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FIXED-BED GASIFICATION RESEARCH USING U.S. COALS, VOLUME 15 GASIFICATION OF "FRESH" ROSEBUD SUBBITUMINOUS COAL

Contract H0222001

Black, Sivalls, and Bryson, Incorporated

MASTER

**BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR**

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FOREWORD

This report was prepared by Black, Sivalls & Bryson, Incorporated of Houston, Texas under USBM contract number HO222001. The contract was administered under the technical direction of the Twin Cities Research Center, with Mr. Robert Zahl acting as Technical Project Officer. Mr. Frank Pavlich was the contract administrator for the Bureau of Mines. This report is a partial summary of the work recently completed as a part of this contract during the period June-September 1985. This report was submitted by the authors September 1985.

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The coal gasified during this test was provided by Northern States Power in exchange for coal fines exchanged on an equivalent Btu basis. The University of Minnesota, Particle Technology Laboratory, Minneapolis, Minnesota, a subcontractor to Black, Sivalls & Bryson, Incorporated, participated in the preparation of this report.

TABLE OF CONTENTS

TABLES

FIGURES

INTRODUCTION

Section 1	TEST SUMMARY.....	10
Section 2	TEST OBJECTIVES	
2.1	Selection of Coal for Testing.....	13
2.2	Test Objectives.....	13
2.3	Test Plan.....	13
Section 3	DESCRIPTION OF FUEL TESTED.....	15
Section 4	FACILITY DESCRIPTION	
4.1	Test Facility.....	19
4.1.1	Gas Producer.....	19
4.1.2	Gas Combustor.....	19
4.2	Gas Sampling and Conditioning System.....	19
4.3	Gas Analysis Equipment.....	22
Section 5	TEST PROCEDURES	
5.1	Test Teams.....	24
5.1.1	Gasifier Operation and Overall Coordination.....	24
5.1.2	Gasifier Monitoring.....	24
5.1.3	Stack Gas Sampling.....	25
5.2	Sampling and Data Acquisition Procedures.	25
5.2.1	Continuous Data.....	25
5.2.2	Gas Analysis Data.....	25
5.2.3	Tar and Oil Data.....	25
5.2.4	Coal Data.....	26
5.2.5	Ash Data.....	26
5.2.6	Dust Data.....	26
5.2.7	Retort Particle Sampling.....	26
5.2.8	Retort Temperature and Pressure Data.....	26
Section 6	CONDUCT OF TEST	
6.1	Test History.....	27
6.2	Chronic Problems During BOM/FGT-016.....	27
Section 7	TEST RESULTS	
7.1	Data Summary.....	29
7.1.1	Continuous Output Transducer Data.....	29
7.1.2	Coal, Ash, and Dust Data.....	31
7.1.2.1	Coal Data.....	31
7.1.2.2	Ash Data.....	31
7.1.2.3	Cyclone Dust Data.....	39
7.1.3	Gas Analysis Data.....	39
7.1.4	Tar and Water Yield Data.....	43

7.2	Material and Energy Balance	43
7.3	Grate Performance Model.....	48
7.4	Tar Yield Correlations.....	48
7.5	Combustion Emissions Monitoring.....	58
7.6	Retort Particle Sampling.....	58
Section 8	CONCLUSIONS AND RECOMENDATIONS.....	60
	REFERENCES.....	62
	APPENDICES.....	64

TABLES

- 1-1 Design Point Characteristics for Gasification of Rosebud Subbituminous Coal
- 3-1 Average Analysis of Rosebud Subbituminous Coal
- 3-2 Characteristics of Rosebud Subbituminous Coal with Regard to the Coal Test Objective Matrix
- 4-1 Operating Configuration and Conditions, Hewlett-Packard Model 5880A Gas Chromatograph
- 4-2 Operating Configuration and Conditions, Hewlett-Packard Model 5793 Gas Chromatograph
- 7-1 Summary of Coal, Ash, and Cyclone Dust Analyses
- 7-2 Physical and Chemical Properties of Coal and Cyclone Dust
- 7-3 Elemental Analysis of Moisture-free Ash
- 7-4 Condensed Material Analysis
- 7-5 Material Balance and Thermal Efficiency Calculation
0.33 tn/hr, 139 F
- 7-6 Material Balance and Thermal Efficiency Calculation
0.71 tn/hr, 138 F
- 7-7 Material Balance and Thermal Efficiency Calculation
0.95 tn/hr, 140 F
- 7-8 Material Balance and Thermal Efficiency Calculation
0.34 tn/hr, 144 F
- 7-9 Material Balance and Thermal Efficiency Calculation
0.40 tn/hr, 148 F
- 7-10 Material Balance and Thermal Efficiency Calculation
Rosebud Overall Average

FIGURES

- 2-1 Proposed Test Plan, BOM/FGT-016
- 3-1 Location of the Rosebud Mine
- 4-1 Coal Gasifier Process Flow Schematic,
U.S. Bureau of Mines, Twin Cities Research Center
- 4-2 Schematic Diagram of the Gas Sampling and
Conditioning System
- 6-1 Test History, BOM/FGT-016
- 7-1 Physical Characteristics of the Gasifier Operation
- 7-2 Feed Coal Size Distribution Analysis and Geometric
Mean Coal Particle Size
- 7-3 Average Particle Size Distribution of Feed Coal
- 7-4 Ash Size Distribution Analysis and Geometric Mean
Ash Particle Size
- 7-5 Ash Characteristics and Operating Conditions
- 7-6 Major Gas Species Measured by the Gas Chromatograph
- 7-7 Dry Gas HHV, Major Gas Species and Gasifier Operational
Parameters
- 7-8 Minor Gas Species Measured by the Gas Chromatograph
- 7-9 Total Gas Sulfur and Normalized H₂S and COS Species
Concentrations
- 7-10 Total Gas Sulfur and Normalized Mercaptans and
Higher Order Sulfur Species Concentrations
- 7-11 Tar/Oil Yield and Water Yield with Operating Conditions
- 7-12 Comparison of the Geometrical Grate Performance Model
with Ash Removal Rates
- 7-13 Correlation of Tar Yield with Volatile Matter and Oxygen
- 7-14 Correlation of Tar Yield with Volatile Btu
- 7-15 Dust Carryover vs. Gas Face Velocity

INTRODUCTION

The United States Department of Interior, Bureau of Mines, Twin Cities Research Center, Minneapolis, Minnesota is the site of a 6.5 foot diameter Wellman-Galusha gasifier, installed in 1977-78. This gasifier, combustor/incinerator, and flue gas scrubber system in the past had been operated jointly by Bureau of Mines personnel, personnel from member companies of the Mining and Industrial Fuel Gas Group (MIFGa), and United States Department of Energy (DOE) personnel/consultants. Numerous tests using a variety of coals have to date been performed.

In May of 1982, Black, Sivalls & Bryson, Incorporated was awarded the contract to plan, execute, and report gasification test performance data from this small industrial fixed-bed gasification test facility. BS&B is responsible for program administration, test planning, test execution, and all documentation of program activities and test reports. The University of Minnesota, Particle Technology Laboratory is subcontractor to BS&B to monitor process parameters, and provide analysis for material inputs and outputs.

This report describes BOM/FGT-016, the gasification of Rosebud subbituminous coal, and is the fifteenth volume of the contract final report prepared under contract HO222001. The report covers the test period June 17, 1985 to June 24, 1985.

Section 1 is a brief summary of the testing. Section 2 identifies the test objectives. Section 3 describes the fuel. Sections 4 and 5 describe the facility and monitoring systems. Sections 6 and 7 describe the test and results. Section 8 gives conclusions.

SECTION 1

TEST SUMMARY

Rosebud subbituminous coal gasified during BOM/FGT-016 was freshly mined as compared to the compacted and stored Rosebud tested during BOM/FGT-002. Rosebud is a subbituminous coal mined in large quantities and is readily available in the midwest. The objective of this test was to compare the gasification performance of freshly mined Rosebud to the Rosebud gasified in BOM/FGT-002 which was recovered from an open-air storage site at Northern States Power's Riverside plant. In addition, the previous gasification test of Rosebud (BOM/FGT-002) did not include particulate sampling from the retort, since the procedure and apparatus was not yet developed. Retort particulate sampling began with BOM/FGT-004 (Stahlman Stoker).

The relatively poor performance of Rosebud as a gasifier feedstock established during BOM/FGT-002 was in sharp contrast with the excellent performance of Absaloka/Robinson subbituminous coal during BOM/FGT-012.

Although these coals originate from different seams in the Powder River basin, the principal distinguishing characteristic was their handling once in the Twin Cities. The Absaloka/Robinson coal was delivered to the Bureau of Mines Twin Cities Research Center fresh from the rail cars as they were unloaded at the NSP Highbridge plant, whereas the Rosebud coal was recovered from a compacted open air storage pile.

Therefore, the principal objective of this test was to determine whether the "fresh" and uncompacted Rosebud subbituminous coal would perform as well as the "fresh" uncompacted Absaloka/Robinson coal and better than the compacted Rosebud tested during BOM/FGT-002.

Rosebud subbituminous coal was gasified in a 6.5 foot diameter Wellman-Galusha, atmospheric pressure, air-blown, fixed-bed gas producer, with the gas incinerated in a combustion chamber. The products of combustion were water-quenched, cleaned of sulfur oxides and particulate, and exhausted.

The performance of the freshly mined Rosebud coal in this gasifier was not good. As with test BOM/FGT-002, gas distribution problems (channeling and burning through) and significant ash clinkering were observed. The maximum sustainable load was nominally 1 ton per hour coal consumption, similar to the previous Rosebud test, but substantially below the 2 ton per hour throughput of the Absaloka/Robinson subbituminous coal.

Gas quality ranged from 150 to 170 Btu/scf, with tar/oil yields averaging 0.056 tar/lb coal. Gasifier design point character-

istics for Rosebud based on a relatively stable period of operation, are given in Table 1-1. Fresh Rosebud produced a very high dust loading in the product gas. At the relatively low throughput achievable with Rosebud, the measured dust loadings in the product gas were substantially greater than that measured with the Absaloka/Robinson subbituminous coal (BOM/FGT-012).

TABLE 1-1

Design Point Characteristics for Gasification
of "Fresh-Mined" Rosebud Subbituminous Coal

Coal Throughput - 0.70 tons/hr (42.2 lb/hr/sq ft grate)

Air/Coal	1.87	lb/lb
Steam/Coal	0.28	lb/lb
Blast Saturation Temperature	138	deg F
Gas Offtake Temperature	507	deg F
Wet Gas/Coal	48.3	scf/lb
Gas Dewpoint	130	deg F
Tar Yield	4.7	lb/100 lb/coal
Tar Analysis		
HHV (dry)	16573	Btu/lb
Pour point	75	deg F
Viscosity (210 F)	201	SUS.
Specific Gravity (60/60 F)	1.0472	
Dry Gas Composition (mol.%)		
Hydrogen	16.4	
Carbon Monoxide	30.0	
Methane	1.60	
Ethane	0.12	
Ethylene	0.06	
Carbon Dioxide	4.47	
Nitrogen	46.5	
Water	8.24	lb/1000 dscf
Dry Gas HHV	172	Btu/dscf
Dry Gas LHV	162	Btu/dscf
Thermal Efficiencies		
Hot, Raw	94.5%	
Cold, with Tar	86.0%	
Cold, without Tar	78.0%	

SECTION 2

TEST OBJECTIVES

2.1 SELECTION OF COAL FOR TESTING

Rosebud subbituminous coal had been gasified previously as part of this program (Thimsen, Maurer et al, 1985a.) The results from this previous test were not particularly encouraging for the use of Rosebud coal as a fixed-bed gasification feedstock. These results stand in sharp contrast to the good performance of Absaloka/Robinson subbituminous coal during another test as part of this program (Thimsen, Maurer et al, 1985b.)

Aside from being mined from different seams in the Powder River basin, the primary difference between the two coals identified above is the handling of the coals in the Twin Cities. The Absaloka/Robinson coal was obtained fresh from the rail cars as they were unloaded in Minneapolis. The Rosebud coal was recovered from compacted inventory, parts of which had lain on the ground for up to 1 year.

The primary objective of this test was to see if relatively "fresh" and uncompacted Rosebud subbituminous coal would perform more like the "fresh", uncompacted Absaloka/Robinson coal, or like the compacted Rosebud coal gasified previously.

2.2 TEST OBJECTIVES

- A. Identify maximum gasifier throughput and the limitations to throughput gasifying relatively "fresh", uncompacted Rosebud subbituminous coal.
- B. Determine total product composition and conversion efficiency during gasification of this subbituminous B coal.
- C. Identify gasifier operational requirements for gasifying friable coals.

2.3 TEST PLAN

The proposed test plan is shown in Figure 2-1. Several load levels are shown over a 5-day period to identify maximum throughput, and the limitations to throughput.

Use of the agitator and establishment of optimum blast saturation temperature (steam/air ratio) were left to the facility manager's judgement based on observed performance during the test. The grate spacings were set at 6 inches and 6.5 inches between the upper and middle levels and the middle and lower levels respectively.

FIGURE 2-1
PROPOSED TEST PLAN, BOM/FGT-016

SECTION 3

DESCRIPTION OF FUEL TESTED

The Rosebud subbituminous coal gasified during BOM/FGT-016 is a non-swelling, high-moisture subbituminous B coal mined by Western Energy Company in the Powder River region. Figure 3-1 shows the location of the Rosebud mining operations near Colstrip, Montana. The coal gasified during BOM/FGT-016 was mined from Area A, Section 6, TUP1N, Range 41E of Treasure County, Montana.

The coal gasified during BOM/FGT-016 was loaded onto a unit train on June 8, 1985 and unloaded at the Northern States Power Company Riverside Generating Plant in Minneapolis on June 10, 1985. The uncompacted coal was screened to a bottomsized of 3/4 inch at the Riverside plant before being trucked 13 miles to the test site. Coal deliveries to the test site occurred from June 11 to 14, 1985.

A complete analysis of the Rosebud coal gasified during BOM/FGT-016 along with an analysis of the Rosebud coal gasified during BOM/FGT-002 (Thimsen, Maurer et al, 1985a) is shown in Table 3-1. As can be seen, the analyses of the two coals are substantially the same. Table 3-2 shows how the coal fits into the coal test objective matrix.

FIGURE 3-1
LOCATION OF THE ROSEBUD MINE

Table 3-1

Average Analysis of Rosebud Subbituminous Coal

	BOM/FGT-016	BOM/FGT-002
Proximate Analysis (%)		
Volatile Matter	26.81	29.14
Fixed Carbon	40.12	35.31
Ash	11.82	12.55
Moisture	21.25	23.00
Sulfur	0.87	1.14
Heating Value (Btu/lb)	8881	8354
Ultimate Analysis (%)		
Carbon	52.70	48.86
Hydrogen	3.31	3.27
Nitrogen	0.71	0.68
Sulfur	0.87	1.14
Oxygen	9.35	10.50
Ash	11.82	12.55
Moisture	21.25	23.00
Ash Fusion Temperatures (deg. F):		
Oxidizing:		
Initial Deformation	2290	2280
Softening	2350	2300
Hemispherical	2380	2320
Fluid	2455	2385
Reducing:		
Initial Deformation	2140	2220
Softening	2210	2270
Hemispherical	2245	2280
Fluid	2310	2300
Free Swelling Index:	0	0
Hargrove Grindability Index:	59*	59*

*Information supplied by Western Energy Company.

Table 3-2

Characteristics of Rosebud Subbituminous Coal
with Regard to the Coal Test Objective Matrix

COAL TEST OBJECTIVE MATRIX									
PHYSICAL CHARACTERISTICS		COAL RANK							
TYPE	RANGE	BITUMINOUS	SUB-BITUMINOUS			LIGNITE	PEAT/BIOMASS	PETROLEUM COKE	BRIQUETTES
			A	B	C				
ASH CONTENT	H + 20%								
	M 10 - 20%			0 16					
	L - 10%								
ASH FUSION	H +2700 F								
	M 2300-2700 F			0 16					
	L - 2300 F								
FREE SWELLING INDEX	H 3 +								
	M 1 - 3								
	L 0 - 1			0 16					
MOISTURE CONTENT	H +15%			0 16					
	M 5 - 15%								
	L - 5%								
FRIABILITY (GRINDABILITY)	H			0 16					
	M								
	L								

SECTION 4

FACILITY DESCRIPTION

The USBM/TCRC gasification facility is described in detail in Volume 1 of this series (Thimsen, Maurer et al, 1984). A brief description of the equipment and monitoring systems is given here.

4.1 Test Facility

The gasification test facility includes a 6.5 foot diameter Wellman-Galusha gas producer, a combustion test chamber and a wet caustic scrubber. The site also includes an iron ore pelletizing kiln which was not used during this test. The entire stream of producer gas was consumed in the combustion chamber. A process flow schematic is shown in Figure 4-1. A bottom size screen removes fine material prior to transport to the overhead storage bin by bucket elevator.

The facility is equipped with standard industrial monitoring equipment for measurement of temperatures, pressures, flows, and process conditions. These are recorded by an automatic data acquisition system for subsequent process analysis.

4.1.1 Gas Producer

The gas producer is a 6.5 foot ID Wellman-Galusha, single-staged, fixed-bed, atmospheric-pressure gasifier. The gasifier has a gravity fuel feed system, a water-cooled agitator, and an eccentric-step type grate for ash removal. The retort is water jacketed and has no refractory lining. Steam generated in the water jacket is mixed with blast air. Steam/air ratio in the blast is controlled with the temperature of the saturated steam/air mixture. Steam is imported if that generated in the water jacket is not adequate.

4.1.2 Gas Combustor

The gas combustor includes a baffle burner and a refractory-lined combustion chamber, and is designed to burn the full gas output of the gasifier at a rated capacity of 30 MMBTU/hour. The combustion products exhaust through an impingement tray-type wet caustic scrubber for sulfur dioxide and particulate removal. An induced draft fan is used to exhaust the scrubbed products of combustion through a flue stack.

4.2 Gas Sampling and Conditioning System

Figure 4-2 is a schematic of the gas sampling and conditioning system. The sampling port is thermally insulated to prevent condensation. The hot producer gas is quenched rapidly upon entering the surface condenser which is cooled by cold water or

FIGURE 4-1

COAL GASIFIER PROCESS FLOW SCHEMATIC,
U.S. BUREAU OF MINES, TWIN CITIES RESEARCH CENTER

FIGURE 4-2

SCHEMATIC DIAGRAM OF THE GAS SAMPLING
AND CONDITIONING SYSTEM

cold, compressed air. The rapid quenching causes tar, oil, and water to condense on the inner surface of the condenser tube. The tar fog generated during cooling is removed in the electrostatic precipitator. The detarred gas is refrigerated and dessicated to remove water remaining in the gas stream. The dry, detarred gas is metered and transported to the instruments. Condensate samples are collected from traps in the condenser, electrostatic precipitator, and refrigerator.

4.3 Gas Analysis Equipment

Carbon dioxide and carbon monoxide concentrations are continuously measured with individual Beckman 864 non-dispersive infrared (NDIR) analyzers. Oxygen is monitored continuously with a Beckman 755 paramagnetic oxygen analyzer. Higher heating value of the sample gas is measured with a SIGMA continuous flow calorimeter. These signals are all recorded by the automatic data acquisition system.

Detailed gas composition is determined every 23 minutes with a Hewlett-Packard model 5880A gas chromatograph. The principal features of this chromatograph are listed in Table 4-1.

Sulfur species concentrations in the gas are determined with a HP 5793 gas chromatograph by manual injection of grab samples. The principal features of the HP 5793 are given in Table 4-2.

Table 4-1

Operating Configuration and Conditions,
Hewlett-Packard Model 5880A Gas Chromatograph

1. Columns used:
 - a. 1-10 ft x 1/8 inch SS Porapak Q
 - b. 1-10 ft x 1/8 inch SS Molecular Sieve 5A
 - c. 2-18 ft x 1/8 inch SS 2% OV-101 on WHP
2. Dual detectors - flame ionization detector in series with thermal conductivity detector
3. Set up for analysis of the following species:
Hydrogen, Carbon dioxide, Ethylene, Ethane, Propane, Propylene, Oxygen, Nitrogen, Methane, and Carbon monoxide
4. Argon Carrier Gas - flow rate of 28 ml/min
5. Programmed Temperature from 75 C to 165 C to 135 C
6. 1.0 ml sample
7. 18 minute analysis time

Table 4-2

Operating Configuration and Conditions,
Hewlett-Packard Model 5793 Gas Chromatograph

1. Flame photometric detector
2. Single column - 18" x 1/8" Teflon Supelpak-S (Porapak QS)
3. Ten port valve for sample injection and column backflush
4. Integrator with limited control capabilities
5. Nitrogen carrier gas: Carrier Flowrate = 32 ml/min
6. Sample loop size = 125 ul
7. Temperature program:
Initial temperature 30 C
Initial time 1.5 min
Program rate 35 C/min
Final temperature 170 C
Final time 5.0 min
8. Analysis cycle time 25 min.

SECTION 5

TEST PROCEDURES

Test procedures are described in detail in Volume 1 of this series (Thimsen, Maurer et al, 1984). The following is a summary of the procedures including specific procedures used in this test only.

5.1 Test Teams

5.1.1 Gasifier Operation and Overall Coordination

The gasifier operations team was organized by Black, Sivalls & Bryson, Incorporated (BS&B) and consisted of the facility manager, facility engineers, three shift lead operators and additional helpers as required. The gasifier was staffed with a lead operator and two helpers, three shifts each day.

The gasifier operations team was responsible for overall operation of the gasifier and associated process equipment and coordination of the three test teams. This includes: gasifier start up, coal gas handling and incineration, exhaust gas cleanup, coal addition and sample collection, fire bed monitoring, process equipment maintenance and repair, operation of the boiler, changes in process conditions, sampling of waste water streams, and measurement of retort temperature and pressure profiles.

5.1.2 Gasifier Monitoring

The gas sampling and data retrieval/monitoring team was organized by the University of Minnesota Particle Technology Laboratory, and consisted of persons with individual responsibility for:

- 1) sample gas cleanup
- 2) gas chromatograph
- 3) continuous gas analysis and SIGMA continuous calorimeter
- 4) data acquisition system
- 5) safety evaluation personnel

and such equipment operators as were necessary. The monitoring systems were staffed 24 hours per day.

The monitoring team was responsible for recording continuous process signals, operation of the gas chromatographs and continuous gas analysis equipment, operation of the gas sampling and conditioning system, collection of tar and oil samples, analysis of coal, ash, and cyclone dust samples, retort exhaust particle sampling and evaluation of health and safety measures.

5.1.3 Stack Gas Sampling

No stack gas sampling was performed on this test due to the fact that it was a rerun of Rosebud subbituminous coal.

5.2 Gasifier Sampling and Data Acquisition Procedures

5.2.1 Continuous Data

An Analog Devices, Incorporated MACSYM 350 data acquisition system was used for this test. Process signals are sampled once a minute. Ten-minute signal averages are recorded on floppy disc. Thirty-minute signal averages are printed by line printer. The operations team also logs these signals hourly along with some twenty other parameters not sampled by the data acquisition system. During observation of transients the sample time is reduced to 6 seconds with one minute averages written to disc.

5.2.2 Gas Analysis Data

The continuous gas analyzers are calibrated daily, according to the manufacturer's recommendations. Output signals are recorded by the data acquisition system.

The HP 5880A gas chromatograph is calibrated using a mixture of oxygen, carbon monoxide, carbon dioxide, hydrogen, methane, ethane, ethylene, propane, propylene, and nitrogen at concentrations which nearly duplicate the gasifier offgas. Another calibration mixture with the concentrations of all the species except nitrogen increased by about 50%, and the nitrogen correspondingly reduced, is used to check the linearity of the detectors.

The HP 5793 gas chromatograph is calibrated before and after the test. Calibrations with varying levels of hydrogen sulfide in nitrogen have confirmed the square root response of the flame photometric detector to gas sulfur concentrations. The hydrogen sulfide FPD calibration factor is used for determination of carbonyl sulfide and mercaptan concentrations.

5.2.3 Tar and Oil Data

The condensed tar, oil, and water are removed from the accumulation reservoirs daily. Water collected in the surface contact condenser and electrostatic precipitator is decanted from the tar and combined with the water from the refrigerator. Tar from the surface contact condenser is combined with tar and oil collected in the electrostatic precipitator. Condensate loadings are measured by weighing both the tar/oil sample and the water sample. Moisture content of each daily tar sample is determined by distillation.

5.2.4 Coal Data

Coal samples are taken by the operations team during coal addition to the lock hopper four times each shift. These four samples are stored in one bucket and submitted as a composite shift sample. Detailed chemical analysis of the coal is performed on a composite of the shift samples.

5.2.5 Ash Data

An ash sample is taken by the operations team each time ash is discharged, and stored in a sealed container. One ash sample for each coal ash was composited with individual samples collected during each ash dump. For each ash sample the bulk density, particle size distributions, and carbon, sulfur, and moisture content of the ash are tabulated by the monitoring team. The carbon and sulfur content of each sample is determined from milled samples submitted by the monitoring team. The ash samples, on which detailed analyses are performed, are composited over the same time periods used for compositing the coal samples.

5.2.6 Dust Data

Samples of cyclone dust are grabbed daily from the dust accumulation bin. A single composite of all daily samples is submitted for analysis.

5.2.7 Retort Particle Sampling

Sampling of the gasifier offtake for particles is performed periodically as operating conditions permit.

5.2.8 Retort Temperature and Pressure Data

Vertical temperature and pressure profiles are taken at a single location periodically. The measurements are made at the end of relatively stable periods of operation just before operational changes are made.

SECTION 6

CONDUCT OF TEST

6.1 Test History

The gasification of Montana subbituminous B coal (BOM/FGT-016) began at 10:15 CST June 17, 1985. The modified startup procedure was used to initiate combustion in the fire bed. The bed was prepared with 14 inches of ash, 400 lbs of charcoal and topped with 10.8 tons of metallurgical coke. The Rosebud coal for this test was pre-screened using over a 1/2" square mesh screen. Figure 6-1 illustrates the "as run" test sequence.

The Rosebud coal entered the retort at 5:45 on June 18, 1985 as the coal feed pipes emptied of coke.

The initial blast air flow rate was 500 CFM with a saturation temperature of 60 C. After 7 hours the blast air flow was increased to 600 CFM and held constant for 14 hours. On June 19, 1985, the blast air flow rate was increased to 800 CFM held steady for 24 hours and subsequently increased to 1,000 CFM for 24 hours. At 9:30 on June 21, 1985 the blast air flow was increased to 1200 CFM, but severe gas channeling, burning through, and clinker formation occurred. At 0030 on June 22, 1985, the load was reduced back to 1,000 CFM and held for several hours. With no significant improvement in the bed condition and gas quality, the saturation air flow was further reduced to 700 CFM at 0930 June 22, 1985 and down to 600 CFM at 1430 June 22, 1985. The saturation air flow was held an additional 40 hours at the low 600 CFM load until termination of the test on 0630 June 24, 1985.

The firebed never really recovered from severe channeling and clinkering until the bed was purged with metallurgical coke at the end of the test. In an attempt to control clinkering, the saturation temperature was increased to 64 deg. C. This had little effect on the ash bed uniformity since some areas would be cool and others extremely hot. Ash depth was also difficult to maintain at a consistent level, as one area would be low and another too high.

6.2 Chronic Problems During BOM/FGT-016

In addition to difficult operations due to clinkering, gas channeling, and unstable gas quality, problems during BOM/FGT 016 were caused by a power blip at 0230 on June 19, 1985. When attempting to restart, the blast air fan generated unusual sounds upon restart. Operators dissassembled the fan, but were unable to locate any mechanical problems. The fan was reassembled, and the gasification system was restarted, and gas was delivered to combustor at 0645 June 19, 1985.

FIGURE 6-1
TEST HISTORY, BOM/FGT-016

SECTION 7

TEST RESULTS

7.1 Data Summary

7.1.1 Continuous Output Transducer Data

The data acquisition system operated smoothly throughout the test. There were, however, four intervals during the course of the test when the 5880A gas chromatograph was off-line due to valve problems.

The physical characteristics of the gasifier operation are presented in Figure 7-1. The gasifier was off-line early in the morning of June 19, 1985, due to the saturation air blower being shut down due to an electrical power outage and an indication of mechanical problems. The other data gaps are due to GC valve problems. Figure 7-1 presents the dry gas heating value, fire loss pressure, and offtake temperature along with the operating parameters.

Under steady operating conditions the product gas offtake temperature varied between 200 and 300 deg. C (390 to 570 deg. F). Under higher load conditions (higher blast air flow) the gasifier bed instabilities significantly increased which, in turn, produced higher differential (fire loss) pressures and higher product gas (offtake) temperatures. The product gas temperature peaked as high as 600 deg. C (1110 deg. F) during the intervals of gasifier bed instabilities. During each offtake temperature excursion the product gas heating value dropped significantly.

The gasifier retort became unstable after the blast air flow was increased from 600 scfm to 800 scfm on Thursday, June 20, 1985. A steady increase in the retort fire loss pressure drop occurred after the blast air flow was increased to 800 scfm. The maximum fire loss pressure of 20 to 25 inches wc occurred on June 21, 1985, with a blast air flow of approximately 1000 scfm. This compares to a typical fire loss pressure below 10 inches wc throughout BOM/FGT-002 with the "recovered" Rosebud which was prescreened at 3/4".

Throughout this test the Rosebud was prescreened at 1/2", consistent with the nominal operation with "fresh mined" Absaloka/Robinson subbituminous coal. It was felt the 1/2" screen would provide a nominal sized feed for stable gasifier operation. Further consideration of the coal feed data is presented in Section 7.1.2.1.

The dry gas heating value averaged 172 Btu/scf early in the test when the blast air flow was nominally 600 scfm. After the blast air flow was increased to 800 scfm the dry product gas HHV was

FIGURE 7-1

PHYSICAL CHARACTERISTICS OF THE GASIFIER OPERATION

generally at or below 150 Btu/dscf. The overall gas quality of the "fresh mined" Rosebud gasified during this test was substantially lower than that on BOM/FGT-002 except for the period of steady operation at a blast air flow of 600 scfm.

7.1.2 Coal, Ash, and Dust Data

A complete listing of the analyses performed on the bulk coal, ash, and cyclone dust samples collected during BOM/FGT-016, together with the number of samples analyzed is shown in Table 7-1.

7.1.2.1 Coal Data

The mass fraction of coal less than each of five indicated mesh sizes and the mean coal particle size are presented in Figure 7-2. The fraction of the coal feed passing a 1/2 inch screen entering the gasifier retort was about 7 to 10 percent. More than 90 percent of the Rosebud coal feed was greater than 1/2 inch. The geometric mean coal size was relatively steady throughout the test ranging from 0.7 to 0.9 inches. The average geometric mean was 0.89 inches as shown in Figure 7-3.

The results of the physical and chemical analyses of a single composite coal sample are presented in Table 7-2. A significant property is the low ash fusion temperature and relatively narrow temperature range from initial deformation to fluid. The combination of a low ash fusion temperature and narrow range implies that the formation of clinkers is difficult to control.

7.1.2.2 Ash Data

The mass fraction of ash less than each of five indicated mesh sizes and the mean ash particle size are shown in Figure 7-4. Throughout the majority of the test when the gasifier performance was upset, the ash geometric mean averaged nominally 0.5 inches. When the load was substantially reduced on June 22, 1985, approximately 24 hours later, the ash geometric mean decreased to less than 0.25 inches indicative of a fine granular material with little clinker material present.

Figure 7-5 shows the physical and chemical characteristics of the ash along with the operating parameters. Ash carbon content was normally less than 10 percent. Ash sulfur content was generally less than 1 percent. The dry ash bulk density was steady throughout the test, typically in the range of 0.8 to 1.0 grams/cc.

(It should be noted that the ash analyses represent ash generated 4 to 6 hours prior to the time of the ash dump. This is the time required to move the ash from the combustion zone to the ashpit.)

Table 7-3 gives the chemical analysis of a single sample of ash composited over the entire test. The relatively high sulfur

Table 7-1

Summary of Coal, Ash and Cyclone Dust Analysis

Material	Type of Analysis	Number of Samples Collected and Analyzed	Number of composite Samples Analyzed

Coal	Particle size distribution	19	---
	Proximate analysis	---	1
	Ultimate analysis	---	1
	Ash fusion temperature	---	1
	Free swelling index	---	1

Ash	Particle size distribution	29	---
	Bulk density	29	---
	Moisture content	29	---
	Carbon content	29	---
	Sulfur content	29	---
	Chemical analysis	---	1

Cyclone	Proximate analysis	---	1(**)
Dust	Ultimate analysis	---	1(**)

(**) Composite of 20 cyclone dust samples.			

