MOBIL OIL CORPORATION

P.O. BOX 1007

CHALMETTE, LOUISIANA 70044

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OXIDES OF NITROGEN and CARBON MONOXIDE EMISSION TESTING on K-402 COMPRESSOR

MARCH 28-29, 1990

Submitted By :

EMISSION TESTING SERVICES, INC.

POST OFFICE BOX 15075

BATON ROUGE, LOUISIANA 70895

90028

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CONFIRMATION OF INFORMATION

EMISSION TEST REPORT

FOR

MOBIL OIL CORPORATION

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OXIDES OF NITROGEN and CARBON MONOXIDE
EMISSION TESTING
on
K-402 COMPRESSOR

MARCH 28-29, 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
Fred Dowling
Emission Testing Services
Senior Consultant

Barry Gipson
Barry Gipson
Emission Testing Services
Manager

OXIDES OF NITROGEN and CARBON MONOXIDE
EMISSION TESTING
on
K-402 COMPRESSOR

MARCH 28-29, 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 #3, K-402, source ID 52, 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 #3 is driven by a natural gas fueled internal combustion engine rated at 800 Bhp at 300 rpm.

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 John Angelloz, Fred Dowling, Billy Magee, and Kevin Thibodeaux. Lisa Sutton represented Mobil and coordinated testing with plant operations.

Emissions were determined on March 28-29, 1990 with three test runs. During testing, the compressor was operating at maximum load conditions, recorded by Mobil personnel.

II. SUMMARY

Emissions data collected from the K-402 Compressor during testing on March 28-29, 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-402 COMPRESSOR

PARAMETER	PERMIT LIMIT	RUN 1	RUN 2	RUN 3	AVG.
DATE		3-28-90	3-28-90	3-29-90	
TIME		1452-1551	1636-1735	753- 835	
OXIDES OF NITROGEN					
(lb/hr)	24.96	0.512	0.502	0.226	0.413
(PPM)		17.95	17.46	7.56	14.32
CARBON MONOXIDE					
(lb/hr)	3.15	2.438	2.484	3.604	2.842
(PPM)		159.6	163.8	236.0	186.5
OXYGEN - test monitor (%)		16.40	16.40	16.65	16.48
ENGINE SPEED - rpm		300	299	300	300
STACK GAS DATA					
TEMPERATURE, F		460	461	443	455
MOISTURE, %		5.07	5.14	4.72	4.98
VELOCITY, ft/ sec		114.91	114.41	112.31	113.88
FLOW RATE, ACFM		6355.0	6327.4	6211.4	6297.9
, DSCFM		3500.1	3476.5	3499.5	3492.0

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-402 Compressor had a stack diameter of 13.00 in. Samples and measurements were collected at a point 2.69 stack diameters upstream and 4.35 stack diameters downstream from the nearest flow disturbances. Under these conditions the method requires 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

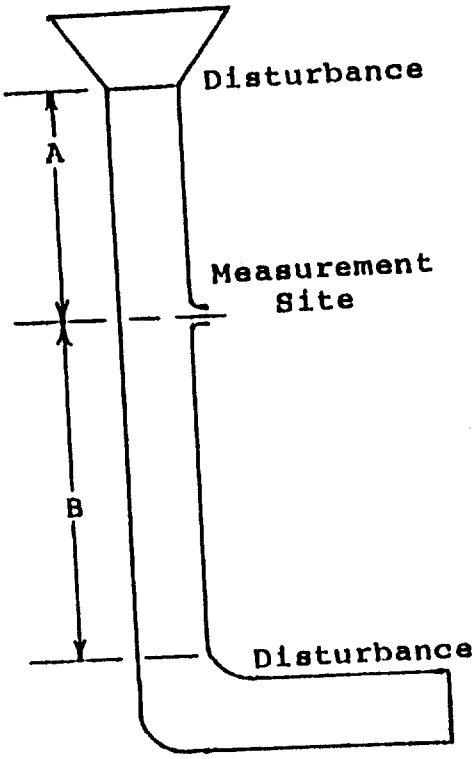
Chain of custody procedures are initiated for all samples transported to the laboratory for analysis. The emission testing conducted produced no samples requiring transport to the laboratory for analyses as all analyses were completed in the field.

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 032790

Unit Tested K-402 COMPRESSOR

Location CHALMETTE, LA

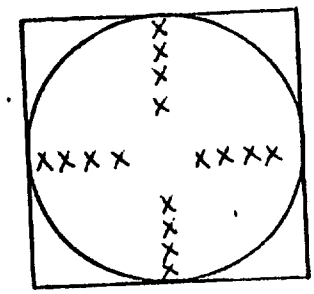
Upstream Distance (A) 35"

Downstream Distance (B) 56.5"

Inside Diameter 13.0"

Coupling Length 6.5"

Coupling Type 3" MALE SCREW-ON

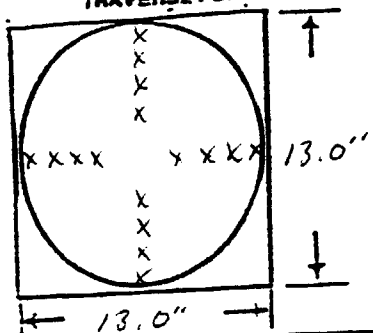


Cross Section Schematic of Stack

Traverse Point	Distance % of Diameter		Stack Diameter		Coupling Length		Traverse Points	
1	* 0.032	x	13.0	+	6.5	=	~~6.916~~	7.000
2	0.105						7.865	
3	0.194						9.022	
4	0.323						10.699	
5	0.677						15.301	
6	0.806						16.978	
7	0.895						18.135	
8	* 0.968		13.0		6.5		~~19.084~~	19.000
9								
10								
11								
12								

NOTE: * MEANS POINTS ARE RELOCATED 0.50" AWAY FROM STACK WALLS

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 032890
LOCATION Chalmette, LA
OPERATOR K. Thibodeaux
STACK NO. K-402 Compressor
RUN NO. 1

