MOBIL OIL CORPORATION

P.O. BOX 1007

CHALMETTE, LOUISIANA 70044

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ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

OXIDES OF NITROGEN and CARBON MONOXIDE EMISSION TESTING on K-401 COMPRESSOR

APRIL 2-3, 1990

Submitted By :

EMISSION TESTING SERVICES, INC.

POST OFFICE BOX 15075

BATON ROUGE, LOUISIANA 70895

90027

EMISSION TESTING SERVICES, INC.

POST OFFICE BOX 15075

BATON ROUGE, LOUISIANA 70895

CONFIRMATION OF INFORMATION

EMISSION TEST REPORT

FOR

MOBIL OIL CORPORATION

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OXIDES OF NITROGEN and CARBON MONOXIDE
EMISSION TESTING
on
K-401 COMPRESSOR

APRIL 2-3, 1990

I certify that I have personally examined and am familiar with the information submitted herein, and based on my inquiries of those individuals immediately responsible for obtaining the information, I believe the submitted information is true, accurate, and complete.

Lisa Sutton
Mobil Oil Company
Representative

Fred Dowling
Emission Testing Services
Senior Consultant

Barry Gipson
Emission Testing Services
Manager

OXIDES OF NITROGEN and CARBON MONOXIDE
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on
K-401 COMPRESSOR

APRIL 2-3, 1990

for

MOBIL OIL CORPORATION

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I. INTRODUCTION

Mobil Oil Corporation contracted Emission Testing Services, Inc. to conduct emission testing on the FCC Compressor #2, K-401, source ID 51, located at Mobil's facility at Chalmette, Louisiana. Emissions of oxides of nitrogen and carbon monoxide were determined in order to demonstrate compliance within permit levels set forth by the State of Louisiana, Department of Environmental Quality permit number 2500-00005-02.

Compressor #2 was manufactured by Ingersoll-Rand, model number 85VG, serial number 8A5147. A natural gas fueled internal combustion engine, rated at 400 Bhp at 375 rpm, drives the compressor.

Emissions were determined using EPA Method 7E, as modified by proposed subpart FF, for oxides of nitrogen emissions, and EPA Method 10 for carbon monoxide emissions. EPA Methods 1-4 were used to determine the number and location of traverse points and stack gas moisture, velocity, and dry molecular weight.

Testing was conducted by the testing team consisting of Fred Dowling, Billy Magee, and Kevin Thibodeaux. Lisa Sutton represented Mobil and coordinated testing with plant operations. The State of Louisiana, Department of Environmental Quality was not represented during the test.

Emissions were determined on April 2-3, 1990 during three test runs while the compressor was operating at maximum load conditions. Mobil personnel recorded unit operating conditions during the test and collected a fuel gas sample for analysis.

II. SUMMARY

Emissions data collected from the K-401 Compressor during testing on April 2-3, 1990 are tabulated below. Oxides of nitrogen data, lb/hr only, are reported corrected as outline in proposed Subpart FF, Part 60, Title 40 of the Code of Federal Regulations.

MOBIL OIL CORPORATION

K-401 COMPRESSOR

PARAMETER	PERMIT LIMIT	RUN 1	RUN 2	RUN 3	AVG.
DATE		4- 2-90	4- 3-90	4- 3-90	
TIME		1620-1719	832- 933	1015-1114	
OXIDES OF NITROGEN					
(lb/hr)	9.77	13.670	16.686	16.626	15.661
(PPM)		2870.81	3458.28	3316.41	3215.17
CARBON MONOXIDE					
(lb/hr)	1.23	1.229	0.341	0.351	0.640
(PPM)		518.2	145.7	147.9	270.6
OXYGEN - test monitor (%)		0.36	0.81	0.98	0.72
ENGINE SPEED - rpm		365	364	364	364
HORSEPOWER - Bhp		401	401	401	401
STACK GAS DATA					
TEMPERATURE, F		763	839	830	811
MOISTURE, %		18.78	17.25	17.50	17.84
VELOCITY, ft/ sec		76.43	77.97	78.72	77.71
FLOW RATE, ACFM		1551.2	1582.3	1597.6	1577.0
, DSCFM		543.5	536.8	543.7	541.3

III. PROCEDURE

Emissions were determined using EPA Methods found in Appendix A, Part 60, Title 40 of the Code of Federal Regulations. A brief description of each method used follows.

METHOD 1: SAMPLE AND VELOCITY TRAVERSES FOR STATIONARY SOURCES

The K-401 Compressor had a stack diameter of 7.875 in. Samples and measurements were collected at a point 2.03 stack diameters upstream and 4.00 stack diameters downstream from the nearest flow disturbances. Method 1 was not applicable for this stacks since the diameter was less than 12 in.; however, in the absence of any other guidance, the method was used. For this stack, the method required 16 traverse points. During sampling the stack cross-section at the sampling point was divided into 16 equal areas with the sampling point located in the centroid of each area. Test points 1, 8, 9, and 16 were calculated to be less than 0.5 in. from the stack wall. These points were relocated to 0.5 in. from the stack wall.

METHOD 2: DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE (TYPE S PITOT TUBE)

The average gas velocity in the stack was determined from the gas molecular weight, moisture content and the average velocity head measured using a type "S" pitot tube. Dry volumetric flow rate was determined from the velocity and stack diameter.

METHOD 3: GAS ANALYSIS FOR CARBON DIOXIDE, OXYGEN, EXCESS AIR, AND DRY MOLECULAR WEIGHT

The dry molecular weight of the stack gas was determined using an Orsat analyzer. The Orsat measured the concentration of oxygen, carbon monoxide and carbon dioxide. The remaining gas components were assumed to be nitrogen. A gas sample was extracted from the centroid of the stack using a stainless steel probe fitted with a particulate filter. The probe, sample lines, and orsat were purged sufficiently to obtain a representative grab sample for analysis.

METHOD 3A: DETERMINATION OF OXYGEN CONCENTRATIONS IN EMISSIONS FROM STATIONARY SOURCES. (INSTRUMENTAL ANALYZER PROCEDURE)

A gas sample was continuously extracted from the stack using a heated probe and sample line. The sample was transferred to an oxygen analyzer for analysis of oxygen concentration. Analyzer output was continuously recorded by a computer data acquisition system. Results from the oxygen monitor were used for reference purposes only and were not used to determine stack gas molecular weight.

METHOD 4: DETERMINATION OF MOISTURE CONTENT IN STACK GASES

A gas sample was extracted from the stack using a heated glass probe fitted with a particulate filter. The sample gas passed from the probe, through a series of four impingers immersed in an ice bath. The first two impingers contained measured volumes of water, the third was empty, and the fourth contained a known weight of silica gel. Any water vapor in the gas stream was condensed and trapped in the impingers. Moisture was determined gravimetrically.

METHOD 7E: DETERMINATION OF NITROGEN OXIDES EMISSIONS FROM STATIONARY SOURCES

A gas sample was continuously extracted from the stack at a centroidal sampling point. The sample was transferred through a heated sample line to continuous chemiluminescence analyzer for the determination of oxides of nitrogen concentration.

METHOD 10: DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

A gas sample was continuously extracted from the stack at a centroidal sampling point. The sample was transferred through a heated sample line to a continuous nondispersive infrared analyzer for the determination of carbon monoxide concentration

IV. ANALYTICAL TECHNIQUE

All sample analysis were conducted following EPA methodology. A brief description follows for each method employed.

METHOD 7E: DETERMINATION OF NITROGEN OXIDES EMISSIONS FROM STATIONARY SOURCES

All samples collected were analyzed at the laboratory using a continuous chemiluminescence analyzer. The analyzer was calibrated using gas standards prepared by EPA protocol number 1, traceable to NBS standards.

METHOD 10: DETERMINATION OF CARBON MONOXIDE EMISSIONS FROM STATIONARY SOURCES

All samples collected were analyzed at the laboratory using a continuous nondispersive infrared analyzer. The analyzer was calibrated using gas standards prepared by EPA protocol number 1, traceable to NBS standards.

V. CHAIN of CUSTODY

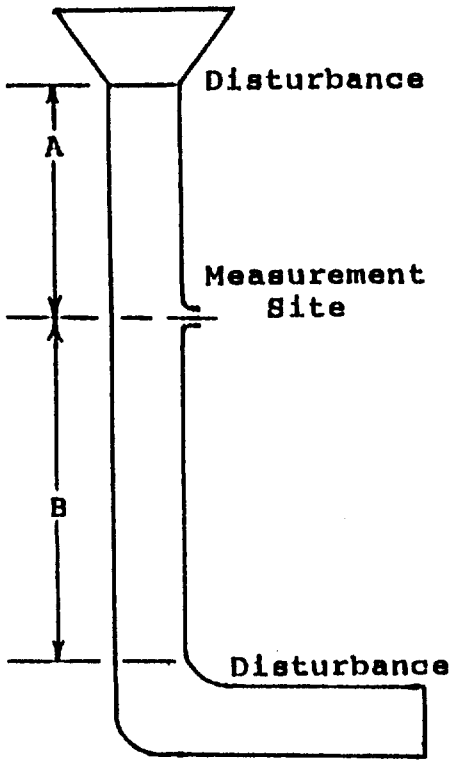
Chain of custody procedures are initiated for all samples transported to the laboratory for analysis. The emission testing conducted produced no samples requiring transport to the laboratory for analyses as all analyses were completed in the field.

VI. TEST DATA & CALCULATIONS

All emission test field data, unit operations data, and laboratory analytical data are contained in this section along with the associated data reduction calculations.

Data from the field data sheets were manually input into a computer for data processing and calculations. Integrity of data input is maintained by using a double entry system. The computer performed all calculations and produced the calculations and results summary pages. Input data accuracy were further verified by comparison of raw field data to the computer data printed on the summary pages. Computer program integrity and calculations verification are validated by processing a known set of data. Further controls on the computer program are conducted by comparison of manual spot calculations of the raw data input to computer calculations results.

Traverse Point Layout



Client: Mobil

Date: 032890

Unit Tested: K-401 Compressor

Location: Chalmette, LA.

