Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Background Report Reference

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Title: Urea Permit Compliance Testing at El Segundo Generating Station Unit 3

Carnot

Carnot

September 1993

AP-42 Section 1.4 (BID Ch.2)

UREA PERMIT COMPLIANCE TESTING AT EL SEGUNDO GENERATING STATION UNIT 3

Prepared For:

SOUTHERN CALIFORNIA EDISON COMPANY
Rosemead, California

For Submittal To:

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
Diamond Bar, California

Prepared By:

Edward J. Filadelfia

CARNOT
Tustin, California

SEPTEMBER 1993

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and documented in this report were carried out under my direction and supervision.

Hung M. Ha Date 9/20/93

FOR Edward J. Filadelfia
Senior Engineer

I have reviewed, technically and editorially, details, calculations, results, conclusions and other appropriate written material contained herein, and hereby certify that the presented material is authentic and accurate.

Hung M. Ha Date 9/20/93

FOR Edward J. Filadelfia
Senior Engineer

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SECTION 1.0

INTRODUCTION

Carnot was contracted to conduct a series of emissions tests on Unit 3 at the El Segundo Generating Station for Southern California Edison (SCE). Carnot conducted testing to comply with South Coast Air Quality Management District (SCAQMD) Permit A/N 236339.

A test program was conducted to quantify the effect of urea injection on various stack emissions as stated in Conditions 11-B and 11-C(b) of the Permit to Construct. Emissions tests were performed on El Segundo Unit 3 for the following:

- NO_x, CO and O_2
- ROG as non-methane Hydrocarbons
- NH_3 (urea on only)

Table 1-1 summarizes the emissions test results.

Per verbal discussion with Mr. Darren Stroud of the SCAQMD, it was agreed that particulate emissions would be measured on one unit of each unit class because of the low potential for urea having an impact on particulate emissions. Therefore, particulates were not measured on this unit. The unit that was tested as representative of the 320/335 MW class of units was Alamitos No. 4. The results are contained in Carnot Report No. SCE1A-10840/R106B956.T and titled **Urea Permit Compliance Testing at Alamitos Generating Station Unit 4.**

Emissions testing was conducted by Edward J. Filadelfia, Jim Mulligan and Marc Rodabaugh of Carnot on May 3-5, 1993. Mike Escarsega and Barry Novodvorsky of SCE coordinated the testing.

TABLE 1-1
EMISSIONS TEST RESULTS SUMMARY
EL SEGUNDO UNIT 3
MAY 1993

	Net Load 310 MW		Net Load 250 MW		Net Load 150 MW	
	Urea Off	Urea On	Urea Off	Urea On	Urea Off	Urea On
NO_x, ppm	66.0	58.6	58.8	49.3	38.3	33.2
NO_x, ppm @ 3% O_2	72.3 11%	64.6	65.4 16%	55.0	43.4 14%	37.4
CO, ppm	34.0	22.0	2.2	1.5	38.6	37.9
CO, ppm @ 3% O_2	37.3 35%	24.2	2.4 29%	1.7	43.6 2%	42.7
Methane, ppm	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0	ND<1.0
TNMHC as CH_4 ppm	9.1 9%	8.3	9.8 17%	8.1	13.1 77%	9.6
Urea flow gpm	0.0	2.1	0.0	1.3	0.0	0.6
NH_3 slip						
ppm	--	4.0	--	8.7	--	1.7
ppm @ 3% O_2	--	4.4	--	9.6	--	1.9

Note: ND indicates that this species was not detected.

SECTION 2.0

UNIT DESCRIPTION

El Segundo Generating Station Unit 3 is one of six similar Combustion Engineering inverted tangentially-fired boilers in the SCE system with a rated load of 335 net MW. The boiler is fired from the top and consists of three tiers of burners with eight burners in each tier. Each burner contains one oil gun and two gas injectors. The unit is divided into two furnaces by a division wall, with burners in each of the four corners to provide the "tangential" firing.

The boiler is equipped with burner tilts, which can be varied from the horizontal to 10 degrees up and 30 degrees down. All three burners in a furnace corner are controlled by one mechanism, with all the burners in a furnace set at the same position. Combustion air is supplied by two forced draft fans through primary and secondary air ducts. The primary air ducts supply air only to the immediate vicinity of the burners. The secondary air is introduced above and below each burner. Air flow to individual burners is controlled by dampers. Existing controls regulate the position of all the primary and secondary dampers separately. The unit has two flue gas recirculation (FGR) fans that mix flue gas with the secondary air supply. The furnace is operated under positive pressure.

SECTION 3.0

TEST DESCRIPTION

3.1 TEST CONDITIONS

The testing was conducted at two conditions and at three loads. Condition 1 was with urea off and Condition 2 was with optimum urea injection. Duplicate tests were performed at each of the following approximate net loads: 310, 250 and 150 MW. Loads below 150 MW were not tested as urea is not used at loads below 150 MW. All testing was performed with the boiler fired on natural gas fuel. The test matrix and unit operating data are outlined in Tables 3-1 and 3-2. Unit operation was established by SCE operators, and unit data were collected by Carnot and SCE personnel.

3.2 SAMPLE LOCATIONS

Measurements were made using two of four sample ports accessible from the newly constructed stack sampling platform. A stack configuration drawing is presented in Figure 3-1. The stack diameter at the cross-sectional plane of the sample ports is 21 feet, 1 inch. This sample location is 62 feet, 2 inches (2.9 diameters) from the nearest upstream flow disturbance and 117 feet, 10 inches (5.6 diameters) from the stack exit.

3.3 TEST PROCEDURES

The test procedures used for the program are presented in Table 3-3. Descriptions of standard procedures are included in Appendix A. Additional information and modifications to standard procedures are presented in the following section.

3.3.1 Gaseous Emissions

Gaseous species (NO_x, CO and O_2) were measured using Carnot's Continuous Emissions Monitor (CEM) described in Appendix A. This system meets SCAQMD, CARB and EPA requirements for gaseous species. Two 30-minute gaseous emission test runs were performed for each test condition and load.

TABLE 3-1
TEST MATRIX
SCE EL SEGUNDO UNIT 3
MAY 1993

Test #	Date	Time	Type of Test	Net Load MW
3-1-CEM	5/3/93	1115/1213	NO_x, CO & O_2	150
3-1-HC	5/3/93	1010/1030	Hydrocarbon	150
3-1-NH_3	5/3/93	1115/1145	Ammonia	150
3-2-CEM	5/3/93	1235/1300	NO_x, CO, & O_2	150
3-2-HC	5/3/93	1200/1230	Hydrocarbon	150
3-2-NH_3	5/3/93	1235/1305	Ammonia	150
3-3-CEM	5/3/93	1200/1231	NO_x, CO, & O_2	150
3-3-HC	5/3/93	1250/1320	Hydrocarbon	150
3-4-CEM	5/3/93	1450/1525	NO_x, CO & O_2	150
3-4-HC	5/3/93	1450/1515	Hydrocarbon	150
3-5-CEM	5/4/93	0910/0940	NO_x, CO & O_2	250
3-5-HC	5/4/93	0915/0935	Hydrocarbon	250
3-6-CEM	5/4/93	1102/1132	NO_x, CO & O_2	250
3-6-HC	5/4/93	1101/1120	Hydrocarbon	250
3-6-NH_3	5/4/93	1102/1132	Ammonia	250
3-7-CEM	5/4/93	1155/1225	NO_x, CO & O_2	250*
3-7-HC	5/4/93	1155/1215	Hydrocarbon	250*
3-7-NH_3	5/4/93	1155/1225	Ammonia	250*
3-8-CEM	5/4/93	1315/1341	NO_x, CO & O_2	250
3-8-HC	5/4/93	1315/1335	Hydrocarbon	250
3-8-NH_3	5/4/93	1315/1345	Ammonia	250
3-9-CEM	5/4/93	1505/1535	NO_x, CO & O_2	250
3-9-HC	5/4/93	1505/1525	Hydrocarbon	250
3-10-CEM	5/4/93	1605/1635	NO_x, CO, & O_2	250
3-10-HC	5/4/93	1605/1625	Hydrocarbon	250
3-11-CEM	5/5/93	1000/1030	NO_x, CO & O_2	310
3-11-HC	5/5/93	1000/1020	Hydrocarbon	310
3-11-NH_3	5/5/93	1000/1030	Ammonia	310
3-12-CEM	5/5/93	1045/1115	NO_x, CO & O_2	310
3-12-HC	5/5/93	1045/1105	Hydrocarbon	310
3-12-NH_3	5/5/93	1045/1115	Ammonia	310
3-13-CEM	5/5/93	1200/1230	NO_x, CO & O_2	310
3-13-HC	5/5/93	1200/1220	Hydrocarbon	310
3-14-CEM	5/5/93	1255/1225	NO_x, CO & O_2	310
3-14-HC	5/5/93	1238/1318	Hydrocarbon	310

* Test void, operations changed during test. Results are presented in the appendix.

TABLE 3-2
UNIT OPERATING CONDITIONS
EL SEGUNDO UNIT 3
MAY 1993

Test No.	Date	Net Load, MW	Urea Status	Total Urea Flow gpm
3-1	5/3/93	150	On	0.63
3-2	5/3/93	150	On	0.63
3-3	5/3/93	150	Off	0.0
3-4	5/3/93	150	Off	0.0
3-5	5/4/93	249	On	1.33
3-6	5/4/93	249	On	1.33
3-7	5/4/93	249	On	1.33
3-8	5/4/93	249	On	1.33
3-9	5/4/93	251	Off	0.0
3-10	5/4/93	250	Off	0.0
3-11	5/5/93	309	On	2.06
3-12	5/5/93	311	On	2.07
3-13	5/5/93	311	Off	0.0
3-14	5/5/93	310	Off	0.0

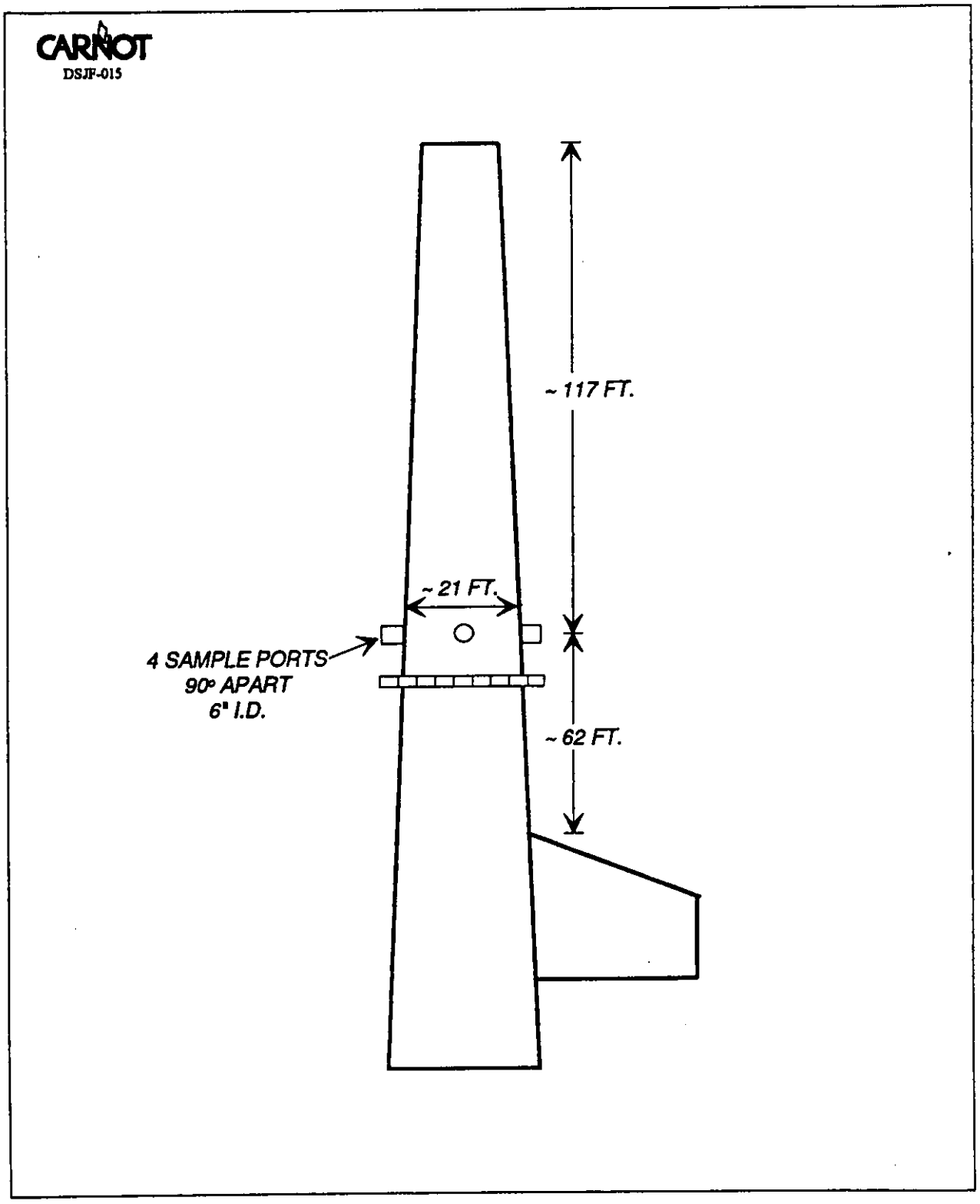


Figure 3-1. El Segundo Unit 3 Sample Location

TABLE 3-3
EMISSIONS TEST PROCEDURES - SCE/EL SEGUNDO UNIT 3
SEPTEMBER 1992

Parameter	Number of Replicates	Duration of Test (Minutes)	Measurement Principle	Reference Method	Method Detection Limit
NO_x	2	30	Chemiluminescent	SCAQMD 100.1	Below 2% of instrument full scale
CO	2	30	NDIR/Gas filter correlation	SCAQMD 100.1	Below 2% of instrument full scale
O_2	2	30	Electrochemical cell	SCAQMD 100.1 EPA 3E	Below 2% of instrument full scale
ROG as Hydrocarbons	2	20	Gas chromatography/FID	SCAQMD 25.2	0.1 ppm
Ammonia	2	30	Colorimetry spectrophotometry	SCAQMD Draft 207.1	0.1 ppm

3.3.2 Reactive Organic Gases (ROG) as Hydrocarbons

Hydrocarbon samples were collected in new tedlar bags and analyzed according to SCAQMD Method 25.2. The samples were analyzed within 72 hours of collection by Atmosphere Assessments in Chatsworth, California.

3.3.3 Ammonia

Ammonia samples were collected non-isokinetically, with NH_3 being absorbed in two impingers containing 0.1 N H_2SO_4. The ammonia samples were analyzed on-site by SCAQMD NH_3 Draft Method.

3.3.4 Moisture

Moisture was determined by SCAQMD Method 4 and in conjection with NH_3 sampling.

SECTION 4.0

RESULTS

Emissions test results are presented in Tables 4-1 through 4-6. Measurement procedures are detailed in Appendix A. Quality assurance and equipment calibrations are in Appendix B. All raw data sheets from Carnot's testing and from unit operation are included in Appendix C. Appendix D contains general and specific emissions calculations. Appendix E contains laboratory reports. Carnot's instrument strip charts are in Appendix F. Chain of Custody information is included in Appendix G.

TABLE 4-1
EMISSIONS TEST RESULTS AT 310 MW
UREA ON
EL SEGUNDO UNIT 3
MAY 5, 1993

Parameter	Test No. 3-11	Test No. 3-12	Test Average
Time	1000/1030	1045/1115	
NO_x, ppm	58.3	59.0	58.6
ppm @ 3% O_2	64.4	64.8	64.6
CO, ppm	20.0	24.0	22.0
ppm @ 3% O_2	22.1	26.3	24.2
O_2%	4.7	4.6	4.7
H_2O%	16.0	16.0	16.0
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	8.1	8.4	8.3
NH_3, ppm	4.3	3.6	4.0
NH_3 @ 3% O_2	4.8	4.0	4.4

Note: ND indicates that this species was not detected.

TABLE 4-2
EMISSIONS TEST RESULTS AT 310 MW
UREA OFF
EL SEGUNDO UNIT 3
MAY 5, 1993

Parameter	Test No. 3-13	Test No. 3-14	Test Average
Time			
NO_x, ppm	65.7	66.3	66.0
ppm @ 3% O_2	71.7	72.8	72.3
CO, ppm	36.8	31.2	34.0
ppm @ 3% O_2	40.2	34.3	37.3
O_2%	4.5	4.6	4.6
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	8.4	9.7	9.1

Note: ND indicates that this species was not detected.

TABLE 4-3
EMISSIONS TEST RESULTS AT 250 MW
UREA ON
EL SEGUNDO UNIT 3
MAY 4, 1993

Parameter	Test No. 3-6	Test No. 3-8	Test Average
Time	1110/1140	1315/1345	
NO_x, ppm	48.3	50.3	49.3
ppm @ 3% O_2	54.0	55.9	55.0
CO, ppm	1.2	1.8	1.5
ppm @ 3% O_2	1.3	2.0	1.7
O_2%[1]	4.7	4.8	4.8
H_2O%	16.0	16.0	16.0
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	9.0	7.2	8.1
NH_3, ppm	8.8	8.5	8.7
NH_3 @ 3% O_2[2]	9.7	9.5	9.6

Note: ND indicates that this species was not detected.

TABLE 4-4
EMISSIONS TEST RESULTS AT 250 MW
UREA OFF
EL SEGUNDO UNIT 3
MAY 4, 1993

Parameter	Test No. 3-9	Test No. 3-10	Test Average
Time	1505/1535		
NO_x, ppm	58.0	59.5	58.8
ppm @ 3% O_2	64.5	66.2	65.4
CO, ppm	1.6	2.7	2.2
ppm @ 3% O_2	1.8	3.0	2.4
O_2%	4.8	4.8	4.8
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	10.3	9.2	9.8

Note: ND indicates that this species was not detected.

TABLE 4-5
EMISSIONS TEST RESULTS AT 150 MW
UREA ON
EL SEGUNDO UNIT 3
MAY 3, 1993

Parameter	Test No. 3-1	Test No. 3-2	Test Average
Time	1115/1213	1235/1320	
NO_x, ppm	33.4	33.0	33.2
ppm @ 3% O_2	37.6	37.2	37.4
CO, ppm	49.6	26.2	37.9
ppm @ 3% O_2	55.8	29.5	42.7
O_2%	5.0	5.0	5.0
H_2O%	16.0	16.0	16.0
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	7.5	11.6	9.6
NH_3, ppm	1.6	1.8	1.7
NH_3 @ 3% O_2	1.8	2.0	1.9

Note: ND indicates that this species was not detected.

TABLE 4-6
EMISSIONS TEST RESULTS AT 150 MW
UREA OFF
EL SEGUNDO UNIT 3
MAY 3, 1993

Parameter	Test No. 3-3	Test No. 3-4	Test Average
Time	1350/1420	1450/1525	
NO_x, ppm	37.7	38.9	38.3
ppm @ 3% O_2	42.4	44.4	43.4
CO, ppm	53.6	23.5	38.6
ppm @ 3% O_2	60.3	26.8	43.6
O_2%	5.0	5.2	5.1
Methane, ppm	ND < 1.0	ND < 1.0	ND < 1.0
Total Non-Methane Hydrocarbons as methane, ppm	13.4	13.8	13.1

Note: ND indicates that this species was not detected.

APPENDIX A
MEASUREMENT PROCEDURES

Continuous Emissions Monitoring System

Oxygen (O_2) by Continuous Analyzer

NO/NO_x by Continuous Analyzer

Carbon Monoxide (CO) by NDIR/Gas Filter Correlation

Hydrocarbons by SCAQMD Micro TCA Method

Ammonia

Continuous Emissions Monitoring System

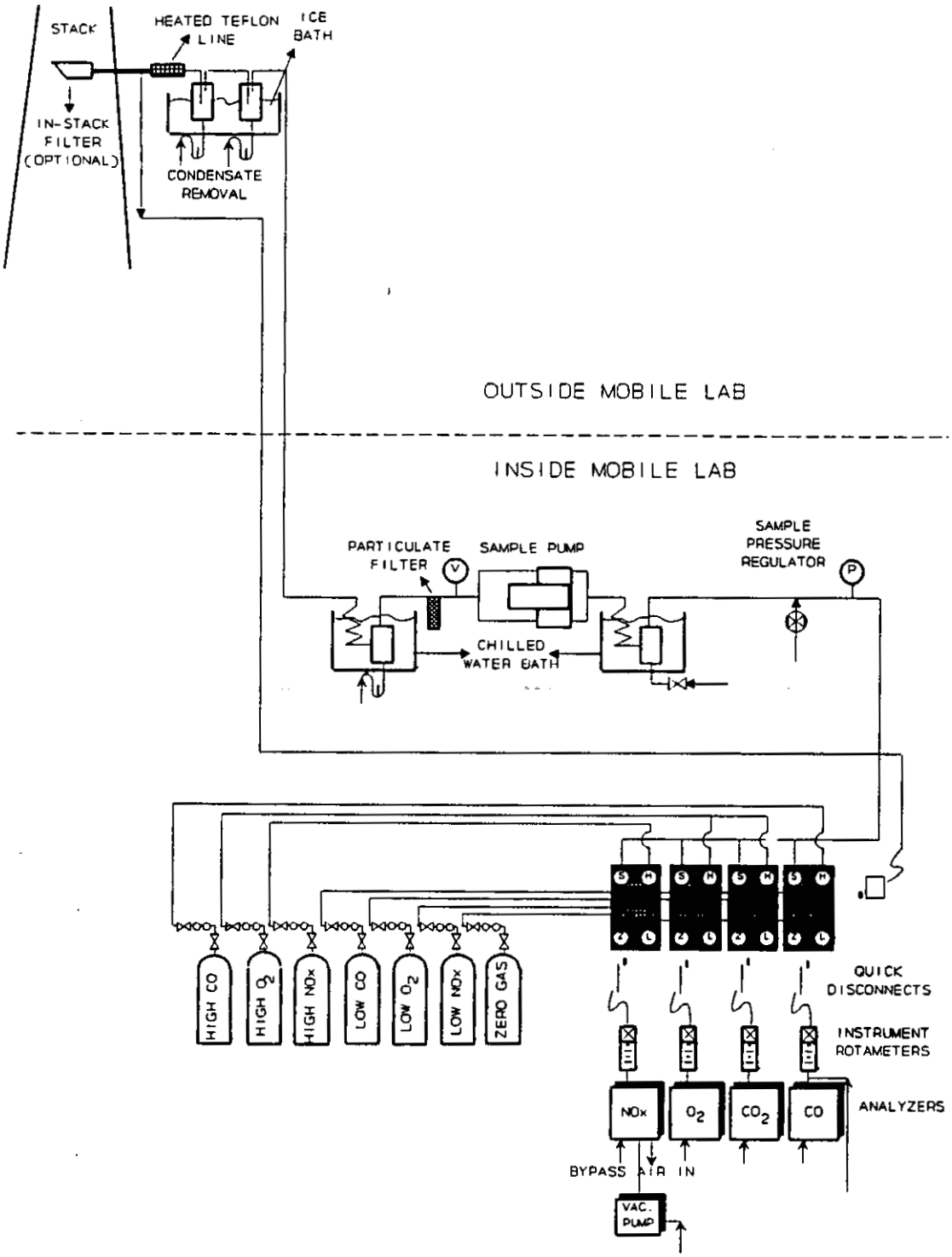
O_2, CO, and NO_x are measured using an extractive continuous emissions monitoring (CEM) package, shown in the following figure. This package is comprised of three basic subsystems. They are: (1) the sample acquisition and conditioning system, (2) the calibration gas system, and (3) the analyzers themselves. This section presents a description of the sampling and calibration systems. Descriptions of the analyzers used in this program and the corresponding reference test methods follow. Information regarding quality assurance information on the system, including calibration routines and system performance data follows.

The sample acquisition and conditioning system contains components to extract a representative sample from the stack or flue, transport the sample to the analyzers, and remove moisture and particulate material from the sample. In addition to performing the tasks above, the system must preserve the measured species and deliver the sample for analysis intact. The sample acquisition system extracts the sample through a stainless steel probe. The probe is insulated or heated as necessary to avoid condensation. If the particulate loading in the stack is high, a sintered stainless steel filter is used on the end of the probe.

Where water soluble NO_2 is to be measured, the sample is drawn from the probe through a heated teflon sample line into an on-stack cooled (approximately 35-40°F) water removal trap. The trap consists of stainless steel flasks in a bath of ice and water. This design removes the water vapor by condensation. The contact between the sample and liquid water is minimized and the soluble NO_2 is conserved. This system meets the requirements of EPA Method 20. The sample is then drawn through a teflon transport line, particulate filter, secondary water removal and into the sample pump. The pump is a dual head, diaphragm pump. All sample-wetted components of the pump are stainless steel or teflon. The pressurized sample leaving the pump flows through a third condensate trap in a refrigerated water bath (≈38°F) for final moisture removal. A drain line and valve are provided to constantly expel any condensed moisture from the dryer at this point. After the dryer, the sample is directed into a distribution manifold. Excess sample is vented through a back-pressure regulator, maintaining a constant pressure of 5-6 psig to the analyzer rotameters.

The calibration system is comprised of two parts: the analyzer calibration, and the system bias check (dynamic calibration). The analyzer calibration equipment includes pressurized cylinders of certified span gas. The gases used are, as a minimum, certified to 1% by the manufacturer. Where necessary to comply with reference method requirements EPA Protocol 1 gases are used. The cylinders are equipped with pressure regulators which supply the calibration gas to the analyzers at the same pressure and flow rate as the sample. The selection of zero, span, or sample gas directed to each analyzer is accomplished by operation of the sample/calibration selector fittings.

The system bias check is accomplished by transporting the same gases used to zero and span the analyzers to the sample system as close as practical to the probe inlet. This is done either by attaching the calibration gas supply line to the probe top with flexible tubing or by actuation of a solenoid valve located at the sample conditioner inlet (probe exit). The span gas is exposed to the same elements as the sample and the system response is documented. The analyzer indications for the system calibration check must agree within 5% of the analyzer calibration. Values are adjusted and changes/repairs are made to the system to compensate for any difference in analyzer readings. Specific information on the analytical equipment and test methods used is provided in the following pages.