SAMPLE BOX NO. BT
METER BOX NO. 500
AMBIENT TEMPERATURE 75°F
BAROMETRIC PRESSURE 30.04
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 13.0"
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	OUTLET (Tmout), °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER F	PUMP VACUUM in. Hg psaps
1	14:58	on @	458	2.50	1.581	1.5	1.5	019.900	88	88	259	64	5.1
2		2.75	457	2.55	1.597								
3			459	2.50	1.581	1.5	1.5						
4	15:28	off @	464	2.60	1.612	1.5	1.5	041.193	105	97	263	67	5.1
5			466	2.65	1.628								
6			472	2.75	1.658								
7			471	3.20	1.789								
8			471	3.25	1.803								
9	15:33	on @	423	3.55	1.884	1.5	1.5	041.193	95	96	271	65	4.9
10			449	2.50	1.581								
11			454	2.45	1.565								
12	16:03	off @	456	2.50	1.581	1.5	1.5	062.569	110	103	256	62	5.0
13			462	2.60	1.612								
14			465	2.70	1.643								
15			466	3.05	1.746								
16			465	3.10	1.761								
AVERAGE	60 min	2.75	459.87		1.664	1.5		42.669		97.75			

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	555.7	1592.8	449.8	1598.6
INITIAL	528.4	1582.0	449.3	1590.7
WEIGHT COLLECTED	27.3	10.8	0.5	7.9
TOTAL WEIGHT				46.5

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	2.0	16.8	0.0	81.2
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 10" Hg - .003 CFM
POST-LEAK CHECK GOOD @ 8" Hg - .002 CFM

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$= (27.3 + 10.8 + .5 + 7.9) / (453.6) = .10251$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.10251)(21.85)(528)}{(29.92)(18.0)} = 2.19599$$

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

$$= (42.669)(1.0101) \frac{(30.040 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(558.)}$$

$$= 41.11508$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(2.19599)}{(2.19599 + 41.11508)} = .0507$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$Md = 0.440(2.0) + 0.320(16.8) + 0.280(81.2 + .0)$$

$$= 28.992$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$= (28.992)(1 - .0507) + (18.0)(.0507) = 28.435$$

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

$$= (85.49)(.7810)(1.6640)\left(\frac{920.}{[30.242][28.435]}\right)^{0.5} = 114.9080$$

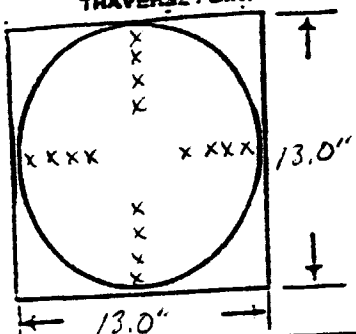
$$Acf = (60)(Vs)(A) = (60)(114.9080)(.9218) = 6355.0$$

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

$$Qsd = 3600(1 - .0507)(114.9080)(.9218)\frac{(528)}{(920.)}\frac{(30.242)}{(29.92)}$$

$$= 210003.1 \text{ DSCFH}$$
$$= 3500.1 \text{ DSCFM}$$

CROSS SECTIONAL SCHEMATIC OF STACK
TRAVERSE POINT LAYOUT



ETS FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 032890
LOCATION Chalmette, LA.
OPERATOR K. Thibodeaux
STACK NO. K-402 Compressor
RUN NO. 2

SAMPLE BOX NO. BL
METER BOX NO. 500
AMBIENT TEMPERATURE 74°F
BAROMETRIC PRESSURE 30.03
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 13.0"
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	16:29	on ⊘	461	2.50	1.581	1.5	1.5	062.571	94	96	240	60	5.8
2		2.90	463	2.60	1.612								
3			463	2.65	1.628								
4	16:58	off ⊘	462	2.60	1.612	1.5	1.5	089.871	105	98	267	64	5.8
5			461	2.55	1.597								
6			463	2.80	1.673								
7			465	2.95	1.717								
8			466	3.25	1.803								
9	1700	on ⊘	452	2.55	1.597	1.5	1.5	083.871	95	96	261	62	5.5
10			453	2.45	1.565								
11			453	2.50	1.581								
12	1730	off ⊘	457	2.60	1.612	1.5	1.5	097.901	111	103	272	63	5.7
13			462	2.70	1.643								
14			467	2.90	1.703								
15			467	3.15	1.775								
16			468	3.25	1.803								
AVERAGE	60 min	2.90	461.44		1.656	1.5		035.330		99.75			

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	589.6	623.2	463.8	604.4
INITIAL	564.5	616.6	463.4	597.6
WEIGHT COLLECTED	25.1	15.6	0.4	6.8
TOTAL WEIGHT				47.9

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	2.7	17.2	0.0	80.6
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 10" Hg. - .006 CFM
POST-LEAK CHECK GOOD @ 8" Hg. - .004 CFM

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$= (25.1 + 6.6 + .4 + 6.8) / (453.6) = .08576$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.08576)(21.85)(528)}{(29.92)(18.0)} = 1.83708$$

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

$$= (35.330)(1.0101) \frac{(30.030 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(560.)}$$

$$= 33.91047$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(1.83708)}{(1.83708 + 33.91047)} = .0514$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$Md = 0.440(2.2) + 0.320(17.2) + 0.280(80.6 + .0)$$

$$= 29.040$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-28-90
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

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

$$= (29.040)(1 - .0514) + (18.0)(.0514) = 28.473$$

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

$$= (85.49)(.7810)(1.6565)\left(\frac{921.}{[30.243][28.473]}\right)^{0.5} = 114.4091$$

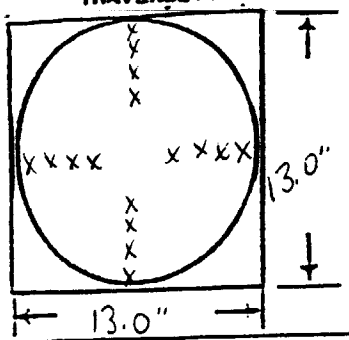
$$Acf = (60)(Vs)(A) = (60)(114.4091)(.9218) = 6327.4$$

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

$$Qsd = 3600(1 - .0514)(114.4091)(.9218)\frac{(528)(30.243)}{(921.)(29.92)}$$

$$= 208592.6 \text{ DSCFH}$$
$$= 3476.5 \text{ DSCFM}$$

CROSS SECTIONAL SCHEMATIC OF STACK TRAVERSE POINT LAYOUT



E T S FIELD DATA, METHOD(S) 1-4

PLANT Mobil
DATE 032990
LOCATION Chalmette, LA.
OPERATOR K. Thibodeaux
STACK NO. K-402 Compressor
RUN NO. 3

SAMPLE BOX NO. BT
METER BOX NO. 500
AMBIENT TEMPERATURE 73°F
BAROMETRIC PRESSURE 30.04
FILTER TARE wt mg N/A
PROBE LENGTH, in. 36"

STACK DIAMETER, in. 13.0"
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	07:53	on @	447	2.75	1.658	1.5	1.5	098.050	76	76	242	60	4.2
2		3.00	450	2.60	1.612								
3			448	2.60	1.612								
4	08:23	off @	447	2.55	1.597	1.5	1.5	119.449	100	91	265	64	4.1
5			447	2.55	1.597								
6	Change port #5		453	2.70	1.643								
7			456	2.90	1.703								
8			456	3.10	1.761								
9	08:25	on @	427	2.60	1.612	1.5	1.5	119.449	90	90	253	61	4.0
10	08:37	off @	430	2.50	1.581	1.5	1.5	129.425	99	96	252	64	4.0
11			427	2.50	1.581								
12	~~08:49~~	~~off @~~	431	2.50	1.581	~~1.5~~	~~1.5~~		~~99~~	~~96~~			
13			438	2.65	1.628								
14			443	2.70	1.643								
15			445	2.95	1.717								
16			444	3.10	1.761								
AVERAGE	~~60 min~~	3.00	443.06		1.643	1.5		31.375		89.75			

VOLUME OF LIQUID WATER COLLECTED	IMPINGER WEIGHTS			
FINAL	555.7	592.8	449.8	598.6
INITIAL	575.1	600.5	450.5	603.0
WEIGHT COLLECTED	19.4	7.7	0.7	4.4
TOTAL WEIGHT				32.2

ORSAT MEASUREMENT

	CO_2	O_2	CO	N_2
1	12.0	16.8	0.0	81.2
2				
3				
4				

COMMENTS:

PRE-LEAK CHECK GOOD @ 10" Hg - .002 CFM
POST-LEAK CHECK GOOD @ 6" Hg - .003 CFM

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

Client : MOBIL
Source : K-402
Testing Date : 3-29-90
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

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

$$= (19.4 + 7.7 + .7 + 4.4) / (453.6) = .07099$$

$$Vw = \frac{Wwc\ R\ Tst}{Pst\ Mw} = \frac{(.07099)(21.85)(528)}{(29.92)(18.0)} = 1.52067$$

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

$$= (31.375)(1.0101) \frac{(30.040 + 1.5000/13.6)}{(29.92)} \frac{(528)}{(550.)}$$

$$= 30.67233$$

$$Bws = \frac{Vw}{Vw + Vmstd} = \frac{(1.52067)}{(1.52067 + 30.67233)} = .0472$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-29-90
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

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

$$Md = 0.440(2.0) + 0.320(16.8) + 0.280(81.2 + .0)$$

$$= 28.992$$

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

Client : MOBIL
Source : K-402
Testing Date : 3-29-90
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 H20)**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

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

$$= (28.992)(1 - .0472) + (18.0)(.0472) = 28.473$$

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

$$= (85.49)(.7810)(1.6431)\left(\frac{903.}{[30.261][28.473]}\right)^{0.5} = 112.3115$$

$$Acf = (60)(Vs)(A) = (60)(112.3115)(.9218) = 6211.4$$

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

$$Qsd = 3600(1 - .0472)(112.3115)(.9218)\frac{(528)(30.261)}{(903.)(29.92)}$$

$$= 209970.1 \text{ DSCFH}$$
$$= 3499.5 \text{ DSCFM}$$

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

Client : MOBIL
Source : K-402
Testing Date : 3/28-29/90

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 - (76.0 - 85)(0.0135) = 1.1215

Kh = 0.844 + (0.151)(80/100) + (0.075)(80/100)2 = 1.0128

ENOX =(17.95)(1.1215)(1.0128)(1.1948 X 10-7)(210003.1)

= 0.512

-------- RUN 2 ------ Kt = 1 - (75.0 - 85)(0.0135) = 1.1350

Kh = 0.844 + (0.151)(81/100) + (0.075)(81/100)2 = 1.0155

ENOX =(17.46)(1.1350)(1.0155)(1.1948 X 10-7)(208592.6)

= 0.502

-------- RUN 3 ------ Kt = 1 - (73.0 - 85)(0.0135) = 1.1620

Kh = 0.844 + (0.151)(84/100) + (0.075)(84/100)2 = 1.0238

ENOX =(7.56)(1.1620)(1.0238)(1.1948 X 10-7)(209970.1)

= 0.226

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

Client : MOBIL
Source : K-402
Testing Date : 3/28-29/90
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 = (159.6)(7.2727 X 10-8)(210003.1) = 2.438

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

ECO = (163.8)(7.2727 X 10-8)(208592.6) = 2.484

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

ECO = (236.0)(7.2727 X 10-8)(209970.1) = 3.604

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 #1

Run Title: MOBIL OIL CORPORATION K402

Date: 3/28/1990

Time	CO VTS	NOX VTS	O2 VTS	CO AV (159.65)	NOX AV (17.95)	O2 AV (16.4)
14:52:40	1.3822	2.1197	6.52	143.66	20.3	16.3243H
14:53:40	1.5254	2.3622	6.52	158.43	23.4	16.3120H
14:54:40	1.3187	1.9650	6.51	137.11	19.3	16.2874H
14:55:41	1.1673	1.4766	6.57	121.50	14.7	16.4308H
14:56:41	1.5124	2.2662	6.52	157.09	22.1	16.3202H
14:57:41	1.4457	1.8673	6.53	150.21	18.1	16.3366H
14:58:41	1.5010	2.1441	6.53	155.91	20.6	16.3407H
14:59:41	1.4799	2.0073	6.51	153.73	18.7	16.2997H
15:00:41	1.3317	1.9259	6.51	138.46	19.0	16.2956H
15:01:41	1.6247	2.5071	6.53	168.67	24.4	16.3530H
15:02:41	1.5043	2.1278	6.53	156.25	20.9	16.3325H
15:03:41	1.3187	1.8494	6.52	137.11	18.1	16.3243H
15:04:41	1.5043	2.0366	6.51	156.25	19.3	16.2874H
15:05:41	1.2340	2.0464	6.51	128.38	19.4	16.2833H
15:06:41	1.3708	2.1018	6.53	142.48	21.0	16.3284H
15:07:41	1.5938	2.0171	6.53	165.48	20.1	16.3294H
15:08:41	1.3496	1.8543	6.52	140.30	18.4	16.3079H
15:09:42	1.4522	2.2906	6.51	150.88	22.7	16.2915H
15:10:42	1.5401	1.7941	6.57	159.94	17.5	16.4308H
15:11:42	1.4392	1.9357	6.53	149.54	19.2	16.3284H
15:12:42	1.6557	2.3687	6.53	171.86	23.2	16.3366H
15:13:42	1.4310	1.9829	6.52	148.70	19.6	16.3079H
15:14:42	1.5678	2.1262	6.53	162.80	21.2	16.3489H
15:15:42	1.5938	1.6280	6.53	165.48	15.3	16.3284H
15:16:42	1.5385	1.8575	6.54	159.78	17.6	16.3571H
15:17:42	1.6296	2.2678	6.54	169.18	21.7	16.3571H
15:18:42	1.5043	1.6850	6.56	156.25	15.7	16.4144H
15:19:42	1.4685	1.9031	6.52	152.56	19.0	16.3120H
15:20:42	1.6540	2.0513	6.53	171.69	20.3	16.3448H
15:21:42	1.5613	1.7924	6.56	162.13	17.4	16.4144H
15:22:42	1.5173	1.7468	6.55	157.59	17.3	16.3816H
15:23:42	1.6394	1.7501	6.55	170.18	16.6	16.3980H
15:24:42	1.4164	1.6622	6.55	147.19	16.0	16.3857H
15:25:43	1.4668	1.8055	6.55	152.39	17.4	16.3816H
15:26:43	1.5564	1.5726	6.53	161.62	15.8	16.3325H
15:27:43	1.5010	1.5499	6.52	155.91	15.6	16.3202H
15:28:43	1.7143	1.8722	6.58	177.91	18.1	16.4636H
15:29:43	1.6410	1.6443	6.57	170.35	16.0	16.4431H
15:30:43	1.5515	1.7013	6.53	161.12	16.9	16.3366H
15:31:43	1.5385	1.7289	6.55	159.78	16.5	16.3816H
15:32:43	1.5075	1.5092	6.56	156.59	15.0	16.4103H
15:33:43	1.6003	1.7257	6.56	166.15	16.1	16.4103H
15:34:43	1.6589	1.6394	6.53	172.20	15.9	16.3530H
15:35:43	1.4375	1.6557	6.54	149.37	16.1	16.3571H
15:36:43	1.6166	1.7924	6.53	167.83	17.6	16.3366H
15:37:45	1.7061	1.4750	6.56	177.07	13.5	16.4267H
15:38:45	1.5743	1.5873	6.54	163.47	14.6	16.3612H
15:39:46	1.6215	1.8722	6.52	168.34	17.3	16.3161H
15:40:46	1.6378	1.6150	6.53	170.02	16.1	16.3530H
15:41:46	1.5482	1.5808	6.55	160.78	15.0	16.4021
15:42:46	1.5710	2.0171	6.52	163.13	19.4	16.3161
15:43:46	1.6475	1.6622	6.57	171.02	16.0	16.4472
15:44:46	1.5987	1.6378	6.56	165.99	15.4	16.4226
15:45:46	1.6443	1.7061	6.54	170.69	16.3	16.3734
15:46:46	1.6329	1.6133	6.57	169.51	16.0	16.4390
15:47:46	1.5303	1.5433	6.55	158.94	15.7	16.4021
15:48:46	1.7354	1.7387	6.54	180.09	16.5	16.3612
15:49:46	1.6606	1.6247	6.56	172.37	15.7	16.4267
15:50:46	1.5368	1.8608	6.53	159.61	17.8	16.3407
15:51:46	1.5059	1.5678	6.55	156.42	15.2	16.3857

RUN #2

Run Title: MOBIL OIL CORPORATION K402

Date: 3/28/1990

Time	CO VTS	NOX VTS	O2 VTS	CO AV (163.77)	NOX AV (17.46)	O2 AV (16.4)
16:36:31	1.4978	2.1652	6.51	156.24	22.0	16.3538
16:37:31	1.2959	2.2694	6.52	135.64	22.7	16.3744
16:38:31	1.3952	2.1864	6.52	145.77	21.7	16.3662
16:39:31	1.6150	1.8982	6.53	168.20	19.1	16.3950
16:40:31	1.5515	1.8575	6.53	161.72	18.0	16.4115
16:41:31	1.6964	2.0057	6.53	176.50	20.3	16.4074
16:42:31	1.6280	1.6540	6.56	169.52	16.3	16.4816
16:43:31	1.6850	1.6117	6.58	175.34	15.1	16.5269
16:44:31	1.7566	1.9113	6.53	182.65	18.6	16.4156
16:45:31	1.5580	1.4701	6.56	162.38	13.9	16.4692
16:46:31	1.4424	1.3496	6.52	150.59	14.8	16.3744
16:47:31	1.7534	1.9943	6.53	182.31	20.2	16.3950
16:48:31	1.6589	1.5645	6.55	172.68	15.5	16.4651
16:49:31	1.6768	1.5726	6.58	174.51	15.4	16.5228
16:50:31	1.7566	1.9406	6.55	182.65	19.4	16.4445
16:51:32	1.5319	1.7175	6.55	159.72	17.5	16.4445
16:52:32	1.4587	1.5466	6.54	152.25	15.1	16.4280
16:53:32	1.6443	1.5336	6.52	171.19	14.6	16.3703
16:54:32	1.6150	1.6036	6.57	168.20	15.9	16.5104
16:55:32	1.4701	1.7843	6.50	153.41	17.7	16.3373
16:56:32	1.6589	1.6801	6.56	172.68	17.1	16.4816
16:57:32	1.5450	1.5352	6.528	161.05	15.8	16.3991
16:58:32	1.4505	1.6703	6.501	151.42	16.3	16.3291
16:59:32	1.4636	1.5206	6.505	152.75	15.3	16.3415
17:00:32	1.4831	1.6915	6.522	154.74	16.2	16.3827
17:01:32	1.7208	2.2206	6.528	178.99	21.6	16.3991
17:02:32	1.6475	1.6215	6.541	171.52	16.5	16.4321
17:03:32	1.6020	1.5531	6.559	166.87	15.5	16.4774
17:04:32	1.5238	1.7192	6.505	158.89	17.0	16.3415
17:05:32	1.4505	1.3854	6.532	151.42	13.7	16.4074
17:06:32	1.4750	1.6215	6.520	153.91	16.7	16.3785
17:07:32	1.6101	1.5694	6.514	167.70	16.0	16.3621
17:08:32	1.4180	1.4733	6.548	148.10	15.0	16.4486
17:09:32	1.5759	1.9113	6.512	164.21	18.5	16.3579
17:10:33	1.4750	1.5385	6.556	153.91	14.7	16.4692
17:11:33	1.3724	1.5678	6.536	143.45	15.9	16.4197
17:12:33	1.6492	2.0497	6.561	171.68	20.4	16.4816
17:13:33	1.6687	1.6882	6.549	173.68	16.6	16.4527
17:14:33	1.6199	1.7696	6.530	168.69	17.9	16.4033
17:15:33	1.6817	1.8217	6.519	175.01	18.6	16.3744
17:16:33	1.4017	1.6980	6.515	146.44	16.2	16.3662
17:17:33	1.5303	1.6557	6.523	159.56	15.7	16.3868
17:18:33	1.6247	1.8152	6.517	169.19	18.4	16.3703
17:19:33	1.5743	1.7973	6.533	164.04	17.3	16.4115
17:20:33	1.4278	1.5938	6.535	149.09	15.7	16.4156
17:21:34	1.6768	2.0545	6.525	174.51	21.1	16.3909
17:22:34	1.4164	1.6508	6.536	147.93	16.7	16.4197
17:23:34	1.4375	1.7289	6.512	150.09	16.7	16.3579
17:24:34	1.7794	1.9552	6.533	184.97	19.4	16.4115
17:25:34	1.5303	1.6671	6.519	159.56	16.9	16.3744
17:26:34	1.4636	1.5140	6.512	152.75	14.7	16.3579
17:27:34	1.5124	1.7582	6.507	157.73	17.5	16.3456
17:28:34	1.6133	1.8852	6.532	168.03	18.6	16.4074
17:29:34	1.6313	2.1245	6.536	169.86	21.5	16.4197
17:30:34	1.5417	1.7517	6.556	160.72	17.7	16.4692
17:31:34	1.4473	1.6768	6.561	151.09	16.6	16.4816
17:32:34	1.6199	2.0155	6.538	168.69	20.1	16.4239
17:33:34	1.6101	1.9357	6.528	167.70	19.2	16.3991
17:34:34	1.4945	1.8934	6.569	155.90	18.9	16.5022
17:35:34	1.5157	2.1604	6.571	158.06	21.2	16.5063

Run TitleMOBIL OIL CORPORATION K400

Date: 3/29/199 RUN #3

Time	CO AV		NOX AV		O2 AV	
07:53:50	172.40	OK	13.04	OK	16.44	OK
07:54:50	186.94	OK	8.63	OK	16.66	OK
07:55:50	196.10	OK	7.22	OK	16.64	OK
07:56:51	213.95	OK	9.22	OK	16.67	OK
07:57:51	218.06	OK	7.61	OK	16.65	OK
07:58:51	225.49	OK	6.81	OK	16.66	OK
07:59:51	231.65	OK	6.85	OK	16.66	OK
08:00:51	231.34	OK	6.73	OK	16.68	OK
08:01:51	228.02	OK	8.36	OK	16.66	OK
08:02:51	230.07	OK	8.43	OK	16.66	OK
08:03:51	224.38	OK	6.94	OK	16.67	OK
08:04:51	222.33	OK	8.58	OK	16.64	OK
08:05:51	231.97	OK	7.22	OK	16.66	OK
08:06:51	214.90	OK	9.40	OK	16.60	OK
08:07:51	204.63	OK	8.78	OK	16.65	OK
08:08:51	206.53	OK	8.41	OK	16.57	OK
08:09:51	212.06	OK	9.98	OK	16.67	OK
08:10:51	204.79	OK	8.86	OK	16.58	OK
08:11:51	216.96	OK	7.94	OK	16.55	OK
08:12:51	231.02	OK	9.15	OK	16.68	OK
08:13:51	211.43	OK	8.07	OK	16.63	OK
08:14:51	226.12	OK	7.92	OK	16.66	OK
08:15:51	223.59	OK	7.70	OK	16.76	OK
08:16:51	234.18	OK	6.26	OK	16.64	OK
08:17:51	254.72	OK	7.82	OK	16.66	OK
08:18:51	240.66	OK	6.01	OK	16.64	OK
08:19:51	245.87	OK	8.53	OK	16.65	OK
08:20:51	252.67	OK	7.72	OK	16.68	OK
08:21:51	257.41	OK	6.98	OK	16.66	OK
08:22:51	261.04	OK	8.12	OK	16.67	OK
08:23:51	271.94	OK	5.31	OK	16.75	OK
08:24:51	269.89	OK	6.88	OK	16.66	OK
08:25:51	250.14	OK	6.63	OK	16.67	OK
08:26:52	272.89	OK	5.69	OK	16.65	OK
08:27:52	284.74	OK	4.71	OK	16.64	OK
08:28:52	295.80	OK	6.22	OK	16.65	OK
08:29:52	284.43	OK	5.86	OK	16.72	OK
08:30:52	290.27	OK	6.15	OK	16.66	OK
08:31:52	268.15	OK	6.30	OK	16.64	OK
08:32:52	260.25	OK	5.86	OK	16.65	OK
08:33:52	258.99	OK	5.97	OK	16.65	OK
08:34:52	208.74	OK	7.88	OK	16.65	OK
08:35:52	222.01	OK	8.35	OK	16.64	OK
AVERAGE	236.04		7.56		16.65	

METHOD 7E DATA SHEET

COMPANY MOBIL SOURCE # K-402 DATE 032890

PARAMETER NOx LOAD% MAX RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N_2	0.10	0.50	0.06	0.10	-0.40
Mid	45.57	4.54	44.51	4.49	44.01	-0.50
High	83.20	8.50	83.76	8.37	82.47	-1.31

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

Slope 9.9120 Intercept -0.4911 Span Range 98.63

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.	44.51	4.60	45.10	0.60	4.31	42.23	-2.31	-2.91

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

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

TEST DATA

Start time _____ Finish time _____ Minutes per point _____

Test Point 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 = 0.99976

ETS

METHOD 10 DATA SHEET

COMPANY MOBIL SOURCE # K400 DATE 032890

PARAMETER CO LOAD% MAX 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	0.01	2.17	0.01	2.17	0.00
Low	201.74	1.97	204.27	1.96	203.24	-0.10
Mid	401.6	3.81	394.00	3.80	392.97	-0.10
High	851.0	8.27	853.89	8.35	862.14	0.80

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

Slope 103.1143 Intercept 1.1382 Span Range 1032.28

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

TEST DATA

Start time _____ Finish time _____ 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 = 0.99990

WET BULB = 66°F

DRY BULB = 76°F

METHOD 3A DATA SHEET

COMPANY MOBIL SOURCE # K402 DATE 032890

PARAMETER Dz LOAD% MAX RUN NUMBER 1

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N2	0.01	-0.07	0.01	-0.07	0.00
Mid	11.96	4.86	12.14	4.87	12.16	0.09
High	20.9	8.30	20.80	8.25	20.67	-0.51

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

Slope 2.5175 Intercept -0.0984 Span Range 25.08

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 _____

Sample port _____

Test Point	v				
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 = 0.99989

METHOD 7E DATA SHEET

COMPANY Mobil SOURCE # K402 DATE 032890

PARAMETER NOx LOAD% MAX RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N2	0.06	0.38	0.07	0.48	0.10
Mid	45.57	4.49	44.76	4.53	45.16	0.40
High	83.20	8.37	83.63	8.20	81.93	-1.70

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

Slope 10.0185 Intercept -0.2229 Span Range 99.96

Analyzer Cal	Init. Analyzer Resp. mv	Init. Analyzer Resp. ppm	Bias ±5	Final Analyzer Resp. mv	Final Analyzer Resp. ppm	Bias ±5	Drift ±3
Conc. 44.76	4.31	42.96	-1.80	4.27	42.56	-2.20	-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 _____

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 = 0.99986

ETS

METHOD 10 DATA SHEET

COMPANY MOBIL SOURCE # K402 DATE 032890

PARAMETER CO LOAD% MAX 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	0.01	4.44	0.02	5.46	0.10
Low	201.74	1.96	203.40	1.97	204.42	0.10
Mid	401.6	3.80	391.13	3.81	392.15	0.10
High	851.0	8.35	855.37	8.30	850.27	-0.50

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

Slope 102.0299 Intercept 3.4196 Span Range 1023.72

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

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 = 0.99981

WET BULB = 66°F

DRY BULB = 75°F

METHOD 3A DATA SHEET

COMPANY MOBIL SOURCE # K402 DATE 032890

PARAMETER O2 LOAD% MAX RUN NUMBER 2

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N2	0.01	-0.10	0.02	-0.07	0.10
Mid	11.96	4.87	12.20	4.86	12.18	-0.09
High	20.9	8.25	20.76	8.32	20.93	0.69

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

Slope 2.5311 Intercept -0.1246 Span Range 25.19

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 _____

Sample port _____

Test Point	v				
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 = 0.99980

METHOD 7E DATA SHEET

COMPANY Mobil SOURCE # K402 DATE 032990

PARAMETER NOx LOAD% MAX RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response mv	Analyzer Response ppm	Absolute Difference mv	Absolute Difference ppm	% Drift ±2%
Zero	N2	0.04	-0.34	0.03	-0.45	-0.10
Mid	45.57	4.40	46.35	4.37	46.03	-0.30
High	83.20	7.80	82.76	7.91	83.94	1.11

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

Slope 10.7092 Intercept -0.7702 Span Range 106.32

Analyzer Cal	Init. Analyzer Resp. mv	ppm	Bias ±5	Final Analyzer Resp. mv	ppm	Bias ±5	Drift ±3
Conc.	46.35	4.11	43.24	-2.92	4.23	44.53	-1.71	1.21

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 = 0.99987

ETS

METHOD 10 DATA SHEET

COMPANY MOBIL SOURCE # K4D2 DATE 032990

PARAMETER CO LOAD% MAX 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	N2	0.02	8.11	0.02	8.11	0.00
Low	201.74	2.01	201.26	2.02	202.23	0.10
Mid	401.6	3.93	387.61	3.95	389.55	0.20
High	851.0	8.77	857.36	8.75	855.42	-0.20

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

Slope 97.0571 Intercept 6.1723 Span Range 976.74

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

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 = 0.99962

WET BULB = 66°F

DRY BULB = 73°F

METHOD 3A DATA SHEET

COMPANY MOBIL SOURCE # K402 DATE 032990

PARAMETER O_2 LOAD% MAX RUN NUMBER 3

CALIBRATION STATISTICS

Cylinder Value		Analyzer Response v	Analyzer Response %	Absolute Difference v	Absolute Difference %	% Span ±2%
Zero	N_2	0.01	-0.08	0.02	-0.06	0.10
Mid	11.96	4.86	12.16	4.86	12.16	0.00
High	20.9	8.28	20.78	8.31	20.86	0.32

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

Slope 2.5231 Intercept -0.1063 Span Range 25.12

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 ____

Sample port _____

Test Point	v				
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 = 0.99987

Following are Compressor operating data recorded during the emission test.

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE OPERATIONAL RECORD

Company Name Mobil Oil Corporation

Company Location 500 W. ST. BERNARD HWY.

Engine Name K-402

Engine Source I. D. No. #52

Design Specifications

Manufacturer's Name Cooper-Bessemer

Model No. GMVA Serial No. 114958

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.) psia

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 _____

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE

TEST RUN LOG

(GAS ENGINES)

Company Mobil

Engine K402

Operator F. Fradella L. Fradella

Date: 3-28-90 Test Time: Start 1631 End 1736

Ambient Temperature, at time of test 78°

Engine Load Condition % 100

DATA LOG TIME (15 minute intervals)	1631	1706	1721	1736
Fuel Feed (flow)	130.4	131	131.7	131.6
Intake Manifold Temp.	73°	75°	73°	74°
Intake Manifold Pressure	2.3 psi	2.3 psi	2.2	2.3
Fuel Header Pressure	20	20	20	20
Engine Speed (rpm)	299	299	299	298
Spark Ignition Timing	Electronically		controlled	
Horse Power				

Run Conditions:

Remarks: Run #2

EMISSION TESTING SERVICES, INC.

INTERNAL COMBUSTION ENGINE

TEST RUN LOG

(GAS ENGINES)

Company MOBIL

Engine K402

Operator J. ANGELLOZ John Angello

Date: 3-29-90 Test Time: Start 0754 End 0854

Ambient Temperature, at time of test 73°F

Engine Load Condition % 100

DATA LOG TIME (15 minute intervals)	0809	0824	0839	0854
Fuel Feed (flow)	123.4	120.7	118.3	
Intake Manifold Temp.	73°	73°	73°	
Intake Manifold Pressure	2.5	2.4	2.3	
Fuel Header Pressure	19.5	19	19	
Engine Speed (rpm)	301	300	299	
Spark Ignition Timing	ELECTRONICALLY		LOCKED	IN PLACE
Horse Power				

Run Conditions:

Remarks: RUN #3

90028

SGS Control Services Inc.
P. O. Box 1328
Kenner, LA 70063
Tel. (504) 468-8401
Telex: 460133

ANALYSIS CERTIFICATE

Lab No: A9004-011 File No: 221216

Sample Description: NATURAL GAS

Sample Submitted By: MOBIL OIL COMPANY
CHALMETTE, LA

Sample Identification: NATURAL GAS 3/29

SUBMITTED: 3/30/90

APRIL 6, 1990

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

ATTN: M. CURTIS
REQUEST NO: 177

— RESULTS OF ANALYSIS —

TEST	RESULT
CARBON, WT. %	74.76
HYDROGEN, WT. %	24.00
OXYGEN, WT. %	0.79
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)

0848 03-29-90 PAGE PRINT CONSOLE 9 08:47:52 29MAR90

87FI122 NAT GAS TO K-402 DRIVER TIME : 08:47

6 MIN. AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
57		125.6	130.6	131.0	131.9	132.9	131.7	131.5
51		125.1	129.9	131.7	132.3	133.0	131.0	132.1
45	.0000	136.1	131.4	132.1	132.2	132.7	131.4	131.9
39	42.14	139.0	130.6	130.8	132.3	132.8	132.2	131.9
MSCFD 33	123.3	133.5	131.1	130.5	132.6	133.4	132.5	132.3
27	124.4	131.6	131.3	130.3	132.3	132.8	131.8	133.1
21	125.1	131.3	130.0	129.8	132.7	133.0	131.9	133.2
15	123.9	131.1	132.0	129.9	132.9	132.4	131.7	133.0
09	125.0	130.5	130.9	130.7	133.0	132.0	131.1	132.6
03	123.1	131.0	131.5	131.9	132.7	131.2	131.4	132.4
HOUR AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
	92.64	130.8	130.9	130.9	132.4	132.7	131.6	132.4
	00HR	23HR	22HR	21HR	20HR	19HR	18HR	17HR
	131.2	130.9	130.5	130.4	130.7	130.8	130.9	130.9
	16HR	15HR	14HR	13HR	12HR	11HR	10HR	09HR
	130.7	130.0	131.5	120.1	112.3	111.9	112.5	112.7
DAY AVERAGE	THR 29	WED 28	TUE 27	MON 26	SUN 25	SAT 24	FRI 23	THR 22
	131.6	120.6	113.0	77.45	101.9	102.1	101.9	108.5

-----ENERG----------MESSAGE----------

0847 03-29-90 PAGE PRINT CONSOLE 9 08:47:24 29MAR90

87TI105 NAT GAS TO MGS COMPRESRS TIME : 08:47

6 MIN. AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
57		68.00	66.68	66.78	67.06	68.65	70.32	68.98
51		67.75	66.72	66.84	67.25	68.60	70.38	68.70
45	70.57	67.50	66.68	66.84	67.55	68.70	70.41	68.37
39	70.00	67.32	66.65	66.75	67.93	68.87	70.40	68.10
DEGF 33	69.50	67.22	66.62	66.68	68.38	69.13	70.33	67.91
27	69.12	67.14	66.67	66.67	68.69	69.41	70.18	67.77
21	68.73	67.02	66.73	66.69	68.83	69.63	70.01	67.65
15	68.49	66.89	66.77	66.69	68.91	69.88	69.80	67.53
09	68.32	66.73	66.80	66.77	68.87	70.13	69.54	67.45
03	68.18	66.65	66.77	66.91	68.74	70.30	69.26	67.44
HOUR AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
	69.25	67.28	66.71	66.75	68.14	69.26	70.11	68.07
	00HR	23HR	22HR	21HR	20HR	19HR	18HR	17HR
	67.83	67.82	67.62	68.17	69.60	73.23	75.02	76.52
	16HR	15HR	14HR	13HR	12HR	11HR	10HR	09HR
	77.26	78.37	79.54	78.57	76.50	72.46	70.16	66.54
DAY AVERAGE	THR 29	WED 28	TUE 27	MON 26	SUN 25	SAT 24	FRI 23	THR 22
	68.02	69.72	64.04	67.85	71.26	69.12	67.31	66.10

-----EMERG----------MESSAGE----------

0846 03-29-90 PAGE PRINT CONSOLE 9 08:46:40 29MAR90

RBK0402DC WGS 43 COMPRSR DUTY, LHV TIME : 08:46 MDATA

6 MIN. AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
57		4.710	4.985	5.000	5.032	5.062	5.012	5.007
51		4.769	4.957	5.026	5.046	5.067	4.984	5.033
45	.0000	5.192	5.014	5.042	5.041	5.054	4.998	5.027
39	1.604	5.303	4.984	4.991	5.042	5.057	5.028	5.029
33	4.694	5.086	5.004	4.983	5.054	5.082	5.039	5.046
27	4.732	5.020	5.012	4.975	5.039	5.056	5.015	5.076
21	4.767	5.011	4.963	4.956	5.053	5.062	5.020	5.080
15	4.725	5.002	5.038	4.957	5.062	5.037	5.013	5.072
09	4.764	4.981	4.997	4.989	5.065	5.023	4.990	5.058
03	4.692	5.002	5.018	5.033	5.055	4.991	5.003	5.052

HOUR AVERAGE	08HR	07HR	06HR	05HR	04HR	03HR	02HR	01HR
	3.605	4.992	4.997	4.995	5.048	5.053	5.008	5.047
	00HR	23HR	22HR	21HR	20HR	19HR	18HR	17HR
	5.001	4.989	4.976	4.970	4.976	4.960	4.958	4.948
	16HR	15HR	14HR	13HR	12HR	11HR	10HR	09HR
	4.938	4.907	4.959	4.534	4.246	4.250	4.281	4.303

DAY AVERAGE	THR 29	WED 28	TUE 27	MON 26	SUN 25	SAT 24	FRI 23	THR 22
	5.018	4.590	4.327	2.954	3.874	3.890	3.888	4.143

-----EMERG----------MESSAGE----------

1753 03-28-90 PAGE PRINT CONSOLE 17:53:28 28MAR90

B7T1105 NAT GAS TO GS COMPRESRS TIME : 17:53

6 MIN. AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10HR
57		77.17	77.97	79.12	79.25	78.15	73.42	71.02
51	76.29	77.10	78.06	79.32	79.02	78.04	72.99	70.63
45	76.25	77.01	78.14	79.52	78.70	77.79	72.69	70.36
39	76.31	76.93	78.21	79.64	78.45	77.26	72.60	70.41
33	76.44	77.05	78.33	79.67	78.49	76.87	72.47	70.50
27	76.57	77.27	78.46	79.82	78.45	76.59	72.29	70.49
21	76.68	77.42	78.59	79.83	78.29	75.62	72.13	70.16
15	76.81	77.47	78.69	79.70	78.19	74.80	71.91	69.55
09	76.97	77.58	78.77	79.49	78.21	74.22	71.66	68.85
03	77.12	77.31	76.91	79.36	78.20	73.76	71.41	68.16

DEGF

HOUR AVERAGE	17HR	16HR	15HR	14HR	13HR	12HR	11HR	10HR
	76.57	77.26	78.37	79.54	78.57	76.50	72.46	70.16
	09HR	08HR	07HR	06HR	05HR	04HR	03HR	02HR
	66.54	63.25	64.43	64.70	63.94	62.23	61.60	64.48
	01HR	00HR	23HR	22HR	21HR	20HR	19HR	18HR
	65.76	65.46	66.21	66.62	66.53	67.57	68.77	69.03

DAY AVERAGE	WED 28	TUE 27	MON 26	SUN 25	SAT 24	FRI 23	THR 22	WED 21
	69.13	68.04	67.85	71.26	69.12	67.31	66.10	58.52

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..

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]

PITOT TUBE CALIBRATION

Pitot Tube Number 3-5 Cp (std) 0.99

Calibrated By Billy Mayo Jr. Date 3-16-90

Point Number	Standard Pitot Δp (in. H_2O)	"S" Type Pitot Δp (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:

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

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

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

"A" Side $Cp_{(s)}$	"A" Side Deviation	"B" Side $Cp_{(s)}$	"B" Side 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 $\leq$ 0.01)

Avg. Dev. (Side A) = .007 (must be $\leq$ 0.01)

(Side B) = .018 (must be $\leq$ 0.01)

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

TELEX: 510-100-8831 (ScotGas)
FAX: 714-887-0549
PHONE: 714-887-2571

Scott Specialty Gases a division of

Scott Environmental Technology Inc. 2600 CAJON BLVD., SAN BERNARDINO, CA 92405

EMISSION TESTING SERVICES
ATTN: FRED DOWLING

Shipped From: Scott SAN BERNARDINO
Date Shipped 8-25-89
Our Project No: 2099
Your P.O. No: FD051989
Page 1 of 1
Expiration Date: 2-25-91

CERTIFICATE OF ANALYSIS—EPA PROTOCOL GASES

Prepared Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM-5586 Cylinder Pressure 1900 psig Certified Accuracy ±1 % NBS 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
tric Oxide	45.53 PPM	SRM 1684 B	AAL-6032	94.86 PPM	Thermo-Electron	8-2-89	Chemi-Luminescen
					10 AR S/N 14853-150		
X	45.57 PPM						

BALANCE GAS Nitrogen

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

Component Nitric Oxide
First Analysis Date 8-17-89 Units PPM

Z	R	T
0.00	94.97	45.49
94.96	0.03	45.52
-0.02	45.53	94.84

Mean Test Assay 45.55 PPM

Second Analysis Date 8-24-89 Units PPM

Z	R	T
0.00	94.65	45.48
94.93	0.02	45.49
0.02	45.50	94.73

Mean Test Assay 45.53

Component ____ 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 ____

Chronology: Date ____
Assay ____

Analyst Carrie Boddy/Doug Hagberg Approved By: [signature]

SCOTT SPECIALTY GASES — a division of Scott Environmental Technology, Inc.
1290 COMBERMERE TROY, MICHIGAN 48083 TELEPHONE # (313) 589-2950 FAX: (313) 589-2134

Shipped From : Scott Troy
Date Shipped :
Our Project # : 928924
Your P.O. # : 88-0615-2
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 # 81
File # PD1485
Certified Accuracy 1 % NBS Traceable

Cylinder Number AAL-1663B
Cylinder Pressure 2000 psig

COMPONENT	CERTIFIED CONC.	REFERENCE STD: SRM # (CRM #)	REFERENCE STD: CYLINDER NUMBER	REFERENCE STD: CONC.	GAS ANALYZER: MAKE/MODEL/SERIAL #	GAS ANALYZER: LAST CALIBRATION DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	401.6 PPM		AAL-7813	500.1 PPM	BECKMAN	6-15-88	NON-DISPERSED INFRARED
		1679	FF-19978	95.40 PPM			
		1680	FF-19741	470.00 PPM			

BALANCE GAS : NITROGEN

FIRST ANALYSIS — DATE 7-1-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	84.40	405.3	470.0 PPM	95.90	474.6
0.00	84.40	405.3		95.90	474.6
0.00	84.40	405.3		95.90	474.6

CALCULATED RESULTS: 401.4 / 401.4 / 401.4

AVERAGE : 401.4 PPM

SECOND ANALYSIS — DATE : 7-11-88

ZERO GAS (mV)	TEST GAS (mV)	RESULTS PPM	REFERENCE GAS CONC.	REFERENCE GAS (mV)	RESULTS PPM
0.00	84.40	405.3	470.0 PPM	95.90	474.6
0.00	84.30	404.7		95.60	472.7
0.00	84.20	404.2		95.70	473.4

CALCULATED RESULTS: 401.4 / 401.4 / 401.3

AVERAGE : 401.7 PPM

CALIBRATION CURVE — 2 nd DEGREE

SRM # (CRM #)	CONC. PPM	SPLIT FT (%)	D.V. (mV)	FITTED VALUE	PERCENT ERROR
	500.1	100	99.97	499.9	-0.04
	400.1	80	85.75	401.5	0.36
	300.1	60	65.84	300.7	0.21
	200.0	40	46.29	200.0	-0.03
	100.0	20	24.54	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	0.98
1679	95.40		23.70	95.76	0.38

* SMIS - GAS MANUFACTURER'S INTERNAL STANDARD

Analyst : [signature]
Approved By : [signature] 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 [signature]

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

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%

LIQUID CARBONIC
SPECIALTY GAS CORPORATION

SPECIALTY GAS and CHEMICAL PRODUCTS

CERTIFICATE OF ANALYSIS

: - Emmission Testing

Date: March 31, 1989

Ref. # SF06859

Cust. P.O. # 882903-2

Product 12% Oxygen, Balance Nitrogen

mponents	Requested	Cyl. Serial No. CC37045 Actual	Cyl. Serial No. CC37032 Actual	Cyl. Serial No. Actual
ygen	12.0%	12.09%	11.94%	
rogen	Balance	Balance		

yl. Volume 140 cuft 140 cuft

A Valve No. 590 590

Total Cyl. Pressure 2000 psig 2000 psig

hod 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.