THE ALMEGA CORPORATION

A DIVISION OF NATIONAL AIR NETWORK, INC.

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Emission Measurements for Speciated PAH's
and BTXE Compounds on Gas Fired Turbine
and Steam Generator

June 24-27, 1991

The Almega Corporation Project #C6823
The Almega Corporation Report #C6823-2

PREPARED FOR

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5060 California Avenue
Bakersfield, California 93309

An ENVIRONMENTAL SERVICES OF AMERICA, INC. Company

NAN

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A DIVISION OF NATIONAL AIR NETWORK, INC.

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August 1, 1991

Shell Western E & P
P.O. Box 11164
5060 California Avenue
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Bakersfield, California 93309

Attention: Elvin Bounds

Subject : Emission Measurements for Speciated PAH'S and BTXE Compounds on Gas Fired Turbine and Steam Generator
The Almega Corporation Project # C6823
The Almega Corporation Report # C6823-2

Gentlemen:

I. INTRODUCTION

An emissions testing series was conducted during the period of June 24 Through 27, 1991 for speciated PAH'S, Benzene, Toluene, Xylene and Ethyl Benzene on one natural gas fired steam generator and one Cogeneration turbine at the Shell Western Facilities in Bakersfield, California.

The purpose of this test series was to satisfy the requirements for measurements of toxic air contaminants from a gas fired steam generator and a gas fired cogeneration unit as mandated by AB2588, Air Toxics "Hot Spots" Information and Assessment Act of 1987.

Testing was performed by M.P.DuBois and R.Neucom of the Almega Corporation.The Gas Turbine and the Steam Generator were operated normally and monitored by Shell Western E & P personnel.

Analysis for the PAH compounds was performed by Alta Labs of Sacramento CA., analysis of the BTXE compounds was performed by Enseco Labs of El Monte/Garden Grove CA.

II. PLANT DESCRIPTION

Testing was performed on one cogeneration unit and one steam generator which are located near Bakersfield, California. Both units are capable of being fired on natural gas.

A.-Cogeneration Unit:

The Cogeneration Unit is rated at an electrical capacity of 20 Mw. Exhaust gas from this turbine is conveyed to the superheater section of a waste heat recovery steam generator, to a CO oxidation catalyst, a catalyst for selective catalytic reduction (SCR) of NO_x and the low pressure section of the steam generator. Ammonia is injected upstream of the SCR to facilitate reduction of NO_x to nitrogen and water.

This unit was fueled on natural gas with a gross calorific value of approximately 1,020 BTU/ft^3. Fuel gas usage and analysis can be found in Appendix K and Table 5.

A schematic of the cogeneration system is shown in Figure I.

The exhaust gas on this unit is discharged through a stack approximately 7' in diameter having a permanently mounted test platform and three mutually orthogonal 3" diameter test ports. A generalized schematic of the stack showing the location of the test ports is presented in Figure II.

Stack gas characteristics for the Cogeneration Unit are summarized in Tables 2 and 4.

B.-Steam Generator:

The output capacity of the steam generator that was tested is rated at 62.5MMBTU/hr, the steam generator was run at a rate of approximately 80% of rated capacity for this test series. For the purpose of this test series a 3' diameter stack extension was mounted on the top of the exhaust duct with two 3" diameter test ports, set 90° apart. Shell Western provided ground mounted construction grade scaffolding for access to the test ports.

A sketch of the stack and port construction is shown in Figure II.

The steam generator was fueled on both natural gas and CVR gas. The gross calorific values of these fuels was 1,020 BTU/ft^3 for natural gas and 110 BTU/ft^3 for CVR gas. Fuel gas usage and analysis can be found in Appendix L and Table 10.

Stack gas characteristics for the Steam Generator are summarized in Tables 7 and 9.

III. TEST METHODS

Since the data are needed for compliance with the requirements mandated by AB2588, the test methods have complied with published CARB procedures.

The following test methods were used:

PAH, speciated	CARB 429
Benzene	CARB 410A
Toluene, Xylene, Ethyl Benzene	CARB 422

Triplicate test repetitions were performed for all PAH and BTXE sampling.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs were determined following CARB Method 429 (Determination of Polycyclic Aromatic Hydrocarbons from Stationary Sources), included in Appendix E. A schematic of this train is shown in Figure 429-9.

The sampling train configuration and procedures are adapted from the USEPA Method 5 procedures. The principal difference is the capability of collecting vapor phase organic compounds downstream of the filter. A trap containing approximately 40 grams of porous polymeric Amberlite XAD-2 adsorbent resin was located just prior to the first impinger. The exhaust gas was isokinetically sampled at a representative number of traverse points (per CARB Method 1), drawn through a glass nozzle, quartz-lined probe, Teflon filter, water cooled condenser and an XAD-2 trap. The gases entering the XAD-2 trap was maintained at or below 20°C.

Liquid condensate was collected in the first impinger, directly underneath the XAD-2 trap, as well as the second and third impingers. Residual water vapor was retained by the silica gel in the fourth impinger.

All glassware was connected with leak-free ground glass fittings without benefit of any sealing agents such as vacuum grease. A leak check of the entire sampling train, including the probe, was performed prior to and after each run.

The teflon filters used in the train were prechecked for the presence of any background contaminants that may have interfered with the analysis.

The XAD-2 resin was precleaned using the extraction procedure as detailed in CARB Method 429, of the Test Methods for Evaluating Solid Waste. Total chromatographable organics checks were run on resin blanks per CARB Method 429 of the Test Methods for Evaluating Solid Waste. These Analysis results are summarized in Appendix J.

During these sampling runs a nominal sampling rate of .65 cf/min. was achieved through out this test series. PAH concentrations for the Cogen can be found in Table 3 and BTXE concentrations can be found in Table 4, PAH concentrations for the steam generator can be found in Table 8 and BTXE concentrations can be found in Table 9.

All glassware used for MM5 sampling, recovery and sample storage was precleaned using the following steps.

a. Hot synthetic detergent wash
b. Hot tap water rinse
c. Chromic/Sulfuric acid soak
d. Hot tap water rinse
e. Deionized water rinse
f. Methanol (distilled-in-glass) triple rinse
g. Methylene chloride (distilled-in-glass) triple rinse

After drying, all glassware was sealed with hexane rinsed aluminum foil to prevent contamination. Teflon liners were used in all sample jar lids.

Recovery of the MM5 train conformed to the following procedure:

a. All recovery vessels such as squirt bottle and graduated cylinder were made of borosilicate glass or teflon.

b. At the end of each sampling period, the train was sealed and transferred to a clean and secured area for recovery.

c. Sample No. 1: The glass fiber filter was transferred to a glass petri dish, sealed with teflon tape and the sample designated "R_-429-S1-Filter." The glass petri dish was wrapped in aluminum foil.

d. Sample No. 2: The nozzle, quartz-lined probe and prefilter glassware was brushed and triple-rinsed with a mixture (1:1, v/v) of HPLC grade methylene chloride ($MeCl_2$) and methanol (MeOH). These rinses were combined and stored in a glass amber jar with a teflon-lined lid and this sample was designated "R_-429-S2-Pre-Wash."

e. Sample No. 3: The XAD-2 trap was sealed with ground glass caps and the sample designated "R_-429-S3-XAD." The trap was wrapped in aluminum foil.

f. Sample No. 4: The volume of condensate in the first impinger directly underneath the XAD-2 trap was volumetrically determined, the impinger triple-rinsed with $MeOH/MeCl_2$ (1:1, v/v), the rinse and condensate fractions combined and stored in a glass amber jar with a teflon-lined lid. This sample was designated "R_-429-S4-Condensate."

g. All glassware between the filter and the XAD-2 traps was triple-rinsed with $MeOH/MeCl_2$ (1:1, v/v) and the rinsings added to Sample No. 4. If there was any condensate present in the elbow prior to the XAD-2 trap, it was volumetrically measured and added to Sample No. 4.

h. Sample No. 5: Volumetric determinations of the liquid in the two impingers (#2 and #3) following the condensate knockout vessel was made. The impingers was triple-rinsed with $MeOH/MeCl_2$ (1:1, v/v) and both fractions combined and stored in a glass amber jar with a teflon-lined lid. This sample was designated "R_-429-S5-Imps."

i. Sample No. 6: The indicating silica gel in the fourth impinger was visually examined to determine if it was completely spent and then transferred to a polyethylene bottle and the sample was designated "R_-429-S6-SG."

J. All samples, other than Sample No. 6, were secured in a refrigerated cooler at (<4°C) for direct transfer to the laboratory for analysis. All liquid samples had the liquid level marked on the side of the jar to check for sample leakage during transport.

BENZENE

Sampling for Benzene followed the principals of CARB Method 410A, (Determination of Benzene from Stationary Sources [low concentration gas chromatographic technique])as reproduced in Appendix F.

In this method an integrated sample of the gas stream was drawn from the stack through a stainless steel probe, by means of an evacuated bladder system, into a new pre-cleaned Tedlar bag. The sample is then analyzed by gas chromatography using a photo ionization detector.

TOLUENE, XYLENE & ETHYL BENZENE

Sampling for Toluene, Xylene and Ethyl Benzene followed the principals of CARB Method 422 (Determination of Halogenated Organics Emissions from Stationary Sources)as reproduced in Appendix G. As in Method 410A, the sample is extracted from the stack through a stainless steel probe, by means of an evacuated bladder system, into a pre-cleaned Tedlar bag. The sample is then analyzed by gas chromatography using a detector suitable for Toluene, Xylene and Ethyl Benzene.

A summary of emission data can be found in Table 4 for the Cogeneration Unit and Table 9 for the Steam Generator. These samples were labeled as R_-410A/422-BTXE.

Sample port locations and velocity traverse points were determined by CARB Method 1, as reproduced in Appendix A. Sampling was performed at 24 points, 12 across each diameter of the stack. The following describes the nozzle distance from the stack wall for each unit tested:

COGEN		STEAM GEN.	
TEST POINT	DISTANCE	TEST POINT	DISTANCE
1	1.5 in.	1	0.5 in.
2	4.8	2	1.6
3	8.5	3	2.8
4	12.8	4	4.3
5	18.0	5	6.0
6	25.6	6	8.5
7	46.4	7	15.5
8	54.0	8	18.0
9	59.3	9	19.8
10	63.5	10	21.2
11	67.2	11	22.4
12	70.5	12	23.5

Stack gas velocity and volumetric flow rates were determined by CARB Method 2, as reproduced in Appendix B.

Permanent gases, excess air and dry molecular weight was determined by CARB Method 3, as reproduced in Appendix C.

Stack gas moisture content was determined by CARB Method 4, as reproduced in Appendix D.

Fuel gas composition and high heat values, for calculations of the emissions in terms of lb/10^6 BTU, was provided by Shell Western E & P personnel. High Heat input values can be found in Tables 5 & 10.

The following stack gas parameters were determined during this test series:

temperature °F
velocity fps
moisture % vol/vol
volume flow acfm and scfh db
orsat CO_2, O_2, and N_2 % vol/vol
concentration grains/dscf
emission rate lb/hr
emission rate lb/10^6 BTU

O_2 percentage for the cogen were taken from the certified O_2 CEM installed on the unit.

IV. QUALITY ASSURANCE:

Quality assurance and quality control procedures were followed as detailed in the test protocol document. Copies of field and laboratory data along with chain-of-custody documentation can be found in Appendix H and I.

V. TESTING LABORATORY

Enseco Air Toxics Laboratory has performed the BTXE analysis described above.

PAH analysis was performed by ALTA Labs. in Sacramento, CA. who was subcontracted by The Almega Corporation for this test series.

The Almega and all the listed sub-contractors are independent testing/analytical laboratories and have no relationship, other than this testing series, to Shell Western E & P.

VI. COMMENTS:

The pre-test spike of the d12-Benz(a)Anthracene isotope was, in anticipation of analysis being performed by GCLRMS, higher than that normally required for GCHRMS analysis. Therefore, during the analytical phase for the PAH's Alta Laboratories experienced some difficulties in determining the concentrations of Benz(a)Anthracene and Chrysene in the sample from the effluent stream. These difficulties manifest themselves as high pre-test spike concentrations as detected by the GC. This signal was large enough to mask the signal for Chrysene since Benz(a)Anthracene and Chrysene have virtually the same retention time in the GC.

In order to quantitate the concentrations of Benz(a)Anthracene and Chrysene in the sample, Alta recalculated a higher detection level for both compounds using the surrogate of d10-Pyrene as an internal standard since Pyrene is also extremely close to the Benz(a)Anthracene and Chrysene GC retention times.

In other words; the detection limits of 7ng for Benz(a)Anthracene and 25ng for Chrysene were determined by Alta to be the limits of the GCHRMS signal of the overspiked isotope by using Pyrene in lieu of Benz(a) Anthracene as a standard.

Subsequent GCHRMS analysis determined that no concentrations of Benz(a)Anthracene or Chrysene existed in the samples above the high pre-test spike values.

VII. CONCLUSION:

Testing has been performed for PAH and BTXE compounds on one 20MW cogeneration unit and one 62.5 MMBTU/hr steam generator during the period of June 24 through 27, 1991 at the Shell Western E & P facilities in Bakersfield CA.

The Almega Corporation is pleased to have been of service to Shell Western E & P, and we look forward to further opportunities of serving your environmental needs.

Respectfully Submitted
THE ALMEGA CORPORATION

Charles A. Petrishe

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Manager of Source Test Services

The Almega Corporation

b:c6823-2t #68
Shell E & P Format
Revised 9/9/91

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TABLE 1

SUMMARY OF EMISSION RATES

COMPANY : Shell Western E & P

SOURCE : Cogen 20 MW

LOCATION : Bakersfield, California

TEST PERIOD : June 24 & 25, 1991

EMISSION RATE UNITS 10^{-6} lb/10^{6} BTU

	Average 3 Runs With N.D. @ 1/2 D. L.	Average 3 Runs With N.D. @ Zero	MQL/Blank
Naphthalene	0.9163	0.9163	0.0224 B
Acenaphthylene	0.002733	0.001889	0.00255 M
Acenaphthene	0.001273	0.0000	0.00255 M
Fluorene	0.01193	0.01193	0.00326 B
Phenanthrene	0.04094	0.04094	0.00916 B
Anthracene	* 0.05322	0.05322	0.00255 M
Fluoranthene	0.01364	0.01364	0.00255 M
Pyrene	0.03409	0.03409	0.00255 M
Benz(a)anthracene	0.001858	0.0000	0.00372 M
Chrysene	0.005933	0.0000	0.01186 M
Benzo(b)fluoranthene	0.003764	0.002921	0.00255 M
Benzo(k)fluoranthene	0.002327	0.001486	0.00255 M
Benzo(a)pyrene	0.001273	0.0000	0.00255 M
Indeno(1,2,3-cd)pyrene	~~0.00754~~ 0.001754	0.0009107	0.00255 M
Dibenzo (ah)anthracene	0.001273	0.0000	0.00255 M
Benzo(ghi)perylene	0.001926	0.001082	0.00255 M
Benzene	18.5766	0.0000	37.0 M
Toluene	125.0165	125.0165	73.0 B
Xylene	42.0781	00.0000	84.1 M
Ethyl Benzene	21.0390	0.0000	42.1 M

B = Blank Value
M = Minimum Quantifiable Level (MQL)
* = Includes R#2 Unusually High Level

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TABLE 2

COMPANY	:	Shell Western E & P		
LOCATION	:	Bakersfield, California		
SOURCE	:	Cogen 20 MW		
TEST DATES	:	June 24 & 25, 1991		
REPETITION	:	1	2	3
TEST TIMES	:	9:34a-2:30p	3:45p-7:52p	7:30a-11:45a
Process Rate MW		20	20	20
Heat Input MMBTU/hr		244.2	239.7	237.9
<u>STACK GAS</u>				
Temperature °F average		305.2	303.9	308.7
Velocity fps average		76.1	78.7	79.7
Volume flow dscfh x 10^6		7.171	7.548	7.584
ascfm		195,111	201,675	204,411
CO_2 %		3.0	3.0	3.5
O_2 %		14.93	14.86	15.05
Moisture %		10.3	8.8	9.0
<u>SAMPLE</u>				
Time, minutes		240	240	240
Volume dscf		131.211	133.975	136.379
isokinetic ratio %		98.9	95.9	97.2

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TABLE 3

PAH's

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COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : Cogen 2O MW

REPETITION :	1	2	3	MQL Blank
Naphthalene				
(mass collected ng)	1,800	1,800	1,800	44 B
concentration, 10^{-9} lb/dscf	30.249	29.625	29.103	0.725
emissions lb/hr x 10^{-3}	0.2169	0.2236	0.2207	0.0054
emissions 10^{-6} lb/10^{6} BTU	0.8882	0.93290	0.9278	0.0224
Acenaphthylene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	11	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.178	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003105	0.001349	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.005669	0.00255
Acenaphthene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.040	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003105	0.0003065	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.001289	0.00255
Fluorene				
(mass collected ng)	16	26	28	6.4 B
concentration, 10^{-9} lb/dscf	0.269	0.428	0.453	0.105
emissions lb/hr x 10^{-3}	0.001928	0.003229	0.003433	0.0008
emissions 10^{-6} lb/10^{6} BTU	0.007896	0.01347	0.01443	0.00326
Phenanthrene				
(mass collected ng)	52	95	93	18 B
concentration, 10^{-9} lb/dscf	0.8738	1.564	1.504	0.297
emissions lb/hr x 10^{-3}	0.006266	0.01180	0.01140	0.002
emissions 10^{-6} lb/10^{6} BTU	0.02566	0.04923	0.04793	0.00916

B = Blank
M = Minimum Quantifiable Level (MQL)
2.5 = Half Detection Level

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Table 3 cont'd...

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REPETITION :	1	2	3	MQL Blank
Anthracene				
(mass collected ng)	7.5	*290	11	5.0 M
concentration, 10^{-9} lb/dscf	0.126	4.773	0.178	0.082
emissions lb/hr x 10^{-3}	0.0009038	0.03603	0.001348	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.003701	0.1503	0.005669	0.00255
Fluoranthene				
(mass collected ng)	19	33	28	5.0 M
concentration, 10^{-9} lb/dscf	0.319	0.543	0.453	0.082
emissions lb/hr x 10^{-3}	0.002289	0.004099	0.003433	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.009376	0.01710	0.01443	0.00255
Pyrene				
(mass collected ng)	48	80	72	5.0 M
concentration, 10^{-9} lb/dscf	0.807	1.317	1.164	0.082
emissions lb/hr x 10^{-3}	0.005784	0.009938	0.008828	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.02369	0.04146	0.03711	0.00255
Benz(a)anthracene				
(mass collected ng)	N/D(3.65)	N/D(3.65)	N/D(3.65)	7.3 M
concentration, 10^{-9} lb/dscf	0.0613	0.0601	0.0590	0.120
emissions lb/hr x 10^{-3}	0.0004399	0.0004534	0.0004476	0.000894
emissions 10^{-6} lb/10^{6} BTU	0.001801	0.001892	0.001881	0.00372
Chrysene				
(mass collected ng)	N/D(11.65)	N/D(11.65)	N/D(11.65)	23.3 M
concentration, 10^{-9} lb/dscf	0.196	0.192	0.188	0.384
emissions lb/hr x 10^{-3}	0.00140	0.00145	0.001429	0.00285
emissions 10^{-6} lb/10^{6} BTU	0.00575	0.00604	0.00601	0.01186
Benzo(b)fluoranthene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	17	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.275	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003106	0.002085	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.008762	0.00255

B = Blank
M = Minimum Quantifiable Level (MQL)
* = Possible Elevated Level Due to Excessive Field Spiking
2.5 = Half Detection Level

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Table 3 cont'd...

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REPETITION :	1	2	3	MQL Blank
Benzo(k)fluroanthene				
(mass collected ng)	N/D(2.5)	8.6	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.142	0.040	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.000068	0.0003065	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.004457	0.001289	0.00255
Benzo(a)Pyrene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.040	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003106	0.0003065	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.001289	0.00255
Indeno(1,2,3-cd)pyrene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	5.3	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.086	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003106	0.0006499	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.002732	0.00255
Dibenzo(ah)anthracene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.040	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003106	0.0003065	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.001289	0.00255
Benzo(ghi)perylene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	6.3	5.0 M
concentration, 10^{-9} lb/dscf	0.042	0.041	0.102	0.082
emissions lb/hr x 10^{-3}	0.0003013	0.0003106	0.0007725	0.0006
emissions 10^{-6} lb/10^{6} BTU	0.001234	0.001296	0.003247	0.00255

B = Blank
M = Minimum Quantifiable Level (MQL)
2.5 = Half Detection Level

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TABLE 4
Benzene, Toluene, Xylene, Ethyl Benzene

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COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : Cogen 20 MW

TEST DATES : June 24, 1991

REPETITION :	1	2	3	MQL/Blank
TEST TIMES :	10:30a-11:30a	12:00p-1:00p	4:00p-5:00p	
Process Rate 10^6 BTU/hr	244.2	244.2	239.7	
STACK GAS				
Temperature °F average	305.2	305.2	303.9	
Velocity fps average	76.1	76.1	78.7	
Volume flow dscfh x 10^6	7.171	7.171	7.548	
ascfm	195,111	195,111	201,675	
CO_2 %	3.0	3.0	3.0	
O_2 %	14.93	14.93	14.86	
Moisture %	10.3	10.3	8.8	
SAMPLE				
Time, minutes	60	60	60	
Benzene				
Mol. Wt. lb/lb mole	78.12	78.12	78.12	78.12
Concentration ppb	N/D(3)	N/D(3)	N/D(3)	6M
Emissions lb/hr	0.0044296	0.004496	0.004662	0.009
Emissions lb/10^6BTU x 10^{-3}	0.01813	0.01813	0.01945	0.037
Toluene				
Mol. Wt. lb/lb mole	92.14	92.14	92.14	92.14
Concentration ppb	16.0	13.0	22.0	10B
Emissions lb/hr	0.02786	0.02264	0.04033	0.018
Emisions lb/10^6BTU x 10^{-3}	0.1141	0.09271	0.1682	0.073
Xylene				
Mol. Wt. lb/lb mole	106.17	106.17	106.17	106.17
Concentration ppb	N/D(5)	N/D(5)	N/D(5)	10 M
Emissions lb/hr	0.01003	0.01003	0.001056	0.02042
Emisions lb/10^6BTU x 10^{-3}	0.04109	0.04109	0.04406	0.08413
Ethyl Benzene				
Mol. Wt. lb/lb mole	106.17	106.17	106.17	106.17
Concentration ppb	N/D(2.5)	N/D(2.5)	N/D(2.5)	5 M
Emissions lb/hr	0.0050168	0.0050168	0.005281	0.01021
Emisions lb/10^6BTU x 10^{-3}	0.02054	0.02054	0.02203	0.0421

*Stack Gas Summary Emission Data Taken From Runs #1 & 2 PAH Sampling

B = Blank Samples M = Minimum Quantifiable Level(MQL) N/D = Non Detectable

The Almega Corporation

Table 5

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

SUMMARY OF BTU HEAT INPUT DATA

COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : Cogen 20 MW

TEST DATE : June 24 & 25, 1991

TIME TIMES :	6/24/91 9:34a-2:30p	6/24/91 3:45p-7:52p	6/25/91 7:30a-11:45a
Fuel Gas HHV BTU/CF	1019	1019	1020
Average Fuel Use MCFH	239.6	235.3	233.3
Heat Input Rate MMBTU/hr	244.2	239.7	237.9

The Almega Corporation

TABLE 6

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

SUMMARY OF EMISSION RATES

COMPANY	:	Shell Western E & P
LOCATION	:	Bakersfield, California
SOURCE	:	62.5 MMBTU/hr Steam Generator
TEST DATE	:	June 26 & 27, 1991
EMISSION RATE UNITS	:	10^{-9} LB/10^{6} BTU

	Average 3 Runs With N.D. @ 1/2 D. L.	Average 3 Runs With N. D. @ Zero	MQL/Blank
Naphthalene	406.0227	406.0227	6.964 B
Acenaphthylene	4.6639	4.5287	0.791 M
Acenaphthene	1.3592	1.2238	0.791 M
Fluorene	8.9372	8.9372	1.013 B
Phenanthrene	21.4439	21.439	2.849 B
Anthracene	2.0115	1.8763	0.791 M
Fluoranthene	5.9383	5.9383	0.791 M
Pyrene	10.0326	10.0326	0.791 M
Benz(a)anthracene	1.1083	0.0000	2.211 M
Chrysene	1.8208	0.0000	3.641 M
Benzo(b)fluoranthene	3.2978	3.2978	0.791 M
Benzo(k)fluoranthene	0.9689	0.8337	0.791 M
Benzo(a)pyrene	0.7026	0.4367	0.791 M
Indeno(1,2,3-cd)pyrene	1.6465	1.5113	0.791 M
Dibenzo(ah)anthracene	0.3955	0.0000	0.791 M
Benzo(ghi)perylene	1.2818	1.1466	0.791 M
Benzene	6,485.540	0.0000	12,972 M
Toluene	26,878.292	26,878.292	38,250 M
Xylene	14,690.428	0.0000	29,383 M
Ethyl Benzene	7,345.214	0.0000	14,691 M

B = Blank Value
M = Minimal Quantifiable Level (MQL)

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TABLE 7

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

COMPANY	:	Shell Western E & P		
LOCATION	:	Bakersfield, California		
SOURCE	:	62.5 MMBTU/hr Steam Generator		
TEST DATES	:	June 26 & 27, 1991		
REPETITION	:	1	2	3
TEST TIMES	:	10:00a-2:10p	2:15p-6:30p	7:40a-11:50a
Heat Input MMBTU/hr		47.0	47.0	46.5
STACK GAS				
Temperature °F average		307.2	316.0	310.5
Velocity fps average		34.9	36.3	33.6
Volume flow dscfh x 10^6		.4908	.4988	.4782
ascfm		14,190	14,476	13,667
CO_2 %		10.0	10.0	10.0
O_2 %		3.5	3.5	3.5
Moisture %		15.1	16.1	15.0
SAMPLE				
Time, minutes		240	240	240
Volume dscf		146.896	150.043	139.725
isokinetic ratio %		96.8	97.3	92.3

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b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

TABLE 8

PAH's

COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : 62.5 MMBTU/hr Steam Generator

REPETITION :	1	2	3	MQL Blank
Naphthalene				
(mass collected ng)	1,700	3,500	2,500	44 B
concentration, 10^{-9} lb/dscf	25.518	51.435	39.452	0.667
emissions lb/hr x 10^{-6}	12.5243	25.6559	18.8662	0.0326
emissions 10^{-9} lb/10^{6} BTU	266.4736	545.8703	405.7243	6.964
Acenaphthylene				
(mass collected ng)	22	65	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.330	0.955	0.039	0.076
emissions lb/hr x 10^{-6}	0.1621	0.47650	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	3.4485	10.1376	0.4057	0.791
Acenaphthene				
(mass collected ng)	8.5	15	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.128	0.220	0.039	0.076
emissions lb/hr x 10^{-6}	0.06262	0.1099	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	1.3324	2.3394	0.4057	0.791
Fluorene				
(mass collected ng)	76	82	13.0	6.4 B
concentration, 10^{-9} lb/dscf	1.141	1.205	0.20515	0.097
emissions lb/hr x 10^{-6}	0.5599	0.6011	0.098104	0.0474
emissions 10^{-9} lb/10^{6} BTU	11.1913	12.7889	2.1098	1.013
Phenanthrene				
(mass collected ng)	170	200	40	18 B
concentration, 10^{-9} lb/dscf	2.552	2.939	0.931	0.273
emissions lb/hr x 10^{-6}	1.2524	1.4661	0.3019	0.133
emissions 10^{-9} lb/10^{6} BTU	26.6474	31.1926	6.4916	2.849

B = Blank
M = Minimum Quantifiable Level (MQL)
2.5 = Half Detection Level

The Almega Corporation

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

Table 8 cont'd...