Schematic of CEM System

Method:	**Oxygen (O_2) by Continuous Analyzer**
Applicable Reference Methods:	EPA 3A, EPA 20, ARB 100, BA ST-14, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of O_2 concentration.
Analyzer:	Teledyne Model 326A
Measurement Principle:	Electrochemical cell
Ranges:	0-5, 0-10, 0-25% O_2
Accuracy:	1% of full scale
Output:	0-100 mV, linear
Interferences:	Halogens and halogenated compounds will cause a positive interference. Acid gases will consume the fuel cell and cause a slow calibration drift.
Response Time:	90% <7 seconds
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If Method 20 is used, that method's specific procedures for selecting sample points are used. Otherwise, stratification checks are performed at the start of a test program to select single or multiple-point sample locations.
Analytical Procedure:	An electrochemical cell is used to measure O_2 concentration. Oxygen in the flue gas diffuses through a Teflon membrane and is reduced on the surface of the cathode. A corresponding oxidation occurs at the anode internally, and an electric current is produced that is proportional to the concentration of oxygen. This current is measured and conditioned by the instrument's electronic circuitry to give an output in percent O_2 by volume.
Special Calibration Procedure:	The measurement cells used with the O_2 instrument have to be replaced on a regular basis. After extended use, the cell tend to produce a nonlinear response. Therefore, a three-point calibration is performed at the start of each test day to check for linearity. If the response is not linear ($\pm$ 2% of scale), the cell is replaced.

Method:	**NO/NO_x by Continuous Analyzer**
Applicable Reference Methods:	EPA 7E, EPA 20; ARB 100, BA ST-13A, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of NO or NO_x.
Analyzer:	Teco Model No. 10AR
Measurement Principle:	Chemiluminescence
Accuracy:	1% of full scale
Ranges:	0-2.5, 0-10, 0-25, 0-100, 0-250, 0-1000, 0-2500, 0-10,000 ppm
Output:	0-10 mV
Inferences:	Compounds containing nitrogen (other than ammonia) may cause interference.
Response Time:	90%, 1.5 seconds (NO mode) and 1.7 seconds (NO_x mode)
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. If EPA Method 20 is used, that method's specific procedures for selecting sample points are used.
Analytical Procedure:	The oxides of nitrogen monitoring instrument is a chemiluminescent nitric oxide analyzer. The operational basis of the instrument is the chemiluminescent reaction of NO and ozone (O_3) to form NO_2 in an excited state. Light emission results when excited NO_2 molecules revert to their ground state. The resulting chemiluminescence is monitored through an optical filter by a high sensitivity photomultiplier tube, the output of which is electronically processed so it is linearly proportional to the NO concentration. The output of the instrument is in ppmV. When NO_2 is expected to be present in the flue gas, a supercooled water dropout flask will be placed in the sample line to avoid loss of NO_2. Since NO_2 is highly soluble in water, "freezing out" the water will allow the NO_2 to reach the analyzers for analysis. The analyzer measures NO only. In the NO_x mode, the gas is passed through a moly converter which converts NO_2 to NO and a total NO_x measurement is obtained. NO_2 is determined as the difference between NO and NO_x. Use of a moly converter instead of a stainless steel converter eliminates NH_3 interference; NH_3 is converted to NO with a stainless converter, but not with a moly converter.

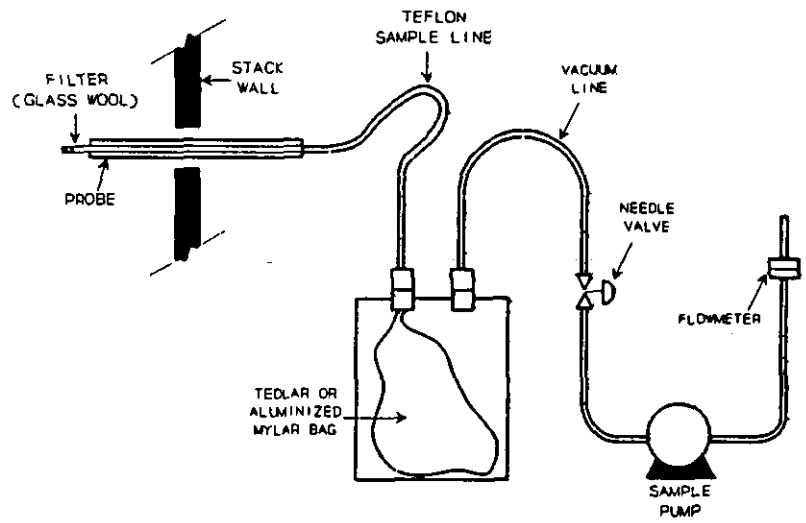
Method:	**Carbon Monoxide (CO) by NDIR/Gas Filter Correlation**
Applicable Reference Methods:	EPA 10; ARB 1-100; BA ST-6, SCAQMD 100.1
Principle:	A sample is continuously drawn from the flue gas stream, conditioned, and conveyed to the instrument for direct readout of CO concentration.
Analyzer:	TECO, Model 48
Measurement Principle:	NDIR/Gas Filter Correlation
Precision:	0.1% ppm
Ranges:	0-5, 0-10, 0-25, 0-50, 0-100, 0-250, 0-500, 0-1000, 0-5000 ppm
Output:	0-100 mV
Interferences:	Negligible interference from water and CO_2
Rise/Fall Times (0-95%)	1 minute @ 1 lpm flow, 30 second integration time
Sampling Procedure:	A representative flue gas sample is collected and conditioned using the CEM system described previously. Sample point selection has been described previously.
Analytical Procedure:	Radiation from an infrared source is chopped and then passed through a gas filter which alternates between CO and N_2 due to rotation of a filter wheel. The radiation then passes through a narrow band-pass filter and a multiple optical pass sample cell where absorption by the sample gas occurs. The IR radiation exits the sample cell and falls on a solid state IR detector.

Method: **Hydrocarbons by SCAQMD Micro Total Carbon Analysis (TCA/FID) Method**

Reference: SCAQMD Method 25.2 (draft Source Test Manual)

Principle: A Tedlar bag is filled with flue gas at a constant rate. The bag contents are analyzed by gas chromatography/flame ionization detection for CO, CO_2, methane and total gaseous non-methane hydrocarbons.

Sampling Procedure: Samples are collected using a lung-type sampling system shown in the attached figure. In this system, a bag is placed in a sealed container and the container is evacuated. Flue gas enters the bag as it expands to fill the container. Sampling rate is monitored by a rotameter on the container exhaust. This system allows sample collection without exposing the sample to pumps, flowmeters, oils, etc.



Sample Train for Determination of Hydrocarbons by SCAQMD Micro TCA Method

Analytical Procedure: In the analytical phase, gaseous carbon compounds from the tank are fractioned on a chromatographic column, eluting in the order: carbon monoxide, methane, carbon dioxide, non-methane hydrocarbons. All resulting vapors are passed through oxidizers where they are combusted to carbon dioxide, then converted to methane and measured by flame ionization detection. CO_2, CO, CH_4, and total gaseous non-methane hydrocarbons are reported separately.

This method provides lower detection limits than the standard TCA procedure, which uses GC/NDIR. Since this method does not use a steel condensate trap, it eliminates positive interferences that have been associated with carbon dioxide dissolved in water frozen in the condensate trap and released during analysis.

The TCA/FID method is appropriate for combustion sources and ambient sampling where low concentrations of hydrocarbons are expected.

Carnot subcontracts TCA analysis to qualified local laboratories experienced in the analytical procedures.

Method: Ammonia

Principle: Ammonia emissions are determined by collecting a dry, metered volume of flue gas containing ammonia vapor in dilute sulfuric acid solution. The ammonia concentration of the sample is then determined by ion selective electrode or colorimetric spectrophotometry.

Sampling Procedure: The ammonia sampling probe/train arrangement used during the test program is shown schematically in the following figure.

A sample is extracted through a glass probe fitted with a quartz wool plug or filter used to remove particulate matter. The plug is located and/or heated to avoid condensation of moisture at the plug. The sample is then passed through four impingers. The first two impingers are filled with 100 ml of 0.1 N sulfuric acid (H_2SO_4), the third is empty, and the fourth is filled with silica gel.

After each sample run, the quartz wool plug is removed and placed in a sample bottle. If a filter is used, it is generally saved but not analyzed. The impingers, glass probe, and sampling train glassware are washed with dilute H_2SO_4 into a separate sample bottle. The sample bottles containing the impinger wash solution and the quartz wool plug or filter are returned to the laboratory for analysis.

Analytical Procedure: Ammonia in source test samples is analyzed by ion selective electrode or colorimetrically. Source test samples are generally at low levels and titrations for ammonia are not applicable. The following sections discuss the two applicable analytical techniques.

Ion Selective Electrode

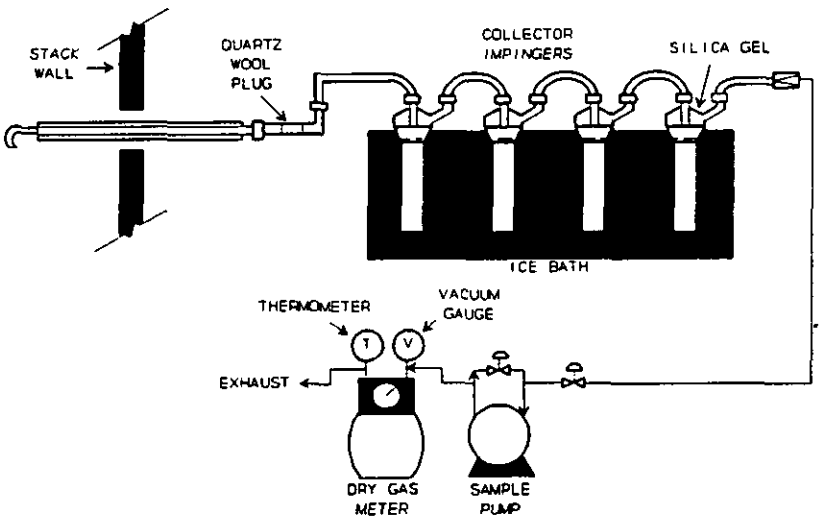
The ammonia samples are analyzed using an Orion Research Model 940 Microprocessor Ionanalyzer equipped with an ammonia ion selective electrode. The ammonia electrode is a glass electrode and reference electrode mounted behind a gas permeable membrane that separates the sample solution from the internal filling solution. After the addition of sodium hydroxide, ammonia in the sample diffuses across the electrode membrane. The measured pH change in the internal electrode solution is proportional to the concentration of ammonia in the sample solution.

The ammonia concentrations of the sample solutions are measured in units of ppm NH_3 by weight with the specific ion analyzer. By using the NH_3 concentration in ppm by weight, measuring the liquid volume of the sample solution, and obtaining the volume of the flue gas sample, the stack flue gas NH_3 concentration in ppm by volume is calculated using the equation:

$$NH_3 \text{ ppmV} = 0.049 \frac{(\text{ppm wt } NH_3 \text{ soln})(\text{liq. vol., ml})}{\text{DSCF (at 60°F) of sampled flue gas}}$$

Colorimetric Spectrophotometry:

In the analytical phase, the resulting ammonium sulfate is mixed with Nessler reagent, forming a yellow-brown compound with a maximum absorbance in the 440 nm range. The ammonia concentration in the sample is determined colorimetrically by comparison to a standard calibration curve. Care will be taken to dilute the sample to the optimum observed range. If turbidity exists upon addition of Nessler reagent, the option of distillation or ion selective electrode will be used. Distillation will remove any aromatic and aliphatic amines along with other organic and inorganic compounds which can cause interference with the analysis.



Ammonia sampling probe/train arrangement

APPENDIX B
QUALITY ASSURANCE

Appendix B.1

Quality Assurance Program Summary

QUALITY ASSURANCE PROGRAM SUMMARY AND ARB CERTIFICATION

Carnot ensures the quality and validity of its emission measurement and reporting procedures through a rigorous quality assurance (QA) program. The program is developed and administered by an internal QA Officer and encompasses seven major areas:

1. Development and use of an internal QA manual.
2. QA reviews of reports, laboratory work, and field testing.
3. Equipment calibration and maintenance.
4. Chain of custody.
5. Training.
6. Knowledge of current test methods.
7. Agency certification.

Each of these areas is discussed individually below.

Quality Assurance Manual. Carnot has prepared a QA Manual according to EPA guidelines. The manual serves to document and formalize all of Carnot's QA efforts. The manual is constantly updated, and each member of the Source Test Division is required to read and understand its contents. The manual includes details on the other six QA areas discussed below.

QA Reviews. Carnot's review procedure includes review of each source test report by the QA Officer, and spot check reviews of laboratory and field work.

The most important review is the one that takes place before a test program begins. The QA Officer works closely with Source Test Division personnel to prepare and review test protocols. Test protocol review includes selection of appropriate test procedures, evaluation of any interferences or other restrictions that might preclude use of standard test procedures, and evaluation and/or development of alternate procedures.

Equipment Calibration and Maintenance. The equipment used to conduct the emissions measurements is maintained according to the manufacturer's instructions to ensure proper operation. In addition to the maintenance program, calibrations are carried out on each measurement device according to the schedule outlined by the California Air Resources Board (CARB). The schedule for maintenance and calibrations are given in Tables B-1 and B-2. Quality control checks are also conducted in the field for each test program. The following is a partial list of checks made as part of each CEM system test series.

- Sample acquisition and conditioning system leak check.
- 2-point analyzer calibrations (all analyzers)
- 3-point analyzer calibrations (analyzers with potential for linearity errors).
- Complete system calibration check ("dynamic calibration" through entire sample system).

- Periodic analyzer calibration checks (once per hour) are conducted at the start and end of each test run. Any change between pre- and post-test readings are recorded.

- All calibrations are conducted using gases certified by the manufacturer to be + 1% of label value (NBS traceable).

Calibration and CEM performance data are fully documented, and are included in each source test report.

Chain of Custody. Carnot maintains full chain of custody documentation on all samples and data sheets. In addition to normal documentation of changes between field sample custodians, laboratory personnel, and field test personnel, Carnot documents every individual who handles any test component in the field (e.g., probe wash, impinger loading and recovery, filter loading and recovery, etc.).

Samples are stored in a locked area to which only Source Test Division personnel have access. Neither other Carnot employees nor cleaning crews have keys to this area.

Data sheets are copied immediately upon return from the field, and this first generation copy is placed in locked storage. Any notes made on original sheets are initialed and dated.

Training. Personnel training is essential to ensure quality testing. Carnot has formal and informal training programs which include:

1. Attendance at EPA-sponsored training courses.
2. Enrollment in EPA correspondence courses.
3. A requirement for all technicians to read and understand Carnot's QA Manual.
4. In-house training and QA meetings on a regular basis.
5. Maintenance of training records.

Knowledge of Current Test Methods. With the constant updating of standard test methods and the wide variety of emerging test methods, it is essential that any qualified source tester keep abreast of new developments. Carnot subscribes to services which provide updates on EPA and CARB reference methods, and on EPA, CARB and SCAQMD rules and regulations. Additionally, source test personnel regularly attend and present papers at testing and emission-related seminars and conferences. Carnot personnel maintain membership in the Air Pollution Control Association, the Source Evaluation Society, and the ASME Environmental Control Division.

AGENCY CERTIFICATION

Carnot is certified by the CARB as an independent source test contractor for gaseous and particulate measurements. Carnot also participates in EPA QA audit programs for Methods 5, 6 and 7.

TABLE B-1
SAMPLING INSTRUMENTS AND EQUIPMENT CALIBRATION SCHEDULE
As Specified by the CARB

Instrument Type	Frequency of Calibration	Standard of Comparison or Method of Calibration	Acceptance Limits
Orifice Meter (large)	12 months	Calibrated dry test meter	± 2% of volume measured
Dry Gas Meter	12 months or when repaired	Calibrated dry test meter	± 2% of volume measured
S-Type Pitot (for use with EPA-type sampling train	6 months	EPA Method 2	Cp constant (+5%) over working range; difference between average Cp for each leg must be less than 2%
Vacuum Gauges Pressure Gauges	6 months	Manometer	± 3%
Field Barometer	6 months	Mercury barometer	± 0.2" Hg
Temperature Measurement	6 months	NBS mercury thermometer or NBS calibrated platinum RTD	± 4°F for <400°F ± 1.5% for >400°F
Temperature Readout Devices	6 months	Precision potentiometer	± 2% full scale reading
Analytical Balance	12 months (check prior to each use)	Should be performed by manufacturer or qualified laboratory	± 0.3 mg of stated weight
Probe Nozzles	12 Months	Nozzle diameter check micrometer	Range < ± 0.10 mm for three measurements
Continuous Analyzers	Depends upon use, frequency and performance	As specified by manufacturers operating manuals, EPA NBS gases and/or reference methods	Satisfy all limits specified in operating specifications

TABLE B-2
EQUIPMENT MAINTENANCE SCHEDULE
Based on Manufacturer's Specifications and Carnot Experience

Equipment	Performance Requirement	Maintenance Interval	Corrective Action
Pumps	1. Absence of leaks 2. Ability to draw manufacturer required vacuum and flow	Every 500 hours of operation or 6 months, whichever is less	1. Visual inspection 2. Clean 3. Replace worn parts 4. Leak check
Flow Measuring Device	1. Free mechanical movement 2. Absence of malfunction	Every 500 hours of operation or 6 months, whichever is less After each test, if used in H_2S sampling or other corrosive atmospheres	1. Visual inspection 2. Clean 3. Calibrate
Sampling Instruments	1. Absence of malfunction 2. Proper response to zero, span gas	As required by the manufacturer	As recommended by manufacturer
Integrated Sampling Tanks	Absence of leaks	Depends on nature of use	1. Steam clean 2. Leak check
Mobile Van Sampling Systems	Absence of leaks	Depends on nature of use	1. Change filters 2. Change gas dryer 3. Leak check 4. Check for system contamination
Sampling Lines	Sample degradation less than 2%	After each test or test series	Blow filtered air through line until dry

Appendix B.2

ARB Certification

State of California
AIR RESOURCES BOARD

Executive Order G-836

Approval to Carnot
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 Carnot meets the requirements of the Board for conducting Board Test Methods 1, 2, 3, 4, 5, 6, 8, 10, and 100 (NOx, O2) when the following conditions are met:

1. Carnot conducts Board Test Method 100 for O2 using a Teledyne 326 analyzer with either a A5 or a B1 sensor, or a paramagnetic analyzer.

NOW, THEREFORE, BE IT ORDERED that Carnot is granted an approval, from the date of execution of this order, until June 30, 1994 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 14th day of July 1993, at Sacramento, California.

James J. Morgester, Chief
Compliance Division

State of California

Air Resources Board

Approved Independent Contractor

Carnot

This is to certify that the company listed above has been approved by the Air Resources Board to conduct compliance testing pursuant to Section 91207, Title 17, California Code of Regulations, until June 30, 1994, for those test methods listed below:

ARB Source Test Methods:
1, 2, 3, 4, 5, 6, 8, 10, 100(NOx, O2)

James J. Morgester, Chief
Compliance Division

Laura McKinney, Manager
Investigation and Certification Section

Appendix B.3

Equipment Calibration

CARNOT
SPAN GAS RECORD

CLIENT/LOCATION: SCC / El Segundo DATE: 5/3/93

BY: SM

GAS	SPAN CYLINDER		AUX. SPAN CYLINDER	
	CYLINDER NO.	CONCENTRATION	CYLINDER NO.	CONCENTRATION
ZERO	AAL 13670			
NOx	ALM007741	51.96 ppm	ALM 075818	91.47 ppm
O_2	ALM 011540	5.00%	ALM017630	8.0%
CO	ALM 027365	274.7 ppm 580	AAL12633	421.7 ppm 84.3
CO_2	ALM011540	15.00% 60	ALM017630	22.0% 88
SO_2	—	—	—	—

CO AAL 21277 53.68 ALM 010534 85.12

CARNOT
INSTRUMENT LINEARITY

	ANALYZER					CO
	O_2	CO_2	CO	NOx	SO_2	
ANALYZER RANGE	10	25	500	100	—	100
SET TO HIGH STD (80-90% OF RANGE)	8.0	~~8~~ 22	421.7	91.47	—	85.2
ACTUAL VALUE OF LOW STD	5.08	15.3	273.5	51.0	—	53.68
AS-FOUND LOW STD (50-60% OF RANGE)	5.0	15.00	274.9	51.96	—	52.7
DIFFERENCE IN % OF FULL SCALE	0.8	1.2	-0.28	-0.96	—	

% ERROR CALCULATION:

$$\frac{(\text{AS FOUND} - \text{ACTUAL VALUE OF SPAN})}{\text{RANGE}} \times 100$$

ALLOWABLE DEVIATION IS 2% OF FULL SCALE (2 SQUARES ON STRIP CHART).

CARNOT

PMF-009

CARNOT
CEM PERFORMANCE DATA

CLIENT/LOCATION: SCE / El Segundo DATE: 5/3/93

BY: SM

SYSTEM CONFIGURATION				
ANALYZERS IN SERVICE				
ANALYZERS:	O_2	CO_2	CO	NOx
MODEL:	Tele Dyne	Horiba Pir 2000	Thermo Environmental	Teco
SERIAL NO.:		107017	48-36003-284	105-36972264

PROBE		SAMPLE CONDITIONER	
LENGTH:	10'	CONDENSER-VACUUM SIDE (CHECK FLOW):	
LINER MATERIAL:	SS	CONDENSER-PRESSURE SIDE (CHECK FLOW):	
HEATED PROBE (Y/N):	NO	CONDENSER TEMPERATURE:	
HEATED LINE (Y/N):	Yes	FILTER CONDITION (COND. OR DATE LAST CHANGED):	
SAMPLE LINE		**SYSTEM LEAK CHECK**	
LENGTH:	100'	PRE-TEST (cfh):	0.0
LINER MATERIAL:	Teflon	POST-TEST (cfh):	0.0
SYSTEM BIAS LINE:	Poly	LEAK RATE (%) = POST-TEST (cfh) / SYSTEM FLOW RATE (cfm) x 60 x 100 = ____%	
ON-STACK CONDITIONER		**NOx CONVERSION EFFICIENCY**	
IN SERVICE (Y/N):	Y	HIGH CAL NOx	51.47
KNOCK-OUT CONDITION (CHECK FLOW):		HIGH CAL NO (AS FOUND)	91.31
COOLANT:	Ice	LOW CAL NOx	51.51
		LOW CAL NO (AS FOUND)	45.01

OPERATING CONDITIONS			
SAMPLE PRESSURE:	5.0	SYSTEM RESPONSE TIME CHECK	
SAMPLE VACUUM:	4	UPSCALE:	10 sec.
NOx VACUUM:	29.	DOWNSCALE:	10 sec.

CARNOT

PMF-011

Scott Specialty Gases, Inc.

PHO[redacted]714-887-0549
[redacted]714-887-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 10/1/92
Our Project No: 21899
Your P.O. No: 7477C #8
Page 1 of 1
Expiration Date: 3/94

CARNOT
ATTN: RICK MADRIGAL
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1

Cylinder No. ALM025818 Cylinder Pressure 2000 PSIG Certified Accuracy ±1% % NIST Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	REFERENCE STD CYL. NO.	REFERENCE STD CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	GAS ANALYZER LAST CAL. DATE	GAS ANALYZER ANALYTICAL PRINCIPLE
NITRIC OXIDE	87.98 PPM	GMIS TRACEABLE TO CRM1684B	ALM003664	95.55 PPM	THERMO-ELECTRON 10AR 14853-150	07/23/92	CHEMI-LUMINESCENT
NOX	91.47 PPM						

BALANCE GAS NITROGEN

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component NITRIC OXIDE
First Analysis Date 05/11/92 Units mv

Z 0.00	R 95.59	T 87.58
R 95.51	Z 0.05	T 87.68
Z 0.00	T 87.72	R 95.55

Mean Test Assay 87.66 PPM

Second Analysis Date 09/25/92 Units mv

Z 0.00	R 95.65	T 88.51
R 95.80	Z 0.07	T 88.43
Z 0.00	T 88.50	R 95.81

Mean Test Assay 88.30 PPM

Component _____ Units mv
Date _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Component _____ Units mv
Date _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Chronology: Date _____
Assay _____

Analyst G. KING

Approved By: A.F. LANGE, Ph.D., MANAGER, QA

Scott Specialty Gases, Inc.

2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411 (909) 887-2571 FAX: (909) 887-0549

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer: Carnot
15991 Red Hill Ave.
Suite 110
Tustin, CA 92680-0740

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order 8957
Scott Project # 24740.001

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number ALM 007741 **Certification Date** 03-22-93 **Expiration Date** 09-22-94
Cylinder Pressure 1900psig **Previous Certification Dates** NONE

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	50.80 ppm	± 1 % NIST Traceable

Balance Gas: Nitrogen

NOX 51.96 ppm

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
CRM1683	01-94	ALM10462	47.53ppm Nitric Oxide

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
TECO / 10AR / 14853-150	01-20-93	Chemi-Luminescent

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Nitric Oxide

First Triad Analysis

Date: 3/15/93 Response Units: mv
Z1= 0.00 R1= 47.58 T1= 50.92
R2= 47.76 Z2= 0.04 T2= 50.93
Z3= 0.06 T3= 50.97 R3= 47.71
Avg. Conc. of Cust Cyl. 50.78 ppm

Date: Response Units: mv
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Second Triad Analysis

Date: 03-22-93 Response Units: mv
Z1= 0.00 R1= 47.53 T1= 50.85
R2= 47.55 Z2= 0.00 T2= 50.81
Z3= 0.00 T3= 50.83 R3= 47.53
Avg. Conc. of Cust Cyl. 50.82ppm

Date: Response Units: mv
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Calibration Curve

Concentration= Ax^2+Bx+C
A =-0.00022788
B =1.011308772
C =0.213935299

Concentration=

Concentration=

Special Notes

Analyst George King

Scott Specialty Gases, Inc.