Figure 7-2

Feed Coal Size Distribution Analysis and
Geometric Mean Coal Particle Size

FIGURE 7-3

AVERAGE PARTICLE SIZE DISTRIBUTION OF FEED COAL

Table 7-2

Physical and Chemical Properties of Coal and Cyclone Dust

Material	Coal	Cyclone Dust (dry basis)

Type of Analysis (*)		

Proximate Analysis, wt % :		
Moisture	21.25	---
Volatile Matter	26.81	18.86
Ash	11.82	23.40
Fixed Carbon (**)	40.12	55.74
Sulfur	0.87	1.51
Ultimate Analysis, wt % :		
Hydrogen	3.31	1.90
Carbon	52.70	65.72
Nitrogen	0.71	0.89
Sulfur	0.87	1.51
Oxygen (**)	9.35	4.59
Ash	11.82	25.40
Moisture	21.25	---
Heating Value, btu/lb :		
As Recieved	8881	---
Moisture Free	11277	10400
Ash Fusion Temp. Deg F:		
(Oxidizing Atmosphere)		
Initial Def., IT	2290	---
Softening, ST	2350	---
Softening, HT	2380	---
Fluid, FT	2455	---
(Reducing Atmosphere)		
Initial Def., IT	2140	---
Softening, ST	2210	---
Softening, HT	2245	---
Fluid, FT	2310	---
Free Swelling Index	0	---

(*) Coal analyses are as received. Cyclone Dust analyses are dry basis

(**) By difference.

FIGURE 7-4

ASH SIZE DISTRIBUTION ANALYSIS AND GEOMETRIC
MEAN ASH PARTICLE SIZE

FIGURE 7-5

ASH CHARACTERISTICS AND OPERATING CONDITIONS

Table 7-3

Elemental Analysis of Moisture-Free Ash

Element	Mass Fraction % for Composite Sample (*)
Fe	10.20
Fe(2+)	1.70
Si	23.40
Al	8.00
C	1.80
Ca	9.80
Mg	2.00
K	0.30
P	0.06
Na	0.23
S	0.15
Ti	0.56

(*) Unaccounted for mass is presumed to be oxygen bound onto metals as oxides

level of ash (0.15%) is consistent with the relatively high alkaline ash.

7.1.2.3 Cyclone Dust Data

The chemical analysis of a single cyclone dust sample composited from eleven daily grab samples is given in Table 7-2. The volatile matter to fixed carbon ratio of the cyclone dust is nominally 50% that of the feed coal, similar to other subbituminous coals gasified. This results from the partial devolatilization of the coal dust in the upper region of the retort and gas offtake duct. The partial devolatilization is not, however, sufficient to account for the increased ash content of the cyclone dust. The ash to fixed carbon ratio of the dust is 45 percent greater than that of the feed coal. These higher ash materials originate from the lower regions of the retort where some of the fixed carbon has been converted to the gas phase via gasification.

7.1.3 Gas Analysis Data

The NDIR gas analyzers and the SIGMA continuous calorimeter operated well during the test. Intervals of lost gas sampling data occurred on June 19, 20, 21, and 23 due to problems with the valves controlling the 5880A gas chromatograph. The HP 5880A gas chromatograph measuring the major gaseous species and hydrocarbons provided data throughout the entire test with the above four "down" intervals. The HP 5793 gas chromatograph measuring the gas sulfur species experienced major electrical control problems and significant problems with the flame photometric detector. As a result, gas phase sulfur data were collected during only the last two full days of the test.

The major gaseous species concentrations are presented in Figure 7-6. Throughout the majority of the test, the hydrogen concentration was nominally 15 percent with CO and CO₂ nominally 22 percent and 8 percent respectively and nitrogen slightly greater than 50 percent. This gas quality is indicative of an upset non-uniform fixed-bed retort. Incomplete reduction of the gas phase as indicated by the results is consistent with gas channeling and reduced gas phase residence times. By establishing a uniform bed (through a reduced load) the gas quality returned to its ultimate steady-state level.

The major gas species and operating parameters are compared in Figure 7-7. These results further indicate the overall deterioration of the gasifier bed after the blast air flow was increased to 800 on June 20, 1985. Shortly after the blast air flow was reduced below 500 scfm on June 22, 1985, the gas quality returned to normal.

The hydrocarbon species concentrations are shown in Figure 7-8. Methane concentrations remained relatively steady throughout the test in the range of 1.5 to 2.0 percent. Ethylene concentrations

FIGURE 7-6

MAJOR GAS SPECIES MEASURED BY THE GAS CHROMATOGRAPH

FIGURE 7-7

DRY GAS HHV, MAJOR GAS SPECIES AND GASIFIER
OPERATIONAL PARAMETERS

FIGURE 7-8

MINOR GAS SPECIES MEASURED BY THE GAS CHROMATOGRAPH

rose during the early part of June 22, 1985, corresponding to a relatively high offtake temperature. The increased ethylene concentration results from cracking of high molecular weight carbons. Ethane concentrations in general follow methane concentrations. Propylene and propane concentrations are also relatively steady throughout the test.

The gas phase sulfur species are shown in Figures 7-9 and 7-10. The measured total sulfur varied between 2000 and 3000 ppm. The major sulfur species identified in the product gas were (1) hydrogen sulfide, (2) carbonyl sulfide, (3) methyl mercaptan, (4) ethyl mercaptan, (5) dimethyl sulfide, and (6) thiophene. Figure 7-9 presents the total sulfur along with the normalized concentrations of hydrogen sulfide and carbonyl sulfide. Hydrogen sulfide contributed nominally 50 to 70 percent of the total sulfur, with carbonyl sulfide contributing from 30 to 45 percent of the total sulfur. Combined, hydrogen sulfide and carbonyl sulfide contained over 97 percent of the total sulfur. The remaining 2 to 3 percent of the sulfur was either in mercaptans or higher order sulfur species as shown in Figure 7-10. These sulfur data are generally consistent with the results from other subbituminous coals.

7.1.4 Tar and Water Yield Data

The gas sampling and conditioning system operated smoothly throughout BOM/FGT-016. The condensate traps were drained daily to measure/calculate tar and water loadings.

Tar and water loadings are shown in Figure 7-11 along with offtake temperature and operating parameters.

During June 18 to 20, 1985, the tar yield data are considered to be unrealistically low due to the fact that the gas offtake temperature was below 300 deg. C (570 deg. F) and a large fraction of the pyrolysis liquids (tars/oils) were condensed and removed upstream of the sample extraction point located downstream of the cyclone. After June 20, 1985, the tar yield data are consistently above 1 lb-tar/1000 scf.

A single tar sample composited from those collected during the entire test was submitted for analysis. The results of the analysis are shown in Table 7-4. The pyrolysis liquid recovered from the fresh mined Rosebud is comparable to the pyrolysis liquids recovered from the previous Rosebud gasification test and the Absaloka gasification test, although the water content of this composited sample was only 12 percent whereas the water content of the other samples generally ran in the range of 20 to 25 percent.

7.2 Material and Energy Balance

The material and energy balance calculation procedure is

Figure 7-9

Total Gas Sulfur and Normalized H_2S and
COS Species Concentrations²

Figure 7-10

Total Gas Sulfur and Normalized Mercaptans
and Higher Order Sulfur Species Concentrations

FIGURE 7-11

TAR/OIL YIELD AND WATER YIELD WITH OPERATING CONDITIONS

Table 7-4

Condensed Material Analysis

Tar	As recieved	Dry Basis
Heating Valve, btu/lb	14586	16573
Flash point, deg. F	212	
Water by distillation, %	11.99	
Specific gravity, 60/60 deg. F	1.0472	
Sediment (solids), % W/W	0.84	
Pour point, deg. F	75	
Cold (solid) point, deg. F	70	
Viscosity at:		
122 deg. F Saybolt Universal, Sec.	50.0	
122 deg. F Kinematic, centistokes	103.0	
210 deg. F Saybolt Universal, Sec.	201.0	
210 deg. F Kinematic, centistokes	42.9	
Ultimate Analysis, WT%		
Hydrogen	6.85	7.78
Carbon	66.49	75.55
Nitrogen	0.62	.70
Oxygen (by difference)	13.45	15.28
Sulfur	0.39	0.44
Moisture (total)	11.99	--
Ash	0.21	.24
Water		
Total organics, % W/W	0.198	

described in detail in Volume 1 of this series (Thimsen, Maurer et al, 1984). A brief description is given here.

The measured values used to calculate balances around the gasifier include process temperatures, pressures, flows, material ultimate analyses, gas compositions, dust carryover measurements (Section 7.6), and tar and water loadings in the gas.

The relative gas phase sulfur species data described in Section 7.1.2 was extrapolated to the entire test. The total gas phase sulfur concentration is calculated assuming that sulfur in the feed coal not appearing in the ash, tar, or dust appears in the gas. Total gas composition is then normalized to 99.9 mol % species accounted for.

The balances are calculated over various time periods representing relatively steady operation. Each time period is characterized by a coal consumption rate and blast saturation temperature, and coal bottomsize. Tables 7-5 to 7-9 show the results of the calculations. Table 7-10 shows the average results of all the calculations.

Tables 7-5 and 7-8 show the cyclone dust loss to be zero. The cyclone dust yield is calculated using a power law correlation based on the measured particulate mass loss from the retort. The extremely low blast air flow for the periods of operation delineated in Tables 7-5 and 7-8 predict the cyclone dust loss to be "zero".

7.3 Grate Performance Model

A geometrical grate performance model was prepared and is described in Volume 1 of this series (Thimsen, Maurer et al, 1984). The model calculates the void volume swept by the eccentric grate and compares it to the volume of ash rejected by the grate. Figure 7-12 shows the experimental data from the test and the theoretical prediction. The theory tends to underpredict the actual measurements for data collected during this test.

7.4 Tar Yield Correlations

The overall average tar yield measured during gasification of freshly mined Rosebud subbituminous coal was 5.3 lb/100 lb coal (as received). This value ranged from 2.9 to 6.2. The Fischer-Schrader Assay tar/oil yield correlations described by Ode and Selvig (1944) and Gomez et al (1958) have predicted the tar/oil yields from past gasification tests within acceptable error bands.

There is no Fischer Assay available for this coal. As can be seen from Figures 7-13 and 7-14, the correlations of tar/oil yields of similar coals predict a tar/oil yield of 5.4 lb/100 lb

Table 7-5

Material Balance and Thermal Efficiency Calculation
0.33 tn/hr, 139 F

Input Data

Time period: 6/18/85 15:00 - 6/19/85 02:00 (11.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.33
Blast air flow (dry) , Scfm = 350.
Saturated air temperature, F = 139.
Steam/Air Ratio (lb./lb.) = 0.15
Ambient air temperature, F = 64.
Off-take temperature, F = 362.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 7.16
Tar yield, lb/1000 SCF = 0.61
Carbon in Tar (percent) = 75.6
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 9.
Ash carbon ,percent = 21.8
Ash sulfur ,percent = 3.03
Ash moisture (wet),percent = 25.3
Cyclone dust,lb/hour(est.) = 0.

Gas Composition (Dry): (normalized to 100.00)

H2	%	= 15.7	CH4	%	= 1.42	H2S	(calc ppm)=	689
CO	%	= 22.3	C2H4	%	= 0.031	COS	(calc ppm)=	276
CO2	%	= 7.61	C2H6	%	= 0.100			
N2	%	= 52.0	C3H6	%	= 0.028			
O2	%	= 0.00	C3H8	%	= 0.031	HHV,	Btu/SCF =	141
Molec. Weight=		24.83	Argon(est. %)=		0.622	LHV,	Btu/SCF =	132

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 4.25)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 655.	26.8	Dry gas	= 2002.	85.5
Steam (total)	= 237.	9.7	Water in gas	= 219.	9.4
Air(calc,dry)	= 1555.	63.6	Oil and tar	= 19.	0.8
			Ash(calc,dry)	= 103.	4.4
			Dust	= 0.	0.0
Total	= 2447.		Total	= 2343.	

Energy Balance (Percent unaccounted for: -1.82)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 5.8	Dry coal gas	= 4.3	72.5
Air	= 0.001	Oil and tar	= 0.31	5.2
Steam(import)	= 0.053	Sensible	= 0.20	3.3
Cooling water	= -0.012	Latent	= 0.234	3.9
		Ash	= 0.318	5.3
		Dust	= 0.000	0.0
		Cooling water	= 0.578	9.7
Total	= 5.9	Total	= 6.0	

Performance Data

Cold gas efficiency, percent = 73.8
Cold gas with tar efficiency, percent = 79.2
Hot gas without tar efficiency percent = 81.1
Hot gas with tar efficiency, percent = 86.5
Air/Coal (lb./lb.) = 2.376
Steam/Coal (lb./lb.) = 0.362
Air/Fixed Carbon (lb./lb.) = 5.922
Coal/Gasifier Area (lb./hr./sqft) = 19.7
Fixed Carbon/Area (lb./hr./sqft) = 7.9
Producer Gas/Coal (SCF/lb.) = 53.8
Producer Gas/Fixed Carbon (SCF/lb.) = 134.2
Tar Yield (lb./lb. coal) = 0.029

Table 7-6

Material Balance and Thermal Efficiency Calculation
0.71 tn/hr, 138 F

Input Data

Time period: 6/19/85 10:00 - 6/20/85 09:00 (23.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.71
Blast air flow (dry) , Scfm = 622.
Saturated air temperature, F= 138.
Steam/Air Ratio (lb./lb.) = 0.15
Ambient air temperature, F = 62.
Off-take temperature, F = 507.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 8.24
Tar yield, lb/1000 SCF = 1.08
Carbon in Tar (percent) = 75.6
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 10.
Ash carbon ,percent = 9.5
Ash sulfur ,percent = 0.36
Ash moisture (wet),percent = 15.1
Cyclone dust,lb/hour(est.) = 6.

Gas Composition (Dry): (normalized to 100.00)

H2 % = 16.4	CH4 % = 1.60	H2S (calc ppm)= 1636
CO % = 30.0	C2H4 % = 0.064	COS (calc ppm)= 655
CO2 % = 4.47	C2H6 % = 0.124	
N2 % = 46.5	C3H6 % = 0.044	
O2 % = 0.00	C3H8 % = 0.041	HHV, Btu/SCF = 172
Molec. Weight= 24.17	Argon(est. %)= 0.556	LHV, Btu/SCF = 162

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 0.33)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 1421.	31.8	Dry gas	= 3722.	83.5
Steam (total)	= 395.	8.8	Water in gas	= 482.	10.8
Air (calc,dry)	= 2656.	59.4	Oil and tar	= 63.	1.4
			Ash (calc,dry)	= 184.	4.1
			Dust	= 6.	0.1
Total	= 4472.		Total	= 4457.	

Energy Balance (Percent unaccounted for: -0.33)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 12.6	Dry coal gas	= 10.1	77.7
Air	= 0.001	Oil and tar	= 1.04	8.1
Steam(import)	= 0.288	Sensible	= 0.58	4.5
Cooling water	= 0.001	Latent	= 0.516	4.0
		Ash	= 0.252	1.9
		Dust	= 0.068	0.5
		Cooling water	= 0.425	3.3
Total	= 12.9	Total	= 13.0	

Performance Data

Cold gas efficiency, percent = 78.0
Cold gas with tar efficiency, percent = 86.0
Hot gas without tar efficiency percent = 86.2
Hot gas with tar efficiency, percent = 94.5
Air/Coal (lb./lb.) = 1.870
Steam/Coal (lb./lb.) = 0.278
Air/Fixed Carbon (lb./lb.) = 4.660
Coal/Gasifier Area (lb./hr./sqft) = 42.8
Fixed Carbon/Area (lb./hr./sqft) = 17.2
Producer Gas/Coal (SCF/lb.) = 48.3
Producer Gas/Fixed Carbon (SCF/lb.) = 120.5
Tar Yield (lb./lb. coal) = 0.044

Table 7-7

Material Balance and Thermal Efficiency Calculation
0.95 tn/hr, 140 F

Input Data

Time period: 6/20/85 10:00 - 6/21/85 09:00 (23.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.95
Blast air flow (dry) , Scfm = 848.
Saturated air temperature, F= 140.
Steam/Air Ratio (lb./lb.) = 0.16
Ambient air temperature, F = 75.
Off-take temperature, F = 611.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 10.37
Tar yield, lb/1000 SCF = 1.37
Carbon in Tar (percent) = 75.6
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 57.
Ash carbon ,percent = 4.9
Ash sulfur ,percent = 0.56
Ash moisture (wet),percent = 10.5
Cyclone dust,lb/hour(est.) = 88.

Gas Composition (Dry): (normalized to 100.00)

H2	%	= 15.2	CH4	%	= 1.52	H2S	(calc ppm)= 1441
CO	%	= 24.5	C2H4	%	= 0.067	COS	(calc ppm)= 577
CO2	%	= 7.25	C2H6	%	= 0.120		
N2	%	= 50.5	C3H6	%	= 0.046		
O2	%	= 0.00	C3H8	%	= 0.038	HHV,	Btu/SCF = 150
Molec. weight=		24.91	Argon(est. %)=	0.604	LHV,	Btu/SCF = 140	

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 0.09)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 1894.	29.5	Dry gas	= 5191.	80.9
Steam (total)	= 628.	9.8	Water in gas	= 819.	12.8
Air (calc,dry)	= 3903.	60.7	Oil and tar	= 108.	1.7
			Ash (calc,dry)	= 213.	3.3
			Dust	= 88.	1.4
Total	= 6425.		Total	= 6419.	

Energy Balance (Percent unaccounted for: -1.30)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 16.8	Dry coal gas	= 11.8	68.6
Air	= 0.014	Oil and tar	= 1.79	10.4
Steam(import)	= 0.181	Sensible	= 1.06	6.1
Cooling water	= -0.008	Latent	= 0.877	5.1
		Ash	= 0.152	0.9
		Dust	= 0.918	5.3
		Cooling water	= 0.604	3.5
Total	= 17.0	Total	= 17.2	

Performance Data

Cold gas efficiency, percent = 69.5
Cold gas with tar efficiency, percent = 80.0
Hot gas without tar efficiency percent = 80.4
Hot gas with tar efficiency, percent = 91.2
Air/Coal (lb./lb.) = 2.060
Steam/Coal (lb./lb.) = 0.332
Air/Fixed Carbon (lb./lb.) = 5.135
Coal/Gasifier Area (lb./hr./sqft) = 57.1
Fixed Carbon/Area (lb./hr./sqft) = 22.9
Producer Gas/Coal (SCF/lb.) = 50.9
Producer Gas/Fixed Carbon (SCF/lb.) = 126.9
Tar Yield (lb./lb. coal) = 0.057

Table 7-8

Material Balance and Thermal Efficiency Calculation
0.34 tn/hr, 144 F

Input Data

Time period: 6/22/85 14:00 - 6/23/85 11:00 (21.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.34
Blast air flow (dry) , Scfm = 349.
Saturated air temperature, F= 144.
Steam/Air Ratio (lb./lb.) = 0.18
Ambient air temperature, F = 66.
Off-take temperature, F = 492.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 9.64
Tar yield, lb/1000 SCF = 1.24
Carbon in Tar (percent) = 75.6
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 122.
Ash carbon ,percent = 8.7
Ash sulfur ,percent = 0.80
Ash moisture (wet),percent = 2.1
Cyclone dust,lb/hour(est.) = 0.

Gas Composition (Dry): (normalized to 100.00)

H2	%	= 17.1	CH4	%	= 1.87	H2S	(calc ppm)= 1429
CO	%	= 22.0	C2H4	%	= 0.071	COS	(calc ppm)= 503
CO2	%	= 8.41	C2H6	%	= 0.134		
N2	%	= 49.5	C3H6	%	= 0.046		
O2	%	= 0.00	C3H8	%	= 0.032	HHV,	Btu/SCF = 152
Molec. Weight= 24.55			Argon(est. %)= 0.592			LHV,	Btu/SCF = 141

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 0.93)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 684.	27.8	Dry gas	= 2009.	82.5
Steam (total)	= 272.	11.0	Water in gas	= 299.	12.3
Air(calc,dry)	= 1503.	61.1	Oil and tar	= 38.	1.6
			Ash(calc,dry)	= 89.	3.7
			Dust	= 0.	0.0
Total	= 2459.		Total	= 2436.	

Energy Balance (Percent unaccounted for: -2.97)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 6.1	Dry coal gas	= 4.7	73.4
Air	= 0.002	Oil and tar	= 0.64	9.9
Steam(import)	= 0.150	Sensible	= 0.31	4.9
Cooling water	= 0.000	Latent	= 0.320	5.0
		Ash	= 0.112	1.7
		Dust	= 0.001	0.0
		Cooling water	= 0.328	5.1
Total	= 6.2	Total	= 6.4	

Performance Data

Cold gas efficiency, percent = 75.5
Cold gas with tar efficiency, percent = 85.7
Hot gas without tar efficiency percent = 85.4
Hot gas with tar efficiency, percent = 95.8
Air/Coal (lb./lb.) = 2.197
Steam/Coal (lb./lb.) = 0.397
Air/Fixed Carbon (lb./lb.) = 5.476
Coal/Gasifier Area (lb./hr./sqft) = 20.6
Fixed Carbon/Area (lb./hr./sqft) = 8.3
Producer Gas/Coal (SCF/lb.) = 54.7
Producer Gas/Fixed Carbon (SCF/lb.) = 136.2
Tar Yield (lb./lb. coal) = 0.056

Table 7-9

Material Balance and Thermal Efficiency Calculation
0.40 tn/hr, 148 F

Input Data

Time period: 6/23/85 11:00 - 6/24/85 06:00 (19.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.40
Blast air flow (dry) , Scfm = 351.
Saturated air temperature, F= 148.
Steam/Air Ratio (lb./lb.) = 0.20
Ambient air temperature, F = 62.
Off-take temperature, F = 822.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 11.52
Tar yield, lb/1000 SCF = 1.44
Carbon in Tar (percent) = 75.6
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 94.
Ash carbon ,percent = 11.1
Ash sulfur ,percent = 0.79
Ash moisture (wet),percent = 3.0
Cyclone dust,lb/hour(est.) = 1.

Gas Composition (Dry): (normalized to 100.00)

H2	%	= 16.1	CH4	%	= 1.40	H2S	(calc ppm)= 1462
CO	%	= 23.6	C2H4	%	= 0.065	COS	(calc ppm)= 558
CO2	%	= 8.59	C2H6	%	= 0.084		
N2	%	= 49.3	C3H6	%	= 0.034		
O2	%	= 0.00	C3H8	%	= 0.027	HHV,	Btu/SCF = 147
Molec. Weight= 24.90			Argon(est. %)= 0.590			LHV,	Btu/SCF = 137

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -0.62)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 798.	28.6	Dry gas	= 2254.	80.3
Steam (total)	= 336.	12.0	Water in gas	= 396.	14.1
Air(calc,dry)	= 1656.	59.4	Oil and tar	= 50.	1.8
			Ash(calc,dry)	= 107.	3.8
			Dust	= 1.	0.0
Total	= 2789.		Total	= 2807.	

Energy Balance (Percent unaccounted for: -2.62)

Input,	MM Btu/hr	Output,	MM Btu/hr	% Total
Coal	= 7.1	Dry coal gas	= 5.1	67.5
Air	= 0.001	Oil and tar	= 0.82	11.0
Steam(import)	= 0.205	Sensible	= 0.65	8.7
Cooling water	= 0.004	Latent	= 0.423	5.7
		Ash	= 0.169	2.3
		Dust	= 0.014	0.2
		Cooling water	= 0.348	4.6
Total	= 7.3	Total	= 7.5	

Performance Data

Cold gas efficiency, percent = 69.3
Cold gas with tar efficiency, percent = 80.6
Hot gas without tar efficiency percent = 83.5
Hot gas with tar efficiency, percent = 95.3
Air/Coal (lb./lb.) = 2.075
Steam/Coal (lb./lb.) = 0.421
Air/Fixed Carbon (lb./lb.) = 5.172
Coal/Gasifier Area (lb./hr./sqft) = 24.0
Fixed Carbon/Area (lb./hr./sqft) = 9.6
Producer Gas/Coal (SCF/lb.) = 53.6
Producer Gas/Fixed Carbon (SCF/lb.) = 133.5
Tar Yield (lb./lb. coal) = 0.062

Table 7-10

Material Balance and Thermal Efficiency Calculation
Rosebud Overall Average

Input Data

Time period: Overall Average (97.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 0.58
Blast air flow (dry) , Scfm = 533.
Saturated air temperature, F= 141.
Steam/Air Ratio (lb./lb.) = 0.16
Ambient air temperature, F = 68.
Off-take temperature, F = 574.

Coal Data:

Type = Rosebud Subbituminous
Mass Fraction Carbon % = 52.7
Mass Fraction Fixed Carbon = 40.12
Mass Fraction Moisture % = 21.25
Mass Fraction nitrogen % = 0.17
Mass Percent sulfur = 0.87
Heating value, Btu/lb = 8881

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 9.59
Tar yield, lb/1000 SCF = 1.22
Carbon in Tar (percent) = 75.5
Sulfur in Tar (percent) = 0.44
Tar HHV, thou. Btu/lb = 16.57

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 61.
Ash carbon ,percent = 8.8
Ash sulfur ,percent = 0.77
Ash moisture (wet),percent = 5.6
Cyclone dust,lb/hour(est.) = 4.

Gas Composition (Dry): (normalized to 100.00)

H2	%	= 16.0	CH4	%	= 1.57	H2S	(calc ppm)= 1453
CO	%	= 25.4	C2H4	%	= 0.064	COS	(calc ppm)= 567
CO2	%	= 6.85	C2H6	%	= 0.117		
N2	%	= 49.2	C3H6	%	= 0.043		
O2	%	= 0.00	C3H8	%	= 0.036	HHV,	Btu/SCF = 155
Molec. Weight= 24.65			Argon(est. %)= 0.588			LHV,	Btu/SCF = 145

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 0.24)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 1165.	29.1	Dry gas	= 3286.	82.4
Steam (total)	= 399.	10.0	Water in gas	= 485.	12.2
Air(calc,dry)	= 2433.	60.9	Oil and tar	= 62.	1.6
			Ash(calc,dry)	= 151.	3.8
			Dust	= 4.	0.1
Total	= 3997.		Total	= 3988.	

Energy Balance (Percent unaccounted for: -1.43)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 10.3	Dry coal gas	= 7.9	73.5
Air	= 0.004	Oil and tar	= 1.02	9.6
Steam(import)	= 0.190	Sensible	= 0.61	5.7
Cooling water	= -0.002	Latent	= 0.519	4.9
		Ash	= 0.192	1.8
		Dust	= 0.043	0.4
		Cooling water	= 0.450	4.2
Total	= 10.5	Total	= 10.7	

Performance Data

Cold gas efficiency, percent = 74.5
Cold gas with tar efficiency, percent = 84.2
Hot gas without tar efficiency percent = 84.9
Hot gas with tar efficiency, percent = 94.9
Air/Coal (lb./lb.) = 2.089
Steam/Coal (lb./lb.) = 0.343
Air/Fixed Carbon (lb./lb.) = 5.207
Coal/Gasifier Area (lb./hr./sqft) = 35.1
Fixed Carbon/Area (lb./hr./sqft) = 14.1
Producer Gas/Coal (SCF/lb.) = 52.3
Producer Gas/Fixed Carbon (SCF/lb.) = 130.3
Tar Yield (lb./lb. coal) = 0.053

FIGURE 7-12

COMPARISON OF THE GEOMETRICAL GRATE PERFORMANCE MODEL
WITH ASH REMOVAL RATES

FIGURE 7-13

CORRELATION OF TAR YIELD WITH VOLATILE MATTER AND OXYGEN

FIGURE 7-14

CORRELATION OF TAR YIELD AND VOLATILE BTU

coal (as received). The tar/oil yield measured during this test is very close to that predicted by the correlations.

7.5 Combustion Emissions Monitoring

No combustion emissions monitoring was performed during this test due to the fact that the test was a re-run of BOM/FGT-002.

7.6 Retort Particle Sampling

Particulate sampling efforts continued in regard to measurement of total particle mass loadings leaving the retort and particle size distributions. The procedures are described in Volume 1 of this series (Thimsen, Maurer et al, 1984). Data collected are included in Appendix F.

A total of 7 product gas particulate sampling runs were made, all resulting in valid data. The particle loading data correlated fairly well with superficial gas velocity leaving the coal bed. These data are shown in Figure 7-15. As can be noted, substantial dust generation and carryover occurred at relatively low face velocities which correspond to the upset bed conditions. The power law correlation was used to calculate dust carryover for the material and energy balances (Section 7.2).

Two of the dust samplings were analyzed for particle size distributions (Appendix F). The mass median particle diameter ranged from approximately 100 μm at low gas flow rates to 250 μm at moderate flows (3500 acfm).

FIGURE 7-15

DUST CARRYOVER VS. GAS FACE VELOCITY

SECTION 8

CONCLUSIONS

1. The maximum throughput observed was 0.95 tons per hour over a 23-hour period. Maximum throughput was limited by firebed conditions, gas channeling, and excessive dust loss overhead.
2. A coal throughput of 0.70 tons per hour is recommended for design purposes. Based on this throughput and a blast saturation temperature of 144 F (62.0 C), the following material and energy flows can be expected:

Material In (lb/lb coal)		Energy In (million Btu/hr)	
Air	1.87	Coal	12.60
Steam	0.278	Steam (import)	0.29
Material Out (lb/lb coal)		Energy Out (million Btu/hr)	
Dry Gas	2.62	Dry Gas	10.1
Tar/oil	.044	Tar/oil	1.04
Water	.339	Sensible/latent	1.10
Dust	.004	Dust	0.07
Ash	.129	Ash	0.25
Unaccounted for	0.11	Cooling Water	0.43

3. The average tar yield measured during the test was 5.2 lb tar/100 lb coal (as received). This represents 9.6% of the energy in the coal. This tar yield conforms to correlations based on Fischer Assay tar yields of similar coals.
4. After the blast air flow was increased to 800 scfm, pockets of clinkered ash were present in the retort throughout the test. It is surmised that the relatively narrow range of ash fusion temperatures from initial deformation to fluid allows these pockets to form when minor flow gradients are present in the retort. Blast saturation temperatures of 142 to 144 F (61 to 62 C) were used.
5. Excessive clinkering was observed when gasifying with a blast air flow above 800 scfm. At similar throughputs, gasification at slightly higher blast saturation temperatures did not result in such ash clinkering.
6. Particle loss in the product gas was severe at relatively low throughputs amounting to as much as 8 to 10% of the wet coal feed. The dust/coal ratio could be expressed as a power function of produced gas flow rate. Dust carried over at high throughput was coarse with a mass median diameter of 650 μ m.
7. Based on the results of this test, fresh Rosebud

subbituminous coal is not recommended as a fixed-bed gasifier feedstock due to the severe degradation of the coal in the upper zone of the retort. The performance of the fresh Rosebud in this test was significantly worse than that of the compacted Rosebud gasified during BOM/FGT-002.

8. Small variations in blast air flow through the bed resulted in clinkers formation. This characteristic of the Rosebud ash caused operating problems throughout the test.

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APPENDICES

A. Gasifier Operator's Log	A-1
B. Coal Sizing Data	B-1
C. Coal Consumption Log	C-1
D. Ash Analysis Data	D-1
E. Ash Removal Log	E-1
F. Retort Particle Sampling Data	F-1
G. Operator Logged Data	G-1
H. Gas Chromatograph Data	H-1
I. Continuous Output Transducer Data	I-1
J. Retort Temperature and Pressure Probe Data ...	J-1
K. Weather Data	K-1

APPENDIX A

Gasifier Operator's Log

These are the comments recorded by the gasifier operators during the course of the test.

Note: Grate speeds are referred to as:

"gear teeth engaged per stroke/Grate RPD per gear tooth engaged"

Grate speed is the multiple of these two numbers.

BOM/FGT 016 ROSEBUD SUBBITUMINOUS

JUNE 14, 1985

Loaded the gasifier with 3000 pounds of ash and 400 pounds of lump charcoal. There currently is 8.25 tons of petroleum coke and 2.42 tons of metallurgical coke in the weigh bins.

June 17, 1985

- 0700 Begin preparations for start-up.
- 1015 Light off.
- 1200 The steam regulator diaphragm case is cracked. Repairs are being undertaken.
- 1407 The regulator has been repaired and reinstalled.
- 1410 Preparing to send gas downstream.
- 1412 Primary and secondary combustion fans as well as the induced draft fan are on.
- 1417 Lit the combustor pilot.
- 1425 Drained the cyclone.
- 1445 Started loading rosebud coal into the weigh bins at 0.27 ton.
- 1520 Stopped loading coal into the weigh bin at 10.25 tons.
- 1620 Ran the agitator one revolution to level out the bed.
- 1650 Ran the agitator 2 revolutions to level the bed.
- 1800 Fire test indicated an average ash depth of 11.71 inches. The bars were barely red after a 2 minute insertion.
- 1805 Continued cycling the lower bin valves every half hour. The south side is now feeding properly. Have had to decrease furnace pressure to zero with the vane valve 15% open to maintain a cyclone pressure of 0.2 inches. The back pressure valve is nearly closed.,

- 1930 Continued cycling the coal valves. Coal leg and offtake temperatures are still reading normal. Coke continues to drop. Ran through the ash dump procedures with the operators. Still flooding the lower level with each cyclone dump. This is with only 30 seconds of flushing. The pH is running between 6.5 and 7.0. The plastic 1.5 inch pipe on the jacket overflow tank must be replaced. It is leaking badly from both ends.
- 2000 Fire test shows the 4-5-6 side to be hot and the 1-2-3 side to still be cold at 2.5 minutes. The bed was very stiff for the last foot in hole number 3.
- 2010 Ran the agitator for 2 cycles to more evenly distribute the coal in the retort.
- 2015 The offtake temperature remains steady at 225 C with a saturation air flow of 500 cfm.
- 2100 Continued cycling the coal valves. The coal leg temperature remains at 25 C.
- 2155 The offtake temperature is up to 290 C. Cycled the coal valves. Coke is still falling down the North leg. The freeboard average is 40 inches.
- 2200 All rods were red at 3 minutes on this fire test. The bed is getting stiffer under holes number 4 and 5.
- 2235 The offtake temperature is 300 C.
- 2300 The offtake temperature is now 314 C. The coal legs are still cool. The freeboard average is 39.5 inches.

