzle identification number	D_1 *mm (in.)*	D_2 *mm (in.)*	D_3 *mm (in.)*	ΔD *mm (in.)*	D_{avg}

where

$D_{1,2,3}$ = *nozzle diameter measured on a different diameter, mm (in.). Tolerance = measure within 0.25 mm (0.001 in.)*

Δ = *maximum difference in any two measurements, mm (in.). Tolerance = 0.1 mm (0.004 in.)*

D_{avg} = *average of* D_1, D_2, D_3.



Nozzle Calibration Data Sheet

Calibration Data Form
Thermocouple-Potentiometer

Field Meter STOC# ____________
Field Meter S/N ____________
Ref. Indication S/N ____________
Ref. Indication STOC# ____________
Lead Wire STOC# ____________

Temperature Source ____________

Calibration
Semiannual ____________
Bimonthly ____________
Other ____________
Date ____________
Cal. By ____________

	I.D. Number		Temperature (°F)							Average Temp., °F			
	Ref. Therm.	Temp. Sensor	Ref. Therm. (A)			Temp. Sensor (B)						Δ°F	
			0 Time	1st minute	2nd minute	0 Time	1st minute	2nd minute	$\bar{A}$	Corrected Ref. $\bar{A}' = (\bar{A})$(Corr Fctr.)	$\bar{B}$	$C = \bar{B} - A'$	
CH #1													
CH #2													
CH #1													
CH #2													
CH #1													
CH #2													
CH #1													
CH #2													
CH #1													
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CH #1													
CH #2													

Calibration Data Form

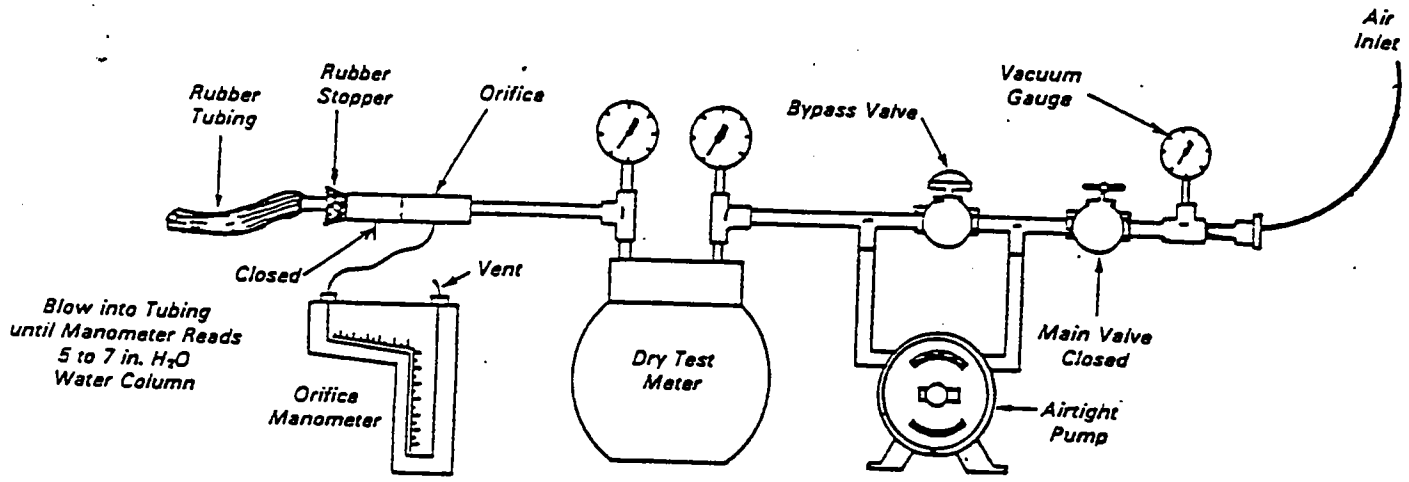

Figure 2.1. Positive leak check of metering system.