FAX [redacted]87-0549
PHONE: [redacted]87-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 12/05/93
Our Project No: 16846
Your P.O. No: 7799
Page 1 of 1
Expiration Date: 05/93

CARNOT JIM MULLIGAN
15991 RED HILL AVE
SUITE 110
TSTIN CA 92680

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

tified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL12633 Cylinder Pressure 1950 PSI Certified Accuracy ±1% % NIST Traceable

REFERENCE STD					GAS ANALYZER		
COMPONENTS	CERTIFIED CONC	SRM/CRM NO.	CYL. NO.	CONC.	MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
ARBON MONOXIDE	421.7 PPM	CRM1680	ALM013394	475.0 PPM	HORIBA AIA-24 4564403	10/23/91	INFRA-RED

ALANCE GAS NITROGEN

ALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

nponent CARBON MONOXIDE
st Analysis Date 11/19/91 Units mv

00.00	R	91.6	T	83.3	
91.6	Z	00.04	T	83.2	
00.05	T	83.2	R	91.6	

Mean Test Assay 421.8 PPM

cond Analysis Date 11/27/91 Units mv

00.00	R	91.6	T	83.2	
91.6	Z	00.00	T	83.2	
00.00	T	83.2	R	91.6	

Mean Test Assay 421.6 PPM

Component
Date Units mv

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay

Date Units mv

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay

Component
Date Units mv

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay

Date Units mv

Z		R		T	
R		Z		T	
Z		T		R	

Mean Test Assay

hronology: Date
Assay

Analyst M. JOHNSON

Approved By: A.F. LANGE, Ph.D., MANAGER, QA

Scott Specialty Gases, Inc.

FAX 714-887-0549
PHONE: 714-887-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 10/15/92
Our Project No: 21912
Your P.O. No: 8957
Page 1 of 1
Expiration Date: 4/94

CARNOT
ATTN: RICK MADRIGAL
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM027365 Cylinder Pressure 1950 PSIG Certified Accuracy ±1% % NIST Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	CYL. NO.	CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	274.9 PPM	CRM1680	ALM013394	475.0 PPM	HORIBA AIA-24 4564403	6/30/92	INFRA-RED

BALANCE GAS NITROGEN

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component CARBON MONOXIDE
First Analysis Date 10/7/92 Units mv

Z 00.00	R 93.0	T 59.0
R 93.0	Z 00.05	T 59.0
Z 00.05	T 59.0	R 93.0

Mean Test Assay 274.9 PPM

Second Analysis Date 10/14/92 Units mv

Z 00.00	R 93.0	T 59.0
R 93.0	Z 00.00	T 59.0
Z 00.02	T 59.0	R 93.0

Mean Test Assay 274.9 PPM

Component ____ Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Component ____ Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Date ____ Units mv
Z ____ R ____ T ____
R ____ Z ____ T ____
Z ____ T ____ R ____
Mean Test Assay ____

Chronology: Date ____
Assay ____

Analyst M. JOHNSON

Approved By: [signature]
A.F. LANGE, Ph.D., M[illegible]CEP, QA

Scott Specialty Gases, Inc.

2600 CAJON BOULEVARD, SAN BERNARDINO, CA 92411 (909) 887-2571 FAX: (909) 887-0549

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
CARNOT
15991 RED HILL AVE
SUITE 110
TUSTIN, CA 92680
ATTN: RICK MADRIGAL

Assay Laboratory
Scott Specialty Gases
2600 Cajon Boulevard
San Bernardino, CA 92411

Purchase Order 9764 REL#5
Project # 25145.001

ANALYTICAL INFORMATION

Certified to exceed the minimum specifications of EPA Protocol 1 Procedure #G1, Section Number 3.0.4

Cylinder Number ALM012534 **Certification Date** 04-02-93 **Expiration Date** * 10-02-94
Cylinder Pressure 2000 psig **Previous Certification Dates** NONE | ** 04-02-96

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
CARBON MONOXIDE	85.12 ppm	± 1 % NIST Traceable

Balance Gas: Nitrogen

*Analytical uncertainty is inclusive of usual known error sources which at least includes reference standard error & precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
CRM1679	10-94	ALM10524	96.67 ppm

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
Horiba / OPE-135D / 56565502	02-10-92	NDIR

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Carbon Monoxide

First Triad Analysis

Date: 03-26-92 Response Units: mv
Z1= 00.00 R1= 40.20 T1= 35.50
R2= 40.20 Z2= 00.01 T2= 35.50
Z3= 00.01 T3= 35.50 R3= 40.20
Avg. Conc. of Cust Cyl. 84.99 ppm

Second Triad Analysis

Date: 04-02-92 Response Units: mv
Z1= 00.00 R1= 40.20 T1= 35.60
R2= 40.20 Z2= 00.09 T2= 35.60
Z3= 00.07 T3= 35.60 R3= 40.20
Avg. Conc. of Cust Cyl. 85.24 ppm

Calibration Curve

Concentration= Ax^2+Bx+C
A =0.00005011
B =0.50595305
C =-0.0100275

Date: Response Units: mv
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Date: Response Units: mv
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Concentration=

Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Date: Response Units:
Z1= R1= T1=
R2= Z2= T2=
Z3= T3= R3=
Avg. Conc. of Cust Cyl.

Concentration=

Special Notes : * Acid Rain Certification Period
** Non-Acid Rain Certification Period

Analyst Maynard Johnson

Scott Specialty Gases, Inc.

FAX: 714-887-0549
PHONE: 714-887-2571

2600 CAJON BLVD., SAN BERNARDINO, CA 92405

CARNOT
15991 RED HILL AVE SUITE 110
IUSTIN, CA 92680
JIM MULLIGAN

Shipped From: Scott SAN BERNARDINO,
Date Shipped 11/12/90
Our Project No: 10003
Your PO. No: 6693
Page 1 of 1
Expiration Date: 5/92

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. AAL-21127 Cylinder Pressure 1900 psig Certified Accuracy ±1% NIST Traceable

REFERENCE STD

COMPONENTS	CERTIFIED CONC	STANDARD NO.	CYL. NO.	CONC.
CARBON MONOXIDE	55.84 ppm	GMIS TRACEABLE TO CRM2636	ALM-12287	260.7 ppm

GAS ANALYZER

MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
HORIBA AIA 24 4564403	8/3/90	INFRA RED

BALANCE GAS NITROGEN

ANALYZER READINGS: Z = Zero Gas T = Test Gas R = Reference Gas

Component CARBON MONOXIDE
First Analysis Date 10/25/90 Units mv

Z 00.0	R 95.0	T 22.7
R 95.0	Z 00.0	T 22.7
Z 00.0	T 22.7	R 95.0

Mean Test Assay 55.84 ppm

Second Analysis Date 10/30/90 Units mv

Z 00.0	R 95.0	T 22.7
R 95.0	Z	T 22.7
Z 00.0	T 22.7	R 95.0

Mean Test Assay 55.84 ppm

Component _____ Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Component _____ Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Date _____ Units _____

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay _____

Chronology: Date _____
Assay _____

Analyst M. JOHNSON

Approved By: [signature]

Scott Specialty Gases, Inc.

hipped
ro
2600 CAJON BLVD.
SAN BERNARDINO CA 92411
Phone: 714-887-2571 Fax: 714-887-0549

CERTIFICATE OF ANALYSIS

ARNOT
ITTN: JOHN FURLONG
5991 RED HILL AVE
SUITE 110
USTIN CA 92680

PROJECT #: 02-20291
PO#: 8536
ITEM #: 0202C3033011AL
DATE: 6/22/92

CYLINDER #: ALM017630
FILL PRESSURE: 1750 PSIG

ANALYTICAL ACCURACY: +/-1%

COMPONENT	REQUESTED GAS CONC	MOLES	ANALYSIS (MOLES)	
CARBON DIOXIDE	22.	PCT	22.00	PCT
OXYGEN	8.	PCT	8.000	PCT
NITROGEN		BAL		BAL

CARNOT 7/1 BIN #10
CERTIFIED TO HAVE BEEN BLENDED
AND VERIFIED TO BE CORRECT BY
ANALYSIS.

GRAVIMETRIC MASTER GAS-
AGAINST NIST CERTIFIED WEIGHTS
INDEPENDENT LABORATORY

ANALYST: LEE OLDHAM

APPROVED BY: DR ARMAND LANGE PHD

CARNOT
DEC 4 1992
RECEIVED

Scott Specialty Gases, Inc.

From: 2600 CAJON BLVD.
SAN BERNARDINO CA 92411
Phone: 714-887-2571 Fax: 714-887-0549

CERTIFICATE OF ANALYSIS

CARNOT
ATTN: RICK MADRIGAL
15991 RED HILL AVE
SUITE 110
TUSTIN CA 92680

PROJECT #: 02-22560
PO#: ITEM #1
ITEM #: 0202C3000701AL
DATE:11/20/92

CYLINDER #: ALM011540
FILL PRESSURE: 1910 PSIG

ANALYTICAL ACCURACY: +/-1%

COMPONENT	REQUESTED GAS CONC	MOLES	ANALYSIS (MOLES)	
CARBON DIOXIDE	15.	PCT	15.00	PCT
OXYGEN	5.	PCT	5.004	PCT
NITROGEN		BAL		BAL

CARNOT 11/23 BIN#3

ANALYST: MJ
MAYNARD JOHNSON

APPROVED BY: A. Lange
DR. ARMAND LANGE, PH.D

POST TEST DRY GAS METER CALIBRATION CHECK

CALIBRATED BY WM
DATE 3/19/93
FIELD GAS METER I.D. ES-30
INITIAL Yd 1.003
INITIAL H@ 1.970

DATA ENTRY BY JP
BAROMETRIC PRESSURE 30.1
TEST METETER ES-13
TEST METER Y (Yt) 1.0006
TEST METER LAST CAL. 12/08/92

FIELD METER				TEST METER				RESULTS	
VOLUME cu.ft.	TEMP. IN	TEMP. OUT	DELTA "H2O	TIME min.	VOLUME cu.ft.	TEMP. Avg.	DELTA "H2O	Q cfm	Y
4.643	72.0	65.0	0.84	10.5	4.732	64.0	0.2	0.442	1.026
4.690	74.0	66.0	0.84	10.5	4.752	64.0	0.2	0.447	1.023
4.686	75.0	67.0	0.84	10.5	4.751	64.0	0.2	0.446	1.026
						AVERAGES		0.445	1.025

PASS - INDIVIDUAL Yd VALUES ACCEPTABLE
PASS - INDIVIDUAL DELTA H@ VALUES ACCEPTABLE
PASS - POST TEST Yd WITHIN LIMITS

POST-TEST DRY GAS
METER CALIBRATION DATA

CALIBRATED BY JP

DATE 3/19/93

FIELD METER ID ES-10

BAROMETRIC PRESS 30.10

TEST METER ID ES-13

TEST METER Y (Y_t) 1.0006

TEST METER LAST CAL 12/8/92

TEST PROGRAM PRECEDING CALIBRATION CHECK

AVERAGE ΔH FROM TEST RUNS .1838

MAXIMUM VACUUM FROM TEST RUNS 11

LEAK CHECK VAC 15" INIT. JP

FIELD METER								TEST METER					
				TEMPERATURE							TEMPERATURE		
ΔH	FINAL VOLUME	INITIAL VOLUME	VOLUME (V_m)	INLET (t_i)	OUTLET (t_o)	VACUUM	TIME (θ)	FINAL VOLUME	INITIAL VOLUME	VOLUME (V_m)	INLET	OUTLET	METER PRESS.
.1838	132.197	127.554	4.643	72	65	11	10.5	4.732	0.0	4.732	68	60	.2
.1838	136.867	132.197	4.69	74	66	11	10.5	4.752	0.0	4.752	68	60	.2
.1838	147.255	142.569 ~~136.867~~	4.686	75	67	11	10	4.751	0.0	4.751	68	60	.2

JP

PMF-055

CARNOT

APPENDIX C
DATA SHEETS

Appendix C.1

Sample Locations

CARNOT
SAMPLING POINT LOCATION DATA - EPA METHOD 1

PLANT: SCE - EL SEGUNDO #3 DATA BY: MM

DATE: 12-4-92

TEST LOCATION: STACK

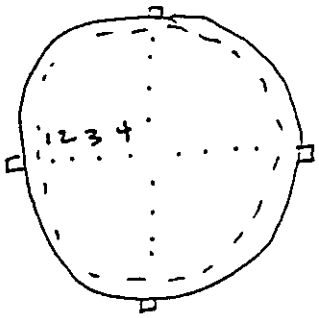


Diagram of Sampling Location

UPSTREAM DIST./DIA.: 62'2" (2.9 diam)

DOWNSTREAM DIST./DIA.: 117'10" (5.6 diam)

COUPLING LENGTH: 15"

NO. OF SAMPLING PTS.: 16

STACK DIMENSION: 21' 0.94" / 252.94"

STACK AREA, FT²: 348.66 ft²

SAMPLE POINT	% OF DIAMETER	IN. FROM NEAR WALL	IN. FROM NOZZLE*
1	3.2	8.1	23.1
2	10.5	26.5	31.5
3	19.4	49.1	64.1
4	32.3	81.7	96.7

**INCHES FROM WALL PLUS COUPLING LENGTH*

Appendix C.2

Unit Data

CARNOT

UNIT DATA

Client: SCE Location: EL SEGUNDO

Unit: 3 Data by: M. ESCAREGA

TEST #	3-1	3-2	3-3	3-4
DATE	5/3/93	5/3/93	5/3/93	5/3/93
TIME	1115	1240	1355	1455
LOAD MW NET	150	150	149	149
AUX. LOAD	5.4	7.8	7.0	6.5
UREA ON/OFF	ON	ON	OFF	OFF
UREA LOOP /MODE	3/4	3/4	—	—
UREA FLOW GPM	0.63	0.63	—	—
H_2O FLOW GPM /PSIG.	6.2/65	6.3/65	—	—
O_2% NORTH	2.0	2.1	1.9	2.0
O_2% SOUTH	1.8	1.9	1.7	1.8
STM. PRES PSI	2399	2400	2395	2401
STM FLOW KLB/HR	1079	1069	1067	1076
FDWTR FLOW KLB/HR	1120	1138	1137	1138
FUEL FLOW 10^6 SCF	1507	1490	1496	1493
FUEL FLOW %	42.1	43.5	43.2	43.5
AIR FLOW % N/S	43/44	45/43	43/44	43/42
SH STM TEMP °F	1045	1046	1049	1045
RH STM TEMP °F	998	1000	1001	998
FD FAN % NORTH	—	—	—	—
FD FAN % SOUTH	—	—	—	—
FD FAN AMPS NORTH	135	134	132	131
FD FAN AMPS SOUTH	124	125	124	123

CARNOT

	3-1	3-2	3-3	3-4
O_2/CO BIAS SET POINT	0.0	0.0	0.0	0.1
BLR MASTER	42.5	42.6	43.6	43.0
FGR AMPS NORTH	57	57	57	57
FGR AMPS SOUTH	56	56	57	56
FGR OUTLET DAMPER NORTH	—	—	—	—
FGR OUTLET DAMPER SOUTH	—	—	—	—
FGR INLET DAMPER NORTH	35.7	35.1	34.6	35.0
FGR INLET DAMPER SOUTH	35.7	35.1	34.6	35.0
BNR TILTS NORTH (0/0)	87.7	82.5	87.2	85.0
BNR TILTS SOUTH (0/0)	79.1	75.6	80.7	75.7
WP/FURN dP	4.3	4.3	4.2	4.3
BOOS	10 N	10 N	10 N	10 N
APH OUT °F NORTH	154	155	152	153
APH OUT °F SOUTH	005	005	005	005

NOTES:

CARNOT

UNIT DATA

Client: SCE

Location: El Segundo

Unit: 3

Data by: B. Noreen/[illegible]

TEST #	3-5/6	3-7	3-8	3-9
DATE	5-4-93	5-4-93	5-4-93	5-4-93
TIME	1000	1155	1315	1505
LOAD MW Net	249	249	249	251
AUX. LOAD	7.2	7.1	7.3	7.1
UREA ON/OFF	ON	ON	ON	Off
UREA LOOP/MODE	1/2	1/2	1/2	N/A
UREA FLOW GPM	1.33	1.33	1.33	N/A
H_2O FLOW GPM/PSIG	2.36/55	2.50/55	2.50/55	N/A
O_2% NORTH	2.2	1.5	1.9	1.8
O_2% SOUTH	2.2	1.9	2.4	2.4
STM. PRES PSI	2400	2404	2400	2398
STM FLOW KLB/HR	1766.2	1749.2	1767.7	1771.4
FDWTR FLOW KLB/HR	1796.4	1807.7	1822.3	1821.2
FUEL FLOW 10^6 SCF N/S	1145/1147	2282	2316	2417.9
FUEL FLOW %	65.35	66.19	64.55	67.7
AIR FLOW % N/S	71/71	69.04	70.77	73.4
SH STM TEMP °F	1053	1048	1047	1049
RH STM TEMP °F	1002	998	1000	1000
FD FAN % NORTH	71 —	—	—	—
FD FAN % SOUTH	71 —	—	—	—
FD FAN AMPS NORTH	188	184	181	189
FD FAN AMPS SOUTH	170	170	171	174

CARNOT

TEST No.	3-5/6	3-7	3-8	3-9
O_2/CO BIAS SET POINT	0.0	-1	0.0	-0.07
BLR MASTER	63.0	63.28	64.90	65.60
FGR AMPS NORTH	58	58	58	58
FGR AMPS SOUTH	57	57	57	57
FGR OUTLET DAMPER NORTH	—	—	—	—
FGR OUTLET DAMPER SOUTH	—	—	—	—
IT FGR INLET DAMPER NORTH	35.8	36.2	36.5	36.9
IT FGR INLET DAMPER SOUTH	35.8	36.2	36.5	37.5
IT BNR TILTS NORTH (%)	46.9	31.4	23.8	27.7
BNR TILTS SOUTH (%)	39.1	28.8	11.1	14.7
WP/FURN dP N/S	5.7/6.1	5.5/5.8	6.2/6.3	5.9/6.2
BOOS	None	None	None	None
APH OUT °F NORTH	170	171	171	171
APH OUT °F SOUTH	005	005	005	005

NOTES:

4,7537

CARNOT

UNIT DATA

Client: SCE

Location: El Segundo

Unit: 3

Data by: B Novodvorsky

TEST #	3-10	3-11	3-12	3-13
DATE	5-4-93	5-5-93	5-5-93	5-5-93
TIME	1605	1000	1045	1200
LOAD MW Net	250	309	311	310
AUX. LOAD	7.2	8.4	8.4	8.5
UREA ON/OFF	Off	ON	ON	Off
UREA LOOP/mode	—	1/1	1/1	—
UREA FLOW GPM	—	2.06	2.07	—
H_2O FLOW GPM / PSIG	—	1.61/55	1.55/55	—
O_2% NORTH	2.0	1.8	1.9	1.6
O_2% SOUTH	2.4	2.2	2.2	2.0
STM. PRES PSI	2402	2401	2398	2400
STM FLOW KLB/HR	1766	2222	2233	2227
FDWTR FLOW KLB/HR	1800	2261	2235	2210
FUEL FLOW 10^6 SCF	2414.8	2948.7	2929.7	2939.2
FUEL FLOW %	65.0	79.9	81.3	82.1
AIR FLOW %	70.1	86.2	87.3	88.1
SH STM TEMP °F	1052	1048	1051	1052
RH STM TEMP °F	1004	1002	1001	1006
FD FAN % NORTH	—	—	—	—
FD FAN % SOUTH	—	—	—	—
FD FAN AMPS NORTH	190	241	236	241
FD FAN AMPS SOUTH	178	244	234	235

CARNOT

Test #	3-10	3-11	3-12	3-13
O_2/CO BIAS SET POINT	-0.07	0.00	0.00	-0.15
BLR MASTER	65.87	80.57	81.95	81.08
FGR AMPS NORTH	58	69	69	70
FGR AMPS SOUTH	57	64	63	64
FGR OUTLET DAMPER NORTH				
FGR OUTLET DAMPER SOUTH				
FGR INLET DAMPER NORTH	36.6	62.6	62.6	62.6
FGR INLET DAMPER SOUTH	36.6	57.6	57.6	57.6
BNR TILTS NORTH %	20.4	22.8	21.8	20.9
BNR TILTS SOUTH %	1.2	0.0	0.0	0.0
WP/FURN dP N/S	5.9/6.2	7.2/7.5	7.3/7.5	7.3/7.4
BOOS	None	None	None	None
APH OUT °F NORTH	171	184	184	185
APH OUT °F SOUTH	005	005	005	005

NOTES: 1 N/A 64 64 71

CARNOT

UNIT DATA

Client: SCE

Location: El Segundo

Unit: 3

Data by: B Novodvorsky

TEST #	3-14			
DATE	5-5-93			
TIME	1255			
LOAD MW Net	310			
AUX. LOAD	8.6			
UREA ON/OFF	Off			
UREA LOOP / mode	—			
UREA FLOW GPM	—			
H_2O FLOW GPM / PSIG	—			
O_2% NORTH	1.7			
O_2% SOUTH	2.2			
STM. PRES PSI	2403			
STM FLOW KLB/HR	2234			
FDWTR FLOW KLB/HR	2227			
FUEL FLOW 10^6 SCF	2984.5			
FUEL FLOW %	82.4			
AIR FLOW %	86.9			
SH STM TEMP °F	1050			
RH STM TEMP °F	1004			
FD FAN % NORTH	—			
FD FAN % SOUTH	—			
FD FAN AMPS NORTH	236			
FD FAN AMPS SOUTH	233			

CARNOT

Test # 3-14

O_2/CO BIAS SET POINT	-0.07			
BLR MASTER	81.58			
FGR AMPS NORTH	71			
FGR AMPS SOUTH	65			
FGR OUTLET DAMPER NORTH	———			
FGR OUTLET DAMPER SOUTH	———			
FGR INLET DAMPER NORTH	62.6			
FGR INLET DAMPER SOUTH	57.6			
BNR TILTS NORTH %	23.4			
BNR TILTS SOUTH %	0.0			
WP/FURN dP N/S	7.3/7.5			
BOOS	None			
APH OUT °F NORTH	186			
APH OUT °F SOUTH	205			

NOTES: 73

Appendix C.3

CEM Data

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: El Segundo / SCE

CONDITION: 140 MW

DATE: 5/3/93

OPERATOR: J.M.

TEST NUMBER: 3-1-Con

TEST LOCATION: Stack

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CORRECTED TO ___% ___, DRY CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN	5.0	15.0	274.5	51.0						
		SYSTEM ZERO	0.0	0.1	0	0						
		SYSTEM SPAN	5.17	16.13	274.9	49.0						
3-1-Con	BEGIN 1115 END 1117	south - 4	5.3	9.43	28.5	32.3						
	BEGIN 1117 END 1119	3	5.28	9.50	25.1	32.						
	BEGIN 1120 END 1122	2	5.32	9.48	25.1	31.8						
	BEGIN 1122 END 1125	1	5.3	9.41	42.0	32.3						
	BEGIN 1129 END 1131	East 4	5.4	9.44	51.0	31.8						
	BEGIN 1131 END 1133	3	5.2	9.44	65	32.1						
	BEGIN 1133 END 1135	2	5.1	9.57	58	31.6						
	BEGIN 1135 END 1137	1	5.18	9.51	46.	32.1						
	BEGIN 1141 END 1143	4	5.20	9.56	28.6	31.2						
	BEGIN 1143 END 1145	3	5.1	9.57	46.8	31.0						
	BEGIN 1145 END 1147	2	5.10	9.60	56.4	31.0						
	BEGIN 1147 END 1149	1	5.10	9.60	65.0	31.5						
		SYSTEM ZERO										
		SYSTEM SPAN										
RAW AVERAGE												
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

PMF-C39

5.2 31.7

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo

CONDITION: 150 MW

DATE: 5/3/93

OPERATOR: L.A.