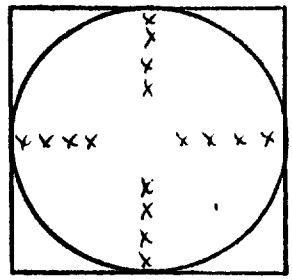
Upstream Distance (A): 16.0"

Downstream Distance (B): 31.5"

Inside Diameter: 7.875"

Coupling Length: 6.0"

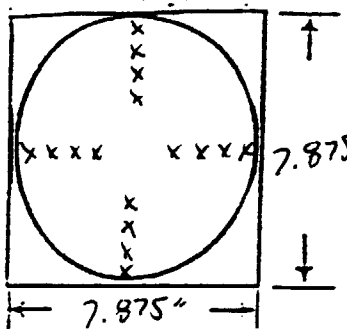
Coupling Type: 3" Male Screwon



Cross Section Schematic of Stack

Traverse Point	Distance % of Diameter		Stack Diameter		Coupling Length		Traverse Points
1	0.032	x	7.875"	+	6.0"	=	~~6.252~~ 6.50
2	0.105						6.827
3	0.194						7.528
4	0.323						8.544
5	0.677						11.331
6	0.806						12.347
7	0.895						13.048
8	0.968		7.875"		6.0"		~~13.623~~ 13.375
9							
10							
11							
12	Note Had to Relocate first & last Point to within 0.50						

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 09 02 90
LOCATION Chalmette, LA.
OPERATOR K. Thibodeaux
STACK NO. K-401
RUN NO. 1

SAMPLE BOX NO. BL
METER BOX NO. 500
AMBIENT TEMPERATURE 78°F
BAROMETRIC PRESSURE 29.91
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 7.875"
PITOT TUBE NO. P-3-5
PITOT FACTOR 0.781
METER Δ Hₒ 1.8270
D.G.M.C. FACTOR 1.0101
K FACTOR N/A

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H_2O)	STACK TEMP (Ts), °F	VELOCITY HEAD (ΔP_s)	($\sqrt{\Delta P_s}$)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H_2O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	16:26	on @	790	.890	.943	1.5	1.5	129.950	84	83	241	64	3.5
2		-0.280	799	.905	.951								
3	16:56	off @	834	.900	.949	1.5	1.5	150.941	106	96	239	55	3.6
4			842	.895	.946								
5			846	.890	.943								
6			853	.885	.941								
7			859	.895	.946								
8			863	.905	.951								
9	17:59	on @	665	.845	.919	1.5	1.5	150.941	99	98	270	59	3.7
10			670	.850	.922								
11	17:29	off @	772	.870	.933	1.5	1.5	171.962	115	107	238	59	3.9
12			828	.870	.933								
13			843	.860	.927								
14			871	.855	.925								
15			871	.890	.943								
16			873	.900	.949								
AVERAGE	60 min	-0.280	817.19		.939	1.5		42.012	98.50				

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	752.5	646.0	465.6	613.6
INITIAL	589.6	622.7	463.5	604.8
WEIGHT CHANGED	162.9	23.3	2.1	8.8
TOTAL WEIGHT				197.1

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	10.6	0.6	0.0	88.8
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 9.5" Hg. -.010 CFM
POST-LEAK CHECK GOOD @ 5.0" Hg. -.008 CFM

Wet: 73°F
Dry: 78°F

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 2-90
Run : 1

DETERMINATION OF STACK GAS MOISTURE CONTENT

Bws - Moisture fraction content
dH - Pressure differential across meter orifice, in H2O
Mw - Molecular weight of water, 18.0 lb/ lb mole
Pb - Barometric pressure at meter, in-Hg
Pst - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft3/ lb-mole deg R
Tm - Absolute temperature at meter, deg R
Tst - Standard absolute temperature, 528 deg R
Vm - Dry gas volume measured by meter, DCF
Vmstd- Dry gas volume at standard conditions, DSCF
Vw - Volume of water vapor collected, SCF
Wwc - Weight of water vapor collected, lb
I1w, I2w, I3w, weight of water condensed by impingers, g
SGw, weight of water collected by silica gel, g
Y - Dry gas meter calibration factor

$$Wwc = (I1w + I2w + I3w + SGw) / (453.6\ g/lb)$$

$$= (162.9 + 23.3 + 2.1 + 8.8) / (453.6) = .43452$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.43452)(21.85)(528)}{(29.92)(18.0)} = 9.30818$$

$$Vmstd = Vm\ Y \frac{(Pb + dH/13.6)}{Pst} \frac{Tst}{Tm}$$

$$= (42.012)(1.0101) \frac{(29.910 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(559.)}$$

$$= 40.25334$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(9.30818)}{(9.30818 + 40.25334)} = .1878$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 2-90
Run : 1

DETERMINATION OF DRY MOLECULAR WEIGHT

Md - Dry molecular weight, lb/ lb-mole
%CO2 - Percent CO2 by volume (dry basis)
%O2 - Percent O2 by volume (dry basis)
%CO - Percent CO by volume (dry basis)
%N2 - Percent N2 by volume (dry basis)
0.280 - Molecular weight of N2 or CO, divided by 100
0.320 - Molecular weight of O2, divided by 100
0.440 - Molecular weight of CO2, divided by 100

$$Md = 0.440(\%CO2) + 0.320(\%O2) + 0.280(\%N2 + \%CO)$$

$$Md = 0.440(10.6) + 0.320(.6) + 0.280(88.8 + .0)$$

$$= 29.720$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 2-90
Run : 1

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

A - Cross-sectional area of stack, ft2
Bws - Moisture fraction of stack gas
Cp - Pitot tube coefficient
dP - Avg., square root of velocity head, (in-H2O)**0.5
Kp - Pitot tube constant,
ft/sec (lb in-Hg/ lb-mole deg R in H2O)**0.5
Md - Molecular weight of stack gas, dry basis, lb/ lb-mole
Ms - Molecular weight of stack gas, wet basis, lb/ lb-mole
Pbar - Barometric pressure at measurement site, in-Hg
Pg - Static pressure of the stack gas, in H2O
Ps - Absolute stack gas pressure, in-Hg
Pstd - Standard absolute pressure, 29.92 in-Hg
Acf - Actual stack gas flow rate, ACF/min
Qsd - Dry volumetric stack gas flow rate
standard conditions, DSCF/Hr
Ts - Average stack gas temperature, deg R
Tstd - Standard absolute temperature, 528 deg R
Vs - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec to Hr
18.0 - Molecular weight of water, lb/lb-mole

$$Ms = Md\ (1 - Bws) + 18.0\ (Bws) =$$

$$= (29.720)(1 - .1878) + (18.0)(.1878) = 27.519$$

$$Vs = Kp\ Cp\ dP \left(\frac{Ts}{Ps\ Ms}\right)^{0.5} =$$

$$= (85.49)(.7810)(.9389)\left(\frac{1223.}{[29.889][27.519]}\right)^{0.5} = 76.4334$$

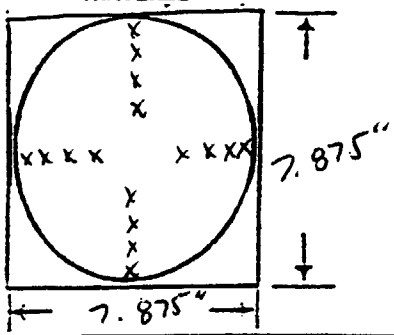
$$Acf = (60)(Vs)(A) = (60)(76.4334)(.3382) = 1551.2$$

$$Qsd = 3600\ (1 - Bws)\ Vs\ A\ \frac{Tstd}{Ts}\ \frac{Ps}{Pstd} =$$

$$Qsd = 3600(1 - .1878)(76.4334)(.3382)\frac{(528)(29.889)}{(1223.)(29.92)}$$

= 32604.6 DSCFH
= 543.4 DSCFM

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 04 03 90
LOCATION Chalmette, LA.
OPERATOR K. Thibodeaux
STACK NO. K-401
RUN NO. 2

SAMPLE BOX NO. BT
METER BOX NO. 500
AMBIENT TEMPERATURE 60°F
BAROMETRIC PRESSURE 30.19
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 7.875"
PITOT TUBE NO. P-3-5
PITOT FACTOR 0.781
METER Δ He 1.8270
D.G.M.C. FACTOR 1.0101
K FACTOR N/A

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in.H₂O)	STACK TEMP (Ts), °F	VELOCITY HEAD (ΔPs)	(√ΔPs)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	(Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	0834	on ⊘	840	.885	0.941	1.5	1.5	172.101	64	65	240	59	4.8
2		-0.205	840	.890	0.943								
3	0904	off ⊘	837	.870	0.933	1.5	1.5	192.837	96	85	267	44	4.9
4			844	.870	.933								
5			839	.885	.941								
6			844	.880	.938								
7			849	.885	.941								
8			852	.905	.951								
9	0907	on ⊘	823	.870	.933	1.5	1.5	192.837	80	80	272	45	4.9
10			829	.880	.938								
11	0937	off ⊘	828	.870	.933	1.5	1.5	213.840	106	98	235	56	4.9
12			824	.865	.930								
13			834	.875	.935								
14			842	.875	.935								
15			847	.870	.933								
16			850	.895	.946								
AVERAGE	60 min	-0.205	838.87		.938	1.5		41.739		84.25			

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	725.9	622.0	452.9	609.8
INITIAL	575.1	600.7	450.6	601.3
WEIGHT COLLECTED	150.8	22.0	2.3	8.5
TOTAL WEIGHT				182.8

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	11.0	0.8	0.0	88.2
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 10" Hg. - .014 CFm
POST-LEAK CHECK GOOD @ 6" Hg. - .011 CFM
Wet: 56°F
Dry: 62°F

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 2

DETERMINATION OF STACK GAS MOISTURE CONTENT

Bws - Moisture fraction content
dH - Pressure differential across meter orifice, in H2O
Mw - Molecular weight of water, 18.0 lb/ lb mole
Pb - Barometric pressure at meter, in-Hg
Pst - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft3/ lb-mole deg R
Tm - Absolute temperature at meter, deg R
Tst - Standard absolute temperature, 528 deg R
Vm - Dry gas volume measured by meter, DCF
Vmstd- Dry gas volume at standard conditions, DSCF
Vw - Volume of water vapor collected, SCF
Wwc - Weight of water vapor collected, lb
I1w, I2w, I3w, weight of water condensed by impingers, g
SGw, weight of water collected by silica gel, g
Y - Dry gas meter calibration factor

$$Wwc = (I1w + I2w + I3w + SGw) / (453.6\ g/lb)$$

$$= (150.8 + 21.3 + 2.3 + 8.5) / (453.6) = .40322$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.40322)(21.85)(528)}{(29.92)(18.0)} = 8.63758$$

$$Vmstd = Vm\ Y \frac{(Pb + dH/13.6)}{Pst} \frac{Tst}{Tm}$$

$$= (41.739)(1.0101) \frac{(30.190 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(544.)}$$

$$= 41.42163$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(8.63758)}{(8.63758 + 41.42163)} = .1725$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 2