REPETITION :	1	2	3	MQL Blank
Benzo(k)fluroanthene				
(mass collected ng)	7.2	8.8	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.108	0.129	0.039	0.076
emissions lb/hr x 10^{-6}	0.0530	0.06451	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	1.1286	1.3725	0.4057	0.7914
Benzo(a)Pyrene				
(mass collected ng)	N/D(2.5)	8.4	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.038	0.123	0.039	0.076
emissions lb/hr x 10^{-6}	0.01842	0.06157	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	0.3919	1.3101	0.4057	0.7914
Indeno(1,2,3-cd)pyrene				
(mass collected ng)	14	15	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.210	0.220	0.039	0.076
emissions lb/hr x 10^{-6}	0.1031	0.1099	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	2.1945	2.3394	0.4057	0.7914
Dibenzo(ah)anthracene				
(mass collected ng)	N/D(2.5)	N/D(2.5)	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.038	0.037	0.039	0.076
emissions lb/hr x 10^{-6}	0.01842	0.1833	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	0.3919	0.3899	0.4057	0.7914
Benzo(ghi)perylene				
(mass collected ng)	11	11	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.165	0.162	0.039	0.076
emissions lb/hr x 10^{-6}	0.0810	0.08063	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	1.7242	1.7156	0.4057	0.7914

B = Blank
M = Minimum Quantifiable Level (MQL)
2.5 = Half Detection Level

The Almega Corporation

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

Table 8 cont'd...

REPETITION :	1	2	3	MQL Blank
Anthracene				
(mass collected ng)	18	18	N/D(2.5)	5.0 M
concentration, 10^{-9} lb/dscf	0.270	0.265	0.039	0.076
emissions lb/hr x 10^{-6}	0.1326	0.1319	0.01887	0.0371
emissions 10^{-9} lb/10^{6} BTU	2.8215	2.8073	0.4057	0.7914
Fluoranthene				
(mass collected ng)	47	57	9.6	5.0 M
concentration, 10^{-9} lb/dscf	0.706	0.837	0.152	0.076
emissions lb/hr x 10^{-6}	0.3463	0.4178	0.07244	0.0371
emissions 10^{-9} lb/10^{6} BTU	7.3672	8.8899	1.5579	0.7914
Pyrene				
(mass collected ng)	66	110	16	5.0 M
concentration, 10^{-9} lb/dscf	0.991	1.617	0.253	0.076
emissions lb/hr x 10^{-6}	0.4862	0.8063	0.1207	0.0371
emissions 10^{-9} lb/10^{6} BTU	10.3454	17.1559	2.5966	0.7914
Benz(a)anthracene				
(mass collected ng)	N/D(7)	N/D(7)	N/D(7)	14.0 M
concentration, 10^{-9} lb/dscf	0.1051	0.1029	0.1105	0.2121
emissions lb/hr x 10^{-6}	0.05157	0.05131	0.05283	0.1038
emissions 10^{-9} lb/10^{6} BTU	1.0972	1.0917	1.1360	2.2160
Chrysene				
(mass collected ng)	N/D(11.5)	N/D(11.5)	N/D(11.5)	23.0 M
concentration, 10^{-9} lb/dscf	0.1726	0.1690	0.1815	0.3484
emissions lb/hr x 10^{-6}	0.08472	0.08430	0.08678	0.1705
emissions 10^{-9} lb/10^{6} BTU	1.8026	1.7936	1.8663	3.6405
Benzo(b)fluoranthene				
(mass collected ng)	30	26	7.0	5.0 M
concentration, 10^{-9} lb/dscf	0.450	0.382	0.110	0.076
emissions lb/hr x 10^{-6}	0.2210	0.1906	0.05283	0.0371
emissions 10^{-9} lb/10^{6} BTU	4.7025	4.0550	1.1360	0.7914

B = Blank
M = Minimum Quantifiable Level (MQL)
* = Possible Elevated Level Due to Excessive
2.5 = Half Detection Level

The Almega Corporation

TABLE 9

Benzene, Toluene, Xylene, Ethyl Benzene

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : 62.5 MMBTU/hr Steam Generator

TEST DATES : June 26, 1991

REPETITION :	1	2	3	MQL/Blank
TEST TIMES :	10:15a-11:15a	11:30a-12:30p	2:30p-3:30p	
Process Rate 10^6 BTU/hr	47.0	47.0	47.0	
STACK GAS				
Temperature °F average	307.2	307.2	316.0	
Velocity fps average	34.9	34.9	36.3	
Volume flow dscfh x 10^6	0.4908	0.4908	0.4988	
ascfm	14,190	14,190	14,746	
CO_2 %	10.0	10.0	10.0	
O_2 %	3.5	3.5	3.5	
Moisture %	15.1	15.1	16.1	
SAMPLE				
Time, minutes	60	60	60	
Benzene				
Mol. Wt. lb/lb mole	78.12	78.12	78.12	78.12
Concentration ppb	N/D(3)	N/D(3)	N/D(3)	6M
Emissions lb/hr x 10^{-3}	0.3032	0.3032	0.3081	0.6097
Emisions lb/10^6BTU x 10^{-6}	6.4505	6.4505	6.5556	12.972
Toluene				
Mol. Wt. lb/lb mole	92.14	92.14	92.14	92.14
Concentration ppb	11.0	8.6	12.0	15B
Emissions lb/hr x 10^{-3}	1.3111	1.02507	1.4536	1.7978
Emisions lb/10^6BTU x 10^{-6}	27.8965	21.8100	30.9286	38.250
Xylene				
Mol. Wt. lb/lb mole	106.17	106.17	106.17	106.17
Concentration ppb	N/D(5)	N/D(5)	N/D(5)	10M
Emissions lb/hr x 10^{-3}	0.6867	0.6867	0.6979	0.6904
Emisions lb/10^6BTU x 10^{-6}	14.6110	14.6110	14.8492	29.383
Ethyl Benzene				
Mol. Wt. lb/lb mole	106.17	106.17	106.17	106.17
Concentration ppb	N/D(2.5)	N/D(2.5)	N/D(2.5)	5M
Emissions lb/hr x 10^{-3}	0.3434	0.3434	0.3490	0.6904
Emisions lb/10^6BTU x 10^{-6}	7.3055	7.3055	7.4246	14.6914

*Stack Gas Summary Emission Data Taken From Runs #1 & 2 PAH Sampling

B = Blank M = Minimum Quantifiable Level(MQL) N/D = Non Detectable

The Almega Corporation

Table 10

b:c6823-2t #68
Shell E & P Format
Revised 9/26/91

SUMMARY OF BTU HEAT INPUT DATA

COMPANY : Shell Western E & P

LOCATION : Bakersfield, California

SOURCE : 62.5 MMBTU/hr Steam Generator

TEST DATE : June 26 & 27, 1991

TIME TIMES :	6/26/91 10:00a-2:10p	6/26/91 2:15p-6:30p	6/27/91 7:40a-11:50a
Fuel Gas HHV BTU/CF	1015	1015	1015
Average Fuel Use MCFH	46.3	46.3	45.8
Heat Input Rate MMBTU/hr	47.0	47.0	46.5

APPENDIX A

CARB Method 1

Sample and Velocity Traverses for Stationary Sources

APPENDIX H

Field Test, Laboratory Analytical Data and
Chain of Custody Sheets - Cogen

The Almega Corporation

PARTICULATE CALCULATION SUMMARY

COMPANY: SHELL E&P BAKERSFIELD

SOURCE: COGEN

REPETITION NO: PAN-1

TEST DATE: 6/24/91

ENGLISH UNITS
(29.92 in. Hg 60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \boxed{17.38}\ V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = \underline{131.211}\ \text{dscf}$$

$Y = \underline{1.0005}$

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = \underline{15.039}\ \text{scf}$$

$V_{lc} = \underline{317}$ ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = \underline{0.1028}$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right]\left[\frac{M_n}{V_{mstd}}\right] = \underline{\qquad}\ \text{grains/dscf}$$

$$= 2.205\ 10^{-6} \frac{M_n}{V_{mstd}} = \underline{\qquad}\ \times 10^{-6}\ \text{lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = \underline{7.170997}\ \times 10^6\ \text{dscf/hr}$$

(A_s = sq.ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate

$Q_s\ c's$ = _____ lbs/hr

$\frac{Q_s\ c's}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in. Hg. cu. ft.}}{\text{ml.}°R} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .0001976 sq.ft.) = $\underline{98.9}$ %

Tstd = 60°F
Pstd = 29.92 in./Hg

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STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield REPETITION NO: PAH-1

SOURCE: Cogen TEST DATE: 6/24/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$

3 14.92 82.02 = 29.060 lb/lb-mole

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 27.923 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = 1.1107

Average absolute stack gas temperature

(T_s) avg. = 305.2 °F + 460 = 765.2 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .90 in. H_2O) = 30.06 in. Hg

Stack gas velocity

(V_s) avg. = (85.49) C_p $(\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 76.1156 ft/sec.

Stack gas volume flow rate

60 V_s A_s (A_s = 42.7 ft²) = 195,317 acfm

Stack gas volume flow rate, dry basis

$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std}\ .\ P_s}{(T_s)\ avg\ .\ P_{std}}\right]$

= 7.1170992 x 10^6 dscf/h

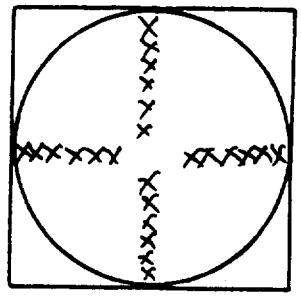
PARTICULATE FIELD DATA

PLANT Shell
DATE 6/24/91
LOCATION Bakersfield
OPERATOR M. DuBois
STACK NO. Coger
RUN NO. PAH-1
SAMPLE BOX NO. 1
METER BOX NO. Jay 2
METER ΔH @ .7831
Y = 1.0005
TIME START = 9:34

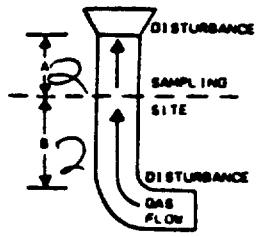
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.99
ASSUMED MOISTURE, % 9
PROBE LENGTH, in. ~~190.191.190~~ 90"
NOZZLE DIAMETER, in. .190.190.191
STACK DIAMETER, in. 88.5
PROBE HEATER SETTING 250±25
HEATER BOX SETTING 250±25
Δ Cp FACTOR .84
FILTER NO. —
FILTER TARE WEIGHT — mg.

T NORTH

SCHEMATIC OF STACK



CROSS SECTION



PRE TEST LEAK CHECKS

METER .000 @ 25 in. Hg
PITOTS 0 @ 2 in. H₂O
ORSAT OK

P #	θ min.	STATIC PRESSURE +/- in H₂O	Ts °F	Δ P in H₂O	√Δ P	Δ H in H₂O	Vm ft³	Tm INLET °F	Tm OUTLET °F	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0	.90	293	1.3		.50	683.191	78	78	270	63	12
2	10		300	1.4		.55	689.7	98	89	271	63	17
3	20		300	1.2		.47	696.0	99	95	265	64	16
4	30		300	1.0		.43	702.0	114	101	260	64	15
5	40		302	1.1		.45	708.2	118	110	255	64	15
6	50		302	1.1		.45	714.1	122	116	270	64	15
7	60		301	1.2		.47	719.9	130	120	265	65	15
8	70		299	1.1		.45	725.6	132	123	245	65	15
9	80		306	1.1		.45	732.8	135	127	235	65	15
10	90		304	1.2		.47	739.0	136	128	234	65	15
11	100		305	1.2		.47	745.1	139	128	230	65	15
12	110		310	1.3		.50	751.1	138	130	230	66	15
13	120		312	1.0		.43	757.0	118	112	240	65	15
14	130		310	1.5		.58	763.2	119	112	245	65	15
15	140		310	1.8		.70	769.8	120	110	240	66	15
16	150		308	1.7		.65	775.7	125	112	230	66	15
17	160		311	1.4		.55	782.0	127	112	230	66	15
18	170		309	1.0		.43	788.1	130	115	235	67	15
19	180		310	1.1		.45	793.8	132	121	240	67	16
20	190		309	1.0		.43	799.8	135	122	240	66	16
21	200		308	1.2		.47	805.2	129	126	235	66	15
22	210		306	1.2		.47	811.1	131	122	230	67	16
23	220		305	1.3		.50	816.8	135	122	230	67	16
24	230		304	1.4		.55	823.1	130	125	230	67	16
Av	240	.90	~~305~~ 305.2	~~1.4~~	1.1107	~~.55~~ .54 √ΔP	828.7 145.581	~~130~~ .4946	~~124~~ 119.5			15

TIME END = 2:30

POST TEST LEAK CHECKS

METER .000 @ 25 in. Hg
PITOTS 0 @ 3 in. H₂O
ORSAT OK

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml. 1	2	3	4	SILICA GEL WEIGHT g
FINAL	305	200			212
INITIAL	50	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		3.0	15.5		81.5
2	From		14.95		82.07
3		O_2 MONITOR			
4					

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PARTICULATE CALCULATION SUMMARY

COMPANY: SNELL B&P BAKERSFIELD

SOURCE: COGEN

REPETITION NO: PAH-2

TEST DATE: 6/24/91

ENGLISH UNITS
(29.92 in. Hg 60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \left[17.38\right] V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 133.975 \text{ dscf}$$

Y = .9952

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = 12.904 \text{ scf}$$

V_{lc} = 272 ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = 0.0879$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right] \left[\frac{M_n}{V_{mstd}}\right] = _____ \text{ grains/dscf}$$

$$= 2.205\ 10^{-6} \frac{M_n}{V_{mstd}} = _____ \times 10^{-6} \text{ lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = 7.548160 \times 10^6 \text{ dscf/hr}$$

(A_s = sq. ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate

$Q_s\ c's$ = _____ lbs/hr

$\frac{Q_s\ c's}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in. Hg. cu. ft.}}{\text{ml} \cdot {}^\circ R} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .0001976 sq. ft.) = 95.9 %

Tstd = 60°F
Pstd = 29.92 in./Hg

The Almega Corporation

STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield

REPETITION NO: PAH-2

SOURCE: Cogen

TEST DATE: 6/24/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$

3 14.86 82.14 = 29.074 lb/lb-mole

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 28.101 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = 1.1527

Average absolute stack gas temperature

(T_s) avg. = 303.9 °F + 460 = 763.9 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .9 in. H_2O) = 30.06 in. Hg

Stack gas velocity

(V_s) avg. = (85.49) C_p $(\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 78.718 ft/sec.

Stack gas volume flow rate

$60\ V_s\ A_s$ (A_s = 42.7 ft²) = 201,675 acfm

Stack gas volume flow rate, dry basis

$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std}\ .\ P_s}{(T_s)\ avg\ .\ P_{std}}\right]$

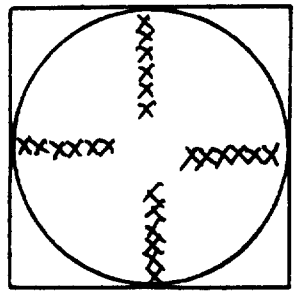
= 7.548160 x 10^6 dscf/h

PARTICULATE FIELD DATA

PLANT Shell
DATE 6/24/91
LOCATION Bakersfield, CA
OPERATOR M. O'Bois
STACK NO. Cogen
RUN NO. 2-PAH
SAMPLE BOX NO. 2
METER BOX NO. Joy II
METER ΔH @ 1.660
Y = .9952
TIME START = 3:45

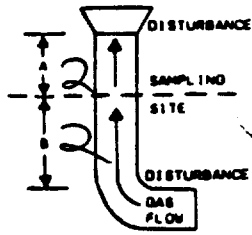
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 30.00
ASSUMED MOISTURE, % 9
PROBE LENGTH, in. 90
NOZZLE DIAMETER, in. .190, .191, .190
STACK DIAMETER, in. 88.5
PROBE HEATER SETTING 250 ±25
HEATER BOX SETTING 250 ±25
Δ Cp FACTOR .84
FILTER NO. —
FILTER TARE WEIGHT — mg.

NORTH



CROSS SECTION

SCHEMATIC OF STACK



PRE TEST LEAK CHECKS

METER .000 @ 25 in. Hg
PITOTS 0 @ 3 in. H₂O
ORSAT OK

P #	θ	STATIC PRESSURE +/- in H₂O	Ts °F	Δ P in H₂O	√Δ P	Δ H in H₂O	Vm (ft³)	Tm INLET °F R.N.	Tm OUTLET °F R.N.	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0		300	1.7		1.45	256.823	90	90	250	65	13
2	10		303	1.9		1.62	264.1	108	96	250	66	15
3	20		305	1.9		1.62	270.2	115	98	255	66	15
4	30		306	1.8		1.55	276.9	122	102	240	66	15
5	40		305	1.4		1.17	283.5	128	108	247	67	15
6	50		305	1.2		0.97	290.0	132	110	252	67	15
7	60		304	1.1		0.90	296.2	135	115	240	67	14
8	70		303	1.2		0.97	301.4	135	115	230	67	14
9	80		303	1.3		1.10	307.5	140	118	230	68	14
10	90		303	1.4		1.17	313.7	140	120	230	68	14
11	100		302	1.3		1.10	320.1	142	122	238	68	14
12	110		300	1.4		1.17	326.4	144	122	241	67	14
13	120		306	1.4		1.17	332.9	135	122	250	67	15
14	130		306	1.5		1.25	339.4	138	122	240	66	15
15	140		306	1.3		1.10	346.1	135	120	245	66	14
16	150		305	1.2		0.97	352.6	138	120	250	68	15
17	160		304	1.1		0.90	358.9	141	122	255	68	14
18	170		304	1.0		.80	365.2	145	124	230	68	14
19	180		303	1.0		.8	371.0	145	124	240	67	12
20	190		304	1.0		.8	377.6	140	123	245	66	12
21	200		304	1.0		.8	383.8	142	122	230	66	13
22	210		304	1.1		.90	390.0	144	122	255	67	14
23	220		304	1.2		0.97	395.6	142	124	255	66	14
24	230		305	1.2		0.97	401.4	142	124	255	67	14
Av	240		303.9		1.1527	1.0925	407.488		125.1			

150.665

TIME END = 7:52

POST TEST LEAK CHECKS

METER .000 @ 25 in. Hg
PITOTS 0 @ 3 in. H₂O
ORSAT OK

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml. 1	2	3	4	SILICA GEL WEIGHT g
FINAL	316	95			211
INITIAL	50	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		3	15.5		
2	FROM O_2				82.1
3	MONITOR	14.86			
4					

The Almega Corporation

PARTICULATE CALCULATION SUMMARY

COMPANY: SHELL E&P BAKERSFIELD

SOURCE: COGEN

REPETITION NO: PAW-3

TEST DATE: 6/25/91

ENGLISH UNITS
(29.92 in. Hg 60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \boxed{17.38}\ V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = \underline{136.379}\ \text{dscf}$$

$Y = \underline{.9952}$

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = \underline{13.520}\ \text{scf}$$

$V_{lc} = \underline{285}$ ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = \underline{0.0902}$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right]\left[\frac{M_n}{V_{mstd}}\right] = \underline{\qquad}\ \text{grains/dscf}$$

$$= 2.205\ 10^{-6}\ \frac{M_n}{V_{mstd}} = \underline{\qquad}\ \times 10^{-6}\ \text{lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = \underline{7.583625}\ \times 10^6\ \text{dscf/hr}$$

(A_s = sq. ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate

$Q_s\ c's$ = _____ lbs/hr

$\frac{Q_s\ c's}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in. Hg. cu. ft.}}{\text{ml.}^\circ R} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .00019 sq. ft.) = $\underline{97.2}$ %

Tstd = 60°F
Pstd = 29.92 in./Hg

The Almega Corporation

STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield REPETITION NO: PAH-3

SOURCE: Cogen TEST DATE: 6/25/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$
3.5 15.05 81.45 = 29.162 lb/lb-mole

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 28.155 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = 1.1658

Average absolute stack gas temperature

(T_s) avg. = 308.7 °F + 460 = 768.7 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .90 in. H_2O) = 30.06 in. Hg

Stack gas velocity

(V_s) avg. = (85.49) C_p $(\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 79.786 ft/sec.

Stack gas volume flow rate

$60\ V_s\ A_s$ (A_s = 42.7 ft²) = 204,411 acfm

Stack gas volume flow rate, dry basis

$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std}\ .\ P_s}{(T_s)\ avg\ .\ P_{std}}\right]$

= 7.583625 x 10^6 dscf/h

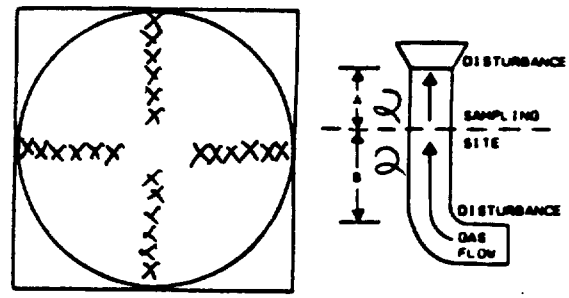
PARTICULATE FIELD DATA

PLANT Shell
DATE 6/25/91
LOCATION Bakersfield, CA
OPERATOR M. DuBois
STACK NO. Cogen
RUN NO. 3-PAH
SAMPLE BOX NO. A
METER BOX NO. Jag 11
METER ΔH @ 1.6660
Y = .9952
TIME START = 7:30

AMBIENT TEMPERATURE 70
BAROMETRIC PRESSURE 29.99
ASSUMED MOISTURE, % 9
PROBE LENGTH, in. 90
NOZZLE DIAMETER, in. .190, .191, .190
STACK DIAMETER, in. 88.5
PROBE HEATER SETTING 250 ±25
HEATER BOX SETTING 250 ±25
Δ Cp FACTOR .84
FILTER NO. —
FILTER TARE WEIGHT — mg.

T NORTH

SCHEMATIC OF STACK



CROSS SECTION

PRE TEST LEAK CHECKS

METER .000 @ 25 in. Hg
PITOTS 0 @ 3 in. H_2O
ORSAT OK

P #	θ	STATIC PRESSURE +/- in H_2O	Ts °F	Δ P in H_2O	√Δ P	Δ H in H_2O	Vm ft³	Tm INLET °F	Tm OUTLET °F	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0	.90	313	1.7		1.45 RN	407.924	85	81	260	68	9
2	10		311	1.8		1.55	414.6	89	81	260	68	9
3	20		313	1.8		1.55	421.6	110	94	260	66	11
4	30		314	1.9		1.62	428.9	120	98	240	66	11
5	40		314	1.8		1.55	436.1	124	106	242	66	11
6	50		314	1.5		1.25	443.4	129	108	242	66	11
7	60		300	1.1		0.90	450.1	135	112	252	66	10
8	70		299	1.1		0.90	456.6	138	116	258	66	9
9	80		298	1.2		0.97	462.2	144	120	260	66	8
10	90		299	1.2		0.97	468.3	146	124	258	67	8
11	100		299	1.4		1.17	474.1	150	128	256	68	8
12	110		307	1.4		1.17	479.8	152	130	255	68	9
13	120		309	1.4		1.17	486.9	130	124	278	68	9
14	130		311	1.5		1.25	493.6	138	122	270	68	9
15	140		312	1.5		1.25	500.5	141	122	248	68	11
16	150		313	1.3		1.10	507.6	145	124	275	68	11
17	160		313	1.3		1.10	514.2	148	128	265	68	10
18	170		311	1.2		0.97	520.8	150	129	260	65	10
19	180		310	1.1		0.90	527.0	151	130	260	66	9
20	190		310	1.0		0.80	532.8	152	131	262	67	9
21	200		310	1.2		0.97	539.2	155	133	255	67	9
22	210		310	1.2		0.97	544.3	158	135	270	67	9
23	220		309	1.1		0.90	549.8	156	134	271	67	9
24	230		309	1.2		0.97	555.9	156	134	265	67	9
Av	240	.90	308.7		1.1658	1.417	562.085		128.0			

154.161

TIME END = 11:45

POST TEST LEAK CHECKS

METER .000 @ 20 in. Hg
PITOTS 0 @ 3 in. H_2O
ORSAT OK

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml. 1	2	3	4	SILICA GEL WEIGHT g
FINAL	325	100			210
INITIAL	50	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		3.5%	16%		
2	FROM O_2				81.45
3	MONITOR		15.0%		
4					

ALTA

July 11, 1991

Alta Batch I.D.: 10506

Mr. John Conley
Almega West
2301 East 28th Street
Signal Hill, CA 90806

Dear Mr. Conley,

Enclosed are the results for ten MM5 trains received at Alta Analytical Laboratory on June 28, 1991. As per the chain-of-custody (C-O-C) these samples were to be extracted and analyzed for polycyclic aromatic hydrocarbons (PAH) per CARB Method 429 using high resolution mass spectrometry (HRMS). A rush turn-around time was requested for these samples.

The following difficulties were associated with these samples. The pre-spike of d12-benz(a)anthracene onto the filters by your field samplers was orders of magnitude higher in concentration than that which is appropriate for HRMS analysis. Because of this the internal standard recovery of d12-chrysene and d12-benz(a)anthracene used in the method could not be calculated. This significant concentration of the d12-benz(a)anthracene also resulted in interferences in the native channel for chrysene and benz(a)anthracene. In all samples a detection limit was calculated for both samples using d10-pyrene as the internal standard. It is common practice of ALTA to provide the pre-spiking for the MM5 trains. In the future, the field samplers will not need to do any pre-spiking. Sample ID. R2 5775/80 had a high concentration of anthracene as compared to the other samples. In some instances the field blanks had greater concentrations of naphthalene than the samples. This is due in large part to the napthalene contamination in the XAD material. The California Air Resource Board is aware of this and is reviewing other options to deal with this problem.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations, and copies of the raw data (if requested).

Alta Analytical Laboratory Inc.

5070 Robert J. Mathews Pkwy., Suite 2
El Dorado Hills, CA. 95630

FAX (916) 933-0940
(916) 933-1640

ALTA

If you have any questions regarding this report please feel free to contact me at (916) 933-1640.

Sincerely,

Robert S. Mitzel

Robert S. Mitzel
Director of Operations

ALTA

DATA QUALIFIERS & ABBREVIATIONS

A	The amount detected is below the Method Calibration Limit.
B	This compound was also detected in the blank.
C	The amount detected is less than five times the Method Calibration Limit.
D	The amount reported is the maximum possible concentration.
E	The detection limit was raised above the Method Calibration Limit due to chemical interferences.
F	This result has been confirmed on a DB-225 column.
G	This resulted has been confirmed on a SP-2331 column.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference
Conc.	Concentration
D.L.	Detection Limit
NA	Not applicable
S/N	Signal-to-noise
*	See Cover Letter
ND	Not Detected
MPC	Maximum Possible Concentration
R.L.	Method Calibration Limit

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

COGEN

Sample ID: R1 5769/74
Lab ID: 10506-006-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	1800		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	16		B
Phenanthrene	52		B
Anthracene	7.5		
Fluoranthene	19		
Pyrene	48		
Chyrsene	ND	25	*
Benz(a)anthracene	ND	7.0	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: JMG

Reviewer: BM

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

1P 0060N

Sample ID: RZ 5769/74
Lab ID: 10506-006-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	63	
d_8-Acenaphthylene	83	
d_{10}-Acenaphthene	66	
d_{10}-Fluorene	67	
d_{10}-Phenanthrene	87	
d_{10}-Anthracene	71	
d_{10}-Fluoranthene	68	
d_{10}-Pyrene	68	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	105	
d_{12}-Benzo(k)fluoranthene	43	H
d_{12}-Benzo(a)pyrene	82	
d_{12}-Indeno(1,2,3-c,d)pyrene	115	
d_{12}-Benzo(g,h,i)perylene	69	
d_{14}-Dibenz(a,h)anthracene	98	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	107	
d_{14}-Terphenyl	107	

Date Analyzed: 7/09/91

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

206611

Sample ID: R2 5775/80
Lab ID: 10506-007-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	1800		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	26		B
Phenanthrene	95		B
Anthracene	290		
Fluoranthene	33		
Pyrene	80		
Chyrsene	ND	20	*
Benz(a)anthracene	ND	8.0	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	8.6		
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

2P COGOTI

Sample ID: ~~R3~~ 5775/80
Lab ID: 10506-007-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	62	
d_8-Acenaphthylene	86	
d_{10}-Acenaphthene	69	
d_{10}-Fluorene	82	
d_{10}-Phenanthrene	106	
d_{10}-Anthracene	84	
d_{10}-Fluoranthene	64	
d_{10}-Pyrene	64	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	114	
d_{12}-Benzo(k)fluoranthene	65	
d_{12}-Benzo(a)pyrene	81	
d_{12}-Indeno(1,2,3-c,d)pyrene	129	
d_{12}-Benzo(g,h,i)perylene	77	
d_{14}-Dibenz(a,h)anthracene	123	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	104	
d_{14}-Terphenyl	102	

Date Analyzed: 7/09/91

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: R3 5793/98 COGBAL
Lab ID: 10506-004-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	1800		B
Acenaphthylene	11		
Acenaphthene	ND	5.0	
Fluorene	28		B
Phenanthrene	93		B
Anthracene	11		
Fluoranthene	28		
Pyrene	72		
Chyrsene	ND	25	*
Benz(a)anthracene	ND	7.0	*
Benzo(b)fluoranthene	17		
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	5.3		
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	6.3		

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

C06811

Sample ID: R3 5793/98
Lab ID: 10506-004-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	65	
d_8-Acenaphthylene	79	
d_{10}-Acenaphthene	73	
d_{10}-Fluorene	85	
d_{10}-Phenanthrene	100	
d_{10}-Anthracene	72	
d_{10}-Fluoranthene	83	
d_{10}-Pyrene	81	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	126	
d_{12}-Benzo(k)fluoranthene	120	
d_{12}-Benzo(a)pyrene	100	
d_{12}-Indeno(1,2,3-c,d)pyrene	115	
d_{12}-Benzo(g,h,i)perylene	92	
d_{14}-Dibenz(a,h)anthracene	129	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	104	
d_{14}-Terphenyl	98	

Date Analyzed: 7/09/91

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: R1+2 5781/87 BLK (CoGsil)
Lab ID: 10506-008-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	2500		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	5.9		B
Phenanthrene	29		B
Anthracene	20		
Fluoranthene	7.7		
Pyrene	6.1		
Chyrsene	ND	55	*
Benz(a)anthracene	ND	32	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Cobsu

Sample ID: R1+2 5781/87 BLK
Lab ID: 10506-008-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	68	
d_8-Acenaphthylene	71	
d_{10}-Acenaphthene	71	
d_{10}-Fluorene	76	
d_{10}-Phenanthrene	76	
d_{10}-Anthracene	61	
d_{10}-Fluoranthene	100	
d_{10}-Pyrene	98	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	126	
d_{12}-Benzo(k)fluoranthene	90	
d_{12}-Benzo(a)pyrene	104	
d_{12}-Indeno(1,2,3-c,d)pyrene	104	
d_{12}-Benzo(g,h,i)perylene	90	
d_{14}-Dibenz(a,h)anthracene	92	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	103	
d_{14}-Terphenyl	85	

Date Analyzed: 7/09/91

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Cohen

Sample ID: R3 5799/02 BLK
Lab ID: 10506-005-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	3600		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	ND	5.0	B
Phenanthrene	14		B
Anthracene	ND	5.0	
Fluoranthene	ND	5.0	
Pyrene	ND	5.0	
Chyrsene	ND	53	*
Benz(a)anthracene	ND	31	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

COGEN

Sample ID: R3 5799/02 BLK
Lab ID: 10506-005-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	76	
d_8-Acenaphthylene	77	
d_{10}-Acenaphthene	81	
d_{10}-Fluorene	81	
d_{10}-Phenanthrene	88	
d_{10}-Anthracene	66	
d_{10}-Fluoranthene	126	
d_{10}-Pyrene	123	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	82	
d_{12}-Benzo(k)fluoranthene	69	
d_{12}-Benzo(a)pyrene	79	
d_{12}-Indeno(1,2,3-c,d)pyrene	60	
d_{12}-Benzo(g,h,i)perylene	55	
d_{14}-Dibenz(a,h)anthracene	41	H
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	113	
d_{14}-Terphenyl	83	

Date Analyzed: 7/09/91

Analyst: [signature]

Reviewer: [signature]

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/25/91 Page 1 of [redacted]1

Project Number C6823

SOURCE Shell Bakersfield Cogen

TEST DATE 6/25/91

Method of Shipment Federal Express

PROJECT MANAGER CAP

PHONE NUMBER 213-426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	CARB 429	Weight							Sample Condition/ REMARKS
R-3-429-S1-Filter	6/25/91	12:00 am	5793			X	1	X								Spiked
R3-429-S2-Prewash			5794	X			1	X								
R-3-429-[redacted]S3-XAD			5795			X	1	X								Spiked
R-3-429-S4-Condensate			5796	X			1	X								
R-3-429-S5-Imps			5797	X			1	X								
R3-429-S6-Sil. Gel.			5798			X	1		X							
R-3 Reagent Blank (H_2O)			5799	X			1	X								
R-3-MeCl+Methanol Blank			5800	X			1	X								
R-3-Filter Blank			5801			X	1	X								Spiked
R-3-XAD Trap Blank			5802			X	1	X								Spiked

SAMPLERS: (Signature) Michael P. DeBoer

Relinquished by: (Signature) M P DeBoer

Received by: (Signature) James Cobale

Date Time 6/26/91 9:00

Received by: (Signature)

Date Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Relinquished by: (Signature)

Date Time

Received for Laboratory by:

Date RECEIVED Time

Date ACCEPTED Time

Special Instructions

Enseco - Air Toxics Laboratory
9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

July 10, 1991

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

ANALYSIS NO.: A9117901-001/004
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/24/91
DATE SAMPLE REC'D: 06/28/91

PROJECT: SHELL BAKERSFIELD COGEN

PROJECT NO.: C6823

Enclosed with this letter is the report on the chemical and physical analyses on the samples from ANALYSIS NO: A9117901-001/004 as shown above.

The samples were received by Enseco - Air Toxics Laboratory, intact and with the chain-of-custody record attached.

Please note that ND means not detected at the detection limit expressed.

Marita M. Lorenzo
REVIEWED

APPROVED

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exc use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prc

Enseco
A Corning Company

ɜeco - Air Toxics Laboratory
r Avenue, Suite 118 • El Monte, CA 91731
.8) 442-8400 • FAX: (818) 442-3758

LABORATORY REPORT

JEST	ANALYSIS NO.: A9117901-001
ɜt 28th Street	ANALYSES: Volatile Organics by
Iill, CA 90806	GCMS - Modified EPA TO14
IR. CHARLES PETRISHE	DATE SAMPLED: 06/24/91
	DATE SAMPLE REC'D: 06/28/91
	DATE ANALYZED: 06/28/91
	SAMPLE TYPE: Air
:D: R-1-410A/422-BTXE	QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

ɔounds	Results ppb(vol/vol)	Detection Limit
ɜene	ND	6
ɪene	16	6
ɣlbenzene	ND	5
ɪl Xylenes	ND	10

The Report Cover Letter is an integral part of this report.
only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive
hom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

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9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: R-3-410A/422-BTXE

ANALYSIS NO.: A9117901-003
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/24/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	22	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

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9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: 410A/422-BTXE BLANK

ANALYSIS NO.: A9117901-004
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/24/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	10	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

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Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

ANALYSIS NO.: A9117901
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/24/91
DATE SAMPLE REC'D: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

QC SUMMARY
Volatile Organics by GCMS
Modified EPA TO14

Compounds	Laboratory Control Sample % Recovery	Duplicate Control Sample % Recovery	RPD
Methylene Chloride	102	104	2
1,1-Dichloroethene	99	108	11
Trichloroethene	101	107	5
Toluene	102	105	2
1,1,2,2-Tetrachloroethane	92	97	5
Limits	80 - 115	80 - 115	20

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ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/24/91 Page 1 of 1

Project Number C6823

QUESTIONS? CONTACT JOHN CONLEY BTXE BY GC/MS NH3 BY ISE

Per Telecon with J Conley on 6/28/91.

SOURCE Shell Bakersfield - Cogen

TEST DATE 6/24/91 - 6/25/91

Method of Shipment Hand Carry

PROJECT MANAGER CAP

PHONE NUMBER 213 426-4221

ANALYSES NCONCOY

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	410A/422 BTXE	NH3 by ISE						Sample Condition/ REMARKS
R-1-410A/422 BTXE	6/24/91	200 PM	5803		X		1	X							-001
R-2-410A/422-BTXE			5804		X		1	X							-002
R-3-410A/422-BTXE			5805		X		1	X							-003
410A/422-BTXE BLANK			5806		X		1	X							-004
R-1-NH3-Imps	6/24/91	1200 PM	5782	X			1		X						-005
R-2-NH3-Imps			5784	X			1		X						-006
R-3-NH3-Imps			5786	X			1		X						-007
NH3 Reagent BLANK			5839						X						-008
[redacted]						X				X					

KF

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Relinquished by: (Signature) [signature]

Received by: (Signature) [signature] Date Time 6-28-91 - 0900

Received by: (Signature) [signature] Date Time 6-28-91 - 0800

Date Time 6-28-91 10:26am

Received for Laboratory by: [signature] Date RECEIVED Time 6-28-91 10:26am

Date ACCEPTED Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Special Instructions Relinquished by: [signature] 6/28/91 2:30 pm Received by: [signature] 6/28/91 3:40 pm

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/24/91 Page 1 of 1

Project Number C6823

SOURCE Shell-Bakersfield-Cogen

TEST DATE 6-24-91

Method of Shipment Federal Express

PROJECT MANAGER CAP

PHONE NUMBER (213) 426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	CARB-429	Weight							Sample Condition/ REMARKS
R-1-429-S1-Filter	6/24/91	500 PM	5769			X	1									spiked
R-1-429-S2-Prewash			5770	X			1									
R-1-429-S3-XAD			5771			X	1									Spiked
R-1-429-S4-condensate			5772	X			1									
R-1-429-S5-imps			5773	X			1									
R-1-429-S6-S.G.			5774			X	1		X							

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Relinquished by: (Signature)

Received by: (Signature) [signature]

Received by: (Signature)

Date Time: 6/26/91 9:00

Date Time

Date Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Received for Laboratory by:

Date RECEIVED Time

Date ACCEPTED Time

Special Instructions

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/24/91 Page 1 of 1

Project Number C6823

SOURCE Shell Bakersfield Cogen

TEST DATE 6/24/91

Method of Shipment Federal Express

PROJECT MANAGER CAP

PHONE NUMBER 213-426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	CARB 429	weight							Sample Condition/ REMARKS
R-2-429-S1-Filter	8:00 PM	6/24/91	5775			X	1	X								spiked
R-2-429-S2-Prewash			5776	X			1	X								
R-2-429-S3-XAD			5777			X	1	X								spiked
R-2-429-S4-condensate			5778	X			1	X								
R-2-429-S5-Imps			5779	X			1	X								
R-2-429-S6-Sil. gel.			5780			X	1		X							
R-1+2 XAD TRAP BLANK			5781			X	1	X								spiked
R-1+2 Filter BLANK			5783			X	1	X								spiked
R1+2 Reagent Blank (H_2O)			5785	X			1	X								
R1+2 MeCl + Methanol BLANK			5787	X			1	X								

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Received by: (Signature) Jennifer Colvale — Date Time 6/28/91 900

Received by: (Signature) — Date Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Relinquished by: (Signature) — Date Time

Received for Laboratory by: — Date RECEIVED Time

Date ACCEPTED Time

Special Instructions

APPENDIX I

Field Test, Laboratory Analytical Data, and
Chain of Custody Sheets - Steam Generator

The Almega Corporation

PARTICULATE CALCULATION SUMMARY

COMPANY: SHELL E&P BAKERSFIELD REPETITION NO: PAH-1

SOURCE: STEAM GENERATOR TEST DATE: 6/26/91

ENGLISH UNITS
(29.92 in. Hg/60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \left[17.38\right] V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 146.896 \text{ dscf}$$

Y = .9952

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = 26.092 \text{ scf}$$

V_{lc} = 550 ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = 0.1508$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right] \left[\frac{M_n}{V_{mstd}}\right] = _____ \text{ grains/dscf}$$

$$= 2.205\ 10^{-6} \frac{M_n}{V_{mstd}} = _____ \times 10^{-6} \text{ lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = 0.490711 \times 10^6 \text{ dscf/hr}$$

(A_s = sq.ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate

Q_s c's = _____ lbs/hr

$\frac{Q_s \text{ c's}}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in.Hg.cu.ft.}}{\text{ml.°R}} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .0005241 sq.ft.) = 96.8 %

Tstd = 60°F
Pstd = 29.92 in./Hg

The Almega Corporation

STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield REPETITION NO: PAH-1

SOURCE: Steam Generator TEST DATE: 6/26/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$ = 29.74 lb/lb-mole

10 3.5

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 27.96 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = .5078

Average absolute stack gas temperature

(T_s) avg. = 307.2 °F + 460 = 767.2 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .19 in. H_2O) = 29.96 in. Hg

Stack gas velocity

(V_s) avg. = $(85.49)\ C_p\ (\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 34.898 ft/sec.

Stack gas volume flow rate

$60\ V_s\ A_s$ (A_s = 6.777 ft²) = 14,190 acfm

Stack gas volume flow rate, dry basis

$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std} \cdot P_s}{(T_s)\ avg \cdot P_{std}}\right]$

= .490711 x 10^6 dscf/h

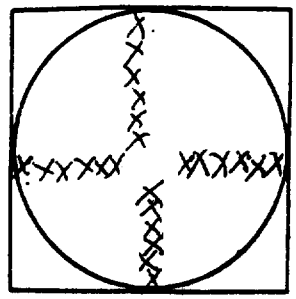
PARTICULATE FIELD DATA

PLANT Shell
DATE 6/26/91
LOCATION Bakersfield
OPERATOR M. DuBois
STACK NO. Stm Generator
RUN NO. 1-PAH
SAMPLE BOX NO. Joy A
METER BOX NO. Joy 11
METER ΔH @ 1.660
Y = .99052
TIME START = 10:00 AM

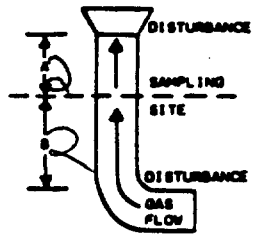
AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.95
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 60
NOZZLE DIAMETER, in. 310 310 310
STACK DIAMETER, in. ~~36~~ 35.25
PROBE HEATER SETTING 250±25
HEATER BOX SETTING 250±25
Δ Cp FACTOR .84
FILTER NO. —
FILTER-TARE WEIGHT — mg.

NORTH

SCHEMATIC OF STACK



CROSS SECTION



PRE TEST LEAK CHECKS

METER 000 @ 25 in. Hg
PITOTS ~~0~~ 3 in. H_2O
ORSAT ok

P #	θ	STATIC PRESSURE +/- in H_2O	Ts °F	ΔP in H_2O	$\sqrt{\Delta P}$	ΔH in H_2O	Vm ft³	Tm INLET °F	Tm OUTLET °F	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0	+.19	296.0	.20		1.0	571.0	94	92	80	65	6
2	10		281	.23		1.17	576.4	96	92	232	62	8
3	20		313	.23		1.17	582.5	111	95	280	60	9
4	30		313	.27		1.43	589.0	116	97	284	61	9
5	40		313	.27		1.43	595.4	123	104	276	64	10
6	50		316	.27		1.43	603.2	129	108	280	64	11
7	60		311	.28		1.45	609.7	130	109	270	60	11
8	70		314	.29		1.51	616.8	135	114	262	61	11
9	80		319	.25		1.30	623.7	139	119	285	64	11
10	90		305	.24		1.21	630.8	139	120	260	65	11
11	100		303	.22		1.1	637.5	139	120	269	66	11
12	110		305	.22		1.1	644.1	140	120	272	66	10
13	120		306	.26		1.35	650.5	130	125	250	66	11
14	130		304	.26		1.35	657.6	136	122	260	67	11
15	140		306	.26		1.35	664.9	139	125	250	67	11
16	150		312	.28		1.45	671.8	141	125	280	66	11
17	160		300	.30		1.55	678.9	139	124	260	66	11
18	170		304	.31		1.65	686.4	140	123	270	66	13
19	180		306	.31		1.65	693.9	145	129	285	66	13
20	190		302	.28		1.45	701.0	143	128	245	66	13
21	200		299	.28		1.45	708.7	139	123	240	66	13
22	210		314	.26		1.35	715.9	139	125	265	66	12
23	220		315	.22		1.1	723.2	139	124	270	66	11
24	230		315	.22		1.1	729.6	138	124	260	66	11
Av	240		307.2		.5078	1.3375	736.114		123.9			

TIME END = 2:10 PM

$\sqrt{\Delta P} \times 1.34$

165.032

.5078

POST TEST LEAK CHECKS

METER 000 @ 25 in. Hg
PITOTS 0 @ 3 in. H_2O
ORSAT ok

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1 (346)	2	3	4	SILICA GEL WEIGHT g
FINAL	541	150			209
INITIAL	50	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		10	3.5		
2					
3					
4					

The Almega Corporation

PARTICULATE CALCULATION SUMMARY

COMPANY: SHELL E&P BAKERSFIELD REPETITION NO: DAH-2

SOURCE: STEAM GENERATOR TEST DATE: 6/26/91

ENGLISH UNITS
(29.92 in. Hg 60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \boxed{17.38}\ V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = \underline{150.043}\ \text{dscf}$$

Y = .9952

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = \underline{28.701}\ \text{scf}$$

V_{lc} = 605 ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = \underline{0.1606}$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right]\left[\frac{M_n}{V_{mstd}}\right] = \underline{\qquad}\ \text{grains/dscf}$$

$$= 2.205\ 10^{-6} \frac{M_n}{V_{mstd}} = \underline{\qquad}\ \times 10^{-6}\ \text{lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = \underline{0.4488}\ \times 10^6\ \text{dscf/hr}$$

(A_s = sq.ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate Q_s c's = _____ lbs/hr

$\frac{Q_s\ c's}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in.Hg.cu.ft.}}{\text{ml.°R}} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .0005241 sq.ft.) = 97.3 %

T_{std} = 60°F
P_{std} = 29.92 in./Hg

The Almega Corporation

STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield REPETITION NO: PAH-2

SOURCE: Steam Generator TEST DATE: 6/26/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$
10 3.5 86.5 = 29.74 lb/lb-mole

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 27.85 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = .5239

Average absolute stack gas temperature

(T_s) avg. = 316.0 °F + 460 = 776.0 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .19 in. H_2O) = 29.99 in. Hg

Stack gas velocity

(V_s) avg. = (85.49) C_p $(\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 36.264 ft/sec.

Stack gas volume flow rate

$60\ V_s\ A_s$ (A_s = 6.777 ft²) = 14,746 acfm

Stack gas volume flow rate, dry basis

$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std}\ .\ P_s}{(T_s)\ avg\ .\ P_{std}}\right]$

= .498817 x 10^6 dscf/h

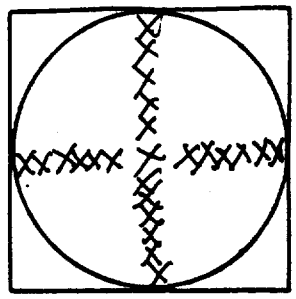
PARTICULATE FIELD DATA

PLANT Shell
DATE 6/27/91
LOCATION Bakersfield CA
OPERATOR M. Olbas
STACK NO. Stm Gen.
RUN NO. 2-PAH
SAMPLE BOX NO. 1
METER BOX NO. Jay II
METER ΔH @ 1.6560
Y = .9952
TIME START = 2:15

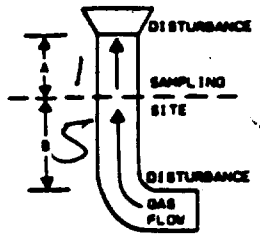
AMBIENT TEMPERATURE 80
BAROMETRIC PRESSURE 29.98
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 60
NOZZLE DIAMETER, in. .310 .311 .319
STACK DIAMETER, in. ~~36~~ 35.25
PROBE HEATER SETTING 250 ±25
HEATER BOX SETTING 250 ±25
Δ Cp FACTOR .84
FILTER NO. —
FILTER TARE WEIGHT — mg.

NORTH

SCHEMATIC OF STACK



CROSS SECTION



PRE TEST LEAK CHECKS

METER .000 @ 20 in. Hg
PITOTS 0 @ 3 in. H_2O
ORSAT ok

P #	θ	STATIC PRESSURE +/- in H_2O	Ts °F	ΔP in H_2O	√ΔP	ΔH in H_2O	Vm ft³	Tm INLET °F	Tm OUTLET °F	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0	.19	316	.27		1.43	736.114	112	110	210	66	10
2	10		313	.27		1.43	743.5	128	112	230	62	10
3	20		316	.28		1.45	750.4	136	130	275	66	11
4	30		315	.28		1.45	757.1	139	129	270	66	11
5	40		310	.30		1.55	763.0	139	126	260	66	14
6	50		312	.31		1.65	771.1	139	129	260	67	14
7	60		313	.32		1.70	778.5	140	125	280	67	14
8	70		314	.30		1.55	785.7	143	127	280	67	14
9	80		317	.28		1.45	793.0	140	125	272	67	14
10	90		314	.28		1.45	800.1	139	123	260	67	14
11	100		314	.28		1.45	807.0	140	123	270	67	14
12	110		314	.28		1.45	814.2	140	124	275	67	14
13	120		310	.25		1.30	821.7	131	126	260	67	13
14	130		320	.25		1.30	828.8	136	122	250	67	13
15	140		319	.26		1.35	835.8	139	121	275	67	13
16	150		318	.25		1.30	842.6	141	121	280	67	13
17	160		320	.26		1.35	849.4	139	122	260	67	13
18	170		320	.28		1.45	856.4	139	122	250	67	13
19	180		319	.30		1.55	863.5	139	121	235	66	14
20	190		318	.30		1.55	870.8	140	121	230	67	14
21	200		317	.26		1.35	879.2	136	120	230	67	13
22	210		318	.28		1.45	885.0	131	119	230	67	14
23	220		319	.24		1.21	892.1	130	118	230	67	12
24	230		314	.22		1.1	899.5	130	115	230	67	11
Av	240		316.0		.5239	1.4279	905.776		129.1			

169.862

TIME END = 6:30

POST TEST LEAK CHECKS

METER .000 @ 20 in. Hg
PITOTS 0 @ 3 in. H_2O
ORSAT ok

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME ml 1	2	3	4	SILICA GEL WEIGHT g
FINAL	587	188			210
INITIAL	80	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		10	3.5		
2					
3					
4					

The Almega Corporation

PARTICULATE CALCULATION SUMMARY

COMPANY: SHELL BAKERSFIELD REPETITION NO: PAH-3

SOURCE: STEAM GENERATOR TEST DATE: 6/27/91

ENGLISH UNITS
(29.92 in. Hg/60 °F)

Volume of sample at standard conditions on dry basis

$$V_{mstd} = \left[17.38\right] V_m Y \left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}\right] = 139.725 \text{ dscf}$$

Y = .9952

Volume of water vapor in sample at standard conditions

$$V_{wstd} = \left[0.04744 \frac{\text{cu. ft.}}{\text{ml}}\right] V_{lc} = 24.669 \text{ scf}$$

V_{lc} = 520 ml

Fractional moisture content of stack gas

$$B_{ws} = \frac{V_{wstd}}{V_{mstd} + V_{wstd}} = 0.1501$$

Particle concentration in stack gas on dry basis

$$c's = \left[0.01543 \frac{\text{gr}}{\text{mg}}\right] \left[\frac{M_n}{V_{mstd}}\right] = _____ \text{ grains/dscf}$$

$$= 2.205\ 10^{-6} \frac{M_n}{V_{mstd}} = _____ \times 10^{-6} \text{ lbs/dscf}$$

Stack gas volume flow rate on dry basis

$$Q_s = 3600\ (1-B_{ws})\ V_s A_s \left[\frac{T_{std} \cdot P_s}{(T_s)avg \cdot P_{std}}\right] = .47106 \times 10^6 \text{ dscf/hr}$$

(A_s = sq.ft. V_s = ft/sec)

Process rate or BTU rating P_w = _____

Emission rate

Q_s c's = _____ lbs/hr

$\frac{Q_s\ c's}{P_w}$ = _____ lbs/

Isokinetic sampling rate

$$I = \left(1.667 \frac{\text{min}}{\text{sec}}\right) T_s \left[\frac{\left(0.002727 \frac{\text{in. Hg. cu. ft.}}{\text{ml.}^\circ R} V_{lc}\right) + \frac{V_m}{T_m} Y \left(P_{bar} + \frac{\Delta H}{13.6}\right)}{\theta V_s P_s A_n}\right]$$

(A_n = .000542 sq.ft.) = 92.3 %

Tstd = 60°F
Pstd = 29.92 in./Hg

The Almega Corporation

STACK VOLUME FLOW RATE CALCULATION SUMMARY

COMPANY: Shell Bakersfield REPETITION NO: PAH-3

SOURCE: Steam Generator TEST DATE: 6/27/91

Dry molecular weight of stack gas

$M_d = 0.44\ (\%CO_2) + 0.32\ (\%O_2) + 0.28\ (\%N_2 + \%CO)$ = 29.74 lb/lb-mole

Molecular weight of stack gas, wet basis

$M_s = M_d\ (1 - B_{ws}) + 18\ B_{ws}$ = 27.978 lb/lb-mole

Pitot tube coefficient

C_p (from calibration curve) = .84

Average velocity head of stack gas, inches H_2O

$(\sqrt{\Delta P})$ avg. = .4882

Average absolute stack gas temperature

(T_s) avg. = 310.5 °F + 460 = 770.5 °R

Absolute stack gas pressure

$P_s = P_B + (P_{stat}/13.6)$

(P_{stat} = .19 in. H_2O) = 29.96 in. Hg

Stack gas velocity

(V_s) avg. = $(85.49)\ C_p\ (\sqrt{\Delta P})$ avg. $\sqrt{\dfrac{(T_s)\ avg.}{P_s\ M_s}}$

= 33.612 ft/sec.

Stack gas volume flow rate

$60\ V_s\ A_s$ (A_s = 6.777 ft²) = 13,667 acfm

Stack gas volume flow rate, dry basis

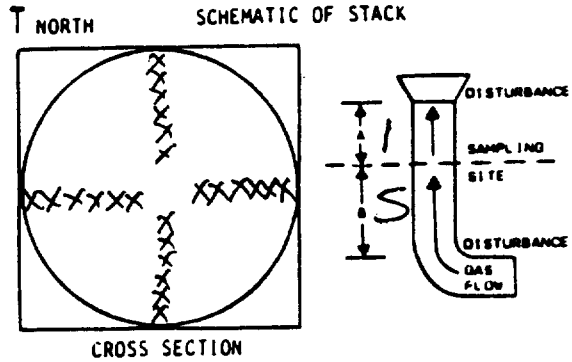
$Q_s = 3{,}600\ (1 - B_{ws})\ V_s\ A_s \left[\dfrac{T_{std}\ .\ P_s}{(T_s)\ avg\ .\ P_{std}}\right]$

= .471062 x 10^6 dscf/h

PARTICULATE FIELD DATA

PLANT Shell
DATE 6/27/91
LOCATION Bakersfield CA
OPERATOR M. D. Bois
STACK NO. Stm. Gen.
RUN NO. 3-PAH
SAMPLE BOX NO. 1
METER BOX NO. Jay 11
METER ΔH @ 1.6660
Y = .9952
TIME START = 7:40

AMBIENT TEMPERATURE 78
BAROMETRIC PRESSURE 29.95
ASSUMED MOISTURE, % 10
PROBE LENGTH, in. 60
NOZZLE DIAMETER, in. .310, .311, .310
STACK DIAMETER, in. ~~36~~ 35.25
PROBE HEATER SETTING 250 ± 25
HEATER BOX SETTING 250 ± 25
Δ Cp FACTOR .84
FILTER NO. —
FILTER TARE WEIGHT — mg.



PRE TEST LEAK CHECKS
METER .000 @ 20 in. Hg
PITOTS 0 @ 3 in. H₂O
ORSAT OK

P	θ	STATIC PRESSURE +/- in H₂O	Ts °F	ΔP in H₂O	√ΔP	ΔH in H₂O	Vm ft³	Tm INLET °F	Tm OUTLET °F	OVEN TEMP. °F	IMP. OUTLET TEMP. °F	VACUUM (in Hg)
1	0	[redacted]	275	.20		1.0	906.412	78	75	250	62	10
2	10		276	.20		1.0	912.4	93	81	260	62	10
3	20	.19	290	.27		1.43	918.4	96	81	255	62	11
4	30		312	.27		1.43	925.3	112	95	285	63	12
5	40		312	.28		1.45	932.3	121	110	285	63	13
6	50		313	.29		1.50	939.4	125	104	270	63	14
7	60		301	.31		1.65	946.6	130	110	260	64	15
8	70		309	.31		1.65	954.1	132	112	265	64	15
9	80		319	.29		1.50	961.5	138	117	255	65	14
10	90		320	.28		1.45	968.7	141	122	255	65	14
11	100		319	.27		1.43	975.8	140	122	250	66	14
12	110		316	.26		1.35	982.8	140	122	250	66	14
13	120		317	.23		1.17	989.6	138	122	250	66	14
14	130		315	.21		1.05	996.0	140	123	245	65	11
15	140		315	.22		1.1	1002.1	140	123	250	66	12
16	150		315	.22		1.1	1008.3	142	130	255	65	12
17	160		316	.21		1.0	1014.6	145	130	260	65	12
18	170		315	.21		1.0	1020.7	145	130	260	66	12
19	180		315	.23		1.17	1027.1	145	130	255	66	14
20	190		315	.20		1.0	1033.6	145	130	255	66	15
21	200		316	.21		1.05	1039.4	145	134	268	67	15
22	210		318	.23		1.17	1045.1	145	135	270	66	15
23	220		316	.18		.90	1051.4	140	129	250	66	14
24	230		316	.18		.90	1057.4	140	130	255	66	14
Av	240	.90	310.5	.4882		1.2271	1063.248		124.0			

TIME END = 11:50

FINAL LEAK CK OBSERVED BY TED STRAUSS, KCAPCD

V_m 156.836

POST TEST LEAK CHECKS
METER .000 @ 15 in. Hg
PITOTS " @ " in. H₂O
ORSAT OK

VOLUME OF LIQUID WATER COLLECTED	IMPINGER VOLUME, ml. 1	2	3	4	SILICA GEL WEIGHT g
FINAL	562	100			208
INITIAL	500	100			200
LIQUID COLLECTED					
TOTAL VOLUME COLLECTED					

ORSAT MEASUREMENT	TIME	CO_2	O_2	CO	N_2
1		10	3.5		86.5
2					
3					
4					

ALTA

July 11, 1991

Alta Batch I.D.: 10506

Mr. John Conley
Almega West
2301 East 28th Street
Signal Hill, CA 90806

Dear Mr. Conley,

Enclosed are the results for ten MM5 trains received at Alta Analytical Laboratory on June 28, 1991. As per the chain-of-custody (C-O-C) these samples were to be extracted and analyzed for polycyclic aromatic hydrocarbons (PAH) per CARB Method 429 using high resolution mass spectrometry (HRMS). A rush turn-around time was requested for these samples.

The following difficulties were associated with these samples. The pre-spike of d12-benz(a)anthracene onto the filters by your field samplers was orders of magnitude higher in concentration than that which is appropriate for HRMS analysis. Because of this the internal standard recovery of d12-chrysene and d12-benz(a)anthracene used in the method could not be calculated. This significant concentration of the d12-benz(a)anthracene also resulted in interferences in the native channel for chrysene and benz(a)anthracene. In all samples a detection limit was calculated for both samples using d10-pyrene as the internal standard. It is common practice of ALTA to provide the pre-spiking for the MM5 trains. In the future, the field samplers will not need to do any pre-spiking. Sample ID. R2 5775/80 had a high concentration of anthracene as compared to the other samples. In some instances the field blanks had greater concentrations of naphthalene than the samples. This is due in large part to the napthalene contamination in the XAD material. The California Air Resource Board is aware of this and is reviewing other options to deal with this problem.

The following report consists of a Sample Inventory (Section I), Analytical Results (Section II) and the Appendix. The Appendix contains a copy of the chain-of-custody, a list of data qualifiers and abbreviations, and copies of the raw data (if requested).

Alta Analytical Laboratory Inc.

5070 Robert J. Mathews Pkwy., Suite 2
El Dorado Hills, CA. 95630

FAX (916) 933-0940
(916) 933-1640

ALTA

If you have any questions regarding this report please feel free to contact me at (916) 933-1640.

Sincerely,

Robert S. Mitzel

Robert S. Mitzel
Director of Operations

ALTA

DATA QUALIFIERS & ABBREVIATIONS

A	The amount detected is below the Method Calibration Limit.
B	This compound was also detected in the blank.
C	The amount detected is less than five times the Method Calibration Limit.
D	The amount reported is the maximum possible concentration.
E	The detection limit was raised above the Method Calibration Limit due to chemical interferences.
F	This result has been confirmed on a DB-225 column.
G	This resulted has been confirmed on a SP-2331 column.
H	The signal-to-noise ratio is greater than 10:1.
I	Chemical Interference
Conc.	Concentration
D.L.	Detection Limit
NA	Not applicable
S/N	Signal-to-noise
*	See Cover Letter
ND	Not Detected
MPC	Maximum Possible Concentration
R.L.	Method Calibration Limit

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

METHOD BLANK
Lab ID: 10506-MB-PAH
Matrix: MM5

Date Received: NA
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	44		
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	6.4		
Phenanthrene	18		
Anthracene	ND	5.0	
Fluoranthene	ND	5.0	
Pyrene	ND	5.0	
Chrysene	ND	5.0	
Benz(a)anthracene	ND	5.0	
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

METHOD BLANK
Lab ID: 10506-MB-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	73	
d_8-Acenaphthylene	70	
d_{10}-Acenaphthene	80	
d_{10}-Fluorene	84	
d_{10}-Phenanthrene	88	
d_{10}-Anthracene	58	
d_{10}-Fluoranthene	114	
d_{10}-Pyrene	115	
d_{12}-Chrysene	72	
d_{12}-Benz(a)anthracene	79	
d_{12}-Benzo(b)fluoranthene	54	
d_{12}-Benzo(k)fluoranthene	61	
d_{12}-Benzo(a)pyrene	50	
d_{12}-Indeno(1,2,3-c,d)pyrene	40	H
d_{12}-Benzo(g,h,i)perylene	52	
d_{14}-Dibenz(a,h)anthracene	33	H

Pre-spike Recovery Standard:

d_{12}-Benzo(e)pyrene	NA
d_{14}-Terphenyl	NA

Date Analyzed: 7/09/91

Analyst: JM

Reviewer: AM

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

LCS RESULTS
Lab ID: 10506-LCS1/LCS2
Matrix: MM5

Date Received: NA
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: NA

COMPOUND	LCS1 % R	LCS2 % R	RPD %
Naphthalene	114	112	1.8
Acenaphthylene	114	113	0.88
Acenaphthene	120	116	3.4
Fluorene	127	123	3.2
Phenanthrene	131	121	7.9
Anthracene	118	106	11
Fluoranthene	119	117	1.7
Pyrene	120	118	1.7
Chrysene	96	108	5.9
Benza(a)anthracene	124	116	6.7
Benzo(b)fluoranthene	118	116	1.7
Benzo(k)fluoranthene	122	114	6.8
Benzo(a)pyrene	110	107	2.8
Benzo(e)pyrene	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	121	124	2.4
Dibenz(a,h)anthracene	138	128	7.5
Benzo(g,h,i)perylene	128	123	4.0

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

LCS RESULTS
Lab ID: 10506-LCS1/LCS2

Isotopic Recovery Results

Internal Standard:	LCS1 % R	LCS2 % R
d_8-Napththalene	86	78
d_8-Acenaphthylene	74	72
d_{10}-Acenaphthene	78	76
d_{10}-Fluorene	74	75
d_{10}-Phenanthrene	67	73
d_{10}-Anthracene	49	47
d_{10}-Fluoranthene	79	101
d_{10}-Pyrene	77	99
d_{12}-Chrysene	118	122
d_{12}-Benz(a)anthracene	65	81
d_{12}-Benzo(b)fluoranthene	114	128
d_{12}-Benzo(k)fluoranthene	82	87
d_{12}-Benzo(a)pyrene	89	75
d_{12}-Indeno(1,2,3-c,d)perylene	121	127
d_{12}-Benzo(g,h,i)perylene	96	103
d_{14}-Dibenz(a,h)anthracene	105	117

Date Analyzed: 7/09/91

Analyst: JMM

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STM - GBN

Sample ID: R1-5807/5811
Lab ID: 10506-001-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	1700		B
Acenaphthylene	22		
Acenaphthene	8.5		
Fluorene	76		B
Phenanthrene	170		B
Anthracene	18		
Fluoranthene	47		
Pyrene	66		
Chyrsene	ND	12	*
Benz(a)anthracene	ND	18	*
Benzo(b)fluoranthene	30		
Benzo(k)fluoranthene	7.2		
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	14		
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	11		

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STM HEN.

Sample ID: R1-5807/5811
Lab ID: 10506-001-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	61	
d_8-Acenaphthylene	74	
d_{10}-Acenaphthene	74	
d_{10}-Fluorene	97	
d_{10}-Phenanthrene	101	
d_{10}-Anthracene	78	
d_{10}-Fluoranthene	69	
d_{10}-Pyrene	68	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	88	
d_{12}-Benzo(k)fluoranthene	94	
d_{12}-Benzo(a)pyrene	85	
d_{12}-Indeno(1,2,3-c,d)pyrene	80	
d_{12}-Benzo(g,h,i)perylene	79	
d_{14}-Dibenz(a,h)anthracene	85	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	106	
d_{14}-Terphenyl	106	

Date Analyzed: 7/09/91

Analyst: [signature] **Page 2 of 2** **Reviewer:** [signature]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STM GEN

Sample ID: R2 5817/23
Lab ID: 10506-003-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	3500		B
Acenaphthylene	65		
Acenaphthene	15		
Fluorene	82		B
Phenanthrene	200		B
Anthracene	18		
Fluoranthene	57		
Pyrene	110		
Chyrsene	ND	20	*
Benz(a)anthracene	ND	18	*
Benzo(b)fluoranthene	26		
Benzo(k)fluoranthene	8.8		
Benzo(a)pyrene	8.4		
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	15		
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	11		

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STMGGN

Sample ID: R2 5817/23
Lab ID: 10506-003-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	65	
d_8-Acenaphthylene	28	H,I
d_{10}-Acenaphthene	80	
d_{10}-Fluorene	106	
d_{10}-Phenanthrene	114	
d_{10}-Anthracene	86	
d_{10}-Fluoranthene	76	
d_{10}-Pyrene	76	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	128	
d_{12}-Benzo(k)fluoranthene	122	
d_{12}-Benzo(a)pyrene	100	
d_{12}-Indeno(1,2,3-c,d)pyrene	112	
d_{12}-Benzo(g,h,i)perylene	87	
d_{14}-Dibenz(a,h)anthracene	127	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	104	
d_{14}-Terphenyl	102	

Date Analyzed: 7/09/91

Analyst: JMB

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: R3 5825/29 STM GBN
Lab ID: 10506-009-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	2500		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	13		B
Phenanthrene	40		B
Anthracene	ND	5.0	
Fluoranthene	9.6		
Pyrene	16		
Chyrsene	ND	37	*
Benz(a)anthracene	ND	6.0	*
Benzo(b)fluoranthene	7.0		
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: JMV

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STAN 60N

Sample ID: R3 5825/29
Lab ID: 10506-009-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	57	
d_8-Acenaphthylene	68	
d_{10}-Acenaphthene	66	
d_{10}-Fluorene	67	
d_{10}-Phenanthrene	71	
d_{10}-Anthracene	58	
d_{10}-Fluoranthene	65	
d_{10}-Pyrene	64	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	110	
d_{12}-Benzo(k)fluoranthene	133	
d_{12}-Benzo(a)pyrene	87	
d_{12}-Indeno(1,2,3-c,d)pyrene	124	
d_{12}-Benzo(g,h,i)perylene	91	
d_{14}-Dibenz(a,h)anthracene	132	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	105	
d_{14}-Terphenyl	107	

Date Analyzed: 7/09/91

Analyst: [illegible] **Page 2 of 2** **Reviewer:** [illegible]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Sample ID: R1+2 5813/16 BLK 57m 6e4
Lab ID: 10506-002-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	1600		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	8.6		B
Phenanthrene	27		B
Anthracene	ND	5.0	
Fluoranthene	ND	5.0	
Pyrene	25		
Chyrsene	ND	56	*
Benz(a)anthracene	ND	32	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

37M 60N

Sample ID: R1+2 5813/16 BLK
Lab ID: 10506-002-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	69	
d_8-Acenaphthylene	64	
d_{10}-Acenaphthene	66	
d_{10}-Fluorene	67	
d_{10}-Phenanthrene	66	
d_{10}-Anthracene	52	
d_{10}-Fluoranthene	65	
d_{10}-Pyrene	65	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	93	
d_{12}-Benzo(k)fluoranthene	73	
d_{12}-Benzo(a)pyrene	85	
d_{12}-Indeno(1,2,3-c,d)pyrene	80	
d_{12}-Benzo(g,h,i)perylene	82	
d_{14}-Dibenz(a,h)anthracene	65	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	105	
d_{14}-Terphenyl	88	

Date Analyzed: 7/09/91

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

Stan Goal

Sample ID: R3 5830/33 BLK
Lab ID: 10506-010-PAH
Matrix: MM5

Date Received: 6/28/91
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	2800		B
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	ND	5.0	B
Phenanthrene	19		B
Anthracene	ND	5.0	
Fluoranthene	ND	5.0	
Pyrene	ND	5.0	
Chyrsene	ND	56	*
Benz(a)anthracene	ND	33	*
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA		
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [illegible]

Reviewer: [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

STM GEN

Sample ID: R3 5830/33
Lab ID: 10506-010-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	70	
d_8-Acenaphthylene	68	
d_{10}-Acenaphthene	69	
d_{10}-Fluorene	72	
d_{10}-Phenanthrene	79	
d_{10}-Anthracene	70	
d_{10}-Fluoranthene	85	
d_{10}-Pyrene	83	
d_{12}-Chrysene	NA	*
d_{12}-Benz(a)anthracene	NA	*
d_{12}-Benzo(b)fluoranthene	84	
d_{12}-Benzo(k)fluoranthene	74	
d_{12}-Benzo(a)pyrene	81	
d_{12}-Indeno(1,2,3-c,d)pyrene	66	
d_{12}-Benzo(g,h,i)perylene	70	
d_{14}-Dibenz(a,h)anthracene	70	
Pre-spike Recovery Standard:		
d_{12}-Benzo(e)pyrene	107	
d_{14}-Terphenyl	88	

Date Analyzed: 7/09/91

Analyst: [signature]

Reviewer: [signature]

ALTA

Section I. Sample Inventory

Date Received: 28-Jun-91

Alta Lab ID.	Client ID.
10506-1-A	R-1-429-S1-Filter
10506-1-B	R-1-429-S2-Prewash
10506-1-C	R-1-429-S3-XAD
10506-1-D	R-1-429-S4-Condensate
10506-1-E	R-1-429-S5-Imps.
10506-2-A	R-1+2 Reagent Blank
10506-2-B	R-1+2 MeCl+Methanol Blank
10506-2-C	R-1+2 XAD Trap Blank
10506-2-D	R-1+2 Filter Blank
10506-3-A	R-2-429-S1-Filter
10506-3-B	R-2-429-S2-Prewash
10506-3-C	R-2-429-S3-XAD
10506-3-D	R-2-429-S4-Condensate
10506-3-E	R-2-429-S5-Imps.
10506-4-A	R-3-429-S1-Filter
10506-4-B	R-3-429-S2-Prewash
10506-4-C	R-3-429-S3-XAD
10506-4-D	R-3-429-S4-Condensate
10506-4-E	R-3-429-S5-Imps.
10506-5-A	R-3-Reagent Blank(H2O)
10506-5-B	R-3-MeCl+Methanol Blank
10506-5-C	R-3-Filter Blank
10506-5-D	R-3-XAD 2 Trap Blank
10506-6-A	R-1-429-S1-Filter
10506-6-B	R-1-429-S2-Prewash
10506-6-C	R-1-429-S3-XAD
10506-6-D	R-1-429-S4-Condensate
10506-6-E	R-1-429-S5-Imps.
10506-7-A	R-2-429-S1-Filter
10506-7-B	R-2-429-S2-Prewash
10506-7-C	R-2-429-S3-XAD
10506-7-D	R-2-429-S4-Condensate
10506-7-E	R-2-429-S5-Imps.
10506-8-A	R-1+2 XAD Trap Blank
10506-8-B	R-1+2 Filter Blank
10506-8-C	R-1+2 Reagent Blank
10506-8-D	R-1+2 MeCl+Methanol Blank
10506-9-A	R-3-429-S1-Filter
10506-9-B	R-3-429-S2-Prewash
10506-9-C	R-3-429-S3-XAD
10506-9-D	R-3-429-S4-Condensate
10506-9-E	R-3-429-S5-Imps.
10506-10-A	R-3 Filter Blank
10506-10-B	R-3 XAD Blank
10506-10-C	R-3 Reagent Blank
10506-10-D	R-3 MeCl+Methanol Blank

SECTION II.

Enseco - Air Toxics Laboratory
9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

July 10, 1991

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

ANALYSIS NO.: A9117902-001/004
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91

PROJECT: SHELL BAKERSFIELD STEAM GEN.

PROJECT NO.: C6823

Enclosed with this letter is the report on the chemical and physical analyses on the samples from ANALYSIS NO: A9117902-001/004 as shown above.

The samples were received by Enseco - Air Toxics Laboratory, intact and with the chain-of-custody record attached.

Please note that ND means not detected at the detection limit expressed.

Marita M. Lerazo
REVIEWED

APPROVED

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

Enseco - Air Toxics Laboratory
9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: R-1-410A/422-BTXE

ANALYSIS NO.: A9117902-001
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	11	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

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9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: R-2-410A/422-BTXE

ANALYSIS NO.: A9117902-002
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	8.6	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

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9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: R-3-410A/422-BTXE

ANALYSIS NO.: A9117902-003
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	12	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

The Report Cover Letter is an integral part of this report.
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Enseco - Air Toxics Laboratory
9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

Enseco
A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

Sample ID: BLANK

ANALYSIS NO.: A9117902-004
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91
DATE ANALYZED: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

Volatile Organics by GCMS - Modified EPA TO14

Compounds	Results ppb(vol/vol)	Detection Limit
Benzene	ND	6
Toluene	15	6
Ethylbenzene	ND	5
Total Xylenes	ND	10

The Report Cover Letter is an integral part of this report.
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9537 Telstar Avenue, Suite 118 • El Monte, CA 91731
(818) 442-8400 • FAX: (818) 442-3758

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A Corning Company

LABORATORY REPORT

ALMEGA WEST
2301 East 28th Street
Signal Hill, CA 90806
ATTN: MR. CHARLES PETRISHE

ANALYSIS NO.: A9117902
ANALYSES: Volatile Organics by GCMS - Modified EPA TO14
DATE SAMPLED: 06/27/91
DATE SAMPLE REC'D: 06/28/91
SAMPLE TYPE: Air
QC BATCH NO.: MS101-9106281

QC SUMMARY
Volatile Organics by GCMS
Modified EPA TO14

Compounds	Laboratory Control Sample % Recovery	Duplicate Control Sample % Recovery	RPD
Methylene Chloride	102	104	2
1,1-Dichloroethene	99	108	11
Trichloroethene	101	107	5
Toluene	102	105	2
1,1,2,2-Tetrachloroethane	92	97	5
Limits	80 - 115	80 - 115	20

The Report Cover Letter is an integral part of this report.
This report pertains only to the samples investigated and does not necessarily apply to other apparently identical or similar materials. This report is submitted for the exclusive use of the client to whom it is addressed. Any reproduction of this report or use of this Laboratory's name for advertising or publicity purposes without authorization is prohibited.

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/27/91 Page 1 of 1

Project Number C6823

Per Telecon with J Conley on 6/27/91. (N Conkey)

SOURCE Shell Bakersfield - Steam Gen.

TEST DATE 6/27/91

PROJECT MANAGER CAP

PHONE NUMBER 213 426-4221

Method of Shipment Hand Carry

ANALYSES: BTXE by GC/MS; CARB 410A/422; CONTACT JOHN CONLEY FOR ANY QUESTIONS

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample: LIQ	AIR	SOLID	Number of Containers	CARB 410A/422	BTXE by GC/MS						Sample Condition/ REMARKS
R-1-410A/422-BTXE	6/27/91	1:00	5835		X		1	✓							-001
R-2 410A/422-BTXE	↓	↓	5836		X		1	✓							-002
R-3 410A/422-BTXE			5837		X		1	✓							-003
BLANK			5838		X		1	✓							-004

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Relinquished by: (Signature) [signature]

Received by: (Signature) Ken Forbes — Date Time 6-28-91 0800

Received by: (Signature) Ken Forbes — Date Time 6-28-91 0800

Date Time 6-28-91 10:26

Received for Laboratory by: [signature]

Date RECEIVED Time 6-28-91 10:26 am

Date ACCEPTED Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Special Instructions
Relinquished by: [signature] 6/28/91 2:39pm Received by: [signature] 6/28/91 3:40 pm

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/26/91 Page 1 of 1

Project Number C6823

SOURCE Shell-Steam Generator

TEST DATE 6/26/91 - Bakersfield

Method of Shipment Federal Express

PROJECT MANAGER CAP

PHONE NUMBER 913-426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	Carb 429							Sample Condition/ REMARKS
MPD R-1 ~~R-4~~-429-S1- Filter	6/24/91	600 am	5807			X	1	X							Spiked
R-1-429-S2- Prewash			5808	X			1	X							
R-1-429-S3- XAD			5809			X	1	X							Spiked
R-1 429-S4 Condensate			5810	X			1	X							
R-1-429-S5 - Imps.			5811	X			1	X							
[redacted]															
R-1+2 Reagent BLANK (H2O)			5813	X			1	X							
R1+2 MECl + Methanol BLANK			5814	X			1	X							
R1+2 XAD Trap Blank			5815			X	1	X							Spiked
R1+2 Filter Blank			5816			X	1	X							Spiked

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Received by: (Signature) [signature]

Received by: (Signature)

Date Time 6-28-91 9:00

Date Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Relinquished by: (Signature) | Date Time | Received for Laboratory by: | Date RECEIVED Time | Date ACCEPTED Time

Special Instructions

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/26/91 Page 1 of 1

Project Number 06823

SOURCE Shell-Steam Generator
TEST DATE Bakersfield- 6/26/91
Method of Shipment Federal Express

PROJECT MANAGER CAP
PHONE NUMBER 213 426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample LIQ	AIR	SOLID	Number of Containers	Carb 429							Sample Condition/ REMARKS
R2-429-S1-Filter	6/26/91	600 PM	5817			X	1	X							
R2-429-S2-Prewash			5818	X			1	X							
R2-429-S3-XAO			5819			X	1	X							
R2-429-S4-condensate			5820	X			1	X							
R2-429-S5-Imps			5821	X			1	X							

SAMPLERS: (Signature) [signature]
Relinquished by: (Signature) [signature]
Relinquished by: (Signature)

Received by: (Signature) [signature] Date 6/26/91 Time 9:00
Received by: (Signature) Date Time
Date Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Received for Laboratory by: Date RECEIVED Time | Date ACCEPTED Time

Special Instructions

ALMEGA WEST

2301 East 28th Street, Signal Hill CA
PH:(213) 426-4221 FAX: (213) 426-1143

CHAIN OF CUSTODY RECORD

Date 6/27/91 Page 1 of 1

Project Number C6823

SOURCE Shell-Bakersfield-Steam Gen.

TEST DATE 6/27/91

Method of Shipment Federal Express

PROJECT MANAGER CAP

PHONE NUMBER 213-426-4221

ANALYSES

Sample No. or Identification	Date	Time	Lab Sample Number	Type of Sample: LIQ	AIR	SOLID	Number of Containers	CARB 429							Sample Condition/ REMARKS
R3-S1-429-Filter	6/27/91	1200 pm	5825			X	1								spiked
R3-S2-429-Prewash			5826	X			1								
R3-S3-XAD-429			5827			X	1								spiked
R3-S4-429-condensate			5828	X			1								
R3-S5-429-Imps			5829	X			1								
R3-Filter Blank			5830			X	1								spiked
R3-XAD BLANK			5831			X	1								spiked
R3-Reagent Blank (H_2O)			5832	X			1								
R3-MeCl+Methanol Blank			5833	X			1								

SAMPLERS: (Signature) [signature]

Relinquished by: (Signature) [signature]

Relinquished by: (Signature)

Received by: (Signature) Jennifer Lobate — Date 6-28-91 Time 9:00

Received by: (Signature) — Date Time

Date Time

Received for Laboratory by: Date RECEIVED Time

Date ACCEPTED Time

INDICATE SAMPLE DISPOSITION
1. Sample to be Returned to Client: Yes _____ No _____ Other _____
2. Requested Sample Storage Time: _____ Days

Special Instructions

APPENDIX J

Lab Blank Analysis

ALTA

POLYCYCLIC AROMATIC HYROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

METHOD BLANK
Lab ID: 10506-MB-PAH
Matrix: MM5

Date Received: NA
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: ng/sample

Compound	Conc.	R.L.	Qualifier
Naphthalene	44		
Acenaphthylene	ND	5.0	
Acenaphthene	ND	5.0	
Fluorene	6.4		
Phenanthrene	18		
Anthracene	ND	5.0	
Fluoranthene	ND	5.0	
Pyrene	ND	5.0	
Chrysene	ND	5.0	
Benz(a)anthracene	ND	5.0	
Benzo(b)fluoranthene	ND	5.0	
Benzo(k)fluoranthene	ND	5.0	
Benzo(a)pyrene	ND	5.0	
Benzo(e)pyrene	NA	NA	
Indeno(1,2,3-c,d)pyrene	ND	5.0	
Dibenz(a,h)anthracene	ND	5.0	
Benzo(g,h,i)perylene	ND	5.0	

Analyst: [signature]

Reviewer: [signature]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

METHOD BLANK
Lab ID: 10506-MB-PAH

Isotopic Recovery Results

Internal Standard:	% R	Qualifier
d_8-Naphthalene	73	
d_8-Acenaphthylene	70	
d_{10}-Acenaphthene	80	
d_{10}-Fluorene	84	
d_{10}-Phenanthrene	88	
d_{10}-Anthracene	58	
d_{10}-Fluoranthene	114	
d_{10}-Pyrene	115	
d_{12}-Chrysene	72	
d_{12}-Benz(a)anthracene	79	
d_{12}-Benzo(b)fluoranthene	54	
d_{12}-Benzo(k)fluoranthene	61	
d_{12}-Benzo(a)pyrene	50	
d_{12}-Indeno(1,2,3-c,d)pyrene	40	H
d_{12}-Benzo(g,h,i)perylene	52	
d_{14}-Dibenz(a,h)anthracene	33	H

Pre-spike Recovery Standard:

d_{12}-Benzo(e)pyrene	NA
d_{14}-Terphenyl	NA

Date Analyzed: 7/09/91

Analyst: [illegible] **Page 2 of 2** **Reviewer:** [illegible]

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

LCS RESULTS
Lab ID: 10506-LCS1/LCS2
Matrix: MM5

Date Received: NA
Date Extracted: 7/02/91
Sample Amount: Sample

ICAL ID: IPNA
QC Lot: LC0702M
Units: NA

COMPOUND	LCS1 % R	LCS2 % R	RPD %
Naphthalene	114	112	1.8
Acenaphthylene	114	113	0.88
Acenaphthene	120	116	3.4
Fluorene	127	123	3.2
Phenanthrene	131	121	7.9
Anthracene	118	106	11
Fluoranthene	119	117	1.7
Pyrene	120	118	1.7
Chrysene	96	108	5.9
Benza(a)anthracene	124	116	6.7
Benzo(b)fluoranthene	118	116	1.7
Benzo(k)fluoranthene	122	114	6.8
Benzo(a)pyrene	110	107	2.8
Benzo(e)pyrene	NA	NA	NA
Indeno(1,2,3-c,d)pyrene	121	124	2.4
Dibenz(a,h)anthracene	138	128	7.5
Benzo(g,h,i)perylene	128	123	4.0

Analyst: JMP

Reviewer: AM

ALTA

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)
CALIFORNIA AIR RESOURCES BOARD METHOD 429

LCS RESULTS
Lab ID: 10506-LCS1/LCS2

Isotopic Recovery Results

Internal Standard:	LCS1 % R	LCS2 % R
d_8-Napththalene	86	78
d_8-Acenaphthylene	74	72
d_{10}-Acenaphthene	78	76
d_{10}-Fluorene	74	75
d_{10}-Phenanthrene	67	73
d_{10}-Anthracene	49	47
d_{10}-Fluoranthene	79	101
d_{10}-Pyrene	77	99
d_{12}-Chrysene	118	122
d_{12}-Benz(a)anthracene	65	81
d_{12}-Benzo(b)fluoranthene	114	128
d_{12}-Benzo(k)fluoranthene	82	87
d_{12}-Benzo(a)pyrene	89	75
d_{12}-Indeno(1,2,3-c,d)perylene	121	127
d_{12}-Benzo(g,h,i)perylene	96	103
d_{14}-Dibenz(a,h)anthracene	105	117

Date Analyzed: 7/09/91

Analyst: [illegible] **Page 2 of 2** **Reviewer:** [illegible]

APPENDIX K

Fuel Gas Usage and Analysis - Cogen

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

S.W.E.P.I.
P.O. Box 11164
Bakersfield, CA 93389-1164

Lab. No.: 027941_001
Received: Jun 25, 1991
Reported: Jun 25, 1991

Attention: K.D Kirkpatrick

Sample Description: SEKR Cogen HRSG #1 6/24/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %
Hydrogen	0.000	0.000
Carbon Dioxide	1.405	3.637
Oxygen	.055	.104
Nitrogen	.641	1.055
Carbon Monoxide	0.000	0.000
Hydrogen Sulfide	0.000	0.000
Methane	95.276	89.908
Ethane	2.043	3.614
Propane	.421	1.091
IsoButane	.040	.135
N-Butane	.077	.262
IsoPentane	.017	.071
N-Pentane	.015	.064
Hexanes+	.011	.058
Totals -	100.000	100.000

CHONS	Wt %
CARBON	72.57
HYDROGEN	23.62
OXYGEN	2.75
NITROGEN	1.06
SULFUR	0.00
Totals	99.99
Total H/C	.33

SPECIFIC GRAVITY (Air = 1)		.5880
SPECIFIC VOLUME, cu.ft./lb	*	22.28
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	1001.42
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	1018.74 ←
GROSS CALORIFIC VALUE, BTU/lb	**	22701.75
NET CALORIFIC VALUE, BTU/cu.ft.	**	918.13
NET CALORIFIC VALUE, BTU/lb	**	20459.65
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		8.6392
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9979
EPA 'F' Factor @ 68 F:		8628.316 DSCF / MM Btu.
KCAPCD 'F' Factor @ 60 F:		8498.892 DSCF / MM Btu. ←

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

Maryann W. Benoit
Organics Supervisor

Richard L. Penner
Laboratory Director

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

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

S.W.E.P.I.
P.O. Box 11164
Bakersfield, CA 93389-1164

Lab. No.: 027941_002
Received: Jun 25, 1991
Reported: Jun 25, 1991

Attention: K.D Kirkpatrick

Sample Description: SEKR Cogen HRSG #2 6/25/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %	CHONS	Wt %
Hydrogen	0.000	0.000	CARBON	72.64
Carbon Dioxide	1.393	3.608	HYDROGEN	23.63
Oxygen	.045	.085	OXYGEN	2.71
Nitrogen	.614	1.012	NITROGEN	1.01
Carbon Monoxide	0.000	0.000	SULFUR	0.00
Hydrogen Sulfide	0.000	0.000		
Methane	95.259	89.901	Totals	99.99
Ethane	2.109	3.731	Total H/C	.33
Propane	.442	1.145		
IsoButane	.042	.144		
N-Butane	.052	.177		
IsoPentane	.015	.065		
N-Pentane	.013	.055		
Hexanes+	.015	.077		
Totals =	100.000	100.000		

SPECIFIC GRAVITY (Air = 1)		.5879
SPECIFIC VOLUME, cu.ft./lb	*	22.29
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	1002.24
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	1019.57 ←
GROSS CALORIFIC VALUE, BTU/lb	**	22722.80
NET CALORIFIC VALUE, BTU/cu.ft.	**	918.89
NET CALORIFIC VALUE, BTU/lb	**	20478.86
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		8.6458
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9979
EPA 'F' Factor @ 68 F:	8628.252 DSCF / MM Btu.	
KCAPCD 'F' Factor @ 60 F:	8498.828 DSCF / MM Btu. ←	

* Water Saturated ** Dry Gas @ 60 F, 14.73 psia

Maryann W. Benoit
Organics Supervisor

Richard L. Penner
Laboratory Director

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

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

Shell Western E & P, Inc.
P.O. Box 11164
Bakersfield, CA 93389-1164

Laboratory No: 27941
Date Received: 6-25-91
Date Reported: 6-26-91
P O #: AFSB 070589 CA

Attention: K.D. Kirkpatrick

Sample: Gas

Sample Description: 27941-1 SEKR Cogen HRSG #1; Sampled on 6-24-91
27941-2 SEKR Cogen HRSG #1; Sampled on 6-25-91
Sampled by K.D. Kirkpatrick

Total Sulfur (ASTM D 3246)	-1	-2
As H_2S, ppm (vol.)	1.2	0.08
As S, Grains/100 SCF*	1.3	0.08

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

Richard L. Penner
Laboratory Director

RLP/tds

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

START

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 09:29:39

24/JUN/91 GROUP 5006 MHCA6 - GROUP 5006 TYPE MAIN 09:29:36

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	11241	PPH
6	FT1243		INJECTION WATER FLOW	8279.6	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	21.61	MW
8	FY8S28		MASS FLOW AMMONIA TO MIXING T	12.36	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	281.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

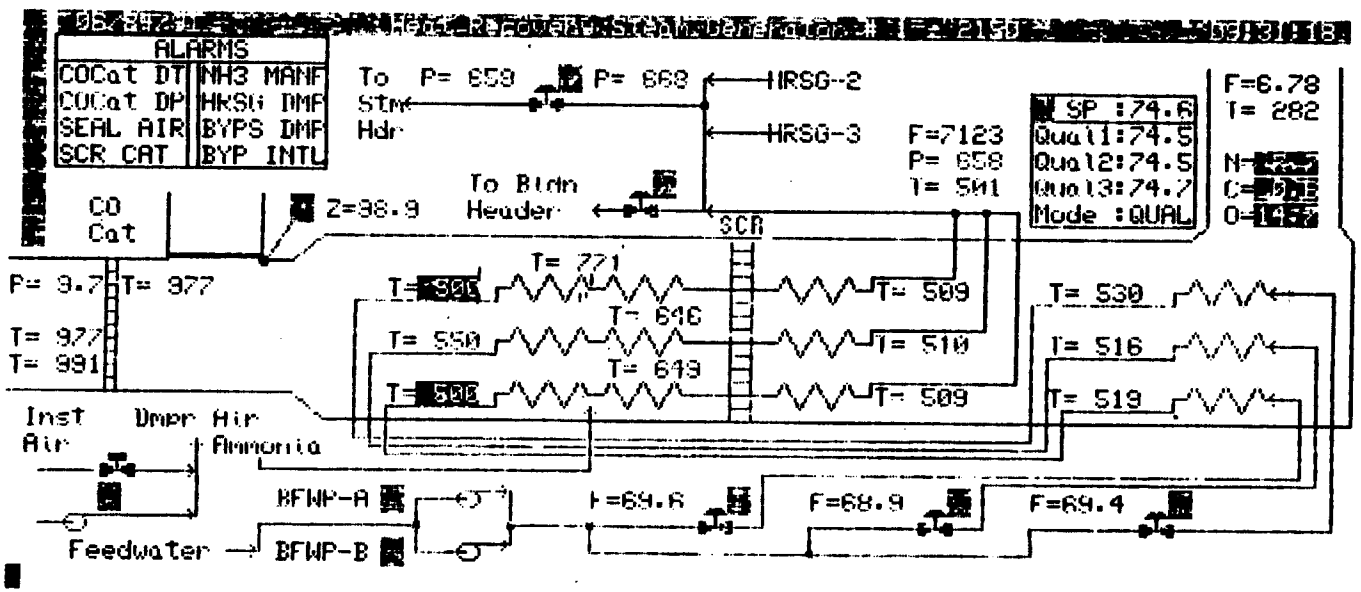
DATE: 06/24/91 TIME: 09:30:55

Gas Gen Speed	9760	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	21.6	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	6.40	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	966	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	52.7	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	6.1	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	30.0	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	11183	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	8280	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.74	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	295	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	271	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	85.1	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	282	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	[illegible]	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	82.6	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 09:31:24



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 10:06:07

24/JUN/91 GROUP 5006 MACMS - GROUP 5006 TYPE MAIN 10:06:00

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	11281	PPH
6	FT1243		INJECTION WATER FLOW	8293.3	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	21.61	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	12.44	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	281.5	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

[redacted] ADD POINT

[redacted] DELETE POINT

[redacted]

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 10:10:46

Gas Gen Speed	9760
Pwr Trb Speed	3597
Gen MW Output	21.7
Gen Megavar Out	6.26
Gen Voltage	13.7
Gen Amperease	971
Turb L.O. Press	52.7
Turb L.O. Temp	142
Trb Scv oil Prs	5.5
Gen L.O. Press	29.7
Gen L.O. Temp	139
Fuel Gas Flow	11281
Inj Water Flow	8362
Inj Water Ratio	0.74
Fuel Manfld Prs	296
Inj Manfld Prs	271
Comp Inlet Temp	65.1
Comp Disch Prs	263
Gas Supply Prs	[illegible]
Gas Supply Tmp	84.1

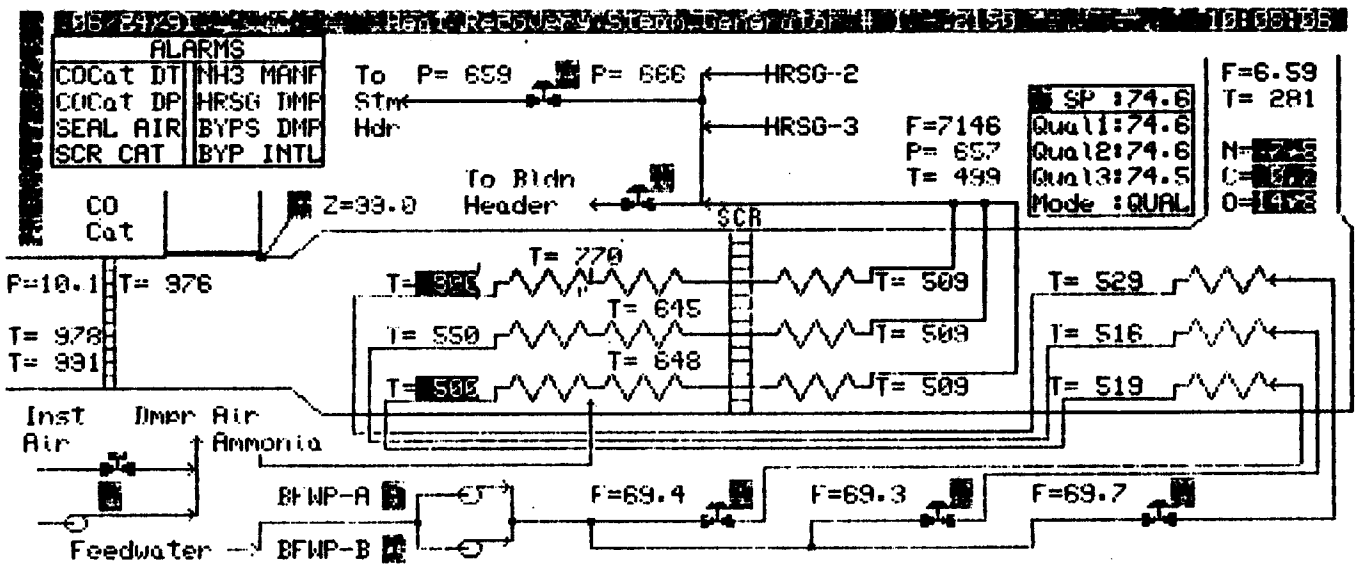
ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 10:08:13



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 10:33:11

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 10:33:06

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	11320	PPH
6	FT1243		INJECTION WATER FLOW	8334.3	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	21.64	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING 1	12.34	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	282.1	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 10:30:40

Gas Gen Speed	9760
Pwr Trb Speed	3602
Gen MW Output	21.7
Gen Megavar Out	6.37
Gen Voltage	13.7
Gen Amperenge	971
Turb L.O. Press	52.6
Turb L.O. Temp	142
Trb Scv oil Prs	6.3
Gen L.O. Press	29.7
Gen L.O. Temp	139
Fuel Gas Flow	11241
Inj Water Flow	8307
Inj Water Ratio	0.74
Fuel Manfld Prs	245
Inj Manfld Prs	271
Comp Inlet Temp	94.8
Comp Disch Prs	262
Gas Supply Prs	[illegible]
Gas Supply Tmp	84.9

ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 10:32:18

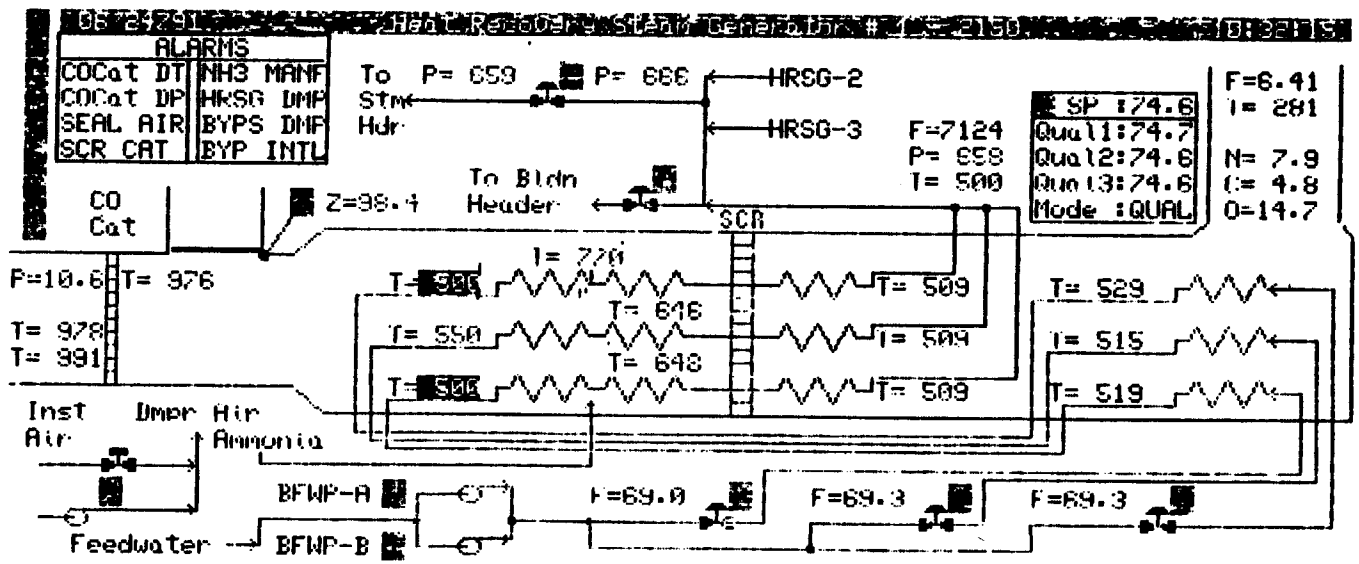


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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 11:01:58

24/JUN/91 GROUP S006 MACRO - GROUP S006 TYPE MAIN 11:01:55

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10479	PPH
6	FT1243		INJECTION WATER FLOW	7403.7	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	11.29	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	284.7	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 11:03:17

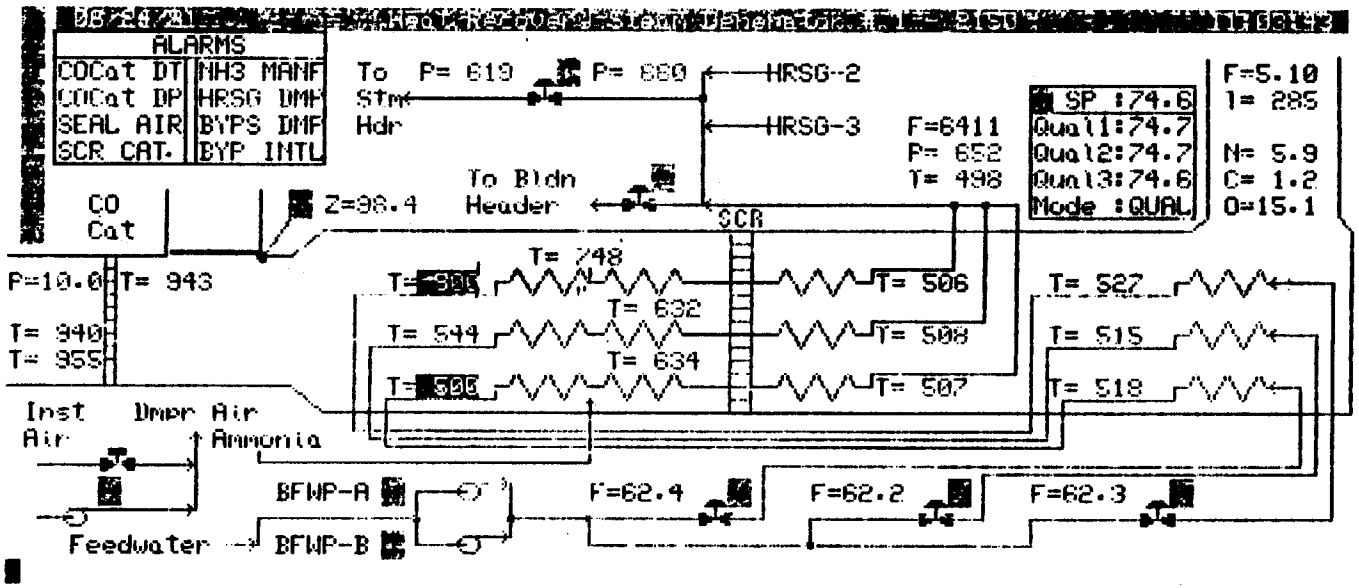
Gas Gen Speed	9372
Pwr Trb Speed	3602
Gen MW Output	19.9
Gen Megavar Out	5.60
Gen Voltage	13.7
Gen Amperage	890
Turb L.O. Press	50.5
Turb L.O. Temp	141
Trb Scv oil Prs	5.9
Gen L.O. Press	29.7
Gen L.O. Temp	139
Fuel Gas Flow	10518
Inj Water Flow	7335
Inj Water Ratio	0.70
Fuel Manfld Prs	279
Inj Manfld Prs	257
Comp Inlet Temp	60.1
Comp Disch Prs	250
Gas Supply Prs	[illegible]
Gas Supply Tmp	86.2

ALARMS & SHUTDOWNS		
LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 11:03:50



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 11:29:23

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 11:29:18

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10499	PPH
6	FT1243		INJECTION WATER FLOW	7444.8	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.95	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.79	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	287.0	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

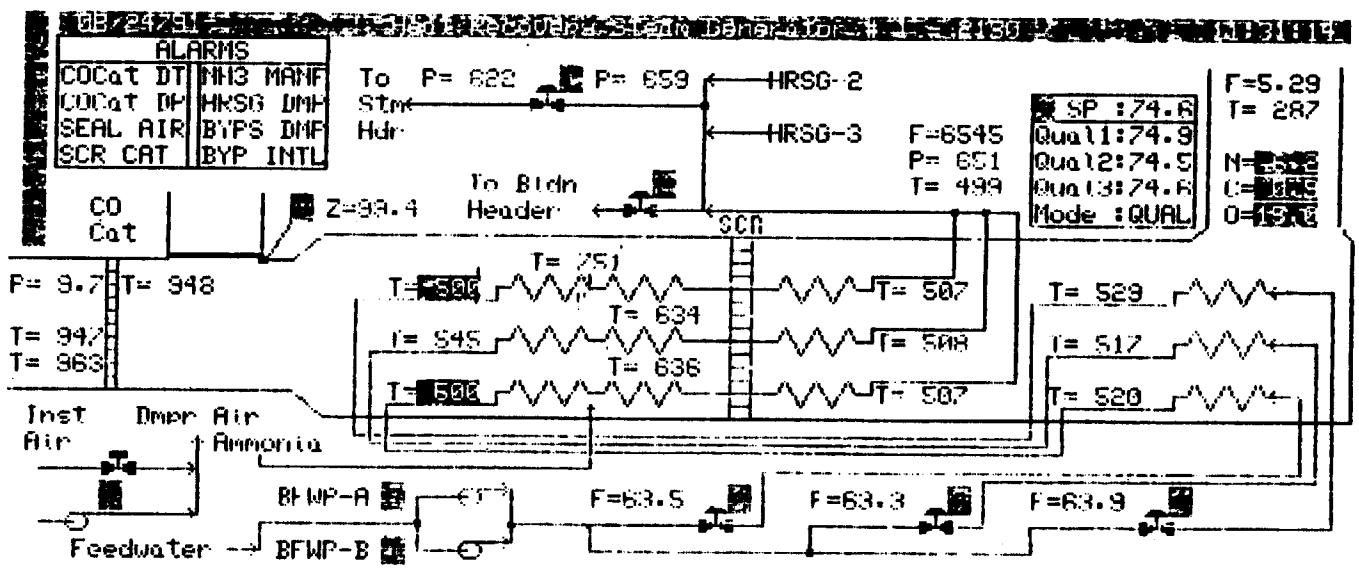
DATE: 06/24/91 TIME: 11:29:45

Gas Gen Speed	9419	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.88	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	894	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.3	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.7	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.8	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	140	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10557	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7417	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.72	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	256	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	70.0	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	250	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	[illegible]	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	87.0	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 11:31:18



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 12:01:09

24/JUN/91 GROUP 5008 MAC06 - GROUP 5006 TYPE MAIN 12:01:05

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7444.8	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.67	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	287.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 12:05:26

Gas Gen Speed	9419
Pwr Trb Speed	3602
Gen MW Output	20.1
Gen Megavar Out	5.98
Gen Voltage	13.8
Gen Amperease	897
Turb L.O. Press	30.6
Turb L.O. Temp	142
Trb Scv oil Prs	5.3
Gen L.O. Press	29.7
Gen L.O. Temp	140
Fuel Gas Flow	10596
Inj Water Flow	7595
Inj Water Ratio	0.72
Fuel Manfld Prs	281
Inj Manfld Prs	258
Comp Inlet Temp	68.8
Comp Disch Prs	252
Gas Supply Prs	[illegible]
Gas Supply Tmp	89.5

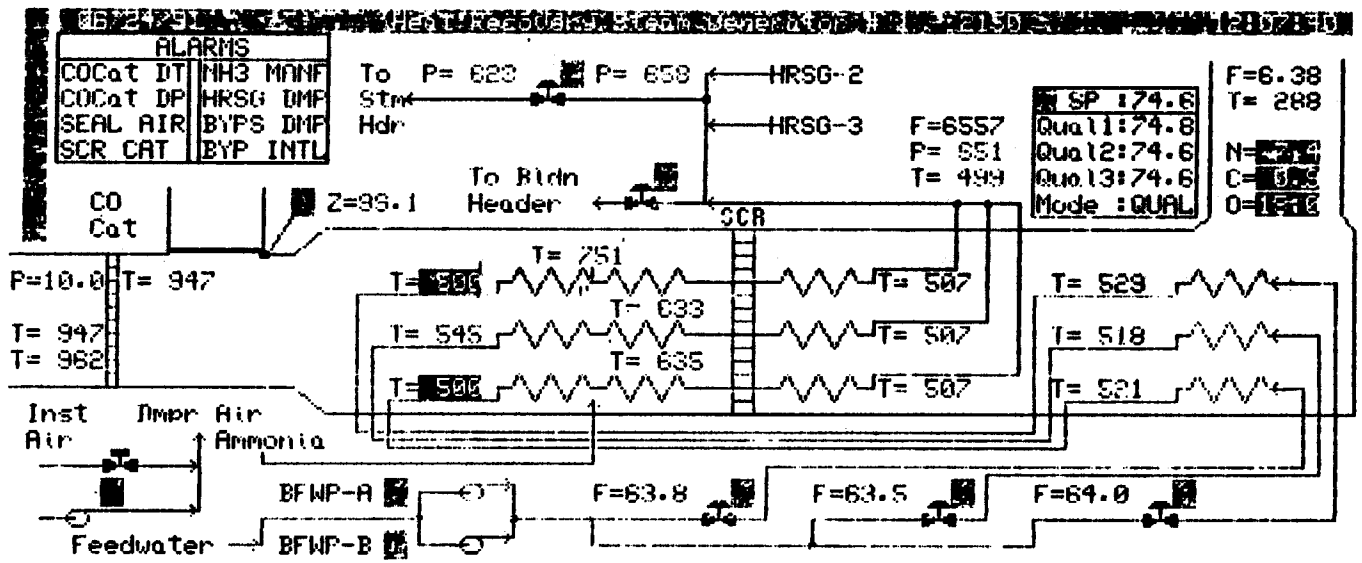
ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 12:07:42



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 12:33:03

24-JUN-91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 12:33:00

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7513.2	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.09	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.42	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	287.4	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 12:34:08

06/24/91 [illegible] 12:38:58

Gas Gen Speed	9431
Pwr Trb Speed	3597
Gen MW Output	20.1
Gen Megavar Out	5.88
Gen Voltage	13.7
Gen Amperease	894
Turb L.O. Press	58.7
Turb L.O. Temp	142
Trb Scv oil Prs	5.5
Gen L.O. Press	23.7
Gen L.O. Temp	140
Fuel Gas Flow	10557
Inj Water Flow	7541
Inj Water Ratio	0.71
Fuel Manfld Prs	280
Inj Manfld Prs	257
Comp Inlet Temp	68.8
Comp Disch Prs	251
Gas Supply Pfs	397
Gas Supply Tmp	89.8

ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 12:34:51

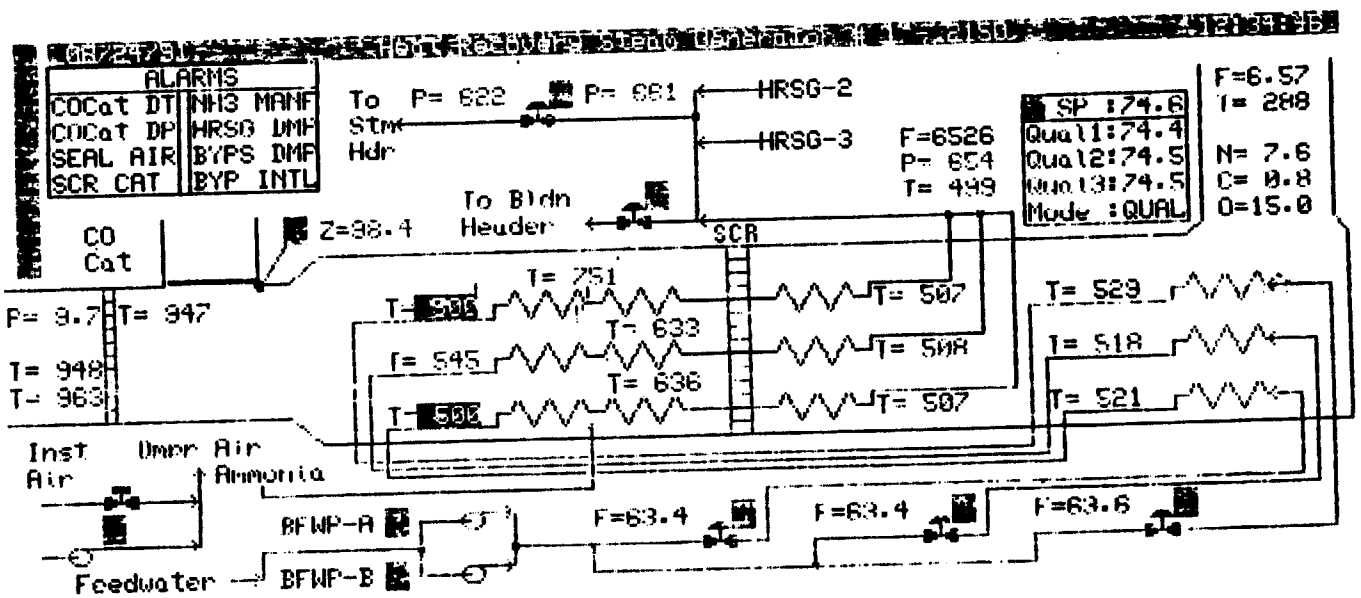


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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 13:02:05

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 13:02:02

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10616	PPH
6	FT1243		INJECTION WATER FLOW	7513.2	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.58	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	287.1	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 13:12:27

Gas Gen Speed	9408
Pwr Trb Speed	3597
Gen MW Output	20.1
Gen Megavar Out	5.84
Gen Voltage	13.7
Gen Amperease	897
Turb L.O. Press	50.5
Turb L.O. Temp	143
Trb Scv oil Prs	6.1
Gen L.O. Press	29.0
Gen L.O. Temp	140
Fuel Gas Flow	10616
Inj Water Flow	7541
Inj Water Ratio	0.71
Fuel Manfld Prs	280
Inj Manfld Prs	257
Comp Inlet Temp	68.8
Comp Disch Prs	250
Gas Supply Prs	404
Gas Supply Tmp	90.2

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 13:03:11

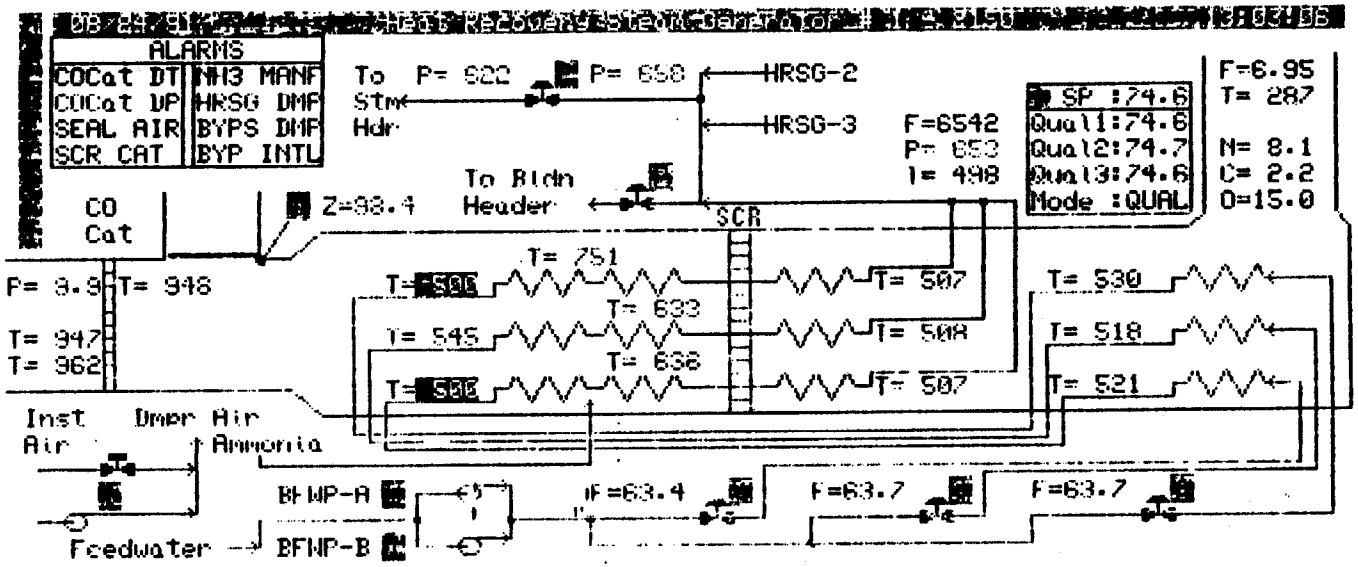

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 13:40:40

24/JUN/91 GROUP 5006 MACOS - GROUP 5006 TYPE MAIN 13:40:33

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10635	PPH
6	FT1243		INJECTION WATER FLOW	7595.3	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.06	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.55	PPH
9	TE1324		HRSG-01 STACK GAS TEMP	285.5	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 13:43:28

Gas Gen Speed	9431	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.1	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.84	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	900	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.4	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.9	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.5	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	140	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10616	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7554	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	280	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	70.8	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	407	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	90.8	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 13:43:49

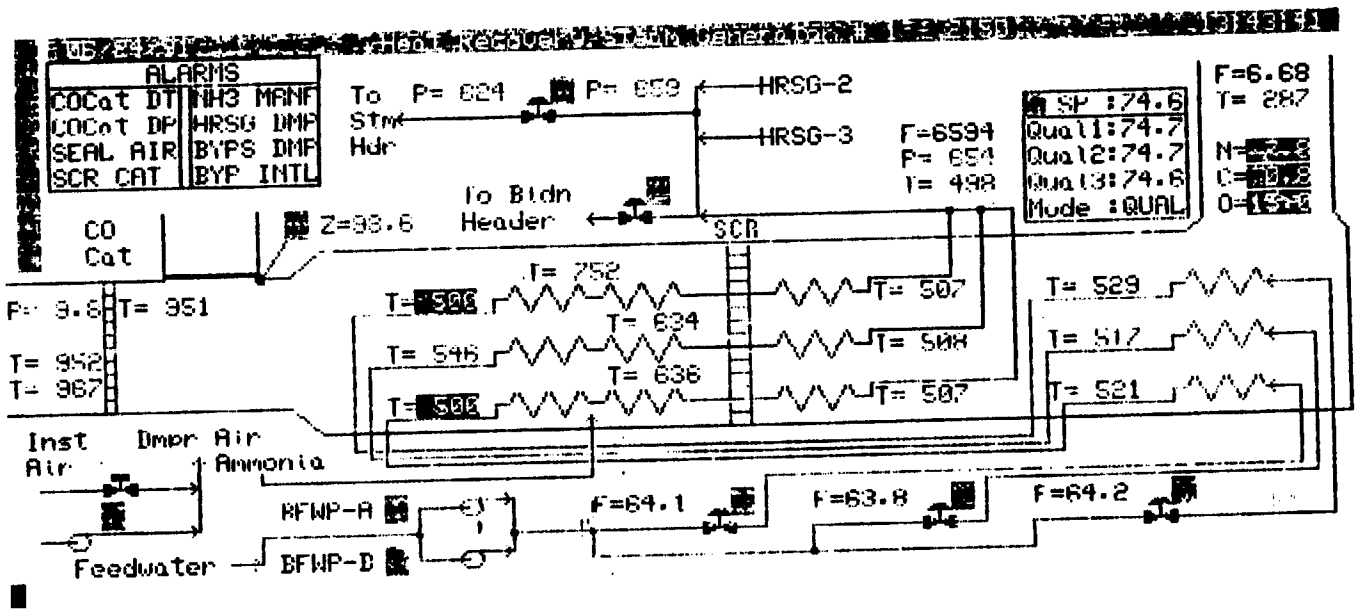

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 13:59:34

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 13:59:30

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10577	PPH
6	FT1243		INJECTION WATER FLOW	7554.3	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING 1	10.35	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	286.1	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

F1 ADD POINT

F2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 14:01:20

[illegible]		[illegible]	[illegible]	[illegible]
Gas Gen Speed	9431		ALARMS & SHUTDOWNS	
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.1	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.88	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.8	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	896	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.4	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.3	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.5	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	140	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10596	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7568	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	70.0	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	410	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	91.0	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 14:02:06

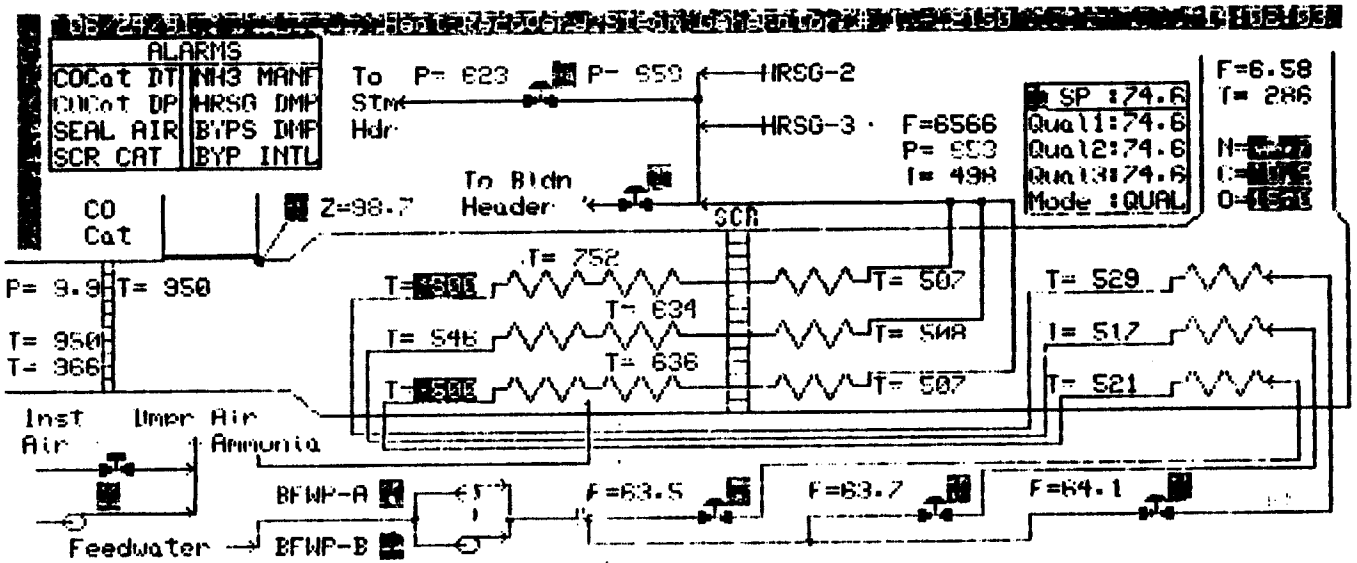

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 14:29:44

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 14:29:40

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10596	PPH
6	FT1243		INJECTION WATER FLOW	7554.3	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.35	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	265.5	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PMT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 14:30:35

Gas Gen Speed	9443
Pwr Trb Speed	3602
Gen MW Output	20.0
Gen Megavar Out	5.98
Gen Voltage	13.8
Gen Amperease	897
Turb L.O. Press	50.4
Turb L.O. Temp	143
Trb Scv oil Prs	5.9
Gen L.O. Press	29.5
Gen L.O. Temp	141
Fuel Gas Flow	10596
Inj Water Flow	7582
Inj Water Ratio	0.71
Fuel Manfld Prs	279
Inj Manfld Prs	256
Comp Inlet Temp	70.8
Comp Disch Prs	250
Gas Supply Prs	411
Gas Supply Tmp	91.2

ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 14:32:49

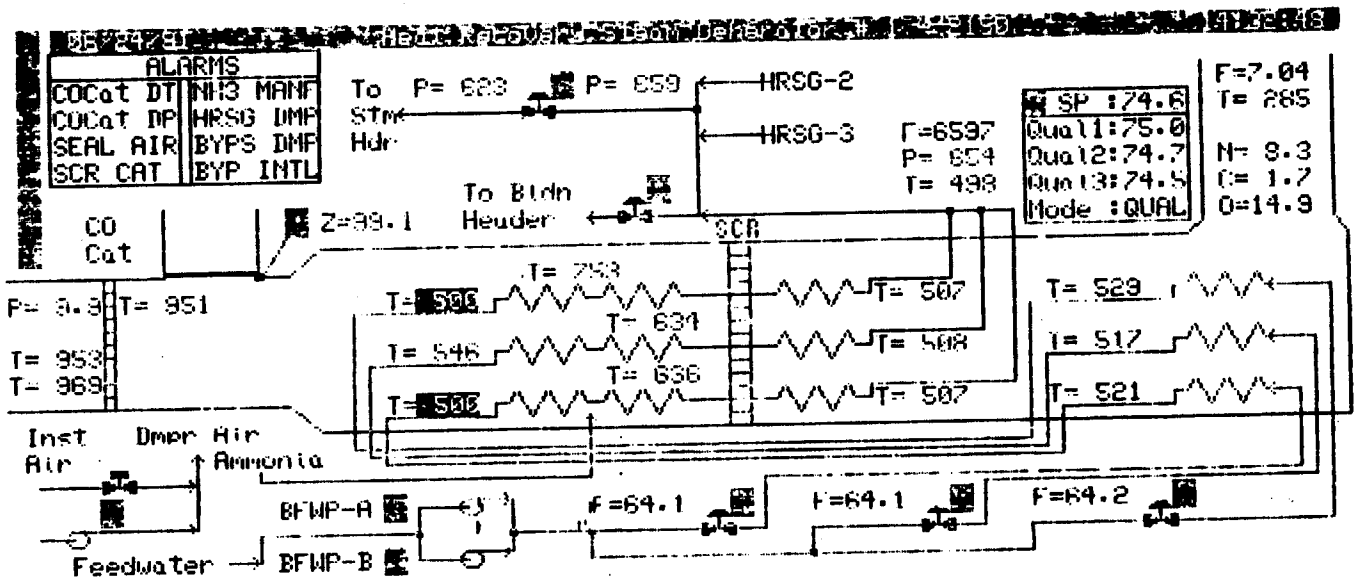

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 14:59:26

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 14:59:22

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10552	PPH
6	FT1243		INJECTION WATER FLOW	7540.6	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.36	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	284.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. POINT ID

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

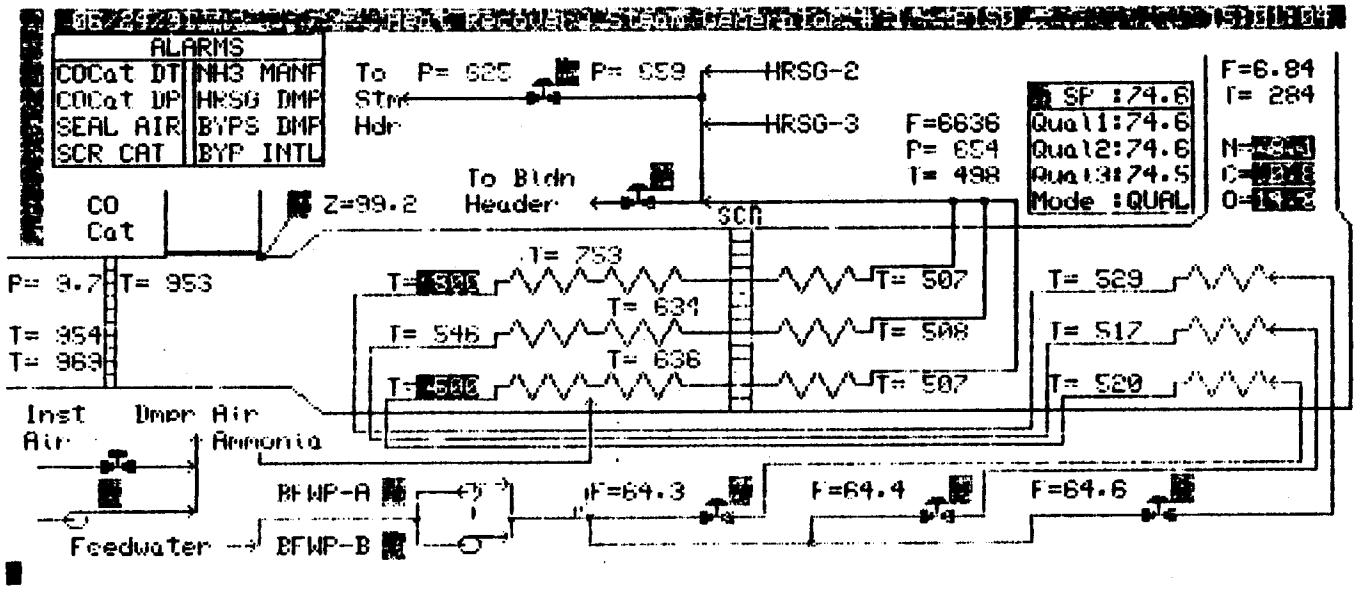
DATE: 06/24/91 TIME: 15:00:50

Gas Gen Speed	9413			
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.70	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	894	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.2	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	144	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.5	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	23.3	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	141	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10616	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7472	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.70	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	71.9	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	250	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	413	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	91.2	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 15:01:09



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 15:29:39

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 15:29:36

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FI1249		FUEL GAS MASS FLOW	10596	PPH
6	FT1243		INJECTION WATER FLOW	7567.9	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.13	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.36	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	285.1	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PAT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 15:30:23

Gas Gen Speed	9443
Pwr Trb Speed	3597
Gen MW Output	20.1
Gen Megavar Out	5.95
Gen Voltage	13.7
Gen Amperease	899
Turb L.O. Press	58.6
Turb L.O. Temp	144
Trb Scv oil Prs	5.9
Gen L.O. Press	29.6
Gen L.O. Temp	141
Fuel Gas Flow	10596
Inj Water Flow	7636
Inj Water Ratio	0.72
Fuel Manfld Prs	279
Inj Manfld Prs	257
Comp Inlet Temp	71.5
Comp Disch Prs	251
Gas Supply Prs	414
Gas Supply Tmp	91.4

ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
MG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 15:32:09

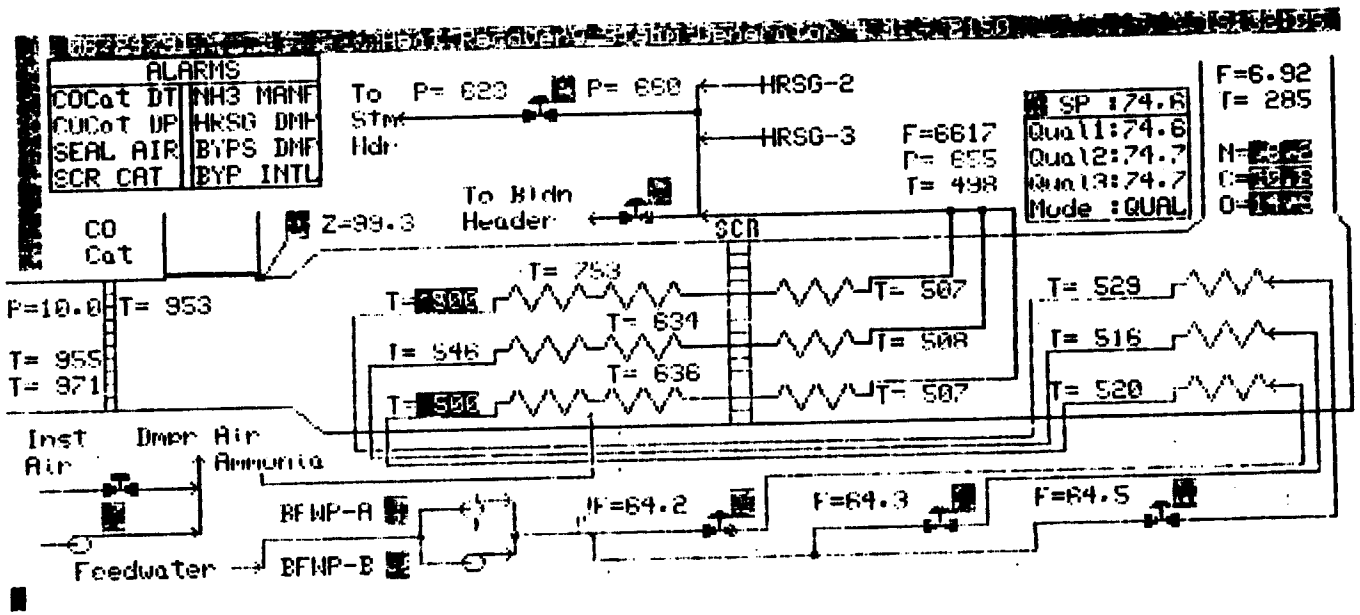


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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 16:01:44

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 16:01:41

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7540.6	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.95	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING [	10.46	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	283.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

[redacted] ADD POINT

[redacted] DELETE POINT

[redacted]

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 16:03:06

Gas Gen Speed	9431
Pwr Trb Speed	3602
Gen MW Output	20.0
Gen Megavar Out	5.88
Gen Voltage	13.7
Gen Amperage	897
Turb L.O. Press	50.5
Turb L.O. Temp	144
Trb Scv oil Prs	5.7
Gen L.O. Press	23.4
Gen L.O. Temp	141
Fuel Gas Flow	10538
Inj Water Flow	7513
Inj Water Ratio	0.71
Fuel Manfld Prs	278
Inj Manfld Prs	257
Comp Inlet Temp	71.5
Comp Disch Prs	250
Gas Supply Prs	416
Gas Supply Tmp	91.0

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 16:05:14

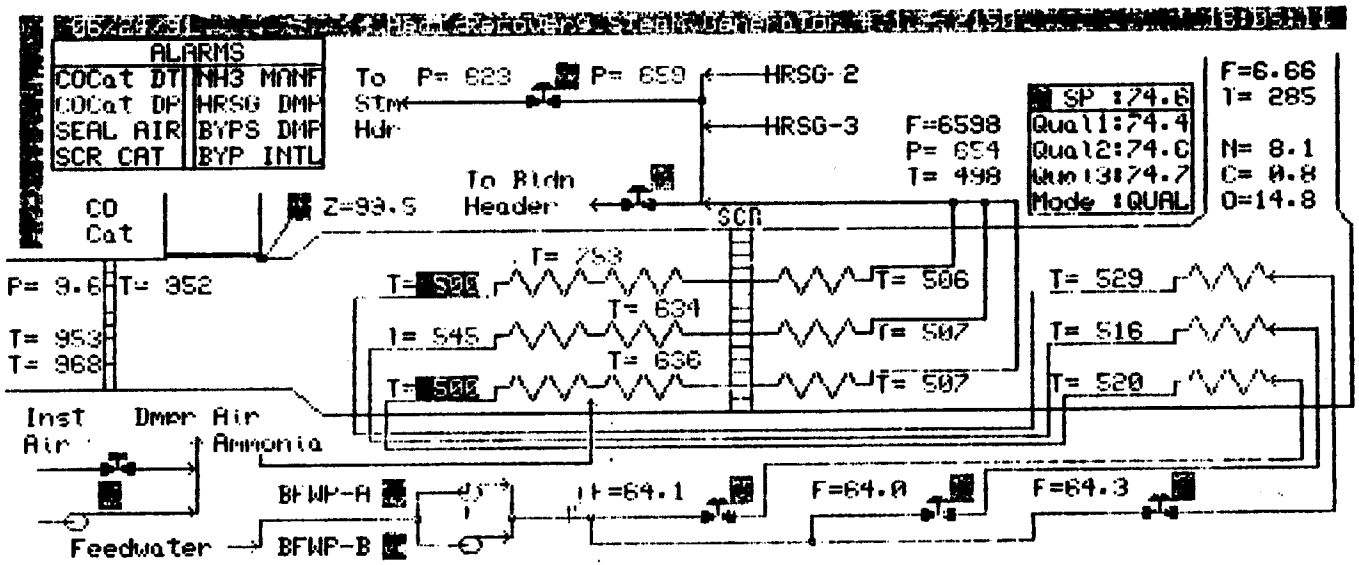

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 16:37:38

24/JUN/91 GROUP 5006 MACAS - GROUP 5006 TYPE MAIN 16:37:38

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10616	PPH
6	FT1243		INJECTION WATER FLOW	7485.8	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.32	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	285.0	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 16:37:59

Gas Gen Speed	9431
Pwr Trb Speed	3597
Gen MW Output	20.0
Gen Megavar Out	5.70
Gen Voltage	13.7
Gen Amperage	896
Turb L.O. Press	50.5
Turb L.O. Temp	143
Trb Scv oil Prs	5.9
Gen L.O. Press	23.5
Gen L.O. Temp	141
Fuel Gas Flow	10538
Inj Water Flow	7554
Inj Water Ratio	0.72
Fuel Manfld Prs	278
Inj Manfld Prs	257
Comp Inlet Temp	71.5
Comp Disch Prs	251
Gas Supply Prs	417
Gas Supply Tmp	91.0

ALARMS & SHUTDOWNS

	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 16:39:53

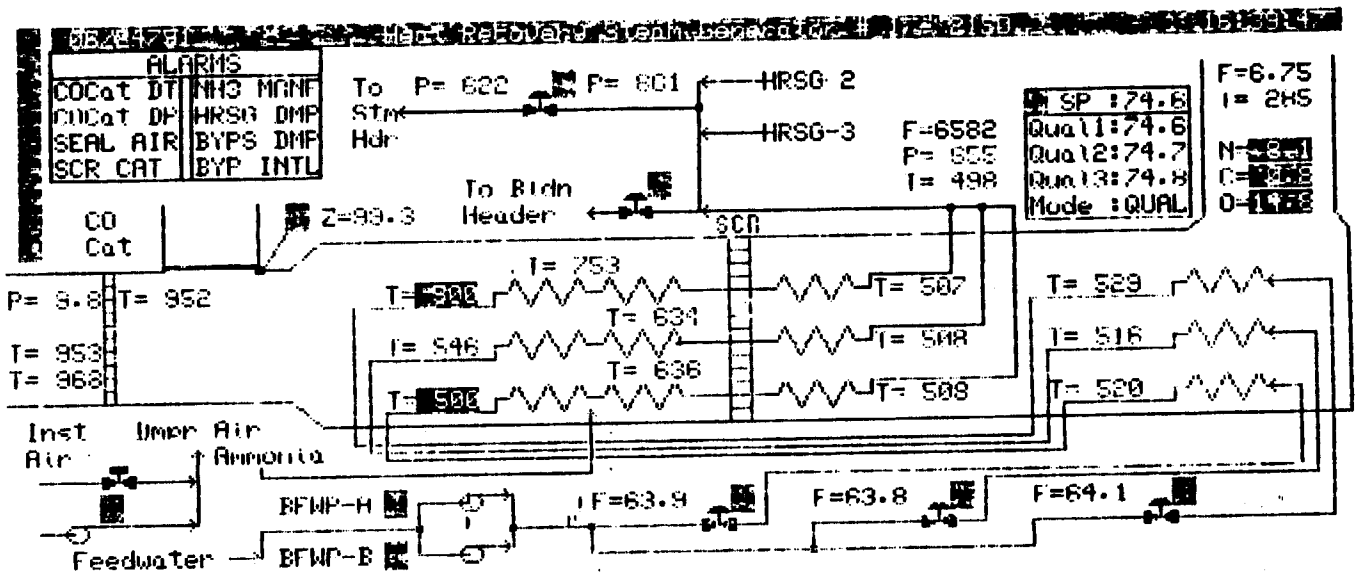

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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 16:59:54

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 16:59:51

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10557	PPH
6	FT1243		INJECTION WATER FLOW	7513.2	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.99	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.50	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	285.0	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

ENT NO. [redacted] POINT ID [redacted]

F1 ADD POINT

F2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

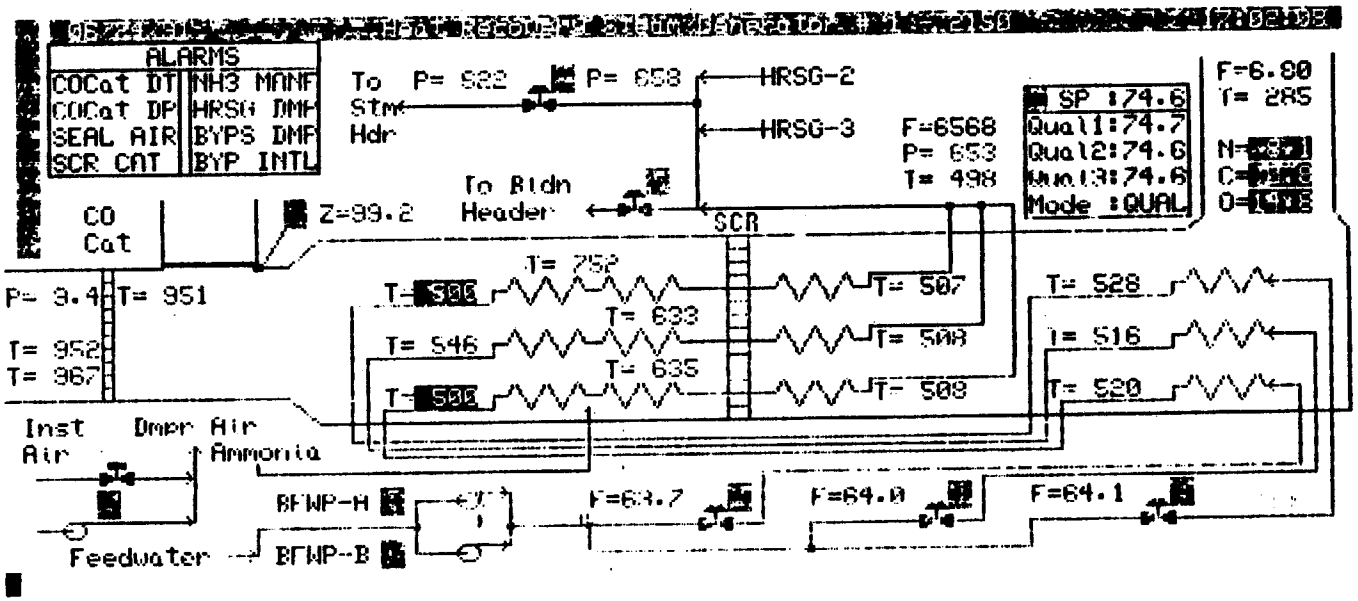
DATE: 06/24/91 TIME: 17:01:16

06/24/91		[illegible]	[illegible]	[illegible]
Gas Gen Speed	9419			
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.81	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	894	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.4	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.7	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	23.4	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	141	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10635	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7541	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	278	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	71.0	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	418	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	90.6	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 17:02:13



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 17:37:39

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 17:37:36

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10577	PPH
6	FT1243		INJECTION WATER FLOW	7513.2	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.40	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	285.1	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

F1 ADD POINT

F2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 17:38:29

Gas Gen Speed	9408
Pwr Trb Speed	3597
Gen MW Output	20.0
Gen Megavar Out	5.84
Gen Voltage	13.7
Gen Amperease	890
Turb L.O. Press	50.3
Turb L.O. Temp	143
Trb Scv oil Prs	5.9
Gen L.O. Press	29.3
Gen L.O. Temp	141
Fuel Gas Flow	10538
Inj Water Flow	7527
Inj Water Ratio	0.71
Fuel Manfld Prs	277
Inj Manfld Prs	257
Comp Inlet Temp	70.8
Comp Disch Prs	250
Gas Supply Prs	422
Gas Supply Tmp	90.2

ALARMS & SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 17:39:30

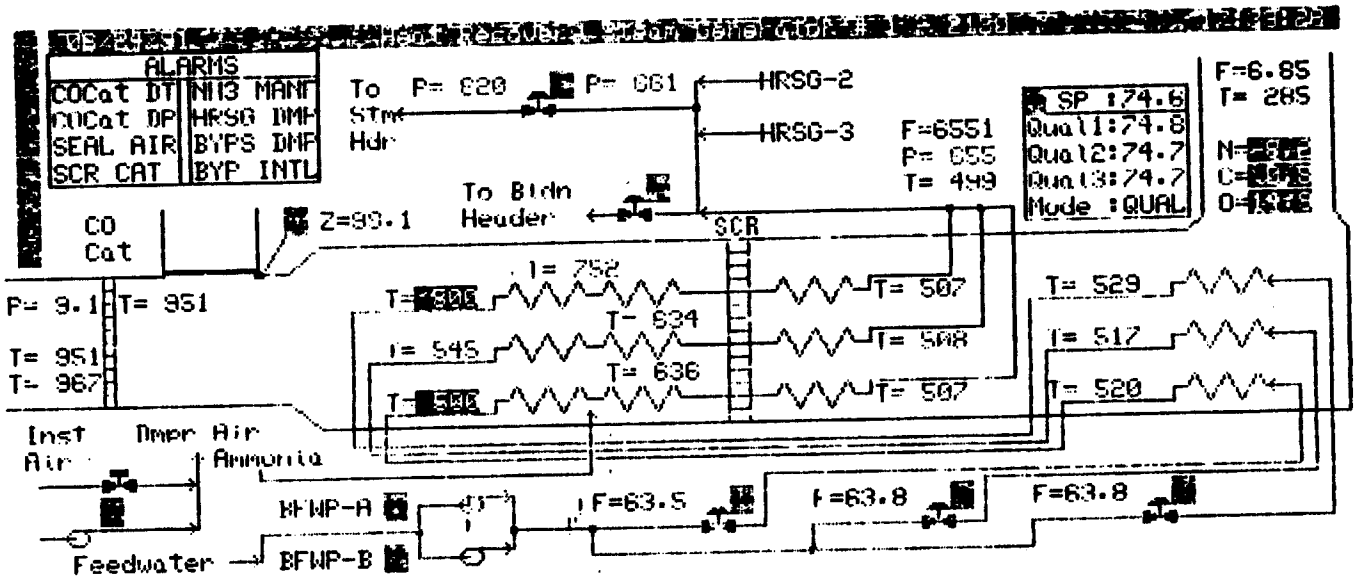


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DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 17:56:52

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 17:56:49

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7540.6	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.37	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	284.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/24/91 TIME: 18:00:03

Gas Gen Speed	9431
Pwr Trb Speed	3597
Gen MW Output	20.0
Gen Megavar Out	5.77
Gen Voltage	13.7
Gen Amperease	893
Turb L.O. Press	50.1
Turb L.O. Temp	143
Trb Scv oil Prs	4.9
Gen L.O. Press	23.0
Gen L.O. Temp	141
Fuel Gas Flow	10596
Inj Water Flow	7513
Inj Water Ratio	0.71
Fuel Manfld Prs	278
Inj Manfld Prs	257
Comp Inlet Temp	71.0
Comp Disch Prs	251
Gas Supply Prs	422
Gas Supply Tmp	90.2

LOCAL EMER STOP
REMOTE EMER STOP
FIRE
FAIL TO CRANK
FAIL TO IGNITE
FLAME OUT
TURBINE OVERTEMP
GG FAIL TO ACCEL
PT FAIL TO ACCEL
GAS GEN UNDERSPD
PWR TRB UNDERSPD
VIBRATN SYS MALF
FUEL GAS PRS HI
GOVERNOR SYSTEM
TRBN LOCKOUT RLY
HIGH VIBRATION
GAS GEN OVERSPD
PWR TRB OVERSPD
START OVER TEMP

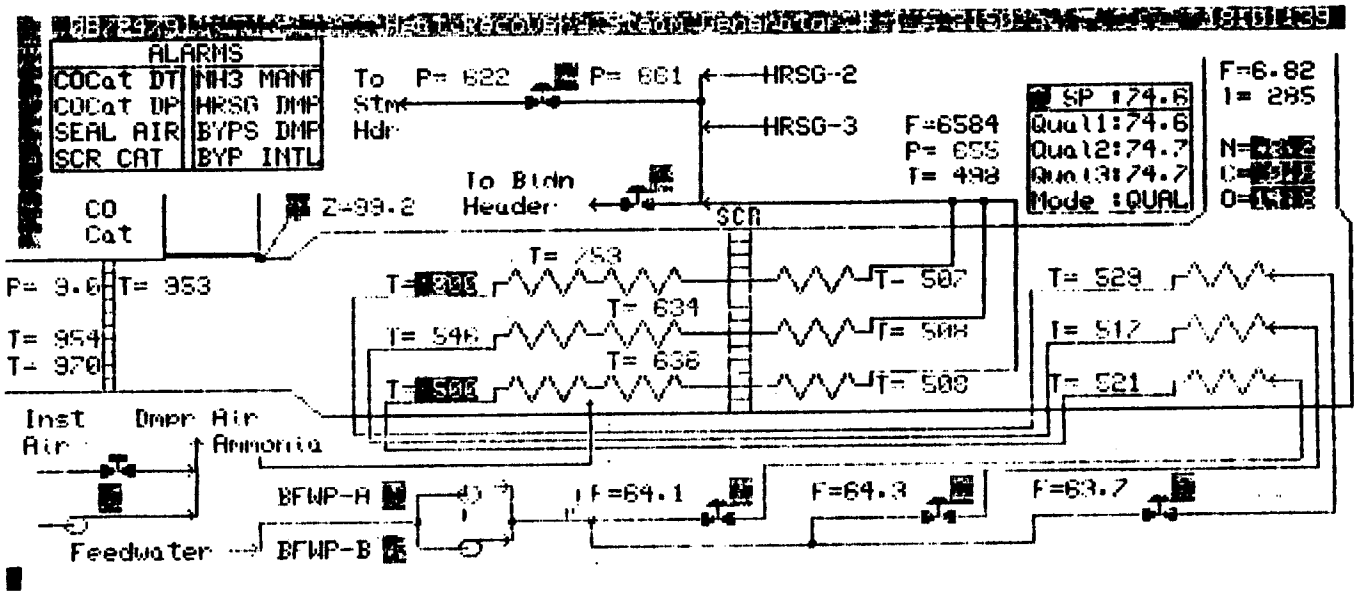
TURB LOW OIL PRS
TURB LOW OIL TMP
TRB ACC GBOX TMP
AIR IN FILT D.P.
SCV OIL FILT DP
GEN LOW OIL PRS
GEN LOW OIL TEMP
GEN BRG D.E. TMP
GEN OIL D.E. TMP
GEN BRG X.E. TMP
GEN OIL X.E. TMP
SUMP A SCAV TEMP
SUMP B SCAV TEMP
SUMP C SCAV TEMP
SUMP D SCAV TEMP
GEN ENCL AIR TEMP
TRB ENCL AIR TEMP
GEN AIR OUT TEMP
EXCITR AIR TEMP

STATOR TEMP A1
STATOR TEMP A2
STATOR TEMP B1
STATOR TEMP B2
STATOR TEMP C1
STATOR TEMP C2
HALON
TRB ROOM LFL
GEN ROOM LFL
120 VOLT BATTERY
24 VOLT BATTERY
START SYS SUMMRY
UPS FAILURE
AC OIL PUMP FAIL
DC OIL PUMP FAIL
AUX OIL PUMP
GEN FAIL TO SYNC
UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 18:01:45



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 18:42:56

24/JUN/91 GROUP 5006 MACAS - GROUP 5006 TYPE MAIN 18:42:50

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4				10616	PPH
5	FT1249		FUEL GAS MASS FLOW	7567.9	PPH
6	FT1243		INJECTION WATER FLOW	20.02	MW
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	10.53	PPH
8	FY8528		MASS FLOW AMMONIA TO MIXING T	284.7	DEGF
9	TE1324		HRSG-01 STACK GAS TEMP		
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PAT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

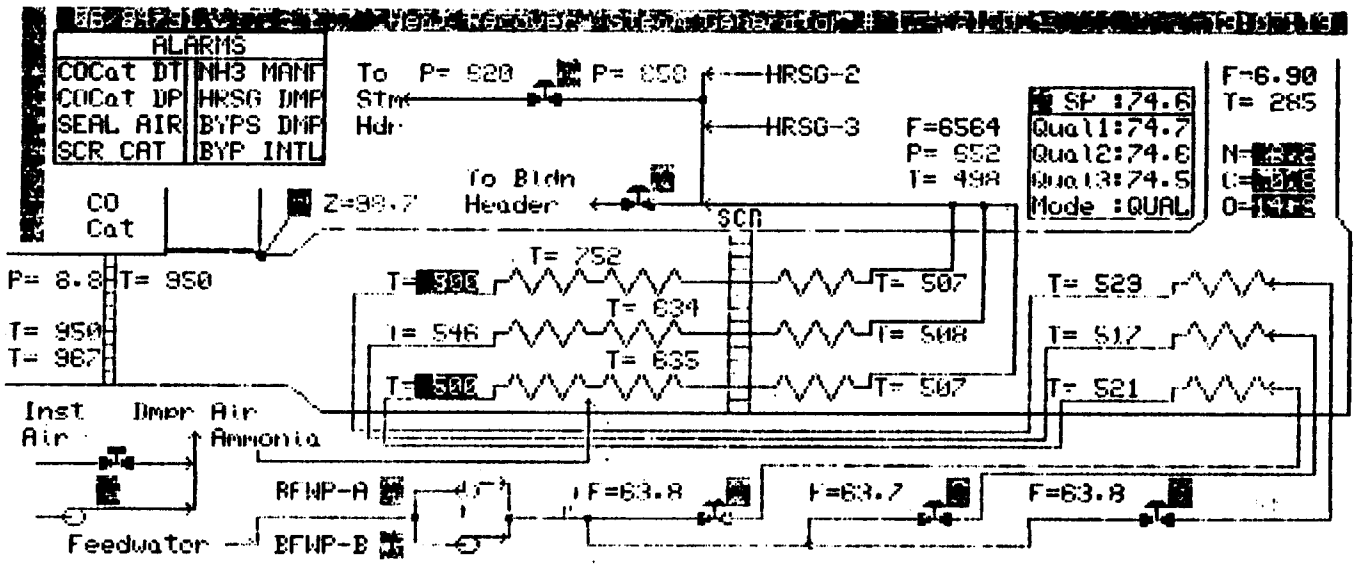
DATE: 06/24/91 TIME: 18:45:17

		ALARMS & SHUTDOWNS		
Gas Gen Speed	9419			
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.1	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.84	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	894	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.3	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.9	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.9	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	140	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10557	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7568	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.72	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	278	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	70.5	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	436	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	89.3	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 19:07:24



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/24/91 TIME: 19:35:07

24/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 19:35:04

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10518	PPH
6	FT1243		INJECTION WATER FLOW	7485.8	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING I	10.67	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	284.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

F1 ADD POINT

F2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

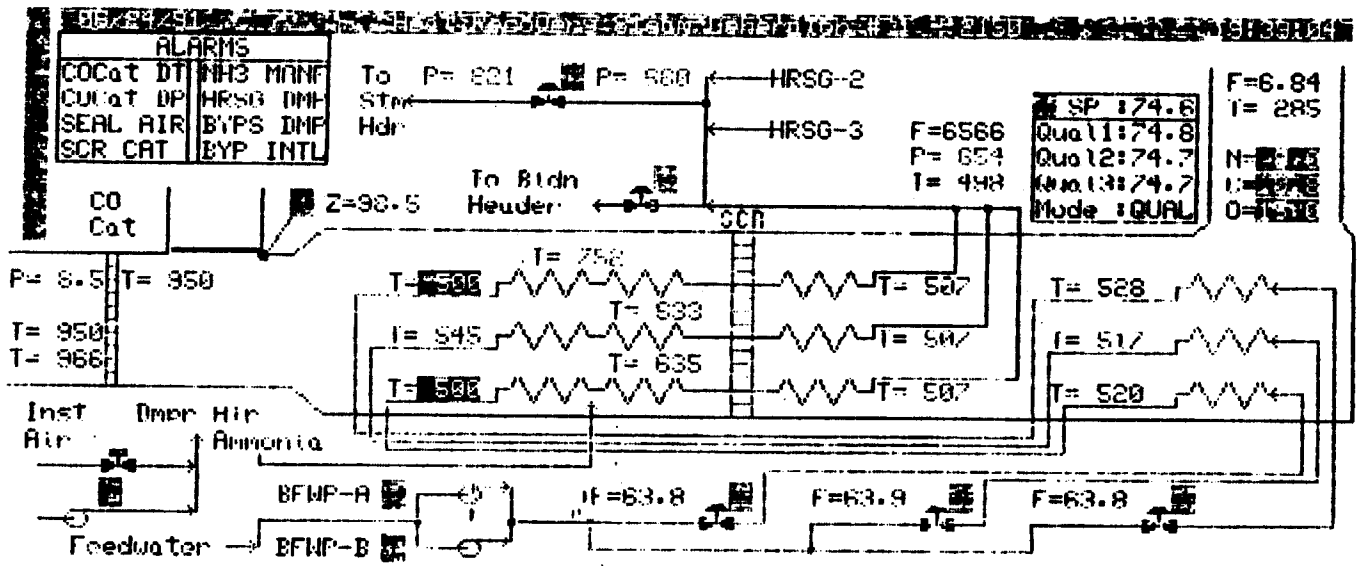
DATE: 06/24/91 TIME: 19:36:32

Gas Gen Speed	9431			
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.70	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.8	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	894	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.4	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.3	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	23.7	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	140	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10557	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7445	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	278	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	256	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	69.8	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	437	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	85.5	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/24/91 TIME: 19:39:06



COPY IN PROGRESS.

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 07:23:58

25/JUN/91 GROUP 5000 MACOR - GROUP 5000 TYPE MAIN 07:23:53

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10440	PPH
6	FT1243		INJECTION WATER FLOW	7390.0	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.95	MW
8	FYA528		MASS FLOW AMMONIA TO MIXING I	10.55	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	292.8	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

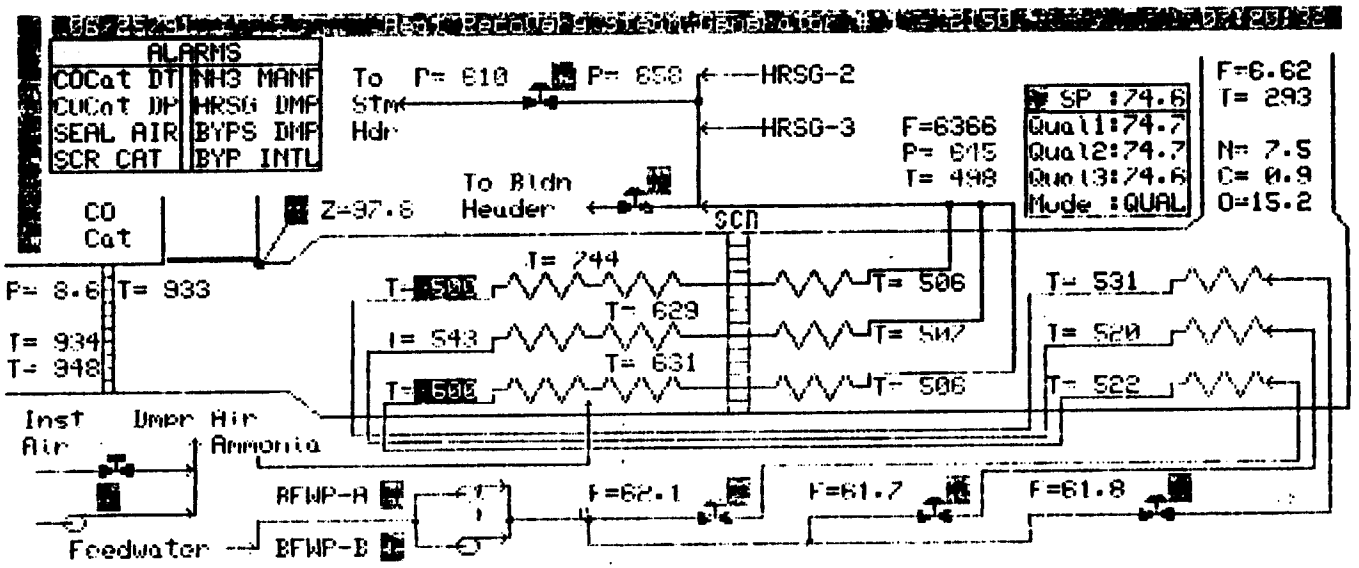
DATE: 06/25/91 TIME: 07:20:14

		ALARMS & SHUTDOWNS		
Gas Gen Speed	9361			
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	19.9	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.88	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	893	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.5	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	141	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.9	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.5	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	138	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10420	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7322	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.70	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	255	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	62.0	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	437	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	75.0	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 07:20:38



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 08:28:42

25/JUN/91 GROUP 5006 MAJOR - GROUP 5006 TYPE MAIN 08:28:39

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10362	PPH
6	FT1243		INJECTION WATER FLOW	7307.9	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING 1	10.31	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	290.7	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. POINT ID

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/25/91 TIME: 08:30:05

Gas Gen Speed	9372
Pwr Trb Speed	3597
Gen MW Output	19.9
Gen Megavar Out	5.91
Gen Voltage	13.7
Gen Amperage	894
Turb L.O. Press	50.6
Turb L.O. Temp	142
Trb Scv oil Prs	6.4
Gen L.O. Press	29.4
Gen L.O. Temp	138
Fuel Gas Flow	10381
Inj Water Flow	7308
Inj Water Ratio	0.70
Fuel Manfld Prs	278
Inj Manfld Prs	256
Comp Inlet Temp	66.1
Comp Disch Prs	250
Gas Supply Prs	435
Gas Supply Tmp	79.2

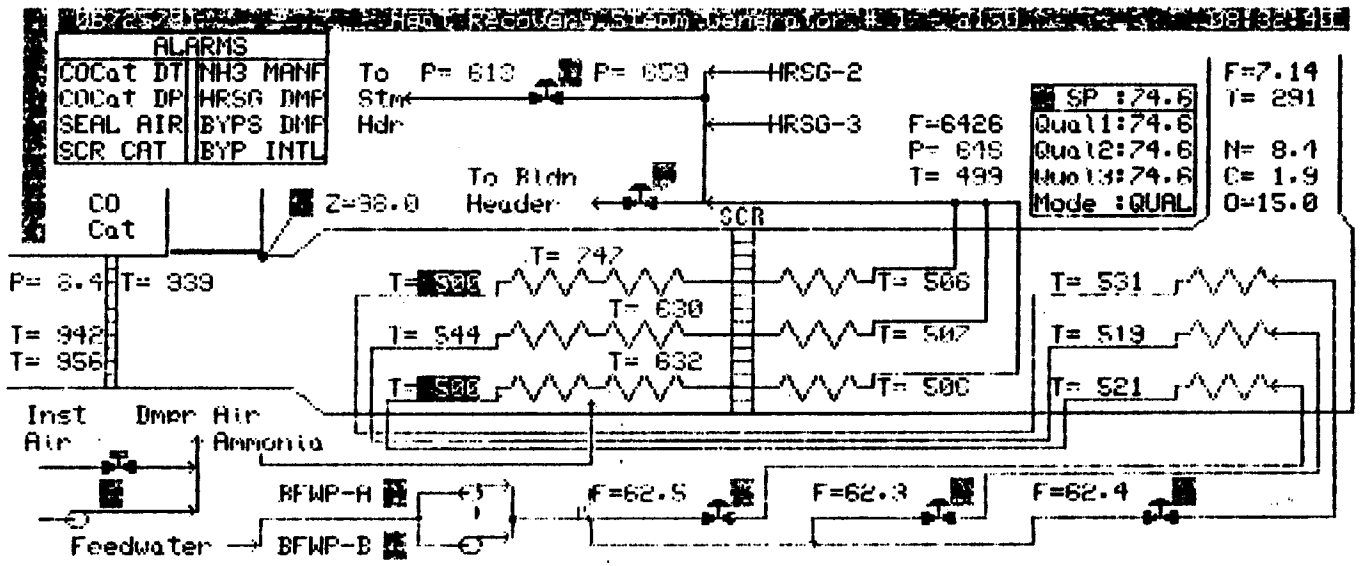
ALARMS/SHUTDOWNS

LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
GG FAIL TO ACCEL	GEN BRG D.E. TMP	
PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
TRDN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 08:32:43



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 09:01:17

25/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 09:01:14

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10479	PPH
6	FT1243		INJECTION WATER FLOW	7403.7	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	20.02	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING 1	10.52	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	289.8	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

END NO. [illegible] POINT ID [illegible]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

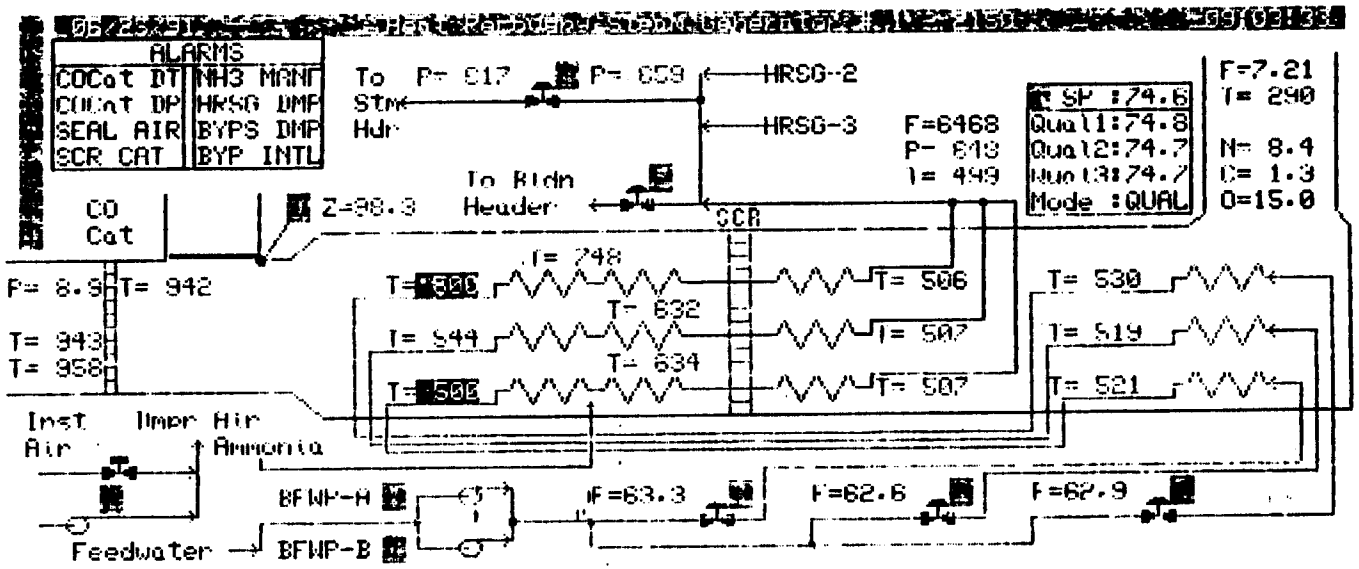
DATE: 06/25/91 TIME: 09:03:08

		ALARMS & SHUTDOWNS		
Gas Gen Speed	9336			
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.1	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.88	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	897	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.4	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.5	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.4	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10499	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7472	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	68.8	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	436	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	80.5	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 09:03:38



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 09:42:36

25-JUN-91 GROUP 5006 MACAG - GROUP 5006 TYPE MAIN 09:42:34

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10401	PPH
6	FT1243		INJECTION WATER FLOW	7321.6	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING [	10.48	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	290.3	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

DATE: 06/25/91 TIME: 09:43:26

Gas Gen Speed	9361	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	19.9	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.84	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	890	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.5	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	6.3	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.6	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	138	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10420	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7363	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	278	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	65.1	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	251	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	434	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	81.3	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 09:44:26

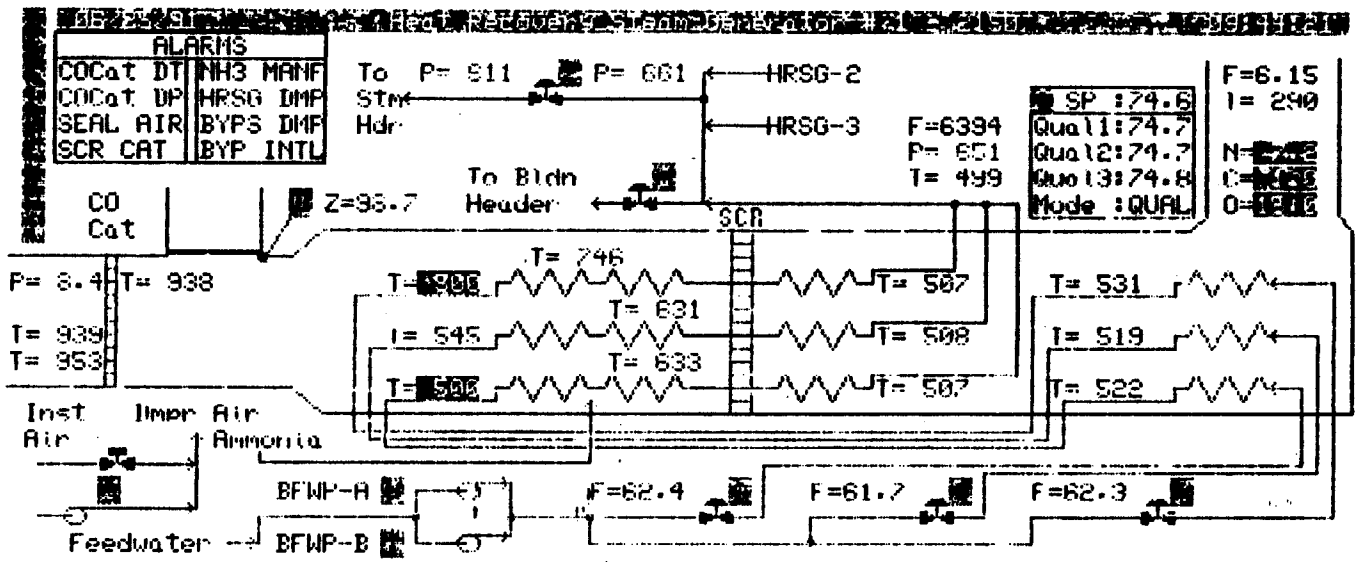


DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 10:01:30

25/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 10:01:27

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10479	PPH
6	FT1243		INJECTION WATER FLOW	7349.0	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.99	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.36	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	290.9	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. POINT ID

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

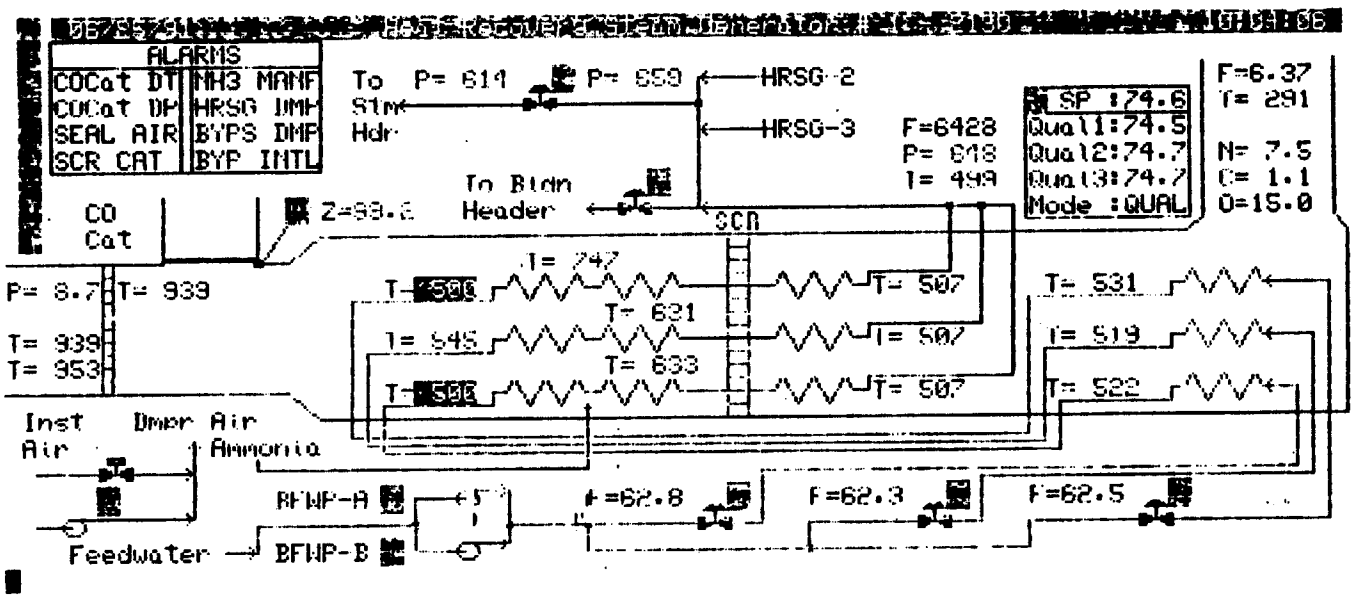
DATE: 06/25/91 TIME: 10:02:50

Gas Gen Speed	9384	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.98	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	891	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.5	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	142	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	6.1	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.7	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10479	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7390	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.70	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	280	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	257	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	84.3	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	254	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	436	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	83.8	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 10:04:11



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 10:50:40

25/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 10:50:37

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10518	PPH
6	FT1243		INJECTION WATER FLOW	7390.0	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.92	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING I	10.19	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	289.7	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

FNI NO. [redacted] POINT ID [redacted]

F1 ADD POINT

F2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

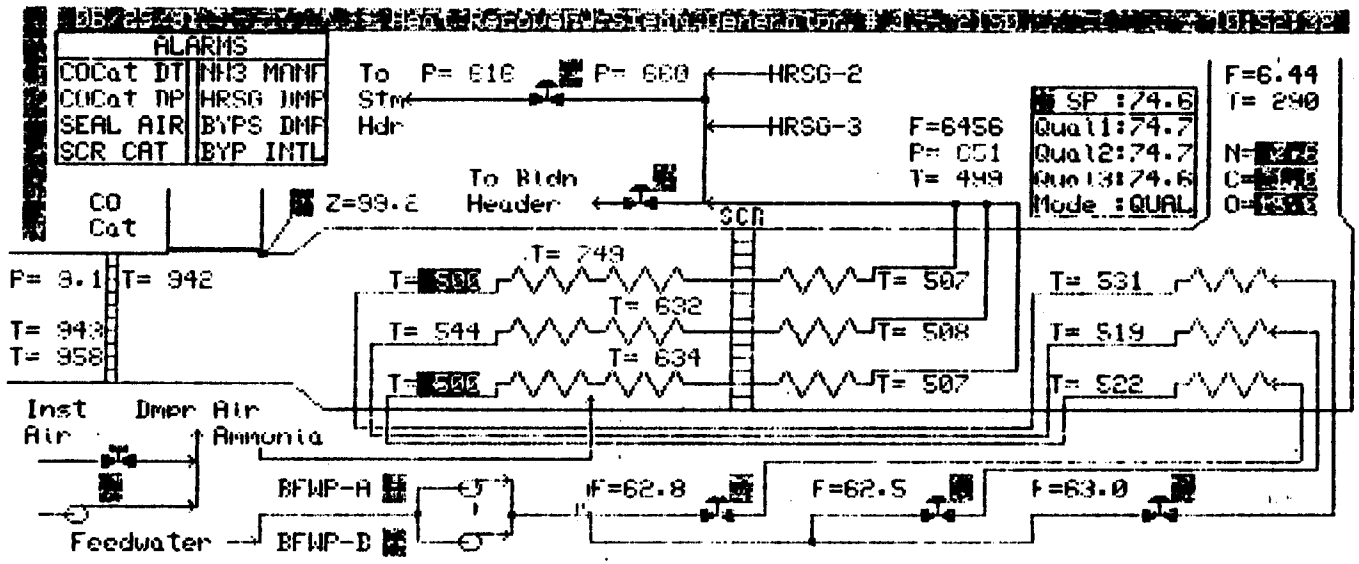
DATE: 06/25/91 TIME: 10:51:13

Gas Gen Speed	9396	ALARMS & SHUTDOWNS		
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.84	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	891	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.6	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	6.1	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	29.9	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10459	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7417	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.70	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	274	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	256	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	66.6	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	250	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	436	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	83.8	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 10:52:33



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 11:01:21

25/JUN/91 GROUP 5006 MAC06 - GROUP 5006 TYPE MAIN 11:01:17

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7403.7	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.95	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.04	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	289.7	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

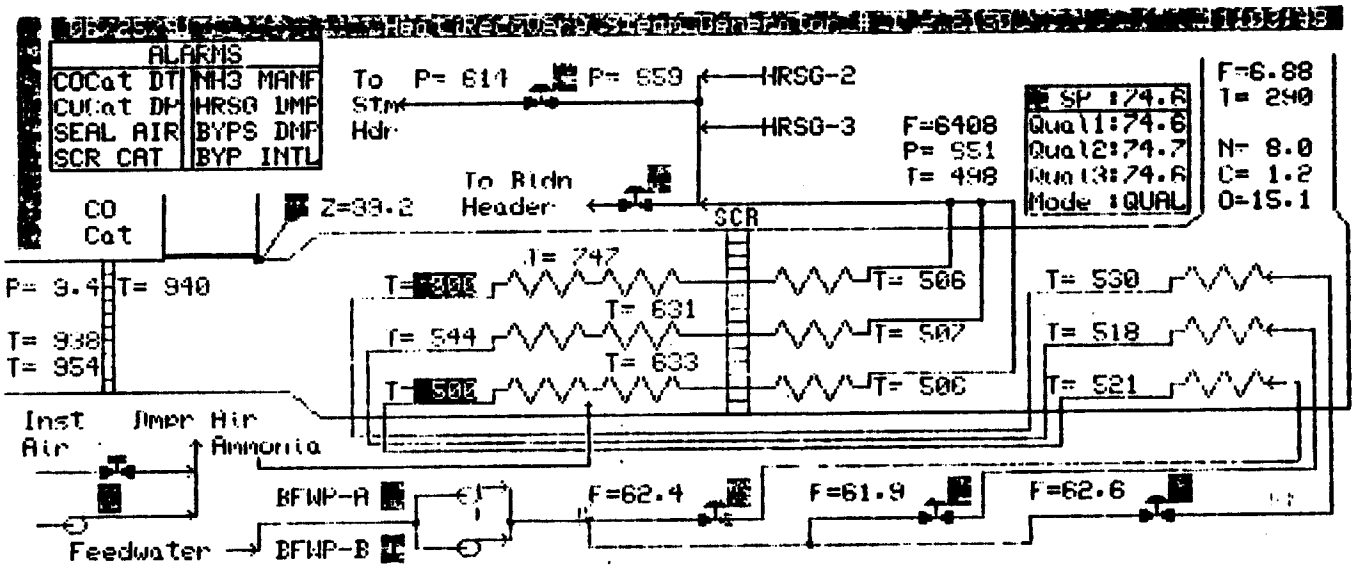
DATE: 06/25/91 TIME: 11:02:34

		ALARMS & SHUTDOWNS		
Gas Gen Speed	9361			
Pwr Trb Speed	3597	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.81	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	893	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.1	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.3	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	23.5	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10518	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7390	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.70	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	278	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	256	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	65.2	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	254	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	435	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	84.7	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 11:03:55



COPY IN PROGRESS

DIAGRAM NUMBER: 1005 VERSION: 8

DATE: 06/25/91 TIME: 11:27:32

25/JUN/91 GROUP 5006 MACAR - GROUP 5006 TYPE MAIN 11:27:29

GRP POS	POINT ID	ALARM	DESCRIPTION	VALUE	UNITS
1					
2					
3					
4					
5	FT1249		FUEL GAS MASS FLOW	10538	PPH
6	FT1243		INJECTION WATER FLOW	7417.4	PPH
7	MEGWATT1		MW LOW ADJUST LOAD OR WASH	19.95	MW
8	FY8528		MASS FLOW AMMONIA TO MIXING T	10.13	PPH
9	TE1924		HRSG-01 STACK GAS TEMP	288.8	DEGF
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					

PNT NO. [redacted] POINT ID [redacted]

P1 ADD POINT

P2 DELETE POINT

COPY IN PROGRESS

DIAGRAM NUMBER: 2100 VERSION: 1

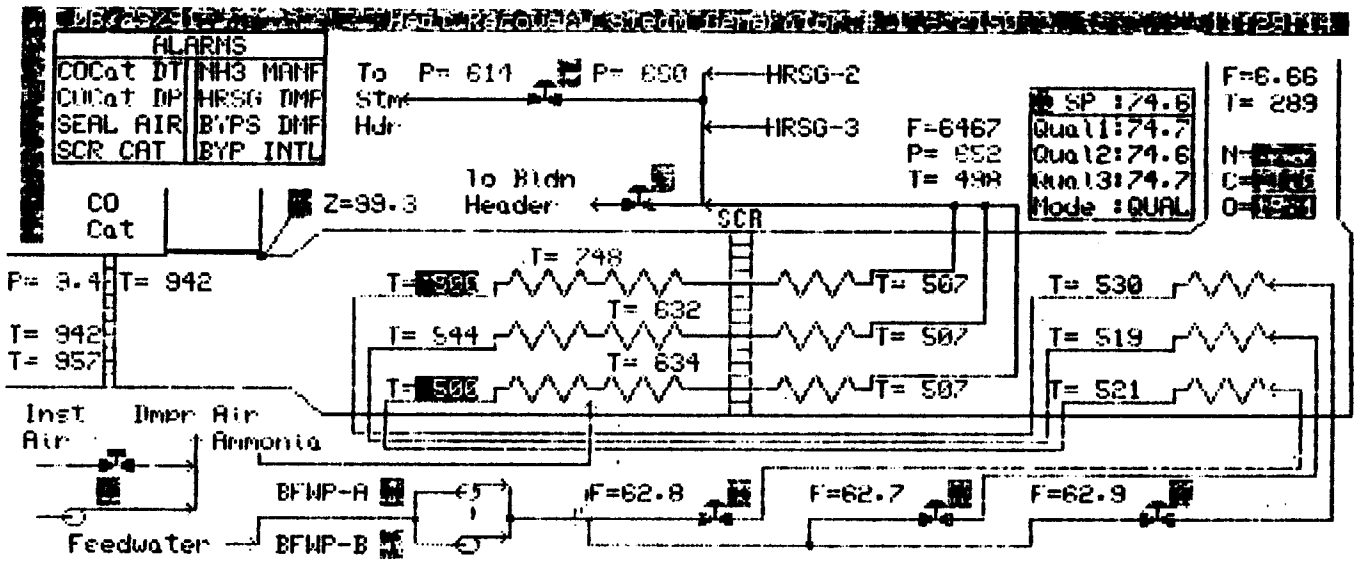
DATE: 06/25/91 TIME: 11:28:04

Gas Gen Speed	9396	ALARMS/SHUTDOWNS		
Pwr Trb Speed	3602	LOCAL EMER STOP	TURB LOW OIL PRS	STATOR TEMP A1
Gen MW Output	20.0	REMOTE EMER STOP	TURB LOW OIL TMP	STATOR TEMP A2
Gen Megavar Out	5.74	FIRE	TRB ACC GBOX TMP	STATOR TEMP B1
Gen Voltage	13.7	FAIL TO CRANK	AIR IN FILT D.P.	STATOR TEMP B2
Gen Amperage	893	FAIL TO IGNITE	SCV OIL FILT DP	STATOR TEMP C1
Turb L.O. Press	50.6	FLAME OUT	GEN LOW OIL PRS	STATOR TEMP C2
Turb L.O. Temp	143	TURBINE OVERTEMP	GEN LOW OIL TEMP	HALON
Trb Scv oil Prs	5.5	GG FAIL TO ACCEL	GEN BRG D.E. TMP	
Gen L.O. Press	23.6	PT FAIL TO ACCEL	GEN OIL D.E. TMP	TRB ROOM LFL
Gen L.O. Temp	139	GAS GEN UNDERSPD	GEN BRG X.E. TMP	GEN ROOM LFL
Fuel Gas Flow	10479	PWR TRB UNDERSPD	GEN OIL X.E. TMP	120 VOLT BATTERY
Inj Water Flow	7445	VIBRATN SYS MALF	SUMP A SCAV TEMP	24 VOLT BATTERY
Inj Water Ratio	0.71	FUEL GAS PRS HI	SUMP B SCAV TEMP	START SYS SUMMRY
Fuel Manfld Prs	279	GOVERNOR SYSTEM	SUMP C SCAV TEMP	UPS FAILURE
Inj Manfld Prs	256	TRBN LOCKOUT RLY	SUMP D SCAV TEMP	AC OIL PUMP FAIL
Comp Inlet Temp	66.6	HIGH VIBRATION	GEN ENCL AIR TEMP	DC OIL PUMP FAIL
Comp Disch Prs	250	GAS GEN OVERSPD	TRB ENCL AIR TEMP	AUX OIL PUMP
Gas Supply Prs	434	PWR TRB OVERSPD	GEN AIR OUT TEMP	GEN FAIL TO SYNC
Gas Supply Tmp	95.3	START OVER TEMP	EXCITR AIR TEMP	UTIL FAIL SYNC

COPY IN PROGRESS

DIAGRAM NUMBER: 2150 VERSION: 3

DATE: 06/25/91 TIME: 11:29:19



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APPENDIX L

Fuel Gas Usage and Analysis - Steam Generator

DATE: 6/26/91

FIELD: KERN RIVER LEASE: RAMBLER

EQUIP. #.	R-7	R-7	R-7	R-7	R-7	R-7			
TIME.	0700	0813	0855	1000	1104	1203			
EFF. %.	88.4	88.3	87.8	87.6	86.7	87.3			
QUAL. %.	76.0	75.5	73.5	73.5	74.0	73.0			
STK.TEMP.	310	310	310	310	310	310			
STM. TEMP.	511	511	508	508	511	511			
STM. PSI.	673	674	674	674	682	682			
ATM.STM. PSI.	N/A	N/A	N/A	N/A	N/A	N/A			
FUEL OIL PSI.	N/A	N/A	N/A	N/A	N/A	N/A			
FUEL OIL TEMP.	N/A	N/A	N/A	N/A	N/A	N/A			
FDWTR. TEMP.	165	165	167	170	168	168			
FDWTR.MTR. GPM.	92	92	92	92	92	92			
GEN. O2 %.	1.2	1.1	1.2	1.3	1.4	1.2			
TST.VAN O2 %.	N/A	N/A	N/A	N/A	N/A	N/A			
NOX PPM.	N/A	N/A	N/A	N/A	N/A	N/A			
SO2 PPM.	N/A	N/A	N/A	N/A	N/A	N/A			
CO PPM.	N/A	N/A	N/A	N/A	N/A	N/A			
CO2 %.	N/A	N/A	N/A	N/A	N/A	N/A			
FUEL OIL #/Hr. ?	N/A	N/A	N/A	N/A	N/A	N/A			
FUEL GAS MCFH.	45.9	46.0	45.7	45.9	46.0	46.0			
CVR GAS MCFH.	0.35	0.35	0.35	0.35	0.35	0.35			
	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4			

COMMENTS:

DATE: 6/27/91

FIELD: KERN RIVER LEASE: RAMBLER

EQUIP. #.	R-7	R-7	R-7	R-7	R-7	R-7	R-7	R-7	R-7
TIME.	0900	1000	1100	1200	1300	1407	1500	1603	1706
EFF. %.	87.5	87.2	87.2	87.3	87.3	87.4	86.9	88.6	88.7
QUAL. %.	72.0	72.5	74.0	74.5	75.5	75.0	75.0	76.0	75.0
STK.TEMP.	301	301	313	313	313	313	316	310	306
STM. TEMP.	508	508	508	508	511	511	511	508	508
STM. PSI.	666	658	666	666	682	674	682	674	668
ATM.STM. PSI.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FUEL OIL PSI.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FUEL OIL TEMP.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FDWTR. TEMP.	156	158	167	170	172	171	174	171	170
FDWTR.MTR. GPM.	92	92	92	92	92	92	92	92	92
GEN. O2 %.	1.3	1.3	1.2	1.2	1.2	1.2	1.4	1.3	1.2
TST.VAN O2 %.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NOX PPM.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SO2 PPM.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CO PPM.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CO2 %.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FUEL OIL #/Hr.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FUEL GAS MCFH.	45.8	45.9	45.8	45.9	45.7	45.9	45.8	45.9	45.9
CVR GAS MCFH.	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4	7.9/4

COMMENTS:

CVR GAS METER
25#X25" BORE I.D. 2.067"
ORIFICE PLT. 0.500"

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

S.W.E.P.I.
P.O. Box 11164
Bakersfield, CA 93389-1164

Lab. No.: 027970_001
Received: Jun 27, 1991
Reported: Jun 28, 1991

Attention: K.D. Kirkpatrick

Sample Description: Kern River Fuel Gas 6/26/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %	CHONS	Wt %
Hydrogen	0.000	0.000	CARBON	72.60
Carbon Dioxide	1.338	3.455	HYDROGEN	23.59
Oxygen	.072	.135	OXYGEN	2.65
Nitrogen	.702	1.153	NITROGEN	1.15
Carbon Monoxide	0.000	0.000	SULFUR	0.00
Hydrogen Sulfide	0.000	0.000		
Methane	95.101	89.491	Totals	99.99
Ethane	2.195	3.871	Total H/C	.32
Propane	.378	.977		
IsoButane	.034	.116		
N-Butane	.052	.179		
IsoPentane	.017	.072		
N-Pentane	.014	.059		
Hexanes+	.097	.492		
Totals =	100.000	100.000		

SPECIFIC GRAVITY (Air = 1)		.5897
SPECIFIC VOLUME, cu.ft./lb	*	22.22
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	1004.30
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	1021.67 ←
GROSS CALORIFIC VALUE, BTU/lb	**	22702.27
NET CALORIFIC VALUE, BTU/cu.ft.	**	920.86
NET CALORIFIC VALUE, BTU/lb	**	20462.23
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		8.6652
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9979
EPA 'F' Factor @ 68 F:		8629.039 DSCF / MM Btu.
KCAPCD 'F' Factor @ 60 F:		8499.604 DSCF / MM Btu. ←

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

Maryann W. Benoit
Organics Supervisor

Richard L. Penner
Laboratory Director

4309 Armour Avenue Bakersfield, California 93308

(805) 395-0539 FAX (805) 395-3069

ZALCO LABORATORIES, INC.

Analytical & Consulting Services

S.W.E.P.I.
P.O. Box 11164
Bakersfield, CA 93389-1164

Lab. No.: 027970_002
Received: Jun 27, 1991
Reported: Jun 28, 1991

Attention: K.D. Kirkpatrick

Sample Description: Rambler #7 CVR Gas 6/26/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %
Hydrogen	0.000	0.000
Carbon Dioxide	88.635	94.650
Oxygen	.160	.124
Nitrogen	1.067	.726
Carbon Monoxide	0.000	0.000
Hydrogen Sulfide	.090	.074
Methane	9.746	3.794
Ethane	0.000	0.000
Propane	0.000	0.000
IsoButane	0.000	0.000
N-Butane	0.000	0.000
IsoPentane	0.000	0.000
N-Pentane	0.000	0.000
Hexanes+	.302	.632
Totals =	100.000	100.000

CHONS	Wt %
CARBON	29.18
HYDROGEN	1.06
OXYGEN	68.96
NITROGEN	.73
SULFUR	.07
Totals	100.00
Total H/C	.04

SPECIFIC GRAVITY (Air = 1)		1.4279
SPECIFIC VOLUME, cu.ft./lb	*	9.18
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	112.08
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	114.01 ←
GROSS CALORIFIC VALUE, BTU/lb	**	1046.22
NET CALORIFIC VALUE, BTU/cu.ft.	**	103.03
NET CALORIFIC VALUE, BTU/lb	**	945.46
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		1.8666
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9961
EPA 'F' Factor @ 68 F:	16182.623 DSCF / MM Btu.	
KCAPCD 'F' Factor @ 60 F:	15939.884 DSCF / MM Btu. ←	

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

Maryann W. Benoit
Organics Supervisor

Richard L. Penner
Laboratory Director

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ZALCO LABORATORIES, INC.

Analytical & Consulting Services

S.W.E.P.I.
P.O. Box 11164
Bakersfield, CA 93389-1164

Lab. No.: 027970_003
Received: Jun 27, 1991
Reported: Jun 28, 1991

Attention: K.D. Kirkpatrick

Sample Description: Kern River Gas 6/27/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %	CHONS	Wt %
Hydrogen	0.000	0.000	CARBON	71.95
Carbon Dioxide	1.431	3.697	HYDROGEN	23.43
Oxygen	.335	.628	OXYGEN	3.32
Nitrogen	.789	1.297	NITROGEN	1.30
Carbon Monoxide	0.000	0.000	SULFUR	0.00
Hydrogen Sulfide	0.000	0.000		
Methane	95.122	89.564	Totals	99.99
Ethane	1.829	3.228	Total H/C	.33
Propane	.292	.755		
IsoButane	.055	.186		
N-Butane	.054	.184		
IsoPentane	.011	.047		
N-Pentane	.009	.037		
Hexanes+	.074	.376		
Totals =	100.000	100.000		

SPECIFIC GRAVITY (Air = 1)		.5895
SPECIFIC VOLUME, cu.ft./lb	*	22.23
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	995.15
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	1012.36 ←
GROSS CALORIFIC VALUE, BTU/lb	**	22500.39
NET CALORIFIC VALUE, BTU/cu.ft.	**	912.32
NET CALORIFIC VALUE, BTU/lb	**	20276.96
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		8.5896
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9980
EPA 'F' Factor @ 68 F:		8622.840 DSCF / MM Btu.
KCAPCD 'F' Factor @ 60 F:		8493.497 DSCF / MM Btu. ←

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

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Lab. No.: 027970_004
Received: Jun 27, 1991
Reported: Jun 28, 1991

Attention: K.D. Kirkpatrick

Sample Description: Rambler #7 CVR Gas 6/27/91

* CHROMATOGRAPHIC ANALYSIS (Z 1635) *

Components	Mole %	Wt %
Hydrogen	0.000	0.000
Carbon Dioxide	88.030	94.149
Oxygen	.082	.064
Nitrogen	.812	.553
Carbon Monoxide	0.000	0.000
Hydrogen Sulfide	.097	.080
Methane	10.467	4.081
Ethane	0.000	0.000
Propane	0.000	0.000
IsoButane	0.000	0.000
N-Butane	0.000	0.000
IsoPentane	0.000	0.000
N-Pentane	0.000	0.000
Hexanes+	.512	1.073
Totals =	100.000	100.000

CHONS	Wt. %
CARBON	29.63
HYDROGEN	1.21
OXYGEN	68.54
NITROGEN	.55
SULFUR	.08
Totals	100.00
Total H/C	.04

SPECIFIC GRAVITY (Air = 1)		1.4257
SPECIFIC VOLUME, cu.ft./lb	*	9.19
GROSS CALORIFIC VALUE, BTU/cu.ft.	*	129.20
GROSS CALORIFIC VALUE, BTU/cu.ft.	**	131.43
GROSS CALORIFIC VALUE, BTU/lb	**	1207.89
NET CALORIFIC VALUE, BTU/cu.ft.	**	118.97
NET CALORIFIC VALUE, BTU/lb	**	1093.36
DSCF EXHAUST PER SCF FUEL (0% Oxygen)		2.0076
COMPRESSIBILITY FACTOR 'Z' (60 F,1 ATM)		.9961
EPA 'F' Factor @ 68 F:	15163.461 DSCF / MM Btu.	
KCAPCD 'F' Factor @ 60 F:	14936.009 DSCF / MM Btu.	

* Water Saturated

** Dry Gas @ 60 F, 14.73 psia

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