TEST NUMBER: 3-1-CA

TEST LOCATION: Stack

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CORRECTED TO ___% ___, DRY CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO										
		SYSTEM SPAN										
	BEGIN 1205 END 1207	Wall 4	5.26	9.52	31.0	31.5						
	BEGIN 1207 END 1209	3	5.25	9.52	27.7	31.3						
	BEGIN 1209 END 1211	2	5.25	9.50	25.0	31.4						
	BEGIN 1211 END 1213	1	5.28	9.47	53.4	30.6						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	0.9	0.07	-0.1	0.1						
		SYSTEM SPAN	5.18	15.28	272.	49.4						
RAW AVERAGE			5.19		49.3	31.6						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

PMF-C39

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo

CONDITION: 150 MW

DATE: 5/3/93

OPERATOR: J. M

TEST NUMBER: 3-2-CEM

TEST LOCATION: stack #3

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN	5.04	15.42	274.5	51.3						
		SYSTEM ZERO										
		SYSTEM SPAN										
	BEGIN 1235 END 1240		5.10	9.46	28.8	32.0						
	BEGIN 1240 END 1245		5.09	9.44	37.75	32.31						
	BEGIN 1245 END 1250		5.09	9.45	31.75	31.45	(O2 WAS ON SPAN GAS FOR 5 MIN, NOT ON SPAN)					
	BEGIN 1250 END 1255		5.09	9.43	22.4	31.61						
	BEGIN 1255 END 1300		5.15	9.41	21.4	31.49						
	BEGIN 1300 END 1305		5.15	9.43	23.65	31.50						
	BEGIN 1305 END 1310		5.16	9.42	27.0	31.46						
	BEGIN 1310 END 1315		5.14	9.46	25.8	31.60						
	BEGIN 1315 END 1320		5.11	9.46	30.85	31.56						
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	0.71	0.18	-0.1	0.1						
		SYSTEM SPAN	5.02	15.75	270	50.0						
RAW AVERAGE			5.13	9.43	25.65	31.58						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo

CONDITION: 150 MW

DATE: 5/3/93

OPERATOR: J. M

TEST NUMBER: 3-3-CCM

TEST LOCATION: Stack #3

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN	5.13	15.25	270.	50.0						
		SYSTEM ZERO										
		SYSTEM SPAN										
	BEGIN 1350 END 1355		5.05	9.58	59.1	36.18						
	BEGIN 1355 END 1400		5.09	9.60	69.20	36.33						
	BEGIN 1400 END 1405		4.99	9.60	59.7	36.07						
	BEGIN 1405 END 1410		5.05	9.56	55.45	37.03						
	BEGIN 1410 END 1415		4.98	9.56	53.3	36.43						
	BEGIN 1415 END 1420		5.10	9.52	22.35	36.27						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	0.90	0.16	0.0	0.1						
		SYSTEM SPAN	50.35	15.29	272.5	50.1						
RAW AVERAGE			5.04	9.57	52.85	36.28						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo

CONDITION: 150 MW

DATE: 5/3/93

OPERATOR: J.M, EP

TEST NUMBER: 3-4/RCM

TEST LOCATION: stack unit 5

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CORRECTED TO ___% ___, DRY CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN	5.04	9.57	272.5	50.1						
		SYSTEM ZERO										
		SYSTEM SPAN										
	BEGIN 1450 END 1455		5.15	9.45	17.65	37.24						
	BEGIN 1455 END 1500		5.14	9.44	25.85	37.28						
	BEGIN 1500 END 1505		5.10	9.44	33.55	37.25						
	BEGIN 1505 END 1510		5.14	9.42	19.40	36.58						
	BEGIN 1510 END 1515		5.18	9.42	15.65	36.5						
	BEGIN 1515 END 1520		5.21	9.40	16.70	37.28						
	BEGIN 1520 END 1525		5.06	9.46	34.0	37.48						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	0.16	0.12	0.1	0.0						
		SYSTEM SPAN	45.38	15.23	273.0	49.0						
RAW AVERAGE			5.14	9.43	23.25	37.14						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

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CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo 3 CONDITION: 250 MW

DATE: 5/4/93 OPERATOR: EF

TEST NUMBER: 5-3-CEM TEST LOCATION: STACK

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CORRECTED TO ___% ___, DRY CO	NOx	SO_2
SPAN GAS CONCENTRATION			5.004	15.00	274.9	51.96						
		AS FOUND ANAL. SPAN	5.8	15.3	273	51.6						
		SYSTEM ZERO	0.11	0.02	0.0	0.0						
5		SYSTEM SPAN	5.04	15.2	272.5	49.7						
	BEGIN 945 END 947	W-4	4.71	9.3	1.7	47.8						
	BEGIN 947 END 949	W-3	4.77	9.3	2.3	47.8						
	BEGIN 949 END 951	W-2	4.80	9.3	2.0	48.0						
	BEGIN 951 END 953	W-1	4.72	9.3	1.9	47.6						
	BEGIN 955 END 957	S-4	4.96	9.3	1.7	53.2						
	BEGIN 957 END 959	S-3	4.88	9.3	1.5	54.1						
	BEGIN 959 END 1001	S-2	4.89	9.3	2.0	53.2						
	BEGIN 1001 END 1003	S-1	4.84	9.3	1.5	51.2						
	BEGIN 1025 END 1027	E-4	4.67	9.3	1.0	49.3						
	BEGIN 1027 END 1029	E-3	4.64	9.3	1.5	48.5						
	BEGIN 1029 END 1031	E-2	4.70	9.3	1.5	49.3						
	BEGIN 1031 END 1033	E-1	4.68	9.3	1.2	48.5						
		SYSTEM ZERO	0.11	0.0	0.0	0.0						
		SYSTEM SPAN	4.95	14.9	273	51.7						
RAW AVERAGE												
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE/EL Segundo 3 CONDITION: 250 MW

DATE: 5/4/93 OPERATOR: EF

TEST NUMBER: 5-3-Cem TEST LOCATION: STACK

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CORRECTED TO ___% ___, DRY CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO										
		SYSTEM SPAN										
5	BEGIN 1038 END 1040	N-4	4.71	9.4	1.5	48.2						
	BEGIN 1040 END 1042	N-3	4.75	9.4	1.5	49.0						
	BEGIN 1042 END 1044	N-2	4.72	9.4	1.5	49.9						
	BEGIN 1044 END 1046	N-1	4.72	9.4	1.5	48.0						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO										
		SYSTEM SPAN										
RAW AVERAGE			4.77	9.33	1.61	49.5						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

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CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo 3 CONDITION: 250MW cross ch

DATE: 5/4/93 OPERATOR:

TEST NUMBER: 3-10-93 TEST LOCATION: -

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION												
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO	0.13	—	0.0	0.2						
		SYSTEM SPAN	4.88	—	27.2	50.2						
	BEGIN 1605 END 1615		4.7.7	—	1.2	58.3						
	BEGIN 1615 END 1625		4.72	—	2.7	58.1						
	BEGIN 1625 END 1635		4.64	—	4.3	57.2						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	.18	—	0.0	0.1						
		SYSTEM SPAN	4.92	—	26.9	50.9						
RAW AVERAGE			4.71	-	2.7	57.9						
CORRECTED AVERAGE												
COMMENTS:												

CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo

CONDITION: 250 MW Unit Off

DATE: 5/4/93

OPERATOR: EF

TEST NUMBER: 3-9-CEM

TEST LOCATION: STACK

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION			5.004	15.00	274.9	51.96						
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO	0.13	—	0.0	0.0						
		SYSTEM SPAN	4.97	—	271.5	49.5						
	BEGIN 1505 END 1518		4.69	-	1.7	55.0						
	BEGIN 1518 END 1525		4.69	—	1.1	55.1						
	BEGIN 1525 END 1535		4.65	—	2.4	54.5						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	.13	—	0.0	0.0						
		SYSTEM SPAN	4.88		272	48.9						
RAW AVERAGE			4.68		1.6	54.9						
CORRECTED AVERAGE						57.9						
COMMENTS:												

CARNOT

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REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / El Segundo CONDITION: 250 MW Unit Off

DATE: 5/4/93 OPERATOR: EF

TEST NUMBER: 3-9-CEM TEST LOCATION: STACK

TEST NO.	TIME	SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
			O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION			5.004	15.00	274.9	51.96						
		AS FOUND ANAL. SPAN										
		SYSTEM ZERO	0.13	—	0.0	0.0						
		SYSTEM SPAN	4.97	—	271.5	49.5						
	BEGIN 1505 END 1518		4.69	-	1.7	55.0						
	BEGIN 1518 END 1525		4.69	—	1.1	55.1						
	BEGIN 1525 END 1535		4.65	—	2.0	54.5						
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
	BEGIN END											
		SYSTEM ZERO	.13	—	0.0	0.0						
		SYSTEM SPAN	4.88		272	48.9						
RAW AVERAGE			4.68		1.6	54.9						
CORRECTED AVERAGE						57.9						
COMMENTS:												

CARNOT

PAGE ___ OF ___

REFERENCE METHOD GASEOUS MEASUREMENTS

CLIENT/LOCATION: SCE / E / Segundo 3

CONDITION: 310 MW Urea Off

DATE: 5/5/93

OPERATOR: EF

TEST NUMBER: 3-14-EM

TEST LOCATION: STACK

TEST NO.	TIME		SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
				O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO_2
SPAN GAS CONCENTRATION													
			AS FOUND ANAL. SPAN	7.97	—	52.3	51.5						
			SYSTEM ZERO	0.05	—	-0.3	0.1						
			SYSTEM SPAN	7.94	—	52.2	50.3						
14	BEGIN	1255	E-4	4.55	—	28.9	640						
	END	1310											
	BEGIN	1310	↓	4.59	—	31.7	636						
	END	1325											
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
			SYSTEM ZERO	.06	—	-0.3	0.2						
			SYSTEM SPAN	7.95	—	52.4	49.8						
RAW AVERAGE				4.57	—	30.3	~~[illegible]~~						
CORRECTED AVERAGE							63.8						
COMMENTS:													

CARNOT

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TEST NUMBER: 3-14-EM TEST LOCATION: STACK

TEST NO.	TIME		SAMPLE POINT/ CONDITION	DRY, UNCORRECTED							CORRECTED TO ___% ___, DRY		
				O_2	CO_2	CO	NOx	NO	NO_2	SO_2	CO	NOx	SO
SPAN GAS CONCENTRATION													
			AS FOUND ANAL. SPAN	7.97	—	52.3	51.5						
			SYSTEM ZERO	0.05	—	-0.3	0.1						
			SYSTEM SPAN	7.94	—	52.2	50.3						
14	BEGIN	1255	E-4	4.55	—	28.9	64.0						
	END	1310											
	BEGIN	1310	✓	4.59	—	31.87	63.6						
	END	1325											
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
	BEGIN												
	END												
			SYSTEM ZERO	.06	—	-0.3	0.2						
			SYSTEM SPAN	7.95	—	52.4	49.8						
RAW AVERAGE				4.57	—	30.3	~~[illegible]~~						
CORRECTED AVERAGE							63.8						
COMMENTS:													

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Appendix C.4

Ammonia

SAMPLE TRAIN TEST DATA 3-1-NH3

ARNOT SCE / El Segundo

CLIENT: SCE / El Segundo
SAMPLE LOCATION: Stack
OPERATOR/ASSISTANT: WM

UNIT: 3
TEST NO.: 3-1-NH3
METHOD: SCAQMD Draft
PAGE 1 OF 1
TEST CONDITION:
AMB. TEMP., °F:
PROJECT #:
METER VOL. (START/END): 495.981 1
DATE: 5-3-93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.98
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, in.	30
Sample Time: Total	70
per point	5 min
Total of Traverse Points	14

ΔH = 2.6 x ΔP

EQUIPMENT INFO:

Meter No.	ES-47
Meter, Yd.	1.0049
CFM @ ΔH = 1.0	
Pitot ID, Cp	
O_2/CO_2 Method	NO
Teflon Connecting Line (Y/N)	NO
Probe: Mat'l	Glass
Length	6'
Nozzle: Mat'l	N/A
Diam.	
Filter: No.	
Mat'l	

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	H2O4	693.2	617.6	75.6
#2	"	603.6	596.9	6.7
#3	—	504.2	501.6	2.6
#4	SG	796.9	787.8	9.1
#5				
Total				94.0

POST TEST INFO:

Filter Appearance	none
Impinger Appearance	Clear
Silica Gel Spent (Y/N)	NO

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.008	15"	—	WM
Post-Test	.007	15"	—	WM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. Iwg
N-4	11:15		2.6	495.981	190	271	70	69	—	ICED	6.1	7"	
	11:25		2.6	503.215	191	270	72	68	—	ICED	6.2	7"	
	11:35		2.6	510.923	190	270	71	68	—		5.9	7.1"	
	11:45		2.6	518.328	190	270	71	69	—		5.9	7.1"	
									—				

CHAIN OF CUSTODY INFORMATION

Impingers Loaded	SG
Impingers Recovered	SG
Filter Loaded	
Filter Recovered	
Probe Wash	WM

TEST SUMMARY

Calculated by:	ES
Checked by:	ES
Sample Vol., c.f.	22.347 ✓
Stack Press., iwg	
ΔH, iwg	2.6 ✓
ΔP, iwg	
Meter Temp., °F	69.75 ✓
Stack Temp., °F	
Water Collected, g	
O_2/CO_2	
Comments:	

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CARNOT

SAMPLE TRAIN TEST DATA

CLIENT SCE | UNIT 3 | TEST NO. 3-2-NH3 | METHOD NH3 Dougt | PAGE 1 OF 1
SAMPLE LOCATION STACK | TEST CONDITION 150MW | AMB. TEMP., °F | PROJECT #
OPERATOR/ASSISTANT WM | METER VOL. (START/END) 518.749 / 540.965 | DATE 5-3-93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.98
Assumed Stack Press.	
Assumed Moisture	
Assumed Molecular Wt.	
Assumed ΔP	
Assumed ΔH	
Stack Diameter, in.	
Sample Time: Total	30
per point	30
Total of Traverse Points	2

ΔH = _____ x ΔP

EQUIPMENT INFO:

Meter No.	EB30
Meter, Yd.	1.0346
CFM @ ΔH = 1.0	0.490
Pitot ID, Cp	
O_2/CO_2 Method	O2
Teflon Connecting Line (Y/N)	Y
Probe: Matl	Glass
Length	10'
Nozzle: Matl	N/A
Diam.	
Filter: No.	
Matl	

Imp.	Matl	Wt.(End)	Wt.(Start)	Wt.(g)
#1	0.1 H2SO4	682.5	610.0	72.95
#2	"	595.1	586.9	9.1
#3	—	486.2	483.3	2.9
#4	SG	756.1	747.8	9.3
#5				
Total				92.75

POST TEST INFO:
Filter Appearance: None
Impinger Appearance: Clear
Silica Gel Spent (Y/N): No

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.002	15"	—	WM
Post-Test	.002	15"	—	WM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. Iwg
W-4	12:35		2.6	518.749	190	266	70	68	—	ICED	6.0	8.1"	
	12:45		2.6	526.105	190	268	73	68	—		6.0	8.5"	
	12:55		2.6	533.528	191	268	73	69	—		6.0	8.5"	
	13:05		2.6	540.965	190	269	73	68	—		5.9	8.5"	
									—				

CHAIN OF CUSTODY INFORMATION

Impingers Loaded	95
Impingers Recovered	95
Filter Loaded	
Filter Recovered	
Probe Wash	WM

TEST SUMMARY

Calculated by:	95
Checked by:	95
Sample Vol., c.f.	22.216
Stack Press., iwg	
ΔH, Iwg	2.6
ΔP, iwg	
Meter Temp., °F	70.25
Stack Temp., °F	
Water Collected, g	92.75
O_2/CO_2	
Comments:	

PAK 057

SAMPLE TRAIN TEST DATA

ARNOT

CLIENT: Sce/E/Scg-Mdo
SAMPLE LOCATION: Stack
OPERATOR/ASSISTANT: J.M

UNIT: 3
TEST NO.: 3-6-H2SO4
METHOD: NH3, ~~Dual~~
PAGE 6 OF 6
PROJECT #: 10 FR1
TEST CONDITION:
AMB. TEMP., °F:
METER VOL. (START/END): 541.532 / 564.535
DATE: 5/4/88

PRE-TEST DATA:

Barometric Press., in. Hg.	29.81
Assumed Stack Press.	
Assumed Moisture	12%
Assumed Molecular Wt.	28.3
Assumed ΔP	
Assumed ΔH	2.5
Stack Diameter, in.	
Sample Time: Total	30
per point	5
Total of Traverse Points	6

ΔH = _____ x ΔP

EQUIPMENT INFO:

Meter No.	ES-32
Meter, Yd.	[illegible]
CFM @ ΔH = 1.0	.490
Pitot ID, Cp	.84
O_2/CO_2 Method	Orsat
Teflon Connecting Line (Y/N)	Y
Probe: Matl	6'
Length	6/8/5.2
Nozzle: Matl	N/A
Diam.	
Filter: No.	
Matl	

Imp.	Matl	Wt.(End)	Wt.(Start)	Wt.(g)
#1	0.1N H2SO4	700.9	614.6	86.3
#2	"	624.6	621.2	3.4
#3	—	503.2	501.3	1.9
#4	SG	753.9	746.9	7.0
#5				
Total				98.6

POST TEST INFO:
Filter Appearance: N/A
Impinger Appearance: Clear
Silica Gel Spent (Y/N): N

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Int.
Pre-Test	0.05	15		JM
Post-Test	.010	12		JM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp In	Meter Temp Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg
S 4	10 02		2.5	541.532	215	260	67	66	N/A	51	5.4	8	
	11 12		2.6	549.000	215	248	68	66		49	5.2	8	
	11 22		2.6	556.781	217	262	68	67		55	5.3	8	
	11 32		2.6	564.535	217	260	68	67		61	5.3	8	

CHAIN OF CUSTODY INFORMATION

Impingers Loaded	JM
Impingers Recovered	ML
Filter Loaded	
Filter Recovered	
Probe Wash	JM

TEST SUMMARY

Calculated by:	ML
Checked by:	[illegible]
Sample Vol., c.f.	22.603
Stack Press., iwg	
ΔH, iwg	2.575
ΔP, iwg	
Meter Temp., °F	67.125
Stack Temp., °F	
Water Collected, g	98.6
O_2/CO_2	5.3
Comments:	

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CARNOT

SAMPLE TRAIN TEST DATA

CLIENT: SCE/E/Segunda
SAMPLE LOCATION: STACK
OPERATOR/ASSISTANT: J. Murray

UNIT: 3
TEST NO.: 3-7-H2SO4
METHOD: S.Co mod
PAGE: 1 OF 1
TEST CONDITION:
AMB. TEMP., °F:
PROJECT #: 10841
METER VOL. (START/END):
DATE: 5/4/93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.
Assumed Stack Press.	
Assumed Moisture	12%
Assumed Molecular Wt.	28.3
Assumed ΔP	
Assumed ΔH	2.5
Stack Diameter, in.	
Sample Time: Total	30
per point	5
Total of Traverse Points	

ΔH = _____ x ΔP

EQUIPMENT INFO:

Meter No.	ES-30
Meter, Yd.	1.0341
CFM @ ΔH = 1.0	.990
Pitot ID, Cp	.84
O_2/CO, Method	Fyrite
Teflon Connecting Line (Y/N)	Y
Probe: Matl	Glass
Length	6'
Nozzle: Matl	M/S
Diam.	
Filter: No.	
Matl	

Imp.	Matl	Wt.(End)	Wt.(Start)	Wt.(g)
#1	H2SO4	688.4	601.7	86.7
#2	H2SO4	591.9	588.4	3.5
#3	0	484.8	483.8	1.0
#4	S/G	758.0	750.2	7.8
#5				
Total				99.0

POST TEST INFO:
Filter Appearance
Impinger Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.010	15		JM
Post-Test	.010	13		JM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. Iwg
W-A	1155		2.6	565.328	217	260	66	67	N/A	54	5.2	7	
	1205		2.6	572.638	216	248	68	66		58	5.2	6	
	1215		2.6	579.630	216	240	69	66		62	5.2	6	
	1225		2.6	587.158	215	239	69	66		64			

CHAIN OF CUSTODY INFORMATION

Impingers Loaded	JM
Impingers Recovered	JM
Filter Loaded	
Filter Recovered	
Probe Wash	JM

TEST SUMMARY

Calculated by:	JM
Checked by:	JM
Sample Vol., c.f.	21.830
Stack Press., Iwg	
ΔH, Iwg	2.6
ΔP, Iwg	—
Meter Temp., °F	67.13
Stack Temp., °F	
Water Collected, g	99.0
O_2/CO_2	
Comments:	

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CARNOT

SAMPLE TRAIN TEST DATA

CLIENT SCE / El Segundo UNIT 3 TEST NO. 3-8 NH3 METHOD SO.CO. draft PAGE 1 OF 1
SAMPLE LOCATION Stack TEST CONDITION AMB. TEMP., °F PROJECT # 10847
OPERATOR/ASSISTANT J. M METER VOL. (START/END) 587.421 / 608.674 DATE 5/4/93

PRE-TEST DATA:

Barometric Press., in. Hg.	29.82
Assumed Stack Press.	
Assumed Moisture	12%
Assumed Molecular Wt.	28.3
Assumed ΔP	
Assumed ΔH	2.6
Stack Diameter, in.	
Sample Time: Total	240
per point	8
Total of Traverse Points	

ΔH = _____ x ΔP

EQUIPMENT INFO:

Meter No.	2530
Meter, Yd.	1.034
CFM @ ΔH = 1.0	.450
Pitot ID, Cp	.84
O_2/CO_2 Method	orsat
Teflon Connecting Line (Y/N)	Y
Probe: Mat'l	stainless
Length	6'
Nozzle: Mat'l	N/A
Diam.	
Filter: No.	
Mat'l	

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	1 (NH3)2SO4	719.7	642.5	77.2
#2	"	620.8	617.2	3.6
#3	—	504.3	503.1	1.2
#4	SG	759.4	753.5	5.9
#5				
Total				87.9

POST TEST INFO:

Filter Appearance	N/A
Impinger Appearance	Clear
Silica Gel Spent (Y/N)	No

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.010	15		JM
Post-Test	.009	10		JM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg
W4	1315		2.6	587.421	216	245	66	66	N/A	57	5.6	7	
	1325		2.6	594.381	215	237	67	66		54	5.3	7	
	1335		2.6	601.350	217	241	69	67		60	5.3	7	
	1345		2.6	608.674	214	241	70	67		63	5.3	7	

CHAIN OF CUSTODY INFORMATION

Impingers Loaded EJ
Impingers Recovered ML
Filter Loaded
Filter Recovered
Probe Wash JM

TEST SUMMARY

Calculated by: ML
Checked by: [illegible]
Sample Vol., c.f. 21.193
Stack Press., iwg
ΔH, iwg 2.6
ΔP, iwg
Meter Temp., °F 68
Stack Temp., °F
Water Collected, g 87.9
O_2/CO_2 5.375
Comments:

PMF-057

CARNOT

SAMPLE TRAIN TEST DATA

CLIENT SCE/El Segundo | UNIT 3 | TEST NO. 3-11-MM3 | METHOD | PAGE 6 OF 1
SAMPLE LOCATION Stack | TEST CONDITION Full load | AMB. TEMP., °F | PROJECT # 70 891
OPERATOR/ASSISTANT J.M | METER VOL. (START/END) 609.210 / 630.815 | DATE 5/5/88

PRE-TEST DATA:

Barometric Press., in. Hg.	29.84
Assumed Stack Press.	
Assumed Moisture	12%
Assumed Molecular Wt.	28.3
Assumed ΔP	
Assumed ΔH	2.7
Stack Diameter, in.	
Sample Time: Total	30
per point	5
Total of Traverse Points	

ΔH = 2.7 x ΔP

EQUIPMENT INFO:

Meter No.	53.30
Meter, Yd.	1.0346
CFM @ ΔH = 1.0	.910
Pitot ID, Cp	.84
O_2/CO_2 Method	ART 4
Teflon Connecting Line (Y/N)	Y
Probe: Mat'l	Glass
Length	6'
Nozzle: Mat'l	N/A
Diam.	
Filter: No.	
Mat'l	

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	0.1N H_2SO_4	688.6	613.4	75.2
#2	"	574.7	569.1	5.6
#3	—	486.6	484.6	2.0
#4	SD	764.8	758.0	6.8
#5				
Total				89.6

POST TEST INFO:

Filter Appearance	N/A
Impinger Appearance	Clean
Silica Gel Spent (Y/N)	No

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.010	15		JM
Post-Test	.008	10		JM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. iwg
	1000		2.4	609.210	234	238	67	67	N/a	45	5.2	7	
	1010		2.7	615.621	235	240	68	67		48	5.3	7	
	1020		2.7	623.681	234	238	70	68		54	5.2	7	
	1030		2.7	630.815	235	266	71	67		60	5.2	7	

CHAIN OF CUSTODY INFORMATION

Impingers Loaded
Impingers Recovered MK
Filter Loaded
Filter Recovered
Probe Wash JM

TEST SUMMARY

Calculated by: MK
Checked by: GF
Sample Vol., c.l. 21.605
Stack Press., iwg
ΔH, iwg 2.625
ΔP, iwg
Meter Temp., °F
Stack Temp., °F 68.125
Water Collected, g 89.6
O_2/CO_2 5.225
Comments: TV=003

PMF-057

SAMPLE TRAIN TEST DATA

ARNOT

CLIENT: SCC / El Segundo
SAMPLE LOCATION: Stack
OPERATOR/ASSISTANT: L.M

UNIT: 3
TEST NO.: 3-12-NH3
METHOD:
PAGE: 1 OF 1
TEST CONDITION: Full Load
AMB. TEMP., °F:
PROJECT #: 10841
METER VOL. (START/END): 613.045 / 653.305
DATE: 5/15/98

PRE-TEST DATA:

Barometric Press., In. Hg.	29.84
Assumed Stack Press.	
Assumed Moisture	12%
Assumed Molecular Wt.	28.1
Assumed ΔP	
Assumed ΔH	2.7
Stack Diameter, In.	
Sample Time: Total	30
per point	5/p
Total of Traverse Points	1

ΔH = 2.7 x ΔP

EQUIPMENT INFO:

Meter No.	25-30
Meter, Yd.	1.034
CFM @ ΔH = 1.0	.450
Pitot ID, Cp	.84
O_2/CO_2 Method	Orsat/Fyrite
Teflon Connecting Line (Y/N)	Y
Probe: Mat'l	S/Glass
Length	6'
Nozzle: Mat'l	N/A
Diam.	
Filter: No.	2
Mat'l	

Imp.	Mat'l	Wt.(End)	Wt.(Start)	Wt.(g)
#1	1NH,SO4	694.2	610.7	83.5
#2	"	640.8	636.4	4.4
#3	—	505.5	504.4	1.1
#4	SG	765.3	760.3	5.0
#5				
Total				94.0

POST TEST INFO:
Filter Appearance
Impinger Appearance
Silica Gel Spent (Y/N)

SAMPLE TRAIN LEAK CHECK:

	CFM	Vac.	Pitot	Init.
Pre-Test	.000	15		SM
Post-Test	.004	10		SM

PRE-TEST CALIBRATION CHECK:

	Time	ΔH	Meter Reading	Meter Temp. In	Meter Temp. Out
Init.					
Final					

SAMPLE POINT	TIME	METER CONDITIONS ΔP	ΔH	METER READING	TEMPERATURES, °F STACK	PROBE	METER IN	METER OUT	OVEN	IMP. OUT	O_2	VAC.	STATIC PRESS. Iwg
	1045		2.7	631.045	234	256	68	67	N/A	47	5.2	8	
	1055		2.7	638.254	234	258	70	68		50	5.4	8	
	1105		2.7	645.681	234	252	71	67		53	5.3	8	
	1115		2.7	653.305	236	252	70	67		56	5.3	8	

CHAIN OF CUSTODY INFORMATION

Impingers Loaded	[illegible]
Impingers Recovered	[illegible]
Filter Loaded	
Filter Recovered	
Probe Wash	

TEST SUMMARY

Calculated by:	[illegible]
Checked by:	
Sample Vol., c.f.	22.263
Stack Press., iwg	
ΔH, Iwg	2.7
ΔP, Iwg	
Meter Temp., °F	68.5
Stack Temp., °F	
Water Collected, g	94.0
O_2/CO_2	
Comments:	TV = 40

PMF-057

Appendix C.5

Non-Methane Hydrocarbon

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TEDLAR BAG SAMPLE DATA

CLIENT/PROJECT: SCE / El Segundo

DATE: 5/4/93 UNIT: 3 / El Segundo BY: J. M

	BAG ID 3-6-HC	BAG ID 3-7-HC	BAG ID 3-8-HC
TEST NO.	3-6-HC	3-7-HC	3-8-HC
SAMPLE RATE	.5 L/m	.5 L/m	.5 L/m
START TIME	11.01	1155	1315
STOP TIME	11.20	1215	1335
SAMPLE LOCATION	stack	stack	stack

DATE: 5/4/93 UNIT: 3 / El Segundo BY: J. M

	BAG ID 3-9-HC	BAG ID 3-10-HC	BAG ID
TEST NO.	3-9-HC	3-10-HC	
SAMPLE RATE	.5 L/m	.5 L/m	
START TIME	15.05	1605	
STOP TIME	15 25	1625	
SAMPLE LOCATION	stack	stack	