DETERMINATION OF DRY MOLECULAR WEIGHT

Md - Dry molecular weight, lb/ lb-mole
%CO2 - Percent CO2 by volume (dry basis)
%O2 - Percent O2 by volume (dry basis)
%CO - Percent CO by volume (dry basis)
%N2 - Percent N2 by volume (dry basis)
0.280 - Molecular weight of N2 or CO, divided by 100
0.320 - Molecular weight of O2, divided by 100
0.440 - Molecular weight of CO2, divided by 100

$$Md = 0.440(\%CO2) + 0.320(\%O2) + 0.280(\%N2 + \%CO)$$

$$Md = 0.440(11.0) + 0.320(.8) + 0.280(88.2 + .0)$$

$$= 29.792$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 2

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

A - Cross-sectional area of stack, ft2
Bws - Moisture fraction of stack gas
Cp - Pitot tube coefficient
dP - Avg., square root of velocity head, (in-H2O)**0.5
Kp - Pitot tube constant,
ft/sec (lb in-Hg/ lb-mole deg R in H2O)**0.5
Md - Molecular weight of stack gas, dry basis, lb/ lb-mole
Ms - Molecular weight of stack gas, wet basis, lb/ lb-mole
Pbar - Barometric pressure at measurement site, in-Hg
Pg - Static pressure of the stack gas, in H2O
Ps - Absolute stack gas pressure, in-Hg
Pstd - Standard absolute pressure, 29.92 in-Hg
Acf - Actual stack gas flow rate, ACF/min
Qsd - Dry volumetric stack gas flow rate
standard conditions, DSCF/Hr
Ts - Average stack gas temperature, deg R
Tstd - Standard absolute temperature, 528 deg R
Vs - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec to Hr
18.0 - Molecular weight of water, lb/lb-mole

$$Ms = Md\ (1 - Bws) + 18.0\ (Bws) =$$

$$= (29.792)(1 - .1725) + (18.0)(.1725) = 27.757$$

$$Vs = Kp\ Cp\ dP \left(\frac{Ts}{Ps\ Ms}\right)^{0.5} =$$

$$= (85.49)(.7810)(.9377)\left(\frac{1299.}{[30.175][27.757]}\right)^{0.5} = 77.9682$$

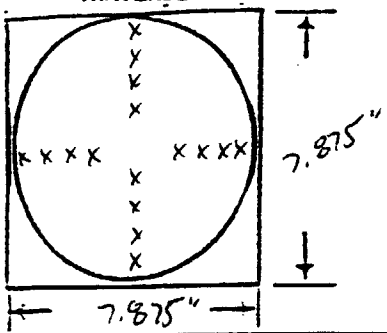
$$Acf = (60)(Vs)(A) = (60)(77.9682)(.3382) = 1582.3$$

$$Qsd = 3600\ (1 - Bws)\ Vs\ A \frac{Tstd}{Ts} \frac{Ps}{Pstd} =$$

$$Qsd = 3600(1 - .1725)(77.9682)(.3382)\frac{(528)(30.175)}{(1299.)(29.92)}$$

= 32206.4 DSCFH
= 536.8 DSCFM

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 04 03 90
LOCATION Chalmette, LA.
OPERATOR K. Thibodeaux
STACK NO. K-401 Compressor
RUN NO. 3

SAMPLE BOX NO. BC
METER BOX NO. 500
AMBIENT TEMPERATURE 63°F
BAROMETRIC PRESSURE 30.18
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 7.875"
PITOT TUBE NO. P-3-5
PITOT FACTOR 0.781
METER Δ Hₐ 1.8270
D.G.M.C. FACTOR 1.0101
K FACTOR N/A

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE (in. H₂O)	STACK TEMP (Ts), °F	VELOCITY HEAD (ΔPs)	(√ΔPs)	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER (ΔH) in. H₂O ACTUAL	DESIRED	GAS SAMPLE VOLUME (Vm), ft³	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET (Tmin), °F	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg gauge
1	10:19	on @	831	.880	.978	1.5	1.5	214.000	85	88	260	60	3.1
2		-0.280	831	.885	.941								
3	10:49	off @	824	.890	.943	1.5	1.5	235.070	100	92	249	50	3.3
4			813	.895	.946								
5			825	.880	.938								
6			840	.890	.943								
7			848	.895	.946								
8			854	.915	.956								
9	10:52	on @	800	.900	.949	1.5	1.5	235.070	81	80	261	51	3.3
10			810	.905	.951								
11	11:22	off @	810	.900	.949	1.5	1.5	256.165	104	96	249	60	3.4
12			823	.905	.951								
13			832	.910	.954								
14			840	.915	.956								
15			848	.915	.956								
16			852	.930	.964								
AVERAGE	60 min	-0.280	830.06		.949	1.5		42.165		90.75			

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	714.8	549.5	452.2	594.1
INITIAL	562.1	529.0	450.4	583.4
WEIGHT COLLECTED	152.7	20.5	1.8	10.7
TOTAL WEIGHT				185.7

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	10.9	0.7	0.0	88.4
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 10" Hg. - .006 CFM
POST-LEAK CHECK GOOD @ 4" Hg. - .004 CFM
Wet: 60°F
Dry: 63°F

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 3

DETERMINATION OF STACK GAS MOISTURE CONTENT

Bws - Moisture fraction content
dH - Pressure differential across meter orifice, in H2O
Mw - Molecular weight of water, 18.0 lb/ lb mole
Pb - Barometric pressure at meter, in-Hg
Pst - Standard absolute pressure, 29.92 in-Hg
R - Ideal gas constant, 21.85 in-Hg ft3/ lb-mole deg R
Tm - Absolute temperature at meter, deg R
Tst - Standard absolute temperature, 528 deg R
Vm - Dry gas volume measured by meter, DCF
Vmstd- Dry gas volume at standard conditions, DSCF
Vw - Volume of water vapor collected, SCF
Wwc - Weight of water vapor collected, lb
I1w, I2w, I3w, weight of water condensed by impingers, g
SGw, weight of water collected by silica gel, g
Y - Dry gas meter calibration factor

$$Wwc = (I1w + I2w + I3w + SGw) / (453.6\ g/lb)$$

$$= (152.7 + 20.5 + 1.8 + 10.7) / (453.6) = .40939$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.40939)(21.85)(528)}{(29.92)(18.0)} = 8.76981$$

$$Vmstd = Vm\ Y \frac{(Pb + dH/13.6)}{Pst} \frac{Tst}{Tm}$$

$$= (42.165)(1.0101) \frac{(30.180 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(551.)}$$

$$= 41.33690$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(8.76981)}{(8.76981 + 41.33690)} = .1750$$

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Baton Rouge, LA 70895
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Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 3

DETERMINATION OF DRY MOLECULAR WEIGHT

Md - Dry molecular weight, lb/ lb-mole
%CO2 - Percent CO2 by volume (dry basis)
%O2 - Percent O2 by volume (dry basis)
%CO - Percent CO by volume (dry basis)
%N2 - Percent N2 by volume (dry basis)
0.280 - Molecular weight of N2 or CO, divided by 100
0.320 - Molecular weight of O2, divided by 100
0.440 - Molecular weight of CO2, divided by 100

$$Md = 0.440(\%CO2) + 0.320(\%O2) + 0.280(\%N2 + \%CO)$$

$$Md = 0.440(10.9) + 0.320(.7) + 0.280(88.4 + .0)$$

$$= 29.772$$

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4- 3-90
Run : 3

DETERMINATION OF STACK GAS VELOCITY AND VOLUMETRIC FLOW RATE

A - Cross-sectional area of stack, ft2
Bws - Moisture fraction of stack gas
Cp - Pitot tube coefficient
dP - Avg., square root of velocity head, (in-H2O)**0.5
Kp - Pitot tube constant,
ft/sec (lb in-Hg/ lb-mole deg R in H2O)**0.5
Md - Molecular weight of stack gas, dry basis, lb/ lb-mole
Ms - Molecular weight of stack gas, wet basis, lb/ lb-mole
Pbar - Barometric pressure at measurement site, in-Hg
Pg - Static pressure of the stack gas, in H2O
Ps - Absolute stack gas pressure, in-Hg
Pstd - Standard absolute pressure, 29.92 in-Hg
Acf - Actual stack gas flow rate, ACF/min
Qsd - Dry volumetric stack gas flow rate
standard conditions, DSCF/Hr
Ts - Average stack gas temperature, deg R
Tstd - Standard absolute temperature, 528 deg R
Vs - Average stack gas velocity, ft/sec
3600 - Conversion factor, sec to Hr
18.0 - Molecular weight of water, lb/lb-mole

$$Ms = Md\ (1 - Bws) + 18.0\ (Bws) =$$

$$= (29.772)(1 - .1750) + (18.0)(.1750) = 27.712$$

$$Vs = Kp\ Cp\ dP \left(\frac{Ts}{Ps\ Ms}\right)^{0.5} =$$

$$= (85.49)(.7810)(.9490)\left(\frac{1290.}{[30.159][27.712]}\right)^{0.5} = 78.7207$$

$$Acf = (60)(Vs)(A) = (60)(78.7207)(.3382) = 1597.6$$

$$Qsd = 3600\ (1 - Bws)\ Vs\ A \frac{Tstd}{Ts} \frac{Ps}{Pstd} =$$

$$Qsd = 3600(1 - .1750)(78.7207)(.3382)\frac{(528)(30.159)}{(1290.)(29.92)}$$

= 32624.7 DSCFH
= 543.7 DSCFM

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895

Client : MOBIL
Source : K-401
Testing Date : 4/2-3/90

OXIDES OF NITROGEN EMISSION RATE - SUBPART FF

ENOX - Oxides of nitrogen emission rate as NO2, lb/Hr
F - NO2 Conv. factor, 1.1948 X 10-7 (lb/ft3)/(PPM)
NOXms - NOX concentration as measured, PPM
Qsd - Dry volumetric stack gas flow rate, DSCF/Hr
H - Observed humidity, grains H2O/ lb dry air
Kh - Humidity correction factor per subpart FF
Kt - Temperature correction factor per subpart FF
T - Observed inlet air temperature, deg. F

Kh =0.844 +(0.151)(H/100)+(0.075)(H/100)2

Kt = 1 - (T - 85)(0.0135) ENOX =(NOXms Kt Kh)(F)(Qsd)

-------- RUN 1 ------ Kt = 1 - (78.0 - 85)(0.0135) = 1.0945

Kh = 0.844 + (0.151)(115/100) + (0.075)(115/100)2 = 1.1168

ENOX =(2870.81)(1.0945)(1.1168)(1.1948 X 10-7)(32604.6)

= 13.670

-------- RUN 2 ------ Kt = 1 - (62.0 - 85)(0.0135) = 1.3105

Kh = 0.844 + (0.151)(58/100) + (0.075)(58/100)2 = 0.9568

ENOX =(3458.28)(1.3105)(0.9568)(1.1948 X 10-7)(32206.4)

= 16.686

-------- RUN 3 ------ Kt = 1 - (63.0 - 85)(0.0135) = 1.2970

Kh = 0.844 + (0.151)(72/100) + (0.075)(72/100)2 = 0.9916

ENOX =(3316.41)(1.2970)(0.9916)(1.1948 X 10-7)(32624.7)

= 16.626

Emission Testing Services, Inc.
P.O. Box 15075
Baton Rouge, LA 70895
504-925-8405

Client : MOBIL
Source : K-401
Testing Date : 4/2-3/90
Run : 1-3

CARBON MONOXIDE EMISSION RATE

ECO - Carbon Monoxide Emission Rate - lb/hr
F - CO conv. factor, 7.2727 X 10-8 (lb/ft3)/(PPM)
COms - Concentration of carbon monoxide as measured - PPM
Qsd - Dry volumetric stack gas flow rate, DSCF/hr

ECO = (COms)(F)(Qsd)

-------- RUN 1 --------

ECO = (518.2)(7.2727 X 10-8)(32604.6) = 1.229

-------- RUN 2 --------

ECO = (145.7)(7.2727 X 10-8)(32206.4) = .341

-------- RUN 3 --------

ECO = (147.9)(7.2727 X 10-8)(32624.7) = .351

Test analyzer response, Method 3A, 7E, 10, and 16A, was recorded by a computer data acquisition system. One minute average data were printed as recorded and served as a hardcopy record of the test data. Presented on the following pages are the computer print outs of the test data.