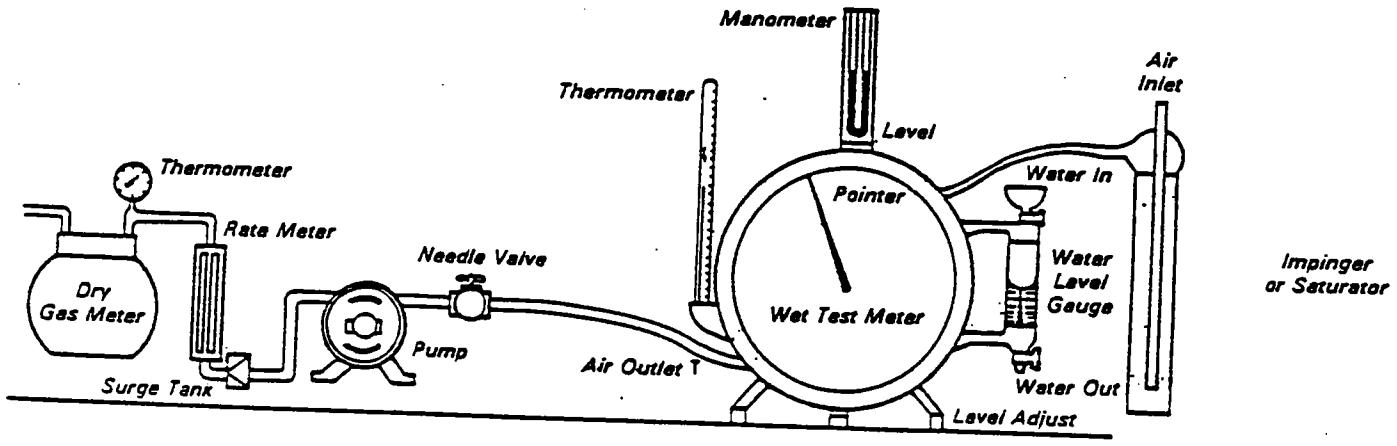

Figure 2.2. Sample meter system calibration setup.

Dry Gas Meter Sample Calibration Data
(English units)

Date _____ Calibrated by _____ Meter box number _____

Barometer pressure, P_m = _____ in. Hg Wet test meter number _____

Dry test meter temperature correction factor _____ °F

Wet test meter pressure drop (D_m), [a] in. H_2O	Rotameter setting (R_s), ft^3/min	Wet test meter gas volume (V_w), [b] ft^3	Dry test meter gas volume (V_d), [b] ft^3		Wet test meter gas temp (t_w), °F	Dry test meter					
			Initial	Final		Inlet gas temp (t_{d_i}), °F	Outlet gas temp (t_{d_o}), °F	Average gas temp (t_d), [c] °F	Time of run (θ), [d] min	Average ratio (Y_d), [e]	(Y_t), [f]

[a] D_m expressed as a negative number.
[b] Volume passing through meter. Dry gas volume is minimum for at least five revolutions of the meter.
[c] The average of t_{d_i} and t_{d_o} if using two thermometers; the actual reading if using one thermometer.
[d] The time it takes to complete the calibration run.
[e] With Y defined as the average ratio of volumes for the wet test and the dry test meters, $Y_t = Y \pm 0.02\,Y$ for calibration and $Y_t = Y \pm 0.05\,Y$ for the posttest checks, thus,

$$Y_t = \frac{V_w (t_d + 460°F)[P_m + (D_m/13.6)]}{V_d (t_w + 460°F)(P_m)} \quad \text{(Eq. 1)} \qquad Y = \frac{Y_1 + Y_2 + Y_3}{3} = \_\_\_\_\_ \quad \text{(Eq. 2)}$$

[f] With Y_t defined as the average ratio of volumetric measurement by wet test meter to rotameter. Tolerance $Y_t = 1 \pm 0.05$ for calibration and Y ± 0.1 for posttest checks

$$Y_{t_1} = \frac{V_w (t_d + 460°F)[P_m + (D_m/13.6)](60)}{\theta (t_w + 460°F)(P_m)(0.035)} \quad \text{(Eq. 3)} \qquad Y_t = \frac{Y_1 + Y_2 + Y_3}{3} = \_\_\_\_\_ \quad \text{(Eq. 4)}$$