NOTES:

CARNOT
TEDLAR BAG SAMPLE DATA

CLIENT/PROJECT: SCE / El Segundo

DATE: 5/5/93 UNIT: 3 BY: SM

	BAG ID	BAG ID	BAG ID
TEST NO.	3-11-HC	3-12-HC	3-13-HC
SAMPLE RATE	.5 L/m	.5 L/m	.5 L/m
START TIME	1000	1045	1200
STOP TIME	1020	1105	1220
SAMPLE LOCATION	Stack	STACK	STACK

DATE: 5/5/93 UNIT: 3 BY: CR

	BAG ID	BAG ID	BAG ID
TEST NO.	3-14-HC		
SAMPLE RATE	.5 L/m		
START TIME	1258		
STOP TIME	1318		
SAMPLE LOCATION	STACK		

NOTES:

APPENDIX D
CALCULATIONS

Appendix D.1

General Emissions Calculations

EMISSION CALCULATIONS

1. Sample Volume and Isokinetics

a. Sample gas volume, dscf

$$V_{m\ std} = 0.03342\ V_m \left(P_{bar} + \frac{H}{13.6}\right)\left(\frac{T_{ref}}{T_m}\right)(Y)$$

b. Water vapor volume, scf

$$V_{w\ std} = 0.0472\ V_{lc} \left(\frac{T_{ref}}{528\ ^\circ R}\right)$$

c. Moisture content, nondimensional

$$B_{wo} = \frac{V_{w\ std}}{V_{m\ std} + V_{w\ std}}$$

d. Stack gas molecular weight, lb/lb mole

$$MW_{dry} = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2)$$

$$MW_{wet} = MW_{dry}\ (1 - B_{wo}) + 18\ (B_{wo})$$

e. Absolute stack pressure, iwg

$$P_s = P_{bar} + \frac{P_{sg}}{13.6}$$

f. Stack velocity, ft/sec

$$V_s = 2.90\ C_p \sqrt{\Delta PT_s} \sqrt{\left(\frac{29.92}{p_s}\right)\left(\frac{28.95}{MW_{wet}}\right)}$$

g. Actual stack flow rate, wacfm

$$Q = (V_s)(A_s)(60)$$

h. Standard stack gas flow rate, dscfm

$$Q_{sd} = Q\ (1 - B_{wo})\left(\frac{T_{ref}}{T_s}\right)\left(\frac{P_s}{29.92}\right)$$

i. Percent isokinetic

$$I = \left(\frac{17.32(T_s)(V_{m\ std})}{(1 - B_{wo})(\Theta)(V_s)(P_s)(D_n^2)}\right)\left(\frac{528\ ^\circ R}{T_{ref}}\right)$$

2. Particulate Emissions

a. Grain loading, gr/dscf

$$C = 0.01543 \left(\frac{M_n}{V_{m\ std}} \right)$$

b. Grain loading at 12% CO_2, gr/dscf

$$C_{12\% CO_2} = C \left(\frac{12}{\% CO_2} \right)$$

c. Mass emissions, lb/hr

$$M = C(Q_{sd}) \frac{(60\ \text{min}/hr)}{(7000\ gr/lb)}$$

3. Gaseous Emissions, lb/hr

$$M = (ppm)(10^{-6}) \left(\frac{MW_i\ lb/lb\ mole}{SV} \right) (Q_{sd})(60\ \text{min}/hr)$$

where,

SV = *specific molar volume of an ideal gas:*

$SV = 385.3\ ft^3/lb\ mole \quad for\ T_{ref} = 528\ °R$

$SV = 379.5\ ft^3/lb\ mole \quad for\ T_{ref} = 520\ °R$

4. Emissions Rates, lb/10^6 Btu

a. Fuel factor at 68 °F, dscf/10^6 Btu at 0% O_2

$$F_{68} = \frac{10^6 [3.64(\%H) + 1.53(\%C) + 0.14\ (\%N) + 0.57(\%S) - 0.46(\%O_{2,}fuel)]}{HHV,\ Btu/lb}$$

b. Fuel factor at 60 °F

$$F_{60} = F_{68} \left(\frac{520\ °R}{528\ °R} \right)$$

c. Gaseous Emissions factor

$$\left(\frac{lb}{10^6\ Btu} \right)_i = (ppm)_i\ (10^{-6}) \left(\frac{MW_i\ lb}{lb\ mole} \right) \left(\frac{1}{SV} \right) (F) \left(\frac{20.9}{20.9 - \%O_2} \right)$$

d. Paticulate emission factor

$$\left(\frac{lb}{10^6\ Btu} \right) = C \left(\frac{1\ lb}{7000\ gr} \right) (F) \left(\frac{20.9}{20.9 - \%O_2} \right)$$

Nomenclature:

A_s = stack area, ft^2

B_{wo} = flue gas moisture content

$C_{12\% CO_2}$ = particulate grain loading, gr/dscf corrected to 12% CO_2

C = particulate grain loading, gr/dscf

C_p = pitot calibration factor, dimensionless

Dn = nozzle diameter, in.

F = fuel F factor, dscf/10^6 Btu at 0% O_2

H = orifice pressure differential, iwg

I = % isokinetics

M_n = mass of collected particulate, mg

M_i = mass emissions of species i, lb/hr

MW = molecular weight of flue gas

MW_i = molecular weight of species i:

NO_x	:	46
CO	:	28
SO_x	:	64
HC	:	16

θ = sample time, min.

ΔP = average velocity head, iwg = $\left(\overline{\sqrt{\Delta P}}\right)^2$

P_{bar} = barometric pressure, in.Hg

P_s = stack absolute pressure, in.Hg

P_{st} = stack static pressure, iwg

Nomenclature (Continued):

Q	=	wet stack gas flow rate at actual conditions, wacfm
Qsd	=	dry stack gas flow rate at standard conditions, dscfm
SV	=	specific molar volume of an ideal gas at standard conditions, ft^3/lb mole
Tm	=	meter temperature, °R
T_{ref}	=	reference temperature, °R
Ts	=	stack temperature, °R
V_s	=	stack velocity, ft/sec
V_{lc}	=	volume of liquid collected in impingers, ml
Vm	=	dry meter volume uncorrected, dcf
$V_{m\ std}$	=	dry meter volume at standard conditions, dscf
$V_{w\ std}$	=	volume of water vapor at standard conditions, scf
Y	=	meter calibration coefficient

Appendix D.2

Specific Emissions Calculations

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7/7/93

CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea On
Load: 150 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		500	100		
Span Value:	5.00		274.90	51.96		
Test #: 3-1-CEM		Time:	1115/1213		Date:	5/3/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.10		0.00	0.00		
System Span	5.18		274.90	49.00		
Raw Average	5.19		49.30	31.60		
System Zero	0.09		-0.10	0.10		
System Span	5.18		272.00	49.40		
Corrected Average	5.01		49.60	33.35		
System Bias Check						
Zero Pre-test	1.00%		0.00%	0.00%	< 5%	Pass
Zero Post-test	0.90%		-0.02%	0.10%	< 5%	Pass
Span Pre-test	1.76%		0.00%	-2.96%	< 5%	Pass
Span Post-test	1.76%		-0.58%	-2.56%	<5%	Pass
Test #: 3-2-CEM		Time	1235/1320		Date	5/3/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.09		-0.10	0.10		
System Span	5.17		272.00	49.40		
Raw Average	5.13		25.68	31.58		
System Zero	0.07		-0.10	0.10		
System Span	5.02		270.00	50.00		
Corrected Average	5.04		26.14	32.98		
System Bias Check						
Zero Pre-test	0.90%		-0.02%	0.10%	< 5%	Pass
Zero Post-test	0.71%		-0.02%	0.10%	< 5%	Pass
Span Pre-test	1.66%		-0.58%	-2.56%	< 5%	Pass
Span Post-test	0.16%		-0.98%	-1.96%	<5%	Pass
Test Average	5.03		37.87	33.17		

15991 Red Hill Ave., Suite 110
Tustin, Califorinia 92680-7388
(714) 259-9520
FAX (714) 259-0372

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7/7/93

CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea Off
Load: 150 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		500	100		
Span Value:	5.00		274.90	51.96		
Test #: 3-3-CEM		Time:	1350/1420		Date:	5/3/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.07		-0.10	0.10		
System Span	5.02		270.00	50.00		
Raw Average	5.04		52.85	36.38		
System Zero	0.09		0.00	0.10		
System Span	5.04		272.50	50.10		
Corrected Average	5.02		53.60	37.74		
System Bias Check						
Zero Pre-test	0.71%		-0.02%	0.10%	< 5%	Pass
Zero Post-test	0.90%		0.00%	0.10%	< 5%	Pass
Span Pre-test	0.16%		-0.98%	-1.96%	< 5%	Pass
Span Post-test	0.31%		-0.48%	-1.86%	<5%	Pass
Test #: 3-4-CEM		Time	1450/1525		Date	5/3/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.09		0.00	0.10		
System Span	5.04		272.50	50.10		
Raw Average	5.14		23.25	37.14		
System Zero	0.07		-0.10	0.00		
System Span	4.94		273.00	49.00		
Corrected Average	5.16		23.48	38.93		
System Bias Check						
Zero Pre-test	0.90%		0.00%	0.10%	< 5%	Pass
Zero Post-test	0.68%		-0.02%	0.00%	< 5%	Pass
Span Pre-test	0.31%		-0.48%	-1.86%	< 5%	Pass
Span Post-test	-0.66%		-0.38%	-2.96%	<5%	Pass
Test Average	5.09		38.54	38.34		

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CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea On
Load: 250 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		500	100		
Span Value:	5.00		274.90	51.96		
Test #: 3-5-CEM		Time:	945/1046		Date:	5/4/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.11		0.00	0.00		
System Span	5.04		272.50	49.70		
Raw Average	4.77		1.50	49.50		
System Zero	0.11		0.00	0.00		
System Span	4.95		273.00	51.70		
Corrected Average	4.77		1.51	50.73		
System Bias Check						
Zero Pre-test	1.10%		0.00%	0.00%	< 5%	Pass
Zero Post-test	1.10%		0.00%	0.00%	< 5%	Pass
Span Pre-test	0.36%		-0.48%	-2.26%	< 5%	Pass
Span Post-test	-0.54%		-0.38%	-0.26%	<5%	Pass
Test #: 3-6-CEM		Time	1110/1140		Date	5/4/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.11		0.00	0.00		
System Span	4.95		273.00	51.70		
Raw Average	4.68		1.20	47.30		
System Zero	0.07		0.00	0.00		
System Span	4.94		273.50	50.10		
Corrected Average	4.73		1.21	48.29		
System Bias Check						
Zero Pre-test	1.10%		0.00%	0.00%	< 5%	Pass
Zero Post-test	0.70%		0.00%	0.00%	< 5%	Pass
Span Pre-test	-0.54%		-0.38%	-0.26%	< 5%	Pass
Span Post-test	-0.64%		-0.28%	-1.86%	<5%	Pass
Test Average	4.75		1.36	49.51		

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Tustin, Califorinia 92680-7388
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CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea On
Load: 250 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		500	100		
Span Value:	5.00		274.90	51.96		
Test #: 3-7-CEM		Time:	1155/1225		Date:	5/4/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.07		0.00	0.00		
System Span	4.94		273.50	50.00		
Raw Average	4.36		7.60	44.60		
System Zero	0.04		0.00	0.00		
System Span	5.04		270.00	50.10		
Corrected Average	4.37		7.69	46.30		
System Bias Check						
Zero Pre-test	0.71%		0.00%	0.00%	< 5%	Pass
Zero Post-test	0.40%		0.00%	0.00%	< 5%	Pass
Span Pre-test	-0.64%		-0.28%	-1.96%	< 5%	Pass
Span Post-test	0.31%		-0.98%	-1.86%	<5%	Pass
Test #: 3-8-CEM		Time	1315/1345			5/4/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.04		0.00	0.00		
System Span	4.96		270.00	50.10		
Raw Average	4.77		1.80	48.20		
System Zero	0.13		0.00	0.00		
System Span	4.97		271.50	49.50		
Corrected Average	4.80		1.83	50.29		
System Bias Check						
Zero Pre-test	0.40%		0.00%	0.00%	< 5%	Pass
Zero Post-test	1.30%		0.00%	0.00%	< 5%	Pass
Span Pre-test	-0.44%		-0.98%	-1.86%	< 5%	Pass
Span Post-test	-0.34%		-0.68%	-2.46%	<5%	Pass
Test Average	4.59		4.76	48.30		

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Tustin, Califorinia 92680-7388
(714) 259-9520
FAX (714) 259-0372

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CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea Off
Load: 250 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		500	100		
Span Value:	5.00		274.90	51.96		
Test #: 3-9-CEM		Time:	1505/1535		Date:	5/4/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.13		0.00	0.00		
System Span	4.97		271.50	49.50		
Raw Average	4.68		1.60	54.90		
System Zero	0.13		0.00	0.00		
System Span	4.88		272.00	48.90		
Corrected Average	4.75		1.62	57.98		
System Bias Check						
Zero Pre-test	1.30%		0.00%	0.00%	< 5%	Pass
Zero Post-test	1.30%		0.00%	0.00%	< 5%	Pass
Span Pre-test	-0.34%		-0.68%	-2.46%	< 5%	Pass
Span Post-test	-1.24%		-0.58%	-3.06%	<5%	Pass
Test #: 3-10-CEM		Time	1605/1635		Date:	5/3/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.13		0.00	0.20		
System Span	4.88		272.00	50.20		
Raw Average	4.71		2.70	57.90		
System Zero	0.18		0.00	0.10		
System Span	4.92		269.00	50.90		
Corrected Average	4.80		2.74	59.54		
System Bias Check						
Zero Pre-test	1.30%		0.00%	0.20%	< 5%	Pass
Zero Post-test	1.80%		0.00%	0.10%	< 5%	Pass
Span Pre-test	-1.24%		-0.58%	-1.76%	< 5%	Pass
Span Post-test	-0.84%		-1.18%	-1.06%	<5%	Pass
Test Average	4.78		2.18	58.76		

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CARNOT

7/7/93

CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea On
Load: 310 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		100	100		
Span Value:	8.00		53.60	51.96		
Test #: 3-11-CEM		Time:	1000/1030		Date:	5/5/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.15		-0.10	-0.10		
System Span	7.91		51.70	49.60		
Raw Average	4.63		19.20	55.60		
System Zero	0.01		-0.30	0.10		
System Span	7.90		52.10	49.60		
Corrected Average	4.65		19.96	58.25		
System Bias Check						
Zero Pre-test	1.50%		-0.10%	-0.10%	< 5%	Pass
Zero Post-test	0.07%		-0.30%	0.10%	< 5%	Pass
Span Pre-test	-0.90%		-1.90%	-2.36%	< 5%	Pass
Span Post-test	-1.00%		-1.50%	-2.36%	<5%	Pass
Test #: 3-12-CEM		Time	1045/1115		Date:	5/5/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.07		-0.30	0.10		
System Span	7.90		52.10	49.60		
Raw Average	4.60		23.20	56.40		
System Zero	0.07		-0.40	0.10		
System Span	7.94		52.30	49.80		
Corrected Average	4.62		24.02	58.98		
System Bias Check						
Zero Pre-test	0.70%		-0.30%	0.10%	< 5%	Pass
Zero Post-test	0.70%		-0.40%	0.10%	< 5%	Pass
Span Pre-test	-1.00%		-1.50%	-2.36%	< 5%	Pass
Span Post-test	-0.60%		-1.30%	-2.16%	<5%	Pass
Test Average	4.63		21.99	58.61		

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7/7/93

CARNOT MOBILE EMISSION LABORATORY
CONTINUOUS GASEOUS MEASUREMENTS SUMMARY

Client: SCE EL SEGUNDO
Unit: #3
Location: STACK

Condition: Urea Off
Load: 310 MW

	O2%	CO2%	CO ppm	NOx ppm		
Analyzer Range:	10		100	100		
Span Value:	8.00		53.60	51.96		
Test #: 3-13-CEM		Time:	1200/1230		Date:	5/5/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.07		-0.40	0.10		
System Span	7.94		52.30	49.80		
Raw Average	4.51		35.80	63.30		
System Zero	0.05		-0.30	0.10		
System Span	7.94		52.20	50.30		
Corrected Average	4.52		36.84	65.74		
System Bias Check						
Zero Pre-test	0.70%		-0.40%	0.10%	< 5%	Pass
Zero Post-test	0.50%		-0.30%	0.10%	< 5%	Pass
Span Pre-test	-0.60%		-1.30%	-2.16%	< 5%	Pass
Span Post-test	-0.60%		-1.40%	-1.66%	<5%	Pass
Test #: 3-14-CEM		Time	1255/1325		Date:	5/5/93
	O2%	CO2%	CO ppm	NOx ppm		
System Zero	0.05		-0.30	0.10		
System Span	7.94		52.20	50.30		
Raw Average	4.57		30.30	~~30.80~~ 63.20		
System Zero	0.06		-0.30	0.20		
System Span	7.95		52.40	49.80		
Corrected Average	4.58		31.18	~~38.16~~ 60.13		
System Bias Check						
Zero Pre-test	0.50%		-0.30%	0.10%	< 5%	Pass
Zero Post-test	0.60%		-0.30%	0.20%	< 5%	Pass
Span Pre-test	-0.60%		-1.40%	-1.66%	< 5%	Pass
Span Post-test	-0.50%		-1.20%	-2.16%	<5%	Pass
Test Average	4.55		34.01	51.95		

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10841CEM.7

CARNOT

7/7/93

Client:	SCE	BP in Hg:	29.98	Blank:	0.04
Date:	5/3/93	Tref R:	520		
Location:	Elsegudo 3	Meter No:	ES-47		
Unit:	Natural Gas	Yd:	1.005		

Test #	Vm (adcf)	Tm (F)	Hm (in. H20)	Tot Vol (ml)	Solution NH3 (ppm)	Vmstd (SCF)	O2 (%)	NH3 (ppm)	NH3 @ 3% O2
3-1-NH3	22.347	69.8	2.60	396	1.89	22.227	5.00	1.6	1.8
3-2-NH3	22.216	70.3	2.60	382	2.16	22.075	5.00	1.8	2.0

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10841NH3.XLS1

CARNOT

Client:	SCE	BP in Hg:	29.81	Blank:	0.04
Date:	5/4/93	Tref R:	520		
Location:	Elsegudo 3	Meter No	ES-30		
Unit:	Natural Gas	Yd:	1.040		

Test #	Vm (adcf)	Tm (F)	Hm (in. H20)	Tot Vol (ml)	Solution NH3 (ppm)	Vmstd (SCF)	O2 (%)	NH3 (ppm)	NH3 @ 3% O2
3-6-NH3	22.603	67.1	2.60	424	9.84	23.242	4.70	8.8	9.7
3-7-NH3	21.830	67.1	2.60	415	9.59	22.448	4.70	8.7	9.6
9-8-NH3	21.253	67.4	2.60	444	8.62	21.843	4.80	8.5	9.5

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7/7/93

Client:	SCE	BP in Hg:	30.25	Blank:	0.04
Date:	9/15/92	Tref R:	520		
Location:	Elsegudo 3	Meter No	ES-30		
Unit:	Natural Gas	Yd:	1.040		

Test #	Vm (adcf)	Tm (F)	Hm (in. H20)	Tot Vol (ml)	Solution NH3 (ppm)	Vmstd (SCF)	O2 (%)	NH3 (ppm)	NH3 @ 3% O2
3-11-NH3	21.605	68.1	2.63	403	4.98	22.500	4.70	4.3	4.8
3-12-NH3	22.263	68.5	2.70	460	3.78	23.173	4.60	3.6	4.0

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Tustin, Califorinia 92680-7388
(714) 259-9520
FAX (714) 259-0372

10841NH3.XLS3

APPENDIX E
LABORATORY REPORTS

AtmAA Inc.
21354 Nordhoff St., Suite 113, Chatsworth, CA 91311 (818) 718-6070 • FAX (818) 718-9779
environmental consultants
laboratory services

May 12, 1993 LTR/175/93

Ed Filadelfia
CARNOT
15991 Red Hill Ave. Suite 110
Tustin, CA 92680

re: 10841

Dear Ed:

Please find enclosed the laboratory analysis report, quality assurance summary, and the original chain of custody form for four Tedlar bag samples received on May 4, 1993.

The samples were analyzed for methane and total gaseous non-methane organics.

Sincerely,

AtmAA, Inc.

Michael L. Porter
Laboratory Director

Encl.
MLP/krp

AtmAA Inc.
21354 Nordhoff St., Suite 113, Chatsworth, CA 91311 (818) 718-6070 • FAX (818) 718-9779
environmental consultants
laboratory services

LABORATORY ANALYSIS REPORT

Methane & Total Gaseous Non-Methane Organics
Analysis in Tedlar Bag Samples

Report Date:	May 11, 1993
Client:	CARNOT
P.O. No.:	9818
Project No.:	10841
Date Received:	May 4, 1993
Date Analyzed:	May 4, & 5, 1993

ANALYSIS DESCRIPTION

Methane and total gaseous non-methane organics were measured by flame ionization detection/total combustion analysis portion (FID/TCA).

AtmAA Lab No.:	91243-5	91243-6	91243-7	91243-8
Sample I.D.:	3-1-HC	3-2-HC	3-3-HC	3-4-HC
Components	(Concentration in ppmv)			
Methane	<1	<1	<1	<1
TGNMO	7.47	11.6	13.4	13.8

TGNMO is total gaseous non-methane organics measured and reported as ppm methane.

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analysis)

Project No.: 10841
Date Received: May 4, 1993
Date Analyzed: May 4, & 5, 1993

Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppmv)			
Methane	3-2-HC	< 1	< 1	---	---
TGNMO	3-2-HC	12.1	11.0	11.6	4.8
	3-3-HC	12.8	14.1	13.4	4.8

A set of 4 Tedlar bag samples laboratory numbers, 91234-(5-8) was analyzed for methane and TGNMO. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean." Repeat analyses are an important part of AtmAA's quality assurance program. The average % Difference from Mean for 2 repeat measurements from the sample set of 4 Tedlar bag samples is 4.8%.

AtmAA Inc.
21354 Nordhoff St., Suite 113, Chatsworth, CA 91311 (818) 718-6070 • FAX (818) 718-9779
environmental consultants
laboratory services

May 13, 1993 LTR/176/93

Ed Filadelfia
CARNOT
15991 Red Hill Ave. Suite 110
Tustin, CA 92680

re: 10841

Dear Ed:

Please find enclosed the laboratory analysis report, quality assurance summary, and the original chain of custody form for nine Tedlar bag samples received on May 6, 1993.

The samples were analyzed for methane and total gaseous non-methane organics.

Sincerely,

AtmAA, Inc.

Michael L. Porter
Laboratory Director

Encl.
MLP/krp

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LABORATORY ANALYSIS REPORT

Methane & Total Gaseous Non-Methane Organics Analysis in Tedlar Bag Samples

Report Date: May 12, 1993
Client: CARNOT
P.O. No.: 9821
Project No.: 10841
Date Received: May 6, 1993
Date Analyzed: May 6, 1993

ANALYSIS DESCRIPTION

Methane and total gaseous non-methane organics were measured by flame ionization detection/total combustion analysis portion (FID/TCA).

AtmAA Lab No.:	91263-37	91263-38	91263-39	91263-40	91263-41	91263-42
Sample I.D.:	3-6-HC	3-7-HC	3-8-HC	3-9-HC	3-10-HC	3-11-HC
Components	(Concentration in ppmv)					
Methane	<1	<1	<1	<1	<1	<1
TGNMO	9.00	7.00	7.20	10.3	9.20	8.10

TGNMO is total gaseous non-methane organics measured and reported as ppm methane.

LABORATORY ANALYSIS REPORT

Methane & Total Gaseous Non-Methane Organics
Analysis in Tedlar Bag Samples

Report Date:	May 12, 1993
Client:	CARNOT
P.O. No.:	9821
Project No.:	10841
Date Received:	May 6, 1993
Date Analyzed:	May 6, 1993

ANALYSIS DESCRIPTION

Methane and total gaseous non-methane organics were measured by flame ionization detection/total combustion analysis portion (FID/TCA).

AtmAA Lab No.:	91263-43	91263-44	91263-45
Sample I.D.:	3-12-HC	3-13-HC	3-14-HC
Components	(Concentration in ppmv)		
Methane	<1	<1	<1
TGNMO	8.40	8.35	9.70

TGNMO is total gaseous non-methane organics measured and reported as ppm methane.

Michael L. Porter
Laboratory Director

QUALITY ASSURANCE SUMMARY
(Repeat Analysis)

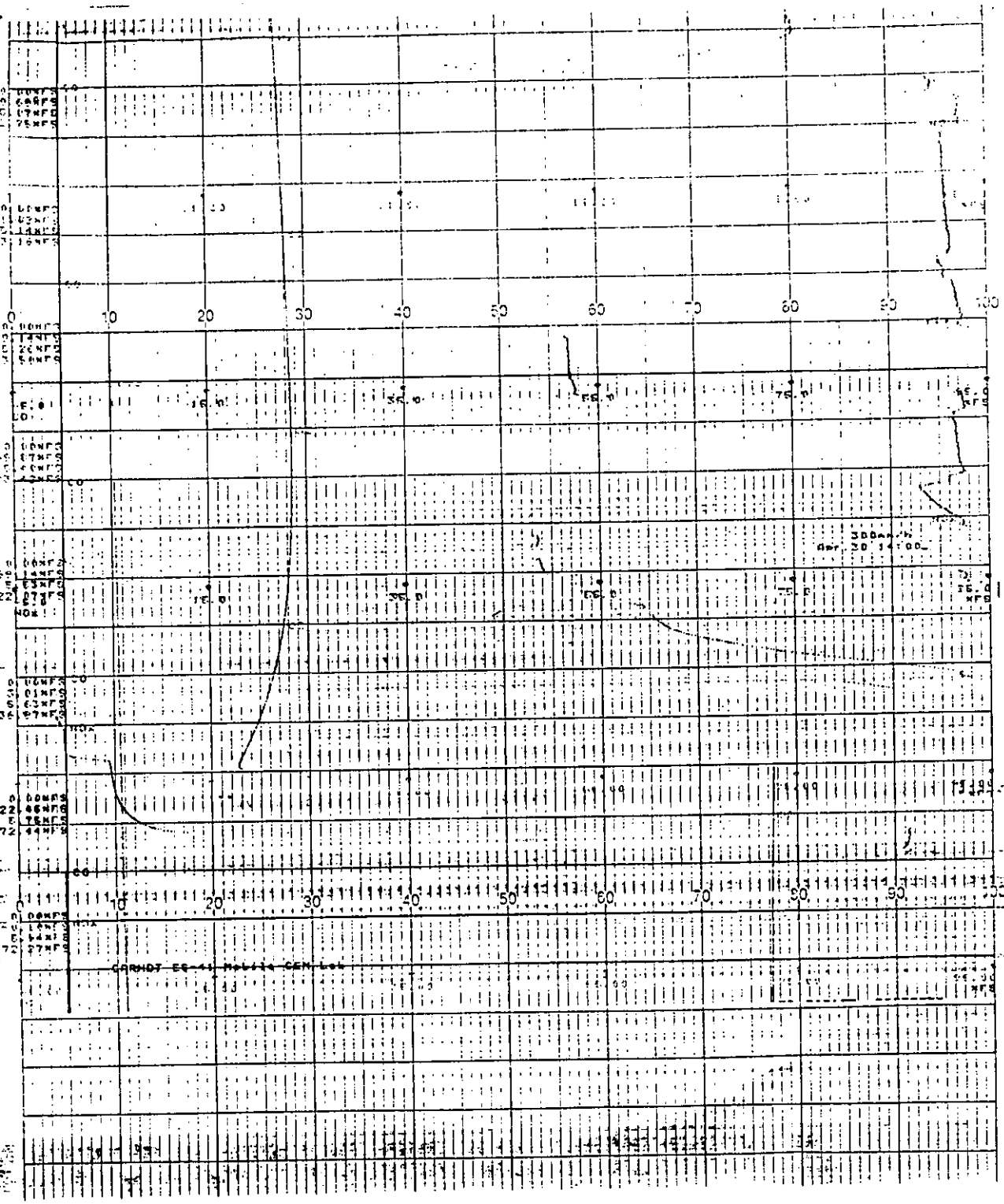
Project No.: 10841
Date Received: May 6, 1993
Date Analyzed: May 6, 1993

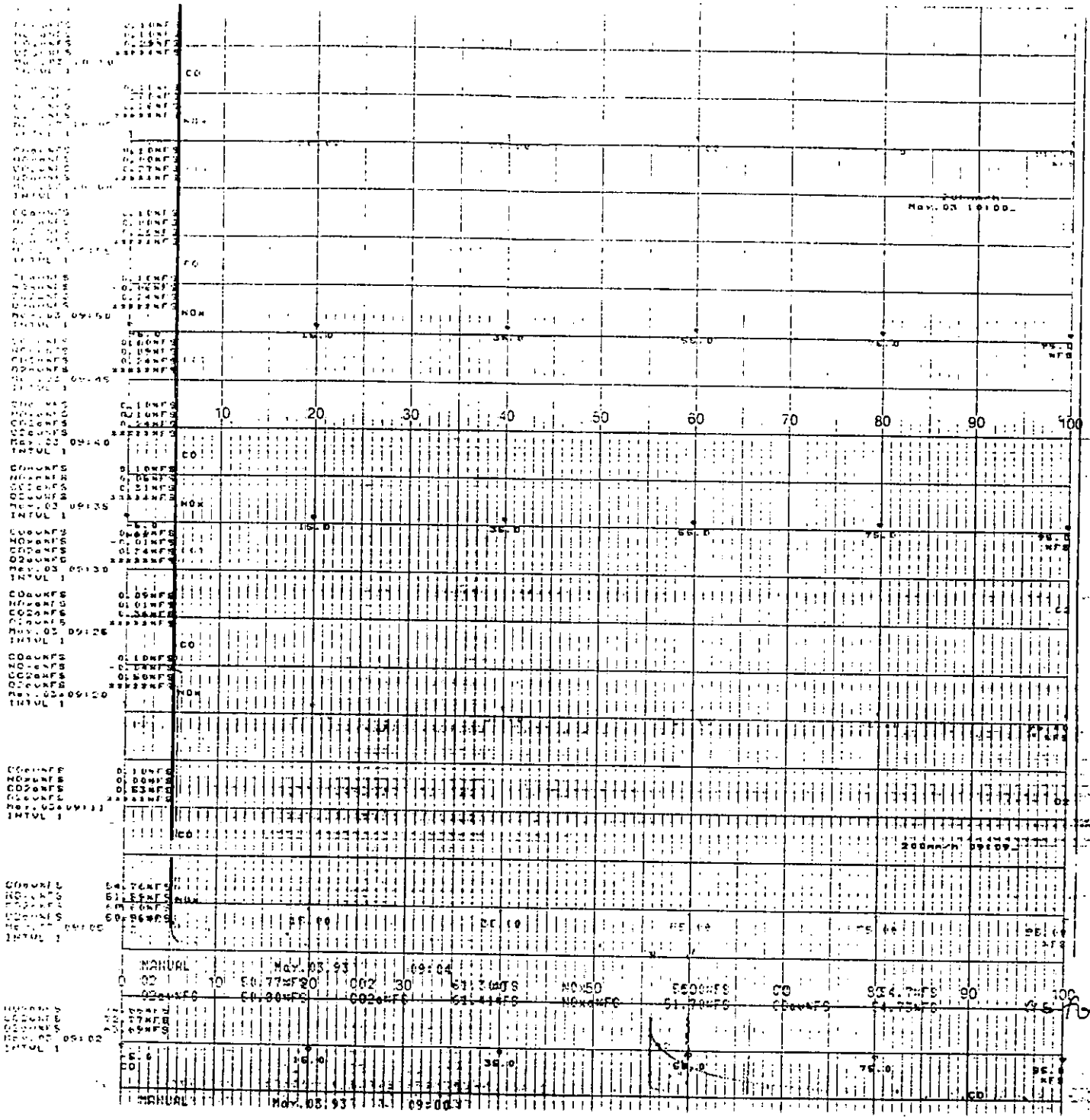
Components	Sample ID	Repeat Analysis Run #1	Repeat Analysis Run #2	Mean Conc.	% Diff. From Mean
		(Concentration in ppmv)			
Methane	3-9-HC	< 1	< 1	---	---
	3-13-HC	< 1	< 1	---	---
TGNMO	3-9-HC	9.60	11.0	10.3	6.8
	3-13-HC	8.30	8.40	8.35	0.60

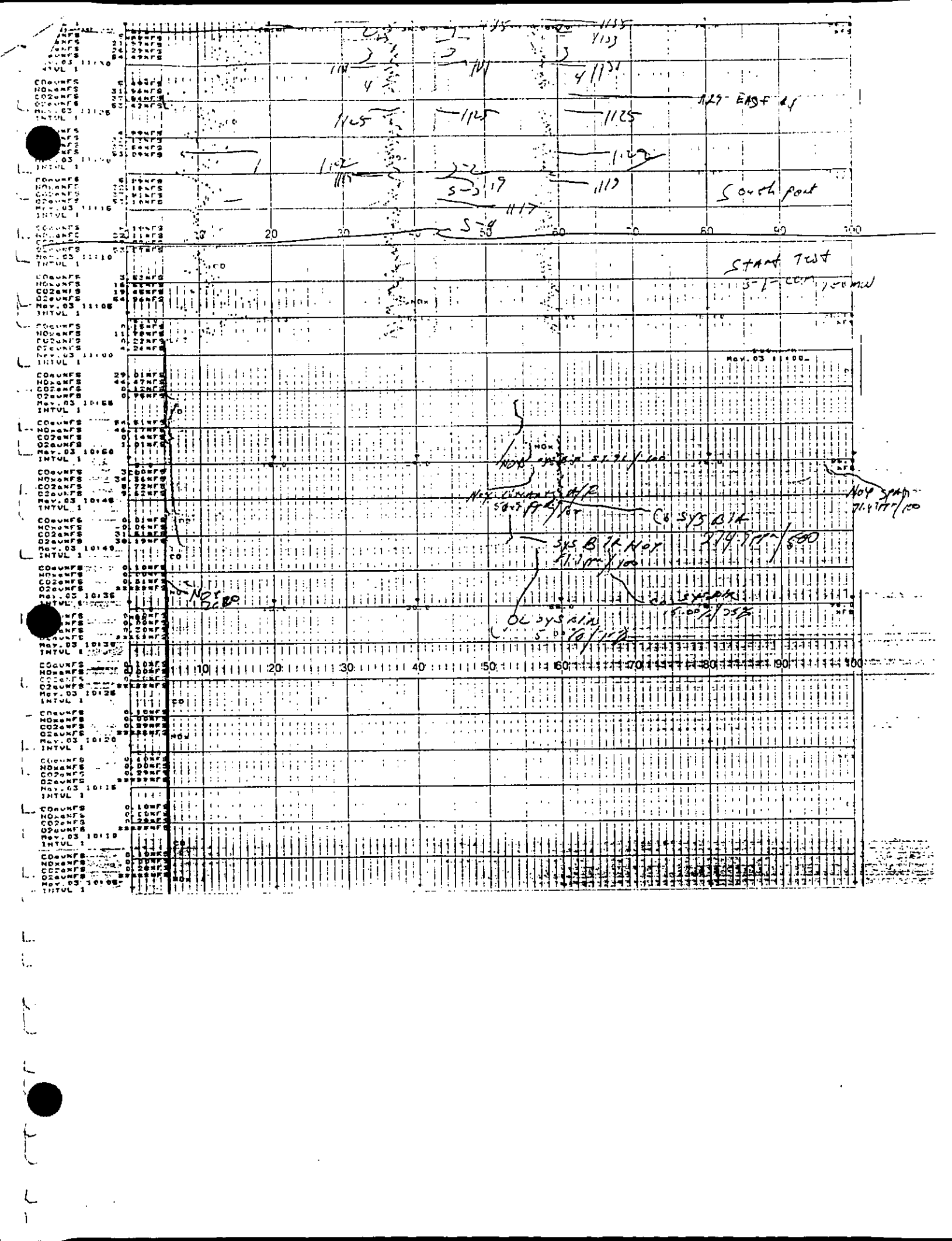
A set of 9 Tedlar bag samples laboratory numbers, 91263-(37-45) was analyzed for methane and TGNMO. Agreement between repeat analyses is a measure of precision and is shown above in the column "% Difference from Mean." Repeat analyses are an important part of AtmAA's quality assurance program. The average % Difference from Mean for 2 repeat measurements from the sample set of 9 Tedlar bag samples is 3.7%.

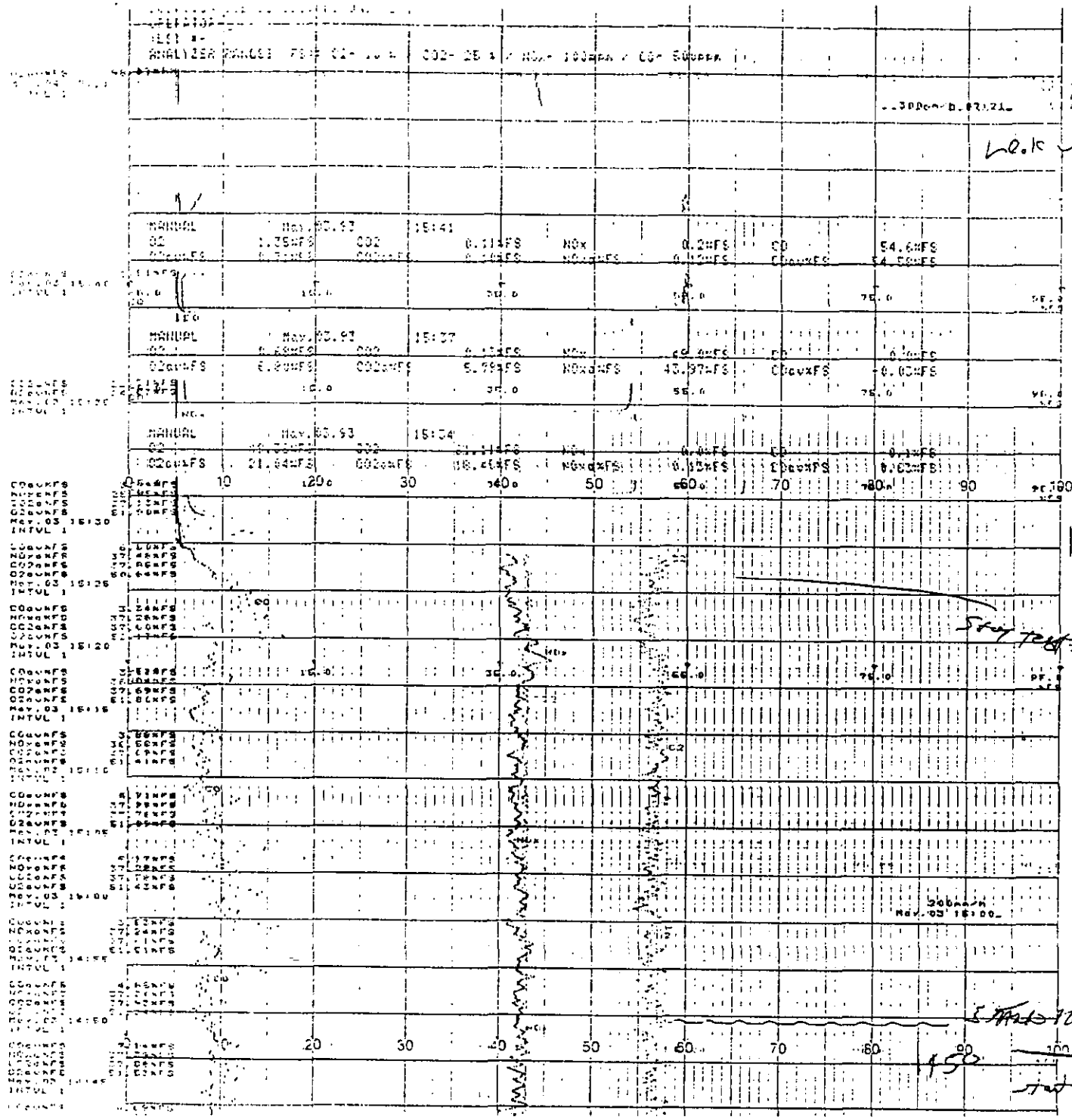
APPENDIX F

INSTRUMENT STRIP CHARTS


0
10
20
30
40
50
60
70
80
90
100
INTVL 1
CARNIDT EE-41 Mobile CEM Lab


10
20
30
40
50
60
70
80
90
100
CO
NOx
MANUAL
May.03.93
09:04
round 2


South port
Start Test
Nov. 03 11:00
Nov. 03 10:50
Nov. 03 10:40
Nov. 03 10:30
Nov. 03 10:20
Nov. 03 10:10
Nov. 03 10:00
INTVL 1
CO
NOx
10
20
30
40
50
60
70
80
90
100


MANUAL
Nov.03.93
15:41
O2
1.75%FS
CO2
0.11%FS
NOx
0.2%FS
CO
54.6%FS
15:37
5.99%FS
43.97%FS
15:34
21.84%FS
0.15%FS
0.02%FS
10
20
30
40
50
60
70
80
90
100
Nov.03 15:30
Nov.03 15:25
Nov.03 15:20
Nov.03 15:15
Nov.03 15:10
Nov.03 15:05
Nov.03 15:00
Nov.03 14:55
Nov.03 14:50
INTVL 1

MANUAL Nov.06.93 07:50

O2	1.10%FS	CO2	0.06%FS	NOx	0.0%FS	CO	0.0%FS
O2dry%FS	21.52%FS	CO2dry%FS	12.29%FS	NOxdry%FS	16.55%FS	COdry%FS	10.64%FS

4/5 low

CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3 PN#: 00-841
OPERATOR-EF JM MR
TEST #: 3-5-CEM
ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100ppm / CO- 500ppm

MANUAL Nov.06.93 07:44

O2	50.76%FS	CO2	61.1[illegible]%FS	NOx	59.[illegible]%FS	CO	54.[illegible]%FS
O2dry%FS	50.87%FS	CO2dry%FS	61.19%FS	NOxdry%FS	49.64%FS	COdry%FS	54.75%FS

as found

CARNOT ES-41 Mobile CEM Lab

MANUAL Nov.06.93 07:40

O2	89.19%FS	CO2	87.93%FS	NOx	91.4%FS	CO	84.1%FS
O2dry%FS	89.25%FS	CO2dry%FS	88.15%FS	NOxdry%FS	91.[illegible]%FS	COdry%FS	84.[illegible]%FS

set high

CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3 PN#: 00-841
OPERATOR-EF JM MR
TEST #: 3-5-CEM
ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100ppm / CO- 500ppm

CO2dryFS	55.57%FS
NOxdryFS	74.76%FS
COdryFS	60.40%FS
O2dryFS	80.[illegible]%FS

Nov.04 07:36 INTVL 1

CO2dryFS	11.62%FS
NOxdryFS	17.26%FS
COdryFS	15.61%FS
O2dryFS	16.[illegible]%FS

Nov.04 07:31 INTVL 1

MANUAL Nov.06.93 07:30

O2	0.64%FS	CO2	0.02%FS	NOx	0.0%FS	CO	0.0%FS
O2dry%FS	0.85%FS	CO2dry%FS	0.10%FS	NOxdry%FS	-0.[illegible]%FS	COdry%FS	0.09%FS

CO2dryFS	18.24%FS
NOxdryFS	0.02%FS
COdryFS	1.[illegible]%FS
O2dryFS	27.60%FS

INTVL 1

CARNOT ES-41 Mobile CEM Lab

CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3
OPERATOR
TEST #:
ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100ppm / CO- 500ppm

Nov.04 07:21 INTVL 1

..300ppm/b_07:21..

Leak check 9:23

1225

CARNOT ES-41 Mobile CEM Lab

CARNOT ES-41 Mobile CEM Laboratory
OPERATOR-EF JM MR
TEST #: 5-8-CEM

0 10 20 30 40 50 60 70 80 90 100

MANUAL Nov.04.93 11:52
O2 0.14%FS CO2 0.11%FS NOx 0.0%FS CO 0.0%FS
O2c%FS 27.47%FS CO2c%FS 31.31%FS NOxc%FS 0.02%FS COc%FS 0.06%FS

MANUAL Nov.04.93 11:50
O2 [illegible]%FS CO2 [illegible]%FS NOx 0.0%FS CO -0.1%FS
O2c%FS [illegible]%FS CO2c%FS [illegible]%FS NOxc%FS 0.07%FS COc%FS 0.03%FS

MANUAL Nov.04.93 11:48
O2 0.79%FS CO2 0.07%FS NOx [illegible] CO [illegible]
O2c%FS 7.98%FS CO2c%FS 2.86%FS NOxc%FS [illegible] COc%FS 0.09%FS

MANUAL Nov.04.93 11:45
O2 [illegible]%FS CO2 [illegible]%FS NOx [illegible] CO [illegible]
O2c%FS 18.65%FS CO2c%FS 4.66%FS NOxc%FS 4.77%FS COc%FS [illegible]

CARNOT ES-41 Mobile CEM Lab

CARNOT ES-41 Mobile CEM Laboratory
OPERATOR-EF JM MR
TEST #: 5-8-CEM

0 10 20 30 40 50 60 70 80 90 100

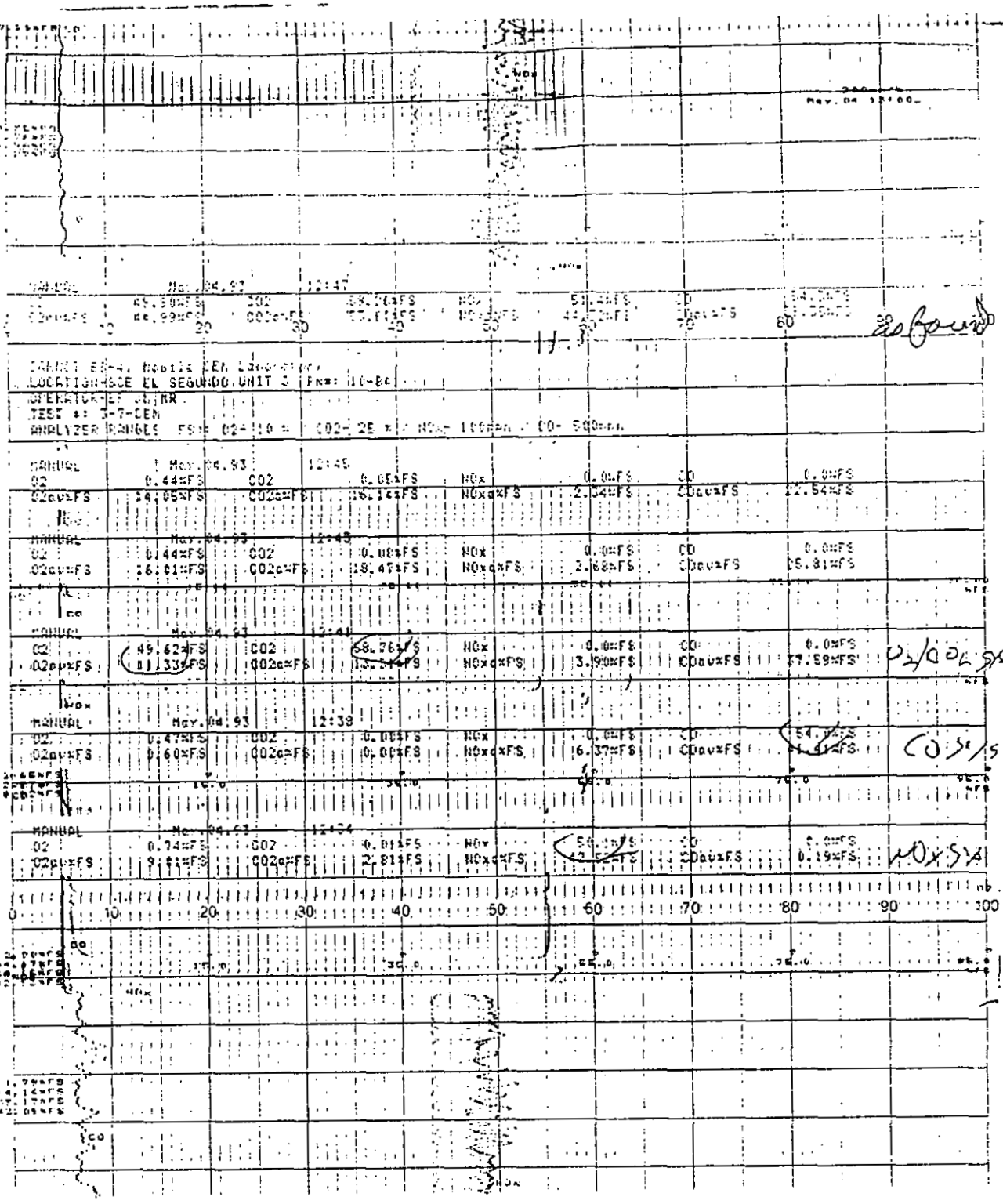
1151 Start

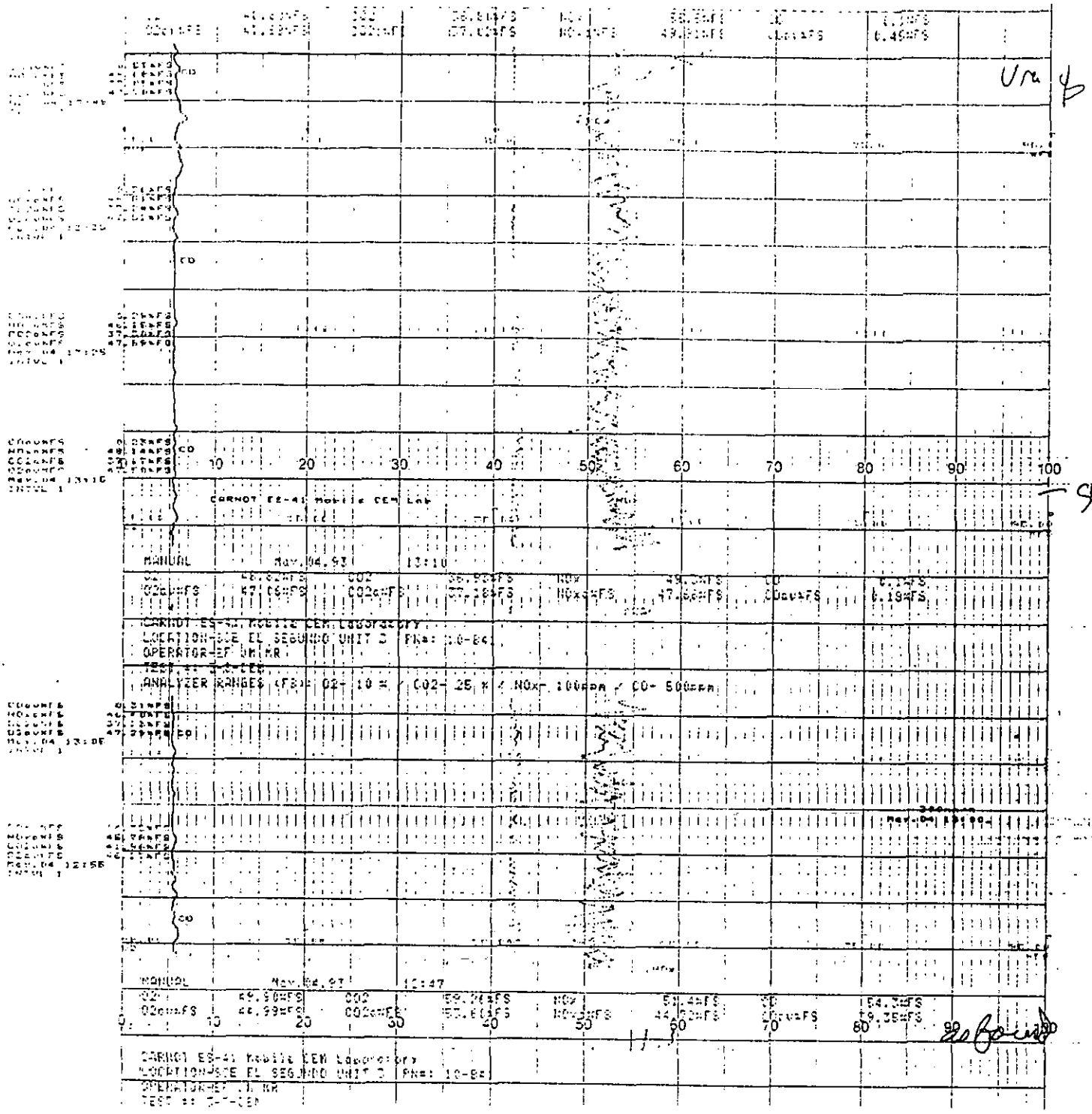
O2 / CO

NOx SPAN

O2 SPAN

STOP


May. 04 12:00
MANUAL May.04.93 12:47
O2 49.39%FS CO2 58.20%FS NOx 51.44%FS CO
O2avx%FS 44.99%FS CO2a%FS 55.11%FS NOxa%FS 47.52%FS COavx%FS
10 20 30 40 50 60 70 80
TARGET EB-4, Mobile CEM Laboratory
LOCATION:SCE EL SEGUNDO UNIT 3 FN#: 10-84
OPERATOR:EF JB,RR
TEST #: 3-7-CEM
ANALYZER RANGES FS= O2= 10 % CO2= 25 % NOx= 100ppm CO= 500ppm
MANUAL May.04.93 12:45
O2 0.44%FS CO2 0.00%FS NOx 0.0%FS CO 0.0%FS
O2avx%FS 14.05%FS CO2a%FS 16.14%FS NOxa%FS 2.54%FS COavx%FS 22.54%FS
MANUAL May.04.93 12:43
O2 0.44%FS CO2 0.00%FS NOx 0.0%FS CO 0.0%FS
O2avx%FS 16.01%FS CO2a%FS 18.47%FS NOxa%FS 2.68%FS COavx%FS 25.81%FS
MANUAL May.04.93 12:41
O2 49.62%FS CO2 58.76%FS NOx 0.0%FS CO 0.0%FS
O2avx%FS 81.33%FS CO2a%FS 96.34%FS NOxa%FS 3.90%FS COavx%FS 37.59%FS
O2/CO2 SPAN
MANUAL May.04.93 12:38
O2 0.47%FS CO2 0.00%FS NOx 0.0%FS CO 54.[illegible]%FS
O2avx%FS 0.60%FS CO2a%FS 0.00%FS NOxa%FS 6.37%FS COavx%FS [illegible]%FS
CO SPAN
MANUAL May.04.93 12:34
O2 0.74%FS CO2 0.01%FS NOx 50.[illegible]%FS CO 0.0%FS
O2avx%FS 9.61%FS CO2a%FS 2.81%FS NOxa%FS [illegible]%FS COavx%FS 0.19%FS
NOx SPAN
0 10 20 30 40 50 60 70 80 90 100
SHUT 1225


CO
10
20
30
40
50
60
70
80
90
100
CARNOT ES-41 Mobile CEM Lab
MANUAL
May.04.93
13:10
CARNOT ES-41 MOBILE CEM LABORATORY
LOCATION-SOLE EL SEGUNDO UNIT 3
OPERATOR-EF BK HR
ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100PPM / CO- 500PPM
MANUAL
May.04.93
13:47
CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SOLE EL SEGUNDO UNIT 3
OPERATOR-EF BK HR

CARNOT ES-41 Mobile CEM Laboratory

LOCATION-SCE EL SEGUNDO UNIT 3 Pnum: 10-841

OPERATOR-EF JH MR

TEST #: 3-9-CEM

ANALYZER RANGES (FS): O2- 10 %, CO2- 25 %, NOx- 100PPM, CO- 500PPM

MANUAL		May.04,93		14:06							
O2	49.87%FS		CO2		59.00%FS	NOx		50.13%FS	CO		54.7%FS
O2cu%FS	49.64%FS		CO2cu%FS		59.03%FS	NOxcu%FS		50.09%FS	COcu%FS		57.05%FS
MANUAL		May.04,93		14:04							
O2	1.36%FS		CO2		0.02%FS	NOx		0.0%FS	CO		0.0%FS
O2cu%FS	2.28%FS		CO2cu%FS		13.75%FS	NOxcu%FS		11.69%FS	COcu%FS		6.32%FS
MANUAL		May.04,93		14:01							
O2	49.67%FS		CO2		59.94%FS	NOx		0.0%FS	CO		0.0%FS
O2cu%FS	52.18%FS		CO2cu%FS		12.71%FS	NOxcu%FS		17.21%FS	COcu%FS		17.70%FS
MANUAL		May.04,93		13:59							
O2	1.44%FS		CO2		0.02%FS	NOx		0.0%FS	CO		54.7%FS
O2cu%FS	2.47%FS		CO2cu%FS		0.01%FS	NOxcu%FS		25.07%FS	COcu%FS		11.95%FS
MANUAL		May.04,93		13:56							
O2	2.22%FS		CO2		0.00%FS	NOx		49.5%FS	CO		0.0%FS
O2cu%FS	3.96%FS		CO2cu%FS		0.04%FS	NOxcu%FS		49.9%FS	COcu%FS		0.04%FS
MANUAL		May.04,93		17:50							
O2	48.68%FS		CO2		56.80%FS	NOx		59.6%FS	CO		0.1%FS
O2cu%FS	47.68%FS		CO2cu%FS		57.02%FS	NOxcu%FS		49.91%FS	COcu%FS		0.45%FS

q s Fam

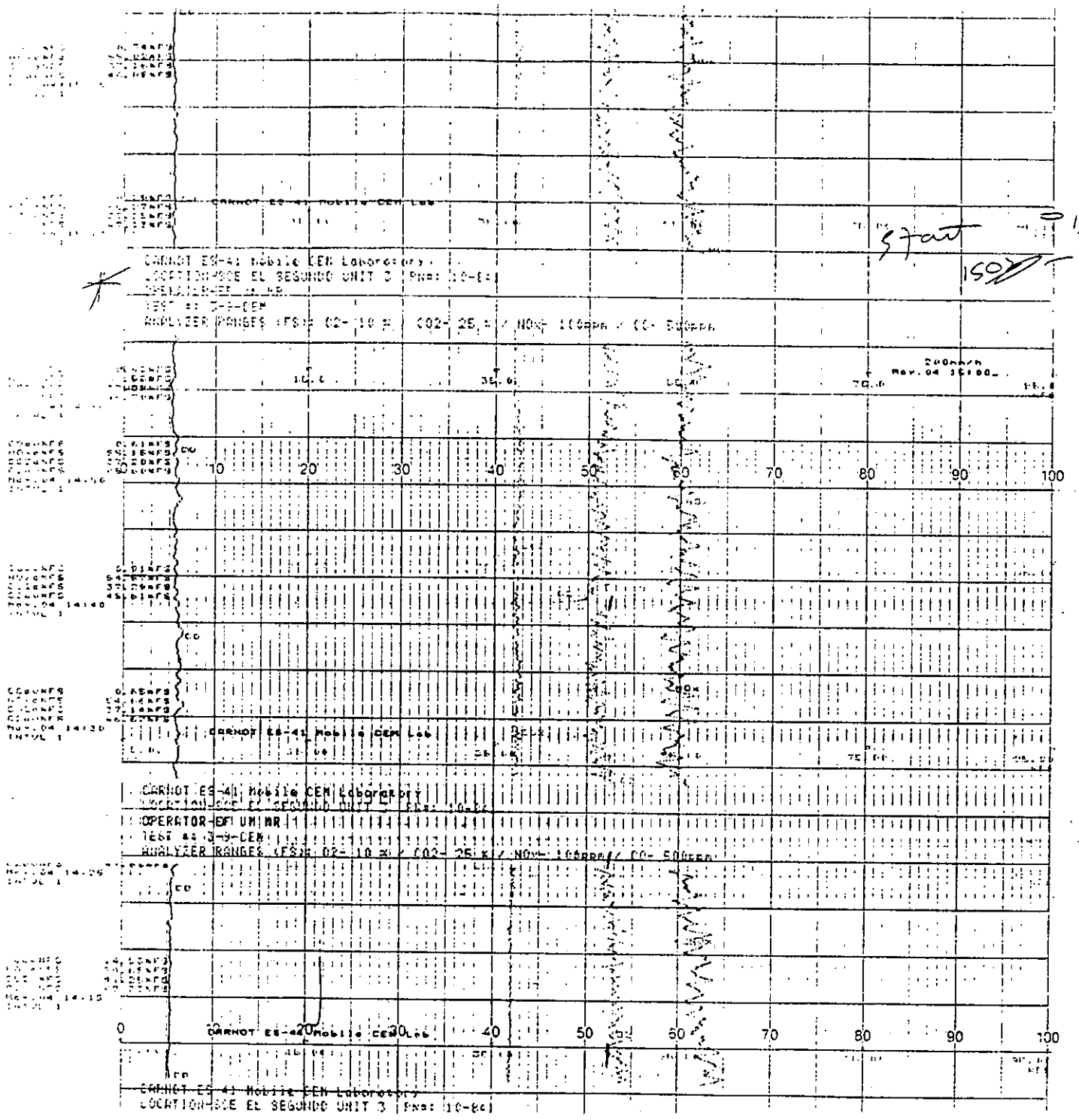
SYS zero

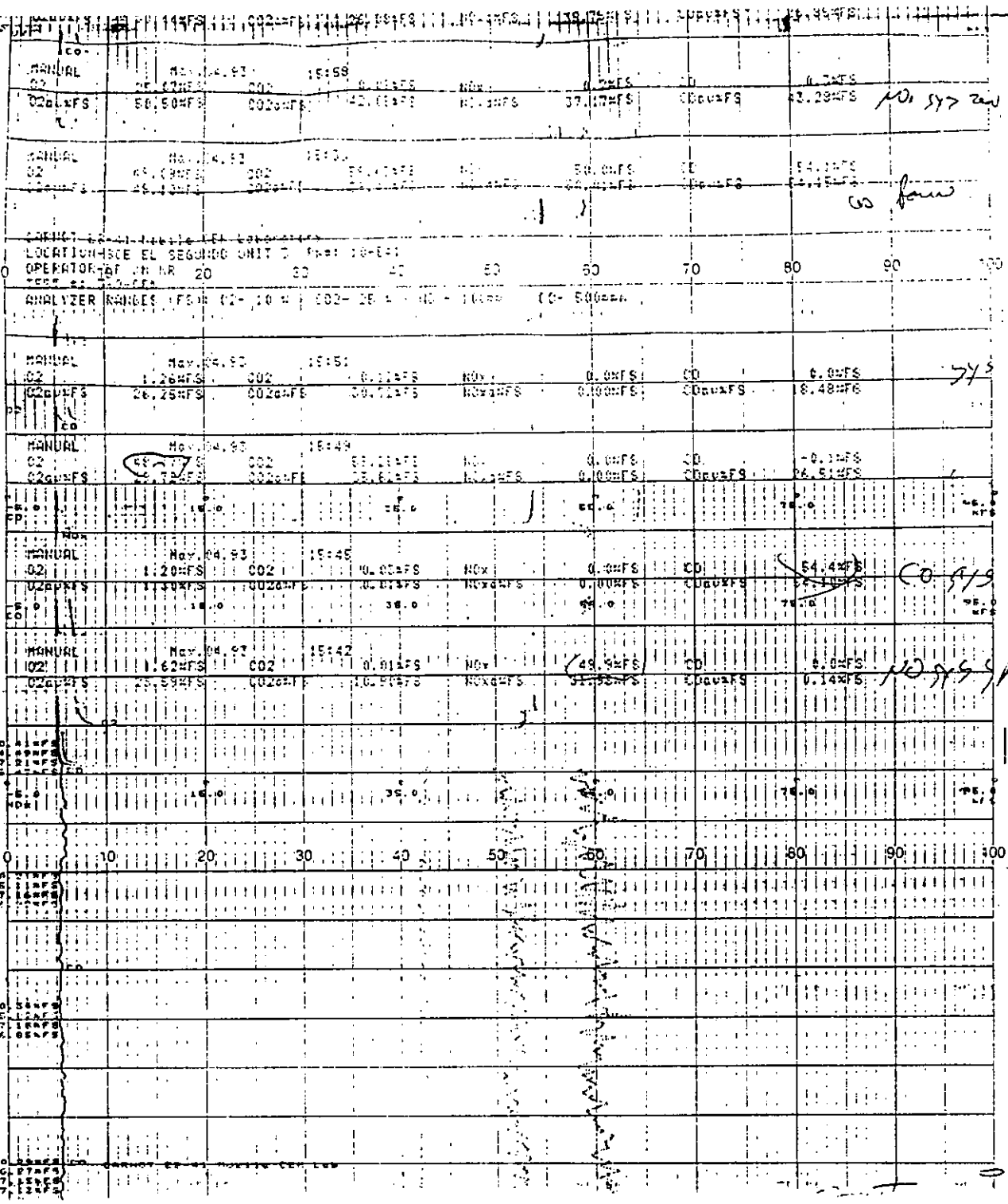
O2 SYS SPAN

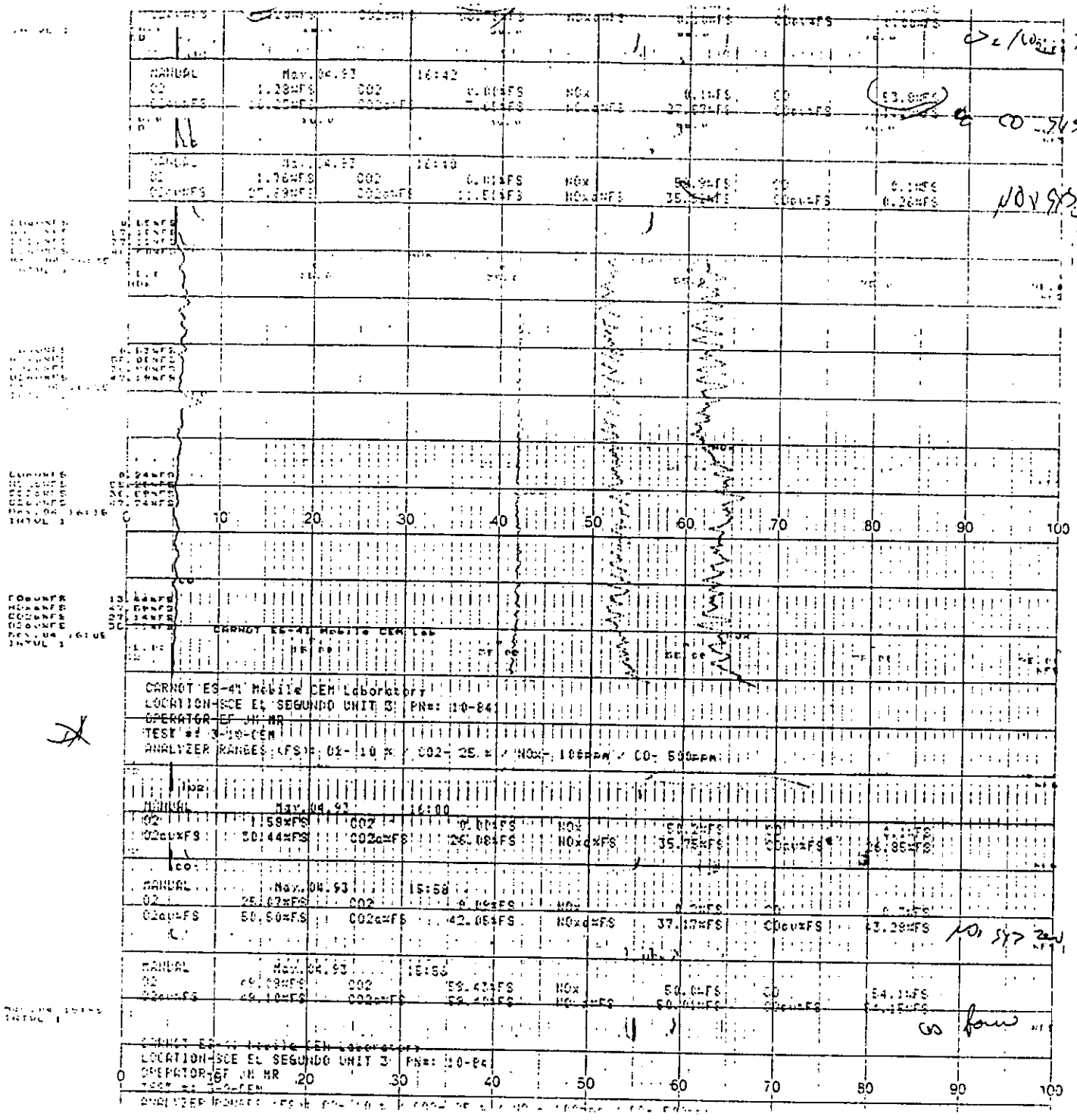
CO >% SPAN

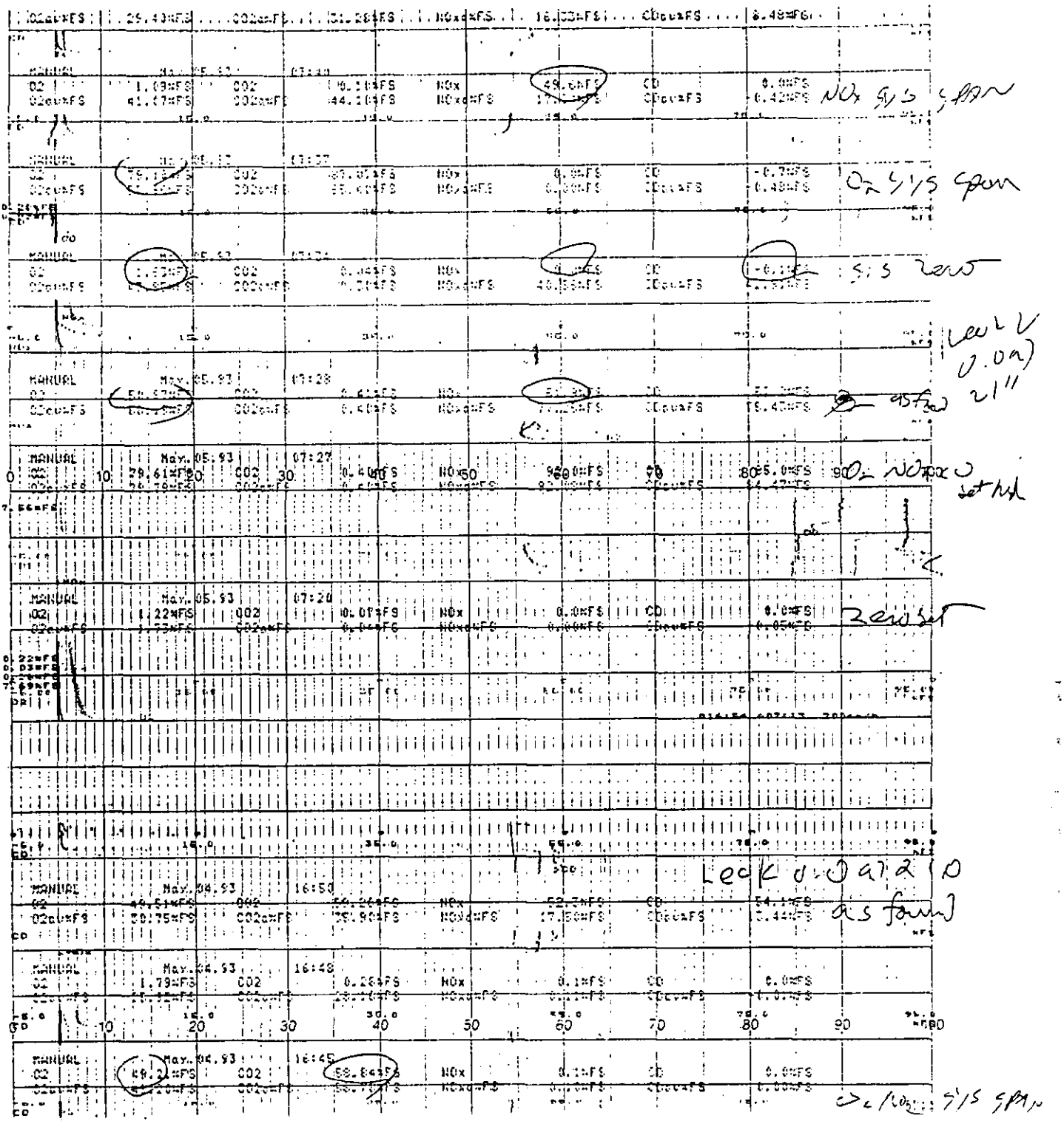
NOx SYS SPA

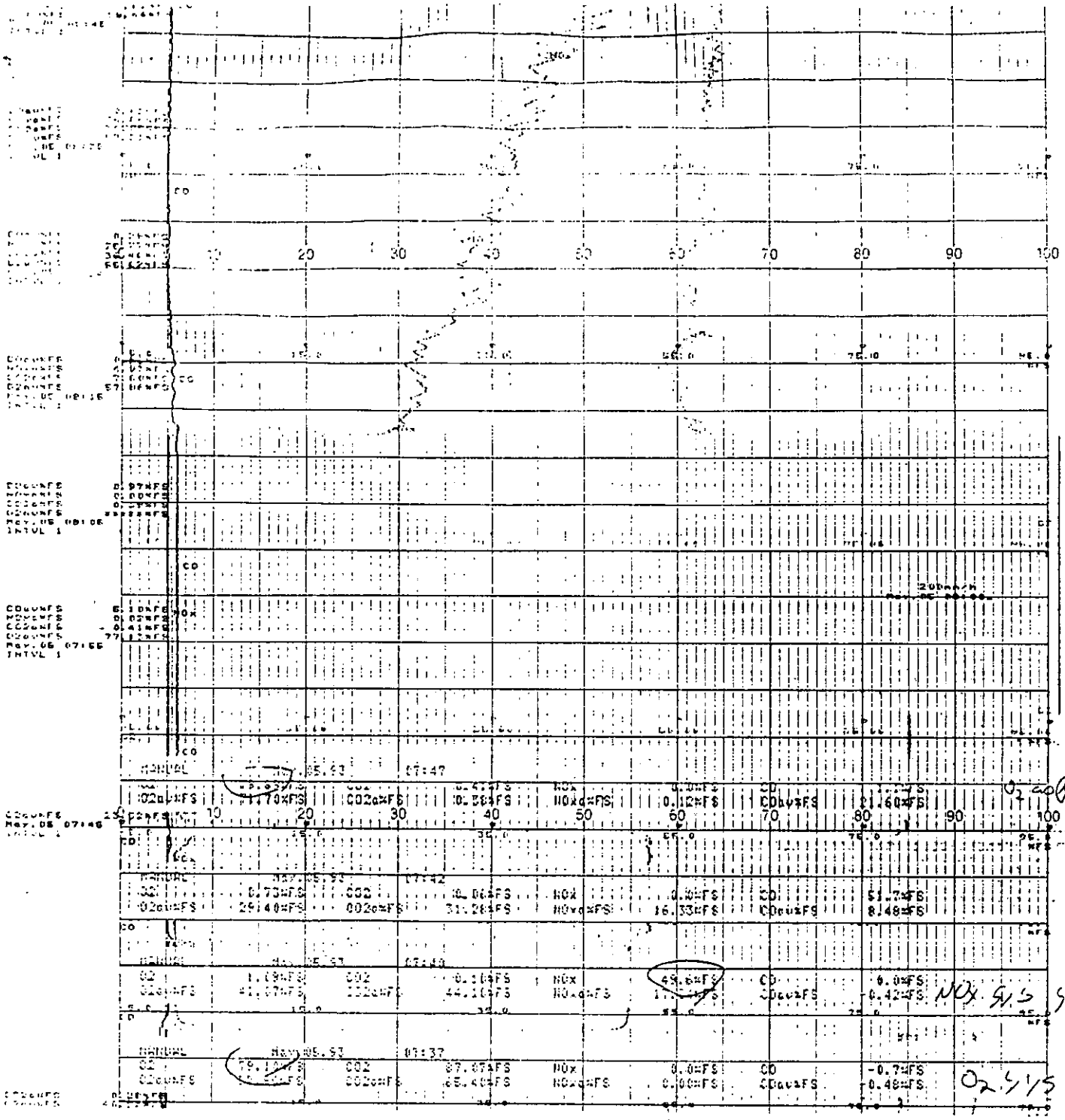
Unit P

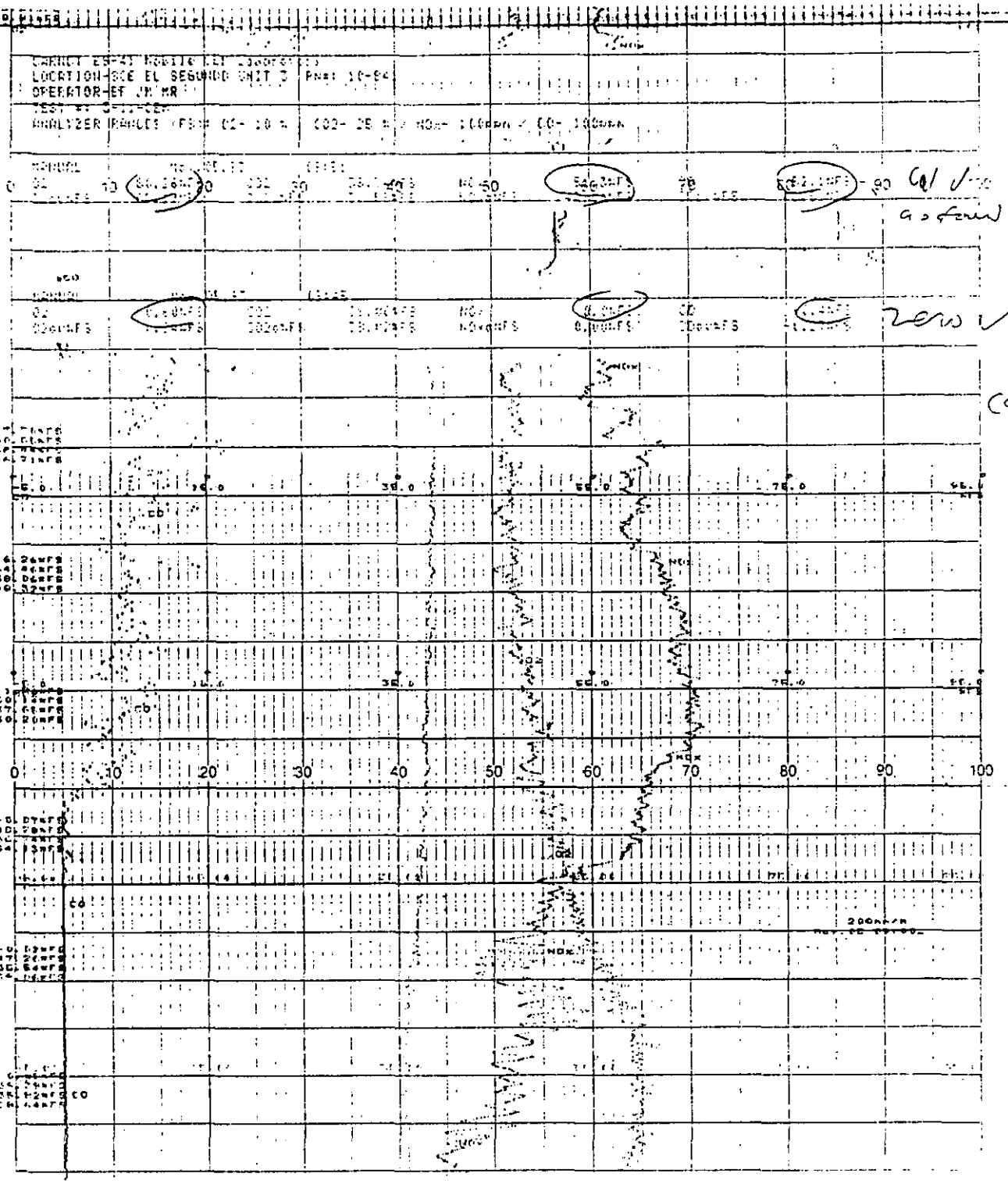

start 1505
1505
CARNOT ES-41 Mobile CEM Lab
CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3
OPERATOR-EFUM MR
TEST #:3-9-CEM
ANALYZER RANGES (FS): O2- 10 %, CO2- 25 %, NOx- 100ppm, CO- 500ppm
0
10
20
30
40
50
60
70
80
90
100


MANUAL
O2
CO2
NOx
CO
LOCATION:HSCE EL SEGUNDO UNIT 2
OPERATOR:
ANALYZER RANGES
CO SPAN
NOx SPAN
1505


MANUAL
O2
CO2
NOx
CO
May.04.93
16:42
16:00
15:58
16:50
CARNOT ES-41 Mobile CEM Lab
LOCATION-SCE EL SEGUNDO UNIT 3
OPERATOR-EF JH MR
ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100ppm / CO- 500ppm
0
10
20
30
40
50
60
70
80
90
100


MANUAL
May. 05.93
07:28
O2
O2cuxFS
CO2
CO2cuxFS
NOx
NOxcuxFS
CO
COcuxFS
NOx S/S SPAN
O2 S/S Span
S/S Zero
Leak V 0.0a) 2"
as found 2"
O2 NOx 0 set pt
Zero set
Leak 0.0a) 2 0
as found
O2 NOx S/S SPAN


CO
NOx
20ppm/M
MANUAL May.05.93 07:47
O2 0.70%FS CO2a%FS 0.58%FS NOxa%FS 0.12%FS COa%FS 21.60%FS
O2 cobra
MANUAL May.05.93 07:42
O2 0.73%FS CO2 0.06%FS NOx 0.0%FS CO 51.7%FS
O2a%FS 29.40%FS CO2a%FS 31.28%FS NOxa%FS 16.33%FS COa%FS 8.48%FS
MANUAL May.05.93 07:40
O2 1.19%FS CO2 0.16%FS NOx 49.6%FS CO 0.0%FS
O2a%FS 41.07%FS CO2a%FS 44.16%FS NOxa%FS COa%FS 0.42%FS
NOx 5/5 span
MANUAL May.05.93 07:37
O2 79.1%FS CO2 87.07%FS NOx 0.0%FS CO -0.7%FS
O2a%FS CO2a%FS 85.40%FS NOxa%FS 0.00%FS COa%FS 0.48%FS
O2 5/5 span


LOCATION-SCE EL SEGUNDO UNIT 3
OPERATOR-EF JM MR
ANALYZER RANGES
Cal ✓
Zero ✓
Cal ✓
0
10
20
30
40
50
60
70
80
90
100

as found

MANUAL May.05.93 10:41
O2 0.7%FS CO2 0.1%FS NOx 0.1%FS CO -0.7%FS
O2dry%FS CO2dry%FS NOxdry%FS COdry%FS

sys zero

MANUAL May.05.93 10:33
O2 5.43%FS CO2 16.66%FS NOx 0.2%FS CO -0.8%FS
O2dry%FS CO2dry%FS NOxdry%FS 21.00%FS COdry%FS 11.23%FS

O2 sys span

MANUAL May.05.93 10:36
O2 0.1%FS CO2 0.04%FS NOx 0.1%FS CO 12.1%FS
O2dry%FS CO2dry%FS NOxdry%FS 29.00%FS COdry%FS

CO sys span

MANUAL May.05.93 10:34
O2 0.92%FS CO2 0.05%FS NOx 0.6%FS CO -0.1%FS
O2dry%FS 15.50%FS CO2dry%FS 7.80%FS NOxdry%FS 40.0%FS COdry%FS 8.56%FS

NOx sys span

0 10 20 30 40 50 60 70 80 90 100

CO2dry%FS 38.64%FS
O2dry%FS 46.00%FS
Nov.05 10:20
INTVL 1

CO2dry%FS 38.61%FS
O2dry%FS 46.12%FS
Nov.05 10:10
INTVL 1

CO2dry%FS 38.55%FS
O2dry%FS 46.22%FS
Nov.05 10:00
INTVL 1

200ppm/m
Nov.05 10:00

CARNOT E9-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3 PN#: 110-84
OPERATOR-EF JN,MR
TEST #: 5-11-CEM
ANALYZER RANGES (FS): O2- 10 %; CO2- 25 %; NOx- 100ppm; CO- 100ppm

MANUAL May.05.93 09:5
O2 80.26%FS CO2 38.34%FS NOx 54.3%FS 82.1%FS
O2dry%FS CO2dry%FS NOxdry%FS

Cal

as found

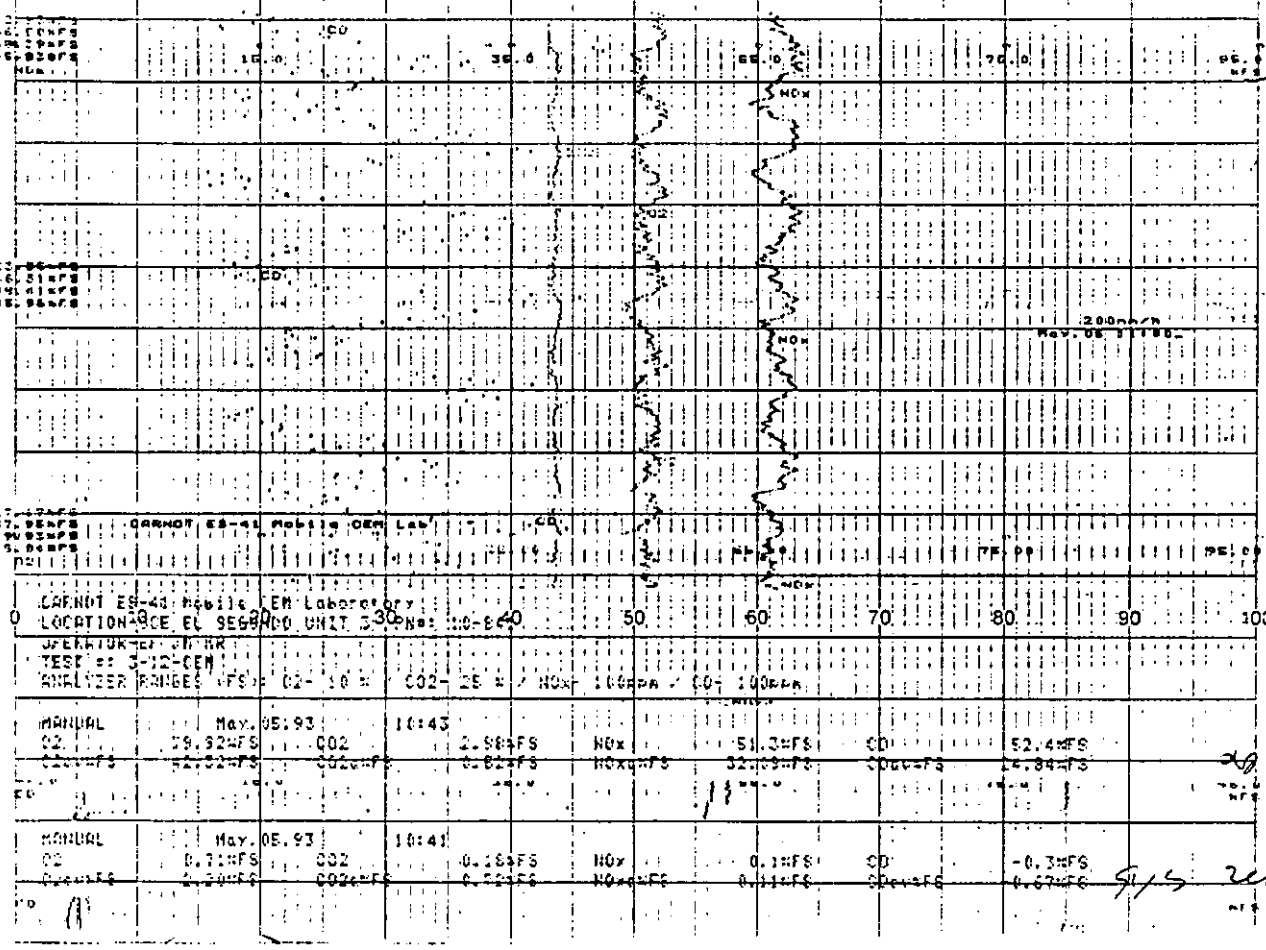
MANUAL May.05.93 11:34
O2 .72%FS CO2 0.01%FS NOx 0.1%FS CO -0.4%FS
O2dry%FS .28%FS CO2d%FS 0.02%FS NOxd%FS 17.3%FS COdry%FS -1.4%FS
sys zero

MANUAL May.05.93 11:32
O2 0.84%FS CO2 0.02%FS NOx 49.3%FS CO 2.7%FS
O2dry%FS 1.18%FS CO2d%FS 0.04%FS NOxd%FS 10.4%FS COdry%FS 52.04%FS
NOx sys span

MANUAL May.05.93 11:30
O2 1.03%FS CO2 0.15%FS NOx 0.1%FS CO 52.3%FS
O2dry%FS 1.18%FS CO2d%FS 0.21%FS NOxd%FS 0.1%FS COdry%FS
10 sys span

0 10 20 30 40 50 60 70 80 90 100

CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3 PNo: 10-84
OPERATOR-EF JN RR
TEST #: 3-12-CEM
ANALYZER RANGES FS: O2- 10 % CO2- 25 % / NOx- 100ppm / CO- 100ppm



top view on

0 10 20 30 40 50 60 70 80 90 100

CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 3 PNo: 10-84
OPERATOR-EF JN RR
TEST #: 3-12-CEM
ANALYZER RANGES FS: O2- 10 % CO2- 25 % / NOx- 100ppm / CO- 100ppm

start

MANUAL May.05.93 10:43
O2 19.92%FS CO2 2.98%FS NOx 51.3%FS CO 52.4%FS
O2dry%FS 22.32%FS CO2d%FS 3.82%FS NOxd%FS 32.03%FS COdry%FS 14.84%FS
29 pm

MANUAL May.05.93 10:41
O2 0.71%FS CO2 0.18%FS NOx 0.1%FS CO -0.3%FS
O2dry%FS 0.20%FS CO2d%FS 0.22%FS NOxd%FS 0.11%FS COdry%FS 0.67%FS
sys zero

CARNOT ES-41 Mobile CEM Lab

LOCATION-SCE EL SEGUNDO UNIT 7 Date: 10-Sep
OPERATOR-EF JH AR

ANALYZER RANGES (FS): O2- 10 % / CO2- 25 % / NOx- 100ppm / CO- 100ppm

CARNOT ES-41 Mobile CEM Lab

MANUAL	May.05.93		11:40							
O2	51.30%FS	CO2	27.21%FS	NOx	68.5%FS	CO	52.2%FS			
O2dv%FS	39.67%FS	CO2d%FS	25.55%FS	NOxd%FS	26.10%FS	COdv%FS	[illegible]%FS			
MANUAL	May.05.93		11:38							
O2	79.81%FS	CO2	0.65%FS	NOx	51.7%FS	CO	52.4%FS			
O2dv%FS	[illegible]%FS	CO2d%FS	[illegible]%FS	NOxd%FS	[illegible]%FS	COdv%FS	[illegible]%FS			
MANUAL	May.05.93		11:36							
O2	20.39%FS	CO2	86.59%FS	NOx	0.2%FS	CO	-1.0%FS			
O2dv%FS	[illegible]%FS	CO2d%FS	21.05%FS	NOxd%FS	11.72%FS	COdv%FS	14.69%FS			
MANUAL	May.05.93		11:34							
O2	[illegible]%FS	CO2	0.01%FS	NOx	0.1%FS	CO	-0.4%FS			
O2dv%FS	[illegible]%FS	CO2d%FS	0.02%FS	NOxd%FS	17.78%FS	COdv%FS	12.72%FS			
MANUAL	May.05.93		11:32							
O2	0.54%FS	CO2	0.02%FS	NOx	49.8%FS	CO	2.7%FS			
O2dv%FS	1.18%FS	CO2d%FS	0.04%FS	NOxd%FS	[illegible]%FS	COdv%FS	42.04%FS			
MANUAL	May.05.93		11:30							
O2	1.63%FS	CO2	0.05%FS	NOx	0.1%FS	CO	52.3%FS			
O2dv%FS	1.18%FS	CO2d%FS	0.05%FS	NOxd%FS	0.10%FS	COdv%FS	[illegible]%FS			

0 10 20 30 40 50 60 70 80 90 100

CARNOT ES-41 Mobile CEM Lab

0 10 20 30 40 50 60 70 80 90 100

Start

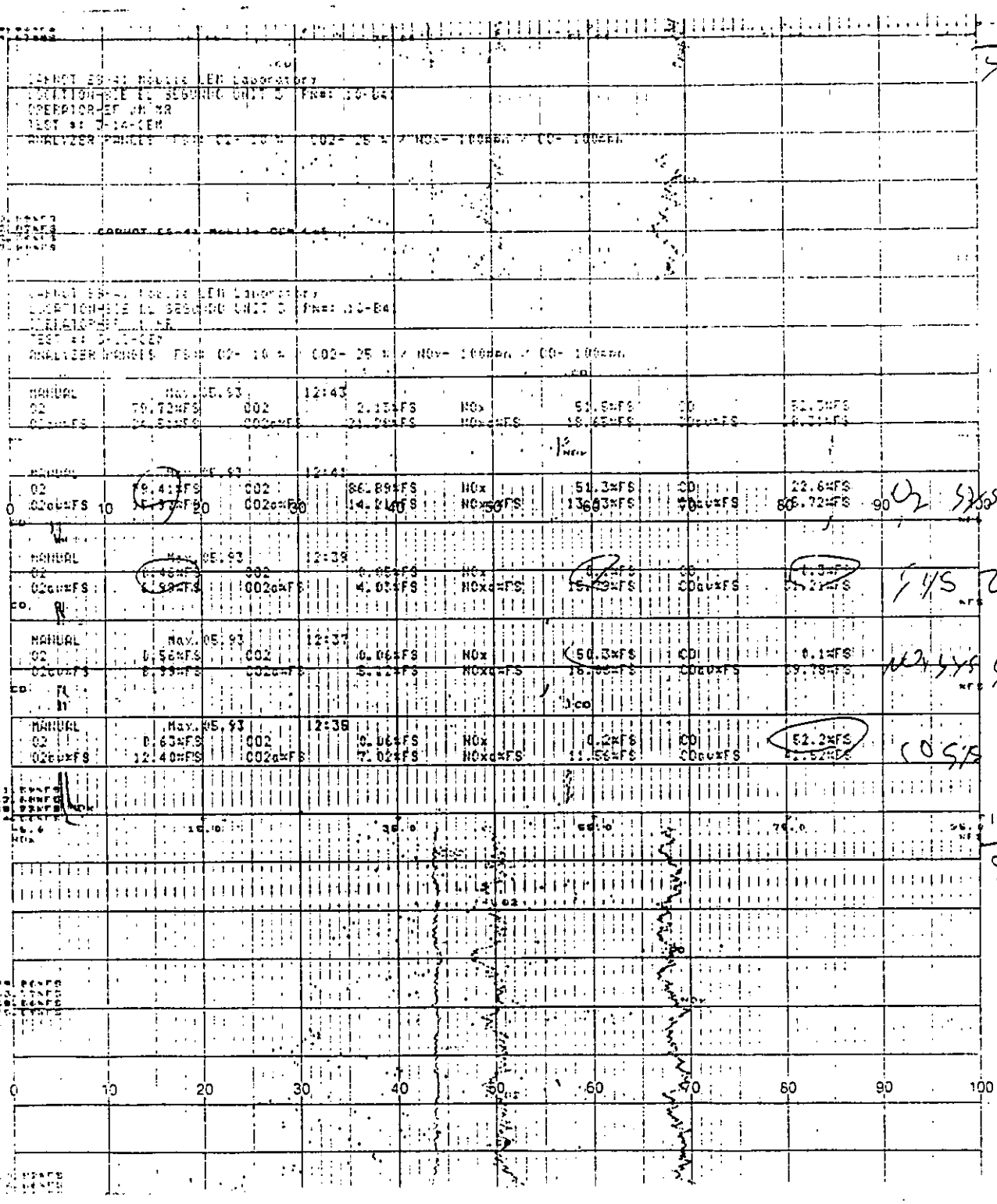
NOx/O2 as found

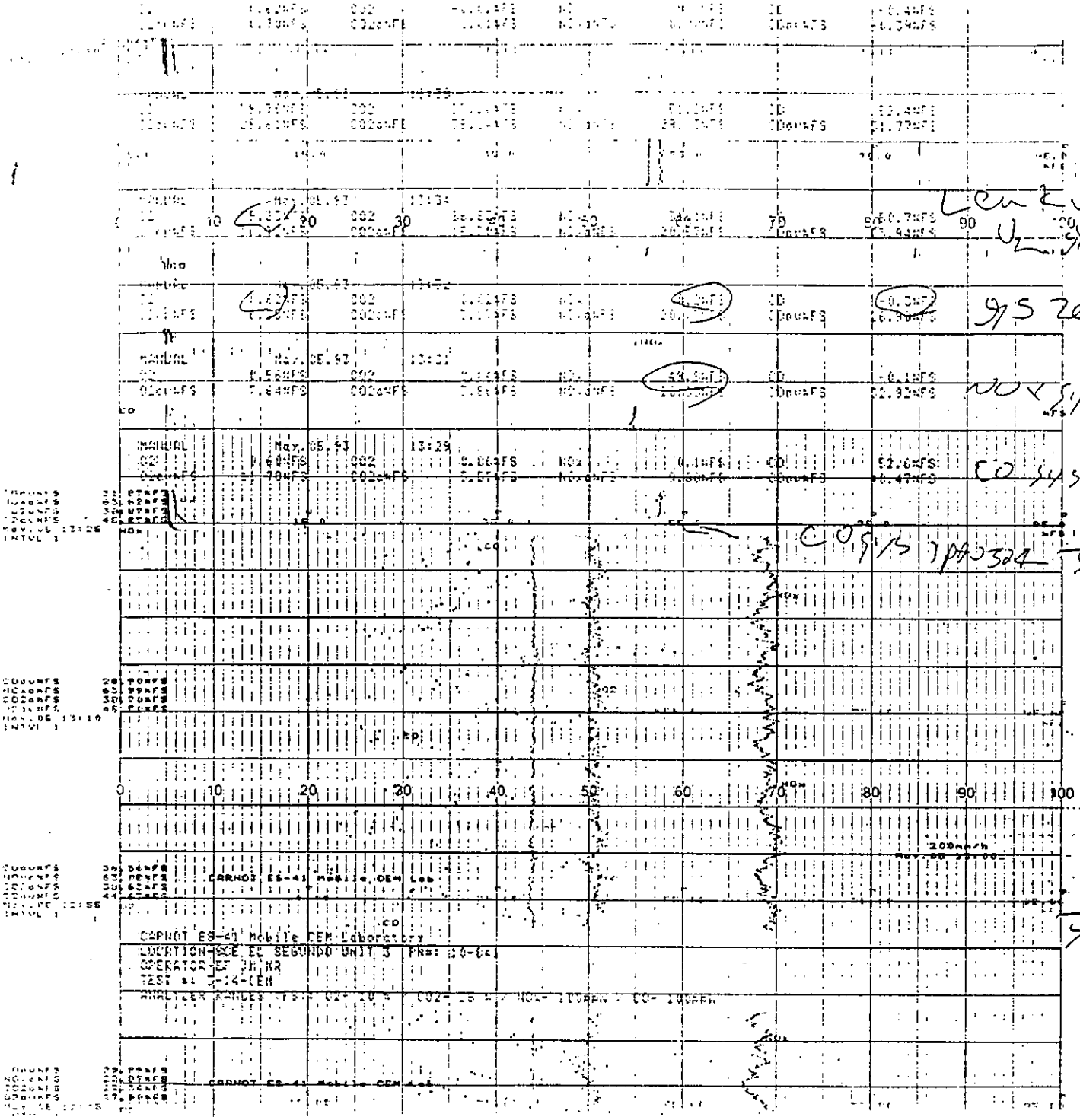
O2 SYS SPAN

SYS zero

NOx SYS SPAN

O2 SYS SPAN


Start
MANUAL Max. 05.93 12:43
O2 79.72%FS CO2 2.13%FS NOx 51.5%FS CO 52.3%FS
MANUAL Max. 05.93 12:41
O2 79.41%FS CO2 86.89%FS NOx 51.3%FS CO 22.6%FS
O2 SYS SPAN
MANUAL Max. 05.93 12:39
O2 0.45%FS CO2 0.05%FS NOx 0.2%FS CO 1.3%FS
SYS zero
MANUAL Max. 05.93 12:37
O2 0.56%FS CO2 0.06%FS NOx 50.3%FS CO 0.1%FS
O2 SYS SPAN
MANUAL Max. 05.93 12:35
O2 0.63%FS CO2 0.06%FS NOx 0.2%FS CO 52.2%FS
CO SYS SPAN
STOP
0 10 20 30 40 50 60 70 80 90 100


Leak 0.0021
O2 sys span
sys zero
NOx sys span
CO sys span
CO sys span
Stop
Start
CARNOT ES-41 Mobile CEM Laboratory
LOCATION-SCE EL SEGUNDO UNIT 5
OPERATOR-EF JH,KR
TEST #: 3-14-CEM

APPENDIX G
CHAIN OF CUSTODY

CERTIFICATION OF SAMPLE RECEIPT

PROJECT # 10 841 OUTSIDE LAB REQUIRED (Y/N) Y SAMPLE DATE 5/3/93

CLIENT/LOCATION PROJECT MANAGER EF

SAMPLE LOCATION STACK METHOD(S) SCAQMD 25.2 TECHNICIAN WM/JM/MR

COMPLIANCE TEST (Y/N) Y DATE DUE 5/11/93

	TEST #	COMPLETE DESCRIPTION
243-5	3-1-HC	1 TEDLAR BAG
-6	3-2-HC	1 TEDLAR BAG
-7	3-3-HC	1 TEDLAR BAG
-8	3-4-HC	1 TEDLAR BAG

CHAIN OF CUSTODY PRIOR TO SHIPMENT:

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
Derek Kumm	5/4/93	9:18	Goldsmo R-O-W	5/4/93	9:18
	/ /	:		/ /	:
	/ /	:		/ /	:

OUTSIDE LAB INFORMATION

SAMPLES SHIPPED TO MIKE PORTER
ATM AA, INC.
CHATSWORTH, CA
PHONE: (818) 718-6070

CARNOT SHIPPER DEREK KUMM
DATE 5/4/93
CARRIER # Right O' Way
AIR BILL #

RECIPIENT [signature]
COMPANY ATM AA, Inc.
DATE 5-4-93

15991 Red Hill Ave., Suite 110, Tustin, California 92680-7388 (714) 259-9520 - FAX (714) 259-0372

CARNOT

PML-001

CERTIFICATION OF SAMPLE RECEIPT

PROJECT # 10841 OUTSIDE LAB REQUIRED (Y/N) Y SAMPLE DATE 5/4/[illegible] 5/15/[illegible]3

CLIENT/LOCATION _____ PROJECT MANAGER EF

SAMPLE LOCATION STACK METHOD(S) SCAQMD 25.2 TECHNICIAN JM/MR

COMPLIANCE TEST (Y/N) Y DATE DUE 5/12/93

TEST #	COMPLETE DESCRIPTION
11268-3 B-6-HC	Gas sample in a Tedlar bag
-38 3-7-HC	Gas sample in a Tedlar bag
-39 3-8-HC	Gas sample in a Tedlar bag
-40 3-9-HC	Gas sample in a Tedlar bag
-41 3-10-HC	Gas sample in a Tedlar bag
-42 3-11-HC	Gas sample in a Tedlar bag
-43 3-12-HC	Gas sample in a Tedlar bag
-44 3-13-HC	Gas sample in a Tedlar bag
-45 3-14-HC	Gas sample in a Tedlar bag

CHAIN OF CUSTODY PRIOR TO SHIPMENT:

RELEASED BY	DATE	TIME	RECEIVED BY	DATE	TIME
Wayne Madd	5/6/93	10:05	ISI #68	5/6/93	10:05
	/ /	:		/ /	:
	/ /	:		/ /	:

OUTSIDE LAB INFORMATION

SAMPLES SHIPPED TO MIKE PORTER
ATMAA, INC.
CHATSWORTH, CA
PHONE: (818) 718-6070

CARNOT SHIPPER WAYNE MADDEN
DATE 5/6/93
CARRIER # Right O' Way
AIR BILL # _____

RECIPIENT Karl R. Paten
COMPANY AtmAA
DATE 5-6-93

15991 Red Hill Ave., Suite 110, Tustin, California 92680-7388 (714) 259-9520 - FAX (714) 259-0372

CARNOT

PML-001