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COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

% REDUCTION OF CO

RUN #	INLET lbs/hr	OUTLET lbs/hr	% REDUCTION
#1	4.58	0.285	93.8
#2	4.76	0.242	94.9

% REDUCTION OF NON-METHANE HYDROCARBONS

RUN #	INLET lbs/hr	OUTLET lbs/hr	% REDUCTION
#1	3.11	2.42	22.2
#2	3.10	2.43	21.6
#3	3.12	2.27	27.2

SUMMARY OF SOURCE TEST RESULTS

COMPANY: BECHTEL PETROLEUM OPERATIONS, INC. APCD #: 4091081 B

TEST DATE: DECEMBER 16, 1991 UNIT #: K-71

INLET EMISSIONS

	gr/scf	@12%CO2	ppm	@ 15% O2	lb/hr	gr/BHP-hr	Permit Limits
PARTICULATE Mean:							
SULFATE Mean:							
SO2 (wet) Mean:			Total Sulfur as H2S = <1 ppm		<0.0012		
NOx (dry)			61.7 53.8	35.4 29.3	0.983 0.882	0.710 0.448	
Mean:			57.8	32.4	0.933	0.579	
NMHC			554 551 555	310 308 310	3.11 3.10 3.12	1.86 1.85 1.86	
Mean:			553	309	3.11	1.86	
CO			473 477	271 260	4.58 4.76	3.31 2.42	
Mean:			475	266	4.67	2.87	

Comments: _____

Petro Chem Environmental Services, Inc.

SUMMARY OF SOURCE TEST RESULTS

COMPANY: BECHTEL PETROLEUM OPERATIONS, INC. APCD #: 4091081 B

TEST DATE: DECEMBER 16, 1991 UNIT #: K-71

OUTLET EMISSIONS

	gr/scf	@12%CO2	ppm	@ 15% O2	lb/hr	gr/BHP-hr	Permit Limits
PARTICULATE Mean:							
SULFATE Mean:							
SO2 (wet) Mean:			Total Sulfur as H2S = <1 ppm		<0.0012		
NOx (dry) Mean:			64.8 59.6 62.2	35.0 32.7 33.9	1.02 0.93 0.97	0.527 0.476 0.502	
NMHC Mean:			445 446 417 436	242 243 227 237	2.42 2.43 2.27 2.37	1.25 1.25 1.17 1.22	
CO Mean:			29.7 25.5 27.6	16.0 14.0 15.0	0.285 0.242 0.264	0.147 0.124 0.136	

Comments: _____

Petro Chem Environmental Services, Inc.

INTRODUCTION

INTRODUCTION

On December 16, 1991, Petro Chem Environmental Services, Inc. (PCES) performed a series of emission source tests for Bechtel Petroleum Operations, Inc. located at the Elk Hills Naval Petroleum Reserve No. 1 located in Tupman, California. The test unit was K-71, a gas fired Waukesha L7042GS1 engine. The engine is rated at 1500 HP and is equipped with PCC and an oxidizing catalyst. Concentrations and emissions of NOx, CO, O_2, NMHC, and fuel sulfur as SO_2 were determined using the following procedures:

Parameters	Method	# Test Runs Catalyst Inlet and Outlet
NOx	CARB Method 100; Chemiluminescent Analyzer	2 - 1 hr.
CO	CARB Method 100; GFC Analyzer	2 - 1 hr.
O_2	CARB Method 100; Fuel Cell Analyzer	2 - 1 hr.
NMHC	EPA Method 18; Bag Sample, C_1-C_6 FID Analysis	3
Fuel Sulfur as SO_2	GC/FPD Analysis	1/day
Volume Flow	EPA Method 19; Fuel Usage (Supplied by Bechtel) and Fuel F-Factor Analysis	2
Fuel Analysis	C_1-C_6+, O_2, CO_2, and N_2	1/day
BHP Analysis	(Supplied by Bechtel)	2

All sampling was performed by James Taplin of Petro Chem Environmental Services, Inc. (PCES). The fuel analysis was performed by Pacific Gas Technology of Bakersfield, California. The hydrocarbons were analyzed by Terry Rowles of PCES. Mike Carr of Bechtel Petroleum Operations, Inc. supervised the operation of the test unit.

US MONITORING DATA

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

CONTINUOUS MONITORING RESULTS

	NOx			CO		
RUN #	ppm @ 15% O2	lbs/hr	gr/BHP-hr	ppm @ 15% O2	lbs/hr	gr/BHP-hr
INLET						
#1	35.4	0.983	0.710	271	4.58	3.31
#2	29.3	0.882	0.448	260	4.76	2.42
OUTLET						
#1	35.0	1.02	0.527	16.0	0.285	0.147
#2	32.7	0.927	0.476	14.0	0.242	0.124

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

INLET
NOx/CO/O2 DATA

RUN #1

TIME INTERVAL			CONCENTRATIONS			% Full Scale		
BEGIN	-	END	O2;%	NOx;ppm	CO;ppm	O2%fs	NOx%fs	CO%fs
08:34 AM	-	08:44 AM	10.70	62.3	494	53.0	72.2	59.2
08:44 AM	-	08:54 AM	10.69	63.1	485	53.0	73.0	58.3
08:54 AM	-	09:04 AM	10.43	63.1	477	52.0	73.0	57.5
09:04 AM	-	09:14 AM	10.43	61.7	467	52.0	71.5	56.5
09:14 AM	-	09:24 AM	10.67	60.1	460	53.0	69.9	55.8
09:24 AM	-	09:34 AM	10.72	60.2	454	53.0	70.2	55.3
	Averages:		**10.60**	**61.7**	**473**	**52.7**	**71.6**	**57.1**

	O2	NOx	CO
INITIAL zero	10	10	10
INITIAL span	93.9	90	93.2
FINAL zero	9.9	9.8	9.9
FINAL span	94.2	90	93.2
ZERO DRIFT %/ppm	-0.02491	-0.2	-1.00336
CALIB. DRIFT %/ppm	0.074731	0.00	0.00
ZERO DRIFT %fs	-0.1	-0.2	-0.1
CALIB.DRIFT %fs	0.3	0	0
CAL GAS value	20.9	80	834.8
FULL SCALE RANGE	25	100	1000

Meter Differential	2.4		
Meter Static	6.65	**MCF/DAY**	159.60
Meter Coefficient	0.01	**DSCFM**	2189
MMBTU/SCF	0.001138		
F @ 60°F	8546		
Operating BHP	628		

NOx	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.60	61.7	107	35.4	0.983	0.710

CO	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.60	473	823	271	4.58	3.31

Petro Chem Environmental Services, Inc.

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

INLET
NOx/CO/O2 DATA

RUN #2

TIME INTERVAL			CONCENTRATIONS			% Full Scale		
BEGIN	-	END	O2;%	NOx;ppm	CO;ppm	O2%fs	NOx%fs	CO%fs
10:50 AM	-	11:00 AM	10.07	51.8	403	50.5	64.2	50.2
11:00 AM	-	11:10 AM	10.15	52.4	493	50.5	65.1	59.2
11:10 AM	-	11:20 AM	10.13	52.6	488	50.1	65.6	58.6
11:20 AM	-	11:30 AM	10.17	59.0	500	49.9	72.6	59.6
11:30 AM	-	11:40 AM	10.20	55.1	497	49.7	68.9	59.2
11:40 AM	-	11:50 AM	9.71	52.2	482	49.7	64.0	58.5
	Averages:		10.07	53.8	477	50.1	66.7	57.6

	O2	NOx	CO
INITIAL zero	10	9.7	9.8
INITIAL span	95.1	93.2	94
FINAL zero	9.8	9.7	9.9
FINAL span	93.3	95	94.9
ZERO DRIFT %/ppm	-0.0491	0	0.9914
CALIB. DRIFT %/ppm	-0.4421	1.72	8.92
ZERO DRIFT %fs	-0.2	0	0.1
CALIB.DRIFT %fs	-1.8	1.8	0.9
CAL GAS value	20.9	80	834.8
FULL SCALE RANGE	25	100	1000

Meter Differential	2.4		
Meter Static	7.2	MCF/DAY	172.80
Meter Coefficient	0.01	DSCFM	2254
MMBTU/SCF	0.001138		
F @ 60°F	8546		
Operating BHP	894		

NOx	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.07	53.8	89.0	29.3	0.882	0.448

CO	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.07	477	789	260	4.76	2.42

Petro Chem Environmental Services, Inc.

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

OUTLET
NOx/CO/O2 DATA

RUN #1

TIME INTERVAL			CONCENTRATIONS			% Full Scale		
BEGIN	-	END	O2;%	NOx;ppm	CO;ppm	O2%fs	NOx%fs	CO%fs
09:40 AM	-	09:50 AM	9.92	62.7	31.1	50.3	73.2	13.0
09:50 AM	-	10:00 AM	9.97	62.1	30.1	50.8	72.8	12.9
10:00 AM	-	10:10 AM	9.91	68.8	30.1	50.8	79.8	12.9
10:10 AM	-	10:20 AM	9.82	67.2	29.1	50.7	78.4	12.8
10:20 AM	-	10:30 AM	9.83	63.0	29.1	51.0	74.5	12.8
10:30 AM	-	10:40 AM	10.30	65.0	29.1	51.3	75.0	12.8
		Averages:	**9.96**	**64.8**	**29.7**	**50.8**	**75.6**	**12.9**

	O2	NOx	CO
INITIAL zero	9.9	10	9.9
INITIAL span	94.2	90.1	93.2
FINAL zero	10	9.5	9.9
FINAL span	95.7	92.1	93.2
ZERO DRIFT %/ppm	0.025	-0.499	0.0
CALIB. DRIFT %/ppm	0.372	2.0	0.0
ZERO DRIFT %fs	0.1	-0.5	0.0
CALIB.DRIFT %fs	1.5	2.0	0.0
CAL GAS value	20.9	80	834.8
FULL SCALE RANGE	25	100	1000

Meter Differential	2.4		
Meter Static	7	**MCF/DAY**	168.00
Meter Coefficient	0.01	**DSCFM**	2168
MMBTU/SCF	0.001138		
F @ 60°F	8546		
Operating BHP	881		

NOx	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	9.96	64.8	106	35.0	1.02	0.527

CO	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	9.96	29.7	48.6	16.0	0.285	0.147

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

OUTLET
NOx/CO/O2 DATA

RUN #2

TIME INTERVAL			CONCENTRATIONS			% Full Scale		
BEGIN	-	END	O2:%	NOx:ppm	CO:ppm	O2%fs	NOx%fs	CO%fs
11:57 AM	-	12:07 PM	10.17	60.0	28.9	50.7	70.1	13.0
12:07 PM	-	12:17 PM	10.13	60.2	26.6	50.7	70.3	13.0
12:17 PM	-	12:27 PM	10.09	59.6	23.4	50.7	69.7	12.9
12:27 PM	-	12:37 PM	10.05	59.8	21.1	50.7	70.0	12.9
12:37 PM	-	12:47 PM	10.03	58.7	19.8	50.8	68.9	13.0
12:47 PM	-	12:57 PM	10.31	59.3	33.5	50.9	69.2	13.0
		Averages:	10.13	59.6	25.5	50.8	69.7	13.0

	O2	NOx	CO
INITIAL zero	9.8	9.9	9.7
INITIAL span	93.3	90	94.9
FINAL zero	10	9.8	10
FINAL span	94.1	90.4	93.8
ZERO DRIFT %/ppm	0.0501	-0.09987	2.9394
CALIB. DRIFT %/ppm	0.2002	0.40	-10.78
ZERO DRIFT %fs	0.2	-0.1	0.3
CALIB.DRIFT %fs	0.8	0.4	-1.1
CAL GAS value	20.9	80	834.8
FULL SCALE RANGE	25	100	1000

Meter Differential	2.4		
Meter Static	6.8	MCF/DAY	163.20
Meter Coefficient	0.01	DSCFM	2140
MMBTU/SCF	0.001138		
F @ 60°F	8546		
Operating BHP	885		

NOx	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.13	59.6	99.0	32.7	0.927	0.476

CO	%O2	ppm	@ 3%O2	@15%O2	lb/hr	gr/BHP-hr
	10.13	25.5	42.4	14.0	0.242	0.124

Petro Chem Environmental Services, Inc.

CALCULATIONS

$$\frac{MCF}{DAY} = Meter\ Positive \times meter\ static \times meter\ coefficient$$

$$DSCFM = \frac{MCF}{DAY} \times .6944 \times \frac{MMBtu}{SCF} \times F\text{-}Factor \times O_2\ correction$$

$$PPM\ @\ 3\%\ O_2$$

$$ppm \times \frac{(20.9 - 3)}{(20.9 - actual O_2)}$$

$$@\ 15\% O_2$$

$$ppm \times \frac{(20.9 - 15)}{(20.9 - actual O_2)}$$

$$\frac{LBS}{HR} = ppm \times MW \times 1.581 \times 10^{-7} \times DSCFM$$

$$\frac{GR}{BHP\text{-}HR} = \left(\frac{\left(\frac{lbs}{hr} \times 454\right)}{Operating\ BHP} \right)$$

DROCARBON DATA

COMPANY : BECHTEL PETROLEUM OPERATIONS. INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

INLET
HYDROCARBON RESULTS

RUN No.: 1
AVG DSCFM 2222
AVG % O2: 10.34

AVERAGE OPERATING BHP 761

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1594	9.0	1594	891	9.0	5.35
Ethane	(C2)	202	2.13	404	226	2.27	1.35
Propane	(C3)	42	0.649	126	70	0.708	0.423
Butane	(C4)	6	0.122	24	13	0.135	0.080
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1844	11.9	2148	1200	12.1	7.20
	Total (non methane)	250	2.90	554	310	3.11	1.86

RUN No.: 2
DSCFM: 2222
AVG % O2: 10.34

AVERAGE OPERATING BHP 761

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1567	8.8	1567	876	8.8	5.25
Ethane	(C2)	199	2.10	398	222	2.24	1.33
Propane	(C3)	43	0.665	129	72	0.725	0.433
Butane	(C4)	6	0.122	24	13	0.135	0.080
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1815	11.7	2118	1183	11.9	7.10
	Total (non methane)	248	2.88	551	308	3.10	1.85

RUN No.: 3
DSCFM: 2222
AVG % O2: 10.34

AVERAGE OPERATING BHP 761

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1567	8.8	1567	876	8.8	5.25
Ethane	(C2)	201	2.12	402	225	2.26	1.35
Propane	(C3)	43	0.665	129	72	0.725	0.433
Butane	(C4)	6	0.122	24	13	0.135	0.080
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1817	11.7	2122	1186	11.9	7.12
	Total (non methane)	250	2.91	555	310	3.12	1.86

COMPANY : BECHTEL PETROLEUM OPERATIONS. INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

OUTLET
HYDROCARBON RESULTS

RUN No.: 1
AVG DSCFM 2154
AVG % O2: 10.05

OPERATING BHP 883

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1594	8.7	1594	867	8.7	4.47
Ethane	(C2)	160	1.63	320	174	1.74	0.90
Propane	(C3)	35	0.524	105	57	0.572	0.294
Butane	(C4)	5	0.099	20	11	0.109	0.056
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1794	10.9	2039	1109	11.1	5.71
	Total (non methane)	200	2.26	445	242	2.42	1.25

RUN No.: 2
DSCFM: 2154
AVG % O2: 10.05

OPERATING BHP 883

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1617	8.8	1617	879	8.8	4.53
Ethane	(C2)	162	1.66	324	176	1.77	0.91
Propane	(C3)	34	0.509	102	55	0.556	0.286
Butane	(C4)	5	0.099	20	11	0.109	0.056
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1818	11.1	2063	1122	11.2	5.78
	Total (non methane)	201	2.26	446	243	2.43	1.25

RUN No.: 3
DSCFM: 2154
AVG % O2: 10.05

OPERATING BHP 883

		ppm	lb/hr	ppm (as methane)	ppm @15% O2 (as methane)	lb/hr (as methane)	gr/BHP-hr (as methane)
Methane	(C1)	1447	7.9	1447	787	7.9	4.05
Ethane	(C2)	149	1.52	298	162	1.62	0.83
Propane	(C3)	33	0.494	99	54	0.539	0.277
Butane	(C4)	5	0.099	20	11	0.109	0.056
Pentane	(C5)	0	0	0	0	0	0
Hexane	(C6)	0	0	0	0	0	0
	Total	1634	10.0	1864	1014	10.2	5.22
	Total (non methane)	187	2.12	417	227	2.27	1.17

EMISSION FACTORS

COMPANY : BECHTEL PETROLEUM OPERATIONS, INC.
UNIT : K-71
DATE : 12-16-91
REPORT : 10-854-03

SULFUR DIOXIDE EMISSION RESULTS

RUN #	H2S, ppm	MCF/DAY	FUEL SCFM	SO2 LBS/HR	
INLET					
1	1.0	159.6	111	0.00112	*
2	1.0	172.8	120	0.00121	*
OUTLET					
1	1.0	168.00	117	0.00118	*
2	1.0	163.20	113	0.00115	*

* INDICATES LOWER LIMIT OF DETECTION

EQUATION:

SCFM = MCF/DAY * 1000/24 * 1/60

H2S ppm * 64 * SCFM * 1.581 * 10^-7

MW SO2 = 64

LAB ANALYSIS

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

PETRO-CHEM ENVIRONMENTAL SERVICES
3207 Antonino Avenue
Bakersfield, CA 93308

Lab. No.: 029891_001
Received: Dec 17, 1991
Reported: Dec 18, 1991

Attention: Terry Rowles

Sample Description: Bechtel Unit #K-71 Job #10-854-03

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %
Hydrogen	0.000	0.000
Carbon Dioxide	2.965	6.584
Oxygen	0.000	0.000
Nitrogen	.348	.492
Carbon Monoxide	0.000	0.000
Hydrogen Sulfide	0.000	0.000
Methane	81.779	66.202
Ethane	10.144	15.391
Propane	3.922	8.726
IsoButane	.249	.732
N-Butane	.452	1.325
IsoPentane	.055	.201
N-Pentane	.042	.151
Hexanes+	.045	.196
Totals =	100.000	100.000

CHONS	Wt %
CARBON	72.94
HYDROGEN	21.77
OXYGEN	4.79
NITROGEN	.49
SULFUR	0.00
Totals	99.99
Total H/C	.30

SPECIFIC GRAVITY (Air = 1)		.6859
SPECIFIC VOLUME, cu.ft./lb	*	19.10
GROSS CALORIFIC VALUE, Btu/cu.ft.	*	1119.24
GROSS CALORIFIC VALUE, Btu/cu.ft.	**	1138.60
GROSS CALORIFIC VALUE, Btu/lb	**	21749.73
NET CALORIFIC VALUE, Btu/cu.ft.	**	1030.38
NET CALORIFIC VALUE, Btu/lb	**	19682.52
COMPRESSIBILITY FACTOR 'Z' (60 F,1 Atm)		.9971

EPA 'F' Factor @ 68 F: 8676.603 DSCF / MM Btu.
KCAPCD 'F' Factor @ 60 F: 8546.454 DSCF / MM Btu.

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

Kathe Zimmerman
Analyst

John Zaletel
for Jim Etherton
Laboratory Director

4309 Armour Avenue Bakersfield, California 93308
(805) 395-0539
FAX (805) 395-3069

ZALCO LABORATORIES, INC.
Analytical & Consulting Services

Petro Chem Environmental Service
3207 Antonino Avenue
Bakersfield, CA 93308

Laboratory No: 29891-2
Date Received: 12-17-91
Date Reported: 12-27-91
P O #: 01666

Attention: Terry Rowles

Sample: Gas

Sample Description: Bechtel Unit #R-71, Job #10-854-03
Sampled on 12-16-91

Total Sulfur
(ASTM D 3246)

As H_2S, ppm (vol.)	< 1.0
As S, Grains/100 SCF*	< 0.06

* Standard cubic feet (60 °F, 14.7 psia)

Jim Etherton
Lab Operations Manager

JE/tds

4309 Armour Avenue Bakersfield, California 93308
(805) 395-0539 FAX (805) 395-3069

Petro Chem Environmental Services, Inc.

EMISSION FACTOR CALCULATIONS

EPA F-FACTOR

$$F = \left(\frac{10^6 \, [3.64 \, (\%H) + 1.53 \, (\%C) + 0.57 \, (\%S) + 0.14 \, (\%N) - 0.46 \, (\%O)]}{GCV} \right) = dscf/MMBtu$$

Where:

GCV = Gross calorific value of fuel combusted, BTU/lb

$$F_{60 \cdot F} = F_{68 \cdot F} \times 0.985$$

GENERAL POLLUTANT LB/MMBTU EQUATION

$$E = F_{60^\circ F} \; C \left(\frac{20.9}{20.9 - \% \, C_2 \, of \, C} \right)$$

Where:

E = *lb/MMBtu*

$F_{60^\circ F}$ = *F-FACTOR @ 60° F*

C = *Concentration of pollutant, lb/dscf*

SULFUR EMISSION FACTOR

$$E = F_{60^\circ F} \, C_{SO_2} \left(\frac{20.9}{20.9 - \%O_2 \, of \, C} \right) = lb_S \, / \, MMBtu$$

METHODOLOGY

CONTINUOUS EMISSION MONITORING SYSTEM (CEMS)

Reference: Manual of Procedures; ST-13A, ST-19A, Jan 1982, State of California, Air Resources Board, Test Methods 1-100, June 1979.
EPA CFR Title 40, Pt. 60, Appendix A, Method 3A, 6C, 7E, & 10.

Instrument Summary

A constant sample of flue gas was extracted, dried, filtered and delivered to an instrument manifold system for distribution to one or more analyzers. Instrument results are recorded on an analog strip chart recorder. System calibration checks are performed as well as calibration checks at the beginning and end of each test run. Final data reduction includes zero and calibration drift corrections.

Sample Conditioning System

Consists of a borosilicate glass tube or 316 grade stainless steel probe fitted with a cindered stainless steel or pyrex glass wool particulate filter. The probe is fitted with a teflon (TFE) sample line which connects to a water condensation system located at the source. The condensation system consists of three 500-ml short stem glass impingers connected in a series, immersed in an ice bath. The gas is delivered to the instrument trailer with a teflon line (3/8" O.D.) through an in-line Balston particulate filter drawn by a teflon-coated diaphragm pump. The sample system is leak checked prior to sampling by plugging the end of the sample probe and adjusting the sample pump to its maximum rate (approximately 22" Hg). The manifold is by-passed and the leak rate monitored through a gas meter or low range flow meter.

Manifold System

Sample gas is delivered to each analyzer through a five way valve and regulated with a needle valve flow meter. Manifold pressure is controlled by a back pressure regulator which is typically set at three psi. Zero gas (N_2) and calibrated gases are delivered to the analyzers using the same five way valve and flow meter. All manifold parts are glass, stainless steel, or teflon materials.

Analog Strip Chart Data Reduction

Analog recordings consists of averaged time increments as shown on the data pages (typically 5,10, or 20 minute increments). Data for each increment was recorded at an average percent of full scale. The readings were then compared with the zero and calibration readings for calculation of the average concentration for each time increment. Any deviation of the zero and calibration readings from the start to the end of a test period was corrected by calculating apparent zero and calibration readings for the mid-point of each time increment. The average concentrations were then calculated from the sample readings and the apparent zero and span readings.

HYDROCARBON EMISSIONS TESTING
METHODS AND EQUATIONS

REF: EPA METHOD 18; FID ANALYSIS

Sampling Procedures

The sample will be pressurized down stream of a sample pump or drawn via an evacuated cannister through a stainless steel/teflon probe into a tedlar bag. Each sample bag will be evacuated, and then filled.

Analytical Procedures

The contents of the tedlar bag will be analyzed by gas chromatography. The gas chromatograph will be calibrated with an appropriate standard for each carbon #, before and after each set of samples are analyzed. The sample is speciated by carbon #-C1, C2, C3, C4, C5, and C6+ backflush.

Symbol Identification

i = carbon #; i = 1 to 6+
s = refers to standard for that carbon #
Rx_i = response factor for C_i
MW = molecular weight - g/mole
DSCFM = Average volume flow rate of unit tested

$$Rx_i = \frac{ppm\ std}{Area_s} \qquad Rx_i = \frac{Area\ std}{ppm\ std}$$

$$Sample\ ppm_i = \frac{1}{Rx_i} \times Area_i$$

$$Sample\ ppm\ (as\ C_1) = Sample\ ppm \times \#\ of\ Carbons$$

$$\frac{lbs}{hr_i} = ppm_i \times MW_i \times DSCFM \times 1.581 \times 10^{-7}$$

$$Total\ non\text{-}methane\ \frac{lbs}{hr} = \sum_{2}^{6+} \frac{lbs}{hr_i}$$

Note 1: *If* $\frac{lbs}{hr}$ *as methane is required, MW will equal* 16.0 (*MW of methane*)

Note 2: # *of carbons: ethane* = 2; *propane* = 3; *etc...*

COMPANY : PETRO CHEM ENVIRONMENTAL SERVICES
UNIT : BV-2
DATE : 10-91

CONTINUOUS MONITORING INSTRUMENT DATA

ANALYZER	MANUFACTURER & MODEL	SERIAL#
NOx ANALYZER	THERMO ELECTRON MODEL 10	10A/R-23488-210
CO ANALYZER	THERMO ELECTRON MODEL 48	48-23438-210
O2 ANALYZER	TELEDYNE MODEL 320AX	SN 106197

RAW DATA

INTERNAL COMBUSTION ENGINE
SOURCE TEST DATA

DEPT 640

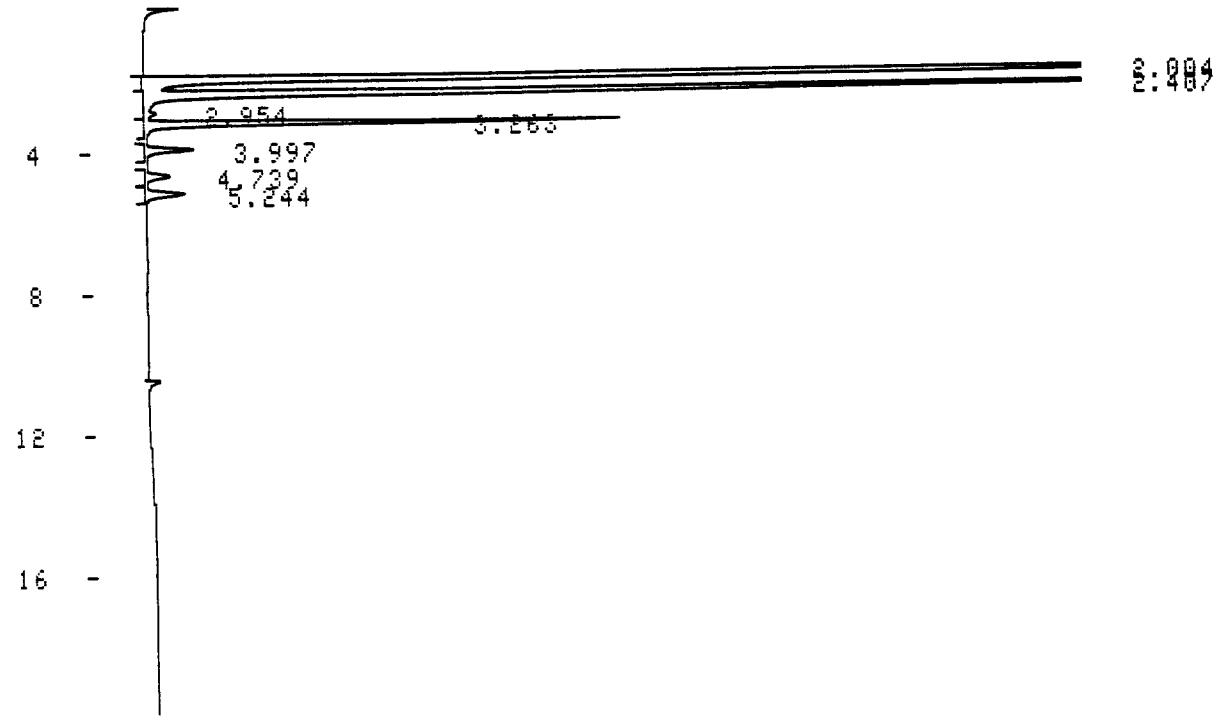
DATE 12-16-91

COMP NO.	K-71	-	-	-				
LOCATION	30R	-	-	-				
START TIME	8:35	9:40	10:50					
END TIME	9:35	10:40	11:50					
FUEL GAS METER DATA	IN	OUT	IN	OUT				
COEFFICIENT	.010	-	-	-				
STATIC	6.65	7.0	7.2	6.8				
DIFF.	2.4	2.4	2.4	2.4				
MCF/D								
COMPRESSOR OPERATION PARAMETERS								
SUC PRESS.	50	50	50	50				
DISCH PRESS.	400	440	445	455				
RATED HP.	1500	-	-	-				
TESTED HP.	628	881	894	885				
% LOAD	42	58	60	59				
RPM	867	865	865	865				
SPARK								
AIR-MANIFOLD PRESS.								
GAS PRESS.								
PRELIMINARY SOURCE TEST DATA (IN GR/BHP-HR AND LBS-HR)								
EF GAS	9.6	-	-	-				
O2 %	10.0	10.25	10.0	10.25				
DSCFM								
PPM NOx	62.5	68	58	59				
LBS-HR NOx								
GR/BHP-HR								
PPM CO	475	29	490	30				
LBS-HR CO								
GR/BHP-HR								

Release No. AEO 022

Petro Chem Environmental Services, Inc.

BECHTEL K-71
12-16-91 JOB # 10-854-03
INLET HC # 1

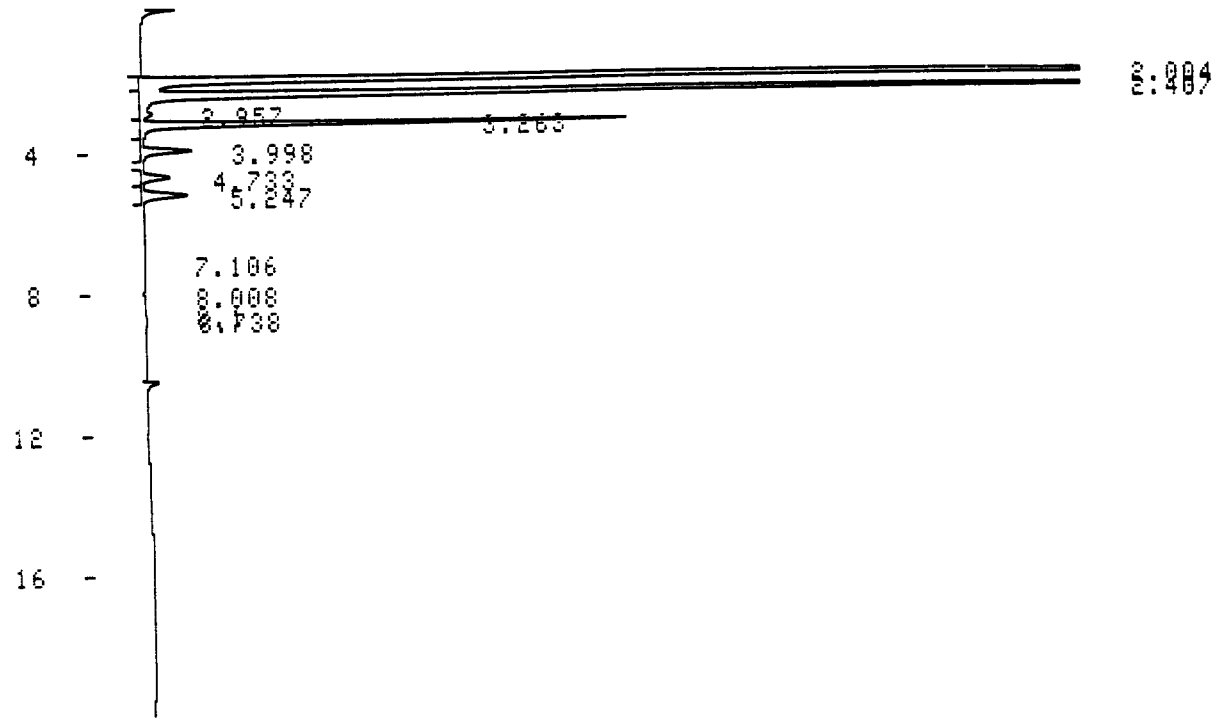


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	370773		1	1594.3802	C-1
2	2.407	90187	SV	2	201.8233	C-2
3	3.263	25495	V	3	37.3499	C-3
4	3.997	3432		11	5.0274	C-3
5	4.739	1967		7	2.1926	C-4
6	5.244	3180		4	3.5457	C-4
	TOTAL	495033			1844.3189	

GROUP(NAME)	CONC
C-1	1594.3802
C-2	201.8233
C-3	42.3773
C-4	5.7384
C-5	0
C-6+	0

BECHTEL K-71
12-16-91 JOB # 10-854-03
INLET HC # 2

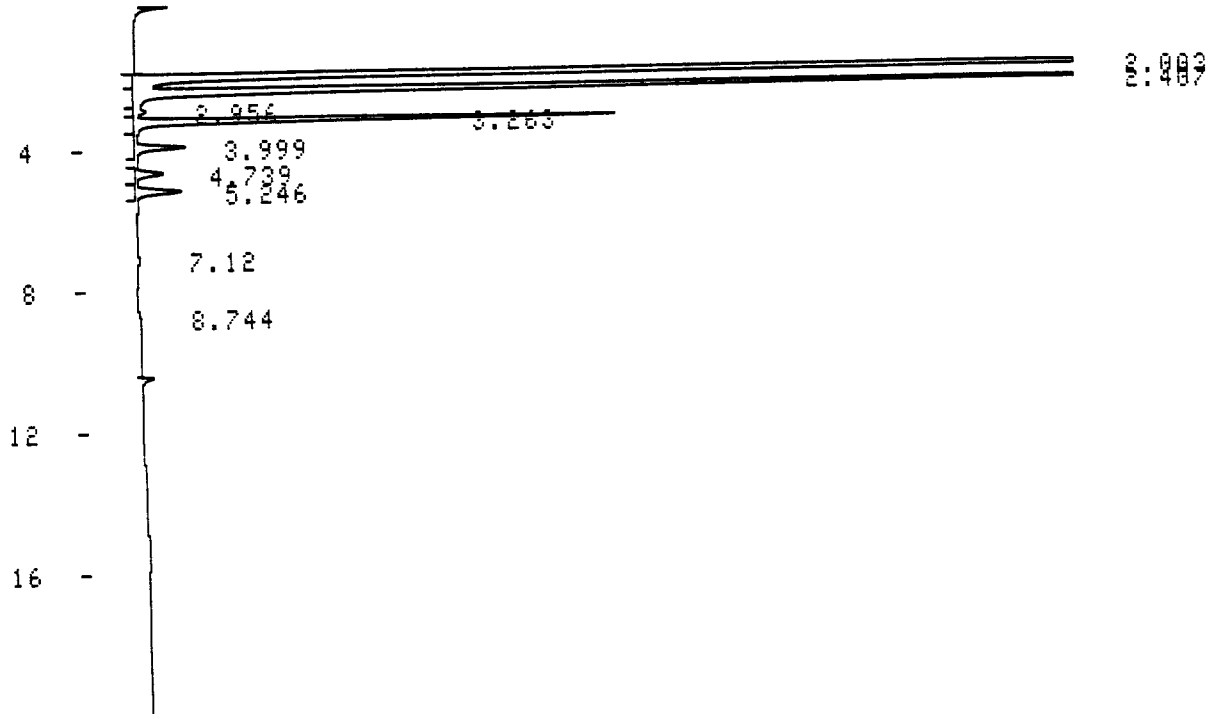


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	364464		1	1567.2518	C-1
2	2.407	88893	SV	2	198.9279	C-2
3	3.263	26181	V	3	38.3556	C-3
4	3.998	3479	V	11	5.0966	C-3
5	4.733	2155		7	2.4025	C-4
6	5.247	3664	V	4	4.0856	C-4
	TOTAL	488836			1816.1198	

GROUP(NAME)	CONC
C-1	1567.2518
C-2	198.9279
C-3	43.4522
C-4	6.4881
C-5	0
C-6+	0

BECHTEL K-71
12-16-91 JOB # 10-854-03
INLET HC # 3

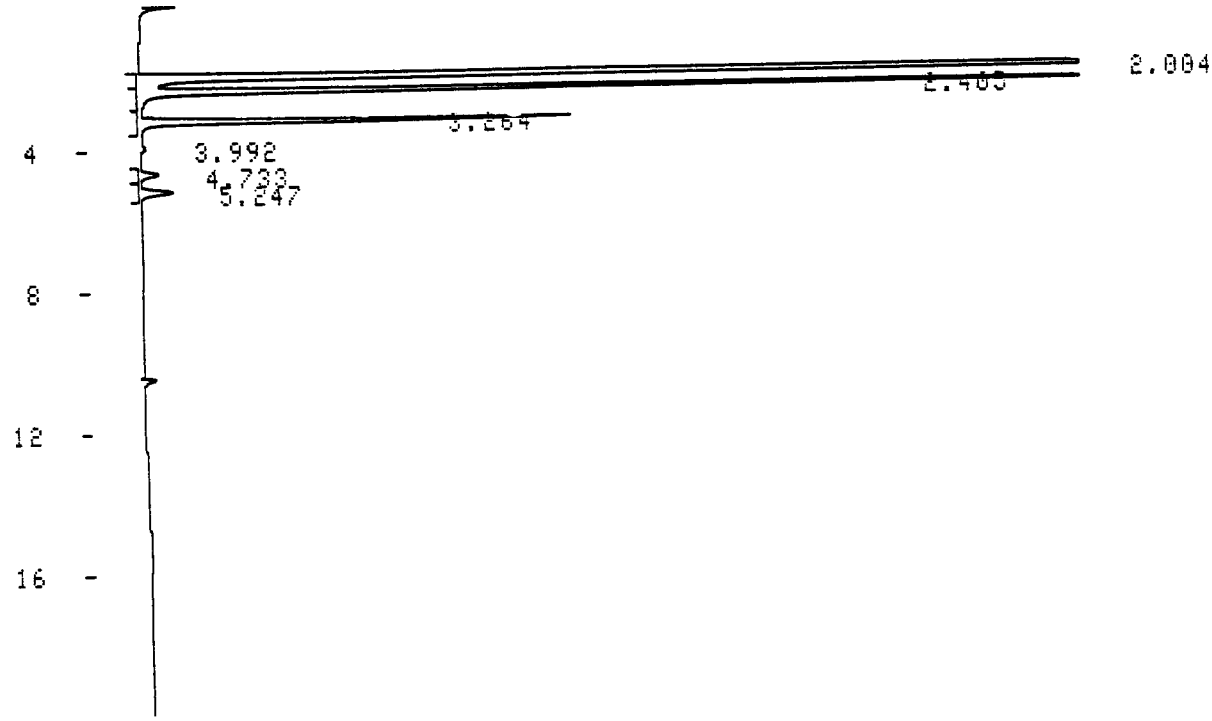


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.003	364311		1	1566.5925	C-1
2	2.407	88770	V	2	198.6532	C-2
3	2.956	861	V	10	1.9263	C-2
4	3.263	25865	V	3	37.8927	C-3
5	3.999	3528	V	11	5.1686	C-3
6	4.739	2110		7	2.3528	C-4
7	5.246	3635		4	4.0528	C-4
	TOTAL	489080			1816.6387	

GROUP(NAME)	CONC
C-1	1566.5925
C-2	200.5795
C-3	43.0613
C-4	6.4056
C-5	0
C-6+	0

BECHTEL K-71
12-16-91 JOB # 10-854-03
OUTLET HC # 1

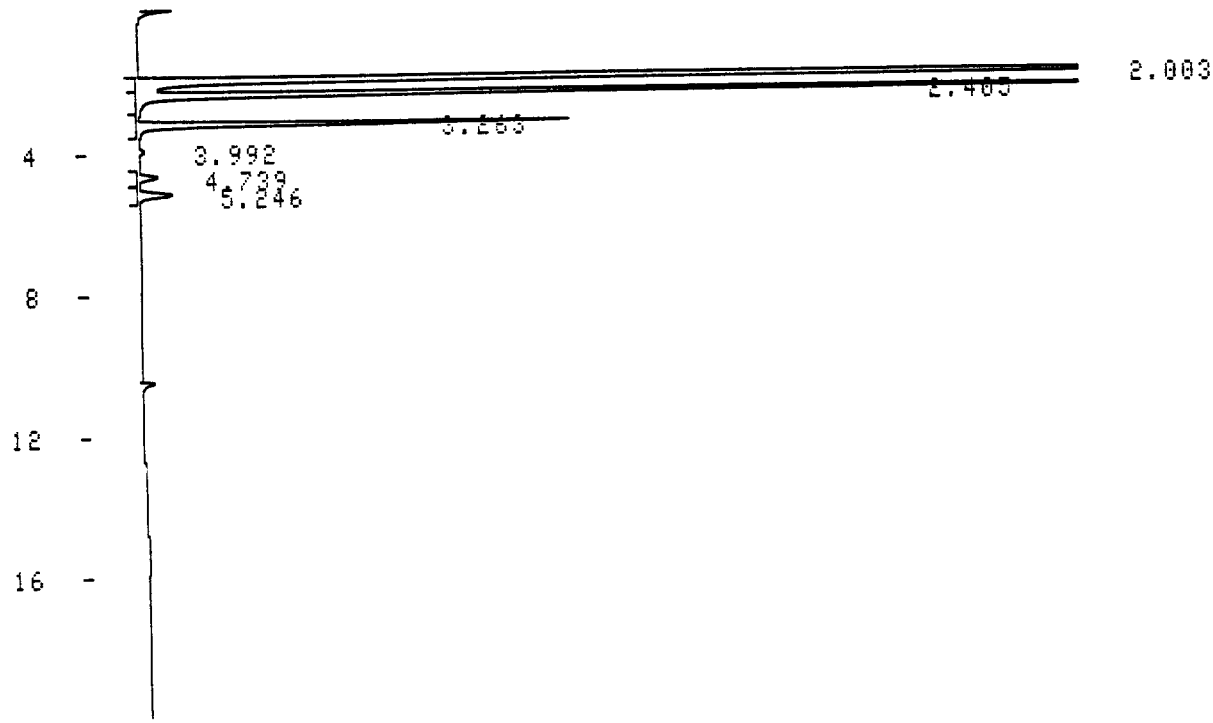


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	370735		1	1594.2174	C-1
2	2.405	71402	V	2	159.7864	C-2
3	3.264	23558	V	3	34.5129	C-3
4	4.733	1423		7	1.5863	C-4
5	5.247	2711	V	4	3.0229	C-4
	TOTAL	469829			1793.1256	

GROUP(NAME)	CONC
C-1	1594.2174
C-2	159.7864
C-3	34.5129
C-4	4.6092
C-5	0
C-6+	0

BECHTEL K-71
12-16-91 JOB # 10-854-03
OUTLET HC # 2

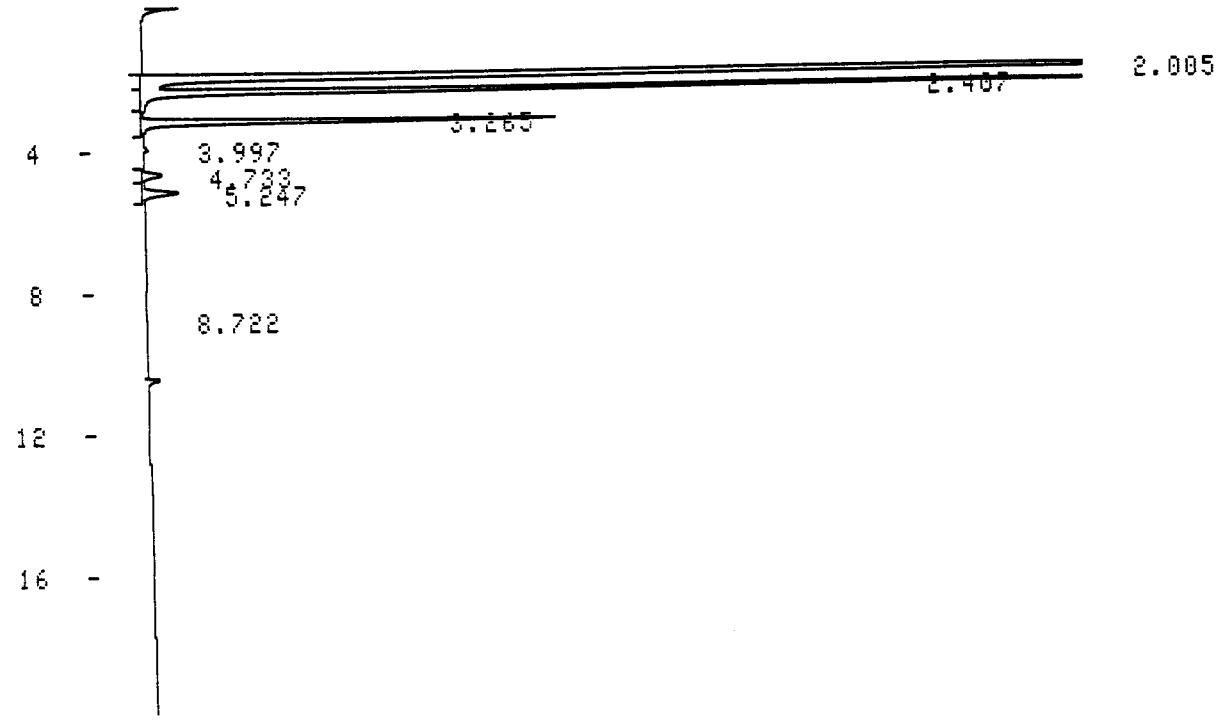


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.003	375950		1	1616.6427	C-1
2	2.405	72479	V	2	162.1964	C-2
3	3.263	23083	V	3	33.8171	C-3
4	4.739	1464		7	1.6322	C-4
5	5.246	2861		4	3.1902	C-4
	TOTAL	475838			1817.4785	

GROUP(NAME)	CONC
C-1	1616.6427
C-2	162.1964
C-3	33.8171
C-4	4.8224
C-5	0
C-6+	0

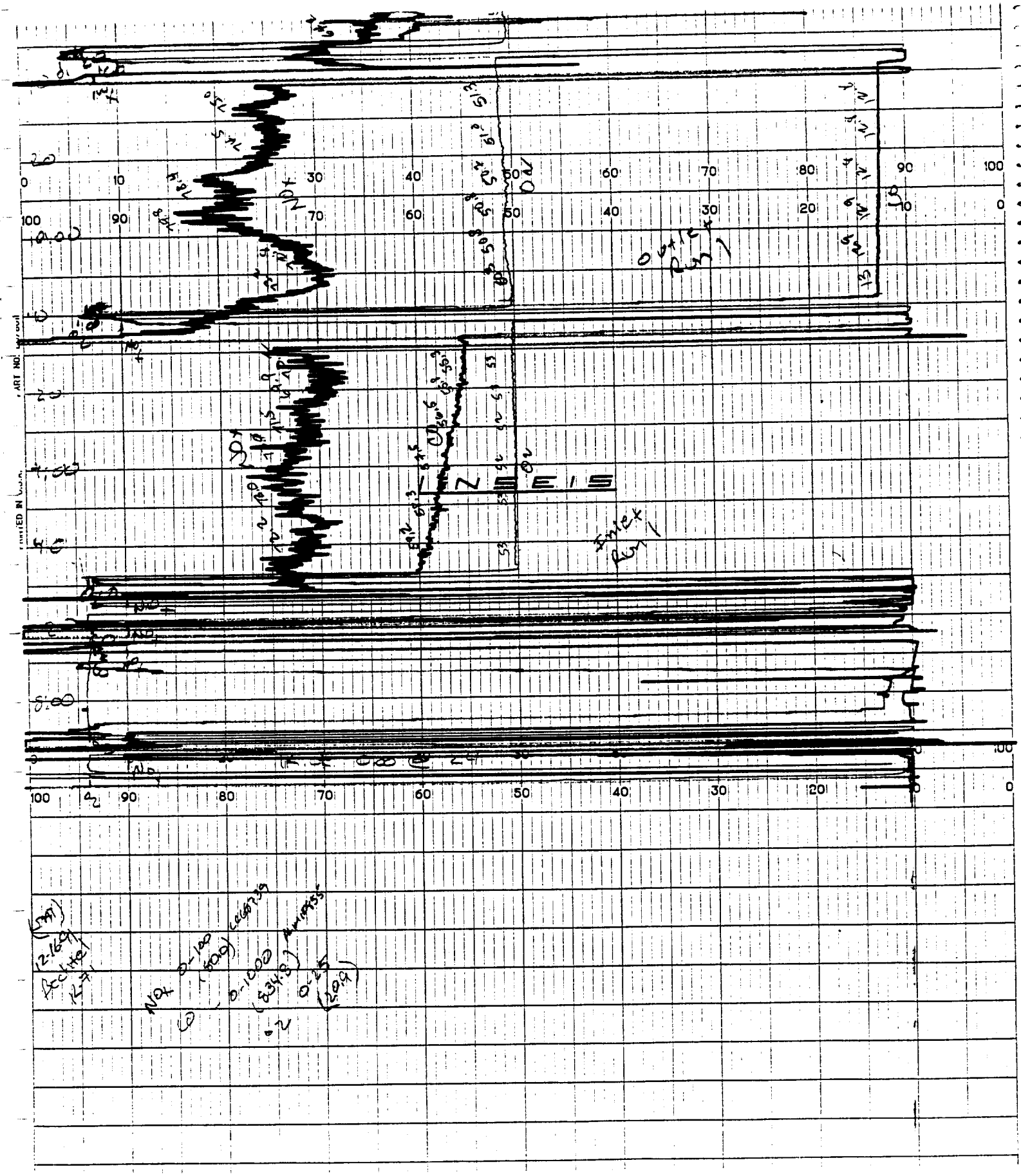
BECHTEL K-71
12-16-91 JOB # 10-854-03
OUTLET HC # 3

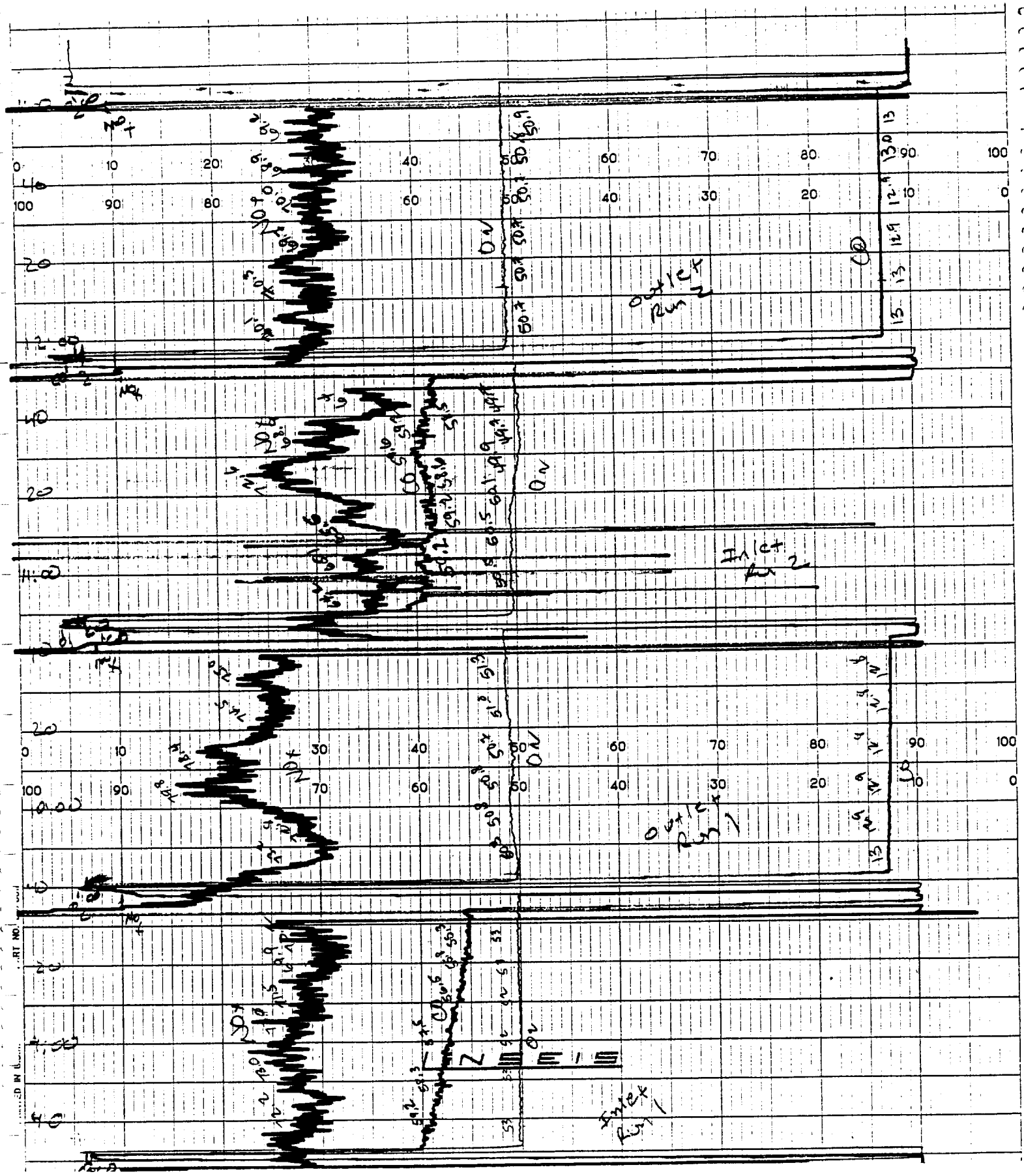


CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.005	336419		1	1446.6524	C-1
2	2.407	66582	V	2	148.9994	C-2
3	3.265	22254	V	3	32.6027	C-3
4	4.733	1503		7	1.6756	C-4
5	5.247	2923	V	4	3.2592	C-4
	TOTAL	429681			1633.1892	

GROUP(NAME)	CONC
C-1	1446.6524
C-2	148.9994
C-3	32.6027
C-4	4.9348
C-5	0
C-6+	0


Outlet
Run 1
Inlet
Run 1


Outlet Run 2
Inlet Run 2
Outlet Run 1
Inlet Run 1

ALITY CONTROL

Client: Bechtel

Report: 10-854-03

Date: 12-16-91

Unit: K-71

Proj. Sup: JAT

IN-HOUSE ANALYSIS:

ANALYSIS

Wet Analysis:

	Grav/Particulate	Blanks	Titrate/Sulfate	Blanks
Probe/Nozzle				
Filter				
Andys				
Condensable				
H_2O_2				
Organics				
Ammonia				

Turnaround Time:
24 Hrs: ____
2-3 Days: X
Normal 1-2 Weeks: ____

Gas Analysis:
Hydrocarbons C1-C6+

____ Low range ppm (0-15 ppm)
____ Med. range ppm (0-100 ppm)
6 High range ppm (0-1000 ppm)
____ Sample blanks

Other Analysis: ____

OUTSIDE SERVICE ANALYSIS:

Hydrocarbons: ____ Stack Gas Compliance: C_1-C6+

Fuel Gas Analysis by GC: 1 Sweet Gas: O_2, N_2, CO, CO_2, C_1-C_6+ (%)
____ Sour Gas: O_2, N_2, CO, CO_2, C_1-C_6+ (%) H_2S mole % (High range H_2S)

P.O.# 1666

Fuel Gas Analysis by Microcoulometer 1 H_2S (Low range), Total sulfur, ppm

Total (# of gas samples) 2

Fuel Oil Analysis: ____ Compliance: C, H, O, N, S (%), BTU, Ash, BS&W, API Gravity, "F" factors

Other Analysis: ____

SAMPLED BY: [signature]

RECEIVED BY: [signature] Petro Chem Environmental Services, Inc.

SCOTT-MARRIN, INC.
2001 THIRD ST. • UNIT H • RIVERSIDE, CA 92507
TELEPHONE (714) 784-1240

REPORT OF ANALYSIS
EPA PROTOCOL GAS MIXTURES

PETRØ1

TO:

RICK WILLIAMS
PETROCHEM ENVIRONMENTAL
32Ø7 ANTONINO AVE.
BAKERSFIELD, CA 93308

DATE : Ø2/11/91

CUSTOMER ORDER NUMBER: Ø1138

PAGE 1

<><><>

Scott Specialty Gases, Inc.

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

2600 CAJON BLVD., SAN BERNARDINO, CA 92411

Shipped From: Scott SAN BERNARDINO, CA
Date Shipped 11/05/91
Our Project No: 16278
Your P.O. No: 1574
Page 1 of 1
Expiration Date: 04/93

PETRO CHEM ENV SERVICES
ATTN: JAMES TAPLIN
3207 ANTONINO AVENUE
BAKERSFIELD CA 93308

CERTIFICATE OF ANALYSIS – EPA PROTOCOL GASES

Certified Per Traceability Protocol No. 1 Procedure No. G1 Cylinder No. ALM010855 Cylinder Pressure 600 PSIG Certified Accuracy ±1% % NIST Traceable

COMPONENTS	CERTIFIED CONC	REFERENCE STD SRM/CRM NO.	CYL. NO.	CONC.	GAS ANALYZER MAKE/MODEL/SERIAL NO.	LAST CAL. DATE	ANALYTICAL PRINCIPLE
CARBON MONOXIDE	834.8 PPM	CRM2637	AAL10112	2408 PPM	HORIBA AIA-24 4564403	7/9/91	INFRA-RED
NITRIC OXIDE	793.7 PPM	CRM1687	AAL19313	966.0 PPM	THERMO-ELECTRON 10AR 14853-150	7/12/91	CHEMI-LUMINENSCENT
NOX	795.7 PPM						

BALANCE GAS NITROGEN

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

Component CARBON MONIXIDE
First Analysis Date 10/10/91 Units mv

Z 00.00	R 93.6	T 51.9
R 93.6	Z 00.00	T 51.9
Z 00.00	T 51.9	R 93.6

Mean Test Assay 833.6 PPM

Second Analysis Date 11/01/91 Units mv

Z 00.00	R 93.6	T 52.0
R 93.6	Z 00.00	T 52.0
Z 00.00	T 52.0	R 93.6

Mean Test Assay 836.0 PPM

Component NITRIC OXIDE
Date 10/07/91 Units mv

Z 0.00	R 96.60	T 79.37
R 96.03	Z -0.06	T 78.76
Z -0.25	T 78.86	R 95.90

Mean Test Assay 793.7 PPM

Date _____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay

Component _____
Date _____ Units mv

Z	R	T
R	Z	T
Z	T	R

Mean Test Assay

Date _____ Units mv

Z	R	T
R	Z	T
Z	T	R

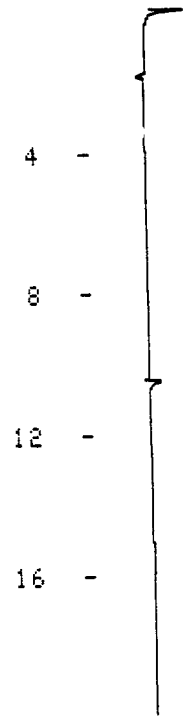
Mean Test Assay

Chronology: Date 12/12/89
Assay CO 794.1 PPM NO 794.1 PPM Analyst G. KING/M JOHNSON
$N2_x$ 796.0 PPM

Approved By: James Ross
JAMES ROSS, PLANT MANAGER

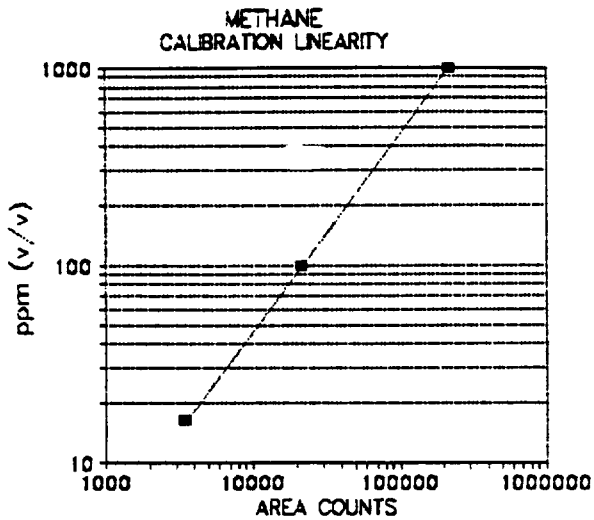
Petro Chem Environmental Services, Inc.

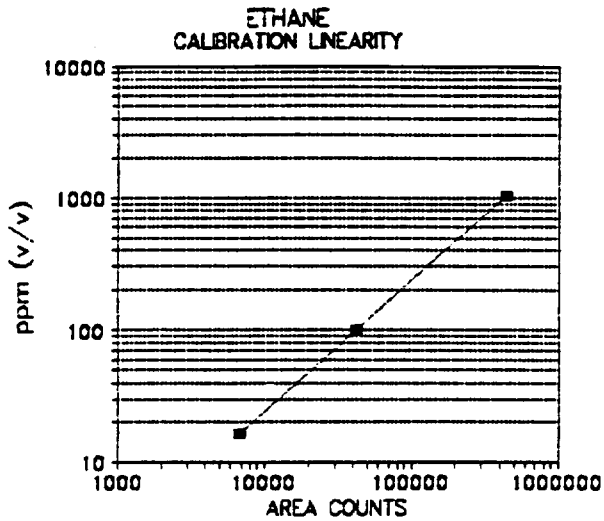
SYSTEM BLANK

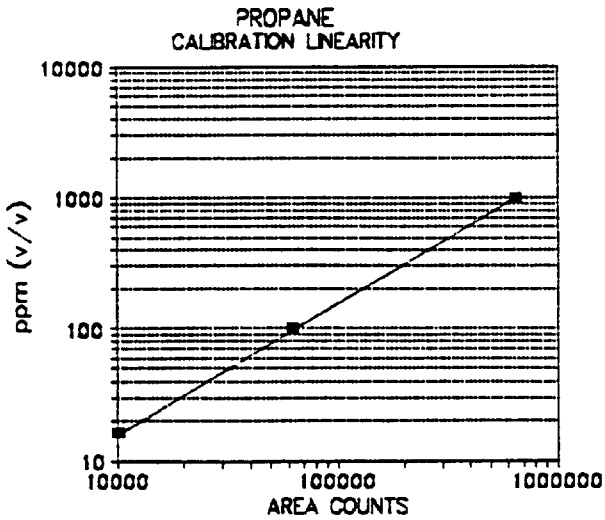


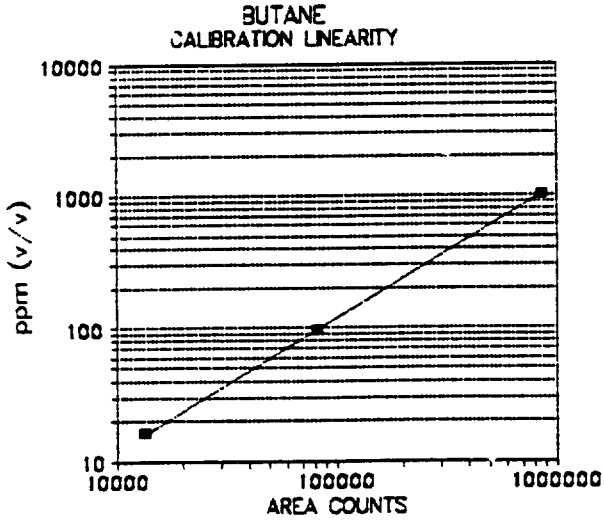
CHROMATOGRAM 1 MEMORIZED
WARNING NO PEAK

CALIBRATION LINEARITIES

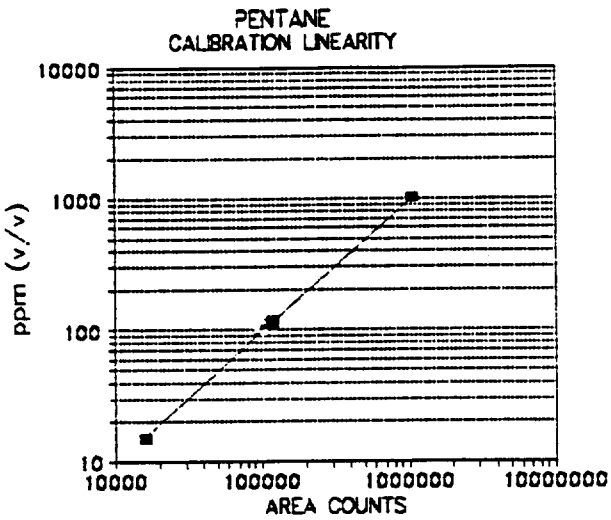


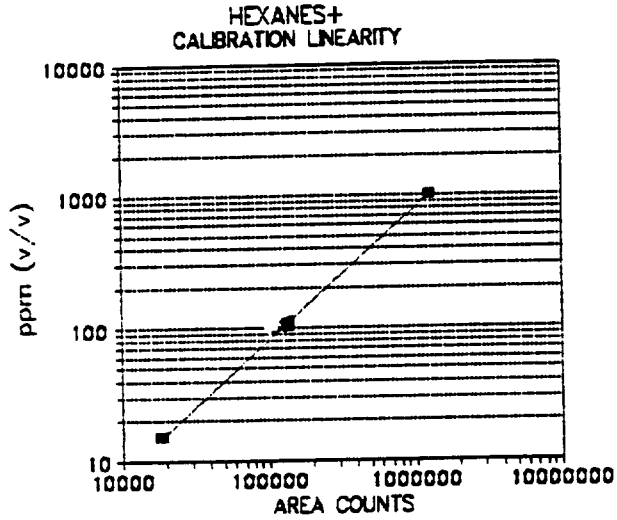




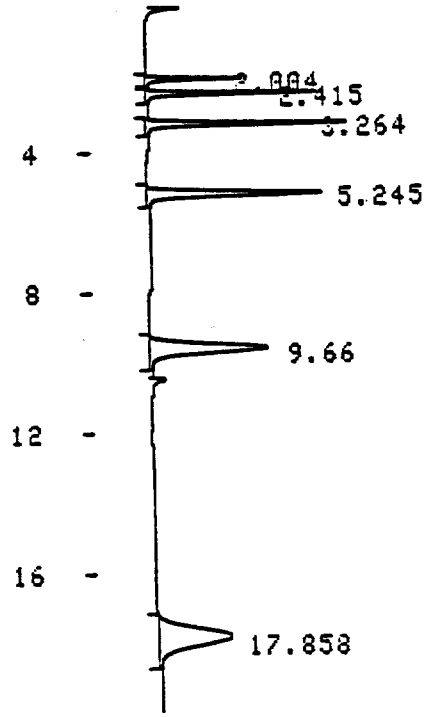


CALIBRATION LINEARITIES





15PPm STANDARD



CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	3609		1	16.7891	C-1
2	2.415	7141		2	16.9085	C-2
3	3.264	10585		3	16.8579	C-3
4	5.245	13941		4	16.9481	C-4
5	9.66	16911		5	15.0121	C-5
6	17.858	19511		6	15.5538	C-6+
	TOTAL	71696			98.0694	

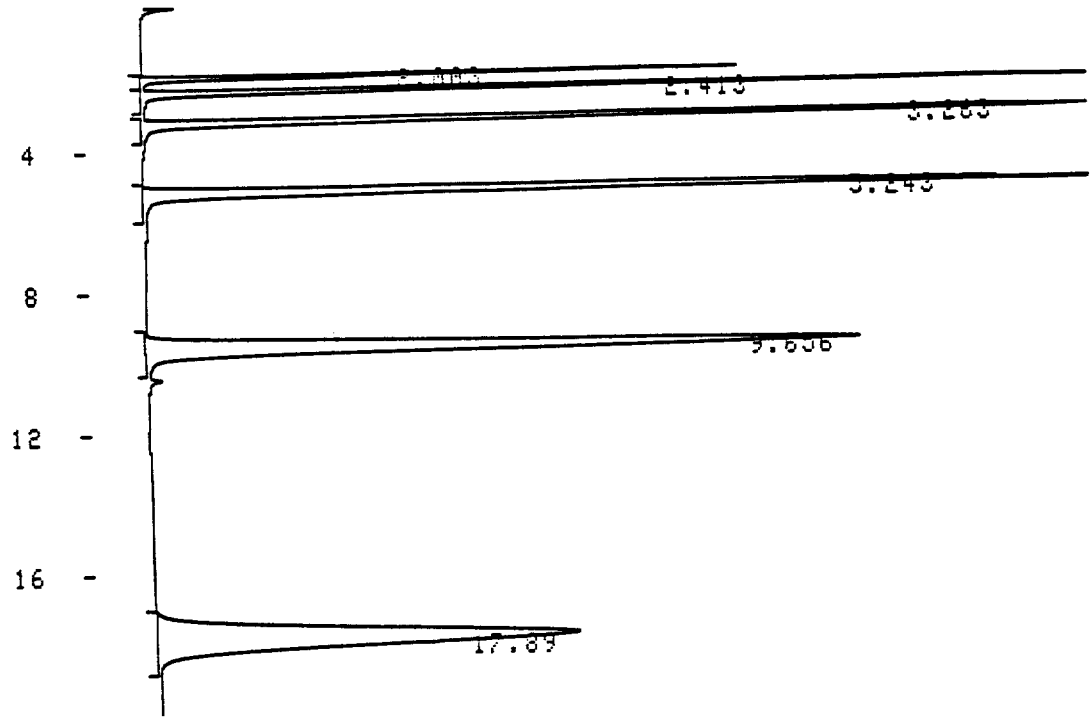
GROUP(NAME)	CONC
C-1	16.7891
C-2	16.9085
C-3	16.8579
C-4	16.9481
C-5	15.0121
C-6+	15.5538

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	3609		1		C-1
2	2.415	7141		2		C-2
3	3.264	10585		3		C-3
4	5.245	13941		4		C-4
5	9.66	16911		5		C-5
6	17.858	19511		6		C-6+
	TOTAL	71696				

CALIBRATION MADE IN IDENTIFICATION FILE 0
MODE# 101 WINDOW 3

Petro Chem Environmental Services, Inc.

100PPm STANDARD



CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.003	22320		1	101.6549	C-1
2	2.413	44487	V	2	101.5854	C-2
3	3.263	65571		3	101.9867	C-3
4	5.243	85911		4	99.4411	C-4
5	9.656	103063		5	102.1131	C-5
6	17.89	112612		6	100.9869	C-6+
	TOTAL	433963			607.768	

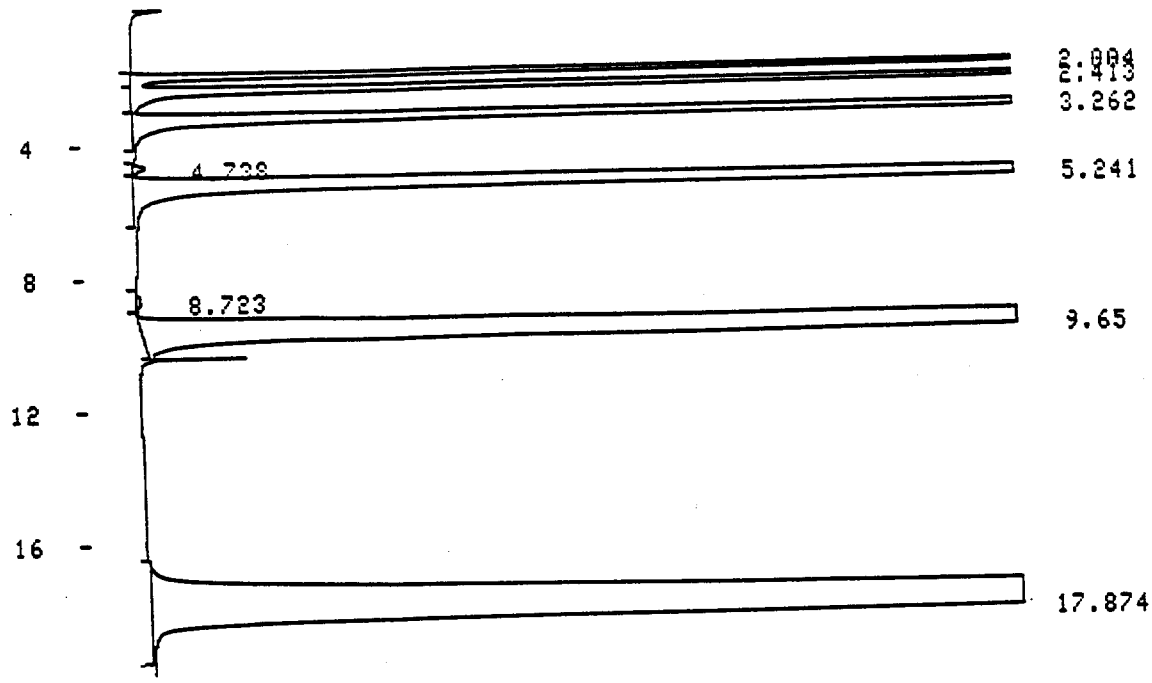
GROUP(NAME)	CONC
C-1	101.6549
C-2	101.5854
C-3	101.9867
C-4	99.4411
C-5	102.1131
C-6+	100.9869

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.003	22320		1		C-1
2	2.413	44487	V	2		C-2
3	3.263	65571		3		C-3
4	5.243	85911		4		C-4
5	9.656	103063		5		C-5
6	17.89	112612		6		C-6+
	TOTAL	433963				

CALIBRATION MADE IN IDENTIFICATION FILE 1
MODE# 101 WINDOW 3

Petro Chem Environmental Services, Inc.

1000PPm STANDARD



CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	232550		1	1024.3299	C-1
2	2.413	464736	V	2	1065.3618	C-2
3	3.262	685998	V	3	1029.5637	C-3
4	4.738	959		7	1.0947	C-4
5	5.241	905851		4	1034.0878	C-4
6	8.723	798		9	0.7516	C-5
7	9.65	1097589		5	1033.64	C-5
8	17.874	1310191		6	1030.7642	C-6+
	TOTAL	4698670			6219.5927	

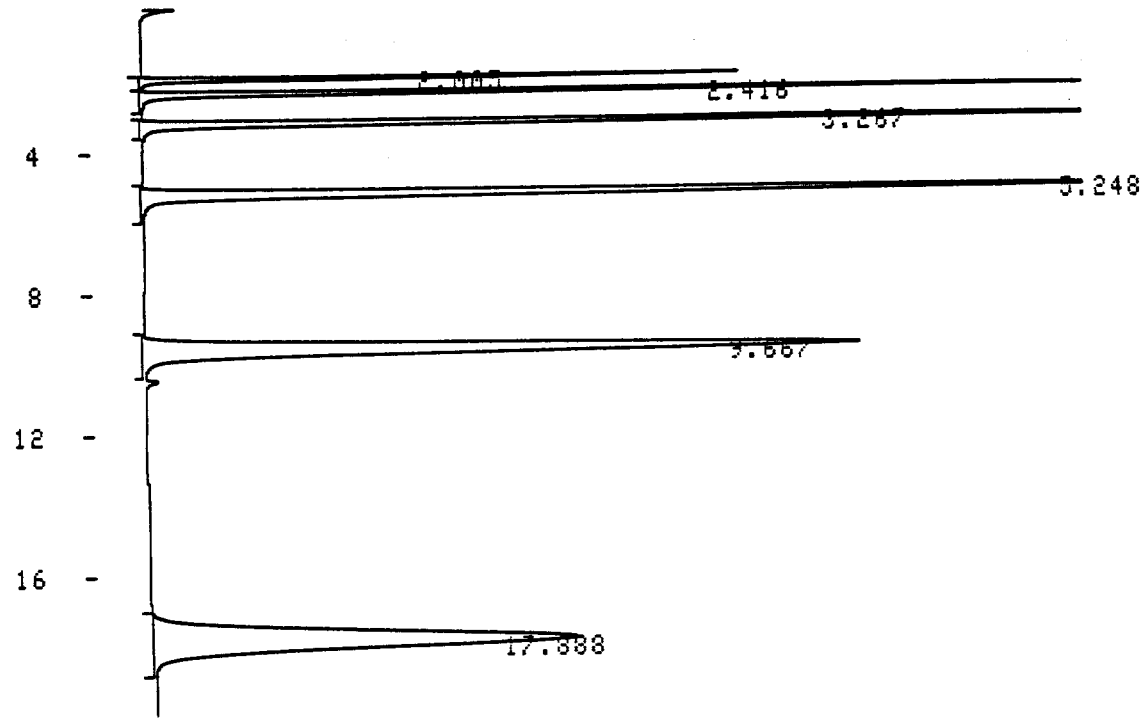
GROUP(NAME)	CONC
C-1	1024.3299
C-2	1065.3618
C-3	1029.5637
C-4	1035.1824
C-5	1034.3916
C-6+	1030.7642

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.004	232550		1		C-1
2	2.413	464736	V	2		C-2
3	3.262	685998	V	3		C-3
4	4.738	959		7		C-4
5	5.241	905851		4		C-4
6	8.723	798		9		C-5
7	9.65	1097589		5		C-5
8	17.874	1310191		6		C-6+
	TOTAL	4698670				

CALIBRATION MADE IN IDENTIFICATION FILE 2

Petro Chem Environmental Services, Inc.

POST CALIBRATION CHECK
100PPm STANDARD



CHROMATOGRAM 1 MEMORIZED

PKNO	TIME	AREA	MK	IDNO	CONC	NAME
1	2.005	22625		1	101.3688	C-1
2	2.416	45117	V	2	101.3149	C-2
3	3.267	66306		3	101.1224	C-3
4	5.248	87344		4	98.9229	C-4
5	9.667	104722		5	101.6096	C-5
6	17.888	114341		6	100.6209	C-6+
	TOTAL	440455			604.9593	

GROUP(NAME)	CONC
C-1	101.3688
C-2	101.3149
C-3	101.1224
C-4	98.9229
C-5	101.6096
C-6+	100.6209

COMPANY :PETRO CHEM ENVIRONMENTAL SERVICES
UNIT :BV-2
DATE :10-91
ANALYZER:O2 TELEDYNE MODEL 320AX
SERIAL # SN106197

QUARTERLY
LINEARITIES

CYL #	RANGE 25	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
AMBIENT	HIGH	21	20.9	0.4
LK273312	MID	15	15	0
	ZERO	0.00	0	0

CYL #	RANGE 25	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
T623349	HIGH	7.1	7	0.4
HK280321	MID	4	4	0
	ZERO	0.00	0	0

DUST ✓
FUEL CELL

COMPANY :PETRO CHEM ENVIRONMENTAL SERVICES
UNIT :BV-2
DATE :10-91
ANALYZER:NOX THERMO ELECTRON MODEL 10
SERIAL # 10A/R-23488-210

QUARTERLY
LINEARITIES

CYL #	RANGE 2500	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
ALM4590	HIGH	2045	2026	0.76
CC74132	MID	830	837	-0.28
	ZERO	0.00	0	0

CYL #	RANGE 1000	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
CC74132	HIGH	835	837	-0.2
CC12121	MID	410	409	0.1
	ZERO	0.00	0	0

CYL #	RANGE 250	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
CC28365	HIGH	205	206.3	-0.52
CC68739	MID	80	80	0
	ZERO	0.00	0	0

CYL #	RANGE 100	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
CC68739	HIGH	81	80	1
CC7382	MID	40	40	0
	ZERO	0.00	0	0

OIL CHANGE ✓
DRIERITE
FILTER ✓

OZONE SCRUBBER
REACTION CHAMBER CLEANOUT
CAPILARIES ✓

Petro Chem Environmental Services, Inc.

COMPANY :PETRO CHEM ENVIRONMENTAL SERVICES
UNIT :BV-2
DATE :10-91
ANALYZER:CO THERMO ELECTRON MODEL 48
SERIAL # 48-23438-210

QUARTERLY
LINEARITIES

CYL #	RANGE 5000	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
ALM4590	HIGH	2000	2014	-0.28
CC74132	MID	815	815	0
	ZERO	0.00	0	0

CYL #	RANGE 1000	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
CC74132	HIGH	800	815	-1.5
CC12121	MID	358	358	0
	ZERO	0.00	0	0

CYL #	RANGE 100	ANALYZER VALUE %	ACTUAL VALUE%	%OF RANGE DEVIATION
CC68739	HIGH	83	81.4	1.6
CC7382	MID	40.5	40.5	0
	ZERO	0.00	0	0

OPTICS CHECK AND CLEAN