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
FIELD DRY GAS TEST METER COEFFICIENT CALCULATIONS

BAROMETRIC PRESSURE (P_{bar}) in. Hg _____ Set # _____ Date _____

AMBIENT TEMPERATURE _____ F Page # _____ Calibrated by _____

CALIBRATION FOR:
Semiannual _____
Bimonthly _____
Other _____

Reference Dry Gas Meter ID # _____ Correction Factor _____

Approx. Flow Rate (Q) cfm	Flow Rate Q_{rm} cfm	Average Meter Temperature ($\bar{T}$) °F	Average Meter Pressure ($\bar{P}$) in.H_2O	Corr. Flow Rate (Q'_{rm}) scfm

1. For Non Temperature Compensated Dry Gas Meter:

$$Q'_{rm} = Q'_{rm}\left(\frac{528}{460+\bar{T}}\right)\left(\frac{P_{bar} + \frac{\bar{P}}{13.6}}{29.92}\right)$$

or

$$Q'_{fm} = Q'_{fm}$$

2. For Temperature Compensated Dry Gas Meter:

$$Q'_{fm} = Q'_{fm}\left(\frac{P_{bar} + \frac{\bar{P}}{13.6}}{29.92}\right)$$

3. $$Y_{fm} = \frac{Q'_{rm}}{Q'_{fm}}$$

* CRITERIA MUST BE SATISFIED BEFORE CALCULATING $\bar{Y}_{fm}$ AND $\bar{Y}_{fm}$

Field Dry Gas Test Meter ID # _____ STQC # _____ Overall Avg. $\bar{Y}_{fm}$ _____ Correction Factor _____

Approx. Flow Rate (Q) cfm	Flow Rate cfm	Average Meter Temperature ($\bar{T}$) °F	Average Meter Pressure ($\bar{P}$) in.H_2O	Corr. Flow Rate (Q'_{fm}) scfm	Coefficient Y_{fm} (1± 0.03)*	$\frac{Y_{dn}\ max. - Y_{dn}\ min.}{}$ ≤ 0.010*	Avg. Coeff. ($\bar{Y}_{fm}$)	$\bar{Y}_{fm}$	Avg. $\bar{Y}_{fm}/\bar{Y}_{fm}$ (1±0.02)

Field Dry Gas Test Meter Coefficient Calculations

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
DATA SHEET FOR REFERENCE DRY GAS METER CALIBRATION

ORIFICE IDENTIFICATION (S/N)
DRY GAS METER IDENTIFICATION (S/N)________
DRY GAS METER IDENTIFICATION (STDC)________
BAROMETRIC PRESSURE (P_{bar})________
AMBIENT TEMPERATURE________
LEAK CHECK________

DATE:________
CALIB. BY:________
CALIBRATION FOR:
ANNUAL________
SEMIANNUAL________
OTHER________

Approx CFM Project	Total CF		Crit. Orif. ΔP in H_2O	ORIFICE Temp. (°F) In/Out	ORIFICE Man. ΔP in H_2O	ORIFICE Flow Rate CFM	ORIFICE Time Min: Sec.	ORIFICE Elapse Time: Min.	ORIFICE Flow Rate CFM	REFERENCE DRY GAS METER Temp. (°F) In/Out	REFERENCE DRY GAS METER Vac. (in H_2O) In/Out	REFERENCE DRY GAS METER Meter Read. CF	REFERENCE DRY GAS METER Time Min: Sec.	REFERENCE DRY GAS METER Elapse Time: Min.	REFERENCE DRY GAS METER Flow Rate CFM
		Start													
		End													
		Avg. or Total													
		Start													
		End													
		Avg. or Total													
		Start													
		End													
		Avg. or Total													
		Start													
		End													
		Avg. or Total													
		Start													
		End													
		Avg. or Total													
		Start													
		End													
		Avg. or Total													