June 18, 1985

- 0000 Fire test ash average is 12.86 inches. All rods went in with ease.
- 0100 Boiler alarm went off. Reset the boiler burner and it seems to be O.K.
- 0130 Freeboard average is 38.5 inches.
- 0200 Fire test ash average is 14.14 inches. The bed is soft and the bars went in easily.
- 0300 North coal leg is warm to the touch, while the south coal leg is cold. Rodded out the North coal leg to break up any blockage. Ran the agitator for 2 revolutions to even out the bed. Freeboard average is

38 inches. Cycled the coal valves. Coke falling was audible in the pipes.

0400 Fire test ash average is 13.86 inches.

0542 The coal legs are empty.

0545 Dropped the Rosebud coal into the retort.

0600 Fire test ash average is 14.57 nches. Started loading Rosebud coal into the weigh bin at 4.84 tons.

0630 Stopped loading coal at 10.78 tons. Cleaned up the coal storage area.

0730 Changed the caustic barrel.

0745 Dumped the cyclone and flushed it for 30 seconds. Left the valve closed.

0750 Freeboard average is 36 inches. Boiler alarm sounded and the boiler was reset.

0800 Furnace pressure transmitter was adjusted. The scale now shows 50% instead of 0. Installed a flow transmitter for the primary combustion air.

0810 Fire test ash average is 14.86 inches.

0815 The pH is 6.5.

0845 This cyclone dump showed very little particulate.

0855 Flame failure alarm sounded on the boiler once again and it was reset. Shut down the water on the jacket outlet to repair defective pipe. At the start of this process the temperature was 45 C and now it has increased to 65 C. We also drained the surge tank.

0910 Started the water again on the jacket outlet. Pipe repair has been completed.

0925 Dumped the cyclone and again there was very little particulate. Left the valve open for 30 seconds and then closed it tightly.

0945 Low water alarm on the boiler sounded. A loose wire was found on the motor below the preheat tank and was repositioned properly. Allen wrenches on the connection were loose and the coupling had slipped back.

1000 Freeboard average is 38.5 inches. Fire test ash average is 15.14 inches.

1015 Started the grate at 1/2.0.

- 1040 Checked the caustic barrel as the hose appeared to be empty. Increased the speed of the caustic pump to check if liquid was in the hose and then returned it to 30/30.
- 1050 Decreased the jacket water outlet for repairs to the boiler.
- 1100 Freeboard average is 38 inches.
- 1115 Increased the jacket water outlet.
- 1135 Increased the jacket water flow as the temperature had reached 90 C.
- 1140 Cyclone dump showed very little particulate with no overflow.
- 1200 Fire test ash average is 13.71 and all bars were red hot.
- 1230 Freeboard average is 39 inches.
- 1245 Decreased the jacket water flow.
- 1300 Dumped ash and sampled it. Large quantity of hot unburned coke was found in it. Turned off the grate drive.
- 1310 Freeboard average is 40 inches.
- 1320 Gas offtake pressure dropped to zero. Discovered the furnace pressure control was set on manual. Upon turning it to automatic the pressure came back to 0.2 -0.3 inches wc.
- 1400 Fire test ash average is 14 inches. Freeboard average is 38.5 inches.
- 1410 Adjusted the saturation steam temperature to 59 C.
- 1430 No particulate was evident in this cyclone dump. Increased the saturation air flow to 600 cfm.
- 1450 Opened the jacket overflow a bit to reduce the jacket outlet temperature.
- 1500 Freeboard average is 42 inches.
- 1600 Fire test ash average is 14.57 inches. The bed is still a combination of coke and Rosebud. All bars went in easily except number 3 which was a little stiff.

1800 Fire test ash average is 15.57 inches. Readjusted the steam to the retort access ports. Still not using the grate.

1810 Gas quality is showing steady improvement. Increased the water flow to the scrubber upper spray ring as the scrubber exhaust temperature had reached 100 C.

1830 Dropped 0.36 tons of rosebud. Ash cone is now holding 115 pounds of ash.

1930 Flushed the cyclone for one minute with no resulting particulate.

2000 Fire test ash average is 14.71. All bars went in easily.

2020 The inboard bearing on the induced shaft fan was making some noise, but after greasing, it was quiet.

2128 Boiler off alarm sounded. Relit the boiler.

2130 Some brownish particulate was evident with this cyclone dump.

2200 Fire test ash average is 13.86 inches. The grate is still off.

2210 Dumped ash and took a sample. Console ash weight reads 185 pounds. The sample was wet with some chalky fleck apparent.

2220 Started loading coal into the weigh bin at 7.23 tons.

2240 Stopped coaling up at 10.9 tons.

2300 Everything is running smoothly.

2330 Flushed the cyclone and found very little carryover. The water in the tank was blue. The boiler went down on "flame failure" once again.

June 19, 1985

0000 Fire test ash average is 14.43 inches.

0130 Flushed the cyclone. Once again the boiler went down on "flame failure".

0135 Flame failure again.

0140 Flame failure again. Cleaned the fire eye and the ignition rod.

0150 Restarted the boiler.

0200 Fire test ash average is 14.57 inches.

0210 System shut down.

0230 Attempted to start up again. The saturation blower is making a lot of noise. Found no material inside the blower.

0415 Still trying to troubleshoot the problem.

0615 Finished the blower assembly.

0634 Restart the saturation blower. The cyclone seal is overflowing.

0636 Started the induced draft fan, primary and secondary combustor fans and lit the combustor.

0645 Delivered gas to the combustor. Saturation air flow is 600 cfm. Reset the agitator and jacket water flows. Started the caustic pumps.

0740 System shut down. Flooded the cyclone.

0748 Scrubber pumps off.

0820 Restart the gasifier.

0822 Lit the combustor pilot.

0825 Draining the cyclone.

0830 Delivered gas to the combustor. Previous shutdown was caused by a loose wire on the contact inside the primary combustion fan push button control box.

0850 Increased the saturation air flow to 800 cfm. Started the grate at 1/2.0.

0855 Increased the furnace pressure to 70 inches wc.

0900 Started to increase the steam input.

0920 Increased the jacket water flow to 9 gpm as the jacket water temperature was 89 C.

0923 Increased the saturation air flow to 825 cfm.

0930 During this cyclone dump the water was a turquoise blue color.

0940 Increased the jacket water flow to 10 gpm as the jacket water temperature was 89 C.

1005 Increased the saturation air flow to 830 cfm. Freeboard average is 38.5 inches.

1010 Fire test ash average is 14 inches.

1015 Scrubber exhaust temperature is running 105 C so it was adjusted downward.

1030 This cyclone dump showed no particulate.

1045 Started the temperature probe in the number 5 hole.

1117 Started the pressure probe and finished the temperature probe.

1125 Completed the pressure probe.

1127 No particulate was evident this cyclone dump.

1210 Fire test ash average is 10.57 inches. Freeboard average is 39 inches.

1227 Flushed the cyclone for 30 seconds.

1300 Freeboard average is 39.5 inches.

1330 Dumped the cyclone and took a sample.

1405 The ash pit pressure gauge all of a sudden showed -13.3 inches wc. Tapped on the gauge and it resumed normal reading.

1406 Fire test ash average is 9.93 inches.

1410 Freeboard average is 36.5 inches.

1425 Flushed the cyclone for 30 seconds with no runover.

1440 Dumped the ash. It was cold and wet.

1500 Freeboard average is 36 inches.

1530 This cyclone dump produced several 1-3 inch chunks. Satauration air flow is 800 cfm.

1600 Fire test ash average is 11.43 inches. The grate speed is 1/2.0.

1700 Dumped and sampled ash. There were chunks up to 2 inches.

- 1800 Fire test ash average is 13 inches. Leaving the grate speed at 1/2.0.
- 1830 Cyclone dump shows very little particulate. Raked the bottom and only got approximately 1 cup of granular matter.
- 2000 Fire test ash average is 11.86 inches. The fire zone is narrow (only about 4 inches). All rods are going in easily. Freeboard average is 38 inches.
- 2025 Decreased the saturation temperature to 58 C. Saturation air flow is remaining at 800 cfm.
- 2030 Dumped the cyclone and flushed it for 1.5 minutes. Absolutely nothing is showing in the bottom of the tank.
- 2100 Dumped and sampled ash.
- 2140 Started loading coal at 6.21 tons.
- 2155 Stopped coaling up at 11.75 tons.
- 2200 Fire test ash average is 10.86 inches. We are noticing some channeling in the area of holes number 5 & 6. Number 2 hole showed 3 zones. Leaving the grate at the slowest speed.
- 2230 Cyclone dump once again produced no particulate. Flushed for 2 minutes. We are getting 153 Btu gas Offtake temperature is 300 C.
- 2300 System appears to be running smoothly.
- 2330 Very little carryover with this cyclone flush (only blue water.)

June 20, 1985

- 0000 Fire test ash average is 8.29 inches. The bed is soft and the bars are going in easily. Burning through is evident in holes 5 & 6. We will poke these down at 20 minute intervals. Multiple zones were noticed on bar number 2. The offtake temperature is 350 C.
- 0030 Poked holes number 5 & 6. This cyclone flush produced particulate in the amount of 5 rakesful.
- 0130 Offtake temperature is 405 C.
- 0140 Ran the agitator for two revolutions and coaled up.
- 0150 Offtake temperature is 200 C.

- 0200 Fire test ash average is 8.71 inches. Multiple zones were noticed on bars 2 & 5. There was a slight crust in the area of hole #6 about 12 inches above the grate. Offtake temperature is 175 C.
- 0220 Ran the agitator for two revolutions.
- 0230 Flushed the cyclone. The water is now more black than blue with very little carryover. Offtake temperature is 135 C.
- 0235 The pH is 5.5. Increased the caustic pump setting to 40/40 from 30/30.
- 0330 This cyclone flush produced very little carryover; mostly granular clusters of 3 inches in size.
- 0400 Fire test ash average is 9.86 inches. The grate speed is 1/2.0. Multiple zones were evident on holes 3 & 5. We are running the agitator intermittently, as needed. CO is 34 and CO2 is 5.
- 0440 Started agitator to stabilize. Off-take temp. running continually at 4.0.
- 0500 Ash Dump - 165# ash - larger chunks were softball size, most was smaller than 2 inches. Color - cream to light brown.
- 0530 Started filling weight bin at 5-64 tons.
- 0555 Finished filling with 10.95 tons.
- 0600 Fire Test - Ash average at 10.33 inches.
Low Holes #3 at 6inches, #1 at 7 inches.
High - #5 at 17inches, #4 at 12 inches.
All rods ahd single fire zones and all went down easy - stopped agitator for fire test.
- 0610 Started outside clean-up.
Started agitator running at 4.0.
- 0620 Cyclone Flush - 1 1/2 rakes of mud.

Second Shift: Everything running smooth!

- 0700 Freeboard av. 34 1/2"
- 0730 Cyclone Dump O.K. Small amount of partiulate; some chunks.
- 0750 Did Freeboard and Firetest early to allow time for temp and pressure tests.

0815 Turned off agitator to allow for temp and pressure test.

0840 Completed temp and pressure test. Started agitator drive.

0850 Cyclone dump O.K. Fine dust out only. Increased agitator speed at 30.3 to bring down offtake temp.

0853 Decreased agitator speed to 4.0 as temp of offtake was going down.

0905 Raised saturation temperature to 60 degrees

0905 Started to increase cfm of air blower to achieve a max of 1000 cfm. First increment was to 900 guage.

0910 Moved to 950 on guage of Sat. airflow

0915 Moved to 1000 on guage of Sat. airflow

0925 Reached 1000 cfm on saturation airflow

0930 Cyclone dump O.K. small amount of fine dust on bottom. 3 rakes full.

1015 Increased agitator speed to 6.
Increased grate speed to 3.

1017 Increased agitator speed to 8.

1030 Cyclone dump O.K. 30 seconds water on valve.

1050 Coal leg seemed plugged as temp ran up to 34 degrees and coal was heard falling down the leg.

1100 Coal leg temp down to 30 degrees.

1125 Cyclone dump more fine dust.

1155 Changed caustic barrel.

1200 Fire test and Freeboard O.K.

1210 Ash Dump UP; Start 505/End 10

1219 Completed Ash Dump start up weight.

1220 Increased Grate speed to 5.0

1300 Freeboard O.K. 35 inch average.

1330 Cyclone dump O.K. 3 rakes of dust (fine).

- 1340 Hose in caustic pump had an air bubble in it so don't know if it was pumping correctly.
- 1415 Reset grate drive to 2.0 and reset grate speed to 2.5.
- 1430 Cyclone dump.
- 1435 Increased water in jacket to 11.0 6.p.m. Jacket outlet was 86.
- 1440 Roded #4 hole to try and bring together multy level zones. Started to coal-up.
- 1455 Finished coal-up.

3rd SHIFT

- 1530 Cyclone dump sample particulate heavy. Many rakes full. Powdery.
- 1600 Firetest with agitator running does not allow enough time to see true fire zone. Bars #2, 5, & 6 were stone cold. Both #1 and #7 showed double zones. Bed even 10" to 14" all around. Some Boston Crust on #2 hole. Leaving Grate Speed at 2/2.5 Slight glowing on #3.
- 1630 Dropping a bit over 1 ton/hr. on coal feed.
- 1645 Dump ash at 840 lbs on console counter. Hopper was filled to the top which verifies console weight indicator rather than down below. Ash chunks still smaller in size. No clunkers.
- 1730 Cyclone dump shows little carry-over. 4-5 rakes full. Small chunks.
- 1800 Firetest shows ash avgerage slightly lower at 11.16 inches without #7 bar, which was dirty and red within 1 inch of tip. No glowing on top but have high and low holes side-by-side on #1, 2 and #5, 6. #1 and 4 bars still cold after 7 minutes insertion. Slow Grate Speed to 2/2.3 to maintain ash level at 11 inches.
- 1830 Second coal feed in a row under 1.0 tons/hr. pH up to 8.0. Turn Caustic down to 30-30.
- 2000 Firetest indicates ash average without #7 hole dropping, so will slow the grate to 2/1.9-2.0. This time #7 has clearly 18 inch ash and an 18 inch firezone. The hole avgerage was 10.5 inches, low of 7 inches on #6 to 14 inches on #5. No dirty bars, but had 5 cold bars after 5-7 minutes. Gas quality deteriorating and offtake temp around 335 C, with a #2 hole glowing slightly. Bed still soft. No clinkers.

2030 #2 and #3 holes bright orange. Poked for 10 minutes.
Offtake only drops 8 C to 327 C.

Cyclone carry-over remains light.
pH has responded; now running 7.0.

2045 Start filling weigh bin at 4.84 tons.

2120 Weigh bin full.

2120 Dropped ash at 721 lbs. Found some larger fused chunks
4-5 inches in size. Gray to chalky color.

2200 Firetest shows only 9.0 inches ash. Slow grate to 1
tooth at slowest speed (+/-2.0).

First time all night had 7 clear firezones. No dirty
bars, but a 2-ft. firezone on #3 bar. #3 also
stiffest.

June 21, 1985

2300 Everything churnen & burnen. Gas quality decreased
since 1st 24 hour period. Offtake slowly increasing,
359 C.

2330 Cyclone Flush - 10 rake full's + powder; a lot of sludge
on bottom of tank. pH-6.5 1/2 inches barrel caustic.

0000 Fire test- ash average - 7.0 inches. Bed in bad shape
multi-zones on holes #2, #5; holes #1, #4, #6 cold; had
to recheck as could not tell where fire zone was due to
agitator time factor. Slowed agitator to 4.0 and
repoked holes #1, #4, #6. Resumed agitator speed at
8.0 after test complete.

0030 Cyclone flush - 12 rake fulls of mud.

0045 Increased agitator speed to 10.0 offtake 425 C.

0130 Cyclone Flush - 2 rake fulls heavy accumulation of dust
floating on water.

0200 Fire Test - ash average 11.16"
Multi-zones on holes #4, 6
All rods down easy, hole #3 has crust area. Agitator
speed reduced to 6.0 for test

0215 Resumed agitator speed of 10.0 offtake temp at 325.

0245 Reduced agitator speed to 8.0 as offtake temp. leveling
out at 326 C.

0300 Ash dump at 490#. Ash mostly small is size; some small sized clinkers; chart taken from console read-out.

0330 Offtake started to increase; increased agitator speed to 10 RPH; Cyclone Flush - 4 full rakes of mud; medium amount floating on top of water.

0400 Fire Test - ash average 12.5; multi-zone on hole 6 only; 36 inches fire zone on holes #2, #5. Hole #1 had 33 inches ash depth with bright red fire zone. Holes #2 & #3 have hard crust about 36 inches to 48 inches from grate; will poke these holes out in 1/2 hour.

0430 Cyclone Flush - 10 Rakes of mud; small amount floating.

0510 Boiler down on flame failure - reset.

0530 Started filling weight bin at 4.21 tons; peat sods arrived - located dumping sight.

0600 Fire Test - 13.1 Ash Average; Rod caught-up on agitator #1 hole, multi zones on #2 & #5.

9:30 - 12:00 STARTED OUTSIDE CLEANING

2nd Shift

0710 Changed water jacket GPM to 13 as water jacket temp was 96 C.

0725 Cyclone Dump; 11 rakes full.

0750 Changed agitator speed to 8.0.

0805 Increased Grate Speed to 4.0.
Fire Test real unlevel (9 inches -33 inches).

0806 Started temperature and pressure test; left agitator on!; Left probe down on each level, only between sweeps.

0830 Cyclone Dump O.K. 30 sec water; 13 rakes heavy sludge.

0840 Completed temp and pressure probe.

0900 Increase cfm on saturation air blower gauge to 1080.
Increase grate speed to 4.5.
Freeboard 34 inches average.

0905 Increase gauge setting on saturation air blower to 1120 cfm.

0907 cfm on saturation air blower reached 1100.

- 0909 Increased 6 p.m. on water jacket cfm to 14. Jacket temperature was 89 C.
- 0915 Increased gauge setting on saturation air blower to 1130 cfm.
- 0922 Increased gauge setting on saturation air blower to 1180 cfm.
- 0927 Cyclone dump - Increased SAB gauge setting to 1200 cfm.
- 0933 Increased SAB control gauge to 1240 cfm.
- 0934 Cyclone dump larger chunks (softball size) 14 rakes full; heavy sludge.
- 0937 Increased SAB control gauge to 1250 cfm; hit 1200 cfm reading.
- 0943 Increased water jacket to 176 p.m.
- 1000 Increased water jacket to 196 p.m.

Temp on jacket 97 C. Freeboard 35 1/2 inches average; Firtest very unlevel 5 inches - 48 inches; average.

Hole #1 Multizone - dirty 7"-47"
 Hole #2 Multizone - 4"-22"
 Hole #3 5" Hot
 Hole #4 6" Hot
 Hole #5 Multizone - dirty 17-48"
 Hole #6 5" Hot
 Hole #7 Multizone - dirty 10-54"

- 1030 Cyclone Dump - 6 rake full; fine dust.
- 1050 Firetest hard to drive in rods; multizone - dirty on most holes; will reduce cfm on SAB.
- 1100 1100 CFM on SAB.
- 1125 Cyclone dump - 30 seconds water on 15 rakes full fine dust.
- 1200 Freeboard - 32 1/2 inches average. Firetest less multizones than last test #1 Hole needs a poke down; it had 36" plus hot on rod; average Ash 8.7 inches.
- 1215 Ash Dump - Gray ash - 480#.
- 1225 Cyclone Dump 3 rakes full.
- 1230 Started to coal up; 5.02 in bin.
- 1235 Poked down #1 hole.
- 1255 Completed coal-up 10.66 in bin.

1325 Cyclone Dump 13 rakes full.

1335 Scrubber inlet temperature seemed to rise quickly; we increased secondary combustor air to 11,500; cfm 88 C.

1339 Scrubber inlet temp still on rise - 97 C.

1350 Scrubber inlet temp came down to 60 C.

1400 Freeboard 36 C average. Firetest getting better; Ash average 12.5 inches; hard spots on #1 and #6 also. #1 and #6 should be poked down at 1445.

1425 Cyclone dump. 30 seconds water on 2 rakes full fine dust.

1435 Started to coal-up 8.65

1440 Finish coal-up 10.65

1450 Tried to poke down #1 and #6 hole. Same hard coal present but hammer not required.

1500 Decreased water jacket 6 p.m. to 17 6.p.m.

3rd SHIFT

1530 Coal up hits 1.17 tons; Cyclone Dump heavy; bed not glowing; fireloss evened out at 12 inches wc. New operator being shown ropes.

1600 Firetest shows 9.3 inch ash average; slowed grate to 1-2.0 in order to build ash. Only one dirty bar. #1 hole with 4 zones up to 52 inches. Holes #1-#5 low, averaging only 6 inches.

1615 Dump ash at 648 lbs; ash very dry; no larger chunks. Mostly 2 inches smaller diameter; ash was gray to chalky-white in color.

Will begin bumping load back to 1200 cfm at 25 cfm increments every 15 minutes; P-704 now at 12" wc; Offtake Temp 298 C. CO at 28%; CO 2 at 7.6%.

1620 Crew will move coal away from wall and I'll have peat dumped and covered on pad.

1730 Truckers finally have articulator working and will start dumping on pad.

15minutes after hitting 1200 CFM load T-705 up to 347 C. CO2 approaching 8, while still 28%; Have gained an inch to 13.3" WS on P-704.

- 1730 Increase agitator water to 3 GPM.
- 1800 Firetest about the same. Ash averages 9.8" with #1 still alive 4-5 ft. and #6 high ash at 25". No other dirty bars; had to pound in #2 bar. Continue to run grate at 1-2.0 speed.
- 1820 Peat dumped and covered on pad; will continue hauling coal up to road out back.
- 1830 Gas quality not rapidly deteriorating, but offtake has hit 385 C. CO still at 28% with CO2 just under 8%.
- 1849 T-705, offtake temp has hit 400 C. Will run agitator at 15 SPH for 10 minutes; no orange holes . . . yet!
- 1900 Having trouble with cyclone valve; will not close all the way.
- Return agitator to 8.0 SPH as offtake temp down 30 C to 380 C.
- 1920 Still working on freeing up the Cyclone Grate valve; packed under cone.
- 1945 Return load to 1100 cfm as our gas quality getting worse; CO at 26%; CO2 at 8.4%; T-705 at 488 C.
- Continue trying to free-up Cyclone Grate valve. Unable to close valve.
- 2000 Had 3 dirty bars. Had to pound in #1, #2, #4, and #6. #1 has all the fire on top. Increase grate speed to 1-3.0.
- 2015 Start filling weigh bin at 4.88 tons, and resume work on hung up cyclone valve; still won't close. Valve won't close past half way point.
- 2038 Boiler off; alarm sounds; relit boiler.
- 2045 Stop filling weigh bin at 12 tons.
- 2100 Still no luck with Cyclone Grate valve; continue trying; Have 95 PSI at cylinder.
- 2110 Finally get valve to close; cycled many times; flushed and got heavy fine powder.
- 2115 Dump and sample ash.
- 2120 T-705 still close to 500 C; #1 hole same as it has been - orange.

2200 Firetest shows 13.6 inch ash average, but #2, 3, 4, & 5 holes 7-8 inches.

#1 still alive with one 4-foot zone at 32 inches. Next hole #6 also high with ash. Slow grate to 1-25 to preserve ash level. Offtake temperature still 493 C.

2220 Resume hauling coal out back.

2230 Cyclone dump; valve functions finally, but limit switch for closed position not correct.

SATURDAY JUNE 2, 1985

1st SHIFT

Good morning every-one

2300 Rosebud not running so well; gas quality not so good.

2330 Ph-7: Caustic barrel almost empty; starting to haul coal to back 40; Cyclone Flush - 8 rakes of small gravel sized carry-over.

2345 Offtake temperature reaching 525 C. Will run agitator at 15-0 for 10 minutes.

0000 Firetest - ash average 12.5 not counting #7.

0030 Cyclone flush - 10 rake; small gravel size.

0115 Reduced air flow to 1000 CFM as offtake temp difficult to keep under 500 C; gas quality not good; 24-CO/10-CO2 burning through on #1, 2, 6 - will poke these holes.

0200 Firetest - Ash average 9.5/ #1, 3, 6, 7 holes have heavy crust layer. Low! 1-0" and 6' to 7' fire zone. High - #6 with 28", rod came out cold; offtake at 496 C.

0220 Ash dump at 513# (Ran agitator at 15.0 for 15 min); mostly small pieces and sand type, - small amount of clinker, handball size.

0300 Cycloneflush - 19 rakes of small gravel size - heavy dust floating on water.

0330 Changed caustic barrel, - poked #1, 5, 6, 7 holes.

0400 Firetest - 9.6" ash average; multi-zone on #1 holes 8" - 36" - 60"; cold rod on hole #3; holes #1, 5, 6, 7

all hard getting rods down in (ran agitator at 15.0 for 15 min.)

0430 Cyclone flush - 12 rakes - sandy type gravel. Boiler down on flame failure - reset.

0500 Started filling weigh bin at 4.28 tons.

0530 Cyclone Flush - 6 rakes - sandy type mud.

0540 Boiler down - reset.

0545 Boiler down again - took fire rod out and cleaned - reset - O.K. for now.

0600 Firetest - ash average 10.16 inches; poking bed has helped; all rods went down easier. #1 Fire zones at 9 inches. #2, 3, 4 all cold; slowed agitator to 8.0 for test.

0615 Resumed agitator speed at 15.0; boiler down - reset.

0630 Cyclone flush - 6 rake fulls of sandy mud.

0630 Finished filling weigh bin with 11.27 tons.

0640 started outside clean-up.

0645 Reduced agitator speed to 12.0 as offtake is down to 477 C.

0700 Cut agitator speed back to 7.0; cut CFM on SAB to 800 CFM as the bed was bad and the offtake temp was too high.

0725 Cyclone Dump O.K. 8 rakes full.

0750 pH was 8 inches, so we cut back speed to 35-35.

0817 Increased grate speed to 3.5; Firetest 12 inches average. Freeboard, 32.5 inches average.

0822 Decreased water on jacket to 15 6.p.m.

0830 Turned agitator speed up to 30.4; offtake 529.

0832 Turned agitator speed down to 7 after 2 revolutions.

0840 Gas offtake down to 469 C.

0845 Poked down hole #5 and #4.

0900 Reduced CFM on SAB to 700; reduced furnace pressure to 50; reduced primary combustion air flow to 1000 cfm. Reduced secondary combustion air flow to 6000 cfm.

0910 Reduced grate speed to 2.5; reduce water on jacket to 13 6.p.m.

0936 Turned off agitator drive.

0940 Change water in agitator to 3.

0955 Turned on agitator drive 2.0.

1000 Turned grate drive up to 5.

1025 Poked down #1, #2 holes.

1030 Gas offtake hit 624 C.

1035 Poked down #6 hole.

1040 Increased Sat. temp 62 C; til 703

1045 Increased grate speed to 2-5.0 (tooth)

1052 Increased grate speed to 2.5.

1055 Increased agitator to 30.4.

1100 Decreased agitator to 5.0.

1105 Grate drive stuck - increased to 2-5.0.

1110 Decreased grate to 3.5

1115 Ash Dump - hotter than normal; lots of clinker.

1125 Decreased grate to 3.0.

1125 Cyclone Dump - 30 sec water on.

1125 Increased sat. temp. to 64 C til 703.

1200 Freeboard 33.5 inches avgerage; Firetest 10.2 inches average #1 hard.

1220 Reduced saturation temperature to 62 C.

1300 Freeboard 34.5 inches average.

1308 Changed back pressure valve to 45 % open.

1318 Changed grate drive to 1-4.0.

1319 Dropped cfm to 600 on SAB.

1330 Cyclone Dump - 30 sec water on; 5 rakes full.

1345 Cut back water on jacket to 10 gpm.

- 1350 Changed back pressure to 50% open.
 - 1415 Freeboard 29 1/2 avg.; Firetest getting better on #1.
 - 1416 Changed agitator to 3.0.
 - 1420 Boiler off - flame out.
 - 1430 Cyclone Dump O.K.; 30 sec water on.
 - 1440 Turned pump down on Caustic to 30-30 as PH read 8.5.
 - 1450 Boiler off - flame out. Reset.
-

3rd SHIFT

- 1530 Cyclone carryover light; pH at 8.5 barrel full; reduce pump to 20-20. Freeboard only 31" opposite agitator. Crew will continue moving rest of coal from pad.
- 1600 Firetest shows low ash all around; have 6.9 inch ash level; some improvement in #1 over last night; have 1 firezone from 15-40 inches. #4 hole was the clinker. Took heavy sledge to get the bar down. Both #4 and #7 hot, with #5 dirty.
- 1600 Slow grate from 1-4.0 to 1-3.5 to preserve what ash we have, while still fast enough to crank out the clinker.
- 1630 Will slow agitator speed to 2.0 sweeps/hr. T-705 down to 217 C. Gas quality poor.
- 1700 Dump and sample ash at 745 lbs. Ash dry and dusty; gray in color; with only a spattering of soft ball sized chunks. Mostly dust to 2 inch size ash.
- 1730 Put agitator back to 2.5 sweeps/hr. to keep offtake from pushing 230 C.
- 1800 Firetest shows bed stiffening up. Had to pound down #1, #3, #7, #6. Can't speed up grate as have barely 6" ash level. No dirty bars, but #3 remains hot. Firezones now quite shallow. #1 hole almost cold; slowed grate speed to 1-3.0 to maintain what little ash is left.
- 1915 Offtake temperature just now goes under 200 C. Presently 197 C. Will turn agitator off and monitor.
- 1922 Restart both grate and agitator. Don't know what happened!!! Before I could turn agitator off (reg: 19:15), lights flickered and both grate and agitator stopped. I got no alarm when either one stopped;

checked combustor and blowers and found all fine; restarted grate and will run at 1-5.0.

- 2000 Firetest shows 7 inch ash average. Pounded down #1 and #6. #7 red to the tip. #1 and #7 have hot zones. Agitator must be turned back on as offtake up over 100 C in 45 minutes. T-705 now 303 C. Grate will remain at 1-30, but will run at 1-5.0 at least 10 minutes each hour.
- 2025 T-705 finally under 300 C again after resuming agitator at 2 SPH.
- 2100 Dump and sample ash - some larger clinkers. Very hot, dry, and dusty dump.
- 2125 T-705 back to 200 C.
- 2152 Boiler goes out - restarted.
- 2200 Firetest shows only 5.4 inch ash average. Still clinkered up down below. #1 dirty with 3 narrow zones. #5 hot with only 2 inch ash temporarily slow grate to 1-2.0.
- 2220 Boiler off again - this time no alarm or light. Only by chance we discovered it. Relay loose. Relit at 2230.

SUNDAY JUNE 23rd 1985

1st SHIFT

- 2300 Everything running good; low ash level.
- 2315 Cyclone outlet P-706 - malfunctioning. Will check for plugged line, as reading high - 1.5 inches P-705 - 0.5
- 2330 Cyclone Flush - 2 rakes of mud.
- 0000 Firetest - ash average low - 3.42 inches; 0 inches on holes #1, 2, 7. Multi zones #2 - #6, hole #1 red from tip to 40 inches high. #2 hole red at tip 2 inches high with second zone at 13 inches. Bed still rather hard, with #1 hole worst. Keeping grate speed at 1-2.0.
- 0045 P-706 lines not plugged, malfunction with transducer. Roded out transducer line - reading 2/10 high.
- 0100 Cyclone Flush - 3 rakes of mud.
- 0115 Ash Dump with 521# ash; lots of clinker. Had one big mass inside of cone. Broke up to let it drop out,

about pillow size. Rest mostly baseball size and smaller.

- 0130 Cyclone flush - 2 rake full's of mud.
- 0200 Firetest - ash average 5 inches; hole #1, #7 both 0 inches again. Multi zone on #5 with 3-9-15 inches. Bed still stiff, but not real bad.
- 0230 Cyclone Flush - very little carry-over; boiler down-reset.
- 0320 Boiler down again - cleaned ignition rod.
- 0340 Cyclone Flush - very little carry-over.
- 0400 Firetest - 7.7" ash average; multi zones - #1 & #6 (17-27/20-32); Low-#4 & #5 with 0"; rods still go down hard.
- 0415 Offtake climbing to 300 C. Run agitator around twice at 15.0.
- 0420 Resume agitator at 2-0.
- 0430 Cyclone flush - very little carry over.
- 0445 Burn through on holes #1 & #6; offtake hitting 350 C; will poke #1 & #6; will speed grate to 1-5-0 for 5 min to help loosen bed.
- 0510 Resumed grate speed of 2.0; increased agitator speed to 6.0.
- 0600 Firetest - 11 inch ash average; holes #1, 2, 3, 4, 7 all cold after 4 min. down. Multi-zone still on #6 with triple zone 6 inches, 18 inches, + hole #4 was 0 inches.
- 0630 Speed grate up to 5.0 for 15 minutes to break up clinkers. Bed still hard, but better than previous test tonight.
- 0640 Ash dump at 503#; large size clinker - 6"-7" size; mostly small golf ball size gray and white in color. Accumulation of black coal type ash mixed in.

2nd SHIFT

- 0730 Cyclone Dump O.K.; water 30 sec on no dust.
- 0817 Dropped saturation temperature to 60 C.

0825 Decided to put a buffer in between the Rosebud and the peat. The buffer will be a Met. Coke. The reason for the buffer is that the bed of Rosebud is hard and in poor condition to put peat on top of it.

0840 Coal weigh bins empty; dial reading -.05.

0840 Cyclone dump O.K.; water 30 seconds. No dust.

0900 Changed agitator speed to 4.0 Freeboard 34 inch average.

0907 Reset coal leg. alarm to 28 C.

0927 Opened coal valve for last time on Rosebud.

0930 Finished moving Rosebud and fines to South Storage area.

0932 Cyclone dump - 30 seconds water on; no ash.

0950 Lube gasifier

1000 Freeboard 32.25 inches average.

1030 Firetest 20.83 inches average. #1 and 4 real hard; had to test twice; #5 and 6 had high ash.

1035 Increased grate speed to 5.0.

1037 Started to put Coke-up.

1045 Turned Agitator Drive off.

1102 Increased Sat. Temp to 64 C.
Freeboard 35 inch average; burning thru on #1.

1105 Started agitator drive at 30.4 for 2 revolutions.

1112 Turned agitator on to 4.0.

1115 Did Ash Dummpp #665 up; hot ash, large chunks.

1117 Turned Grate Speed down to 3.0 as we had some fire come out with the ash during dump.

1130 Cyclone Dump - enough ash came out to take a sample.

1200 Freeboard 33 inch average. #2 and #5.

1215 Increased Grate Speed to 5.0; Firetest showed improvement on all holes except #1; #1 was hard and low as 12.85 in ash average

1230 Reduced Grate to 3.0.

- 1256 Increased Grate Speed to 5.0.
- 1400 Firetest showed multizone on #6 and #1; was too hard to put in test rod; Freeboard 33 inch average; #1 showed red hot when poke hole open.
- 1415 Poked down #6; it had clinker pretty high.
- 1425 Cyclone dump 30 seconds water on; 1/2 rake ash.
- 1430 Ash dump early again to reduce offtake temperature; some hot ash and chunks are getting smaller.
- 1450 Tried to bust off more clinker on #1 hole - still hard and very little came off.
- 1500 Freeboard 36 inch average.
-

3rd SHIFT

- 1530 Continue cycling disc coal valves; pipes not yet empty; T-714 at 26 C. Offtake temp continuing nosedive; now at 175 C.
- 1600 Firetest show the loss of 4+ inches ash on average with the grate churning at 1-5.0. #1 hole looser; some pounding to get bar down. Now shows one 8-10 inch firezone at 12 inches. #6 hole dirty with 5 zones all the way up the rod. Holes #2, 3, 4, & 7 were cold after 5-6 minutes; slow grate speed to 1-3.0. Freeboard at 36 inches on hole #6.
- 1620 By the way, at this low load, we're making the best gas of the run. CO at 31%, CO2 about 7.8 %, higher heating value about 150 BTU/3.
- 1630 Turn agitator back on to 4.0; sweeps/hr. as offtake temp up +100 C to 269 C in 30 minutes.
- 1645 PH at 6.5; Cyclone particulate light; will dump and sample as at 460 lbs; T-705 now up to 290 C; will crank grate hard 1-5.0 for 10 minutes.
- 1700 Ash dump revealed the normal soft ball sized chunks. Very dry. Very hot. But, because of the billowing dust, operator saw no larger clinkers evidenced in earlier dumps.
- 1705 T-705 now on the down swing; coming down from 290 C to 262 C. Slow grate speed to 1-3.0. Agitator remains at 4.0 SPH.
- 1752 T-705 returns under 200 C; now at 106 C.

1800 Firetest shows only 6.0" ash, but is very even all around with 5" to 9" from #1 through #6 holes. #6 still dry with cold bars on #1, 2, 3, 4, & 7. Pounded #4 & #5. Leave grate at 1-3.0 speed.

1815 Continue cycling valves, as north leg warm to the touch. Then again pipes might not empty out until 8:00 or 9:00 p.m. tonight.

1910 Offtake still rising, now at 330 C. Currently at 312 C.

1925 Offtake hits 352 C.

1930 Take final Ash Dump for FGT-016 at 370 lbs.

1955 Offtake back down to 311 C.

2000 Firetest indicates #6 alive on top. Have 4 ft fire zone and 39" Freeboard. Large clinker around #6 hole. Bars cold all around, except #6 hole.

2025 Run grate at 1-5.0 for 10 minutes, hoping to move clinker; still not out of Rosebud, but north leg continues warmer.

2035 Slow grate to 1-2.5 from 1-5.0. Agitator running 2.0 SPH; continue cycling coal valves; offtake back down under 300 C to 291 C.

2100 T-705 back over 300 C. Cycle coal valve and use vibrators; coal leg temps the same.

2126 Offtake going up; now 411 C.

2150 Offtake approaching 500 C. Coal legs still cool, i.e.: 24 C.; will take Firetest 10 mins. early.

2156 T-705 high offtake alarm sounds at 507 C. Coal legs still 24 C. Firetest same as previous tests. #6 hole has fire on top. Rod shows multiple zones. Get visible zone after 10 mins only on other rods, #12 & #5.

2210 Continue cycling valves. South leg packed; north leg running empty; T-714 only at 26 C. Freeboard on #3 and #6 averages 35 inches. Will run grate hard again for 10 minutes.

2220 Offtake levels off awhile at 533 C. Coal legs at 28 C.

2240 South leg finally warming up T-714 at 29 C. Offtake hits 60 C.

2245 T-705 up to 630 C. Both legs running out. T-714 at 30 C.

2251 Drop coke - hangs up in both sides of weigh bin. T-705 hits 665 C. T-714 at 34 C.

- 2255 Weigh bins cleaned out; get negative numbers on coal wt.
- 00.04 tons.
- 2300 34" and 35" on #3 and #6 directly opposite agitator.
- 2305 Agitator off; #6 hole still alive.

JUNE 24th, 1985 MONDAY

1st SHIFT

- 2300 Reviewed operation with lead operator; slide gates on weight bin; shut off for peat coal-up.
- 2330 Ran agitator around at 30.0 as offtake T-705 reached 725 C. Cyclone flush - very little carry-over; water color taking on that blue color again.
- 0000 Firetest - Ash average at 10.71 inches. Rod down 4 to 10 minutes with #6 hot all way up rod. Fire Zone (red) on #3, 4, 5, 6; rest were cold. Clinkering around #6 hole yet.
- 0030 Called Facility Manager to verify using 1/2 inch screen for peat coal-up. Started filling weight bin with peat.
- 0100 Freeboard at 32 inches on 2 & 5 holes.
- 0115 Started agitator running at 6.0 to help bring down T-705. (785 C).
- 0135 Finished filling weigh bin with 4.17 tons; Cyclone flush - very little carry-over.
- 0140 Ash dump at 620#, soft ball size clinker, gray in color.
- 0200 Firetest - 6.0 Ash average; #1 hole red at tip, dirty at 36 inches; #6 hole had triple red zones with 7 inches of ash. #6 also hard putting down.
- 0230 Cycled lower bin again and cleaned around upper valves. - off.
- 0400 Firetest - 13.5 ash average; #1 hole = bright orange at 60 inches high for 35 inches, hole #2 slight orange at 9 inches, hole #4 has 0 ash with fire zone from tip to 18 inches; hole #5 multizone at 9 inches, 12 inches long and 40 inch mark 6 inches wide; hole #6 0 inches ash fire zone from tip to 6 ft. high.

0430 Decreased grate speed to 2.5 at 1 tooth; Cyclone flush
- very little carry-over.

0500 Started outside clean-up.

0530 Increased grate speed to 1/5.0 for 15 min.

0600 Firetest - Ash average 27.42 inches; all rods down
fairly easy; #1, 5, 6 all high fire zones; average ash
depth - 56" on these 3.

0650 Dropped Peat for Test .017.

END .016

APPENDIX B
Coal Sizing Data

Feed Coal Size Distribution for BOM/FGT-016

Sample Number	Date	Time	Screen Mesh Size inch	Cumulative Mass Fraction, % less than stated mesh size, inch				
				1/4	1/2	3/4	1	1 1/2
1	6/18/84	7:00	1/2	2.9	7.9	43.5	75.9	96.9
2	6/18/84	12:00	1/2	3.0	7.1	31.8	65.3	92.0
3	6/18/84	20:00	1/2	1.5	3.8	22.9	56.7	93.1
4	6/19/84	4:00	1/2	1.0	3.5	26.2	61.1	94.4
5	6/19/84	12:00	1/2	2.5	6.1	32.6	63.4	96.3
6	6/19/84	20:00	1/2	2.9	6.3	30.3	70.5	95.1
7	6/20/84	4:00	1/2	3.1	8.0	34.0	69.5	95.9
8	6/20/84	12:00	1/2	3.1	9.8	42.4	75.9	96.6
9	6/20/84	20:00	1/2	5.6	12.7	37.3	74.9	96.6
10	6/21/84	4:00	1/2	2.6	7.0	31.5	71.7	97.2
11	6/21/84	12:00	1/2	2.3	6.5	30.7	67.4	92.8
12	6/21/84	20:00	1/2	3.9	9.1	31.1	68.8	94.9
13	6/22/84	4:00	1/2	4.1	9.2	32.4	77.7	97.2
14	6/22/84	12:00	1/2	2.6	6.1	29.4	66.5	91.6
15	6/22/84	20:00	1/2	1.9	6.0	27.3	72.3	96.2
16	6/23/84	4:00	1/2	4.3	11.2	45.3	85.9	98.1
17	6/23/84	12:00	1/2	7.0	14.0	40.7	72.5	100.0
18	6/23/84	20:00	1/2	6.1	12.1	40.8	67.6	92.1
19	6/24/84	4:00	1/2	0.8	1.3	4.0	21.2	77.4

APPENDIX C

Coal Addition Log

Coal weights are given in short tons.

COAL FEED LOG

BOM/FGT 016

ROSEBUD

DATE	TIME	SAMPLE #	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)	SCREEN (IN)	WASH
6-17	0945	COKE	10.67	0.30	10.37	0.5	NO
6-17	1430	COKE	0.30	0.03	0.27	0.5	NO
6-17	1530	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1630	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1700	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1730	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1800	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1830	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1900	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	1930	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2000	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2030	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2100	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2130	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2200	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2230	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-17	2300	COKE	CYCLE VALVES - LOWER BIN ONLY				
6-18	0545	C1	10.64	4.84	5.80	0.5	NO
6-18	0630	C1	10.78	10.42	0.36	0.5	NO
6-18	0730	C2	10.42	10.39	0.03	0.5	NO
6-18	0830	C2	10.39	10.28	0.11	0.5	NO
6-18	0930	C2	10.28	10.20	0.08	0.5	NO
6-18	1030	C2	10.20	10.08	0.12	0.5	NO
6-18	1130	C2	10.08	9.98	0.10	0.5	NO
6-18	1230	C2	9.98	9.76	0.22	0.5	NO
6-18	1330	C2	9.76	9.55	0.21	0.5	NO
6-18	1430	C2	9.55	9.43	0.12	0.5	NO
6-18	1530	C3	9.43	9.14	0.29	0.5	NO
6-18	1630	C3	9.14	8.86	0.28	0.5	NO
6-18	1730	C3	8.86	8.57	0.29	0.5	NO
6-18	1830	C3	8.57	8.21	0.36	0.5	NO
6-18	1930	C3	8.21	7.87	0.34	0.5	NO
6-18	2030	C3	7.87	7.53	0.34	0.5	NO
6-18	2130	C3	7.53	7.23	0.30	0.5	NO
6-18	2230	C3	8.47	8.13	0.34	0.5	NO
6-18	2330	C4	10.90	10.57	0.33	0.5	NO
6-19	0030	C4	10.57	10.19	0.38	0.5	NO
6-19	0130	C4	10.19	9.86	0.33	0.5	NO
6-19	0430	C4	9.86	9.27	0.59	0.5	NO
6-19	0730	C5	9.27	8.97	0.30	0.5	NO
6-19	0830	C5	8.97	8.82	0.15	0.5	NO
6-19	0930	C5	8.82	8.22	0.60	0.5	NO
6-19	1030	C5	8.22	7.49	0.73	0.5	NO
6-19	1130	C5	7.49	6.86	0.63	0.5	NO

DATE	TIME	SAMPLE #	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)	SCREEN (IN)	WASH
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6-19	1230	C5	6.86	6.16	0.70	0.5	NO
6-19	1330	C5	6.16	5.47	0.69	0.5	NO
6-19	1430	C5	5.47	4.74	0.73	0.5	NO
6-19	1530	C6	11.17	10.45	0.72	0.5	NO
6-19	1630	C6	10.45	9.73	0.72	0.5	NO
6-19	1730	C6	9.73	9.03	0.70	0.5	NO
6-19	1830	C6	9.03	8.33	0.70	0.5	NO
6-19	1930	C6	8.33	7.63	0.70	0.5	NO
6-19	2030	C6	7.63	6.92	0.71	0.5	NO
6-19	2130	C6	6.92	6.21	0.71	0.5	NO
6-19	2230	C6	11.75	11.00	0.75	0.5	NO
6-19	2330	C7	10.99	10.34	0.65	0.5	NO
6-20	0030	C7	10.34	9.59	0.75	0.5	NO
6-20	0130	C7	9.59	8.96	0.63	0.5	NO
6-20	0140	C7	8.96	8.35	0.61	0.5	NO
6-20	0230	C7	8.35	7.55	0.80	0.5	NO
6-20	0330	C7	7.55	6.78	0.77	0.5	NO
6-20	0430	C7	6.78	6.02	0.76	0.5	NO
6-20	0530	C7	6.53	5.64	0.89	0.5	NO
6-20	0630	C7	10.95	10.19	0.76	0.5	NO
6-20	0730	C8	10.19	9.31	0.88	0.5	NO
6-20	0830	C8	9.31	8.72	0.59	0.5	NO
6-20	0930	C8	8.72	7.81	0.91	0.5	NO
6-20	1030	C8	7.81	6.95	0.86	0.5	NO
6-20	1130	C8	6.95	5.83	1.12	0.5	NO
6-20	1230	C8	5.83	4.89	0.94	0.5	NO
6-20	1330	C8	4.89	3.87	1.02	0.5	NO
6-20	1430	C8	3.87	2.84	1.03	0.5	NO
6-20	1530	C9	10.69	9.60	1.09	0.5	NO
6-20	1630	C9	9.60	8.58	1.02	0.5	NO
6-20	1730	C9	8.58	7.63	0.95	0.5	NO
6-20	1830	C9	7.63	6.64	0.99	0.5	NO
6-20	1930	C9	6.64	5.69	0.95	0.5	NO
6-20	2030	C9	5.69	4.83	0.86	0.5	NO
6-20	2130	C9	11.97	11.10	0.87	0.5	NO
6-20	2230	C9	11.10	10.21	0.89	0.5	NO
6-20	2330	C10	10.21	9.41	0.80	0.5	NO
6-21	0030	C10	9.41	8.58	0.83	0.5	NO
6-21	0130	C10	8.58	7.62	0.96	0.5	NO
6-21	0230	C10	7.62	6.77	0.85	0.5	NO
6-21	0330	C10	6.77	5.84	0.93	0.5	NO
6-21	0430	C10	5.84	5.06	0.78	0.5	NO
6-21	0530	C10	5.06	4.21	0.85	0.5	NO
6-21	0630	C10	11.03	10.29	0.74	0.5	NO
6-21	0730	C11	10.28	9.45	0.83	0.5	NO
6-21	0830	C11	9.45	8.62	0.83	0.5	NO
6-21	0930	C11	8.62	7.83	0.79	0.5	NO
6-21	1030	C11	7.83	6.96	0.87	0.5	NO

DATE	TIME	SAMPLE #	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)	SCREEN (IN)	WASH
6-21	1130	C11	6.96	5.90	1.06	0.5	NO
6-21	1230	C11	5.90	5.01	0.89	0.5	NO
6-21	1330	C11	10.65	9.71	0.94	0.5	NO
6-21	1430	C11	9.71	8.65	1.06	0.5	NO
6-21	1530	C12	10.65	9.48	1.17	0.5	NO
6-21	1630	C12	9.48	8.37	1.11	0.5	NO
6-21	1730	C12	8.37	7.22	1.15	0.5	NO
6-21	1830	C12	7.22	6.10	1.12	0.5	NO
6-21	1930	C12	6.10	4.88	1.22	0.5	NO
6-21	2030	C12	7.70	6.74	0.96	0.5	NO
6-21	2130	C12	12.01	11.03	0.98	0.5	NO
6-21	2230	C12	11.03	10.03	1.00	0.5	NO
6-21	2330	C13	10.03	9.09	0.94	0.5	NO
6-22	0030	C13	9.09	8.06	1.03	0.5	NO
6-22	0130	C13	8.06	7.06	1.00	0.5	NO
6-22	0230	C13	7.06	6.18	0.88	0.5	NO
6-22	0330	C13	6.18	5.30	0.88	0.5	NO
6-22	0430	C13	5.30	4.28	1.02	0.5	NO
6-22	0530	C13	10.92	10.08	0.84	0.5	NO
6-22	0630	C13	10.08	9.26	0.82	0.5	NO
6-22	0730	C14	11.27	10.55	0.72	0.5	NO
6-22	0830	C14	10.55	9.95	0.60	0.5	NO
6-22	0930	C14	9.95	9.30	0.65	0.5	NO
6-22	1030	C14	9.30	8.97	0.33	0.5	NO
6-22	1130	C14	9.04	8.51	0.53	0.5	NO
6-22	1230	C14	8.51	7.96	0.55	0.5	NO
6-22	1330	C14	7.96	7.41	0.55	0.5	NO
6-22	1430	C14	7.41	6.98	0.43	0.5	NO
6-22	1530	C15	6.98	6.67	0.31	0.5	NO
6-22	1630	C15	6.67	6.39	0.28	0.5	NO
6-22	1730	C15	6.39	6.13	0.26	0.5	NO
6-22	1830	C15	6.13	5.82	0.31	0.5	NO
6-22	1930	C15	5.82	5.49	0.33	0.5	NO
6-22	2030	C15	5.49	5.25	0.24	0.5	NO
6-22	2130	C15	5.25	4.97	0.28	0.5	NO
6-22	2230	C15	4.97	4.63	0.34	0.5	NO
6-22	2330	C16	4.62	4.28	0.34	0.5	NO
6-23	0030	C16	4.28	3.87	0.41	0.5	NO
6-23	0130	C16	3.87	3.45	0.42	0.5	NO
6-23	0230	C16	3.45	2.99	0.46	0.5	NO
6-23	0330	C16	2.99	2.44	0.55	0.5	NO
6-23	0430	C16	2.44	1.81	0.63	0.5	NO
6-23	0530	C16	1.81	1.36	0.45	0.5	NO
6-23	0630	C16	1.36	0.77	0.59	0.5	NO
6-23	0730	C17	0.77	0.42	0.35	0.5	NO
6-23	0830	C17	0.42	0.00	0.42	0.5	NO
6-23	0930	C18	CYCLED COAL VALVES				
6-23	1030	C18	CYCLED COAL VALVES				

APPENDIX D
Ash Analysis Data

ASH ANALYSIS FOR BOM/FGT-016

Sample Number	Date	Time	Cumulative Mass Fraction, % less than stated size, inch					Bulk Density gm/cc	Moisture content %	Carbon content %	Sulfur content %
			1/4	1/2	3/4	1	2				
1	6/18/84	12:39	5.0	19.1	30.4	48.2	81.7	0.49	32	24.7	2.50
2	6/18/84	22:00	30.7	54.5	74.8	88.8	100.0	0.66	27	30.1	6.30
3	6/19/84	14:30	44.5	65.4	79.0	85.8	98.9	0.76	17	10.6	0.29
4	6/19/84	17:00	23.5	48.2	63.0	71.8	85.5	0.77	17	7.2	0.21
5	6/19/84	21:00	16.5	46.8	66.0	79.2	96.9	0.78	15	13.1	0.28
7	6/20/84	5:00	11.9	22.6	32.2	40.9	65.9	0.71	11	9.2	0.29
8	6/20/84	12:10	46.1	65.4	73.3	85.0	100.0	0.51	—	7.5	0.75
9	6/20/84	16:45	32.3	56.8	71.9	82.2	90.4	0.78	9	4.8	0.63
10	6/20/84	21:29	17.7	32.6	46.1	56.5	83.7	0.76	8	3.0	0.62
11	6/21/84	3:00	26.1	49.6	63.3	72.1	93.5	0.75	16	2.7	0.60
12	6/21/84	9:00	22.8	36.0	49.3	63.1	76.3	0.75	9	0.0	0.45
13	6/21/84	12:14	42.0	58.8	68.5	75.2	86.7	0.99	10	4.7	1.00
14	6/21/84	16:20	28.8	34.7	45.3	59.7	73.9	0.96	4	3.4	0.00
15	6/21/84	21:20	28.3	40.0	50.7	58.3	83.3	1.03	10	8.2	0.00
16	6/22/84	2:20	23.9	39.6	49.3	57.2	81.2	0.83	8	6.7	0.80
17	6/22/84	7:30	22.0	33.5	40.2	48.7	68.8	0.88	8	2.6	0.41
18	6/22/84	11:00	57.1	65.8	72.0	77.0	95.0	0.81	6	6.4	1.10
19	6/22/84	13:00	30.8	47.1	59.1	68.9	92.4	0.85	1	12.6	0.00
20	6/22/84	17:00	35.1	47.9	54.7	62.2	78.3	0.86	1	15.1	0.00
21	6/22/84	21:20	12.0	17.6	20.9	26.2	45.2	0.94	0	1.6	0.26
22	6/23/84	1:14	11.8	18.4	22.7	27.0	53.6	0.98	1	13.1	1.30
23	6/23/84	6:40	27.1	40.8	46.1	54.3	70.2	0.95	8	1.5	0.38
24	6/23/84	11:14	64.6	75.9	82.1	87.6	97.2	0.72	1	8.1	0.88
25	6/23/84	13:00	57.6	69.2	77.8	83.9	100.0	0.74	0	12.4	0.80
26	6/23/84	14:44	52.0	64.0	73.4	81.8	100.0	0.74	8	14.4	1.40
27	6/23/84	16:45	24.8	31.9	36.7	39.8	47.1	0.90	1	0.0	0.26
28	6/23/84	19:29	22.7	30.7	35.4	41.6	56.8	0.91	4	13.5	0.65
30	6/23/84	1:39	23.6	31.5	35.8	40.6	54.7	0.96	3	13.9	0.72
31	6/23/84	6:15	14.2	20.2	25.3	28.9	37.1	1.06	4	12.5	0.79

AVERAGES

5 - 31	30.1	43.1	51.9	59.9	77.1	0.845	6.1	7.8	0.74
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APPENDIX E

Ash Removal Log

Ash weights are given in pounds.

Flush water is given in gallons.

GASIFIER ASH DUMP

BOM/FGT 016 ROSEBUD

DATE	TIME	SAMPLE #	INITIAL DRY WT.	FINAL DRY WT.	NET DRY WT	INITIAL WET WT.	FINAL WET WT.	NET WET WT	NET DRY + NET WET
6-18	1240	A1	304	161	143	139	124	15	158
6-18	2200	A2	320	129	191	154	137	17	208
6-19	1430	A3	315	225	90	120	110	10	100
6-19	1700	A4	116	101	15	107	94	13	28
6-19	2100	A5	233	131	102	90	85	5	107
6-20	0500	A7	165	115	50	124	104	20	70
6-20	1210	A8	375	200	175	166	142	24	199
6-20	1645	A9	644	145	499	180	134	46	545
6-20	2130	A10	585	102	483	189	149	40	523
6-21	0300	A11	490	120	370	200	115	85	455
6-21	0900	A12	507	135	372	228	160	68	440
6-21	1215	A13	460	55	405	180	105	75	480
6-21	1620	A14	570	90	480	140	110	30	510
6-21	2120	A15	389	63	326	112	102	10	336
6-22	0220	A16	513	77	436	192	68	124	560
6-22	0730	A17	437	101	336	112	107	5	341
6-22	1100	A18	400	134	266	140	125	15	281
6-22	1300	A19	441	150	291	138	103	35	326
6-22	1700	A20	652	76	576	103	62	41	617
6-22	2100	A21	506	40	466	69	46	23	489
6-23	0115	A22	521	33	488	258	132	126	614
6-23	0640	A23	503	51	452	298	130	168	620
6-23	1115	A24	535	24	511	49	40	9	520
6-23	1300	A25	179	40	139	67	57	10	149
6-23	1445	A26	246	102	144	84	60	24	168
6-23	1645	A27	300	82	218	79	71	8	226
6-23	1930	A28	259	110	149	87	80	7	156
6-24	0140	A30	620	024	596	268	214	54	650
6-24	0615	A31	516	24	492	267	211	56	548

APPENDIX F

Retort Particle Sampling Data

Reference: Volume 1, Thimsen, Maurer et al, 1984

F-1. Dust Loading Data

F-2. Cumulative Dust Data

F-3. Cumulative Dust Size Distribution

F-4. Cumulative Dust Size Distribution

DUST DATA for BOM/FGT-016

Grand Average Gas/Air Ratio
1.9Estimated Offtake Elbow Area/ Sampler Inlet Area
4310Retort Area Less Draft Shroud Area
28.75 square feetFitted Equation: $0.137 * \text{Face Velocity (ft/sec)}^{**5.16}$

RUN #	DATE TIME	TEST LENGTH (min)	MASS PARTICLES (milligram)	COAL FEED RATE (lb/hr)	T- 705 (deg. K)	P-705 ("hg abs)	F-701 (scfm)	GAS FLOW RATE (acfm)	DUST RT/ COAL RT (%)	PROBE DEPTH (inch)	AGITATOR ANGLE (deg)	AGITATOR RATE (sw/hr)	FREE-BOARD (inch)
1	20-JUN-85 02:44	2.0	66.51	1453	440	29.18	800	2341	1.31	34	0	0	39.0
2	20-JUN-85 03:22	3.0	62.00	1553	472	29.20	802	2521	0.76	34	0	0	39.5
3	20-JUN-85 03:37	3.0	63.02	1553	442	29.20	801	2356	0.77	34	0	0	39.5
4	21-JUN-85 01:49	1.0	188.60	1760	594	28.92	990	3781	6.11	34	210	10	39.0
5	21-JUN-85 02:36	0.8	219.00	1827	596	28.90	992	3806	8.54	34	325	8	36.0
6	21-JUN-85 03:02	1.0	280.70	1707	601	28.07	990	3836	9.38	34	325	10	39.0
7	21-JUN-85 03:29	1.0	251.60	1707	597	28.60	989	3811	8.41	34	270	10	39.0

Cumulative Dust Data for BOM/FGT-016

			Cumulative Percent Less Than	
Particle Size			Run Number	
(micron)			016-03	016-07
Sieved	Shifted	Sieved		
1400		1892	---	99.64
840		1135	---	95.62
595		804	99.38	87.44
420		568	97.37	73.74
250		338	93.54	54.58
149		201	88.43	40.68
74		100	43.33	14.16
Microscopy				
(micron)				
		100	43.33	14.16
		56	22.97	5.97
		32	9.14	2.71
		17.8	3.08	0.84
		10	1.11	0.16
		5.6	0.14	0.03
		3.2	----	----

Figure E-3

Figure F-4

DATE	TIME	SAMPLE #	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)	SCREEN (IN)	WASH
6-23	1130	C18		CYCLED COAL VALVES			
6-23	1230	C18		CYCLED COAL VALVES			
6-23	1330	C18		CYCLED COAL VALVES			
6-23	1430	C18		CYCLED COAL VALVES			
6-23	1530	C19		CYCLED COAL VALVES			
6-23	1630	C19		CYCLED COAL VALVES			
6-23	1730	C19		CYCLED COAL VALVES			
6-23	1830	C19		CYCLED COAL VALVES			
6-23	1930	C19		CYCLED COAL VALVES			
6-23	2030	C19		CYCLED COAL VALVES			
6-23	2130	C19		CYCLED COAL VALVES			
6-23	2230	C19		CYCLED COAL VALVES			
6-23	2251	C19	DROPPED 2.25 TONS MET. COKE FROM WEIGH BIN				
6-23	2330	C20		CYCLED COAL VALVES			
6-24	0030	C20		CYCLED COAL VALVES			
6-24	0130	C20		CYCLED COAL VALVES			
6-23	0230	C20		CYCLED COAL VALVES			
6-23	0330	C20		CYCLED COAL VALVES			
6-23	0430	C20		CYCLED COAL VALVES			
6-23	0530	C20		CYCLED COAL VALVES			
6-23	0630	C20		CYCLED COAL VALVES			

END OF BO#1/FGT 016 ROSEBUD

APPENDIX G

Gasifier Operator Logged Data

Included are three tables of data:

G-1. Freeboard Data

G-2. Firetest Data

D - Multiple incandescent zones

H - Relatively hot incandescent zone

C - Relatively cold incandescent zone

G-3. Operator Logged Data I

Water flows in gpm.

Water totals in gallons.

Steam flows in lb/min.

G-4. Operator Logged Data II

Agitator counter in (total revolutions * 2)

Grate Gear counter in (total grate revolutions * 116)

Further description of these data are given in Volume 1 of this series (Thimsen, Maurer et al, 1984).

TABLE G-1
FREEBOARD HEIGHT LOG

DATE	TIME	#1	#2	#3	#4	#5	#6	#7	AVERAGE	AGITATOR DEPTH
6-17	1530	45			37				41	40 INCHES
6-17	1630	36			35				35.5	40 INCHES
6-17	1700			30			32		31	40 INCHES
6-17	1800		36			38			37	40 INCHES
6-17	1900		41				40		40.5	40 INCHES
6-17	2000	36			41				38.5	40 INCHES
6-17	2100	36			36				36	40 INCHES
6-17	2200		37			40			38.5	40 INCHES
6-17	2300		38			41			39.5	40 INCHES
6-18	0030	39		38					38.5	40 INCHES
6-18	0130		42			44			43	40 INCHES
6-18	0230			41			39		40	40 INCHES
6-18	0330	37			42				39.5	40 INCHES
6-18	0430		42			42			42	40 INCHES
6-18	0530			33			35		34	40 INCHES
6-18	0730	36			36				36	40 INCHES
6-18	0830		38			38			38	40 INCHES
6-18	1000			39			38		38.5	40 INCHES
6-18	1100	37			39				38	40 INCHES
6-18	1200		38			40			39	40 INCHES
6-18	1300			40			40		40	40 INCHES
6-18	1400	38			39				38.5	40 INCHES
6-18	1500	36			35				35.5	40 INCHES
6-18	1600		39			39			39	40 INCHES
6-18	1700			35			38		36.5	40 INCHES
6-18	1800	36			35				35.5	40 INCHES
6-18	1900		40			40			40	40 INCHES
6-18	2000			35			38		36.5	40 INCHES
6-18	2100	36			39				37.5	40 INCHES
6-18	2200		37			38			37.5	40 INCHES
6-18	2300			36			37		36.5	40 INCHES
6-19	0000	40			39				39.5	40 INCHES
6-19	0100		41			38			39.5	40 INCHES
6-19	0200			46			45		45.5	40 INCHES
6-19	0300	43			42				42.5	40 INCHES
6-19	0400		45			44			44.5	40 INCHES
6-19	0700			45			43		44	40 INCHES
6-19	0830	39			37				38	40 INCHES
6-19	0900		41			40			40.5	40 INCHES
6-19	1000			37			40		38.5	40 INCHES
6-19	1100	37			36				36.5	40 INCHES
6-19	1200		38			40			39	40 INCHES
6-19	1300			40			39		39.5	40 INCHES
6-19	1400	35			38				36.5	40 INCHES

DATE	TIME	#1	#2	#3	#4	#5	#6	#7	AVERAGE	AGITATOR DEPTH
6-19	1500	36			36				36	40 INCHES
6-19	1600		39			37			38	40 INCHES
6-19	1700			38			38		38	40 INCHES
6-19	1800	35			35				35	40 INCHES
6-19	1900		39			41			40	40 INCHES
6-19	2000			38			38		38	40 INCHES
6-19	2100	35			36				35.5	40 INCHES
6-19	2200		41			41			41	40 INCHES
6-19	2300			36			37		36.5	40 INCHES
6-20	0000	37			39				38	40 INCHES
6-20	0100		45			45			45	40 INCHES
6-20	0200			33			33		33	40 INCHES
6-20	0300	39			39				39	40 INCHES
6-20	0400		39			39			39	40 INCHES
6-20	0500			38			37		37.5	40 INCHES
6-20	0600	37			37				37	40 INCHES
6-20	0700		34			35			34.5	40 INCHES
6-20	0800			30			29		29.5	40 INCHES
6-20	0900	36			35				35.5	40 INCHES
6-20	1020			36				35	35.5	40 INCHES
6-20	1100		36			37			36.5	40 INCHES
6-20	1200	35			34				34.5	40 INCHES
6-20	1300			36			34		35	40 INCHES
6-20	1400		33			33			33	40 INCHES
6-20	1500		33			34			33.5	40 INCHES
6-20	1600	38			36				37	40 INCHES
6-20	1700	34			33				33.5	40 INCHES
6-20	1800			34			34		34	40 INCHES
6-20	1900	33			32				32.5	40 INCHES
6-20	2000		34			33			33.5	40 INCHES
6-20	2100	34			33				33.5	40 INCHES
6-20	2200			33			33		33	40 INCHES
6-20	2300	32			32				32	40 INCHES
6-21	0000	34			34				34	40 INCHES
6-21	0100		34			34			34	40 INCHES
6-21	0200			31			30		30.5	40 INCHES
6-21	0300	32.5			35.5				34	40 INCHES
6-21	0400		27			29			28	40 INCHES
6-21	0500			32			32		32	40 INCHES
6-21	0600	32			32				32	40 INCHES
6-21	0700		32			32			32	40 INCHES
6-21	0800			34			33		33.5	40 INCHES
6-21	0900	35			33				34	40 INCHES
6-21	1000		35			36			35.5	40 INCHES
6-21	1045		36			36			36	40 INCHES
6-21	1200			33			32		32.5	40 INCHES
6-21	1300	35			36				35.5	40 INCHES
6-21	1400		36			36			36	40 INCHES

DATE	TIME	#1	#2	#3	#4	#5	#6	#7	AVERAGE	AGITATOR DEPTH
6-21	1500		33			33			33	40 INCHES
6-21	1600		34			35			34.5	40 INCHES
6-21	1700	33			32				32.5	40 INCHES
6-21	1800		35			33			34	40 INCHES
6-21	1900	35			32				33.5	40 INCHES
6-21	2000		34			34			34	40 INCHES
6-21	2100	33			31				31.5	40 INCHES
6-21	2200			33			32		32.5	40 INCHES
6-21	2300		34			35			34.5	40 INCHES
6-22	0000	32			30				31	40 INCHES
6-22	0100		27			29			28	40 INCHES
6-22	0200			29			31		30	40 INCHES
6-22	0300	32			26				29	40 INCHES
6-22	0400		30			27			28.5	40 INCHES
6-22	0500			25			32		28.5	40 INCHES
6-22	0600	31			25				28	40 INCHES
6-22	0700		25			26			25.5	40 INCHES
6-22	0800	36		32	32	30	33		32.6	40 INCHES
6-22	0830			32			34		33	40 INCHES
6-22	0900	37			32				34.5	40 INCHES
6-22	1000		31			30			30.5	40 INCHES
6-22	1100			31			32		31.5	40 INCHES
6-22	1200	37			30				33.5	40 INCHES
6-22	1300		35			34			34.5	40 INCHES
6-22	1400			30			29		29.5	40 INCHES
6-22	1500	32			30				31	40 INCHES
6-22	1600		31			31			31	40 INCHES
6-22	1700			29			30		29.5	40 INCHES
6-22	1800	35			33				34	40 INCHES
6-22	1900			31			35		33	40 INCHES
6-22	2000		33			33			33	40 INCHES
6-22	2100	34			31				32.5	40 INCHES
6-22	2200			35			35		35	40 INCHES
6-22	2300			31			34		32.5	40 INCHES
6-23	0000	34			34				34	40 INCHES
6-23	0100		34			36			35	40 INCHES
6-23	0200			40			38		39	40 INCHES
6-23	0300	34			34				34	40 INCHES
6-23	0400		29			28			28.5	40 INCHES
6-23	0500			32			34		33	40 INCHES
6-23	0600	35			35				35	40 INCHES
6-23	0700		24			23			23.5	40 INCHES
6-23	0800			29			29		29	40 INCHES
6-23	0900	36			32				34	40 INCHES
6-23	1000		30	32		33	34		32.25	40 INCHES
6-23	1100	36			34				35	40 INCHES
6-23	1200		32		34				33	40 INCHES
6-23	1300			31			34		32.5	40 INCHES
6-23	1400	34			32				33	40 INCHES

DATE	TIME	#1	#2	#3	#4	#5	#6	#7	AVERAGE	AGITATOR DEPTH
6-23	1500		36			36			36	40 INCHES
6-23	1600			32			36		34	40 INCHES
6-23	1700	33			33				33	40 INCHES
6-23	1800			34			36		35	40 INCHES
6-23	1900		36			35			35.5	40 INCHES
6-23	2000			34			39		36.5	40 INCHES
6-23	2100	33			32				32.5	40 INCHES
6-23	2200			35			37		36	40 INCHES
6-23	2300			34			35		34.5	40 INCHES
6-24	0000	30			30				30	40 INCHES
6-24	0100		32			32			32	40 INCHES
6-24	0200			28			29		28.5	40 INCHES
6-24	0300	28			28				28	40 INCHES
6-24	0400		28			23			25.5	40 INCHES
6-24	0500			28			28		28	40 INCHES
6-24	0600	35			30				32.5	40 INCHES
6-24	0700		32			33			32.5	40 INCHES

END OF BOM/FGT 016 ROSEBUD

TABLE G-2
FIRE TEST LOG

DATE	TIME	INSERT TIME	POKE HOLE NUMBER													AVERAGE (IN)	E	
			RD	#1	RD	#2	RD	#3	RD	#4	RD	#5	RD	#6	RD			#7
6-17	1600	1		13		10		15		14	C	18	C	16	C	8	13.43	
6-17	1800	1.5	C	9	C	9	C	10	C	16	C	15	C	10	C	13	11.71	
6-17	2000	2.5	C	12		18	C	13		18		15		17	C	14	15.29	
6-17	2200	3	C	18		17		16		15		17		16	C	20	17.00	
6-18	0000	3		11		15		15		15		16		14		4	12.86	
6-18	0200	3		15		13		15		17		17		15		7	14.14	
6-18	0400	3		14		13		17		15		19		14		5	13.86	
6-18	0600	3		16		13		16		16		18		15		8	14.57	
6-18	0800	3		19		12		18		12		18		15		10	14.86	
6-18	1000	3		14		15		17		16		17		17		10	15.14	
6-18	1200	3		12		11		18		15		14		14		12	13.71	
6-18	1400	3		13		13		19		13		16		13		11	14.00	
6-18	1600	3		13		17		11		15		18		17		11	14.57	
6-18	1800	3		13		17		20		16		16		16		11	15.57	
6-18	2000	3		17		16		20		14		16		13		7	14.71	
6-18	2200	3		15		12		16		16		14		15		9	13.86	
6-19	0000	3		18		14		17		16		14		17		5	14.43	
6-19	0200	3		14		18		18		16		14		14		8	14.57	
6-19	0830	3		18		11		21		17		12		15		10	14.86	
6-19	1000	3		15		14		20		16		11		13		9	14.00	
6-19	1200	3.5		15		14		12		12		4		10		7	10.57	
6-19	1400	3.5		14		18		13		9		6		9		0.5	9.93	
6-19	1600	3-5	C	10		15		6		10	C	15	C	17		7	11.43	
6-19	1800	4-6	C	9		17	C	15		12	C	17		19		2	13.00	
6-19	2000	5-8	C	14	C	9		12	C	17	C	17		7		7	11.86	
6-19	2200	5-8		8	D	16	C	16		10		18		5	C	3	10.86	
6-20	0000	3		12	D	13		9		10		7		4		3	8.29	
6-20	0200	5-6		11	D	10		6		13	D	11		8		2	8.71	
6-20	0400	5-6		9		11	D	5		8		20	D	11		5	9.86	
6-20	0600	5-6		7		10		6		12		17		10		5	9.57	
6-20	0800	5-6		10		11		6		12		24		13		4	11.43	
6-20	1000	5-6		14		21		10		11		20		12		7	13.57	
6-20	1200	5-6	C	15	H	13	H	12	D	14	H	29	H	17	H	7	15.29	
6-20	1400	5	C	15	H	13	H	10	D	11	C	13	H	16	H	3	11.57	
6-20	1600	5-7	D	10		13	C	10		14	C	14	C	14	D	5	11.43	
6-20	1800	5-7	C	13		7		15	C	12		5		15	D	1	9.71	
6-20	2000	5-7	C	9	C	11		9	C	13	C	14	C	7		18	11.57	
6-20	2200	5-7		11		7		1		9		10		8		3	8.43	
6-21	0000	4-8	C	9	D	14		2	C	4	D	6	C	7		0	6.00	
6-21	0200	4-8		11		16		11	D	8		8	D	13		4	10.14	
6-21	0400	4-8		33		5		10		4		12	D	11		8	11.86	
6-21	0600	4-8	D	11	D	14		4		8	D	19	C	23		0	11.29	
6-21	0800	4-5	D	18	H	11	C	12		9	H	23	H	6	H	26	15.00	
6-21	1000	4-6	D	7	D	4	H	5	H	6	D	17	H	5	D	10	7.71	

DATE	TIME	INSERT TIME	POKE HOLE NUMBER														AVERAGE (IN)
			RD	#1	RD	#2	RD	#3	RD	#4	RD	#5	RD	#6	RD	#7	
6-21	1200	5	H	7	D	12	H	7	C	9	D	6	D	6	H	14	8.71
6-21	1400	5	D	36	C	10	C	10	C	5	D	7	D	12	H	8	12.57
6-21	1600	5	D	4		8		2	C	8		7		25	C	11	9.28
6-21	1800	5	D	4		12	C	13		4		8		25	C	3	9.86
6-21	2000	5	D	35		13	D	7		6		9		27	D	3	14.29
6-21	2200	5		32	C	7		8		7	C	7		21	C	13	13.57
6-22	0000	4-8	D	33		3		4		15	C	5	D	15	D	3	11.14
6-22	0200	4-8	D	0	D	6	C	16	C	4	C	3	C	28	D	2	8.43
6-22	0400	4-8	D	8		7	C	8		5		12		18		20	11.14
6-22	0600	4-8	D	9	C	9	C	9	C	11		10		13		8	9.86
6-22	0800	4	H	8	C	17	C	8	H	10	H	21	H	20		5	12.71
6-22	1000	4	D	0	D	4		7	C	13	C	14	C	20		5	9.00
6-22	1200	5	D	0	D	7		9	C	17	C	10		8		0	7.29
6-22	1400	5	D	21	C	8	H	2	C	9	C	15	H	14	H	5	10.57
6-22	1600	6-8	H	15	C	6		8	H	6	D	7	C	5	H	7	6.86
6-22	1800	6		4	C	9	H	4	C	5		7		13		1	6.14
6-22	2000	6-8	H	14	C	9		5		8		5		9	H	0	7.14
6-22	2200	6	D	12		4		3		9	H	2		4		4	5.43
6-23	0000	3-5		0	D	0		7		6		5	D	6		0	3.43
6-23	0200	3-5		0		9		5		6	D	3	D	12		0	5.00
6-23	0400	3-5	D	17		4		6		0		0	D	20		7	7.71
6-23	0600	3-6	C	26	C	8	C	6	C	0		20	D	6	C	11	11.00
6-23	0800	6	C	4	D	2	C	4		6	D	7	H	22	C	12	8.14
6-23	1000	5	H	0	H	20	C	10	C	3	H	38	H	38	C	16	17.86
6-23	1200	6	H	2		10	C	8		9		9	C	39	C	13	12.86
6-23	1400	6		0	C	12	C	7	H	5	C	9	D	26	C	10	9.86
6-23	1600	5-6		12	C	8	C	3	C	8		18	D	7	C	6	8.86
6-23	1800	6-8	C	7	C	5	C	7	C	5	H	5	D	9	C	4	6.00
6-23	2000	10		4	C	7	C	7	C	6		9	H	7	C	5	6.43
6-23	2150	10		12	C	6	C	6	C	8		9	D	7	C	10	8.29
6-24	0000	10	C	17		5	D	14		14		10	D	7	C	8	10.71
6-24	0200	5-10	D	0	CD	5	C	7		11	D	12	D	7	C	0	6.00
6-24	0400	5-10		60	C	9		8		0	D	9		0	D	9	13.57
6-24	0600	5-10		60	CD	7	CD	8	D	9		48		60	D	0	27.43

END OF BOY/FGT 016 ROSEBUD

TABLE G-3

OPERATOR DATA LOG I

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER IN			JACKET WATER OUT		STEAM				
			FLOW	METER TOTAL	HOURLY USAGE	METER TOTAL	HOURLY USAGE	REG. INLET PRESSURE	REGULATED PRESSURE	TEMP	ORIFICE DELTA P	VALVE POSIT
6-17	1530	2.5	5.0	32893		7220		46	39	285	2	26
6-17	1630	2.75	5.0	32904	110	8210	99	46	38	285	2	18
6-17	1730	2.5	5.0	32913	90	9110	90	45	39	285	2	15
6-17	1830	2.5	5.0	32925	120	10310	120	45	39	285	4	17
6-17	1930	2.5	5.0	32938	130	11580	127	45	39	285	3	15
6-17	2030	2.5	4.0	32949	110	12730	115	45	39	285	3	13
6-17	2130	2.5	4.0	32962	130	14120	139	45	39	285	3	13
6-17	2230	2.5	4.0	32975	130	15400	128	46	38	285	3.5	13
6-17	2330	3.0	4.0	32988	130	16700	130	90	40	280	4	15
6-18	0030	3.0	4.0	33003	150	18200	150	90	40	285	3.5	15
6-18	0130	3.0	4.0	33013	100	19220	102	90	40	285	4	16
6-18	0230	3.0	4.0	33026	130	20560	134	85	40	290	5	18
6-18	0330	3.0	4.0	33040	140	22010	145	90	39.5	290	4.5	18
6-18	0430	3.0	4.0	33051	110	23130	112	90	39.5	285	4	12
6-18	0530	3.0	4.0	33066	150	24610	148	90	40	285	4.5	16
6-18	0630	3.0	4.0	33079	130	25960	135	85	39	295	3	14
6-18	0730	3.0	4.0	33092	130	27340	138	74	39	285	3.5	15
6-18	0830	3.0	4.0	33104	120	28530	119	92	39	285	3	10
6-18	0930	3.0	2.0	33110	60	29110	58	86	39	285	1.5	8
LOW WATER PRESSURE DUE TO BOILER REPAIRS												
6-18	1030	3.0	3.0	33117	70	29690	58	92	39	285	2	10
6-18	1130	3.0	3.5	33119	20	29970	28	64	38.5	285	.5	4
6-18	1230	3.0	3.0	33131	120	31100	113	76	38.5	285	1	12
6-18	1330	3.0	3.0	33136	50	31660	56	81	39	285	1	12
6-18	1430	3.0	3.0	33140	40	32140	48	72	38.5	290	2.5	8
6-18	1530	3.0	3.0	33146	60	32680	54	56	38	285	2.5	9
6-18	1630	2.5	3.0	33152	60	33310	63	84	38	285	4	17
6-18	1730	2.5	3.0	33158	60	33920	61	86	38	285	4	13
6-18	1830	2.5	3.0	33166	80	34670	75	88	39	285	4.5	16
6-18	1930	2.5	3.0	33172	60	35290	60	85	39	285	3.5	17
6-18	2030	2.5	3.0	33178	60	35890	60	85	39.5	285	3.5	13
6-18	2130	2.5	3.0	33184	60	36550	66	73	39	285	3.0	19
6-18	2230	2.5	3.0	33191	70	37210	66	90	39.5	285	2.5	19
6-18	2330	2.5	3.0	33197	60	37880	67	90	40	285	5	20
6-19	0030	2.5	3.0	33203	60	38450	57	90	40	290	4	14
6-19	0130	2.5	3.0	33209	60	39100	55	70	39	280	2	16
SYSTEM DOWN DUE TO SATURATION AIR BLOWER PROBLEMS												
6-19	0830	3.0	8.0	33228		40970		66	38	285	3	10
6-19	0930	3.0	9.0	33233	50	41400	43	76	39	287	2.5	15
6-19	1030	3.0	10.0	33239	60	41930	53	66	37.5	290	1.0	22
6-19	1130	3.0	10.0	33244	50	42440	51	86	39	285	6.0	22
6-19	1230	3.0	10.0	33249	50	42940	50	92	39	285	4.0	18
6-19	1330	3.0	10.0	33254	50	43470	53	90	39	285	22.5	24
6-19	1430	3.0	10.0	33260	50	44030	56	84	39	285	5.0	21

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER IN			JACKET WATER OUT		STEAM				
			FLOW	METER TOTAL	HOURLY USAGE	METER TOTAL	HOURLY USAGE	REG. INLET PRESSURE	REGULATED PRESSURE	TEMP	ORIFICE DELTA P	VALVE POSIT
6-19	1530	3.0	10.0	33265	50	44550	52	85	39	280	4.0	23
6-19	1630	3.0	10.0	33270	50	45140	59	84	39	285	2.0	23
6-19	1730	3.0	10.0	33276	60	45740	60	90	39.5	285	3.5	19
6-19	1830	3.0	10.0	33281	50	46170	43	91	39	285	4.0	20
6-19	1930	3.0	10.0	33287	60	46760	59	88	39	285	5.0	18
6-19	2030	3.0	10.0	33293	60	47280	52	85	39	285	3.0	16
6-19	2130	3.0	10.0	33298	50	47860	58	88	39	285	4.0	23
6-19	2230	3.0	10.0	33303	50	48320	46	92	39	285	4.0	23
6-19	2330	3.0	10.0	33308	50	48880	56	80	39	290	4.0	22
6-20	0030	3.0	10.0	33314	60	49460	58	90	40	295	5.0	18
6-20	0130	3.0	10.0	33319	50	49980	52	90	39.5	290	3.0	20
6-20	0230	3.0	10.0	33325	60	50500	52	90	39.5	290	5.0	15
6-20	0330	3.0	10.0	33330	50	51010	51	85	39	290	3.0	22
6-20	0430	3.0	10.0	33335	50	51560	55	85	39.5	285	4.0	24
6-20	0530	3.0	10.0	33341	60	52160	60	90	39.5	290	2.5	26
6-20	0630	3.0	10.0	33346	50	52640	52	85	39.5	290	3.5	24
6-20	0730	3.0	10.0	33352	60	53240	60	85	39.5	290	2.5	22
6-20	0830	3.0	10.0	33358	60	53820	58	85	39.5	290	4.5	
6-20	0930	3.0	10.0	33363	50	54340	52	90	39.5	290	5.0	19
6-20	1030	3.0	10.0	33368	50	54840	50	78	39.5	290	4.0	18
6-20	1130	3.0	10.0	33373	50	55350	51	82	39.5	290	3.5	19
6-20	1230	3.0	10.0	33379	60	55930	58	88	40	285	5.0	18
6-20	1330	3.0	10.0	33384	50	56430	50	92	39.5	285	3.0	20
6-20	1430	3.0	11.0	33389	50	56890	46	80	39.5	285	3.0	20
6-20	1530	3.0	11.0	33396	70	57520	63	92	39.5	285	5.0	21
6-20	1630	3.0	11.0	33403	60	58170	65	88	39	285	4.0	18
6-20	1730	3.0	11.0	33409	60	58730	56	90	39	285	4.0	20
6-20	1830	3.0	11.0	33414	50	59250	52	86	39	285	3.5	22
6-20	1930	3.0	11.0	33420	60	59870	62	78	39.5	285	2.0	20
6-20	2030	3.0	11.0	33427	70	60430	56	87	39.5	285	4.0	24
6-20	2130	3.0	11.0	33433	60	61050	62	91	39.5	285	5.0	17
6-20	2230	3.0	11.0	33439	60	61610	56	91	39.5	285	4.0	17
6-20	2330	3.0	11.0	33445	60	62200	59	90	40	285	4.0	18
6-21	0030	3.0	11.0	33451	60	62770	57	90	40	290	6.5	16
6-21	0130	3.0	11.0	33457	60	63310	54	80	39.5	290	5.0	18
6-21	0230	3.0	11.0	33463	60	63900	59	85	39.5	290	6.0	14
6-21	0330	3.0	11.0	33469	60	64520	62	90	40	290	2.0	12
6-21	0430	3.0	11.0	33475	60	65060	54	90	39.5	290	4.0	10
6-21	0530	3.0	11.0	33481	60	65600	54	85	39.5	290	3.0	10
6-21	0630	3.0	11.0	33488	70	66270	67	90	39.5	290	4.0	8
6-21	0730	3.0	13.0	33495	70	66840	57	86	40	285	3.0	16
6-21	0830	3.0	13.0	33502	70	67570	73	78	40	290	2.0	21
6-21	0930	3.0	15.0	33510	80	68290	72	86	40	290	3.0	14
6-21	1030	3.0	19.0	33520	100	69210	92	82	40	285	5.0	10
6-21	1130	3.0	19.0	33530	100	70230	102	86	40	285	3.5	18
6-21	1230	3.0	19.0	33541	110	71260	103	80	40	285	3.5	11
6-21	1330	3.0	19.0	33553	120	72320	106	78	39.5	285	2.0	20
6-21	1430	3.0	19.0	33563	100	73370	105	88	39.5	290	2.5	23

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER IN			JACKET WATER OUT		SIFAM				
			FLOW	METER TOTAL	HOURLY USAGE	METER TOTAL	HOURLY USAGE	REG. INLET PRESSURE	REGULATED PRESSURE	TEMP	ORIFICE DELTA P	VALVE POSIT
6-21	1530	3.0	17.0	33574	110	74440	107	82	39	295	2.0	25
6-21	1630	3.0	17.0	33586	120	75650	121	80	39	293	4.0	26
6-21	1730	3.0	17.0	33592	60	76370	72	78	39.5	292	3.0	26
6-21	1830	3.5	17.0	33603	110	77290	92	92	39.5	290	3.5	28
6-21	1930	3.5	17.0	33612	90	78240	95	86	39	290	2.5	26
6-21	2030	3.5	17.0	33621	90	79130	89	84	39	289	2.5	28
6-21	2130	3.5	17.0	33632	110	80180	105	92	39.5	287	6.0	29
6-21	2230	3.5	17.0	33641	900	81020	840	92	39.5	290	4.0	27
6-21	2330	3.5	17.0	33650	90	81990	97	90	39.5	290	5.0	26
6-22	0030	3.5	17.0	33660	100	82900	91	85	39.5	290	6.0	26
6-22	0130	3.5	17.0	33669	90	83870	97	90	39.5	290	5.0	24
6-22	0230	3.5	17.0	33680	110	84960	109	90	39.5	290	7.0	24
6-22	0330	3.5	17.0	33689	90	85790	83	90	39.5	295	5.0	22
6-22	0430	3.5	17.0	33698	100	86750	96	90	39.5	295	4.0	28
6-22	0530	3.5	17.0	33708	100	87740	99	80	39	300	2.5	28
6-22	0630	3.5	17.0	33716	80	88560	82	50	34	290	3.0	24
6-22	0730	3.5	17.0	33728	120	89730	117	90	39.5	285	3.5	25
6-22	0830	3.5	15.0	33737	90	90620	89	84	39	285	2.5	23
6-22	0930	3.5	13.0	33745	80	91490	87	90	39.5	285	5.0	18
6-22	1030	3.5	13.0	33752	70	92120	63	84	29.5	285	5.0	20
6-22	1130	3.0	13.0	33759	70	92840	72	90	39.5	285	4.0	20
6-22	1230	3.0	13.0	33767	80	93580	74	82	39.5	290	4.0	20
6-22	1330	3.0	13.0	33774	70	94310	73	78	39.5	290	3.0	14
6-22	1430	3.0	10.0	33780	60	94880	57	90	39.5	285	2.5	14
6-22	1530	3.0	10.0	33785	50	95440	56	79	39	285	5.0	14
6-22	1630	3.0	10.0	33791	60	95960	52	86	39	282	4.5	14
6-22	1730	3.0	10.0	33796	50	96470	51	90	39.5	282	2.5	14
6-22	1830	3.0	10.0	33801	50	97070	60	92	39.5	285	5.0	10
6-22	1930	3.0	10.0	33807	60	97580	51	86	39	285	2.0	10
6-22	2030	3.0	10.0	33812	50	98160	58	92	39.5	285	2.5	14
6-22	2130	3.0	10.0	33818	60	98700	54	88	40	282	5.0	16
6-22	2230	3.0	10.0	33823	50	99210	51	88	39.5	285	4.0	18
6-22	2330	3.0	10.0	33828	50	99720	51	85	39.5	290	4.0	14
6-23	0030	3.0	10.0	33833	50	100240	52	90	40	290	5.0	18
6-23	0130	3.0	10.0	33839	60	100830	59	90	39.5	290	5.0	18
6-23	0230	3.0	10.0	33844	50	101340	51	80	39.5	295	3.0	20
6-23	0330	3.0	10.0	33849	50	101850	51	70	39	290	3.0	22
6-23	0430	3.0	10.0	33855	60	102450	60	90	39.5	290	4.0	20
6-23	0530	3.0	10.0	33861	66	102960	51	90	39.5	290	3.0	20
6-23	0630	3.0	10.0	33866	50	103490	53	90	39.5	295	3.0	18
6-23	0730	3.0	10.0	33872	60	104080	59	86	39.5	285	1.5	20
6-23	0830	3.0	10.0	33877	50	104620	54	78	39.5	285	1.0	17
6-23	0930	3.0	10.0	33882	50	105140	52	84	39.5	285	1.5	19
6-23	1030	3.0	10.0	33888	60	105700	56	80	39.5	290	2.5	18
6-23	1130	3.0	10.0	33893	50	106210	51	90	39.5	285	3.5	18
6-23	1230	3.0	10.0	33899	60	106730	52	78	39.5	290	1.0	20
6-23	1330	3.0	10.0	33904	50	107250	42	78	39.5	290	1.0	19
6-23	1430	3.0	10.0	33909	50	107750	50	82	39.5	290	1.5	20

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER IN			JACKET WATER OUT		STEAM				
			FLOW	METER TOTAL	HOURLY USAGE	METER TOTAL	HOURLY USAGE	REG. INLET PRESSURE	REGULATED PRESSURE	TEMP	ORIFICE DELTA P	VALVE POSIT
6-23	1530	3.0	10.0	33915	60	108440	69	84	39.5	285	2.0	18
6-23	1630	3.0	10.0	33920	50	108910	47	79	39	285	4.0	16
6-23	1730	3.0	10.0	33926	60	109470	56	80	39	285	2.0	20
6-23	1830	3.0	10.0	33931	50	109980	51	92	39	280	6.0	18
6-23	1930	3.0	10.0	33937	60	110510	53	88	39.5	285	5.0	20
6-23	2030	3.0	10.0	33942	50	111110	60	84	39.5	285	1.5	22
6-23	2130	3.0	10.0	33947	50	111620	510	81	39	285	2.0	22
6-23	2230	3.0	10.0	33953	60	112140	520	86	39	285	2.0	22
6-23	2345	2.5	10.0	33959	60	112760	62	90	39.5	295	3.0	20
6-24	0030	2.5	10.0	33963	40	113240	48	90	40	295	7.5	20
6-24	0130	2.5	10.0	33968	50	113740	50	90	40	295	5.0	20
6-24	0230	2.5	10.0	33975	70	114420	68	85	39.5	290	3.0	22
6-24	0330	2.5	10.0	33980	50	114870	45	90	39.5	290	4.0	20
6-24	0430	2.5	10.0	33985	50	115370	50	85	39.5	290	4.5	22
6-24	0530	2.5	10.0	33990	50	115900	53	85	39.5	290	2.5	25
6-23	0630	2.5	10.0	33996	60	116410	51	80	39.5	290	2.5	20

END OF BOM/FGT 016 ROSEBUD

TABLE G-4

OPERATOR DATA LOG 1B

DATE	TIME	AGITATOR			GRATE		
		COUNTER TOTAL	SWEEPS PER HR	DRIVE SETTING	GEAR COUNTER	GEAR REVOLUTIONS RPH	DRIVE SETTING TEETH/RPD
6-17	1530						
6-17	1630						
6-17	1730						
6-17	1830						
6-17	1930						
6-17	2030						
6-17	2130						
6-17	2230						
6-17	2330						
6-18	0030						
6-18	0130						
6-18	0230						
6-18	0330	2	2				
6-18	0430	4	2				
6-18	0530	9	5				
6-18	0630	11	2				
6-18	0730	11					
6-18	0830	11					
6-18	0930	11					
6-18	1030	11			3	3	1/2.0
6-18	1130	11			13	10	1/2.1
6-18	1230	11			24	11	1/2.2
6-18	1330	11			27	3	
6-18	1430	11			27		
6-18	1530	11			27		
6-18	1630	11			27		
6-18	1730	11			27		
6-18	1830	11			27		
6-18	1930	11			27		
6-18	2030	11			27		
6-18	2130	11			27		
6-18	2230	11			27		
6-18	2330	11			27		
6-19	0030	11			27		
6-19	0130	11			27		
SHUTDOWN DUE TO SATURATION AIR BLOWER							
6-19	0830	11			27		
6-19	0930	11			34	7	1/2.0
6-19	1030	11			44	10	1/2.0
6-19	1130	11			53	9	1/2.0
6-19	1230	11			63	10	1/2.0
6-19	1330	11			72	9	1/2.0
6-19	1430	11			82	10	1/2.0

DATE	TIME	AGITATOR			GRATE		
		COUNTER TOTAL	SWEEPS PER HR	DRIVE SETTING	GEAR COUNTER	GEAR REVOLUTIONS RPH	DRIVE SETTING TEETH/RPD
6-19	1530	11			92	10	1/2.0
6-19	1630	11			102	10	1/2.0
6-19	1730	11			112	10	1/2.0
6-19	1830	11			121	9	1/2.0
6-19	1930	11			131	10	1/2.0
6-19	2030	11			141	10	1/2.0
6-19	2130	11			150	9	1/2.0
6-19	2230	11			159	9	1/2.0
6-19	2330	11			168	9	1/1.9
6-20	0030	11			178	10	1/1.9
6-20	0130	11			188	10	1/1.9
6-20	0230	15	4		197	9	1/1.9
6-20	0330	17	2		207	10	1/1.9
6-20	0430	19	2		216	9	1/1.9
6-20	0530	23	4	4	227	11	1/1.9
6-20	0630	26	3	4	235	8	1/1.9
6-20	0730	31	5	4	246	11	1/1.9
6-20	0830	33	2	4	256	10	1/1.9
6-20	0930	40	7	4	265	9	1/1.9
6-20	1030	45	5	8	276	11	1/3.0
6-20	1130	53	8	8	291	15	1/3.0
6-20	1230	61	8	8	310	19	1/5.0
6-20	1330	69	8	8	334	24	1/5.0
6-20	1430	76	7	8	355	21	2/2.5
6-20	1530	85	9	8	381	26	2/2.5
6-20	1630	93	8	8	406	25	2/2.5
6-20	1730	100	7	8	430	24	2/2.5
6-20	1830	107	7	8	451	21	2/2.3
6-20	1930	116	9	8	474	23	2/2.3
6-20	2030	124	8	8	496	22	2/2.0
6-20	2130	132	8	8	515	19	2/2.0
6-20	2230	140	8	8	530	15	1/2.0
6-20	2330	147	7	8	541	11	1/2.0
6-21	0030	154	7	8	551	10	1/2.0
6-21	0130	163	9	10	560	9	1/2.0
6-21	0230	172	9	10	570	10	1/2.0
6-21	0330	182	10	10	580	10	1/2.0
6-21	0430	191	9	10	589	9	1/2.0
6-21	0530	201	10	10	599	10	1/2.0
6-21	0630	209	8	10	610	11	1/2.0
6-21	0730	219	10	10	619	9	1/2.0
6-21	0830	227	8	8	634	15	1/4.0
6-21	0930	235	8	8	655	21	1/4.5
6-21	1030	243	8	8	677	22	1/4.5
6-21	1130	251	8	8	699	22	1/4.5
6-21	1230	259	8	8	721	22	1/4.5
6-21	1330	267	8	8	744	23	1/4.5

DATE	TIME	AGITATOR			GRATE		
		COUNTER TOTAL	SWEEPS PER HR	DRIVE SETTING	GEAR COUNTER	GEAR REVOLUTIONS RPH	DRIVE SETTING TEETH/RPD
6-21	1430	275	8	8	765	21	1/4.5
6-21	1530	283	8	8	787	22	1/4.5
6-21	1630	292	9	8	802	15	1/2.0
6-21	1730	300	8	8	818	16	1/2.0
6-21	1830	308	8	8	826	8	1/2.0
6-21	1930	318	10	8	835	9	1/2.0
6-21	2030	325	7	8	845	10	1/3.0
6-21	2130	334	9	8	862	17	1/3.0
6-21	2230	341	7	8	874	12	1/2.5
6-21	2330	351	10	8	887	13	1/2.5
6-22	0030	360	9	8	898	11	1/2.5
6-22	0130	370	10	8	911	13	1/2.5
6-22	0230	379	9	8	925	14	1/2.5
6-22	0330	387	8	8	936	11	1/2.5
6-22	0430	399	12	8	948	12	1/2.5
6-22	0530	411	12	8	961	13	1/2.5
6-22	0630	422	11	15	971	10	1/2.5
6-22	0730	434	12	7	986	15	1/2.5
6-22	0830	443	9	7	1000	14	1/3.5
6-22	0930	450	7	7	1016	16	1/2.5
6-22	1030	452	2	2	1030	14	1/5.0
6-22	1130	457	5	5	1058	28	2/3.0
6-22	1230	462	5	5	1087	29	2/3.0
6-22	1330	467	5	5	1112	25	1/4.0
6-22	1430	472	5	3	1131	19	1/4.0
6-22	1530	475	3	3	1151	20	1/4.0
6-22	1630	477	2	2	1170	19	1/3.5
6-22	1730	479	2	2.5	1186	16	1/3.5
6-22	1830	481	2	2.5	1202	16	1/3.5
6-22	1930	484	3		1218	16	1/5.0
6-22	2030	486	2	2	1235	17	1/5.0
6-22	2130	488	2	2	1252	17	1/5.0
6-22	2230	490	2	2	1265	13	1/2.0
6-22	2330	492	2	2	1276	11	1/2.0
6-23	0030	494	2	2	1286	10	1/2.0
6-23	0130	496	2	2	1297	11	1/2.0
6-23	0230	498	2	2	1306	9	1/2.0
6-23	0330	501	3	2	1315	9	1/2.0
6-23	0430	506	5	2	1325	10	1/2.0
6-23	0530	511	5	6	1338	13	1/2.0
6-23	0630	517	6	6	1348	10	1/2.0
6-23	0730	523	6	6	1361	13	1/2.0
6-23	0830	529	6	6	1371	10	1/2.0
6-23	0930	534	5	4	1380	9	1/2.0
6-23	1030	538	4	4	1395	15	1/5.0
6-23	1130	543	5	4	1416	21	1/3.0
6-23	1230	547	4	4	1434	18	1/3.0

APPENDIX H

Gas Chromatograph Data

The results of each successful gas chromatograph analysis are included here. Results from both the HP5880A (analysis for permanent gasses and hydrocarbons) and the HP5793 (analysis for gaseous sulfur species) are included in separate tables.

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AR

6/17/1985																
16:30	16.335	7.170	0.002	0.009	0.000	50.64	1.015	24.25	0.001	0.001	0.000	141.2	132.0	99.42	24.63	0.850
16:48	15.759	7.279	0.002	0.007	0.000	50.76	0.819	24.27	0.001	0.001	0.000	137.4	128.7	98.91	24.68	0.852
17:06	17.278	7.053	0.003	0.012	0.000	49.70	1.362	23.54	0.001	0.001	0.000	145.6	135.6	98.94	24.19	0.835
17:25	19.671	5.151	0.000	0.005	0.000	47.66	1.457	25.06	0.001	0.001	0.000	159.0	147.7	99.00	23.27	0.803
18:01	16.008	7.491	0.002	0.006	0.000	52.17	0.803	22.94	0.000	0.001	0.000	133.8	125.0	99.42	24.79	0.856
18:19	14.919	8.041	0.002	0.005	0.000	53.29	0.668	22.42	0.000	0.001	0.000	127.2	119.1	99.35	25.16	0.868
18:37	14.233	8.195	0.002	0.005	0.000	54.21	0.581	22.54	0.000	0.001	0.000	124.5	116.8	99.77	25.49	0.880
18:55	13.713	8.267	0.001	0.004	0.000	54.41	0.509	22.66	0.000	0.001	0.000	122.4	115.1	99.57	25.59	0.883
19:13	13.211	8.301	0.000	0.004	0.000	54.34	0.454	22.88	0.000	0.001	0.000	120.9	113.8	99.18	25.62	0.885
19:31	12.856	8.420	0.001	0.003	0.000	55.04	0.419	22.74	0.000	0.001	0.000	118.9	112.1	99.47	25.82	0.891
19:48	12.587	8.317	0.001	0.003	0.000	55.49	0.372	23.00	0.000	0.001	0.000	118.4	111.8	99.77	25.96	0.896
20:24	12.769	8.487	0.002	0.008	0.000	55.21	0.646	22.43	0.001	0.001	0.000	120.1	113.1	99.55	25.85	0.892
20:42	12.890	8.499	0.001	0.006	0.000	55.05	0.571	22.48	0.000	0.001	0.000	119.8	112.8	99.50	25.81	0.891
21:00	12.708	8.563	0.001	0.006	0.000	55.44	0.573	22.19	0.000	0.001	0.000	118.3	111.4	99.48	25.87	0.893
21:35	12.538	8.704	0.001	0.005	0.000	55.50	0.562	22.43	0.000	0.000	0.000	118.4	111.6	99.74	26.01	0.898
21:53	12.530	8.680	0.001	0.005	0.000	55.49	0.539	22.27	0.000	0.000	0.000	117.6	110.8	99.52	25.95	0.896
22:29	12.490	8.747	0.001	0.004	0.000	55.81	0.434	21.85	0.000	0.000	0.000	115.1	108.4	99.34	25.93	0.895
22:46	12.287	8.705	0.001	0.003	0.000	55.27	0.401	22.03	0.000	0.000	0.000	114.6	108.1	98.69	25.80	0.891
23:05	12.189	8.612	0.001	0.003	0.000	55.56	0.325	22.77	0.000	0.000	0.000	115.9	109.5	99.46	26.03	0.899
23:23	12.137	8.569	0.001	0.003	0.000	55.62	0.289	22.62	0.000	0.000	0.000	114.9	108.6	99.24	25.98	0.897
23:41	12.026	8.564	0.000	0.002	0.000	55.44	0.261	22.58	0.000	0.000	0.000	114.1	107.8	98.88	25.91	0.894
23:58	12.015	8.617	0.000	0.002	0.000	55.88	0.231	22.55	0.000	0.000	0.000	113.7	107.4	99.29	26.04	0.899

6/18/1985

0:16	11.970	8.724	0.000	0.002	0.000	55.90	0.246	22.04	0.000	0.000	0.000	112.0	105.8	98.88	25.96	0.896
0:34	11.761	8.770	0.000	0.002	0.000	55.67	0.223	22.14	0.000	0.000	0.000	111.5	105.4	98.57	25.93	0.895
0:51	11.923	8.679	0.000	0.002	0.000	56.08	0.209	22.43	0.000	0.000	0.000	112.8	106.6	99.33	26.09	0.901
1:09	11.913	8.611	0.000	0.002	0.000	55.96	0.204	22.38	0.000	0.000	0.000	112.5	106.4	99.07	26.01	0.898
1:27	11.808	8.717	0.001	0.002	0.000	56.02	0.203	22.31	0.000	0.000	0.000	111.9	105.8	99.06	26.05	0.899
1:45	11.821	8.727	0.000	0.002	0.000	56.20	0.199	22.42	0.000	0.000	0.000	112.3	106.2	99.37	26.14	0.902
2:02	11.742	8.777	0.000	0.002	0.000	55.57	0.212	22.25	0.000	0.000	0.000	111.6	105.6	98.56	25.94	0.895
2:20	11.858	8.869	0.000	0.002	0.000	55.83	0.247	22.11	0.000	0.000	0.000	111.9	105.8	98.92	26.02	0.898
2:38	11.926	8.792	0.000	0.002	0.000	56.06	0.245	22.10	0.000	0.000	0.000	112.1	105.9	99.13	26.05	0.899
2:56	11.986	8.719	0.001	0.002	0.000	56.26	0.261	22.03	0.000	0.000	0.000	112.2	106.0	99.27	26.06	0.899
3:14	11.809	8.692	0.000	0.002	0.000	56.73	0.261	21.75	0.000	0.000	0.000	110.7	104.6	99.24	26.09	0.901
3:31	11.872	8.689	0.001	0.004	0.000	55.78	0.355	21.80	0.000	0.001	0.000	112.1	105.9	98.50	25.86	0.892
3:49	12.398	8.581	0.001	0.004	0.000	56.00	0.440	21.78	0.000	0.001	0.000	114.6	108.0	99.20	25.89	0.894
4:07	12.826	8.797	0.001	0.004	0.000	55.90	0.464	21.67	0.000	0.001	0.000	115.9	109.0	99.66	25.94	0.895
4:25	12.544	8.628	0.001	0.004	0.000	56.33	0.378	21.61	0.000	0.001	0.000	113.9	107.3	99.49	25.95	0.896
4:43	13.005	8.337	0.001	0.007	0.000	55.89	0.507	21.68	0.001	0.001	0.000	117.0	110.0	99.43	25.75	0.889
5:01	13.033	8.159	0.001	0.005	0.000	55.90	0.462	21.90	0.000	0.001	0.000	117.3	110.3	99.47	25.73	0.888
5:19	12.977	8.347	0.001	0.005	0.000	56.49	0.501	21.21	0.000	0.000	0.000	115.3	108.3	99.52	25.78	0.890
5:37	12.890	8.344	0.001	0.004	0.000	55.69	0.434	21.69	0.000	0.000	0.000	115.9	109.0	99.05	25.68	0.886
5:55	12.978	8.220	0.002	0.006	0.000	55.42	0.450	21.69	0.001	0.001	0.000	116.4	109.4	98.76	25.56	0.882
6:13	13.250	8.287	0.004	0.013	0.000	56.26	0.493	21.05	0.004	0.000	0.000	115.9	108.7	99.37	25.66	0.886

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/18/1985																
6:31	13.118	8.170	0.006	0.020	0.000	55.23	0.565	21.11	0.005	0.005	0.000	116.7	109.5	98.23	25.35	0.875
6:50	12.851	8.472	0.016	0.046	0.000	55.81	0.611	21.90	0.006	0.014	0.000	119.7	112.5	99.72	25.88	0.893
7:08	13.299	8.274	0.018	0.055	0.000	54.32	0.830	21.39	0.016	0.017	0.000	122.2	114.6	98.21	25.29	0.873
7:26	14.066	7.980	0.017	0.057	0.000	54.55	0.925	20.93	0.018	0.017	0.000	124.2	116.1	98.56	25.13	0.867
7:44	13.868	7.650	0.018	0.059	0.000	53.73	0.969	21.33	0.017	0.018	0.000	125.3	117.3	97.66	24.87	0.858
8:02	13.898	8.494	0.018	0.059	0.000	53.85	0.976	21.20	0.017	0.018	0.000	125.1	117.0	98.54	25.24	0.871
8:20	14.017	8.591	0.017	0.055	0.000	54.81	0.939	20.92	0.015	0.016	0.000	124.0	116.0	99.38	25.46	0.879
8:45	13.788	8.737	0.017	0.054	0.000	54.19	0.933	22.25	0.015	0.017	0.000	127.5	119.5	100.00	25.72	0.888
9:03	13.828	8.565	0.016	0.053	0.000	53.84	0.922	21.49	0.015	0.017	0.000	125.0	117.1	98.75	25.33	0.874
9:21	13.814	8.597	0.016	0.052	0.000	53.29	0.908	20.99	0.014	0.016	0.000	123.2	115.2	97.69	25.05	0.865
9:39	13.863	8.645	0.016	0.051	0.000	53.89	0.898	21.44	0.008	0.015	0.000	124.5	116.6	98.83	25.36	0.875
9:57	13.751	8.682	0.015	0.050	0.000	53.62	0.879	21.35	0.013	0.015	0.000	123.8	115.9	98.38	25.27	0.872
10:15	13.775	8.793	0.016	0.052	0.000	53.94	0.898	21.16	0.014	0.016	0.000	123.5	115.6	98.67	25.36	0.876
10:33	13.703	8.634	0.015	0.050	0.000	53.96	0.855	21.33	0.008	0.015	0.000	123.2	115.4	98.57	25.33	0.875
10:51	13.633	8.662	0.016	0.051	0.000	53.78	0.857	21.68	0.008	0.015	0.000	124.1	116.3	98.70	25.39	0.877
11:09	13.841	9.724	0.017	0.054	0.000	54.93	0.913	19.70	0.015	0.017	0.000	119.3	111.3	99.21	25.65	0.885
11:27	13.304	10.156	0.017	0.057	0.000	54.97	0.910	19.14	0.015	0.017	0.000	115.8	108.1	98.59	25.68	0.886
11:46	13.894	10.366	0.018	0.058	0.000	54.75	0.964	18.81	0.016	0.017	0.000	117.2	109.2	98.89	25.64	0.885
12:04	14.233	10.613	0.020	0.065	0.000	55.35	1.033	18.07	0.018	0.019	0.000	116.9	108.6	99.42	25.73	0.888
12:22	14.807	11.167	0.020	0.066	0.000	54.23	1.063	17.95	0.018	0.020	0.000	118.7	110.1	99.34	25.65	0.885
12:40	14.141	11.133	0.020	0.067	0.000	54.64	1.029	17.85	0.018	0.020	0.000	115.9	107.7	98.92	25.70	0.887
12:58	15.177	11.282	0.023	0.073	0.000	54.70	1.108	17.17	0.019	0.021	0.000	118.1	109.2	99.57	25.63	0.885
13:16	13.172	11.002	0.021	0.070	0.000	56.10	1.033	17.83	0.020	0.021	0.000	112.9	105.1	99.27	26.03	0.898
13:34	12.767	10.944	0.021	0.069	0.000	56.24	0.994	17.98	0.019	0.021	0.000	111.6	104.1	99.06	26.07	0.900
13:52	12.642	10.922	0.021	0.069	0.000	56.11	0.994	18.13	0.019	0.021	0.000	111.7	104.2	98.93	26.06	0.900
14:10	12.607	10.901	0.021	0.068	0.000	56.93	1.001	18.00	0.019	0.021	0.000	111.2	103.8	99.57	26.25	0.906
14:28	12.503	10.705	0.020	0.065	0.000	56.50	0.950	18.55	0.018	0.020	0.000	112.0	104.7	99.33	26.18	0.904
14:54	13.841	9.275	0.022	0.072	0.000	54.13	1.086	21.53	0.020	0.023	0.000	127.6	119.4	100.00	25.78	0.890
15:11	14.598	8.903	0.023	0.077	0.000	53.86	1.159	20.68	0.022	0.023	0.000	128.2	119.5	99.34	25.33	0.874
15:29	14.834	8.612	0.025	0.082	0.000	53.38	1.251	21.65	0.023	0.025	0.000	133.2	124.3	99.89	25.36	0.876
15:47	14.945	8.407	0.026	0.085	0.000	52.47	1.294	21.59	0.023	0.025	0.000	133.9	124.9	98.86	25.01	0.863
16:22	15.243	8.186	0.029	0.096	0.000	51.91	1.375	22.11	0.027	0.028	0.000	137.7	128.5	99.01	24.93	0.860
16:40	15.404	8.028	0.030	0.098	0.000	51.83	1.421	22.00	0.027	0.029	0.000	138.4	129.0	98.86	24.81	0.857
16:58	15.365	8.215	0.030	0.099	0.000	52.01	1.411	20.98	0.027	0.029	0.000	135.0	125.6	98.16	24.66	0.851
17:15	15.342	8.138	0.031	0.102	0.000	50.96	1.449	21.41	0.028	0.030	0.000	136.8	127.4	97.48	24.46	0.844
17:33	15.267	8.123	0.031	0.102	0.000	51.15	1.440	22.20	0.028	0.031	0.000	139.0	129.7	98.38	24.73	0.854
17:51	15.518	8.048	0.032	0.105	0.000	51.92	1.454	21.72	0.029	0.032	0.000	138.5	129.0	98.85	24.78	0.855
18:08	15.375	7.976	0.031	0.103	0.000	51.28	1.438	21.73	0.028	0.031	0.000	137.9	128.5	98.00	24.57	0.848
18:26	16.049	7.871	0.032	0.105	0.000	51.42	1.486	21.20	0.029	0.031	0.000	138.9	129.1	98.23	24.44	0.844
18:44	15.614	7.814	0.031	0.102	0.000	51.16	1.437	21.27	0.028	0.031	0.000	137.1	127.6	97.49	24.34	0.840
19:02	15.523	7.649	0.030	0.100	0.000	51.69	1.400	21.96	0.027	0.030	0.000	138.6	129.1	98.41	24.60	0.849
19:19	15.584	7.548	0.030	0.101	0.000	51.53	1.404	21.83	0.027	0.029	0.000	138.4	128.9	98.08	24.48	0.845
19:37	15.903	7.587	0.031	0.102	0.000	50.99	1.434	21.44	0.028	0.030	0.000	138.5	128.9	97.55	24.25	0.837
19:55	15.736	7.465	0.031	0.103	0.000	51.81	1.410	21.51	0.028	0.030	0.000	138.0	128.4	98.13	24.44	0.843
20:13	15.521	7.518	0.031	0.102	0.000	51.42	1.391	22.61	0.028	0.030	0.000	140.6	131.2	98.65	24.65	0.851
20:30	15.390	7.444	0.031	0.101	0.000	51.18	1.384	22.89	0.028	0.030	0.000	141.0	131.6	98.48	24.62	0.850

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/18/1985																
20:48	15.303	7.360	0.031	0.101	0.000	50.65	1.378	22.51	0.028	0.031	0.000	139.5	130.2	97.39	24.33	0.840
21:06	15.465	7.241	0.031	0.103	0.000	51.21	1.384	22.97	0.028	0.031	0.000	141.6	132.2	98.46	24.57	0.848
21:24	15.332	7.288	0.031	0.103	0.000	51.17	1.386	22.53	0.028	0.030	0.000	139.7	130.4	97.90	24.45	0.844
21:41	15.443	7.323	0.031	0.103	0.000	51.20	1.357	22.60	0.029	0.030	0.000	140.0	130.7	98.11	24.49	0.845
21:59	15.746	7.527	0.033	0.107	0.000	50.06	1.451	23.04	0.031	0.031	0.000	143.5	133.9	98.02	24.41	0.843
22:17	14.745	7.142	0.032	0.105	0.000	51.97	1.375	23.07	0.029	0.030	0.000	139.5	130.5	98.49	24.75	0.854
22:36	15.292	7.106	0.032	0.105	0.000	50.79	1.389	22.33	0.029	0.031	0.000	139.1	129.7	97.10	24.21	0.836
22:54	15.411	7.141	0.031	0.104	0.000	50.94	1.309	23.03	0.028	0.030	0.000	140.8	131.5	98.02	24.45	0.844
23:12	15.400	7.173	0.032	0.104	0.000	50.40	1.327	22.52	0.029	0.031	0.000	139.4	130.1	97.01	24.17	0.834
23:29	15.529	7.202	0.032	0.107	0.000	50.45	1.338	22.28	0.030	0.032	0.000	139.3	129.9	97.00	24.14	0.833
23:47	15.606	7.153	0.032	0.105	0.000	51.09	1.416	22.70	0.030	0.032	0.000	141.6	132.1	98.17	24.43	0.843
6/19/1985																
0:05	15.890	7.231	0.034	0.109	0.000	49.90	1.504	22.76	0.031	0.034	0.000	143.7	134.0	97.49	24.17	0.834
0:23	15.664	7.049	0.034	0.111	0.000	50.73	1.480	22.70	0.031	0.034	0.000	142.6	133.0	97.83	24.30	0.839
0:41	15.990	6.883	0.034	0.109	0.000	51.58	1.499	22.89	0.031	0.033	0.000	144.4	134.6	99.05	24.52	0.847
0:59	16.055	6.680	0.033	0.015	0.000	50.94	1.491	21.72	0.030	0.035	0.000	139.2	129.5	97.00	23.90	0.825
1:16	16.112	6.690	0.031	0.109	0.000	50.93	1.510	21.55	0.030	0.036	0.000	140.7	130.8	97.00	23.89	0.825
1:34	16.187	6.486	0.031	0.107	0.000	51.10	1.496	21.52	0.031	0.035	0.000	140.6	130.8	97.00	23.84	0.823
1:52	16.440	6.470	0.032	0.108	0.000	51.50	1.497	20.88	0.030	0.036	0.000	139.4	129.4	97.00	23.77	0.820
2:10	15.908	7.084	0.034	0.109	0.000	50.78	1.487	21.53	0.031	0.033	0.000	139.7	130.0	97.00	24.01	0.829
2:46	15.261	8.432	0.042	0.136	0.000	50.09	1.693	22.14	0.039	0.041	0.000	142.6	132.9	97.87	24.61	0.850
9:03	17.876	5.924	0.033	0.110	0.000	51.22	1.535	20.23	0.032	0.037	0.000	142.5	131.7	97.00	23.30	0.804
9:20	18.706	5.222	0.036	0.121	0.000	49.65	1.728	21.46	0.035	0.041	0.000	151.5	140.1	97.00	22.95	0.792
10:14	19.162	4.492	0.038	0.115	0.000	49.05	1.686	22.38	0.035	0.038	0.000	155.4	143.8	97.00	22.72	0.784
10:32	19.493	4.307	0.039	0.117	0.000	49.17	1.697	22.10	0.037	0.041	0.000	155.8	144.0	97.00	22.61	0.780
10:50	19.657	4.152	0.039	0.117	0.000	49.15	1.680	22.13	0.037	0.041	0.000	156.2	144.4	97.00	22.54	0.778
15:12	17.583	3.833	0.040	0.118	0.000	45.83	1.560	27.96	0.035	0.038	0.000	167.0	156.3	97.00	23.04	0.795
15:30	16.897	3.773	0.037	0.110	0.000	45.37	1.450	29.30	0.034	0.034	0.000	167.6	157.4	97.00	23.22	0.802
15:48	16.633	3.864	0.038	0.113	0.000	45.08	1.479	29.72	0.035	0.038	0.000	168.6	158.5	97.00	23.30	0.804
16:07	16.411	3.938	0.037	0.111	0.000	45.00	1.449	31.46	0.034	0.037	0.000	173.1	163.1	98.47	23.79	0.821
16:25	16.377	3.973	0.038	0.115	0.000	45.18	1.483	32.08	0.036	0.035	0.000	175.4	165.4	99.31	24.03	0.830
16:43	16.447	3.948	0.038	0.115	0.000	45.10	1.495	31.49	0.040	0.037	0.000	174.0	163.9	98.72	23.84	0.823
17:02	16.322	4.036	0.038	0.114	0.000	45.14	1.501	31.73	0.036	0.037	0.000	174.3	164.3	98.95	23.96	0.827
17:38	16.646	3.980	0.039	0.114	0.000	45.71	1.497	30.28	0.039	0.040	0.000	170.8	160.6	98.34	23.69	0.818
17:57	16.483	4.085	0.040	0.118	0.000	45.17	1.531	29.49	0.038	0.038	0.000	168.1	158.0	97.00	23.37	0.807
18:15	16.351	4.244	0.040	0.117	0.000	45.59	1.522	30.36	0.037	0.039	0.000	170.3	160.3	98.30	23.80	0.821
18:33	16.593	3.973	0.040	0.119	0.000	45.21	1.548	31.31	0.039	0.043	0.000	174.6	164.4	98.87	23.85	0.823
18:52	16.719	3.906	0.041	0.119	0.000	45.21	1.556	30.78	0.039	0.046	0.000	173.5	163.2	98.41	23.68	0.817
19:10	16.669	3.969	0.042	0.120	0.000	44.81	1.561	30.11	0.040	0.041	0.000	171.2	160.9	97.37	23.41	0.808
19:29	16.895	3.995	0.042	0.118	0.000	45.28	1.541	29.12	0.040	0.043	0.000	168.5	158.2	97.07	23.27	0.803
19:47	17.122	4.056	0.044	0.121	0.000	45.62	1.576	28.38	0.038	0.042	0.000	167.3	156.8	97.00	23.20	0.801
20:06	17.162	3.991	0.043	0.120	0.000	45.85	1.572	28.18	0.039	0.042	0.000	166.7	156.2	97.00	23.18	0.800
20:51	16.751	4.059	0.049	0.122	0.000	45.84	1.579	28.51	0.041	0.041	0.000	166.6	156.3	97.00	23.29	0.804
21:16	15.550	3.866	0.050	0.115	0.000	44.48	1.460	34.41	0.033	0.037	0.000	180.1	170.5	100.00	24.43	0.843

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/19/1985																
23:45	15.006	4.776	0.066	0.104	0.000	47.33	1.375	31.27	0.037	0.031	0.000	167.4	158.2	100.00	24.72	0.853
6/20/1985																
0:04	14.601	4.656	0.071	0.101	0.000	46.71	1.337	32.45	0.037	0.032	0.000	169.5	160.6	100.00	24.82	0.857
0:24	14.704	4.804	0.076	0.107	0.000	47.32	1.394	31.52	0.041	0.033	0.000	167.8	158.7	100.00	24.81	0.856
0:43	15.045	4.980	0.087	0.112	0.000	47.01	1.471	28.22	0.045	0.034	0.000	159.4	150.1	97.00	23.90	0.825
1:01	14.897	4.828	0.083	0.106	0.000	47.84	1.409	30.76	0.039	0.030	0.000	166.1	156.9	100.00	24.76	0.855
1:20	15.027	4.739	0.089	0.105	0.000	47.92	1.417	30.63	0.041	0.031	0.000	166.3	157.0	100.00	24.71	0.853
1:38	15.712	4.361	0.085	0.129	0.000	46.05	1.615	31.96	0.048	0.040	0.000	175.6	165.7	100.00	24.45	0.844
1:57	16.625	4.101	0.070	0.157	0.000	44.58	1.858	32.51	0.054	0.051	0.000	183.4	172.8	100.00	24.14	0.833
2:15	16.339	3.975	0.064	0.138	0.000	45.17	1.705	30.90	0.051	0.045	0.000	175.1	164.8	98.39	23.76	0.820
2:33	16.798	4.121	0.072	0.164	0.000	44.54	1.935	31.76	0.057	0.056	0.000	182.7	171.8	99.50	23.95	0.827
2:52	16.456	4.200	0.072	0.168	0.000	43.90	1.966	30.67	0.057	0.055	0.000	178.5	167.8	97.55	23.50	0.811
3:10	15.793	4.093	0.066	0.134	0.000	44.64	1.714	33.46	0.053	0.045	0.000	181.7	171.6	100.00	24.37	0.841
3:29	17.530	3.878	0.068	0.157	0.000	43.61	1.988	32.66	0.055	0.055	0.000	188.2	177.0	100.00	23.86	0.824
3:47	16.738	4.205	0.070	0.160	0.000	43.85	1.923	30.17	0.054	0.053	0.000	177.1	166.3	97.23	23.35	0.806
4:06	16.158	4.862	0.076	0.118	0.000	46.64	1.612	27.45	0.043	0.037	0.000	162.0	151.9	97.00	23.57	0.814
4:24	17.256	4.438	0.075	0.151	0.000	44.12	1.896	28.96	0.054	0.050	0.000	174.4	163.4	97.00	23.19	0.800
4:43	16.166	4.948	0.076	0.131	0.000	46.55	1.696	29.62	0.048	0.044	0.000	170.3	160.1	99.28	24.21	0.836
5:01	16.279	4.660	0.085	0.135	0.000	45.39	1.708	29.95	0.052	0.046	0.000	172.2	161.9	98.31	23.87	0.824
5:20	16.746	4.249	0.061	0.135	0.000	44.63	1.696	31.77	0.048	0.052	0.000	179.1	168.6	99.38	23.98	0.828
5:38	15.998	3.966	0.070	0.139	0.000	45.28	1.692	31.99	0.052	0.054	0.000	177.7	167.6	99.25	24.09	0.832
5:57	16.368	4.124	0.073	0.129	0.000	45.39	1.609	31.04	0.051	0.051	0.000	174.8	164.6	98.83	23.92	0.826
6:15	15.461	4.683	0.084	0.113	0.000	46.56	1.502	29.86	0.046	0.039	0.000	166.5	156.9	98.35	24.12	0.832
6:34	16.458	4.721	0.098	0.135	0.000	45.71	1.706	28.06	0.060	0.046	0.000	167.1	156.7	97.00	23.46	0.810
6:52	16.204	4.584	0.086	0.125	0.000	45.87	1.592	28.44	0.054	0.044	0.000	165.8	155.7	97.00	23.52	0.812
7:11	16.891	4.787	0.078	0.133	0.000	46.02	1.662	27.33	0.053	0.046	0.000	165.2	154.7	97.00	23.37	0.807
7:29	15.353	4.975	0.075	0.121	0.000	46.45	1.530	29.96	0.046	0.041	0.000	166.8	157.2	98.56	24.25	0.837
7:48	14.702	5.153	0.086	0.111	0.000	47.55	1.464	30.85	0.051	0.038	0.000	166.9	157.7	100.00	24.86	0.858
8:26	13.328	6.448	0.112	0.092	0.000	50.19	1.285	26.15	0.046	0.031	0.000	145.4	137.0	97.69	24.79	0.856
8:44	11.413	8.444	0.168	0.107	0.000	53.28	1.406	22.09	0.059	0.035	0.000	128.9	121.3	97.00	25.41	0.877
9:03	16.505	5.055	0.063	0.137	0.000	45.71	1.737	28.78	0.051	0.049	0.000	169.2	158.8	98.08	23.80	0.822
9:21	15.991	5.477	0.070	0.122	0.000	45.87	1.529	27.86	0.045	0.034	0.000	161.8	152.0	97.00	23.72	0.819
9:40	14.399	6.284	0.096	0.108	0.000	48.88	1.398	28.75	0.054	0.036	0.000	158.6	149.6	100.00	25.12	0.867
9:59	13.917	6.853	0.110	0.102	0.000	50.21	1.388	26.66	0.051	0.032	0.000	150.2	141.5	99.33	25.15	0.868
10:17	14.385	6.796	0.107	0.109	0.000	49.07	1.457	24.99	0.049	0.034	0.000	147.2	138.1	97.00	24.36	0.841
10:36	15.602	6.367	0.089	0.126	0.000	47.69	1.610	25.42	0.056	0.043	0.000	154.4	144.6	97.00	23.96	0.827
10:54	15.382	6.265	0.089	0.122	0.000	47.86	1.550	25.64	0.051	0.041	0.000	153.6	144.0	97.00	24.01	0.829
11:13	15.511	6.174	0.075	0.125	0.000	47.53	1.550	25.95	0.047	0.041	0.000	154.7	145.0	97.00	23.96	0.827
11:31	15.563	6.208	0.079	0.124	0.000	48.00	1.543	25.39	0.055	0.045	0.000	153.3	143.6	97.00	23.95	0.827
11:50	15.603	6.146	0.073	0.125	0.000	47.42	1.556	25.98	0.051	0.049	0.000	155.4	145.7	97.00	23.93	0.826
12:09	15.010	6.169	0.062	0.117	0.000	48.18	1.447	28.10	0.052	0.050	0.000	159.0	149.6	99.19	24.72	0.853
12:27	14.750	6.289	0.071	0.116	0.000	48.33	1.453	25.90	0.048	0.040	0.000	150.9	141.7	97.00	24.19	0.835
12:46	14.915	6.283	0.064	0.119	0.000	47.87	1.473	26.19	0.046	0.039	0.000	152.5	143.2	97.00	24.14	0.833
13:04	15.066	6.236	0.069	0.121	0.000	48.43	1.518	26.68	0.045	0.038	0.000	155.0	145.6	98.20	24.42	0.843

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/20/1985																
13:23	15.543	6.189	0.062	0.123	0.000	47.39	1.512	26.09	0.046	0.044	0.000	154.7	145.0	97.00	23.96	0.827
13:42	15.583	5.912	0.068	0.125	0.000	47.08	1.555	26.59	0.048	0.042	0.000	157.0	147.3	97.00	23.90	0.825
14:00	15.878	6.028	0.068	0.130	0.000	47.25	1.597	25.96	0.049	0.044	0.000	156.5	146.6	97.00	23.84	0.823
19:13	15.114	6.530	0.071	0.128	0.000	48.96	1.647	27.44	0.054	0.048	0.000	159.5	149.9	100.00	24.95	0.861
19:32	15.561	6.819	0.083	0.135	0.000	48.28	1.720	24.31	0.054	0.041	0.000	151.8	141.9	97.00	24.03	0.829
23:18	14.779	7.139	0.061	0.119	0.000	48.69	1.554	24.58	0.044	0.036	0.000	147.5	138.2	97.00	24.30	0.839
23:36	14.995	7.033	0.073	0.121	0.000	49.08	1.639	23.98	0.046	0.037	0.000	147.4	137.9	97.00	24.22	0.836
23:55	15.107	7.043	0.066	0.120	0.000	49.01	1.582	23.99	0.044	0.037	0.000	147.1	137.6	97.00	24.20	0.835
6/21/1985																
0:13	14.545	7.207	0.074	0.114	0.000	49.55	1.534	23.90	0.044	0.035	0.000	144.4	135.3	97.00	24.38	0.841
0:32	14.150	7.559	0.068	0.102	0.000	50.54	1.400	23.11	0.040	0.031	0.000	138.8	130.0	97.00	24.55	0.847
0:51	14.391	7.696	0.066	0.114	0.000	50.23	1.475	22.95	0.043	0.035	0.000	140.2	131.1	97.00	24.50	0.846
1:09	15.058	7.151	0.064	0.124	0.000	49.03	1.571	23.92	0.043	0.037	0.000	146.6	137.1	97.00	24.23	0.836
1:28	15.137	7.273	0.064	0.121	0.000	49.30	1.568	23.46	0.043	0.034	0.000	145.2	135.7	97.00	24.23	0.836
1:46	14.829	7.148	0.062	0.120	0.000	48.79	1.514	24.46	0.043	0.034	0.000	146.8	137.5	97.00	24.29	0.839
2:05	14.932	7.123	0.059	0.119	0.000	49.26	1.512	23.92	0.043	0.034	0.000	145.3	136.0	97.00	24.26	0.838
2:24	14.810	7.506	0.061	0.111	0.000	50.33	1.430	22.68	0.041	0.032	0.000	139.9	130.7	97.00	24.37	0.841
2:42	15.186	7.355	0.060	0.122	0.000	49.91	1.500	22.78	0.044	0.037	0.000	142.5	133.1	97.00	24.24	0.837
3:01	15.153	7.377	0.067	0.116	0.000	50.74	1.465	22.01	0.043	0.035	0.000	139.5	130.1	97.00	24.25	0.837
3:20	14.644	7.484	0.060	0.114	0.000	50.54	1.428	22.65	0.041	0.036	0.000	139.4	130.3	97.00	24.41	0.842
3:38	14.792	7.710	0.060	0.119	0.000	50.17	1.472	22.60	0.042	0.037	0.000	140.3	131.1	97.00	24.40	0.842
3:57	14.920	7.359	0.057	0.114	0.000	50.82	1.419	22.24	0.040	0.035	0.000	138.8	129.6	97.00	24.32	0.839
4:15	14.794	7.781	0.058	0.105	0.000	51.53	1.360	21.30	0.038	0.031	0.000	134.5	125.4	97.00	24.42	0.843
4:34	14.638	7.912	0.054	0.111	0.000	51.46	1.343	21.41	0.039	0.033	0.000	134.3	125.3	97.00	24.49	0.845
4:53	14.977	7.698	0.056	0.116	0.000	50.36	1.452	22.27	0.041	0.035	0.000	139.4	130.2	97.00	24.35	0.841
5:11	14.855	7.808	0.050	0.112	0.000	51.04	1.380	21.68	0.039	0.034	0.000	136.2	127.0	97.00	24.41	0.843
5:30	14.791	7.934	0.054	0.118	0.000	50.99	1.426	21.61	0.041	0.033	0.000	136.4	127.2	97.00	24.44	0.844
5:49	14.591	8.023	0.054	0.119	0.000	50.89	1.432	21.82	0.041	0.034	0.000	136.6	127.5	97.00	24.51	0.846
6:07	13.774	8.118	0.046	0.098	0.000	50.85	1.270	22.97	0.034	0.028	0.000	135.1	126.7	97.19	24.80	0.856
6:26	12.182	8.523	0.065	0.076	0.000	53.94	1.069	21.09	0.032	0.022	0.000	121.6	114.2	97.00	25.25	0.872
6:44	14.500	7.822	0.060	0.122	0.000	49.89	1.395	23.13	0.046	0.038	0.000	140.5	131.4	97.00	24.50	0.846
7:03	14.923	7.552	0.059	0.125	0.000	50.07	1.529	22.66	0.044	0.039	0.000	141.7	132.3	97.00	24.33	0.840
7:23	14.691	7.741	0.056	0.116	0.000	50.93	1.429	21.96	0.040	0.036	0.000	137.3	128.2	97.00	24.44	0.843
23:49	14.675	8.824	0.168	0.114	0.000	50.15	1.460	21.51	0.062	0.035	0.007	138.4	129.1	97.00	24.61	0.850
6/22/1985																
0:08	13.130	9.155	0.116	0.105	0.000	52.84	1.312	20.25	0.051	0.031	0.005	126.5	118.2	97.00	25.08	0.866
0:27	12.764	11.383	0.141	0.095	0.000	53.83	1.315	17.39	0.047	0.029	0.005	116.2	108.1	97.00	25.53	0.881
0:45	14.091	8.263	0.114	0.097	0.000	51.11	1.248	22.92	0.047	0.029	0.004	137.2	128.5	97.92	24.95	0.861
1:03	14.365	8.015	0.134	0.098	0.000	50.90	1.290	23.36	0.050	0.030	0.006	140.3	131.5	98.25	24.93	0.861
1:21	13.724	9.204	0.165	0.107	0.000	52.10	1.418	21.13	0.058	0.031	0.008	133.3	124.5	97.94	25.19	0.869
1:39	14.775	8.213	0.115	0.099	0.000	51.14	1.307	23.29	0.046	0.027	0.006	141.2	132.1	99.02	25.07	0.865
1:58	14.417	8.741	0.186	0.105	0.000	50.76	1.475	21.69	0.058	0.027	0.006	138.1	128.9	97.47	24.79	0.856

GAS CHROMATOGRAPH DATA

DATE	H2	CO2	C2H4	C2H6	O2	N2	CH4	CO	C3H6	C3H8	C3H4	HHV	LHV	TMP	MW	S.G.
TIME	%	%	%	%	%	%	%	%	%	%	%	BTU/SCF		%		WRT AIR

6/22/1985																
2:16	14.072	8.568	0.133	0.094	0.000	51.57	1.295	22.34	0.047	0.024	0.004	135.9	127.2	98.15	25.06	0.865
2:34	13.584	8.895	0.201	0.105	0.000	52.03	1.429	21.44	0.058	0.027	0.006	134.3	125.6	97.77	25.12	0.867
2:52	15.056	8.102	0.218	0.111	0.000	50.51	1.562	22.74	0.061	0.029	0.007	145.2	135.5	98.40	24.77	0.855
3:11	14.118	7.879	0.146	0.093	0.000	50.78	1.300	23.15	0.047	0.025	0.004	138.9	130.1	97.54	24.77	0.855
3:29	13.818	9.379	0.194	0.107	0.000	52.48	1.492	20.64	0.057	0.029	0.006	133.1	124.3	98.20	25.25	0.872
3:47	14.223	8.148	0.166	0.092	0.000	51.42	1.336	22.94	0.049	0.025	0.005	139.3	130.4	98.40	25.02	0.864
4:05	13.124	8.951	0.201	0.106	0.000	53.71	1.451	20.36	0.056	0.029	0.005	129.7	121.2	97.99	25.31	0.874
4:24	15.587	8.498	0.205	0.144	0.000	49.97	1.755	22.45	0.073	0.038	0.007	148.8	138.6	98.73	24.77	0.855
4:42	13.832	8.651	0.157	0.108	0.000	52.26	1.398	21.51	0.052	0.028	0.004	134.3	125.5	97.99	25.09	0.866
5:00	14.250	8.634	0.186	0.089	0.000	52.07	1.372	21.77	0.049	0.021	0.005	136.1	127.2	98.44	25.10	0.866
5:19	14.372	8.979	0.209	0.141	0.000	52.51	1.727	20.66	0.072	0.036	0.005	138.8	129.3	98.71	25.16	0.869
5:37	14.260	9.301	0.220	0.121	0.000	52.44	1.651	20.17	0.064	0.030	0.006	135.5	126.2	98.26	25.13	0.867
5:55	14.812	8.795	0.165	0.109	0.000	52.26	1.485	21.69	0.055	0.027	0.004	139.1	129.8	99.41	25.24	0.871
6:14	13.138	9.265	0.161	0.093	0.000	54.27	1.315	20.25	0.048	0.023	0.003	126.7	118.5	98.56	25.53	0.881
6:32	15.322	8.768	0.180	0.123	0.000	51.31	1.581	21.74	0.062	0.032	0.004	142.7	132.9	99.12	25.01	0.863
6:50	13.475	9.498	0.231	0.120	0.000	54.37	1.594	19.35	0.065	0.031	0.005	130.0	121.1	98.75	25.50	0.880
7:08	14.309	8.044	0.143	0.090	0.000	52.49	1.357	22.20	0.047	0.021	0.001	136.8	128.0	98.71	25.07	0.865
7:27	12.880	9.229	0.167	0.101	0.000	54.72	1.343	19.74	0.050	0.025	0.004	124.9	116.7	98.26	25.51	0.880
7:46	14.303	9.171	0.226	0.110	0.000	52.46	1.575	20.79	0.063	0.026	0.006	136.7	127.4	98.73	25.23	0.871
8:04	14.445	8.724	0.189	0.102	0.000	52.85	1.483	21.60	0.055	0.024	0.005	137.8	128.7	99.47	25.34	0.875
8:23	13.904	9.179	0.184	0.096	0.000	53.10	1.435	20.73	0.052	0.022	0.004	132.5	123.7	98.70	25.34	0.875
8:41	13.929	9.469	0.206	0.131	0.000	54.39	1.648	19.78	0.066	0.033	0.005	133.2	124.1	99.65	25.63	0.885
8:59	14.500	9.506	0.207	0.109	0.000	52.86	1.573	20.30	0.061	0.028	0.006	135.4	126.1	99.15	25.35	0.875
9:18	14.622	9.238	0.179	0.115	0.000	52.78	1.584	20.94	0.058	0.028	0.004	137.5	128.2	99.55	25.39	0.876
9:36	15.212	8.855	0.142	0.115	0.000	52.14	1.530	21.92	0.054	0.029	0.002	141.4	131.8	100.00	25.31	0.874
9:55	12.697	9.800	0.136	0.073	0.000	55.28	1.140	20.03	0.040	0.018	0.002	121.8	114.0	99.22	25.94	0.895
10:13	10.721	11.282	0.118	0.092	0.000	59.62	1.187	16.30	0.042	0.024	0.001	104.1	97.2	99.38	26.73	0.923
10:31	10.833	12.665	0.152	0.092	0.000	59.49	1.321	14.54	0.046	0.025	0.003	100.9	93.7	99.17	26.85	0.927
10:50	13.023	11.069	0.102	0.075	0.000	55.78	1.108	18.36	0.038	0.020	0.003	116.7	108.7	99.57	26.16	0.903
11:08	15.922	9.365	0.098	0.113	0.000	51.47	1.439	21.52	0.048	0.031	0.002	140.6	130.8	100.00	25.21	0.870
11:27	16.131	9.961	0.129	0.116	0.000	51.42	1.621	20.54	0.052	0.029	0.004	140.6	130.5	100.00	25.23	0.871
11:45	15.136	10.657	0.104	0.104	0.000	53.37	1.457	18.81	0.042	0.027	0.001	129.3	119.9	99.71	25.54	0.882
12:04	15.522	10.160	0.109	0.101	0.000	52.60	1.457	19.98	0.044	0.026	0.002	134.4	124.8	100.00	25.44	0.878
12:22	14.899	10.590	0.087	0.103	0.000	53.25	1.413	19.37	0.040	0.028	0.001	129.6	120.4	99.79	25.62	0.884
12:40	14.711	10.265	0.129	0.110	0.000	53.34	1.530	19.74	0.049	0.029	0.002	132.4	123.1	99.90	25.64	0.885
12:59	14.314	10.550	0.116	0.101	0.000	53.79	1.389	19.48	0.045	0.027	0.002	128.3	119.4	99.81	25.77	0.890
13:17	14.824	9.754	0.135	0.118	0.000	53.23	1.624	20.24	0.050	0.031	0.003	135.6	126.1	100.00	25.54	0.882
13:36	15.546	9.137	0.108	0.130	0.000	51.54	1.718	21.73	0.051	0.034	0.001	143.5	133.6	100.00	25.24	0.871
13:54	15.970	9.187	0.114	0.147	0.000	51.01	1.885	21.58	0.057	0.041	0.001	146.8	136.5	100.00	25.12	0.867
14:13	14.935	9.439	0.091	0.126	0.000	53.20	1.631	20.41	0.048	0.037	0.001	136.1	126.6	99.92	25.44	0.878
14:31	15.332	9.540	0.108	0.136	0.000	52.20	1.745	20.85	0.052	0.038	0.001	140.5	130.6	100.00	25.36	0.875
14:49	15.354	9.898	0.078	0.134	0.000	52.44	1.709	20.30	0.048	0.038	0.002	137.9	128.1	100.00	25.42	0.877
15:08	15.586	10.099	0.061	0.130	0.000	52.31	1.690	20.05	0.042	0.036	0.001	137.1	127.2	100.00	25.39	0.876
15:26	16.314	9.626	0.060	0.125	0.000	51.46	1.711	20.62	0.040	0.034	0.001	141.3	131.1	100.00	25.12	0.867
15:46	16.642	9.822	0.060	0.128	0.000	50.92	1.750	20.60	0.042	0.035	0.001	142.8	132.4	100.00	25.06	0.865
16:04	16.592	10.825	0.051	0.133	0.000	51.29	1.811	19.22	0.042	0.038	0.000	138.8	128.3	100.00	25.23	0.871

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/22/1985

16:23	15.098	11.879	0.057	0.147	0.000	53.83	1.870	17.04	0.044	0.042	0.000	128.1	118.3	100.00	25.78	0.890
16:41	16.447	10.517	0.077	0.134	0.000	51.69	1.841	19.22	0.046	0.037	0.000	139.2	128.7	100.00	25.22	0.870
17:00	16.542	9.915	0.059	0.131	0.000	51.19	1.811	19.88	0.044	0.037	0.000	140.9	130.5	99.61	24.99	0.863
17:18	15.996	9.759	0.075	0.135	0.000	51.47	1.870	20.21	0.047	0.038	0.000	141.2	131.0	99.60	25.10	0.866
17:37	16.966	8.899	0.074	0.142	0.000	50.03	1.913	21.82	0.050	0.042	0.000	150.2	139.4	99.93	24.80	0.856
17:55	17.976	8.425	0.061	0.139	0.000	48.39	1.932	22.75	0.047	0.040	0.000	156.3	145.0	99.77	24.41	0.843
18:14	17.131	8.507	0.074	0.136	0.000	49.82	1.919	22.33	0.048	0.038	0.002	152.2	141.3	100.00	24.71	0.853
18:32	17.985	8.116	0.065	0.141	0.000	48.28	1.937	23.39	0.047	0.040	0.002	158.5	147.2	100.00	24.42	0.843
18:51	18.115	7.926	0.055	0.127	0.000	48.22	1.833	23.64	0.041	0.036	0.001	158.1	146.8	100.00	24.37	0.841
19:28	17.948	8.159	0.088	0.163	0.000	48.35	2.194	22.99	0.058	0.047	0.001	160.9	149.3	100.00	24.41	0.843
19:46	17.402	8.466	0.075	0.140	0.000	49.62	1.989	22.22	0.048	0.040	0.001	153.6	142.5	100.00	24.62	0.850
20:23	17.084	9.158	0.059	0.122	0.000	50.62	1.821	21.06	0.042	0.035	0.000	146.3	135.6	100.00	24.83	0.857
20:41	16.089	9.821	0.072	0.130	0.000	52.46	1.881	19.50	0.042	0.000	0.000	138.2	127.9	100.00	25.19	0.869
20:59	16.650	9.817	0.070	0.138	0.000	51.61	1.911	19.76	0.047	0.000	0.000	141.3	130.7	100.00	25.04	0.864
21:18	17.131	9.421	0.056	0.132	0.000	50.70	1.841	20.63	0.049	0.040	0.000	145.7	134.9	100.00	24.86	0.858
21:36	17.605	8.745	0.068	0.135	0.000	50.18	1.940	21.28	0.045	0.000	0.000	149.5	138.4	100.00	24.61	0.850
21:54	17.444	8.762	0.070	0.136	0.000	50.23	1.909	21.40	0.045	0.000	0.001	149.1	138.1	100.00	24.66	0.851
22:12	17.257	8.975	0.065	0.129	0.000	50.76	1.827	20.90	0.044	0.047	0.000	147.0	136.1	100.00	24.76	0.855
22:30	16.044	9.183	0.073	0.133	0.000	50.37	1.871	19.24	0.045	0.044	0.000	138.3	128.0	97.00	24.26	0.838
22:48	16.608	9.909	0.068	0.141	0.000	51.62	1.916	19.62	0.047	0.073	0.000	142.7	132.0	100.00	25.07	0.866
23:06	16.735	9.715	0.051	0.133	0.000	51.55	1.861	19.87	0.045	0.046	0.000	142.1	131.5	100.00	25.01	0.863
23:24	17.046	9.050	0.069	0.144	0.000	50.76	1.969	20.87	0.050	0.047	0.000	148.1	137.2	100.00	24.81	0.856
23:49	18.046	7.637	0.070	0.142	0.000	47.93	1.969	24.16	0.046	0.000	0.001	160.6	149.3	100.00	24.32	0.839

6/23/1985

0:07	18.787	6.710	0.059	0.133	0.000	47.10	1.873	25.25	0.044	0.041	0.000	166.2	154.5	100.00	23.99	0.828
0:25	18.076	6.937	0.077	0.130	0.000	48.27	1.902	24.51	0.048	0.041	0.000	162.2	150.8	100.00	24.21	0.836
0:43	18.866	6.281	0.080	0.137	0.000	47.21	1.936	25.45	0.043	0.000	0.001	167.0	155.3	100.00	23.89	0.825
1:01	18.991	5.827	0.072	0.124	0.000	47.59	1.826	25.48	0.045	0.041	0.000	167.2	155.4	100.00	23.81	0.822
1:19	20.121	6.001	0.076	0.150	0.000	45.35	2.276	25.93	0.053	0.045	0.000	177.6	164.9	100.00	23.49	0.811
1:37	19.058	5.616	0.070	0.141	0.000	46.54	1.906	26.57	0.051	0.047	0.000	172.3	160.4	100.00	23.75	0.820
1:55	18.487	5.970	0.078	0.123	0.000	47.85	1.847	25.61	0.041	0.000	0.002	165.1	153.7	100.00	23.95	0.827
2:13	18.867	6.210	0.066	0.139	0.000	46.81	1.930	25.88	0.047	0.048	0.000	169.5	157.7	100.00	23.89	0.825
2:31	18.480	5.929	0.066	0.126	0.000	47.48	1.766	26.06	0.045	0.045	0.000	166.8	155.4	100.00	23.96	0.827
2:49	17.669	6.626	0.087	0.135	0.000	48.81	1.912	24.72	0.046	0.000	0.002	160.7	149.7	100.00	24.26	0.837
3:07	18.413	6.653	0.084	0.149	0.000	47.76	1.977	24.91	0.052	0.000	0.001	164.8	153.2	100.00	24.06	0.831
3:25	17.283	7.014	0.104	0.128	0.000	49.76	1.847	23.82	0.043	0.000	0.002	156.0	145.2	100.00	24.43	0.843
17:08	18.625	7.055	0.091	0.144	0.000	43.38	2.060	25.54	0.054	0.044	0.002	169.5	157.7	97.00	23.23	0.802
17:25	18.567	7.112	0.073	0.145	0.000	43.34	2.076	25.59	0.050	0.046	0.000	169.3	157.5	97.00	23.25	0.803
17:43	18.608	7.056	0.071	0.145	0.000	43.42	2.074	25.95	0.051	0.046	0.006	170.6	158.8	97.43	23.35	0.806
18:01	18.784	6.681	0.066	0.147	0.000	43.09	2.134	26.19	0.050	0.045	0.000	172.4	160.4	97.18	23.17	0.800
18:19	18.209	7.033	0.075	0.136	0.000	44.26	2.017	25.70	0.048	0.040	0.002	167.6	156.1	97.52	23.48	0.811
18:37	17.785	7.334	0.087	0.137	0.000	45.09	2.036	24.99	0.050	0.041	0.004	164.4	153.0	97.55	23.65	0.816
18:54	16.683	8.085	0.097	0.128	0.000	46.91	1.945	23.58	0.052	0.042	0.008	155.5	144.8	97.53	24.06	0.831
19:12	17.218	7.807	0.103	0.130	0.000	45.95	1.965	24.05	0.054	0.043	0.007	159.1	148.1	97.32	23.82	0.822

H-H

GAS CHROMATOGRAPH DATA

DATE TIME	H2 %	CO2 %	C2H4 %	C2H6 %	O2 %	N2 %	CH4 %	CO %	C3H6 %	C3H8 %	C3H4 %	HHV BTU/SCF	LHV BTU/SCF	TMP %	MW	S.G. WRT AIR

6/23/1985

19:31	16.942	7.635	0.100	0.126	0.000	46.57	1.950	24.17	0.048	0.041	0.007	158.2	147.3	97.59	23.94	0.826
19:49	18.176	6.694	0.101	0.133	0.000	43.90	2.034	25.90	0.057	0.046	0.006	169.0	157.4	97.05	23.31	0.804
20:07	17.304	6.773	0.087	0.124	0.000	45.26	1.895	25.46	0.049	0.043	0.009	162.7	151.8	97.00	23.55	0.813
20:25	18.224	7.014	0.125	0.143	0.000	44.13	2.126	25.12	0.062	0.048	0.010	168.3	156.6	97.00	23.32	0.805
20:43	17.975	6.904	0.124	0.137	0.000	44.35	2.060	25.33	0.059	0.047	0.011	167.3	155.7	97.00	23.37	0.807
21:01	17.106	7.155	0.084	0.115	0.000	45.76	1.832	24.85	0.048	0.041	0.009	159.2	148.4	97.00	23.67	0.817
21:19	15.777	7.962	0.108	0.102	0.000	47.91	1.721	23.33	0.047	0.036	0.009	148.9	138.9	97.00	24.15	0.834
21:37	15.677	8.033	0.101	0.106	0.000	48.31	1.745	22.98	0.050	0.036	0.009	147.7	137.8	97.05	24.20	0.835
21:55	16.731	8.334	0.134	0.130	0.000	47.20	2.150	22.21	0.058	0.039	0.008	154.0	143.0	97.00	23.91	0.826
22:13	15.401	9.023	0.094	0.098	0.000	50.06	1.860	20.38	0.044	0.032	0.008	139.2	129.2	97.00	24.40	0.842
22:45	14.025	9.570	0.109	0.083	0.000	51.93	1.684	19.53	0.041	0.022	0.002	129.9	120.9	97.00	24.87	0.858
23:03	14.853	9.573	0.084	0.079	0.000	51.17	1.613	19.56	0.034	0.023	0.002	131.3	122.0	97.00	24.66	0.851
23:21	13.393	9.975	0.055	0.055	0.000	52.63	1.142	19.71	0.026	0.015	0.002	121.0	113.0	97.00	25.16	0.868
23:39	11.747	11.239	0.083	0.058	0.000	54.90	1.144	17.78	0.037	0.013	0.003	110.2	103.0	97.00	25.79	0.890
23:57	14.483	10.306	0.016	0.035	0.000	51.82	0.857	19.58	0.012	0.011	0.000	119.9	111.7	97.12	24.99	0.863

6/24/1985

2:22	13.859	9.397	0.006	0.006	0.000	51.23	0.371	22.12	0.004	0.004	0.000	120.0	112.7	97.00	25.03	0.864
2:40	14.026	9.239	0.006	0.012	0.000	50.91	0.350	22.45	0.004	0.004	0.000	121.5	114.1	97.00	24.96	0.862
2:58	14.072	9.136	0.005	0.011	0.000	51.04	0.327	22.41	0.004	0.004	0.000	121.3	113.9	97.01	24.94	0.861
3:37	14.466	9.100	0.010	0.015	0.000	50.51	0.397	23.15	0.004	0.000	0.000	125.7	118.0	97.65	25.00	0.863
3:55	14.769	8.989	0.010	0.016	0.000	49.88	0.520	22.80	0.006	0.004	0.000	127.0	119.0	97.00	24.71	0.853
4:12	13.496	9.302	0.005	0.011	0.000	52.22	0.404	21.56	0.003	0.003	0.000	117.4	110.2	97.00	25.11	0.867
4:30	14.618	8.840	0.005	0.012	0.000	49.65	0.436	23.43	0.004	0.004	0.000	127.4	119.7	97.00	24.74	0.854
4:47	14.381	8.952	0.007	0.011	0.000	50.15	0.405	23.09	0.004	0.003	0.000	125.3	117.7	97.00	24.82	0.857
5:05	13.629	9.636	0.010	0.013	0.000	51.36	0.437	21.90	0.006	0.004	0.000	119.5	112.2	97.00	25.12	0.867
5:40	13.754	9.456	0.013	0.016	0.000	51.04	0.457	22.25	0.006	0.005	0.000	121.4	114.0	97.00	25.06	0.865
5:57	13.247	9.629	0.015	0.018	0.000	52.08	0.453	21.55	0.007	0.005	0.000	117.5	110.4	97.00	25.22	0.870
6:15	13.248	10.077	0.023	0.046	0.000	51.76	0.746	21.08	0.012	0.013	0.000	119.9	112.4	97.00	25.26	0.872
6:32	14.112	9.213	0.082	0.020	0.000	50.96	0.578	22.03	0.005	0.007	0.000	124.2	116.5	97.00	24.91	0.860

SULFUR GAS CHROMATOGRAPH DATA

DATE TIME	H2S PPM	COS PPM	TOTAL PPM
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6/21/1985

14:53	764	495	1259
15:15	1082	565	1647
19:11	1705	719	2424
19:30	1100	603	1703
19:55	1514	689	2203
20:38	1279	639	1918
21:04	1140	646	1786

6/22/1985

1:54	1029	601	1630
9:56	1153	669	1822
10:40	991	656	1648
11:23	1546	362	1908
12:26	1346	686	2032
13:28	1550	754	2304
15:10	1064	635	1699
16:17	1322	584	1906
20:06	1169	714	1883
21:31	1419	610	2029
22:34	1448	420	1868
23:27	2775	601	3376

6/23/1985

0:32	1991	543	2534
1:33	1978	519	2497
2:35	2041	563	2604
3:24	2054	539	2593
4:34	2011	1196	3207
7:31	2284	738	3021
9:54	2443	985	3428
11:21	2223	689	2911
12:46	1335	690	2025
13:57	1586	825	2411
15:20	2087	444	2531
16:00	2090	455	2546
18:14	2004	487	2491
20:17	1813	679	2492
22:10	2186	1755	3942
22:32	1877	1247	3124
23:25	2956	730	3687

6/24/1985

5:37	1850	399	2248
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APPENDIX I

Continuous Output Transducer Data

These are averages of the continuous output transducer data averaged for the time periods over which material and energy balance calculations were made.

AVERAGE FROM PERIOD: 6/17/85 22: 0 TO 6/18/85 14: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	23.086	%	1.391
CO2	9.278	%	0.700
O2	0.032	%	0.384
SIGMA	100.011	BTU/SCF	9.165
AG VEL	73.400	SPH	265.645
GR VEL	0.004	RPD/T	0.008
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	14.737	DEG C	1.836
T-702	28.259	DEG C	1.679
T-703	59.219	DEG C	0.449
T-703A	34.432	DEG C	5.319
TT1-703	60.365	DEG C	0.215
TT2-703	60.558	DEG C	0.209
T-705	255.860	DEG C	47.974
T-706	100.579	DEG C	5.089
T-707	142.852	DEG C	11.011
T-710	15.172	DEG C	0.533
T-711	50.619	DEG C	8.454
T-712	15.328	DEG C	0.443
T-713	17.878	DEG C	1.219
T-715	--OFF--	DEG C	
T-806	105.613	DEG C	6.977
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	210.694	DEG C	14.321
T-820	61.240	DEG C	3.983
T-821	96.805	DEG C	4.031
T-822	48.089	DEG C	0.989
T-823	71.206	DEG C	2.656
F-701	105.302	SCFM	6.017
F-715	--OFF--	LBS/HR	
F-802	334.796	SCFM	465.789
F-803	3368.975	SCFM	82.874
P-703	0.562	IN WC	0.126
P-705	0.193	IN WC	0.053
P-704	0.369	IN WC	0.084
P-706	0.267	IN WC	0.054
P-707	--OFF--	IN WC	
P-810	0.630	IN WC	0.531

AVERAGE BASE TEMPERATURE 19.439

AVERAGE FROM PERIOD: 6/18/85 15: 0 TO 6/19/85 2: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	27.358	%	1.471
CO2	8.052	%	0.560
O2	-0.097	%	0.188
SIGMA	152.260	BTU/SCF	6.684
AG VEL	-0.154	SPH	0.068
GR VEL	0.000	RPD/T	0.000
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	17.598	DEG C	1.666
T-702	30.797	DEG C	1.421
T-703	57.983	DEG C	0.430
T-703A	39.928	DEG C	1.195
TT1-703	59.282	DEG C	0.037
TT2-703	59.495	DEG C	0.036
T-705	183.253	DEG C	8.264
T-706	95.571	DEG C	1.379
T-707	132.087	DEG C	4.141
T-710	14.292	DEG C	2.426
T-711	78.381	DEG C	0.861
T-712	15.635	DEG C	0.634
T-713	16.559	DEG C	0.688
T-715	--OFF--	DEG C	
T-806	106.650	DEG C	4.953
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	334.364	DEG C	25.475
T-820	89.669	DEG C	3.183
T-821	123.484	DEG C	27.964
T-822	58.629	DEG C	1.738
T-823	86.863	DEG C	4.246
F-701	350.490	SCFM	2.187
F-715	46.096	LBS/HR	57.571
F-802	980.874	SCFM	8.887
F-803	3232.784	SCFM	104.798
P-703	1.536	IN WC	0.183
P-705	0.439	IN WC	0.025
P-704	1.097	IN WC	0.165
P-706	0.441	IN WC	0.022
P-707	--OFF--	IN WC	
P-810	0.038	IN WC	0.013

AVERAGE BASE TEMPERATURE 20.568

AVERAGE FROM PERIOD: 6/19/85 10: 0 TO 6/20/85 9: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	32.543	%	2.582
CO2	4.871	%	0.815
O2	-0.040	%	0.453
SIGMA	146.664	BTU/SCF	20.550
AG VEL	145.219	SPH	299.723
GR VEL	0.019	RPD/T	0.001
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	16.890	DEG C	3.746
T-702	28.175	DEG C	3.812
T-703	57.043	DEG C	2.884
T-703A	37.500	DEG C	3.969
TT1-703	58.851	DEG C	1.133
TT2-703	59.063	DEG C	1.140
T-705	263.997	DEG C	73.371
T-706	124.078	DEG C	18.704
T-707	190.877	DEG C	38.781
T-710	15.598	DEG C	0.900
T-711	66.113	DEG C	5.526
T-712	15.875	DEG C	0.873
T-713	28.582	DEG C	9.886
T-715	--OFF--	DEG C	
T-806	165.842	DEG C	29.971
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	308.218	DEG C	81.447
T-820	56.860	DEG C	8.203
T-821	62.384	DEG C	11.903
T-822	68.238	DEG C	3.912
T-823	65.199	DEG C	3.822
F-701	625.851	SCFM	3.473
F-715	249.065	LBS/HR	34.800
F-802	990.459	SCFM	56.822
F-803	3239.516	SCFM	226.473
P-703	4.450	IN WC	1.425
P-705	0.481	IN WC	0.442
P-704	3.969	IN WC	1.196
P-706	0.298	IN WC	0.432
P-707	--OFF--	IN WC	
P-810	-0.340	IN WC	0.111

AVERAGE BASE TEMPERATURE 19.244

AVERAGE FROM PERIOD: 6/20/85 10: 0 TO 6/21/85 9: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	27.941	%	2.528
CO2	7.690	%	0.937
O2	-0.061	%	0.168
SIGMA	143.638	BTU/SCF	13.263
AG VEL	817.243	SPH	226.746
GR VEL	0.025	RPD/T	0.009
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	23.943	DEG C	2.700
T-702	34.514	DEG C	3.130
T-703	57.344	DEG C	3.847
T-703A	48.880	DEG C	4.096
TT1-703	60.034	DEG C	1.482
TT2-703	60.258	DEG C	1.492
T-705	321.759	DEG C	48.734
T-706	155.693	DEG C	12.705
T-707	251.244	DEG C	30.661
T-710	14.699	DEG C	1.660
T-711	84.825	DEG C	7.494
T-712	15.127	DEG C	1.080
T-713	39.223	DEG C	4.186
T-715	--OFF--	DEG C	
T-806	219.107	DEG C	24.819
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	280.324	DEG C	32.556
T-820	57.676	DEG C	5.317
T-821	61.941	DEG C	8.186
T-822	63.440	DEG C	4.434
T-823	61.320	DEG C	4.370
F-701	847.774	SCFM	4.601
F-715	155.936	LBS/HR	60.223
F-802	1434.621	SCFM	140.906
F-803	5501.497	SCFM	403.669
P-703	16.230	IN WC	3.207
P-705	0.919	IN WC	0.580
P-704	15.311	IN WC	2.973
P-706	0.520	IN WC	0.550
P-707	--OFF--	IN WC	
P-810	-0.342	IN WC	0.143

AVERAGE BASE TEMPERATURE 19.781

AVERAGE FROM PERIOD: 6/22/85 14: 0 TO 6/23/85 11: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	26.293	%	3.169
CO2	8.861	%	1.494
O2	0.045	%	0.387
SIGMA	142.398	BTU/SCF	11.114
AG VEL	334.373	SPH	255.119
GR VEL	0.027	RPD/T	0.009
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	18.868	DEG C	4.779
T-702	30.654	DEG C	4.273
T-703	60.307	DEG C	1.271
T-703A	38.086	DEG C	2.907
TT1-703	62.078	DEG C	0.809
TT2-703	62.308	DEG C	0.817
T-705	255.389	DEG C	54.444
T-706	147.549	DEG C	21.825
T-707	198.780	DEG C	29.220
T-710	15.522	DEG C	0.462
T-711	53.571	DEG C	2.459
T-712	15.753	DEG C	0.469
T-713	28.094	DEG C	3.297
T-715	--OFF--	DEG C	
T-806	159.660	DEG C	22.036
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	326.868	DEG C	34.082
T-820	74.565	DEG C	5.240
T-821	85.211	DEG C	5.033
T-822	57.017	DEG C	4.019
T-823	53.807	DEG C	4.383
F-701	349.410	SCFM	3.906
F-715	129.317	LBS/HR	36.390
F-802	892.784	SCFM	22.761
F-803	3541.467	SCFM	152.139
P-703	5.210	IN WC	1.192
P-705	0.601	IN WC	0.183
P-704	4.609	IN WC	1.105
P-706	0.663	IN WC	0.316
P-707	--OFF--	IN WC	
P-810	0.021	IN WC	0.034

AVERAGE BASE TEMPERATURE 19.731

AVERAGE FROM PERIOD: 6/23/85 11: 0 TO 6/24/85 6: 0

SIGNAL	AVERAGE	UNITS	STD.DEV.
CO	27.031	%	2.835
CO2	9.369	%	1.361
O2	-0.055	%	0.297
SIGMA	137.322	BTU/SCF	16.813
AG VEL	325.179	SPH	279.679
GR VEL	0.032	RPD/T	0.010
T - 3	--OFF--	DEG C	
T - 8	--OFF--	DEG C	
T - 9	--OFF--	DEG C	
T-701	16.887	DEG C	3.900
T-702	28.836	DEG C	3.640
T-703	62.756	DEG C	0.548
T-703A	36.622	DEG C	1.521
TT1-703	64.215	DEG C	0.044
TT2-703	64.462	DEG C	0.044
T-705	438.828	DEG C	185.745
T-706	149.200	DEG C	21.988
T-707	275.584	DEG C	81.070
T-710	15.857	DEG C	0.574
T-711	53.948	DEG C	4.998
T-712	16.078	DEG C	0.649
T-713	37.430	DEG C	13.370
T-715	--OFF--	DEG C	
T-806	215.608	DEG C	57.826
T-811	--OFF--	DEG C	
T-812	--OFF--	DEG C	
T-813	--OFF--	DEG C	
T-814	--OFF--	DEG C	
T-815	--OFF--	DEG C	
T-816	--OFF--	DEG C	
T-817	--OFF--	DEG C	
T-818	--OFF--	DEG C	
T-819	313.752	DEG C	25.043
T-820	67.998	DEG C	5.199
T-821	78.446	DEG C	5.230
T-822	56.847	DEG C	2.347
T-823	53.561	DEG C	2.508
F-701	351.752	SCFM	2.906
F-715	177.083	LBS/HR	38.778
F-802	900.675	SCFM	14.056
F-803	3581.168	SCFM	162.057
P-703	5.065	IN WC	1.103
P-705	0.795	IN WC	0.144
P-704	4.269	IN WC	1.185
P-706	0.779	IN WC	0.127
P-707	--OFF--	IN WC	
P-810	0.018	IN WC	0.011

AVERAGE BASE TEMPERATURE 20.159

DATE	TIME	AGITATOR			GRATE		
		COUNTER TOTAL	SWEEPS PER HR	DRIVE SETTING	GEAR COUNTER	GEAR REVOLUTIONS RPH	DRIVE SETTING TEETH/RPD
6-23	1330	551	4	4	1455	19	1/5.0
6-23	1430	554	3	4	1477	22	1/5.0
6-23	1530	560	6	4	1508	31	1/5.0
6-23	1630	561	1	2	1526	18	1/3.0
6-23	1730	565	4	4	1543	17	1/3.0
6-23	1830	568	3	1.7	1558	15	1/3.0
6-23	1930	570	2	1.7	1569	11	1/2.0
6-23	2030	575	5	2	1582	13	1/5.0
6-23	2130	577	2	2	1594	12	1/2.5
6-23	2230	579	2	2	1610	16	1/2.5
6-23	2330	585	6		1624	14	1/2.5
6-24	0030	586	1		1630	6	1/2.5
6-24	0130	588	2	6	1650	20	1/2.5
6-24	0230	596	8	6	1665	15	1/2.5
6-24	0330	601	5	6.0	1675	10	1/2.5
6-24	0430	603	2		1690	15	1/2.5
6-24	0530	603			1703	13	1/2.5
6-24	0630	606	3	3.1	1719	16	1/5.0

APPENDIX J

Retort Pressure and Temperature Probe Data

Reference: Volume 1, Thimsen, Maurer et al (1984)

RETORT TEMPERATURE AND PRESSURE PROBE DATA

TEST: BOM/FGT-016

COAL: ROSEBUD

DATE: 06/19/85

RETORT ACCESS PORT NUMBER:

5

DATA: INCHES ABOVE GRATE	PRESSURE (inwc)	TEMPERATURE (deg C)	TIME (hrs)	1045	1120
0	0.5	---	Blast Air (scfm)	800	800
6	0.6	---			
12	0.8	---			
18	1.1	1121	Saturation Temperature (deg C)	58.6	58.4
24	1.3	943			
30	1.6	899			
36	1.9	915			
42	2.0	893	Ashpit Pressure (inwc)	3.7	3.4
48	2.3	838			
54	2.5	827			
60	2.6	816			
66	2.9	788	Offtake Temperature (deg C)	255	260
72	3.0	760			
78	3.0	204			

LOCAL CLIMATOLOGICAL DATA Monthly Summary

INTERNATIONAL AIRPORT

LATITUDE 44°53' LONGITUDE 93°13' ELEVATION (GROUND) 834 FEET TIME ZONE CENTRAL 14922

DATE	TEMPERATURE °F					DEGREE DAYS BASE 65°F		WEATHER TYPES 1 FOG 2 HEAVY FOG 3 THUNDERSTORM 4 ICE PELLETS 5 HAIL 6 GLAZE 7 DUSTSTORM 8 SMOKE, HAZE 9 BLOWING SNOW	SNOW ICE PELLETS OR ICE ON GROUND AT 0600 INCHES	PRECIPITATION		AVERAGE STATION PRESSURE IN INCHES ELEV. 838 FEET ABOVE M.S.L.	WIND (M.P.H.)				SUNSHINE		SKY COVER (TENTHS)			
	MAXIMUM	MINIMUM	AVERAGE	DEPARTURE FROM NORMAL	AVERAGE DEW POINT	HEATING I (SEASON BEGINS WITH JUL)	COOLING I (SEASON BEGINS WITH JAN)			WATER EQUIVALENT (INCHES)	SNOW, ICE PELLETS (INCHES)		RESULTANT DIR.	RESULTANT SPEED	AVERAGE SPEED	FASTEST MILE		MINUTES	PERCENT OF TOTAL POSSIBLE	SUNRISE TO SUNSET	MIDNIGHT TO MIDNIGHT	
																SPEED	DIRECTION					
1	2	3	4	5	6	7A	7B	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
01	65	47	56	-8	48	9	0		0	0.17	0.0	28.910	29	5.9	12.5	23	33	828	90	7	4	01
02	59	39*	49*	-15	36	16	0		0	0.00	0.0	29.140	35	7.3	7.9	14	36	874	95	7	5	02
03	62	40	51	-14	41	14	0		0	0.00	0.0	29.240	18	1.6	4.1	9	17	855	92	10	8	03
04	65	53	59	-6	46	6	0		0	0.00	0.0	29.190	21	4.7	8.4	13	20	744	80	8	8	04
05	70	45	58	-7	41	7	0		0	0.00	0.0	29.210	32	2.7	5.8	12	32	883	95	0	1	05
06	83	51	67	1	47	0	2		0	0.00	0.0	29.110	18	13.0	13.8	22	19	874	94	5	5	06
07	87	63	75	9	59	0	10	8	0	0.00	0.0	28.960	25	7.4	10.7	18	29	798	86	9	7	07
08	102*	64	83*	17	60	0	18		0	0.00	0.0	28.760	25	6.8	15.9	30	30	845	91	4	4	08
09	75	58	67	0	44	0	2		0	0.00	0.0	29.025	31	17.9	18.4	23	32	896	96	2	2	09
10	66	52	59	-8	48	6	0		0	0.02	0.0	29.180	09	2.4	6.0	10	12	713	76	10	9	10
11	59	51	55	-12	51	10	0	1	0	0.92	0.0	29.140	06	7.0	9.2	16	07	538	58	10	10	11
12	68	44	56	-11	42	9	0		0	0.00	0.0	29.180	33	10.6	11.9	24	33	878	94	4	3	12
13	72	46	59	-9	44	6	0		0	0.00	0.0	29.060	22	4.0	7.2	12	26	854	91	6	6	13
14	65	54	60	-8	53	5	0	1 3	0	0.32	0.0	28.935	14	9.2	9.6	20	13	585	63	9	9	14
15	73	57	65	-3	58	0	0	1	0	0.00	0.0	28.870	33	6.6	8.4	18	32	801	86	8	7	15
16	80	55	68	0	57	0	3	3	0	0.11	0.0	28.870	17	5.3	10.5	23	23	819	88	8	6	16
17	68	54	61	-8	47	4	0	1	0	0.14	0.0	28.850	28	15.9	16.9	29	28	823	88	6	5	17
18	70	55	63	-6	50	2	0		0	0.00	0.0	28.970	34	12.3	13.6	21	36	717	77	9	8	18
19	71	50	61	-8	46	4	0		0	0.00	0.0	29.080	31	8.0	8.7	16	33	937	100	4	3	19
20	82	51	67	-2	51	0	2		0	0.00	0.0	28.870	16	11.6	12.2	24	15	895	96	4	3	20
21	81	59	70	0	59	0	5	3	0	0.07	0.0	28.590	20	11.3	19.1	30	30	554	59	9	8	21
22	81	58	70	0	50	0	5	1 3 5	0	0.25	0.0	28.820	28	15.3	17.3	30	30	867	93	0	2	22
23	71	56	64	-6	49	1	0		0	0.00	0.0	29.060	34	8.5	10.3	17	32	922	98	0	0	23
24	80	51	66	-4	53	0	1		0	0.00	0.0	29.180	12	11.1	11.9	17	11	935	100	1	1	24
25	93	67	80	9	64	0	15		0	0.00	0.0	28.980	16	15.7	18.4	31	18	758	81	8	9	25
26	81	66	74	3	67	0	9		0	0.05	0.0	28.950	26	3.4	10.1	20	23	725	77	10	10	26
27	69	57	63	-8	58	2	0	1	0	0.13	0.0	29.060	30	8.4	11.6	21	29	644	69	9	7	27
28	70	54	62	-9	51	3	0		0	0.00	0.0	29.260	32	6.4	7.2	12	31	898	96	6	6	28
29	76	53	65	-6	54	0	0		0	0.00	0.0	29.300	36	7.3	8.4	14	01	812	87	7	8	29
30	82	58	70	-1	57	0	5		0	0.00	0.0	29.330	06	4.9	6.2	10	07	827	89	7	6	30
SUM	SUN					TOTAL	TOTAL	NUMBER OF DAYS		TOTAL	TOTAL		FOR THE MONTH:				TOTAL	%	SUM	SUM		
2226	1608					104	77			2.18	0.0	29.040	28	2.4	11.1	31	18	24099	88	187	170	
AVG.	AVG.	AVG.	DEP.	AVG.		63	-57	PRECIPITATION > .01 INCH.	10	-1.89							DATE: 25	POSSIBLE	PERCENT	AVG.	AVG.	
74.2	53.6	63.9	-4.2	50.9														27995	86	6.2	5.7	
NUMBER OF DAYS								SEASON TO DATE	SNOW, ICE PELLETS	GREATEST IN 24 HOURS AND DATES				GREATEST DEPTH ON GROUND OF								
								TOTAL	> 1.0 INCH					SNOW, ICE PELLETS OR ICE AND DATE								
MAXIMUM TEMP								76.82	4	PRECIPITATION												
MINIMUM TEMP								76.82	4	SNOW, ICE PELLETS												
5 90° 2 32° 2 32° 2 0°								DEP.	DEP.	HEAVY FOG												
2 0								-325	-28	CLEAR 5 PARTLY CLOUDY 12 CLOUDY 13												

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.
† TRACE AMOUNT.
• ALSO ON EARLIER DATE(S).
HEAVY FOG: VISIBILITY 1/4 MILE OR LESS.
BLANK ENTRIES DENOTE MISSING OR UNREPORTED DATA.

FUNNEL CLOUD OBSERVED DAY 16 AND DAY 22.

DATA IN COLS 6 AND 12-15 ARE BASED ON 21 OR MORE OBSERVATIONS AT HOURLY INTERVALS. RESULTANT WIND IS THE VECTOR SUM OF WIND SPEEDS AND DIRECTIONS DIVIDED BY THE NUMBER OF OBSERVATIONS. ONE OF THREE WIND SPEEDS IS GIVEN UNDER FASTEST MILE: FASTEST MILE - HIGHEST RECORDED SPEED FOR WHICH A MILE OF WIND PASSES STATION (DIRECTION IN COMPASS POINTS). FASTEST OBSERVED ONE MINUTE WIND - HIGHEST ONE MINUTE SPEED (DIRECTION IN TENS OF DEGREES). PEAK GUST - HIGHEST INSTANTANEOUS WIND SPEED (A / APPEARS IN THE DIRECTION COLUMN). ERRORS WILL BE CORRECTED AND NOTED IN SUBSEQUENT PUBLICATIONS.

I CERTIFY THAT THIS IS AN OFFICIAL PUBLICATION OF THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, AND IS COMPILED FROM RECORDS ON FILE AT THE NATIONAL CLIMATIC DATA CENTER, ASHEVILLE, NORTH CAROLINA, 28801

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NATIONAL
ENVIRONMENTAL SATELLITE, DATA
AND INFORMATION SERVICE

NATIONAL
CLIMATIC DATA CENTER
ASHEVILLE NORTH CAROLINA

Kenneth D. Hasler
DIRECTOR
NATIONAL CLIMATIC DATA CENTER

OBSERVATIONS AT 3-HOUR INTERVALS

JUN 1985 14922
MINNEAPOLIS-ST. PAUL, MINNESOTA

HOUR U.S.T.	SKY COVER (TENTHS)			VISI-BILITY		TEMPERATURE							WIND		SKY COVER (TENTHS)			VISI-BILITY		TEMPERATURE							WIND		SKY COVER (TENTHS)			VISI-BILITY		TEMPERATURE							WIND																																																																														
	0-3	4-7	8-10	WHOLE MILES	16THS MILE	WEATHER	AIR OF	WET BULB OF	DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)	0-3	4-7	8-10	WHOLE MILES	16THS MILE	WEATHER	AIR OF	WET BULB OF	DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)	0-3	4-7	8-10	WHOLE MILES	16THS MILE	WEATHER	AIR OF	WET BULB OF	DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)																																																																																			
JUN 1st																																								JUN 2nd																																								JUN 3rd																																							
03	0	UNL	20			RW RW	52	50	48	86	20	6	0	UNL	20				42	39	34	73	36	7	0	UNL	20				42	40	38	86	31	3																																																																																			
06	1	UNL	20				55	52	50	83	22	6	7	150	20				44	41	37	77	36	5	9	UNL	12				47	46	44	89	00	0																																																																																			
09	10	75	12				62	56	52	70	24	12	10	90	15				48	43	36	63	02	5	10	UNL	15				55	48	40	57	16	5																																																																																			
12	10	70	12				62	59	57	84	20	11	10	75	15				51	45	37	59	34	8	9	250	15				59	50	40	50	17	3																																																																																			
15	10	28	10				62	60	58	87	29	9	6	120	15				56	47	38	51	33	7	10	220	15				61	51	41	48	16	7																																																																																			
18	3	UNL	25				63	54	47	56	33	20	5	UNL	20				58	48	38	48	02	10	10	150	15				61	51	41	48	00	0																																																																																			
21	0	UNL	25			53	46	38	57	35	15	0	UNL	20				51	44	35	55	01	5	9	110	15				59	50	42	54	00	0																																																																																				
24	0	UNL	20			47	42	35	63	36	12	0	UNL	20				47	43	39	74	33	6	10	75	15				55	49	43	64	17	8																																																																																				
JUN 4th																																								JUN 5th																																								JUN 6th																																							
03	10	100	15			H H	55	50	45	69	00	0	0	UNL	20				47	44	41	80	33	6	1	UNL	15				54	49	44	69	12	5																																																																																			
06	10	60	15				55	51	47	75	03	4	1	UNL	20				48	46	43	83	00	0	2	UNL	20				55	50	45	69	14	7																																																																																			
09	10	100	15				60	52	45	58	17	7	0	UNL	20				61	50	39	44	34	10	1	UNL	20				69	57	48	47	17	12																																																																																			
12	10	50	15				61	53	46	58	18	8	0	UNL	20				65	52	40	40	28	7	6	UNL	20				78	60	46	32	19	17																																																																																			
15	8	50	15				63	55	48	58	23	10	0	UNL	20				68	54	40	36	15	4	8	UNL	25				80	61	47	31	19	18																																																																																			
18	6	UNL	15				64	56	49	58	21	9	0	UNL	20				69	54	40	35	22	4	9	UNL	25				80	62	50	35	19	14																																																																																			
21	7	90	15			56	52	49	78	20	9	2	UNL	20				64	52	41	43	00	0	7	90	15				73	59	48	41	18	13																																																																																				
24	6	49	20			56	50	43	62	35	10	1	UNL	15				57	50	44	62	10	6	3	UNL	15				70	59	50	49	19	14																																																																																				
JUN 7th																																								JUN 8th																																								JUN 9th																																							
03	10	UNL	15			H H	67	59	52	59	22	10	8	100	15				66	64	62	87	10	5	0	UNL	5			BD	67	54	43	42	30	19																																																																																			
06	10	UNL	15				66	60	55	68	22	8	8	UNL	15				69	66	64	84	13	6	6	UNL	6			BD	62	52	43	50	29	17																																																																																			
09	10	100	6				70	64	60	71	24	3	9	110	20				76	70	67	74	11	5	3	UNL	15				66	55	46	49	31	20																																																																																			
12	8	UNL	6				78	70	65	64	21	12	4	UNL	20				89	78	73	59	18	15	0	UNL	20				72	57	45	38	31	20																																																																																			
15	8	UNL	10				85	70	62	46	32	14	1	UNL	12				102	73	58	23	24	24	0	UNL	20				75	58	43	32	33	16																																																																																			
18	8	UNL	20				84	68	58	41	29	13	2	UNL	20				85	70	62	46	31	24	0	UNL	20				72	55	40	32	32	20																																																																																			
21	6	UNL	20			75	67	63	66	05	8	2	UNL	15				76	59	46	35	29	14	0	UNL	20				65	54	44	47	31	6																																																																																				
24	0	UNL	15			69	64	61	76	19	5	0	UNL	12				73	57	43	34	30	15	3	UNL	15				60	53	47	62	33	6																																																																																				
JUN 10th																																								JUN 11th																																								JUN 12th																																							
03	5	UNL	15			R RF R R RW RW RW RW	55	50	45	69	23	2	10	55	7				55	53	52	90	36	8	0	UNL	20				46	44	41	83	36	6																																																																																			
06	9	250	15				58	54	50	75	06	3	10	7	6				56	54	53	90	06	7	2	UNL	20				47	45	42	83	35	6																																																																																			
09	10	150	15				63	54	45	52	12	9	10	60	12				57	54	51	81	10	11	2	UNL	15				57	50	43	60	33	8																																																																																			
12	10	150	15				66	55	46	49	07	8	10	50	15				58	53	49	72	07	7	5	UNL	15				65	52	40	40	33	15																																																																																			
15	10	150	15				64	56	49	58	12	6	10	31	12				59	55	52	78	09	8	5	UNL	15				68	54	40	36	34	16																																																																																			
18	10	75	20				64	55	47	54	07	7	10	50	10				58	53	48	70	05	7	4	UNL	15				67	55	44	44	32	15																																																																																			
21	8	70	15			59	55	52	78	01	7	10	36	4				53	51	49	86	04	13	5	UNL	15				60	51	43	54	29	9																																																																																				
24	10	60	10			57	55	53	87	28	5	10	55	20				52	49	47	83	36	9	1	UNL	15				55	49	43	64	30	7																																																																																				
JUN 13th																																								JUN 14th																																								JUN 15th																																							
03	3	UNL	15			R R TRW F F	51	48	44	77	00	0	2	UNL	20				56	50	45	67	13	5	9	3	2			F	58	57	56	93	24	3																																																																																			
06	1	UNL	15				50	48	46	86	21	5	7	120	20				59	53	48	67	11	5	10	16	2			F	60	59	58	93	30	6																																																																																			
09	2	UNL	15				66	55	46	49	29	8	10	100	15				64	57	51	63	15	10	9	8	10				65	61	59	81	32	12																																																																																			
12	10	UNL	15				66	53	40	39	26	7	10	90	9				64	59	55	73	16	9	10	26	15				68	62	57	68	33	12																																																																																			
15	7	250	20				72	57	44	37	25	9	10	65	8				63	60	57	81	16	13	10	30	15				71	63	58	64	34	9																																																																																			
18	10	120	25				71	56	42	35	34	4	10	13	1				61	59	57	87	13	17	5	UNL	20				72	64	58	62	34	13																																																																																			
21	8	110	25			64	54	46	52	12	8	10	6	6				60	58	57	90	10	9	1	UNL	25				66	61	57	73	06	4																																																																																				
24	9	120	20			61	53	45	56	13	9	10	7	5				60	59	58	93	14	3	0	UNL	12				60	58	56	87	07	4																																																																																				
JUN 16th																																								JUN 17th																																								JUN 18th																																							
03	2	UNL	10			T	56	54	53	90	15	3	9	UNL	20				55	50	46	72	24	9	10	65	20				55	52	50	83	28	10																																																																																			
06	4	UNL	7				58	57	56	93	13	4	0	UNL	20				58	51	44	60	26	11	10	29	25				57	54	51	81	32	10																																																																																			
09	9	UNL	20				67	62	59	76	15	8	1	UNL	20				66	53	41	40	29	20	8	70	25				62	56	51	67	36	11																																																																																			
12	10	70	20				74	64	58	58	16	13	10	55	20				64	54	46	52	27	22	8	200	20				67	58	51	57	35	16																																																																																			
15	9	UNL	20				78	67	60	54	17	19	10	44	15				64	55	47	54	28	24	7	200	20				66	58	52	61	33	14																																																																																			
18	5	250	20				73	69	66	79	23	20	8	20	25				58	54	50	75	30	15	10	75	15				67	56	46	47	35	16																																																																																			
21	4	UNL	20			68	59	53	59	32	8	1	UNL	25				55	52	49	80	29	8	4	UNL	15				62	56	51	67	02	7																																																																																				
24	1	UNL	20			59	52	45	60	24	5	7	110	20				55	52	49	80	29	11	3	UNL	20				57	53	50	78	34	10																																																																																				

OBSERVATIONS AT 3-HOUR INTERVALS

JUN 1985 14922
MINNEAPOLIS-ST. PAUL, MINNESOTA

HOUR L.S.T.	SKY COVER (TENTHS)	CEILING IN HUNDREDS OF FEET	VISI-BILITY		WEATHER	TEMPERATURE				WIND		SKY COVER (TENTHS)	CEILING IN HUNDREDS OF FEET	VISI-BILITY		WEATHER	TEMPERATURE				WIND		SKY COVER (TENTHS)	CEILING IN HUNDREDS OF FEET	VISI-BILITY		WEATHER	TEMPERATURE				WIND																																													
			WHOLE MILES	16THS MILE		AIR OF	WET BULB OF	DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)			AIR OF	WET BULB OF		DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)	WHOLE MILES	16THS MILE			AIR OF	WET BULB OF		DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)	WHOLE MILES	16THS MILE	AIR OF	WET BULB OF	DEW POINT OF	REL HUMIDITY %	DIRECTION	SPEED (KNOTS)																																						
																																	JUN 19th															JUN 20th															JUN 21st														
03	7	80	20			52	49	47	83	31	6	1	UNL	15				53	50	48	83	00	0	1	UNL	12				68	61	57	68	14	12																																										
06	0	UNL	20			55	51	48	77	33	10	0	UNL	15				54	51	49	83	12	6	10	UNL	15				69	62	57	66	17	14																																										
09	2	UNL	15			64	56	49	58	29	6	2	UNL	15				69	59	51	53	18	12	10	110	12				76	67	61	60	18	15																																										
12	7	280	15			67	55	44	44	33	14	6	UNL	15				78	63	52	41	17	13	8	UNL	15				74	67	63	69	14	22																																										
15	5	UNL	15			71	57	46	41	31	11	8	130	15				79	63	53	41	16	16	10	55	15				80	70	64	58	17	17																																										
18	4	UNL	15			70	57	46	42	29	8	2	UNL	20				81	65	54	39	16	14	10	40	12				72	69	68	87	21	10																																										
21	0	UNL	15			63	54	45	52	25	3	2	UNL	20				74	62	54	50	15	11	10	20	12				62	57	54	75	27	20																																										
24	0	UNL	15			57	51	46	67	00	0	6	70	15				72	62	56	57	14	13	10	29	15				60	54	49	67	30	26																																										
																																	JUN 22nd															JUN 23rd															JUN 24th														
03	7	31	20			60	56	52	75	28	20	0	UNL	15				58	56	55	90	36	7	0	UNL	20				53	50	47	80	00	0																																										
06	0	UNL	25			59	52	45	60	29	15	1	UNL	15				58	55	53	84	34	11	3	UNL	20				57	53	50	78	07	6																																										
09	0	UNL	20			64	53	43	47	28	22	0	UNL	20				61	54	48	63	32	12	1	UNL	20				68	58	50	53	13	13																																										
12	0	UNL	20			71	58	47	43	26	18	0	UNL	25				65	56	48	54	34	13	1	UNL	20				74	62	53	48	11	13																																										
15	0	UNL	20			78	62	50	38	27	17	0	UNL	25				70	58	48	46	30	9	3	UNL	20				79	65	56	45	14	13																																										
18	0	UNL	15			81	63	50	34	27	11	0	UNL	25				71	58	47	43	32	11	0	UNL	20				80	66	58	47	11	14																																										
21	7	90	15			68	60	54	61	34	10	0	UNL	25				65	54	44	47	03	5	0	UNL	20				73	64	58	60	12	13																																										
24	5	UNL	15			62	60	59	90	12	7	0	UNL	25				61	52	44	54	00	0	7	UNL	15				70	62	57	64	12	11																																										
																																	JUN 25th															JUN 26th															JUN 27th														
03	10	31	15			68	62	58	71	13	13	10	44	15				77	70	66	69	15	9	10	4	5				65	63	61	87	35	9																																										
06	10	40	15			68	63	60	76	13	14	10	250	8				78	73	70	77	18	9	10	4	2				65	63	62	90	06	8																																										
09	8	UNL	15			78	70	66	67	14	19	10	23	7				79	73	70	74	21	15	10	8	7				63	61	60	90	33	14																																										
12	10	42	15			85	76	72	65	14	18	10	9	12				71	67	64	79	28	8	10	15	15				66	61	58	76	28	12																																										
15	8	UNL	15			92	75	67	44	20	21	10	24	20				76	70	66	71	31	8	10	36	20				68	61	56	66	26	15																																										
18	8	UNL	15			92	72	62	37	18	22	10	22	20				74	69	66	76	35	10	5	UNL	25				68	60	55	63	27	12																																										
21	10	250	15			85	73	68	57	17	14	10	17	10				69	65	63	81	02	7	0	UNL	25				64	58	54	70	25	8																																										
24	10	33	15			78	71	68	72	30	7	10	7	8				66	64	62	87	01	10	0	UNL	20				58	55	53	84	22	4																																										
																																	JUN 28th															JUN 29th															JUN 30th														
03	2	UNL	20			54	53	52	93	08	4	9	90	15				56	53	51	83	32	6	0	UNL	20				60	56	53	78	04	5																																										
06	2	UNL	20			56	54	52	87	00	0	4	UNL	15				56	54	52	87	34	4	6	UNL	20				59	56	53	81	05	8																																										
09	8	UNL	20			62	56	51	67	30	9	9	80	15				65	59	55	70	36	7	6	UNL	20				68	61	56	66	06	6																																										
12	8	250	20			67	59	52	59	29	8	2	UNL	20				73	62	54	52	01	12	10	UNL	20				78	67	61	56	14	7																																										
15	8	250	20			68	58	49	51	31	10	8	46	20				73	62	54	52	34	6	7	UNL	15				79	67	59	51	09	5																																										
18	6	UNL	20			67	58	50	55	31	8	8	UNL	15				74	63	55	52	35	7	5	UNL	15				81	67	58	46	07	9																																										
21	6	UNL	20			62	55	50	65	35	7	10	UNL	15				70	62	57	64	02	11	5	UNL	12				77	65	58	52	05	3																																										
24	8	UNL	20			60	55	50	70	31	3	10	250	20				66	60	56	70	05	9	2	UNL	10				69	64	60	73	00	0																																										

HOURLY PRECIPITATION (WATER EQUIVALENT IN INCHES)

JUN 1985 14922
MINNEAPOLIS-ST. PAUL, MINNESOTA

DATE	A.M. HOUR ENDING AT												P.M. HOUR ENDING AT												DATE
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
01									T	0.08	0.05	0.02	T	T	0.02										01
02																									02
03																									03
04														T	T										04
05																									05
06																									06
07											T														07
08								T	T	T															08
09																									09
10										T	T	T	T	T	T	T		T	T	T	T	T	T	0.02	10
11	0.03	0.03	0.08	0.01	0.02	0.09	0.06	0.04	0.02	T	T			T	T	0.03	T	0.01	T	0.08	0.18	0.19	0.01	0.04	11
12																T	T								12
13																									13
14											T	0.02	0.02	0.08	0.02	T		0.16	0.02						14
15							T	T																	15
16							T				T	T						0.11							16
17															T	0.06	0.08	T							17
18														T	T				T						18
19																									19
20																									20
21										T	0.02	T					0.04	0.01					T	T	21
22	T	T																			0.05	0.13	0.07		22
23																									23
24																									24
25																									25
26	T										T	T													26
27	0.01	T				0.06	T	0.02	0.04	T	T								T	0.02	T	0.01	0.02		27
28																									28
29																									29
30																									30

MAXIMUM SHORT DURATION PRECIPITATION

TIME PERIOD (MINUTES)	5	10	15	20	30	45	60	80	100	120	150	180
PRECIPITATION (INCHES)	0.11	0.14	0.15	0.15	0.20	0.20	0.24	0.28	0.33	0.38	0.44	0.45
ENDED: DATE	22	22	22	22	22	22	11	11	11	11	11	11
ENDED: TIME	2154	2155	2200	2200	2215	2215	2133	2156	2200	2138	2200	2230

THE PRECIPITATION AMOUNTS FOR THE INDICATED TIME INTERVALS MAY OCCUR AT ANY TIME DURING THE MONTH. THE TIME INDICATED IS THE ENDING TIME OF THE INTERVAL. DATE AND TIME ARE NOT ENTERED FOR TRACE AMOUNTS.

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FIRST CLASS

RETORT TEMPERATURE AND PRESSURE PROBE DATA

TEST: BOM/FGT-016

COAL: ROSEBUD

DATE: 06/20/85

RETORT ACCESS PORT NUMBER:

5

DATA: INCHES ABOVE GRATE	PRESSURE (inwc)	TEMPERATURE (deg C)	TIME (hrs)	800	840
0	1.2	---	Blast Air (scfm)	800	800
6	1.3	---			
12	1.3	1316	Saturation Temperature (deg C)	58.2	58.2
18	1.5	1121			
24	1.8	1086			
30	2.0	---			
36	2.2	960			
42	2.5	893	Ashpit Pressure (inwc)	6.9	6.5
48	2.8	827			
54	3.1	821			
60	3.8	804			
66	5.0	799	Offtake Temperature (deg C)	410	680
72	5.4	793			
78	5.4	343			
84	5.4	282			