Each test analyzer is calibrated before and after each test run by challenging the analyzer with a set of certified calibration gases. Analyzer response is recorded by a computer data acquisition system. Calibration data sheets are manually completed as the calibrations are performed serving as hardcopy records of the calibration. Calibration results are taken from the computer system to avoid any data acquisition bias. Analyzer calibration data sheets are presented following the test data.

Run Title: MOBIL OIL CORP. E401 RUN 1
Date: 4/ 2/1990

Time	CO VTS	NOX VTS	O2 VTS	CO AV	NOX AV	O2 AV
11:53:18	9.9976	1.9129	0.007	946.59	511.8	-0.0852L
11:54:18	8.4806	1.8250	-0.005L	803.91	474.5	0.1133L
11:55:18	9.9943	1.8608	-0.002L	946.28	498.3	-0.1056L
11:56:18	9.0404	1.8717	-0.002L	2.67	481.3	-0.1056L
11:57:18	6.5902	1.7631	-0.007L	626.18	480.0	0.1178L
11:58:18	0.0408	1.8608	0.002	11.09	478.7	-0.0974L
11:59:18	6.5739	1.7061	-0.013L	624.65	452.7	-0.1340L
12:00:18	3.3867	1.8478	0.005	321.91	486.1	-0.0893L
12:01:18	-0.0733L	1.7192	-0.010L	-0.39L	455.8	-0.1259L
12:02:18	-0.0979L	1.7110	-0.013L	-1.77L	454.1	-0.1340L
12:03:19	0.1221	1.9210	0.013	17.98	513.6	-0.0607L
12:04:19	0.0377L	1.7875	-0.005L	3.90	480.0	-0.1133L
12:05:19	0.0277	1.8364	0.003	9.10	498.3	-0.0934L
12:06:19	0.0163	1.8582	0.005	8.03	494.6	0.0893L
12:07:19	0.0830	1.8673	0.011	14.31	499.2	-0.0730L
12:08:19	9.9357	1.6736	-0.015L	939.85	443.2	-0.1381L
12:09:19	6.6862	1.8071	0.005	635.21	482.6	-0.0873L
12:10:19	0.0961	1.8559	0.013	15.53	498.3	-0.0689L
12:11:19	3.3016	1.7485	-0.002L	316.95	482.6	-0.1056L
12:12:19	0.0326	1.7908	0.002	9.56	468.7	-0.0974L
12:13:19	3.3439	1.8168	0.007	320.93	489.1	-0.0852L
12:14:19	6.6667	1.7859	0.003	633.38	463.4	-0.0974L
12:15:19	9.9976	1.8445	0.015	946.59	492.2	-0.0649L
12:16:19	9.9959	1.8022	0.002	946.43	469.5	-0.0974L
12:17:19	9.9862	1.7631	-0.003L	945.51	450.4	-0.1096L
12:18:19	9.9731	1.4050	-0.008L	944.29	377.1	0.1218L
12:19:19	9.9552	1.6687	-0.013L	942.61	436.6	-0.1340L
12:20:19	9.9813	1.7761	0.002	945.06	458.2	-0.0974L
12:21:19	9.9976	1.8006	0.008	946.59	475.2	-0.0812L
12:22:19	9.9976	1.8103	0.010	946.59	485.7	-0.0771L
12:23:19	9.9976	1.8494	0.011	946.59	498.1	-0.0730L
12:24:19	9.9683	1.7338	-0.007L	943.83	450.6	-0.1178L
12:25:19	9.9552	1.7289	-0.002L	942.61	470.8	-0.1056L
12:26:20	3.3944	1.8348	0.013	325.68	492.8	-0.0689L
12:27:20	0.1319L	1.8348	0.015	-5.90L	496.8	-0.0649L
12:28:20	0.0798	1.8103	0.015	14.00	479.1	-0.0649L
12:29:20	9.9650	1.6687	-0.011L	943.52	446.4	-0.1300L
12:30:20	9.9976	1.8331	0.015	946.59	482.8	-0.0649L
12:31:20	9.9585	1.6964	-0.003L	942.91	448.2	-0.1096L
12:32:20	9.9617	1.7029	-0.010L	943.22	464.1	-0.1259L
12:33:20	0.1074	1.8364	0.010	16.60	488.5	-0.0771L
12:34:20	9.9129	1.6606	-0.013L	938.63	442.1	-0.1340L
12:35:20	9.9976	1.8348	0.013	946.59	485.7	-0.0689L
12:36:21	-0.0977L	1.6329	-0.013L	-2.68L	431.8	-0.1340L
12:37:21	9.9976	1.8282	0.013	946.59	482.8	-0.0689L
12:38:21	9.9337	1.6296	-0.013L	939.54	432.7	-0.1340L
12:39:21	9.9976	1.7941	0.008	946.59	478.2	-0.0812L
12:40:21	9.9207	1.6378	-0.010L	939.34	433.8	-0.1259L
12:41:21	9.9976	1.8022	0.008	946.59	489.8	-0.0812L
12:42:21	9.9927	1.7550	0.003	946.13	461.9	-0.0934L
12:43:21	9.9536	1.6817	-0.011L	942.45	456.7	-0.1300L
12:44:21	9.9976	1.8022	0.008	946.59	474.8	-0.0812L
12:45:21	9.9976	1.8103	0.008	946.59	483.7	-0.0812L
12:46:22	-0.0130L	1.7257	0.002	5.28	455.4	-0.0974L
12:47:22	9.9422	1.6638	-0.007L	941.38	437.9	-0.1178L
12:48:22	9.9976	1.7827	0.010	946.59	482.6	-0.0771L
12:49:22	9.9276	1.6296	-0.011L	940.00	430.1	-0.1300L
12:50:22	9.9845	1.7354	0.005	945.36	453.4	-0.0893L
12:51:22	9.9976	1.8168	0.015	946.59	489.1	-0.0649L
12:52:22	9.9796	1.7078	-0.008L	944.90	466.0	-0.1218L
12:53:22	9.9976	1.7794	0.010	946.59	468.4	-0.0771L
12:54:23	9.9327	1.6475	-0.011L	939.54	438.4	-0.1300L
12:55:23	9.9976	1.8413	0.031	946.59	495.0	-0.0242L
12:56:23	9.9959	1.7517	0.005	946.43	460.8	-0.0893L
12:57:23	9.9503	0.3272	0.011	942.15	75.9	-0.0730L

Converter test check
4-2-90

Run TitleMOBIL OIL CORP. K401 RUN 1
Date: 4/ 2/1990

Time	CO AV		NOX AV		O2 AV	
16:20:59	494.5	OK	2903.01	OK	0.40512	OK
16:21:59	197.994	OK	3118.83	OK	0.60336	OK
16:22:59	362.178	OK	2894.46	OK	0.34318	OK
16:23:59	433.704	OK	2978.23	OK	0.40925	OK
16:24:59	303.169	OK	2928.65	OK	0.46294	OK
16:25:59	296.342	OK	2938.05	OK	0.4299	OK
16:26:59	255.54	OK	2921.81	OK	0.35969	OK
16:27:59	343.321	OK	2864.55	OK	0.36795	OK
16:28:59	265.456	OK	2921.81	OK	0.43816	OK
16:29:59	253.751	OK	3114.13	OK	0.46294	OK
16:31:00	241.397	OK	2918.4	OK	0.32253	OK
16:32:00	250.013	OK	2970.96	OK	0.38447	OK
16:33:00	341.045	OK	3088.06	OK	0.43816	OK
16:34:00	381.36	OK	2952.16	OK	0.35556	OK
16:35:00	389	OK	2900.45	OK	0.33492	OK
16:36:00	265.618	OK	2879.51	OK	0.30601	OK
16:37:00	252.288	OK	3094.47	OK	0.44642	OK
16:38:00	285.125	OK	2918.4	OK	0.36382	OK
16:39:00	343.971	OK	2844.89	OK	0.34318	OK
16:40:00	778.49	OK	2808.56	OK	0.37621	OK
16:41:00	418.26	OK	2817.54	OK	0.38034	OK
16:42:00	410.783	OK	3004.29	OK	0.45055	OK
16:43:00	476.294	OK	2926.94	OK	0.48359	OK
16:44:00	536.603	OK	2797.02	OK	0.4299	OK
16:45:00	371.606	OK	2912.41	OK	0.35969	OK
16:46:00	306.583	OK	2867.54	OK	0.28536	OK
16:47:01	375.833	OK	2820.1	OK	0.3886	OK
16:48:01	448.171	OK	2988.48	OK	0.39686	OK
16:49:01	448.821	OK	2872.67	OK	0.39273	OK
16:50:01	772.638	OK	2676.51	OK	0.27297	OK
16:51:01	622.271	OK	2742.75	OK	0.17798	OK
16:52:01	452.235	OK	2902.16	OK	0.34731	OK
16:53:01	333.242	OK	2783.78	OK	0.36795	OK
16:54:01	397.941	OK	2784.63	OK	0.26471	OK
16:55:01	369.981	OK	2815.4	OK	0.44229	OK
16:56:01	330.154	OK	2824.38	OK	0.32666	OK
16:57:02	600.976	OK	2874.8	OK	0.53315	OK
16:58:02	420.049	OK	3025.24	OK	0.39686	OK
16:59:02	443.945	OK	2913.27	OK	0.48772	OK
17:00:02	476.944	OK	2905.57	OK	0.37621	OK
17:01:02	567.814	OK	2817.54	OK	0.41338	OK
17:02:02	901.384	OK	2539.75	OK	0.35969	OK
17:03:02	906.423	OK	2860.7	OK	0.40099	OK
17:04:02	514.983	OK	2747.88	OK	0.33905	OK
17:05:02	573.991	OK	2837.62	OK	0.37208	OK
17:06:02	639.34	OK	2874.38	OK	0.42164	OK
17:07:02	520.51	OK	2883.78	OK	0.30188	OK
17:08:02	578.706	OK	3021.39	OK	0.42577	OK
17:09:02	830.833	OK	2923.52	OK	0.21515	OK
17:10:02	999.406	OK	2627.36	OK	0.04582	OK
17:11:03	994.205	OK	2797.02	OK	0.4299	OK
17:12:03	780.928	OK	2775.66	OK	0.26471	OK
17:13:03	999.894	OK	2688.47	OK	0.16972	OK
17:14:03	999.894	OK	2761.98	OK	0.36382	OK
17:15:03	994.53	OK	2688.9	OK	0.17798	OK
17:16:03	999.406	OK	2754.29	OK	0.1945	OK
17:17:03	773.125	OK	2820.96	OK	0.3184	OK
17:18:03	721.107	OK	2856.43	OK	0.34731	OK
17:19:03	531.238	OK	2885.06	OK	0.34731	OK
AVERAGE	518.2255		2870.806		0.363123	0

Run title:MOBIL OIL CORP K401 RUN #2
Date: 4/ 3/1990

Time	CO AV		NOX AV		O2 AV	
08:32:36	145.789	OK	3372.68	OK	1.04006	OK
08:33:36	137.888	OK	3268.52	OK	0.7139	OK
08:34:36	151.923	OK	3408.34	OK	1.0039	OK
08:35:36	149.34	OK	3520.2	OK	0.8006	OK
08:36:36	141.593	OK	3344.71	OK	0.80473	OK
08:37:37	148.372	OK	3347.55	OK	0.54875	OK
08:38:37	142.561	OK	3611.79	OK	0.79234	OK
08:39:37	146.274	OK	3437.52	OK	0.88317	OK
08:40:37	142.884	OK	3389.29	OK	0.8006	OK
08:41:37	146.274	OK	3335.39	OK	0.71802	OK
08:42:37	145.144	OK	3422.93	OK	0.81298	OK
08:43:37	140.786	OK	3368.22	OK	0.79234	OK
08:44:37	148.056	OK	3393.75	OK	0.92033	OK
08:45:37	145.789	OK	3404.29	OK	0.75510	OK
08:46:37	144.014	OK	3377.14	OK	0.59004	OK
08:47:37	148.695	OK	3443.2	OK	0.70977	OK
08:48:37	147.403	OK	3453.33	OK	0.90794	OK
08:49:37	145.467	OK	3520.2	OK	0.70564	OK
08:50:37	149.825	OK	3223.94	OK	0.66022	OK
08:51:37	148.533	OK	3396.59	OK	0.93684	OK
08:52:37	149.179	OK	3357.68	OK	0.92859	OK
08:53:37	143.853	OK	3445.63	OK	0.90381	OK
08:54:37	142.238	OK	3361.33	OK	0.83363	OK
08:55:37	145.951	OK	3310.67	OK	0.78408	OK
08:56:37	161.607	OK	3464.68	OK	0.95749	OK
08:57:37	140.14	OK	3470.75	OK	0.84603	OK
08:58:37	145.789	OK	3469.13	OK	0.8584	OK
08:59:37	143.53	OK	3485.75	OK	0.89143	OK
09:00:37	149.179	OK	3457.38	OK	0.92859	OK
09:01:37	142.561	OK	3419.28	OK	0.90381	OK
09:02:37	141.431	OK	3362.95	OK	0.89969	OK
09:03:37	139.817	OK	3278.65	OK	0.93684	OK
09:04:37	141.27	OK	3453.33	OK	0.83776	OK
09:05:37	145.628	OK	3501.56	OK	0.81711	OK
09:06:37	143.691	OK	3418.80	OK	0.83776	OK
09:07:38	142.238	OK	3429.01	OK	0.87491	OK
09:08:38	146.919	OK	3488.99	OK	0.92033	OK
09:09:38	145.467	OK	3409.56	OK	1.08135	OK
09:10:38	155.151	OK	3426.17	OK	0.73867	OK
09:11:38	148.533	OK	3387.27	OK	0.75105	OK
09:12:38	148.372	OK	3521.41	OK	0.82537	OK
09:13:38	148.856	OK	3585.45	OK	0.77995	OK
09:14:38	140.947	OK	3528.71	OK	0.68087	OK
09:15:38	146.435	OK	3474.4	OK	0.75518	OK
09:16:38	147.081	OK	3512.09	OK	0.86666	OK
09:17:38	141.27	OK	3521.41	OK	0.70564	OK
09:18:38	148.695	OK	3577.34	OK	0.78408	OK
09:19:38	144.014	OK	3595.18	OK	0.82124	OK
09:20:38	142.561	OK	3507.64	OK	0.73867	OK
09:21:38	146.274	OK	3429.82	OK	0.77995	OK
09:22:38	137.719	OK	3527.09	OK	0.61894	OK
09:23:38	144.337	OK	3432.66	OK	0.59829	OK
09:24:38	150.47	OK	3365.79	OK	0.82537	OK
09:25:38	141.109	OK	3727.3	OK	0.70151	OK
09:26:38	145.628	OK	3761.75	OK	0.85427	OK
09:27:38	142.077	OK	3535.6	OK	0.70977	OK
09:28:38	139.495	OK	3586.26	OK	0.73454	OK
09:29:38	139.333	OK	3624.36	OK	0.66848	OK
09:30:38	143.853	OK	3470.35	OK	0.67261	OK
09:31:38	167.579	OK	3568.83	OK	0.73454	OK
09:32:38	144.014	OK	3650.29	OK	0.8295	OK
09:33:38	141.916	OK	3471.57	OK	1.02	
AVERAGE	145.7035		3458.282		0.808598	

Run TitleMOBIL OIL CORP K401 RUN #3
Date: 4/ 3/1990

Time	CO AV		NOX AV		O2 AV	
10:15:05	145.82	OK	3248.61	OK	0.71	OK
10:16:05	142.60	OK	3260.87	OK	0.73	OK
10:17:05	136.80	OK	3252.84	OK	0.92	OK
10:18:06	134.87	OK	3287.93	OK	1.04	OK
10:19:06	151.30	OK	3347.13	OK	1.00	OK
10:20:06	150.98	OK	3288.36	OK	0.81	OK
10:21:06	155.81	OK	3282.86	OK	0.72	OK
10:22:06	150.82	OK	3360.23	OK	0.77	OK
10:23:06	142.92	OK	3367.00	OK	0.82	OK
10:24:06	140.19	OK	3362.35	OK	0.90	OK
10:25:06	150.01	OK	3332.75	OK	1.06	OK
10:26:06	148.24	OK	3282.01	OK	0.70	OK
10:27:06	144.05	OK	3274.40	OK	0.84	OK
10:28:06	155.49	OK	3375.45	OK	0.81	OK
10:29:06	150.49	OK	3405.47	OK	0.87	OK
10:30:06	148.24	OK	3450.29	OK	1.04	OK
10:31:06	148.72	OK	3379.68	OK	0.85	OK
10:32:06	150.17	OK	3411.81	OK	0.92	OK
10:33:07	144.37	OK	3360.65	OK	0.89	OK
10:34:07	144.86	OK	3397.01	OK	0.96	OK
10:35:07	145.98	OK	3355.58	OK	0.88	OK
10:36:07	155.00	OK	3309.50	OK	0.67	OK
10:37:07	145.18	OK	3296.39	OK	0.83	OK
10:38:07	143.73	OK	3203.37	OK	0.66	OK
10:39:07	157.74	OK	3376.72	OK	0.91	OK
10:40:07	157.58	OK	3330.64	OK	0.80	OK
10:41:07	161.12	OK	3396.17	OK	1.01	OK
10:42:07	146.63	OK	3377.57	OK	0.85	OK
10:43:07	143.25	OK	3313.72	OK	1.00	OK
10:44:07	147.59	OK	3230.43	OK	0.75	OK
10:45:07	134.71	OK	3239.31	OK	0.82	OK
10:46:07	147.92	OK	3353.47	OK	0.86	OK
10:47:07	147.92	OK	3316.26	OK	0.99	OK
10:48:07	150.82	OK	3358.12	OK	0.88	OK
10:49:08	143.57	OK	3188.15	OK	0.83	OK
10:50:08	152.26	OK	3277.79	OK	0.92	OK
10:51:08	172.24	OK	3286.24	OK	0.77	OK
10:52:08	149.20	OK	3403.78	OK	0.76	OK
10:53:08	151.14	OK	3388.98	OK	0.62	OK
10:54:08	139.70	OK	3449.86	OK	0.86	OK
10:55:08	154.04	OK	3347.97	OK	1.03	OK
10:56:08	145.02	OK	3301.04	OK	1.22	OK
10:57:08	147.92	OK	3184.35	OK	1.19	OK
10:58:08	144.53	OK	3258.34	OK	1.08	OK
10:59:08	141.96	OK	3398.28	OK	1.14	OK
11:00:08	144.53	OK	3000.86	OK	1.24	OK
11:01:08	147.43	OK	3309.50	OK	1.43	OK
11:02:08	137.77	OK	3257.92	OK	1.10	OK
11:03:08	144.37	OK	3395.32	OK	1.24	OK
11:04:08	172.40	OK	3287.93	OK	1.34	OK
11:05:08	136.32	OK	3273.56	OK	1.21	OK
11:06:08	139.70	OK	3245.23	OK	1.25	OK
11:07:08	142.28	OK	3331.90	OK	1.15	OK
11:08:09	161.77	OK	3208.49	OK	1.14	OK
11:09:09	143.08	OK	3147.01	OK	1.31	OK
11:10:09	142.28	OK	3231.70	OK	1.19	OK
11:11:09	148.40	OK	3353.04	OK	1.29	OK
11:12:09	158.71	OK	3431.67	OK	1.47	OK
11:13:09	141.15	OK	3219.02	OK	1.21	OK
11:14:09	147.59		[illegible]		1.18	
AVERAGE	147.8[illegible]		[illegible]		0.98	

METHOD 7E DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-2-90

PARAMETER NOx LOAD: 365 RPM RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N_2	-0.01	-68.6	.04	-42.3	0.51
Mid	1517	3.21	1622	3.23	1632.5	0.20
High	4840	9.22	4804	9.31	4825	0.40

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 525.013963 Intercept -63.308039 Span Range 5186.8

Analyzer Cal	Init. Analyzer Resp. mv	Init. Analyzer Resp. ppm	Init. Analyzer Resp. Bias ±5	Final Analyzer Resp. mv	Final Analyzer Resp. ppm	Final Analyzer Resp. Bias ±5	Final Analyzer Resp. Drift ±3
Conc. 1622	3.10	1564.2	-2.11	3.05	1538	-1.63	0.51

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time _____ Finish time _____ Minutes per point ____

Sample port _____

Test Point	mv		mv		mv
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv ____

Ave. conc. _____ ppm

COMMENTS:

r = 0.999304

ETS

METHOD 10 DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-2-90

PARAMETER CO LOADS 365 RPM RUN NUMBER 1

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N_2	0.00	1.6	.04	5.62	0.40
Low	201.74	1.98	189.3	2.12	213.3	1.40
Mid	401.6	4.01	402.0	4.00	401.0	-0.00
High	851.0	8.51	851.4	8.49	849.4	-0.20

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 99.8744 Intercept 1.623528 Span Range 1000.1

$$\%Drift = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{Span (ppm)}} \times 100$$

TEST DATA

Start time _____ Finish time _____ Minutes per point ____

Sample port _____

Test Point	mv				
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv ____

Ave. conc. _____ ppm

COMMENTS:

r = 0.999989

METHOD 3A DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-2-96

PARAMETER O_2 LOAD% 365 RPM RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N_2	0.00	-0.11	.01	-0.08	0.11
Mid	11.96	4.86	12.22	4.84	12.17	-0.19
High	20.9	8.22	20.75	8.27	20.87	0.48

Calibration curve: ppm = (response v)(slope) + intercept

Slope 2.578769 Intercept -0.10698 Span Range 25.26

Analyzer Cal	Init. Analyzer Resp. v	ppm	Bias ±5	Final Analyzer Resp. v	ppm	Bias ±5	Span Drift ±3
Conc.							

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 16:19 Finish time 17:19 Minutes per point 1

Test Point v Sample port

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Ave. v

Ave. conc. %

COMMENTS:

r = 0.999764

METHOD 7E DATA SHEET

COMPANY Mobil SOURCE #401 DATE 9-3-90

PARAMETER NO_x LOADS _____ RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N_2	.04	-38.5	.02	-48.5	-0.20
Mid	1517	3.28	1574.6	3.46	1664.3	1.82
High	4840	9.80	4820.9	~~9.88~~	~~4860~~	0.81

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 492.886496 Intercept -58.423607 Span Range 4920.4

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Drift ±3
Conc.	1574.6	3.26	1564.7	-0.20	3.30	1584.6	0.20	0.40

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time _____ Finish time _____ Minutes per point _____

Sample port _____

Test Point	mv				
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv _____

Ave. conc. _____ ppm

COMMENTS:

r = 0.999795

ETS

METHOD 10 DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-3-90

PARAMETER CO LOAD% 365 RPM RUN NUMBER 2

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N_2	.02	8.2	.02	8.2	0.00
Low	201.24	1.98	202.5	1.99	203.5	0.10
Mid	401.6	3.83	385.9	3.85	387.9	0.20
High	857.0	8.59	857.8	8.61	859.8	0.20

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 98.14369 Intercept 6.173155 Span Range 997.60

$$\%Drift = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{Span (ppm)}} \times 100$$

TEST DATA

Start time _____ Finish time _____ Minutes per point ____

Sample port _____

Test Point	mv				
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv ____

Ave. conc. _____ ppm

COMMENTS:

r = .999547

METHOD 3A DATA SHEET

COMPANY Mobil Oil SOURCE #K401 DATE 4-3-90

PARAMETER O_2 LOAD% _____ RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N_2	.01	-0.07	.01	-0.07	0.00
Mid	11.96	4.82	12.13	4.81	12.10	-0.11
High	20.9	8.24	20.80	8.25	20.83	0.10

Calibration curve: ppm = (response v)(slope) + intercept

Slope 2.53603 Intercept -0.015324 Span Range 25.2650

Analyzer Cal	Init. Analyzer Resp. v	ppm	Bias ±5	Final Analyzer Resp. v	ppm	Bias ±5	Span Drift ±3
Conc.							

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time _____ Finish time _____ Minutes per point _____

Test Point v Sample port _____

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Ave. v _____

Ave. conc. _____ %

COMMENTS:

r = 0.999902

METHOD 7E DATA SHEET

COMPANY Mobil SOURCE #K401 DATE 4-3-90

PARAMETER NOx LOAD% 365 RPM RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N_2	.02	-43.5	.02	-43.5	0.00
Mid	1517	3.15	1582.3	3.14	1577.1	-0.10
High	4840	9.38	4818.2	9.81	4781.8	-0.71

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 518.40399 Intercept -53.840029 Span Range 5140.2

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Drift ±3
Conc.	1582.3	3.12 1566.7	-.30	3.12	1566.7	-0.30	0.00

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 10:15 Finish time 11:15 Minutes per point ____

Sample port _____

Test Point	mv				
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv ____

Ave. conc. _____ ppm

COMMENTS:

r = 0.99973

ETS

METHOD 10 DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-3-90

PARAMETER CO LOAD% 365 MW RUN NUMBER 3

CALIBRATION STATISTICS

	Cylinder Value	Initial Analyzer Response mv	Initial Analyzer Response ppm	Final Analyzer Response mv	Final Analyzer Response ppm	%Drift
Zero	N_2	.02	2.2	.02	2.2	0.00
Low	201.74	1.99	202.6	1.99	202.6	0.00
Mid	401.6	3.85	386.6	3.91	392.5	0.60
High	817	8.61	857.5	8.53	855.5	-0.20

Calibration curve: ppm = (response mv)(slope) + intercept

Slope 99.97197 Intercept 5.6995-99 Span Range 985.0

$$\%Drift = \frac{\text{Final response (ppm)} - \text{Initial response (ppm)}}{\text{Span (ppm)}} \times 100$$

TEST DATA

Start time 10:15 Finish time 11:15 Minutes per point ____

Test Point mv Sample port _____

1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

Ave. mv ____

Ave. conc. _____ ppm

COMMENTS:

r = 0.999988

METHOD 3A DATA SHEET

COMPANY Mobil SOURCE # K401 DATE 4-3-90

PARAMETER O_2 LOAD% 365 RPM RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N/A	.01	-0.06	.01	-0.06	0.00
Mid	11.96	4.81	12.10	4.83	12.	.21
High	20.9	8.25	20.8	8.25	20.8	0.00

Calibration curve: ppm = (response v)(slope) + intercept

Slope 2.530337 Intercept -0.062068 Span Range 25.24

Analyzer Cal	Init. Analyzer Resp. v	ppm	Bias ±5	Final Analyzer Resp. v	ppm	Bias ±5	Span Drift ±3
Conc.							

Sys. Cal. Bias = $\frac{\text{Sys. cal. (ppm)} - \text{analyzer cal. (ppm)}}{\text{Span (ppm)}} \times 100$

%Drift = $\frac{\text{Final sys. resp. (ppm)} - \text{Initial sys. resp. (ppm)}}{\text{span (ppm)}} \times 100$

TEST DATA

Start time 10:15 Finish time 11:15 Minutes per point ____

Test Point v Sample port _____

1		11		21	
2		12		22	
3		13		23	
4		14		24	
5		15		25	
6		16		26	
7		17		27	
8		18		28	
9		19		29	
10		20		30	

Ave. v ____

Ave. conc. _____ %

COMMENTS:

r = 0.999924

Following are Compressor operating data recorded during the emission test and the results of the fuel gas analysis.

[illegible] hr
NOx = [illegible]/hr
CO = 1.23 [illegible]/hr

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE
OPERATIONAL RECORD

Company Name Mobil Oil Corporation

Company Location

Engine Name K-401

Engine Source I. D. No. #51

Design Specifications

Manufacturer's Name INGERSOLL RAND

Model No. 8SW G Serial No. 8A5147

Parameter Specifications

A. Fuel Type Natural Gas B. Fuel Supplier Creole

C. Fuel Flow Units MSCFD Meas. Method meter

D. Is unit equipped for waste heat recovery? No

Describe

E. Does unit use water or steam injection? neither

If so, describe measurement method (continuous flow, start-finish volumes, etc) —

F. Manifold Pressure units (psia, kpa, etc.) psig

G. Manifold Temp.(°F, °C, etc.) °F

Ultimate Fuel Analysis

C _____ S _____ H _____ Ash _____

O _____ H_2O _____ N _____

Trace Metals: Na _____ Va _____ K _____

Fuel elements added

Fuel elements added for smoke suppression

1,000 std. cu. ft.
K-401 WASTE GAS to FUEL

87FZ 121

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE

TEST RUN LOG

(GAS ENGINES)

Company Mobil Oil Corporation

Engine K-401

Operator S. Bartenz

Date: 4-2-90 Test Time: Start 16:20 End 17:20

Ambient Temperature, at time of test 78°F

Engine Load Condition % Max - 365 Rpm

DATA LOG TIME (15 minute intervals)	16:35	16:50	17:05	17:20
Fuel Feed (flow)	87.20	88.51	91.40	90.65
Intake Manifold Temp.	86°	86°	86°	86°
Intake Manifold Pressure	8"	8"	7.5"	7.5"
Fuel Header Pressure	2"	2"	2"	2"
Engine Speed (rpm)	365	367	364	363
Spark Ignition Timing	10°	10°	10°	10°
Horse Power	401	401	401	401

Run Conditions: Max. Load

Remarks:

87F1121
R8091

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE

TEST RUN LOG

(GAS ENGINES)

Company Mobil Corporation

Engine K 401

Operator S. Thompson

Date: 4-3-90 Test Time: Start 08:45 End 09:30

Ambient Temperature, at time of test 60°F

Engine Load Condition % Max Load

DATA LOG TIME (15 minute intervals)	08:45	09:00	09:15	09:30
Fuel Feed (flow)	85.70	85.92	86.00	85.67
Intake Manifold Temp.	78°	74°	74°	74°
Intake Manifold Pressure	8½"	8½"	8½"	8½"
Fuel Header Pressure	2"	2"	2"	2"
Engine Speed (rpm)	365	364	364	363
Spark Ignition Timing	10°	10°	10°	10°
Horse Power	401	401	401	401

Run Conditions: Max Load

Remarks:

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE

TEST RUN LOG

(GAS ENGINES)

Company Mobil

Engine K401

Operator L. Thompson

Date: 4-3-90 Test Time: Start 10:30 AM. End 11:15 A.M.

Ambient Temperature, at time of test 63°F

Engine Load Condition % Max Load

DATA LOG TIME (15 minute intervals)	10:30	10:45	11:00	11:15
Fuel Feed (flow)	85.61	85.42	85.84	86.00
Intake Manifold Temp.	75	75°	76°	76°
Intake Manifold Pressure	8½"	8½"	8½"	8½"
Fuel Header Pressure	2"	2"	2"	2"
Engine Speed (rpm)	364	364	363	364
Spark Ignition Timing	10°	10°	10°	10°
Horse Power	401	401	401	401.

Run Conditions: Max Load

Remarks:

SGS Control Services Inc.
P. O. Box 1328
Kenner, LA 70063
Tel. (504) 469-6401
Telex: 460133

90027

ANALYSIS CERTIFICATE

Lab No: A9004-119 File No: 221216

Sample Description: NATURAL GAS

Sample Submitted By: MOBIL OIL COMPANY
CHALMETTE, LA

Sample Identification: NATURAL GAS 4/3

SUBMITTED: 4/5/90

APRIL 6, 1990

MOBIL OIL COMPANY
P.O. BOX 1007
CHALMETTE, LA 70044

ATTN: M. CURTIS
REQUEST NO: 199

— RESULTS OF ANALYSIS —

TEST	RESULT
CARBON, WT. %	74.74
HYDROGEN, WT. %	24.04
OXYGEN, WT. %	0.77
NITROGEN, WT. %	0.45

SGS CONTROL SERVICES INC.

LARRY MC CARTHY
LABORATORY MANAGER

LM/tb

Description of the tested sample material is as indicated by our Client. This report covers only those chemical components and physical properties for which tests were requested. No other tests were performed, and no liability is assumed for anything not tested and reported.

Member of the SGS Group (Société Générale de Surveillance)

SGS Control Services Inc.
P. O. Box 1328
Kenner, LA 70063
Tel. (504) 469-8401
Telex: 460133

ANALYSIS CERTIFICATE

Lab No: A9004-061 File No: 221216

Sample Description: NATURAL GAS

Sample Submitted By: MOBIL OIL COMPANY
CHALMETTE, LA

Sample Identification:

NATURAL GAS 4/2

SUBMITTED: 4/3/90

APRIL 6, 1990

MOBIL OIL COMPANY
P.O. BOX 1007
CHALMETTE, LA 70044

ATTN: M. CURTIS
REQUEST NO: 191

— RESULTS OF ANALYSIS —

TEST	RESULT
CARBON, WT. %	74.73
HYDROGEN, WT. %	24.03
OXYGEN, WT. %	0.78
NITROGEN, WT. %	0.46

SGS CONTROL SERVICES INC.

LARRY MC CARTHY
LABORATORY MANAGER

LM/tb

Description of the tested sample material is as indicated by our Client. This report covers only those chemical components and physical properties for which tests were requested. No other tests were performed, and no liability is assumed for anything not tested and reported.

Member of the SGS Group (Société Générale de Surveillance)

1423 04-03-90 PAGE PRINT CONSOLE 1 14:23:21 03APR90

87FI121 NAT GAS TO K-401 DRIVER TIME : 14:23

6 MIN. AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
57		86.77	86.16	86.28	85.45	85.13	85.79	64.39
51		86.46	86.90	86.48	85.24	85.16	85.75	64.56
45		85.53	85.98	86.31	85.31	85.25	86.16	64.57
39		86.92	86.14	86.76	85.37	84.98	86.68	64.61
MSCFD 33		87.18	86.24	86.54	85.71	85.20	86.48	64.47
27		85.66	86.60	86.60	85.48	85.38	86.74	64.61
21	86.95	87.06	86.67	85.80	85.63	85.78	86.70	64.61
15	86.90	86.54	86.46	85.33	86.13	85.76	86.59	64.50
09	86.77	87.04	86.68	85.53	85.58	86.12	87.34	64.47
03	86.90	86.23	86.83	85.81	85.20	85.84	78.04	64.43

HOUR AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
	86.92	85.86	86.44	86.18	85.55	85.43	86.57	64.67
	06HR	05HR	04HR	03HR	02HR	01HR	00HR	23HR
	63.94	63.84	63.73	63.64	64.03	63.81	63.81	63.70
	22HR	21HR	20HR	19HR	18HR	17HR	16HR	15HR
	63.79	65.28	87.56	87.11	86.55	88.82	86.91	86.32

DAY AVERAGE	TUE 03	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27
	75.46	44.98	.0000	.0000	.0000	.0000	.0000	.0000

-----EMERG---------ALARM----------

1423 04-03-90 PAGE PRTUI CONSOLE 1 14:23:49 03APR90

87TI105 NAT GAS TO PGS COMPRESRS TIME : 14:23

6 MIN. AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
57		66.49	65.17	62.24	61.13	57.08	55.53	53.78
51		66.66	65.12	61.92	60.83	56.67	55.43	53.56
45		66.74	64.72	61.77	60.51	56.31	55.29	53.39
39		66.65	64.44	61.78	60.02	56.00	55.16	53.22
DEGF 33		65.85	64.32	61.84	59.57	55.79	55.05	53.06
27		64.97	64.22	61.77	59.14	55.68	54.89	52.96
21	65.56	64.58	63.96	61.70	58.68	55.88	54.64	52.95
15	65.78	64.73	63.38	61.70	58.40	55.77	54.30	53.03
09	65.96	64.31	62.77	61.64	58.09	55.87	54.06	53.11
03	66.14	64.90	62.48	61.44	57.62	55.70	53.99	53.15

HOUR AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
	65.78	65.29	64.18	61.82	59.59	56.16	54.91	53.26
	06HR	05HR	04HR	03HR	02HR	01HR	00HR	23HR
	53.47	54.46	55.58	56.75	58.08	59.87	63.13	66.95
	22HR	21HR	20HR	19HR	18HR	17HR	16HR	15HR
	68.87	70.64	71.74	73.00	75.01	75.53	76.08	77.07

DAY AVERAGE	TUE 03	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27
	58.55	73.73	74.61	68.63	66.60	75.18	69.72	64.04

-----EMERG---------ALARM----------

1424 04-03-90 PAGE PRINT CONSOLE 14:24:29 03APR90

RBK0401QC WGS #2 CH PRSR DUTY, LHV TIME : 14:24 MDATA

6 MIN. AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
57		3.104	3.086	3.100	3.073	3.074	3.102	2.332
51		3.093	3.113	3.108	3.070	3.073	3.101	2.339
45		3.098	3.081	3.102	3.070	3.078	3.116	2.340
39		3.110	3.088	3.118	3.073	3.071	3.135	2.341
MMBTUH 33		3.121	3.092	3.110	3.087	3.080	3.124	2.336
27		3.105	3.105	3.112	3.080	3.087	3.139	2.342
21	3.114	3.120	3.109	3.084	3.087	3.101	3.138	2.342
15	3.111	3.112	3.103	3.067	3.105	3.100	3.135	2.337
09	3.106	3.119	3.112	3.073	3.087	3.111	3.162	2.336
03	3.110	3.090	3.119	3.084	3.074	3.105	2.826	2.335
HOUR AVERAGE	14HR	13HR	12HR	11HR	10HR	09HR	08HR	07HR
	3.112	3.110	3.099	3.097	3.082	3.087	3.131	2.343
	06HR	05HR	04HR	03HR	02HR	01HR	00HR	23HR
	2.316	2.311	2.304	2.298	2.309	2.297	2.290	2.278
	22HR	21HR	20HR	19HR	18HR	17HR	16HR	15HR
	2.277	2.362	3.117	3.097	3.072	3.150	3.082	3.056
DAY AVERAGE	TUE 03	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27
	2.643	1.773	.0000	.0000	.0000	.0000	.0000	.0000

-----EMERG----------ALAR

1759 04-02-90 PAGE PRTDT CONSOLE 9 17:58:53 02APR90

87FI121 NAT GAS TO K-401 DRIVER TIME : 17:58

6 MIN. AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10HR
57	87.51	86.37	86.54	86.16	98.64	101.1	103.0	103.0
51	86.22	90.16	86.25	86.43	100.7	102.8	103.0	103.0
45	84.50	87.70	85.91	86.58	100.6	103.0	103.0	103.0
39	87.28	85.70	86.41	92.93	98.60	103.0	103.0	103.0
MSCFD 33	89.19	85.65	86.25	95.52	99.05	103.0	103.0	103.0
27	89.95	85.54	86.57	95.59	99.85	103.0	103.0	55.87
21	91.23	85.77	86.45	95.79	100.5	103.0	103.0	21.67
15	92.81	86.46	86.22	96.94	102.9	103.0	103.0	21.20
09	92.00	86.14	86.47	98.48	103.0	103.0	103.0	21.29
03	89.42	86.32	86.03	98.75	99.48	103.0	103.0	21.21
HOUR AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10HR
	88.96	85.91	86.32	92.72	100.3	102.6	103.0	69.71
	09HR	08HR	07HR	06HR	05HR	04HR	03HR	02HR
	14.23	.0000	.0000	.0000	.0000	.0000	.0000	.0000
	01HR	00HR	23HR	22HR	21HR	20HR	19HR	18HR
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
DAY AVERAGE	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27	MON 26
	38.58	.0000	.0000	.0000	.0000	.0000	.0000	45.02

1800 04-02-90 PAGE PRINT CONSOLE 9 18:00:05 02APR90

87TI105 NAT GAS TO WGS COMPRESRS TIME : 18:00

6 MIN. AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10HR
57	75.67	75.70	76.16	78.98	81.05	82.32	77.82	75.69
51	75.58	75.85	76.27	79.19	81.44	82.25	77.44	75.40
45	75.59	76.03	76.42	79.40	81.75	81.93	76.92	75.02
39	75.54	76.16	76.58	79.52	81.86	81.44	76.38	[illegible]
DEGF 33	75.53	76.21	76.78	79.69	81.69	81.00	76.14	[illegible]
27	75.47	76.20	77.07	79.95	81.76	80.54	76.11	73.9[illegible]
21	75.41	76.20	77.51	80.08	81.95	79.8[illegible]	76.07	[illegible]
15	75.47	76.23	77.98	80.10	82.02	79.08	76.00	[illegible]
09	75.54	76.22	78.40	80.28	82.16	78.33	75.93	73.57
03	75.57	75.19	78.73	80.57	82.30	78.07	75.84	[illegible]
HOUR AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10[illegible]
	75.53	76.08	77.07	79.69	81.73	80.68	76.57	74.41
	09HR	08HR	07HR	06HR	05HR	04HR	03HR	[illegible]
	73.28	71.60	70.98	70.96	72.01	72.04	71.72	[illegible]
	01HR	00HR	23HR	22HR	21HR	20HR	19HR	18HR
	72.83	73.27	71.99	71.29	69.23	72.12	77.95	[illegible]
DAY AVERAGE	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27	MON [illegible]
	74.58	74.61	68.63	66.60	75.18	69.72	64.04	67.85

1600 04-02-90 PAGE PRINT CONSOLE 9 18:00:45 02APR90

RBK0401DC WGS #2 COMPRSR DUTY, LHV TIME : 18:00 MDATA

6 MIN. AVERAGE	18HR	17HR	16HR	15HR	14HR	13HR	12HR	11HR
57		3.104	3.137	3.068	3.046	3.481	3.565	3.646
51		3.058	3.197	3.058	3.056	3.552	3.626	3.647
45		2.997	3.110	3.045	3.060	3.547	3.632	3.649
39		3.096	3.038	3.062	3.284	3.477	3.634	3.651
MMBTUH 33		3.164	3.036	3.056	3.375	3.494	3.635	3.652
27		3.194	3.033	3.066	3.377	3.522	3.637	3.652
21		3.236	3.041	3.061	3.384	3.545	3.639	3.652
15		3.292	3.065	3.051	3.424	3.630	3.642	3.652
09		3.253	3.054	3.059	3.478	3.630	3.644	3.652
03		3.172	3.060	3.042	3.486	3.507	3.645	.0000
HOUR AVERAGE	18HR	17HR	16HR	15HR	14HR	13HR	12HR	11HR
	BAD	3.150	3.082	3.058	3.276	3.537	3.624	3.651
	10HR	09HR	08HR	07HR	06HR	05HR	04HR	03HR
	2.475	.5056	.0000	.0000	.0000	.0000	.0000	.0000
	02HR	01HR	00HR	23HR	22HR	21HR	20HR	19HR
	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
DAY AVERAGE	MON 02	SUN 01	SAT 31	FRI 30	THR 29	WED 28	TUE 27	MON 26
	1.464	.0000	.0000	.0000	.0000	.0000	.0000	1.610

VII. **APPENDIX**

Contained in this section is a copy of the dry gas meter calibration, pitot tube calibration, gas standard certifications and resumes of Emission Testing Service's personnel who performed the testing. Also contained at the end of this section are excerpts from the operating manuals for each of the continuous analyzers used. The excerpts describe the principle operation of the instrument, analytical technique, performance characteristics, etc..

PITOT TUBE CALIBRATION

Pitot Tube Number P-3-5

Calibrated By Billy Mayo Jr.

Cp (std) 0.99

Date 3-16-90

Point Number	Standard Pitot Δ p (in. H_2O)	"S" Type Pitot Δ p (in. H_2O) "A" Side	"B" Side
1	1.150	1.850	1.850
2	0.545	0.925	0.920
3	0.075	0.115	0.115

Calculations:

$$Cp_{(s)} = Cp_{(std)} \times \sqrt{\frac{\Delta p\ (std)}{\Delta p\ (s)}}$$

$$\text{Deviation} = Cp_{(s)} - \overline{Cp} \quad \text{(Side A or B)}$$

$$\text{Avg. Dev.} = \frac{\sum_{1}^{3} \left| Cp_{(s)} - \overline{Cp} \right|}{3} \quad \text{(Side A or B)}$$

"A" Side $Cp_{(s)}$	Deviation	"B" Side $Cp_{(s)}$	Deviation
0.781	.001	0.781	.001
0.760	.002	0.762	.019
0.799	0.019	0.799	.019

$\overline{Cp}$ = 0.780 = 0.781

$\left| \overline{Cp}\ (\text{Side A}) - \overline{Cp}\ (\text{Side B}) \right|$ = .001 (must be ≤ 0.01)

Avg. Dev. (Side A) = .007 (must be ≤ 0.01)

(Side B) = .018 (must be ≤ 0.01)

$$Cp = \frac{\overline{Cp}\ (\text{Side A}) + \overline{Cp}\ (\text{Side B})}{2} \quad (\text{should be } 0.80 \leq Cp \leq 0.85) = 0.781$$

METER BOX CALIBRATION DATA AND CALCULATION FORM

(English Units)

Leak Check Good @ 0.00792

T.D.G.M.R. 536.200

Date 030790

Meter box number 500

Barometric pressure, P_b 30.18 in. Hg

Calibrated by K. Thibodeaux

Orifice manometer setting (ΔH), in. H_2O	Wet test meter (V_w), ft^3	Dry gas meter (V_d), ft^3	Wet test meter (t_w), °F	Dry gas meter Inlet (t_{d_i}), °F	Dry gas meter Outlet (t_{d_o}), °F	Dry gas meter Avg[a] (t_d), °F	Time (θ), min.
0.5	5	541.199	73.7	90 / 85	84 / 84	85.74	13.30
1.0		542.259	74.0	93 / 86	85 / 84	87.0	10.90
1.5	10	557.373	74.4	95 / 88	86 / 85	88.5	14.67
2.0	10	567.529	74.7	96 / 90	87 / 86	89.75	12.83
3.0	10	577.753	75.0	97 / 91	87 / 86	90.25	10.55
4.0	10						

ΔH, in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6}) (t_w + 460)}$	$\Delta H@_i = \frac{0.0317 \; H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$
0.5	0.0368	1.0215	1.9395
1.0	0.0737	1.0117	1.8071
1.5	0.110	1.0111	1.7654
2.0	0.147	1.0074	1.7984
3.0	0.221	0.9987	1.8244
4.0	0.294		
Average		1.0101	1.8270

Y = Ratio of reading of wet test meter to dry test meter; tolerance for individual values ± 0.02 from average.

$H_@$ = Orifice pressure differential that equates to 0.75 cfm of air @ 68 F and 29.92 inches of mercury, in. H_2O; tolerance for individual values ± 0.20 from average.

Calibrated by [signature]

SCOTT SPECIALTY GASES Scott Environmental Technology, Inc.

1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Sales Prod. Sales. by
Date Shipped :
Our Project # : 92592a
Your P.O. # : 89-0615-2
Page ____ of ____
Expiration Date : 1-11-90

Customer :
EMISSIONS TESTING SERVICES
P.O. BOX 15075
BATON ROUGE, LA 70895

**** CERTIFICATE OF ANALYSIS - EPA PROTOCOL GASES ****

Certified Per Traceability Protocol # 1 Procedure # E1

File # P014E5

Certified Accuracy 1 % NBS Traceable

Cylinder Number AAL-16638

Cylinder Pressure 2000 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD SRM # (CRM #)	CYLINDER NUMBER	CONC.	GAS ANALYZER MAKE/MODEL/SERIAL #	LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	401.6 PPM		AAL-7813	500.1 PPM	BECKMAN	6-15-88	NON-DISPERSED INFRARED
		1679	FF-19673	95.40 PPM			
		1680	FF-19741	470.00 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS DATE : 7-1-88

CYL. GAS (CRM #)	TEST GAS (PPM)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (PPM)	RESULTS PPM
[illegible]	84.40	405.2	470.0 PPM	95.51	474.6
[illegible]	84.40	405.2		95.51	474.6
[illegible]	84.40	405.2		95.51	474.6
[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]			
AVERAGE : 401.6 PPM					

SECOND ANALYSIS DATE : 7-11-88

CYL. GAS (CRM #)	TEST GAS (PPM)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (PPM)	RESULTS PPM
[illegible]	84.40	405.2	470.0 PPM	95.50	474.6
[illegible]	84.20	404.2		95.50	474.7
[illegible]	84.20	404.2		95.70	475.6
[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]			
AVERAGE : 401.7 PPM					

CALIBRATION CURVE 2 nd DEGREE

CRM # (CRM #)	CONC. PPM	SPLIT %	DAS (PPM)	FITTED VALUE	RESIDUAL ERROR
	500.1	100	95.57	499.9	-0.04
	400.1	80	80.75	401.2	0.36
	300.1	60	60.54	300.7	0.23
	200.0	40	40.25	200.0	-0.02
	100.0	20	20.54	99.40	-0.62
	0.0000	0	0.00	0.0000	0.00
	0.00			0.00	0.00
1680	470.0		95.90	474.6	0.95
1679	95.40		23.70	95.76	0.36

* GMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : [signature] Approved By : J. Shapiro

Scott Specialty Gases
TROY, MI. 48083 PHONE: 313-589-2950 FAX NO: 313-589-2134

Date Shipped 10/23/87
Our Project No: 924323
Your P.O. No: VERBAL
Page _____ of _____

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES*
(Concentrations are in mole % or ppm)

Cylinder Number AAL-837 Certified Accuracy ±1% % NBS Traceable Analysis Dates: First 9/18/87 Last 9/25/87

P-0735 CYLINDER PRESSURE 2000 PSIG

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND
CARBON MONOXIDE	201.74 PPM	3/25/89	BECKMAN NDIR	1680B CAL-2284 475 PPM	201.47 PPM	201.47 PPM
					201.78 PPM	202.41 PPM
NITROGEN	BALANCE			1679C CAL-5168 97.10 PPM	201.47 PPM	201.32 PPM

Cylinder Number _____ Certified Accuracy _____ % NBS Traceable Analysis Dates: First _____ Last _____

COMPONENTS	CERTIFIED CONC	EXPIRATION DATE	ANALYTICAL PRINCIPLE	PRIMARY STANDARD NBS/SRM's	REPLICATE CONCENTRATIONS FIRST	SECOND

*We hereby certify the cylinder gas has been analyzed according to EPA Protocol No:

Analyst [signature] Approved By J. Shapiro

The only liability of this Company for gas which fails to comply with this analysis shall be replacement thereof by the Company without extra cost.

CERTIFIED REFERENCE MATERIALS ■ EPA PROTOCOL GASES ■ ACUBLEND® ■ CALIBRATION & SPECIALTY GAS MIXTURES
PURE GASES ■ ACCESSORY PRODUCTS ■ CUSTOM ANALYTICAL SERVICES

PLUMSTEADVILLE, PENNSYLVANIA / SAN BERNARDINO, CALIFORNIA / HOUSTON, TEXAS / WHEELING, ILLINOIS
SOUTH PLAINFIELD, NEW JERSEY / FREMONT, CALIFORNIA / WAKEFIELD, MASSACHUSETTS / LONGMONT, COLORADO

LIQUID CARBONIC
SPECIALTY GAS CORPORATION

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

T : Emmission Testing

Date: March 31, 1989

Ref. # SF06859

Cust. P.O. # 882903-2

Product 12% Oxygen, Balance Nitrogen

Components	Requested	Cyl. Serial No. CC37045 Actual	Cyl. Serial No. CC37032 Actual	Cyl. Serial No. Actual
xygen	12.0%	12.09%	11.94%	
itrogen	Balance	Balance		

y Volume 140 cuft 140 cuft

G Valve No. 590 590

Total Cyl. Pressure 2000 psig 2000 psig

e od of Analysis:

Gas Chromatograph

Gas Chromatograph

Certified By: Jim Felps
Jim Felps

It is recommended the above cylinders not be depleted below 50 psig unless otherwise indicated.

ETS
EMISSION TESTING SERVICES, INC.
P.O. BOX 15075 • BATON ROUGE, LA 70895

Company: Scott Specialty Gases

Analyst: Brad Latham

Cylinder # AAL-18808

Date: 5/26/89

Instrument: Orsat Analysis

Trial	O_2	CO_2
1	20.9	0.0
2	20.9	0.0
3	20.9	0.0
4	20.9	0.0
5	20.9	0.0
6	20.9	0.0
7	20.9	0.0
8	20.9	0.0
9	20.9	0.0

Mean O_2 = 20.9%