Data Sheet for Reference Dry Gas Meter Calibration

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ATTACHMENT E

SCEC QA/QC FORMS

TRACEABILITY AND ACCEPTABLE STANDARDS OF SOURCE TESTING INSTRUMENTS

Equipment	Traceability	Acceptable Standard
S-type Pitot Tube (Conical), (CFR40-60-App. A, Meth. 2)	NBS Traceable or STD Pitot with Correction Factor of 0.99 ± 0.01	≤ 0.02 or Calibration Curve
Differential Pressure Gauge	Magnehelic Gauge, Inclined Manometer, Liquid in U-Tube Manometer	± 5 percent of the Reading
Liquid in Glass Thermometer or Temperature Sensor	ASTM (NBS Traceable) Mercury in Glass Thermometer or Equivalent	± 1.5 percent
Thermocouple-Potentiometer	ASTM (NBS Traceable) Mercury in Glass Thermometer or Equivalent	± 1.5 percent
Aneroid Barometer	NBS Traceable Mercury Barometer	2.54 mm Hg (0.1 in. Hg)
(Reference Standard) Dry Gas Meter	NBS Traceable Orifice Gauge or Bell Prover	± 2 percent
Field Dry Gas Test Meter	(Reference Standard) Dry Gas Meter	± 2 percent
Turbine Meter	NBS Traceable Orifice Gauge or Equivalent	± 2 percent
Dry Gas Meter Orifice	Proper Construction	3.8 mm H_2O (0.15 in. H_2O)

FREQUENCY OF CALIBRATION OF SOURCE TESTING INSTRUMENTS

Equipment	Frequency	Procedure
S-Type Pitot Tube	Annual Calibrations (optional)	Measure the configuration multiple (3) points calibration or wind tunnel.
	Seminannual	Measure the Configuration.
	Reshape Pitot Tube	Measure the configuration and conduct multiple (3) point calibration if dimensions do not conform to Figures III-2 and III-3.
Standard Pitot Tube	Semiannual	Measure the configuration
Differential Pressure Gauge (Magnelhelic)	Semiannual Calibration	Point leak check and triplicate runs over 5 points.
	Bimonthly Calibration	Point leak check and 1 run over 3 points.
Differential Pressure Gauge (Monometer)	Semiannual	Clean and replace fluid.
Liquid in Glass Thermometer or Temperature Sensor	Annual Calibration	Triplicate runs at each of 3 temperatures.
	Monthly Calibration	1 run at each of 3 temperatures.
Thermocouple-Potentiometer	Semiannual Calibration	Triplicate runs at each of 3 temperatures.
	Bimonthly Calibration	1 run at each of 3 temperatures.
Aneroid Barometer	Semiannually	Single point calibration 2.54 mm Hg. (0.10 Hg barometer).

Equipment	Frequency	Procedure
(Reference Standard) Dry Gas Meter or Wet Meter	Annual Calibration	Triplicate runs at each of 4 flow rates (0.25-1.0 cfm).
	Semiannual Calibration	2 point check.
Field Dry Gas Test Meter (use Secondary STD)	Semiannual Calibration	Triplicate runs at 4 flow rates (0.25-1.0 cfm).
	Bimonthly Calibration	2 flow rates check.
	Check against dry gas meter orifice before and after every test.	
Turbine Meter	Semiannual Calibration	Triplicate runs at 4 flow rates.
	Annual Calibration	Triplicate runs at 10 flow rates.
Dry Gas Meter Orifice	Annual Calibration	H@ multiple (4) points calibration.
	Check against field dry gas meter before and after every test.	

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ATTACHMENT F

CHAIN OF CUSTODY FORM

COAST
ENVIRO'MENTAL
COMPA /

La Verne, CA 91750
714-596-6540
714-596-5619 (FAX)

CHAIN OF CUSTODY RECORD

Parameters:

Samplers: (signature)

Run Number	Station Location	Date	Time	Sample Type: Water comp	Sample Type: Water grab	Sample Type: AIR	Sample ID #	Analysis Required

RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
RELINQUISHED BY: (SIGNATURE)	RECEIVED BY: (SIGNATURE)	DATE/TIME
DISPATCHED BY: (SIGNATURE) DATE/TIME	RECEIVED BY LAB BY:	DATE/TIME

METHOD OF SHIPMENT: