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FIXED-BED GASIFICATION RESEARCH USING U.S. COALS, VOLUME 3 GASIFICATION OF ROSEBUD SUBBITUMINOUS COAL

Contract H0222001
Black, Sivalls, and Bryson, Incorporated

BUREAU OF MINES
UNITED STATES DEPARTMENT OF THE INTERIOR

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16. Abstract (Limit: 200 words) A single-staged, fixed-bed Wellman-Galusha gasifier coupled with a hot, raw gas combustion system and scrubber has been used to gasify numerous coals from throughout the United States. The gasification test program is organized as a cooperative effort by private industrial participants and governmental agencies. The consortium of participants is organized under the Mining and Industrial Fuel Gas (MIFGa) Group. This report is the third volume in a series of documents prepared by Black, Sivalis and Bryson, Incorporated and describes the gasification of Rosebud subbituminous coal during the time period November 2-20, 1982. Test results and data are presented for the gasification of the coal and the operation of a slipstream tar scrubber to cool the gas and remove condensed tar.			
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FOREWORD

This report was prepared by Black, Sivalls, and Bryson, Inc., Houston, Texas under USBM contract number H0222001. 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 1982 to May 1984. This final report was submitted by the authors on March 31, 1985.

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The University of Minnesota, Particle Technology Laboratory, Minneapolis, Minnesota, a subcontractor to Black, Sivalls, and Bryson, Inc., participated in preparation of this report.

The coal gasified during the operations described here was donated by Western Energy Company. Transportation of the coal from the mine to Minneapolis, Minnesota was donated by Burlington Northern Railroad.

The slipstream quench/ESP whose operation is reported here was designed and engineered at no cost to this program by personnel from American Natural Resources, Incorporated. Operation of the quench/ESP was undertaken at no cost to this program by personnel from American Natural Resources, Incorporated, Stone and Webster Engineering Corporation, and Dravo Corporation.

The pilot Stretford plant used to desulfurize the detarred gas was loaned to the program by the U. S. Environmental Protection Agency and operated under contract to the Electric Power Research Institute (Contract No. RP 1041-13) and the U. S. Environmental Protection Agency (Contract No. 68-02-3173, Task No. 076) by PEDCo Environmental, Inc.

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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 (BS&B) 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 (UMPTL) is subcontractor to BS&B to monitor process parameters, and provide analysis for material inputs and outputs.

This report is the third volume in a series of reports describing the fixed-bed gasification of U.S. coals at the Bureau of Mines, Twin Cities Research Center. This report covers the test period identified as BOM/FGT-002, gasification of Rosebud subbituminous coal. The time period covered is November 2 - 20, 1982.

Section 1 gives a brief summary of test. Section 2 identifies test objectives. Section 3 contains a description of the fuels. Sections 4 and 5 describe the facility and monitoring systems. Sections 6 and 7 describe the conduct and results of the tests. Section 8 presents conclusions. Test data is included in the Appendices.

SECTION 1

TEST SUMMARY

Rosebud subbituminous coal gasified during BOM/FGT-002 is a readily available coal in the Midwest, mined in large quantities. The objectives of the test were to characterize the performance of Rosebud coal in a Wellman-Galusha fixed-bed gasifier, to evaluate a gas quench and electrostatic precipitator for tar removal, and a Stretford chemistry acid gas removal plant to produce cold, clean, desulfurized coal gas.

Rosebud coal was gasified in a 6.5 foot Wellman-Galusha, atmospheric pressure, air-blown, fixed-bed gas producer, with the gas being incinerated in a combustion chamber. A slipstream of the product gas was sent to a water spray quench tank which cools the gas and condenses the tars, and then to a wet electrostatic precipitator which provides the final tar removal. The cooled, detarred gas was sent to an acid gas removal plant using Stretford chemistry for removal of hydrogen sulfide.

The performance of Rosebud coal in this gasifier was not good. Both gas distribution problems (channeling and burning through) and severe ash clinkering were observed. The maximum sustainable load was about 1.1 tons per hour coal consumption. Offtake temperatures were well below the tar dewpoints (based on visual observation of a heavy tar fog in the uncooled raw gas) which caused dust accumulations downstream of the retort. Wet screening seemed to help stabilize operations, but freezing weather prohibited extensive wet screening.

Gas quality had a higher heating value of 165-185 Btu/scf, and tar/oil yields averaged 0.044 lb tar/lb coal. Results for a relatively stable period of operation are given in Table 1-1.

The water quench/electrostatic precipitator had several operational problems, all related to control of high voltage and high voltage insulators. Operation of the Stretford acid gas removal plant proceeded smoothly with the exception of one incident where tar was blown to the Stretford plant when a high voltage insulator on the ESP failed. Hydrogen sulfide removals as high as 99.5% were observed. The slipstream operated 60% of the time of gasifier operation.

Emissions measurements on the combustion chamber exhaust showed particulate emission factors from 0.094 to 0.142 lb/million Btu, and a sulfur dioxide emission factor of 1.67 lb/million Btu. (Stretford acid gas removal was not operating during this determination.)

Problems related to the gasification of this coal are primarily physical. Minus 3/4 inch screenings from compacted run of the mine inventory yielded about 12%. Further degradation of the coal was noticed in handling prior to entering the retort.

Table 1-1

Design Point Characteristics for Gasification
of Rosebud Subbituminous Coal

Coal Throughput - 1.1 tons/hour (66.3 lb/hr/sq ft grate)		
Air/Coal	1.55	lb/lb
Steam/Coal	.29	lb/lb
Blast Saturation Temperature	146	deg F
Gas Offtake Temperature	533	deg F
Wet Gas/Coal	44.3	scf/lb
Gas Dewpoint	137	deg F
Tar Yield	5.2	lb/100lb coal
Tar Analysis		
HHV (dry)	17050	Btu/lb
Pourpoint	85	deg F
Viscosity (210 F)	128	SUS
Specific Gravity (60/60 F)	1.0746	
Dry Gas Composition (mol%)		
Hydrogen	18.1	
Carbon Monoxide	28.4	
Methane	1.63	
Ethane	.13	
Ethylene	.85	
Carbon Dioxide	5.97	
Nitrogen	44.0	
Water	10.3	lb/1000 dscf
Dry Gas HHV	184	Btu/dscf
Dry Gas LHV	172	Btu/dscf
Thermal Efficiencies		
Hot, Raw	98 %	
Cold, with Tar	89 %	
Cold, without Tar	79 %	

Channeling in the retort and excessive ash clinkering are problems symptomatic of size deterioration. It would be difficult to recommend this fuel for fixed-bed gasification due to the low maximum throughput and high operating labor demands.

SECTION 2

TEST OBJECTIVES

2.1 Selection of Coal to be Tested

Rosebud is a subbituminous coal and is mined and used in very large quantities in the North Central states. Its ready availability creates interest in evaluation of the coal as a fixed-bed gasification feedstock.

Rosebud coal is high moisture (25%), medium ash (12%), medium sulfur (1%), and medium ash fusion temperature with a narrow range from initial deformation to fluid temperatures. These characteristics fit well into the coal test objective matrix.

The coal is readily available in Minneapolis. The coal was donated by Western Energy Company. Transportation to Minneapolis was donated by Burlington Northern, Incorporated, minimizing the acquisition costs to the project.

2.2 Test Objectives

- A. Gasifier performance (thermal efficiency and capacity) with a non-swelling, friable, high moisture subbituminous coal.
- B. Evaluation of gasifier performance with coal sizing (capacity/stability).
- C. Characterization of LBG quality and composition with load and operational variations (size consist, agitation, and saturation temperature).
- D. Evaluation of a water spray quench system and wet electrostatic precipitator for gas cooling and tar/oil removal.
- E. Evaluation of Stretford technology for the removal of sulfur species from cooled, detarred LBG.

2.3 Test Plan

Figure 2-1 shows the projected load levels and activities for BOM/FGT-002. Saturation temperature was varied methodically at each load level. Establishment of maximum load level was left to the facility manager's judgement based on operational performance during the test, as was the use of smaller screen sizes. Ash depth was to be maintained at 15 inches plus or minus 3 inches. The spacing between the three grate levels was set at 6 inches plus or minus 1/8 inch each.

Figure 2-1
Test Plan for BOM/EGT-002

A slipstream of approximately 1000 dscfm (approximately 1/3 of normal gasifier rated output) of the gasifier output was sent to a water spray quench tank and wet electrostatic precipitator. The cooled, detarred gas was sent to an acid gas removal plant that employs Stretford technology for hydrogen sulfide removal. The cooled, cleaned, desulfurized gas is returned to the hot, raw gas flow for incineration in the combustion chamber. The slipstream equipment was installed specifically for this test.

SECTION 3

DESCRIPTION OF FUEL TESTED

The Rosebud coal gasified during BOM/FGT-002 is a non-swelling, high-moisture subbituminous C coal mined by Western Energy Company in Treasure County, Montana. Figure 3-1 shows the location of the Rosebud mining operations near Colstrip, Montana. The coal is surfaced mined from a seam 280 inches thick, with an overburden to coal ratio of 4:1. The mine reserves are in excess of 600,000,000 tons with annual production in excess of 10,000,000 tons. The coal is currently used 100% as steam coal.

The mine is served by Burlington Northern Railroad, and the coal is moved almost exclusively by unit train from the mine. Crushers and screens are used at the tipple to size the coal to 1 1/2 x 0 inches for shipping.

The coal gasified during BOM/FGT-002 was recovered from inventory at the Northern States Power Company (NSP) Riverside generating plant in Minneapolis, Minnesota. Coal is bottom unloaded from unit trains and transported 1/4 mile to uncovered storage by scrapers. Movement of the scrapers on the coal pile compacts it. The coal gasified during BOM/FGT-002 was in inventory at the NSP plant for up to 1 year.

Coal gasified during BOM/FGT-002 was recovered from the compacted pile and screened over a 3/4 inch mesh. The +3/4 inch fraction was conveyed to a pile with minimum drop. The -3/4 inch fraction was returned to the NSP pile. The screeners estimate that the +3/4 inch fraction was 1/8 of the total moved to the screen. The screened coal was loaded into trucks and moved 13 miles to the test site. Approximately 970 tons were delivered to the test site between November 1, 1982 and November 20, 1982. Approximately 500 tons were gasified during BOM/FGT-002, and 300 tons of screenings were removed from the site. This coal is very friable, as indicated by screenings rejected, size analysis performed at various handling points at the gasifier site (see Section 7.1.2.1), and qualitative observations by the operators.

The complete analysis of this coal is shown in Table 3-1. The results are averages of two composite samples covering the entire test period. Table 3-2 shows how this coal fits into the coal test objective matrix. Contact for this coal is:

Western Energy Company
107 East Granite
Butte, Montana 59701

(409) 723-4349

Figure 3-1
Location of the Rosebud Mining Site

Table 3-1

Average Analysis of Rosebud Subbituminous Coal

Proximate Analysis (%)		
Volatile Matter		29.14
Fixed Carbon		35.31
Ash		12.55
Moisture		23.00
Sulfur		1.14
Heating Value (Btu/lb)		8354
Ultimate Analysis (%)		
Carbon		48.86
Hydrogen		3.27
Nitrogen		0.68
Sulfur		1.14
Oxygen		10.50
Ash		12.55
Moisture		23.00
Ash Fusion Temperatures (deg F):		
	Oxidizing	Reducing
Initial deformation	2280	2220
Softening	2300	2270
Hemispherical	2320	2280
Fluid	2385	2300
Free Swelling Index:		0
Hargrove Grindability Index		59*

* Information supplied by Western Energy Company

Table 3-2

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

COAL TEST OBJECTIVE MATRIX								
PHYSICAL CHARACTERISTICS		COAL RANK						
TYPE	RANGE	BITUMINOUS	SUB-BITUMINOUS			LIGNITE	PEAT/BIO MASS	PETROLEUM COKE
			A	B	C			
ASH CONTENT	H + 20%							
	M 10 - 20%				002			
	L - 10%							
ASH FUSION	H + 2700 F							
	M 2300-2700 F				002			
	L - 2300 F							
FREE SWELLING INDEX	H 3 +							
	M 1 - 3							
	L 0 - 1				002			
MOISTURE CONTENT	H + 15%				002			
	M 5 - 15%							
	L - 5%							
FRIABILITY (GRINDABILITY)	H				002			
	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. A description of the slipstream tar scrubber and Stretford acid gas removal systems installed specifically for this test is also included here.

4.1 Test Facility

The gasification test facility includes a 6.5 foot diameter Wellman-Galusha gas producer, a combustion 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 measured and controlled by 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 MM BTU/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.

4.1.3 Tar Scrubber

The newly installed tar scrubber consists of two subsystems: a water spray quench tank and a process electrostatic precipitator.

Figure 4-1

Coal Gasifier Process Flow Schematic
U.S. Bureau of Mines, Twin Cities Research Center

A process flow schematic for the entire tar scrubber is shown in Figure 4-2.

The water spray quench tank is three feet in diameter and nine feet tall. Dirty tar laden gas enters through a tangential entrance near the top of the tank. Two fresh water fogging nozzles, two fresh water spray nozzles, and three recycle water spray nozzles quench the gas and wash tar to the tank bottom. The cooled gas and tar fog exit upward through a central pipe located just above the surface of the quench liquor reservoir at the bottom of the tank and pass through the tank sidewall to the electrostatic precipitator.

The process electrostatic precipitator is a parallel plate unit having six high voltage electrodes and seven grounded collecting plates. Dirty gas entering the precipitator passes through a crossed matrix of 1" pipes to distribute the gas uniformly over the cross section of the precipitator. Three spray nozzles are available above the distributor to further quench the gas or wash the distributor with fresh water.

4.1.4 Stretford Acid Gas Removal Plant

A skid mounted Stretford acid gas removal plant was brought on site for BOM/FGT-002. The cooled detarred gas from the electrostatic precipitator is compressed and sent through a spray Venturi, where hydrogen sulfide is absorbed by a spray of Stretford solution. The desulfurized gas is sent back to the coal gas combustor. The Stretford solution remains in a reaction vessel until the liquid phase reactions are completed. It then moves to an aeration tank where oxygen in air supplied by a compressor reacts with the liquor and is consumed and elemental sulfur is produced. The liquid is decanted from the sulfur in a third tank for return to the Venturi. Make up Stretford solution is stored in a fourth tank. Further details of the Stretford acid gas removal process and plant are given by PEDCo (1983).

4.2 Gas Sampling and Conditioning System

Figure 4-3 is a schematic of the gas sampling and conditioning system used during BOM/FGT-002.

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 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.

Figure 4-2
Tar Scrubber Process Flow Schematic

Figure 4-3

Schematic Diagram of the Gas Sampling and Conditioning System

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 33 minutes with a Hewlett-Packard model 5880A gas chromatograph. The principal features of this chromatograph are listed in Table 4-1.

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, Oxygen,
Nitrogen, Methane, and Carbon monoxide
4. Argon Carrier Gas - flow rate of 28 ml/min
5. Isothermal operation at 70 C
6. 1.0 ml sample
7. 33 minute analysis time

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 four 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 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

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, operations 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

Interpoll, Incorporated, Circle Pines, Minnesota, subcontractor to the University of Minnesota, had a two-man team on site on November 15, 1982. They sampled for exhaust emissions from the gas combustor.

5.1.4 Water Quench/Electrostatic Precipitator Operation and Monitoring

Operation and monitoring of the slipstream water spray quench and electrostatic precipitator (Quench ESP) was performed by a team from American Natural Resources, Incorporated (ANR), with additional personnel from Dravo Corporation and Stone and Webster Engineering Corporation. During operation of the slipstream, there were two people per eight hour shift operating and monitoring this equipment.

The responsibility of this team included operation of the quench/ESP and logging of Quench ESP operational data, and collection of liquid samples.

Further details of this operation are given in Appendix K.

5.1.5 Stretford Acid Gas Removal Plant Operation and Monitoring

PEDCo, Incorporated had a team on site to operate and monitor the Stretford acid gas removal plant. There was one operator present for each 12 hour shift. This operator was also trained in the operation of the on-line monitoring equipment, and grab sampling of the gas streams were performed by a separate crew.

The Stretford operation and monitoring team was responsible for the operation of the Stretford plant, measurement of inlet and outlet gas compositions and collection of liquid samples. Monitoring equipment was on line 24 hours per day during operation of the slipstream.

Further details of this operation are given by PEDCo (1983).

5.2 Gasifier Sampling and Data Acquisition Procedures

5.2.1 Continuous Data

An Analog Devices, Incorporated MACSYM 2 data acquisition system was used for this test. Process signals are sampled once a minute. Ten-minute signal averages are recorded on magnetic tape. Thirty-minute signal averages are printed by line printer. The operations team also logs these signals hourly along with some twenty parameters not sampled by the data acquisition system.

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.

5.2.3 Tar and Oil Data

The condensed tar, oil, and water are removed from the accumulation reservoirs twice daily. Water collected in the surface condenser and sample electrostatic precipitator is decanted from the tar and combined with the water from the refrigerator. Tar from the surface condenser is combined with tar and oil collected in the sample electrostatic precipitator. Condensate yields are measured by weighing both the tar/oil sample and the water sample.

5.2.4 Coal Data

Coal samples are taken from each of the two weigh bin legs by the operations team during coal addition to the lock hopper four times each shift. These four samples are stored in a sealed bucket and submitted as a composite shift sample for each weigh bin leg. 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. 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 to the USBM Twin Cities Research Center Laboratories. The ash samples on which detailed analyses are performed by the USBM Twin Cities Research Center are composited over the same time periods used for compositing the coal samples.

5.2.6 Dust Data

Samples of cyclone dust are grabbed from the dust accumulation bin. Samples of duct dust are removed from an access port near a right angle turn in the main gas duct where the dust

accumulates.

5.2.7 Exhaust Gas Sampling

The gas phase combustion exhaust is analyzed by EPA methods 5 and 6 for sulfur dioxide, nitrogen oxides, and particulates once during the test.

SECTION 6

CONDUCT OF TEST

6.1 Test History

BOM/FGT 002, gasification of Montana, subbituminous coal began at 1600 CST, November 2, 1982. Prior to this time, Jetson Bituminous coal was being gasified in BOM/FGT 001A. The coal feed bins, and feed legs were emptied of Jetson coal, and Rosebud coal entered the retort at 2000 hrs. By 0100, November 3, the retort was occupied exclusively by Rosebud coal. There was no break in the operation of the gasifier.

The saturation air flow, at this point, was 1100 scfm leading to a coal consumption of about 1.4 tons per hour. This load level was maintained for about 36 hours, during which time saturation temperatures were 58-60 C and gas quality was good (160-180 BTU/DSCF). Towards the end of this period, clinkering of ash became more noticeable, fire loss pressure increased dramatically, and the fire began to burn through at the retort walls. The agitator and raking were used to spread coal to the walls, and high fires were poked down. The saturation temperature was raised in an attempt to bring the clinkering under control.

After this period, the saturation air flow was raised to 1300 scfm for a brief period (6 hours). Clinkering remained a problem and the saturation temperature was increased further. Burning through to the top became such a problem that the saturation air flow was reduced to 1000 scfm, and then to 850 scfm to manage this problem. Clinkering continued to be severe despite saturation temperatures as high as 70 C. The ash was finely divided and caked.

Relatively stable operation was achieved at saturation air flow rates of 850-900 scfm from 2100, November 5, to 800, November 8 (59 hours). Saturation temperature was brought down to 62-63 C. Coal consumption was about 1.12 tons per hour. Clinkering remained a serious problem, and the grate was operated at full capacity in an attempt to remove the clinker. These efforts were, for the most part, successful but clinker continued to be generated, and poking was required to break it up. Poking and raking were required to minimize burning through. The agitator was turned off to minimize the degradation of the coal in the retort. The coal was wet screened for about half of this period.

The load was gradually increased to 1050 scfm, but this had to be reduced back to 850 scfm due to increased burning through, and high offtake temperatures.

A second period of relatively stable operation was achieved from 0900 on November 9 to 0900 on November 11, at saturation air flow rates of 850 scfm, at saturation temperatures of 64 C and 65 C. Coal consumption was about 1.14 tons per hour. Clinkering was serious, but manageable. Fire continued to appear near the walls, requiring poking and raking. Wet screened coal was used for the last half of this period, but this had to be terminated due to freezing weather. Attempts to increase the load were met with burning through, and had to be abandoned.

On the morning of November 12, ambient temperatures dropped below freezing for three days. Wet screening had to be abandoned, and the coal froze. The remainder of the test was spent trying to deal with frozen coal, and freezing weather. Saturation air flow, and, to a lesser degree, saturation temperature were varied to control burning through. Attempts to raise the load were unsuccessful.

On November 17, the 3/4 inch mesh screen was replaced with a 1 1/4 inch mesh screen for the remainder of the test. Only slight improvements in stability were achieved.

The test was interrupted four times. There were two momentary power blinks that shut the fans down. Restart was within 30 minutes. The saturation air blower bearings froze on one occasion. The sealed bearings were externally greased for the remainder of the test. The gasifier was down for about two hours.

The grate stopped at about 2300 on November 17. The gasifier was banked, and the ashpit inspected. It was clogged with ash, and the drive and check dogs were hung up. The ash was chiseled out and substantial amounts of ash removed. The gasifier was banked for about two hours.

The test was terminated at 1215 on November 20, 1982 due to an excessive gas leak through the north upper coal valve. Figure 6-1 compares the planned operation with that actually achieved, and identifies significant events during the test. (The substantial differences between projected and achieved saturation air flows reflects an error in the operators air flow display that was corrected subsequent to the test.)

6.2 Chronic Problems During BOM/FGT-002

Freezing weather caused several problems. On several occasions, steam pressure was lost due to freezing of the boiler control piping and gas supply valve. The compressed air lines froze on one occasion, as did a heat traced water line to the scrubber demister pad. Frozen coal handled poorly and frozen chunks of fines went over the screen. Freezing weather precluded wet screening.

Test History, BOM/FGT-002

Figure 6-1

As the test proceeded, the offtake pressure rose steadily over the test and reached pressures as high as 9 in WC. This pressure is determined by the resistance to gas flow between the retort and the gas burner (and to a lesser extent by combustion chamber pressure). The system is designed to throttle the gas flow at a 24" butterfly valve in a horizontal gas duct. This valve was frozen at 30% open after two days of operation gasifying Rosebud coal. The gas safety shut off butterfly valve also exhibited restricted motion (i.e. it would move only 10% of full stroke). These symptoms indicated plugging of the gas line by particulate not collected by the cyclone.

After the test was completed, air was moved through this gas duct. Material in the gas duct ignited and burned throughout the duct from the cyclone to the flame holder for 7 to 10 days. Upon removal of the duct sections, it was observed that the duct was more than half filled with ash and char which was still burning. Prior to the combustion of the char, the duct may have been more than 65% filled with solid material.

It is surmised that tar fog observed by the operators in the uncooled raw gas (at 200 C) served to cement the char particles together in the duct. This effect was not observed during BOM/FGT 001A when higher offtake temperatures occurred (greater than 400 C).

6.3 Operation of the Quench/ESP

The Quench/ESP system operated approximately 60% of the time of gasifier operation. System shakedown problems were encountered primarily with the high voltage controls, and high voltage insulators. On three occasions the high voltage control shut the slipstream down due to a false undervoltage signal. On two occasions, high voltage insulators failed and the slipstream was shut down.

On the occasion of one of the high voltage insulator failures, tar fog was blown into the Stretford plant. This necessitated cleaning of the tanks and replacement of the Stretford plant chemical inventory.

A thorough history of the Quench/ESP operation is given in Appendix K.

SECTION 7

TEST RESULTS

7.1 Data Summary

7.1.1 Continuous Output Transducer Data

The data acquisition system was available 100% of the time during BOM/FGT-002. For the first ten days, the write to tape function of the data acquisition system did not operate correctly. Thirty-minute averages only are available for this time period. Ten-minute averages are available for the remainder of the test. The data have also been averaged every 12-hour period. These data are used for the mass balance and thermal efficiency calculation.

Figure 7-1 shows the offtake temperature, fire loss pressure, and dry gas higher heating value along with the operating parameters observed during the test. During most of the test the offtake temperature was approximately 200 - 230 C (390 - 445 F). During periods of upset conditions, the offtake temperature rose to as high as 400 C (750 F). The higher offtake temperatures occurred during the initial upset conditions November 3 - 8.

The gas higher heating value was fairly steady, varying between 165 and 180 Btu/dscf during most of the test. During the upset conditions at the beginning of the test values as low as 130 Btu/dscf were observed.

The fire loss pressure was high (15 - 20 in wc) during the upset conditions observed the first few days of the test when severe clinkering was observed, but fell to relatively stable and moderate levels (6 in wc) November 7 - 12. This pressure drop rose again to about 9 in wc November 13 - 20 as ash clinkering was observed again.

The higher blast saturation temperatures recorded during November 5 - 6 were used to minimize the clinkering observed during that period. Spikes in the blast saturation temperature correspond to loss of boiler pressure or shut down of the gasifier.

Figure 7-2 shows the blast air flow rate and the producer gas flow rate during the entire test period. The indicated producer gas flow increases gradually over the test period while the blast air flow decreases. The unexpected increase in producer gas flow can be attributed to the tar accumulation in the Venturi flowmeter during the test rendering the Venturi calibration useless.

The pressure at the Venturi flowmeter is shown in Figure 7-3.

Figure 7-1

Physical Characteristics of Gasifier Operation

Figure 7-2

Blast Air Flow and Indicated Raw Gas Flow

Figure 7-3

Pressure at the Venturi Flowmeter

The pressure increases steadily during the test, reaching a high value of nearly 8 in wc. This is the pressure needed to move the gas to the burner. The increase in this pressure is consistent with the buildup of dust in the horizontal ductwork downstream. (See section 6.2.)

7.1.2 Coal, Ash and Cyclone Dust

A complete list of the tests performed on the bulk coal, ash and cyclone dust samples collected during BOM/FGT-002, together with the number of samples analyzed, is presented in Table 7-1. A total of 101 coal, 161 ash, 1 cyclone and 1 duct dust samples were collected and individually analyzed.

7.1.2.1 Coal

The mass fraction of coal less than each of five indicated mesh sizes along with the geometrical mean coal particle size is shown Figure 7-4. The data are the average size distribution obtained by averaging, on a shift basis, the data for the samples obtained from the north and south coal bin legs. The decrease in the fraction of particles less than 3/4 inch and 1 inch on November 18 is due to the change in the screen mesh size from 3/4 inch to 1 1/4 inch. (All mesh sizes are U.S. series.) These data show some variation in the size distribution as a function of time. Most of this variation is probably due to operation of the gasifier during sub-freezing conditions which caused blinding of the screen and coal particles to freeze together which subsequently thaw prior to analysis.

The average size distributions of the feed coal during two different time periods are presented in Figure 7-5. Data for samples obtained from the north and south legs of the coal feed bin are presented separately. The data for each leg were averaged over the entire test period. The two periods correspond to the use of the 3/4 inch and the 1 1/4 inch mesh size screen which was used to remove the fines from the feed coal. For each time period, the data show no systematic variation in the size distributions as obtained for the north and south legs. The mean particle sizes were 0.86 inch and 1.0 inch respectively for the period of time when the 3/4 inch and 1 1/4 inch screens were in use.

The coal size distributions in Figure 7-5 show that a significant fraction of the feed coal was less than 3/4 inch and 1 inch mesh sizes during the time when the 3/4 inch and 1 1/4 inch mesh screens were being used in the coal feed system. The fraction of material less than 3/4 inch was 31.1% during the period when the 3/4 inch mesh screen was in use and 48.2% less than one inch when the 1 1/4 inch mesh was being used. The screen was used to remove the fine particles before the coal was transported by the bucket elevator to the load bin.

On November 17, 1982, special coal samples were obtained to

Table 7-1

Summary of Coal, Ash, and Cyclone Dust Analyses Performed

Material	Type of Analysis	No. of Samples Collected/Analyzed	No. of Composite Samples Analyzed
Coal	Particle Sized Distribution	101	-
	Proximate Analysis	-	19
	Ultimate Analysis	-	19
	Heating Value	-	19
	Ash Fusion Temperature	-	19
	Free Swelling Index	-	19
Ash	Particle Size Distribution	161	-
	Bulk Density	161	-
	Moisture Content	161	-
	Carbon Content	161	19
	Sulfur Content	161	19
	Chemical Analysis	-	19
Cyclone Dust	Ash Fraction	1	-
	Ash Chemical Analysis	1	-
Duct Dust	Ash Fraction	1	-
	Ash Chemical Analysis	1	-

Figure 7-4

Feed Coal Size Distribution and Mean Coal Particle Size

Figure 7-5

Average Particle Size Distribution of Feed Coal

determine the source of the fine particles in the coal fed to the retort. In addition to the standard coal samples collected on a per shift basis from the lock hopper, three coal samples were collected before the coal was transported up the bucket elevator. By comparing the coal size distribution before transport to that obtained for the coal in the lock hopper, it was possible to determine the fraction of fine particles resulting from the carryover from the screen and the fraction resulting from coal breakage during transport to the lock hopper.

The size distribution data are presented in Table 7-2 for the three special samples and the data obtained from the standard coal samples collected at the north and south legs of the coal lock hopper. The data shows that 55-75% of the material less than 1/4 inch, 1/2 inch, 3/4 inch, and 1 inch result from particle carryover from the screen. However, there is a marked increase in the fine fraction as sampled at the lock hopper which indicates particle breakage during transport.

The summary results of the chemical analysis of the composited coal samples are presented in Table 7-3.

7.1.2.2 Ash

The mass fraction of ash less than each of five indicated mesh sizes along with the geometrical mean ash particle size is shown in Figure 7-6. These data show significant variations in the size distributions with time. These variations are discussed below.

The bulk density and carbon and sulfur content of the ash, and geometrical mean ash particle size for the entire test period are presented in Figure 7-7. From these graphs, one can determine that four ash dumps were required for Jetson coal ash to be completely eliminated from the retort. The average steady state carbon content of Rosebud ash was typically 1 to 2% as compared to the grand average of 21% obtained with the Jetson coal. The decrease in carbon content on November 3 resulted from the gradual replacement of the Jetson coal by the Rosebud coal.

In the period from November 4-8, the carbon content increased to a high level of 44%. This corresponded to the increase of grate speed which was used to remove clinkers from the retort. The grate action stirred up the bed such that unburned coal particles were removed together with the ash from the retort.

After the bed was stabilized on November 9 all short term increases in carbon content can be correlated well with the step function increases in the saturation air flow. Similar short term increases were also observed during gasification of the Jetson bituminous coal during BOM/FGT-001/001A.

Table 7-2

Comparison of Coal Size Distribution
After Screening to that in Feed Coal Bin

Date	Shift	Screen Mesh Size, inch		Sampling Location	Sample Number	Accumulative Mass Fraction % less than stated mesh size				
						1/4	1/2	3/4	1	1 1/4
11/7	3	1	1/4	After Screen	1	0.3	0.7	2.8	14.0	73.0
					2	1.5	3.6	9.0	32.2	90.4
					3	0.4	2.2	23.6	58.4	95.6
					Avg	0.7	2.2	11.8	34.9	86.3
				Feed Bin (**)	Avg	1.2	4.0	16.5	47.4	87.9

(**) Average of sample number 044 and 045 from north and south coal bin leg

Table 7-3

Chemical Analysis of Feed Coal

Samples Composited	000-020	021-023	Average
<u>Type of Analysis</u>			
Proximate Analysis, wt %:			
Moisture	22.26	23.73	23.00
Volatile Matter	27.99	30.30	29.14
Ash	14.78	10.32	12.55
Fixed Carbon (*)	34.97	35.65	35.31
Ultimate Analysis, wt %:			
Hydrogen	3.21	3.33	3.27
Carbon	47.82	49.90	48.86
Nitrogen	0.67	0.69	0.68
Sulfur	1.32	0.97	1.14
Oxygen (*)	9.94	11.06	10.50
Ash	14.78	10.32	12.55
Moisture	22.26	23.73	23.00
Heating Value	8249	8460	8354
Ash Fusion Temperature, Degree F, Reducing Atmosphere			
Initial Def., IT	2090	2355	2223
Softening, ST	2145	2395	2270
Softening, HT	2150	2405	2278
Fluid, FT	2170	2430	2300
Degree F, Oxidizing Atmosphere			
Initial Def., IT	2220	2335	2278
Softening, ST	2245	2360	2302
Softening, HT	2260	2380	2320
Fluid, FT	2350	2420	2385
Free Swelling Index	0	0	0

(*) By difference.

Completed data presented in Appendix C for tests performed by DOE-Morgantown Energy Technology Center on daily composite samples.

Figure 7-6

Ash Particle Size Distribution and Mean Ash Particle Size

Figure 7-7

Ash Characteristics and Operating Conditions

The average bulk density and carbon and sulfur contents were 0.93 gm/cc (58.0 lbs/cu ft), 9.3%, 0.87%, and 8.6% respectively. While these values represent the average values obtained over the entire gasifier test period, the values during the long term steady-state period would be somewhat different. In particular, the carbon and sulfur content would be approximately 1-2% and 0.4-0.6%, respectively.

Analysis of the variations of these four parameters with time, show that the variations of all five parameters can be qualitatively correlated. In general, as the carbon content of the ash decreases, the particle size and bulk density increase. Furthermore, there is good agreement between the peaks in the carbon content and an initial increase in the gasifier load. It is difficult to correlate ash sulfur with any operational variable.

When comparing the ash dump data to the continuous output data associated with the gasifier operating conditions, one must consider the fact that the ash data are presented as a function of time of ash dump. Since several ash dumps are required to transport material from the upper portions of the ash layer to the ash pit, any step function changes in the gasifier operating conditions which affect the ash, will not be reflected in the reported ash data until several ash dumps later. This time was typically about six to eight hours.

7.1.2.3 Cyclone and Duct Dust

The ash content and detailed chemical analysis of one cyclone dust and one duct dust sample were obtained. The duct dust sample was obtained from a tee in the producer gas duct. The ash contents of the cyclone and duct dust were found to be 26.5% and 28.4% respectively. This compares to a dry basis coal ash content of 16.3%.

The results of the elemental analysis of the cyclone and the duct dust ash are presented in Table 7-4. A comparison of the elemental mass fractions in the cyclone and duct dust ash, and the ash from the retort show that on a carbon-free basis the mass fractions are similar for most of the elements. The sodium concentration appears to be higher in the dust ashes. The reduced Fe²⁺ concentrations in the dusts are due to sample preparation procedures.

7.1.3 Gas Analysis Data

Gas chromatograph data are obtained every half hour. The gas chromatograph operated for 72% of the test period. There were three unscheduled shutdowns due to technical problems during which no data was collected. They are:

11/5, 1900 to 11/9 1300	90 hours
11/12 2100 to 11/13 0200	5 hours

Table 7-4

Chemical analysis of Moisture Free Ash

Mass Fraction, %, For Composited Samples (**)

Element	Dry Gasifier Ash Average (*)	Cyclone Dust	Duct Dust
Fe	4.6	3.8	3.2
Fe(2+)	2.8	0.2	0.2
Si	19.8	19.3	18.2
Al	6.9	8.7	9.5
C	9.1	.11	.10
Ca	10.7	13.9	14.1
Mg	1.7	7.5	8.1
K	.45	.50	.77
P	.10	.12	.14
Na	.68	1.4	2.0
S	.84	4.1	4.8
Ti	.38	.42	.56

(*) Neglecting samples which contained coke ash.

(**) The remaining mass is presumed to be oxygen bound into metal oxides

The periods when the gas chromatograph was not taking data are shown in the figures as no data.

The major gas species concentrations (measured by the gas chromatograph) are shown in Figure 7-8. These concentrations along with dry gas heating value and operating parameters are shown in Figure 7-9. During the upset conditions early in the test and from November 14 to the end of the test the nitrogen and carbon dioxide concentrations are higher with hydrogen and carbon monoxide concentrations correspondingly lower. This incomplete reduction of the gas phase is consistent with the gas channeling observed during these periods.

The hydrocarbon species concentrations measured by the gas chromatograph are shown in Figure 7-10. These concentrations were relatively constant through the test with the exception of an increase in ethylene concentration during the initial upset period. This increase is consistent with increased ethylene production by cracking of higher molecular weight hydrocarbons at the higher temperatures observed during this upset period.

7.1.4 Tar and Water Yield Data

The gas sampling and conditioning system operated continuously without major interruption. During the beginning of the test, the condenser was steam cleaned once every day as a routine maintenance procedure. The steam clean procedure was subsequently considered to be unnecessary and was discontinued during the last week of the test. With the installation of the parallel drierite system before the test, the system operated non-stop during the last seven days. Post-test inspection showed no evidence of tar buildup throughout the entire system.

The gas supplied to the sampling manifold was virtually free of tar particles and water vapor. In addition, the system was entirely free of air leaks; both the Beckman O2 analyzer and the HP gas chromatograph indicated the absence of oxygen in the sample gas.

The condensed material in the condenser reservoir, the ESP reservoir and the refrigeration reservoir were drained twice a day, at 0900 and 2100 hours. The material collected in the condenser reservoir consisted mostly of water with approximately 20% tar. The material collected in the ESP reservoir consisted mostly of tar with approximately 20-40% water. The refrigeration reservoir contained mostly water with a minute amount of oil.

The tar and water yields for the entire test period have been measured and are shown in Figure 7-11. Tar and water yields per 1000 dscf gas appear to be relatively insensitive to load or saturation temperature during this test.

Figure 7-8

Major Species Measured by the Gas Chromatograph:

Figure 7-9

Dry Gas HHV, Major Gas Species and Operational Parameters

Figure 7-10

Minor Species Measured by the Gas Chromatograph

Figure 7-11

Tar/oil Yield and Water Yield with Operational Parameters

Three sets of tar samples were prepared for analysis. They were obtained during the following time periods:

Sample No.	Tar Collection Period
1	11/15 2030 to 11/7 2100
2	11/9 2100 to 11/10 0900
3	11/12 2100 to 11/14 2100

The results of the analyses are included in Table 7-5.

7.2 Material and Energy Balances

The material and energy balance calculation procedures are described in Volume 1 of this series (Thimsen, Maurer et al, 1984). A brief description follows.

The measured data used to calculate material and energy balances around the gasifier include process temperatures, pressures, and flows, tar/water yields, material ultimate analyses and gas compositions. The calculations for this test also include the following assumptions:

- A. Dust carryover is estimated to be 1% of the coal feed rate.
- B. Coal bound sulfur not reporting to the tar or ash is reported as hydrogen sulfide in the gas. No measurements of gas phase sulfur or dust bound sulfur were taken during this test.
- C. Coal gas flow and blast air flow are calculated assuming a simultaneous nitrogen and carbon balance around the gasifier. The coal gas flow meter gave a reproducible but inaccurate signal. The air flow signal was also reproducible but inaccurate due to a misapplied flow element.
- D. The total gas analysis is normalized to 99.9%.
- E. Ash discharge is calculated to be the ash associated with the measured coal consumption plus the carbon and sulfur analyzed for each ash sample.

The continuous process variables of interest are the saturation air flow, blast saturation temperature, offtake temperature, ambient temperature, cooling water inlet and outlet temperatures, cooling water flow and saturation steam imported. Ten-minute averages are available for all of these parameters except the cooling water flow and saturation steam imported. Hourly totals and flow rates logged by the operators are used

Table 7-5

Condensed Material Analyses

Composite Date	11/7	11/10	11/13
WATER			
Total Organics, %	0.70	0.66	1.79
TAR (AS RECEIVED) (**)			
Heating Value, Btu/lb	13396 (17091)	12713 (17057)	14862 (16993)
Flashpoint, Deg. F.	228	231	209
Water by Distillation, %	21.62	25.47	12.54
Specific Gravity, 60/60 Deg F	1.0604	1.0746	1.0388
Pour Point, Deg. F.	90	70	85
Cold (solid) point, Deg. F.	85	65	80
VISCOSITY AT:			
122 Deg F Saybolt Furol, Sec.	85.4	232	63.4
122 Deg F Kinematic, Centi.	16.87	49.6	11.17
210 Deg F Saybolt Univ, sec	214.7	127.6	168.9
210 Deg F Kinematic, Centi.	45.6	26.47	33.54
ULTIMATE ANALYSIS (WT%) :			
Hydrogen	6.79 (8.66)	6.33 (8.49)	7.73 (8.83)
Carbon	62.75 (80.06)	62.86 (84.43)	69.71 (79.71)
Nitrogen	.73 (.93)	.70 (.94)	.74 (.85)
Oxygen (by difference)	7.66 (9.77)	4.30 (5.77)	8.76 (10.02)
Sulfur	.33 (.42)	.34 (.46)	.33 (.38)
Moisture, total	31.62	25.47	12.54
Ash	.12 (.15)	---	.19 (.22)

(**) Dry basis values in parentheses

for these parameters.

Condensable yields in the gas stream were obtained from the gas sampling and conditioning system.

Ultimate analyses and heating values of the coal and moisture-free tar samples were used for the carbon-nitrogen balance calculations as well as the dry gas compositions from the gas chromatograph. Higher order hydrocarbons and sulfur species in the dry gas were not measured, but in any event account for less than 1% of the dry gas volume.

Tables 7-6, 7-10, and 7-12 represent time periods when bed conditions were unstable. As can be observed, hot raw thermal efficiencies were still high (91-97%) during these periods. (Gas composition for the time period of Table 7-6 do not represent averages over the entire period. The gas chromatograph was down during the last part of this period. The NDIR CO measurement increased, and NDIR CO₂ decreased after loss of the gas chromatograph, but has negligible effect on the overall mass and energy balance.)

Table 7-7 represents a transitional time period when relative stability was being established. Tables 7-8, and 7-9 give calculations for the most stable operating periods, and Table 7-11 represents conditions during the combustor exhaust sampling period. (Section 7.4)

7.3 Grate Performance Model

A simple grate performance model has been developed to calculate the ash removal rate from the gasifier. The model is based entirely on geometrical considerations and is described in detail in the first volume of this series (Thimsen, Maurer et al, 1984). This model can be used as a basis for developing a more sophisticated model in which the coal and ash properties and the gasifier operating conditions will also be considered.

Figure 7-12 compares the theoretical and the actual ash removal rates from the producer as a function of grate speed. While there is a large amount of scatter in the data, the measured values center on the theoretical removal rate.

7.4 Combustion Emissions Monitoring

Emissions from the gas combustor were monitored on November 15, 1982. The slipstream was not operating at this time. Hot, raw coal gas was being burned in the combustion chamber.

The particulate concentrations averaged 5.6 gr/1000 acf. This corresponds to a particulate emission rate of 2.4 lb/hr and a particulate emission factor of 0.11 lb/million Btu. This

Table 7-6

Material Balance and Thermal Efficiency Calculation
 +3/4 inch, 1.28 tn/hr, 141 F

Input Data

Time period: 11/2/82 22:45 - 11/4/82 10:00 (35.3 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.28
 Blast air flow (dry) , Scfm = 1128.
 Saturated air temperature, F = 141.
 Steam/Air Ratio (lb./lb.) = 0.16
 Ambient air temperature, F = 47.
 Off-take temperature, F = 550.

Coal Data:

Type = Rosebud Subbituminous Coal
 Mass Fraction Carbon % = 48.9
 Mass Fraction Fixed Carbon = 35.31
 Mass Fraction Moisture % = 23.00
 Mass Fraction nitrogen % = 0.68
 Mass Percent sulfur = 1.14
 Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 7.52
 Tar yield, lb./1000 SCF = 0.74
 Carbon in Tar (percent) = 81.4
 Sulfur in Tar (percent) = 0.42
 Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 120.
 Ash carbon ,percent = 7.3
 Ash sulfur ,percent = 0.54
 Ash moisture (wet),percent = 22.6
 Cyclone dust,lb/hour(est.) = 26.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 16.0	CH4 % = 1.61	H2S (est ppm) = 3132
CO % = 27.0	C2H4 % = 0.100	COS (est ppm) = ---
CO2 % = 6.78	C2H6 % = 0.124	CH3SH (est ppm) = ---
N2 % = 47.4	C3H6 % = ---	C2H5SH (est ppm) = ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 161
Molec. Weight = 24.60	Argon(est. %) = 0.565	LHV, Btu/SCF = 151

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 2.70)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2551.	32.1	Dry gas	= 6531.	84.5
Steam (total)	= 743.	9.4	Water in gas	= 757.	9.8
Air(calc,dry)	= 4649.	58.5	Oil and tar	= 75.	1.0
			Ash(calc,dry)	= 340.	4.4
			Dust	= 26.	0.3
Total	= 7944.		Total	= 7729.	

Energy Balance (Percent unaccounted for: 4.20)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 21.3	Dry coal gas	= 16.2	78.7
Air	= -0.014	Oil and tar	= 1.28	6.2
Steam(import)	= 0.163	Sensible	= 1.08	5.3
Cooling water	= 0.006	Latent	= 0.809	3.9
		Ash	= 0.358	1.7
		Dust	= 0.264	1.3
		Cooling water	= 0.589	2.9
Total	= 21.5	Total	= 20.6	

Performance Data

Cold gas efficiency, percent = 75.4
 Cold gas with tar efficiency, percent = 81.3
 Hot gas without tar efficiency percent = 84.0
 Hot gas with tar efficiency, percent = 90.1
 Air/Coal (lb./lb.) = 1.822
 Steam/Coal (lb./lb.) = 0.291
 Air/Fixed Carbon (lb./lb.) = 5.160
 Coal/Gasifier Area (lb./hr./sqft) = 76.9
 Fixed Carbon/Area (lb./hr./sqft) = 27.2
 Producer Gas/Coal (SCF/lb.) = 45.8
 Producer Gas/Fixed Carbon (SCF/lb.) = 129.6
 Tar Yield (lb./lb. coal) = 0.029

Table 7-7

Material Balance and Thermal Efficiency Calculation
+3/4 inch, 1.15 tn/hr, 151 F

Input Data

Time period: 11/ 5/82 5:40 - 11/ 7/82 8:00 (50.3 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.15
Blast air flow (dry) , Scfm = 865.
Saturated air temperature, F= 151.
Steam/Air Ratio (lb./lb.) = 0.22
Ambient air temperature, F = 51.
Off-take temperature, F = 504.

Coal Data:

Type = Rosebud Subbituminous Coal
Mass Fraction Carbon % = 48.9
Mass Fraction Fixed Carbon = 35.31
Mass Fraction Moisture % = 23.00
Mass Fraction nitrogen % = 0.68
Mass Percent sulfur = 1.14
Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 11.29
Tar yield, lb/1000 SCF = 1.31
Carbon in Tar (percent) = 81.4
Sulfur in Tar (percent) = 0.42
Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 332.
Ash carbon ,percent = 34.4
Ash sulfur ,percent = 3.04
Ash moisture (wet),percent = 9.1
Cyclone dust,lb/hour(est.) = 23.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 18.8	CH4 % = 1.86	H2S (est ppm) = 1757
CO % = 22.4	C2H4 % = 0.110	COS (est ppm) = ---
CO2 % = 9.79	C2H6 % = 0.127	CH3SH (est ppm) = ---
N2 % = 46.1	C3H6 % = ---	C2H5SH (est ppm) = ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 157
Molec. Weight= 24.32	Argon(est. %)= 0.549	LHV, Btu/SCF = 145

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: 1.35)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2292.	34.6	Dry gas	= 5072.	77.5
Steam (total)	= 791.	11.9	Water in gas	= 893.	13.7
Air(calc,dry)	= 3549.	53.5	Oil and tar	= 104.	1.6
			Ash(calc,dry)	= 450.	6.9
			Dust	= 23.	0.4
Total	= 6632.		Total	= 6542.	

Energy Balance (Percent unaccounted for: 5.08)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 19.1	Dry coal gas	= 12.4	67.0
Air	= -0.008	Oil and tar	= 1.77	9.5
Steam(import)	= 0.395	Sensible	= 0.85	4.6
Cooling water	= -0.018	Latent	= 0.955	5.2
		Ash	= 2.195	11.9
		Dust	= 0.237	1.3
		Cooling water	= 0.105	0.6
Total	= 19.5	Total	= 18.5	

Performance Data

Cold gas efficiency, percent = 63.6
Cold gas with tar efficiency, percent = 72.6
Hot gas without tar efficiency percent = 72.6
Hot gas with tar efficiency, percent = 81.8
Air/Coal (lb./lb.) = 1.548
Steam/Coal (lb./lb.) = 0.345
Air/Fixed Carbon (lb./lb.) = 4.385
Coal/Gasifier Area (lb./hr./sqft) = 69.1
Fixed Carbon/Area (lb./hr./sqft) = 24.4
Producer Gas/Coal (SCF/lb.) = 42.8
Producer Gas/Fixed Carbon (SCF/lb.) = 121.2
Tar Yield (lb./lb. coal) = 0.045

Table 7-8

Material Balance and Thermal Efficiency Calculation
+3/4 inch, 1.08 tn/hr, 146 F

Input Data

Time period: 11/ 9/82 7:45 - 11/ 9/82 21:00 (13.3 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.08
Blast air flow (dry) , Scfm = 859.
Saturated air temperature, F = 146.
Steam/Air Ratio (lb./lb.) = 0.19
Ambient air temperature, F = 48.
Off-take temperature, F = 533.

Coal Data:

Type = Rosebud Subbituminous Coal
Mass Fraction Carbon % = 48.9
Mass Fraction Fixed Carbon = 35.31
Mass Fraction Moisture % = 23.00
Mass Fraction nitrogen % = 0.68
Mass Percent sulfur = 1.14
Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 10.26
Tar yield, lb/1000 SCF = 1.44
Carbon in Tar (percent) = 81.4
Sulfur in Tar (percent) = 0.42
Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 323.
Ash carbon ,percent = 2.0
Ash sulfur ,percent = 1.06
Ash moisture (wet),percent = 9.1
Cyclone dust,lb/hour(est.) = 22.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 18.1	CH4 % = 1.63	H2S (est ppm) = 3168
CO % = 28.4	C2H4 % = 0.846	COS (est ppm) = ---
CO2 % = 5.97	C2H6 % = 0.129	CH3SH (est ppm) = ---
N2 % = 44.0	C3H6 % = ---	C2H5SH (est ppm) = ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 184
Molec. Weight= 23.93	Argon(est. %) = 0.523	LHV, Btu/SCF = 172

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -0.27)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2164.	35.1	Dry gas	= 4959.	80.3
Steam (total)	= 631.	10.2	Water in gas	= 807.	13.1
Air(calc,dry)	= 3363.	54.6	Oil and tar	= 113.	1.8
			Ash(calc,dry)	= 274.	4.4
			Dust	= 22.	0.4
Total	= 6158.		Total	= 6175.	

Energy Balance (Percent unaccounted for: -0.69)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 18.1	Dry coal gas	= 14.5	78.2
Air	= -0.009	Oil and tar	= 1.93	10.4
Steam(import)	= 0.345	Sensible	= 0.89	4.8
Cooling water	= -0.021	Latent	= 0.864	4.7
		Ash	= 0.084	0.5
		Dust	= 0.224	1.2
		Cooling water	= 0.038	0.2
Total	= 18.4	Total	= 18.5	

Performance Data

Cold gas efficiency, percent = 78.8
Cold gas with tar efficiency, percent = 89.3
Hot gas without tar efficiency percent = 87.9
Hot gas with tar efficiency, percent = 98.7
Air/Coal (lb./lb.) = 1.554
Steam/Coal (lb./lb.) = 0.291
Air/Fixed Carbon (lb./lb.) = 4.401
Coal/Gasifier Area (lb./hr./sqft) = 65.2
Fixed Carbon/Area (lb./hr./sqft) = 23.0
Producer Gas/Coal (SCF/lb.) = 44.3
Producer Gas/Fixed Carbon (SCF/lb.) = 125.3
Tar Yield (lb./lb. coal) = 0.052

Table 7-9

Material Balance and Thermal Efficiency Calculation
+3/4 inch, 1.19 tn/hr, 147 F

Input Data

Time period: 11/10/82 2:00 - 11/11/82 9:00 (31.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.19
Blast air flow (dry) , Scfm = 873.
Saturated air temperature, F= 147.
Steam/Air Ratio (lb./lb.) = 0.20
Ambient air temperature, F = 51.
Off-take temperature, F = 432.

Coal Data:

Type = Rosebud Subbituminous Coal
Mass Fraction Carbon % = 48.9
Mass Fraction Fixed Carbon = 35.31
Mass Fraction Moisture % = 23.00
Mass Fraction nitrogen % = 0.68
Mass Percent sulfur = 1.14
Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 10.93
Tar yield, lb/1000 SCF = 1.68
Carbon in Tar (percent) = 81.4
Sulfur in Tar (percent) = 0.42
Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 242.
Ash carbon ,percent = 1.1
Ash sulfur ,percent = 1.59
Ash moisture (wet),percent = 10.0
Cyclone dust,lb/hour(est.) = 24.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 19.4	CH4 % = 1.70	H2S (est ppm)= 2906
CO % = 28.7	C2H4 % = 0.061	COS (est ppm)= ---
CO2 % = 6.14	C2H6 % = 0.133	CH3SH (est ppm)= ---
N2 % = 42.9	C3H6 % = ---	C2H5SH (est ppm)= ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 177
Molec. Weight= 23.62	Argon(est. %)= 0.511	LHV, Btu/SCF = 166

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -1.84)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2374.	35.3	Dry gas	= 5432.	79.2
Steam (total)	= 712.	10.6	Water in gas	= 954.	13.9
Air(calc,dry)	= 3646.	54.2	Oil and tar	= 146.	2.1
			Ash(calc,dry)	= 300.	4.4
			Dust	= 24.	0.3
Total	= 6731.		Total	= 6855.	

Energy Balance (Percent unaccounted for: -0.34)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 19.8	Dry coal gas	= 15.5	76.9
Air	= -0.007	Oil and tar	= 2.49	12.4
Steam(import)	= 0.251	Sensible	= 0.78	3.9
Cooling water	= -0.025	Latent	= 1.023	5.1
		Ash	= 0.054	0.3
		Dust	= 0.246	1.2
		Cooling water	= 0.044	0.2
Total	= 20.0	Total	= 20.1	

Performance Data

Cold gas efficiency, percent = 77.2
Cold gas with tar efficiency, percent = 89.6
Hot gas without tar efficiency percent = 85.9
Hot gas with tar efficiency, percent = 98.5
Air/Coal (lb./lb.) = 1.535
Steam/Coal (lb./lb.) = 0.300
Air/Fixed Carbon (lb./lb.) = 4.349
Coal/Gasifier Area (lb./hr./sqft) = 71.5
Fixed Carbon/Area (lb./hr./sqft) = 25.3
Producer Gas/Coal (SCF/lb.) = 45.3
Producer Gas/Fixed Carbon (SCF/lb.) = 128.3
Tar Yield (lb./lb. coal) = 0.062

Table 7-10

Material Balance and Thermal Efficiency Calculation
 +3/4 inch, 1.19 tn/hr, 148 F

Input Data

Time period: 11/11/82 21:00 - 11/15/82 00:50 (75.8 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.19
 Blast air flow (dry) , Scfm = 873.
 Saturated air temperature, F = 148.
 Steam/Air Ratio (lb./lb.) = 0.20
 Ambient air temperature, F = 45.
 Off-take temperature, F = 409.

Coal Data:

Type = Rosebud Subbitimous Coal
 Mass Fraction Carbon % = 48.9
 Mass Fraction Fixed Carbon = 35.31
 Mass Fraction Moisture % = 23.00
 Mass Fraction nitrogen % = 0.68
 Mass Percent sulfur = 1.14
 Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 12.47
 Tar yield, lb/1000 SCF = 1.17
 Carbon in Tar (percent) = 81.4
 Sulfur in Tar (percent) = 0.42
 Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 257.
 Ash carbon ,percent = 2.7
 Ash sulfur ,percent = 0.96
 Ash moisture (wet),percent = 11.9
 Cyclone dust,lb/hour(est.) = 24.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 19.5	CH4 % = 1.76	H2S (est ppm) = 3065
CO % = 27.6	C2H4 % = 0.053	COS (est ppm) = ---
CO2 % = 6.86	C2H6 % = 0.128	CH3SH (est ppm) = ---
N2 % = 43.2	C3H6 % = ---	C2H5SH (est ppm) = ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 175
Molec. Weight= 23.71	Argon(est. %) = 0.514	LHV, Btu/SCF = 163

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -3.82)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2385.	34.1	Dry gas	= 5686.	78.4
Steam (total)	= 777.	11.1	Water in gas	= 1135.	15.6
Air(calc,dry)	= 3826.	54.8	Oil and tar	= 106.	1.5
			Ash(calc,dry)	= 304.	4.2
			Dust	= 24.	0.3
Total	= 6988.		Total	= 7255.	

Energy Balance (Percent unaccounted for: 0.39)

Input,	MM Btu/hr	Output,	MM Btu/hr	% Total
Coal	= 19.9	Dry coal gas	= 15.9	79.0
Air	= -0.013	Oil and tar	= 1.81	9.0
Steam(import)	= 0.292	Sensible	= 0.77	3.8
Cooling water	= -0.027	Latent	= 1.211	6.0
		Ash	= 0.124	0.6
		Dust	= 0.247	1.2
		Cooling water	= 0.048	0.2
Total	= 20.2	Total	= 20.1	

Performance Data

Cold gas efficiency, percent = 78.7
 Cold gas with tar efficiency, percent = 87.7
 Hot gas without tar efficiency percent = 88.3
 Hot gas with tar efficiency, percent = 97.5
 Air/Coal (lb./lb.) = 1.604
 Steam/Coal (lb./lb.) = 0.326
 Air/Fixed Carbon (lb./lb.) = 4.543
 Coal/Gasifier Area (lb./hr./sqft) = 71.9
 Fixed Carbon/Area (lb./hr./sqft) = 25.4
 Producer Gas/Coal (SCF/lb.) = 48.2
 Producer Gas/Fixed Carbon (SCF/lb.) = 136.6
 Tar Yield (lb./lb. coal) = 0.045

Table 7-11

Material Balance and Thermal Efficiency Calculation
+3/4 inch, 1.11 tn/hr, 142 F

Input Data

Time period: 11/15/82 9:30 - 11/16/83 9:00 (23.5 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.11
Blast air flow (dry) , Scfm = 804.
Saturated air temperature, F= 142.
Steam/Air Ratio (lb./lb.) = 0.17
Ambient air temperature, F = 53.
Off-take temperature, F = 428.

Coal Data:

Type = Rosebud Subbituminous Coal
Mass Fraction Carbon % = 48.9
Mass Fraction Fixed Carbon = 35.31
Mass Fraction Moisture % = 23.00
Mass Fraction nitrogen % = 0.68
Mass Percent sulfur = 1.14
Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 11.00
Tar yield, lb/1000 SCF = 0.94
Carbon in Tar (percent) = 81.4
Sulfur in Tar (percent) = 0.42
Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 274.
Ash carbon ,percent = 4.0
Ash sulfur ,percent = 0.37
Ash moisture (wet),percent = 4.1
Cyclone dust,lb/hour(est.) = 22.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 17.6	CH4 % = 1.59	H2S (est ppm)= 3182
CO % = 26.4	C2H4 % = 0.060	COS (est ppm)= ---
CO2 % = 7.20	C2H6 % = 0.127	CH3SH (est ppm)= ---
N2 % = 46.0	C3H6 % = ---	C2H5SH (est ppm)= ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 163
Molec. Weight= 24.25	Argon(est. %)= 0.548	LHV, Btu/SCF = 152

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -2.20)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2223.	32.5	Dry gas	= 5634.	80.6
Steam (total)	= 669.	9.8	Water in gas	= 969.	13.9
Air(calc,dry)	= 3950.	57.7	Oil and tar	= 83.	1.2
			Ash(calc,dry)	= 286.	4.1
			Dust	= 22.	0.3
Total	= 6843.		Total	= 6994.	

Energy Balance (Percent unaccounted for: 1.69)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 18.6	Dry coal gas	= 14.4	77.8
Air	= -0.007	Oil and tar	= 1.41	7.6
Steam(import)	= 0.297	Sensible	= 0.76	4.1
Cooling water	= -0.066	Latent	= 1.034	5.6
		Ash	= 0.168	0.9
		Dust	= 0.230	1.2
		Cooling water	= 0.496	2.7
Total	= 18.8	Total	= 18.5	

Performance Data

Cold gas efficiency, percent = 76.5
Cold gas with tar efficiency, percent = 84.0
Hot gas without tar efficiency percent = 85.9
Hot gas with tar efficiency, percent = 93.5
Air/Coal (lb./lb.) = 1.777
Steam/Coal (lb./lb.) = 0.301
Air/Fixed Carbon (lb./lb.) = 5.032
Coal/Gasifier Area (lb./hr./sqft) = 67.0
Fixed Carbon/Area (lb./hr./sqft) = 23.7
Producer Gas/Coal (SCF/lb.) = 48.9
Producer Gas/Fixed Carbon (SCF/lb.) = 138.4
Tar Yield (lb./lb. coal) = 0.037

Table 7-12

Material Balance and Thermal Efficiency Calculation
 +3/4 inch and +1 1/4 inch, 1.23 tn/hr, 146 F

Input Data

Time period: 11/16/82 9:00 - 11/20/83 9:00 (96.0 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.23
 Blast air flow (dry) , Scfm = 743.
 Saturated air temperature, F= 146.
 Steam/Air Ratio (lb./lb.) = 0.19
 Ambient air temperature, F = 61.
 Off-take temperature, F = 443.

Coal Data:

Type = Rosebud Subbituminous Coal
 Mass Fraction Carbon % = 48.9
 Mass Fraction Fixed Carbon = 35.31
 Mass Fraction Moisture % = 23.00
 Mass Fraction nitrogen % = 0.68
 Mass Percent sulfur = 1.14
 Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 11.92
 Tar yield, lb/1000 SCF = 1.07
 Carbon in Tar (percent) = 81.4
 Sulfur in Tar (percent) = 0.42
 Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 344.
 Ash carbon ,percent = 6.5
 Ash sulfur ,percent = 0.41
 Ash moisture (wet),percent = 4.8
 Cyclone dust,lb/hour(est.) = 25.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 19.1	CH4 % = 1.69	H2S (est ppm)= 3240
CO % = 26.5	C2H4 % = 0.060	COS (est ppm)= ---
CO2 % = 7.39	C2H6 % = 0.130	CH3SH (est ppm)= ---
N2 % = 44.2	C3H6 % = ---	C2H5SH (est ppm)= ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 169
Molec. Weight= 23.91	Argon(est. %)= 0.527	LHV, Btu/SCF = 157

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -3.34)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2467.	33.6	Dry gas	= 6005.	79.1
Steam (total)	= 777.	10.6	Water in gas	= 1136.	15.0
Air(calc,dry)	= 4104.	55.9	Oil and tar	= 102.	1.3
			Ash(calc,dry)	= 326.	4.3
			Dust	= 25.	0.3
Total	= 7348.		Total	= 7593.	

Energy Balance (Percent unaccounted for: 0.36)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 20.6	Dry coal gas	= 16.1	77.7
Air	= 0.001	Oil and tar	= 1.73	8.3
Steam(import)	= 0.268	Sensible	= 0.87	4.2
Cooling water	= -0.057	Latent	= 1.212	5.8
		Ash	= 0.307	1.5
		Dust	= 0.256	1.2
		Cooling water	= 0.253	1.2
Total	= 20.8	Total	= 20.7	

Performance Data

Cold gas efficiency, percent = 77.4
 Cold gas with tar efficiency, percent = 85.7
 Hot gas without tar efficiency percent = 87.2
 Hot gas with tar efficiency, percent = 95.7
 Air/Coal (lb./lb.) = 1.664
 Steam/Coal (lb./lb.) = 0.315
 Air/Fixed Carbon (lb./lb.) = 4.711
 Coal/Gasifier Area (lb./hr./sqft) = 74.3
 Fixed Carbon/Area (lb./hr./sqft) = 26.3
 Producer Gas/Coal (SCF/lb.) = 48.4
 Producer Gas/Fixed Carbon (SCF/lb.) = 137.0
 Tar Yield (lb./lb. coal) = 0.041

Figure 7-12

Comparison of the Geometrical Grate Performance Model with
Ash Removal Rates

material corresponds to less than 1% of the ash entering the gasifier at this time.

The sulfur dioxide concentrations averaged 188 ppm (wet). This corresponds to a sulfur dioxide emission rate of 34 lb/hr and a sulfur dioxide emission factor of 1.67 lb/million Btu. If all of the coal sulfur appeared as sulfur dioxide in the combustor exhaust the sulfur dioxide emission rate would be 50 lb/hr. The sulfur dioxide equivalent leaving through the ashpit at this time is approximately 2 lb/hr. The remaining 14 lb/hr sulfur dioxide equivalent is unaccounted for.

Nitric oxide concentrations ranged from 80 to 100 ppm (dry).

7.5 Tar/Oil Yield Correlations

The overall average tar yield measured during this test was 4.4 lb/100 lb coal. This tar yield can be compared with tar + oil yields reported for Fischer-Schrader Assays of similar coals (Selvig and Ode, 1957). There is no Fischer-Schrader assay available for this coal.

Figures 7-13 and 7-14 show the tar yield observed during fixed-bed gasification of this coal plotted against parameters that correlate well with Fischer-Schrader assay tar + oil yields (Ode and Selvig, 1944, Gomez et al, 1958). As can be seen in these figures, the overall average tar yield observed during this test is somewhat lower than that predicted by the correlations. This may be due to the poor gasification conditions present during most of the test. The tar yields measured during the more stable periods of operation were 5.2 to 6.2 lb/100 lb coal. These yields are more in line with the predictions of the correlations.

7.6 Quench/ESP Tar Analysis

A complete discussion of the Quench/ESP tar analyses appears in Appendix K. This section is abstracted from that report.

Table 7-14 presents a summary of the chemical and physical analyses for 10 liquid samples collected from the tar scrubber on three dates by the Quench/ESP operating team. Due to the tendency for tar samples to separate from water, over time, tar samples were decanted for these analyses. Ultimate analyses and heating value are reported on a moisture-free basis where moisture content is determined by distillation curves. The analyses of these tar samples are very similar to the analyses of tar samples collected in the gas sampling and conditioning system and reported in Section 7.1.4.

Figures 7-15 to 7-18 show the tar distillation curves for the samples collected on an as-received and moisture-free basis.

Figure 7-13

Tar/Oil - Volatile Matter-Oxygen Correlation

(Ode & Selvig, 1944)

Figure 7-14

Tar/oil - Volatile BTU Correlation

(Gomez et al, 1958)

Table 7-13

Material Balance and Thermal Efficiency Calculation
Rosebud Overall Average

Input Data

Time period: Overall Average (325.2 hours)

Gasifier Operation:

Coal feed, Ton/hour = 1.20
 Blast air flow (dry) , Scfm = 855.
 Saturated air temperature, F = 146.
 Steam/Air Ratio (lb./lb.) = 0.19
 Ambient air temperature, F = 51.
 Off-take temperature, F = 461.

Coal Data:

Type = Rosebud Subbituminous Coal
 Mass Fraction Carbon % = 48.9
 Mass Fraction Fixed Carbon = 35.31
 Mass Fraction Moisture % = 23.00
 Mass Fraction nitrogen % = 0.68
 Mass Percent sulfur = 1.14
 Heating value, Btu/lb = 8354

Tar and Water Yield (dry basis):

Water yield, lb./1000 SCF = 11.10
 Tar yield, lb/1000 SCF = 1.15
 Carbon in Tar (percent) = 81.4
 Sulfur in Tar (percent) = 0.42
 Tar HHV, thou. Btu/lb = 17.05

Ash and Dust Data:(dry basis)

Ash discharge ,lb/hour = 281.
 Ash carbon ,percent = 10.0
 Ash sulfur ,percent = 1.15
 Ash moisture (wet),percent = 8.9
 Cyclone dust,lb/hour(est.) = 24.

Gas Composition (Dry): (normalized to 99.90)

H2 % = 18.6	CH4 % = 1.71	H2S (est ppm) = 2972
CO % = 26.5	C2H4 % = 0.105	COS (est ppm) = ---
CO2 % = 7.36	C2H6 % = 0.128	CH3SH (est ppm) = ---
N2 % = 44.7	C3H6 % = ---	C2H5SH (est ppm) = ---
O2 % = 0.00	C3H8 % = ---	HHV, Btu/SCF = 168
Molec. Weight = 24.02	Argon(est. %) = 0.533	LHV, Btu/SCF = 157

Calculation Results (based on nitrogen and carbon balance)

Material Balance (Percent unaccounted for: -1.57)

Input,	lb/hr	% Total	Output,	lb/hr	% Total
Coal	= 2391.	33.7	Dry gas	= 5742.	79.7
Steam (total)	= 757.	10.7	Water in gas	= 1006.	14.0
Air(calc,dry)	= 3948.	55.6	Oil and tar	= 104.	1.4
			Ash(calc,dry)	= 331.	4.6
			Dust	= 24.	0.3
Total	= 7095.		Total	= 7207.	

Energy Balance (Percent unaccounted for: 1.54)

Input,	MM BTU/hr	Output,	MM Btu/hr	% Total
Coal	= 20.0	Dry coal gas	= 15.3	76.7
Air	= -0.008	Oil and tar	= 1.78	8.9
Steam(import)	= 0.286	Sensible	= 0.86	4.3
Cooling water	= -0.033	Latent	= 1.075	5.4
		Ash	= 0.474	2.4
		Dust	= 0.248	1.2
		Cooling water	= 0.206	1.0
Total	= 20.2	Total	= 19.9	

Performance Data

Cold gas efficiency,	percent = 75.5
Cold gas with tar efficiency,	percent = 84.3
Hot gas without tar efficiency	percent = 84.8
Hot gas with tar efficiency,	percent = 93.8
Air/Coal	(lb./lb.) = 1.651
Steam/Coal	(lb./lb.) = 0.316
Air/Fixed Carbon	(lb./lb.) = 4.675
Coal/Gasifier Area	(lb./hr./sqft) = 72.1
Fixed Carbon/Area	(lb./hr./sqft) = 25.4
Producer Gas/Coal	(SCF/lb.) = 46.8
Producer Gas/Fixed Carbon	(SCF/lb.) = 132.7
Tar Yield	(lb./lb. coal) = 0.044

Table 7-14

Tar Scrubber Sample Analyses

Sample	Sink Tar	Float Tar	Recycle Liquor	Tar Discharge	ESP Drain	Sink Tar	Float Tar	Recycle Liquor	Tar Discharge	ESP Drain
Date	11/11/82	11/11/82	11/10/82	11/10/82	11/10/82	11/19/82	11/19/82	11/18/82	11/18/82	11/18/82
Time	1000h	0900h	1130h	1130h	1130h	1400h	1400h	0400h	2000h	2000h
Tot. Sample	1550 ml	0	0	0	375 ml	2500 ml	2400 ml	0	0	650 ml
Tar *	1500 ml	(100%)	(100%)	(100%)	150 ml	800 ml	1600 ml	(100%)	(100%)	250 ml
Tar Analysis *										
VM	78.52	84.20	-	-	(68.59)**	74.94	80.48	-	-	(77.62)**
FC	6.63	7.14	-	-	5.01	3.95	1.48	-	-	4.67
Ash	0.05	0.16	-	-	(trace)	0.11	0.04	-	-	0.01
H ₂ O	14.8	8.5	97	96	(26.4) **	21	18	96	96	(17.7) **
MAF ²										
C	80.69	81.45	-	-	(89.38)**	86.51	87.12	-	-	(79.68)**
H	9.07	9.18	-	-	(9.49)**	8.91	9.25	-	-	(9.03)**
O	8.45	8.47	-	-	-	3.68	2.40	-	-	(10.48)**
N	1.54	0.46	-	-	(0.90)**	0.58	0.95	-	-	(0.46)**
S	0.25	0.44	-	-	(0.30)**	0.32	0.28	-	-	(0.35)**
HHV	16,433	16,487	-	-	(16,450)**	16,460	16,339	-	-	(16,450)**
Distillation										
IBP	212	212	212	212	(N.A.)	216	219	212	212	(N.A.)
5	223	216	212	212		232	241	212	212	
10	219	226	212	212		241	255	212	212	
20	482	252	212	212		262	496	212	212	
30	558	558	212	212		543	552	212	212	
40	604	622	212	212		594	604	212	214	
50	626	662	212	212		640	655	212	214	
60	698	694	212	214		676	687	212	214	
70	734d	748d	214	216		705	705	212	214	
80			217	237		766	698	214	214	
85			228	248		774d	720d	216	214	
90			234	257				217	214	
95			244	277				221	219	
97			248	282				226	239d	
98			262d	284d				228		
99								230d		
Reid Vapor										
Pressure	1.16 psig	0.90	0.90	1.05	0.90	0.79	0.51	1.23	1.01	0.43
SPGR	1.118	0.952	0.998	0.998	1.009	1.044	1.073	0.999	1.000	1.009
pH	-	-	9.2	9.1	8.8	9.2	8.6	8.5	9.1	(N.A.)
Phenols, ppm	-	-	1392	208	-	-	-	2368	1776	-

* Tar analyses are based on the decanted wet samples.

** ESP Drain Moisture contents were estimated assuming a dry tar heating value of 16,450 Btu/lb.

Figure 7-15

Tar Boiling Point Diagram (as Received) 11/10-11/82

TAR BOILING POINT DIAGRAM

(As Received)

Figure 7-16

Tar Boiling Point Diagram (Dry Basis) 11/10-11/82

TAR BOILING POINT DIAGRAM

(Dry Basis)

Figure 7-17

Tar Boiling Point Diagram (as Received) 11/18-19/82

TAR BOILING POINT DIAGRAM

(As Received)

Figure 7-18

Tar Boiling Point Diagram (Dry Basis) 11/18-19/82

Quench tank tar samples show about 20% moisture and fairly straight line boiling curves. The recycle liquor and tar disposal samples are predominantly water with some dissolved solids which show the gradual rise in boiling point. Tar content in these streams is 3-4%. Tar fractions of all samples exhibit similar boiling characteristics as evidenced by Figures 7-16 and 7-18.

From the vacuum distillation curves prepared in Figures 7-19 and 7-20, the tar vapor pressure curves in Figures 7-21 and 7-22 were prepared.

Figure 7-23 gives the viscosity of the various tar streams as a function of temperature. As expected, all streams have viscosities very much like number 6 fuel oil.

Figure 7-19

Tar Boiling Point Diagram (as Received) Vacuum 11/19/82

TAR BOILING POINT DIAGRAM

(As Received)

Figure 7-20

Tar Boiling Point Diagram (Dry Basis) Vacuum 11/19/82

Figure 7-21

Tar Vapor Pressure-Sink Tar 11/19/82

TAR VAPOR PRESSURE

Figure 7-22

Tar Vapor Pressure-ESP Drain 11/19/82

TAR VAPOR PRESSURE

Figure 7-23
Tar Viscosity

SECTION 8

CONCLUSIONS

1. Maximum coal throughput under stable operation conditions was 1.1 ton/hour (66.3 lb/hr/sq ft grate). Stable operation was limited by gas channeling and ash clinkering. Based on this throughput and a saturation temperature of 63.3 C (146 F) the following material and energy flows can be expected:

Material Input

lb air/lb coal = 1.554
lb steam/lb coal = .291

Energy Input (MM Btu/hr)

Coal = 18.4
Steam (import) = .35

Material Output

lb dry gas/lb coal = 2.292
lb tar-oil/lb coal = .052
lb dust/lb coal (est) .010
lb ash/lb coal = .127
lb water/lb coal = .373

Energy Output (MM Btu/hr)

Dry coal gas 15.0
Tar and oil 1.97
Sensible and latent
heat 1.79
Cooling water .04
Dust .23
Ash .08

Hot, raw gas energy, conversion efficiency - 98 %

2. The average tar yield was 4.4 lb/100 lb coal. This represents 10% of the total energy content of the hot gas with tar. Tar yields measured during the more stable periods of operation were in excess of 5 lb/100 lb coal.
3. The +3/4" fraction of the compacted run of the mine coal was 12%. High percentage (31%) of fine coal particles less than the screen mesh size was found in the coal weigh bin downstream of the screen. This resulted from material carry-over from the screen and also degradation caused by subsequent handling via the bucket elevator and coal chute. Size degradation occurred throughout coal handling and gasification.
4. The increase in ash particle size can be correlated with the increase in the carbon content of the ash and the increase in the bulk density.
5. Stack emissions measurements indicated that the particulate concentration was in the range of 0.042 to 0.0068 Gr/Acf, sulfur dioxide concentration in the range of 179 to 194 ppm, and nitric oxide concentration in the range of 80 to 100 ppm

(dry). The corresponding particulate emission factor ranged from 0.094 to 0.142 lb/million Btu and the SO₂ emission factor, 1.67 lb/million Btu.

6. Serious ash clinkering and channeling of gas flow occurred under all operating conditions.
7. The use of a 1 1/4" screen to reject undersize coal rather than a 3/4" screen did not improve any aspect of performance appreciably.
8. Coal distribution in the retort was poor without the agitator operating as a spreader, but operating the agitator as a spreader increased the size degradation of the coal. An improved coal distribution system would be highly desirable.
9. Dust carryover problems were compounded by gas offtake temperatures below the tar dew point. Condensed tars acted to cement dust particles together in downstream equipment and duct work. Higher offtake temperatures, or more efficient dust collection devices would be highly desirable.
10. It would be difficult to recommend this coal for fixed-bed gasifiers due to limited throughput, and excessive operating labor required to monitor the retort.

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APPENDIX A

Gasifier Operator's Log

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

TEST LOG

November 2, 1982

1530 Start of BOM/FGT-002

1610 Ash average is 16.8 inches. Slowed the grate down to BC-5.
The freeboard average is 36 inches.

1615 The offtake temperature is 375 F. Slowed the agitator
speed to 2.5 sweeps/hour.

1630 The South coal leg is empty.

1645 The North coal leg is now empty. Started filling the weigh
bin with Rosebud coal.

1745 Coal bin weight is 11.89 tons.

1800 Poked the fire down. Number 1 poke rod was dirty this fire
test.

1815 Offtake temperature is 434 F. The agitator drive is set at
3 sweeps/hour.

1830 Checked the coal gates.

1845 Particulate is hanging up in the cyclone. Freed up the
valve.

1915 Cleaned the combustion burner. The opening had become
carboned up.

2005 Ran out of Jetson coal. Filled the coal chutes with 4.09
tons of Rosebud coal. Lowered the blast air flow to 800
cfm.

2015 The offtake temperature is 333 F. Slowed the agitator to
.5 sweeps/hour.

2040 The offtake temperature is 309 F. Saturation control
appears to be good.

2050 Offtake temperature is 277 F. Finished coaling up at 12.51
tons.

2100 Slowed the grate drive to C-3.

2200 This fire test showed clinkering in the region of number 1
RAP and a dirty rod in RAP number 4. Freeboard average is
40 inches. Increased the agitator speed to 1.5
sweeps/hour. Poked holes number 1 and 4.

2215 Offtake temperature is dropping (169 F.) after speeding up the agitator.

2230 Coal up at 1.64 tons.

November 3, 1982

0005 Fire test ash average is 22.7 inches. Freeboard average is 38 inches. Increased the grate speed to D-3. Straightened poke rods. Clunkering was evident in the region of number 4 RAP.

0030 Coal up at 1.56 tons. Ash average is 33.5 inches.

0100 Freeboard average is 35 inches. Checked the caustic pump. It had stopped, but is now working.

0130 Coal up at 1.55 tons.

0200 Fire test ash average is 13.5 inches. Freeboard average is 41.5 inches. Boiler flame failure. We lost steam. Reset the boiler and light off was normal. Found a loose wire on the alarm which had prevented normal warning of boiler failure.

0230 Coal up at 1.6 tons. Dumped 570 pounds of ash.

0300 Freeboard average is 40.5 inches.

0330 Coal up at 1.40 tons. Checked the caustic pump as it had, once again, stopped. Got it going again and changed barrels.

0400 Fire test ash average is 15.4 inches. Number 2 poke hole is clunkering. Freeboard average is 41.5 inches. Increased the agitator speed to 2 sweeps/hour.

0430 Coal up at 1.3 tons. Started loading coal.

0500 Freeboard average is 40.5 inches.

0515 Stopped loading coal at 11.52 tons.

0530 Coal up at 1.49 tons. Dumped the cyclone.

0600 Fire test ash average is 18.0 inches. Freeboard average is 37.5 inches.

0630 Coal up at 1.5 tons.

0700 Saturation air flow is 800 cfm. Offtake temperature is 203 F. Ash average is 18 inches. Freeboard average is stable at 38 inches.

0730 Coal up at 1.47 tons. Cyclone is working well, with no jamming evident when opening or closing.

0738 The pH is 2.46. Checked on the front end loader and the caustic pumps. Dumped ash.

0800 Offtake temperature has risen to 218 F. Fire test ash average is 20.4 inches. Freeboard average is 41 inches. We are reducing the saturation temperature to 57 C.

0830 Saturation temperature is 57 C and the saturation air flow is 800 cfm. Offtake temperature is 211 C. Coal up at 1.47 tons.

0900 Freeboard average is 36.5 inches. Saturation temperature is 57 C. Saturation air flow is 800 cfm. Offtake temperature is 239 C.

0930 Coal up at 1.58 tons. Saturation temperature is 57 C. Saturation air flow is 800 cfm. Offtake temperature is 256 C.

1000 Offtake temperature is 252 C. Channeling was evident in the region of number 3 RAP. Poked down number 3. Reduced the grate drive speed to B-3. Ash average is 13.3 inches. Freeboard average is 38 inches.

1030 Coal up at 1.25 tons.

1040 Increased the agitator speed to 4 sweeps/hour.

1100 Freeboard test.

1200 Increased the agitator drive speed to 5 sweeps/hour.

1230 Increased the saturation temperature to 59 C. Fire bed was developing clinkers and channeling on the low saturation temperature.

1250 Poked down all the retort access ports to even out the bed.

1300 Freeboard average is 33 inches. Offtake temperature is 300 C.

1330 Coal up at 1.38 tons. Dumped the cyclone.

1400 Freeboard average is 33 inches. Fire test ash average is 13.9 inches. Rotated the slipstream spectacle valve. Slowed the grate drive to BA-3. Slowed the agitator to give more time for the bars to heat up.

1420 Saturation temperature is dropping. Lost steam. Boiler shut down. Cut back the jacket water flow to 1 gpm.

1430 Reset the boiler saturation to normal. Reset the jacket

water flow to 12 gpm./ Coaled up at 1.28 ton. Agitator is 34 inches down from the top.

1500 Freeboard average is 34 inches.

1600 Number 4 hole is showing clinkering.

1630 pH is 5.6.

1645 Dumped the particulate hopper.

1720 Lowered the agitator to 38 inches from the top. Offtake temperature has dropped to 365 C.

1730 Poked number 3 hole and found no clinkering.

1745 Increased the saturation temperature to 60 C. The pH is 2.6 and we are out of caustic.

1750 Water jacket outlet temperature is 78 C.

1800 Holes number 3 and 6 are showing clinkering (3 on top and 6 on the bottom).

1830 Slowed the jacket water to 11.5 gpm.

1845 Holes number 2,3,4 and 6 showed signs of clinkering.

1945 Poked holes 3,4 and 6.

2000 Holes 2,4 and 6 are cold holes this fire tet. Ash average is 22 inches. Increased the grate drive speed to BC-3.

2045 Increased the saturation temperature to 61 C. Started to leave the cyclone gate open.

2100 Freeboard average is 28.5 inches. Increased the agitator to 6 sweeps/hour.

2130 Cleaned the combustion burner.

2200 Slowed the agitator speed to 4 sweeps/hour. Number 3 poke rod was dirty this fire test and there was clinkering against the side wall in the region of the number 3 hole.

2210 Agitator speed is 6 sweeps/hour.

2220 Increased the grate drive to C-3.

2330 Coal up at 1.31 tons. Number 3 hole shows clinkering and burning through. Raked the bed.

November 4, 1982

- 0005 Fire test ash average is 26 inches. Increased the grate speed to E-3. Freeboard average is 33.5 inches. Slowed the agitator to 4 sweeps/hour. Increased the saturation temperature to 63 C.
- 0030 Coal up at 1.04 tons. Poked number 3 hole. Took a coal sample. Flame failure on the boiler.
- 0100 Freeboard average is 30 inches.
- 0130 Coal up at 1.11 tons.
- 0200 Fire test ash average is 23.5 inches. Freeboard average is 32.5 inches. Clinkers were evident in the region of holes number 3 and 4.
- 0230 Coal up at 1.41 tons. Increased the saturation temperature to 64 C. Slowed the agitator to 2 sweeps/hour.
- 0250 Dumped ash.
- 0300 Freeboard average is 35.5 inches.
- 0330 Coal up at 0.82 ton.
- 0400 Fire test ash average is 18.1 inches. Freeboard average is 35.5 inches. Clinkers are still apparent in holes 3 and 5. Decreased the saturation temperature to 62 C. There is still burning through on the bed.
- 0430 Coal up at 1.31 tons. Raked poke holes 2,3 and 5.
- 0500 Freeboard average is 32.5. Raked poke holes 2,3 and 5.
- 0530 Coal up at 1.06 tons.
- 0600 Fire test ash average is 17.2 inches. Freeboard average is 37 inches.
- 0630 Coal up at 1.29 tons. Raked holes number 2,3,4 and 5.
- 0700 Raked holes 2,3,4 and 5. Freeboard average is 37 inches. The agitator speed is at 2 sweeps/hour and the grate drive is set at E-3.
- 0730 Coal up at 1.24 tons. Cyclone dump has shown very large deposits of particulate. The offtake temperature is 277 C. Saturation temperature is 62 C.
- 0758 Fire los pressure is 19.5 inches wc.
- 0800 Lost steam and had to stop the fire test. Switched to water jacket saturation.

0830 Steam is back. Poked and raked the fire bed. Offtake temperature is 228 C. Freeboard average is 35.5 inches. Saturation temperature is 65 C.

0855 Offtake temperature has fallen to 220 C.

0900 Increased the saturation air flow to 1000 cfm. Increased the agitator speed to 3 sweeps/hour.

0935 Poked the bed to break up the clinkers.

1000 Poked and raked the bed. The ash pit pressure dropped.

1030 Fire test ash average is 8.9 inches. The offtake temperature is 271 C. Saturation air flow is 1000 cfm. Saturation temperature is 65 C. Took a coal sample and coaled up at 1.52 tons.

1045 Ash pit pressure is climbing again.

1100 Poked the bed.

1130 Cyclone dump produced a large amount of particulate. Poked down the bed in the region of number 3 hole.

1140 Increased the saturation temperature to 66 C.

1146 Increasing the agitator speed to 4 sweeps/hour. Fire loss pressure is dropping. Saturation air flow is 1000 cfm and the saturation temperature is 66 C. Agitator speed is 4 sweeps/hour. Offtake temperature is 270 C. Fire loss pressure is 20.8 inches wc. Ash pit pressure is 22.8 inches wc.

1158 Offtake temperature is 260 C.

1200 Fire test ash average is 14 inches.

1230 Coal up at 1.43 tons.

1245 Poked the fire bed.

1255 Increased the saturation temperature to 67 C.

1300 Started loading coal at 2.96 tons. Freeboard average is 32 inches. Slowed the agitator speed to 3.5 sweeps/hour. Poked the bed in the region of the number 3 hole.

1330 Coaled up at 1.45 tons.

1400 Fire test ash average is 19.5 inches. Burning through is evident in holes number 2,3 and 4. Holes 4,5 and 6 are colder.

1430 Coaled up at 1.43 tons. Reducing the jacket water to 10

gpm.

- 1440 Tried to put chimneys on holes number 5 and 6. Poked down number 3. Reduced the saturation air flow to 900 cfm.
- 1530 Lowered the agitator.
- 1615 Increased the saturation temperature to 68 C.
- 1700 Lowered the jacket water flow to 7 gpm. The steam valve is 100% open. Saturation temperature is 67 C. Poked the clinkers in the number 3 hole.
- 1745 Lowered the saturation air flow to 800 cfm. The offtake temperature is 416 C. Clinkering is evident in all holes.
- 1800 Steam took over. Saturation temperature is 68 C. The steam valve is at 30%.
- 1930 Saturation temperature is 60 C and going down. The boiler has stopped.
- 1945 Saturation temperature is 69 C and the boiler is working.
- 1950 Saturation air flow is 700 cfm.
- 1955 Increased the agitator speed to 4 sweeps/hour. Freeboard average is 32.5 inches.
- 2115 Belt broke on the coal conveyor. Found a new one in the cabinet.
- 2130 The boiler is down. Flame failure. Saturation temperature is 65 C and the steam is 0.
- 2215 Saturation air flow from 600 cfm to 70 cfm. Lowered the ID to 75.
- 2220 Opened the steam valve 1/2 to stack so the boiler does not recycle.
- 2245 Checked the bed and finding the clinkers diminishing as is the burning through. Closed the steam valve to the stack 1/4 turn. No steam to the retort holes.
- 2330 Coal up at 1.15 tons. Dumped ash. Poked hole number 3.

November 5, 1982

- 0005 Fire test ash average is 20.2 inches. Freeboard average is 35 inches. Hole number 3 is burning through so we poked it down. Still some clinkering.
- 0030 Coaled up at 1.13 tons and took a coal sample.

0100 Freeboard average is 29.5 inches.

0130 Coaled up at 1.06 tons. Increased the grate drive speed to E-5. Dumped ash.

0200 Fire test ash average is 10.2 inches and freeboard average is 36 inches. Slowed the grate speed to D-5.

0230 Coaled up at 1.19 tons and dumped ash.

0300 Freeboard average is 34.5 inches.

0330 Coaled up at 1.13 tons.

0400 Freeboard average is 37.5 inches. Decreased the saturation temperature to 68 C from 70 C. Dumped ash.

0430 Coaled up at 1.27 tons.

0500 Having difficulty maintaining a saturation temperature. It is now 67 C. Turned on the water saturation control.

0530 Coaled up at 1.36 tons. The offtake temperature is settling down and the saturation temperature is under control at 70 C. CO is coming up and the CO2 is dropping. Have both the steam and water controls on automatic.

0600 Fire test ash average is 11.7 inches. Freeboard average is 31.5 inches.

0630 Coaled up at 0.87 ton.

0700 Freeboard average is 34.5 inches.

0730 Coaled up at 1.36 tons.

0800 During this fire test rods number 5,6 and 7 were cold. It was difficult to get a clear reading. Number 3 was very high. The offtake temperature is fluctuating up and down. Switching the jacket water off automatic control and reduced the saturation temperature to 68 C.

0845 Poked the bed and increased the saturation temperature to 69 C. Increased the grate speed to E-5.

0858 Slowed the agitator to 0. Cut back on the steam and water flow.

0900 Freeboard average is 32 inches.

0930 Dumped ash.

0945 Reduced the saturation air flow to 500 cfm. Saturation temperature is 68 C.

1000 Fire test ash average is 9.6 inches. The grate speed is E-5.

1030 Coaled up at 0.97 ton.

1045 Offtake temperature is 245 C.

1055 Reducing the saturation temperature to 67 C.

1100 Freeboard average is 37.5 inches.

1130 Coaled up at 1.11 tons. Saturation temperature is 67 C. Offtake temperature is 293 C. The CO is coming up.

1150 Slowed the grate speed to C-5.

1200 Bad clinkering was evident this fire test. Freeboard average is 37.5 inches.

1230 Increased the saturation temperature to 69 C.

1240 Offtake temperature is 284 C.

1300 Freeboard average is 35 inches.

1310 Got a poke rod caught and had to cut it off.

1430 Coaled up at 0.88 ton. Freeboard average is 33 inches.

1450 Stretford system is drawing gas.

1500 Freeboard average is 36.5 inches.

1630 Dumped ash.

1645 Increased steam to the retort.

1700 Increased the grate drive speed to 9.

1745 Decreased steam to the retort. Saturation temperature is 69 C.

1830 Dumped ash.

1910 Slowed the saturation water to 3.5 gpm.

1930 Closed the steam valve to the stack.

1945 Slowed the grate drive speed to CD-5.

2035 Dumped ash.

2045 The conveyor belt ripped. Adjusted the hopper.

- 2110 The caustic pump has stopped and is out of caustic. Changed the barrel and primed the pump.
- 2115 Saturation temperature has dropped to 62.5 C. Offtake temperature is 255 C. Clinkering is very heavy in holes 5 and 6.
- 2120 Number 5 hole has heavy clinkering. Sharpened the new poke rods. Broke up the clinker in holes number 5 and 6. The offtake temperature has dropped to 220 C.
- 2245 Holes number 4 and 5 have heavy clinkering again.
- 2250 University of Minnesota has no distilled water for a pH reading.
- 2330 Coaled up at 0.96 ton. Poked holes 2 and 5 for clinkers.
- 2345 Poked holes 2,3 and 5.

November 6, 1982

- 0005 Fire test ash average is 9.4 inches. Freeboard average is 34.5 inches. The bed appears to be softening.
- 0030 Coaled up at 1.19 tons. Poked holes 2 and 5.
- 0100 Freeboard average is 35.5 inches.
- 0130 Coaled up at 1.12 tons. Poked holes 2,5 and 7.
- 0200 Fire test ash average is 9.1 inches. Reduced the grate speed to C-5. Freeboard average is 36 inches.
- 0230 Coaled up at 1.09 tons.
- 0300 Freeboard average is 35.5 inches. Poked holes number 2,5 and 7. Found hard clinker.
- 0330 Coaled up at 1.14 tons. Washed coal entered the firebed.
- 0400 Fire test ash average is 8.7 inches. Slowed the grate to B-5. Got 0 readings on rods number 2 and 5 during this fire test.
- 0430 Coaled up at 1.22 tons. CO is climbing and CO2 is dropping. Saturation temperature appears to have leveled off at 65 C.
- 0500 Freeboard average is 33 inches.
- 0530 Coaled up at 1.05 tons.
- 0600 Ash average is 10.4 inches. Freeboard average is 33

inches.

0630 Coaled up at 1.15 tons.

0700 Freeboard average is 33 inches.

0730 Coaled up at 1.09 tons.

0800 Fire test ash average is 10.4 inches. Freeboard average is 34.5 inches.

0830 Coaled up at 1.28 tons. Increased the grate speed to DE-5.

0900 Reduced the agitator speed to 0. The freeboard average is 36.5 inches.

0920 Poked down the fire bed. Offtake temperature is 272 C. Fire loss is 14.4 inches wc.

0930 Coaled up at 1.09 tons. Offtake temperature is 272 C. Saturation temperature is 65 C.

0935 Increasing the saturation temperature to 66 C. Dumped the cyclone. Used a 30 second flush. One bouyant chunk came out.

1030 Saturation temperature is 67 C.

1200 Fire test ash average is 7.4 inches. Freeboard average is 37 inches.

1215 Saturation temperature is 65 C. Poked the bed.

1220 Decreased the secondary air to the combustor to increase the temperature. The Stretford is operating.

1230 Coaled up at 1.18 tons. The saturation air flow is 500 cfm. Fire test ash average is 15.5 inches. Fire loss pressure is 12.4 inches wc. Offtake temperature is 241 C and the saturation temperature is 64.5 C.

1235 The saturation air temperature is 64 C.

1240 Decreased the grate drive speed to D-5.

1300 Freeboard average is 37.5 inches. Offtake temperature is 215 C. Saturation temperature is 64 C. Fire loss pressure is 11.3 inches. Ash average is 15.4 inches. Poked the firebed.

1330 Coaled up at 1.16 tons.

1340 Exercised the vent valve.

1400 Fire test ash average is 8.5 inches.

1415 Loaded coal at 4.84 tons. 9.42 tons loaded dry. 11.48 tons of coal were loaded wet.

1438 Coaled up at 1.28 tons.

1500 Freeboard average is 38.5 inches.

1530 Coaled up at 0.80 tons.

1610 Increased the grate speed to E-5.

1625 Poked holes number 1,2,6 and 7 for clinkers.

1715 Poked holes 1,2 and 3. Holes 1 and 2 had clinkers. Straighten and sharpen the poke rods.

1740 The Stretford system is down (high voltage insulator). The induced draft fan is back to 70 inches wc. Poked holes 4,5 and 6. Number 6 had hard clinkers. Slowed the agitator to DE-5.

1815 Increased the induced draft fan to lower the outlet pressure to 4.4 inches wc.

1840 Poked all holes. Numbers 1,5 and 6 have hard clinkers.

1940 Poked all holes again. Numbers 5 and 6 are heavy with clinkering.

2010 Number 1 hole has fire burning through. Poked holes 1 and 6.

2035 Caustic pump had stopped, was cleaned and reprimed.

2045 Started coaling up.

2100 Offtake temperature is 330 C. Poked holes 1 and 6.

2115 Poked and raked holes 1 and 6. Offtake temperature is 260 C.

2220 Slowed the grate drive to CD-5.

2245 Number 3 hole is spongy. Poked holes 1,2,3 and 6 and found clinkering in 1,2 and 6. Slowed the caustic pump down. Number 6 hole has fire burning on top. Poked and raked.

2255 Offtake temperature is 243 C.

2330 Coaled up at 1.15 tons.

November 7, 1982

0005 Fire test ash average is 11 inches. Cleaned the orifices

in the retort access ports and adjusted them. Increased the steam pressure to the poke holes to 30 pounds.

- 0030 Coaled up at 1.05 tons.
- 0100 Freeboard average is 32.5 inches.
- 0130 Coaled up at 1.06 tons.
- 0200 Fire test ash average is 13.0 inches. Freeboard average is 40 inches.
- 0230 Coaled up at 1.07 tons. Poked holes 1 and 6.
- 0300 Freeboard average is 38 inches.
- 0330 Coaled up at 1.25 tons. Poked holes 1 and 6.
- 0400 Fire test ash average is 13.8 inches. Holes 1 and 6 are burning through. Freeboard average is 40 inches. Increased the agitator speed to 1.5 sweeps/hour.
- 0430 Coaled up at 1.08 tons.
- 0500 Freeboard average is 38 inches. Finished loading coal.
- 0530 Coaled up at 1.11 tons. Unwashed coal enters the retort.
- 0600 Fire test ash average is 12.8 inches and freeboard is 39 inches.
- 0630 Coaled up at 1.2 tons.
- 0730 Coaled up at 1.21 tons.
- 0750 Power blink caused shutdown. Induced draft fan is venting and saturation blower is on. The combustion burner is out. The cyclone has been flooded and the steam valves are off.
- 0807 Induced draft fan was started. Restarted the combustor.
- 0910 Coaled up at 1.39 tons.
- 0925 Slowed the agitator speed to 0.
- 0930 Adjusted the agitator drive speed control.
- 0935 Set the saturation temperature at 63 C. Offtake temperature is 267 C. Saturation air flow is 500 cfm. Fire test ash average is 10.9 inches and fire loss pressure is 6.2 inches wc.
- 1025 Increased the agitator speed to CD-5.
- 1030 Coaled up at 1.21 tons.

1100 Freeboard average is 41 inches. Poked the fire bed.

1130 Coaled up at .99 ton. Slowed the agitator.

1200 Fire test ash average is 14.7 inches.

1230 Coaled up at 1.12 tons. Decreased grate speed to C-5.

1300 Freeboard average is 41.5 inches. Poked the bed.

1330 Coaled up at 1.21 tons. Shut off the agitator.

1400 Fire test ash average is 11.5 inches. Freeboard average is 41.8 inches. Coaled up with dry coal at 2.54 tons. Power blink caused another shutdown. Induced draft and combustor fans are off. The 10-inch vent valve is open. The steam valves are closed. Flooded the cyclone. Loaded 9.96 tons.

1455 Coaled up at 1.05 tons.

1600 Ash average is 40 inches. Increased the grate speed to E-5.

1610 Moved the agitator off holes 2 and 5.

1615 Saturation air flow is 450 cfm.

1630 Poked holes 5 and 6 as they are burning through.

1645 Stopped the agitator.

1815 Ash average is 45 inches. Increased the grate drive to CD-6. The rods went in with ease.

1845 Raked holes 5 and 6. Increased the grate speed to D-6.

1915 Bed is burning through between holes 5 and 6 and holes 2 and 3. Raked these holes.

2015 Increased the grate drive speed to E-7. Ash average is 55 inches.

2040 Started coaling up. The last conveyor V-belt broke.

2120 Opened the valve to the Stretford.

2125 Turned the saturation steam control to automatic. The bolts on the shaker motor mount broke.

2210 Dumped ash. Ash average is 43 inches. The grate drive shaft is making 103 rph. Offtake temperature is 231 C.

2330 Coaled up at 1.40 tons.

2340 The Stretford has shut down.

November 8, 1982

0005 Fire test ash average is 43.5 inches. The bed is soft.
Freeboard average is 45 inches. Dumped ash.

0030 Coaled up at 1.4 tons.

0100 Freeboard average is 46 inches. Dumped ash.

0130 Coaled up at 1.5 tons.

0200 Fire test ash average is 35 inches. Dumped ash. Freeboard
average is 39 inches.

0230 Coaled up at 1.4 tons.

0300 Freeboard average is 42 inches. Dumped ah.

0330 Coaled up at 1.41 tons.

0400 Freeboard ash average is 43 inches. Dumped ash. Fire test
ash average is 31.2 inches.

0430 Coaled up at 1.41 tons.

0500 Freeboard ash average is 43.5 inches. Dumped ash.

0530 Coaled up at 1.22 tons.

0600 Fire test ash average is 22.2 inches.

0630 Coaled up at 1.43 tons.

0700 Freeboard average is 43 inches.

0730 Coaled up at 1.3 tons.

0750 Grate speed is DE-7.

0755 Increased the saturation air flow to 500 cfm. The pH is
3.4. Saturation temperature is 63 C. Offtake temperature
is 152 C.

0830 Coaled up at 1.12 tons.

0845 Increased the saturation flow to 550 cfm.

0900 Freeboard average is 45 inches. Saturation air flow is 550
cfm. Offtake temperature is 191 C. Fire loss pressure is
4.8 inches wc.

0930 Coaled up at 1.15 tons.

0945 Exercised the vent valve.

1000 Fire test ash average is 11.7 inches. Decreasing the grate to 5 teeth.

1025 Saturation air flow is 560 cfm.

1030 Coaled up at 1.14 tons.

1055 Saturation air flow is 570 cfm.

1100 Saturation air flow is 600 cfm. Freeboard average is 44.25 inches.

1130 Coaled up at 1.24 tons.

1210 Saturation air flow is 610 cfm. Grate speed is D-5.

1215 Saturation air flow is 620 cfm.

1230 Freeboard average is 44.25 inches. Coaled up at 1.29 tons.

1245 Saturation air flow is 630 cfm. Coaled up at 3.0 tons.

1300 Coaled up at 1.33 tons. Saturation air flow is 640 cfm. Freeboard average is 44.25 inches.

1345 Saturation air flow is 650 cfm.

1400 Fire test ash average is 7.9 inches and freeboard is 44 inches.

1426 Saturation temperature is 62 C.

1430 Coaled up at 1.23 tons. Saturation air flow is 660 cfm.

1440 Saturation air flow is 670 cfm.

1455 Saturation air flow is 680 cfm.

1505 Saturation air flow is 690 cfm.

1510 Saturation air flow is 700 cfm. Freeboard average is 45 inches. Offtake temperature is 263 C.

1535 Stretford has started taking gas.

1615 Ash average is 3.4 inches. Slowed the grate to C-5.

1800 Fire test ash average is 7.7 inches. Rods 1,2,5 and 6 were cold rods. No spikes in the offtake temperature.

1830 Stretford shut down.

1900 Holes 2,3,4,5 and 6 are burning on top. Offtake

temperature is 352 C.

2000 Holes 1,4,5 and 7 are cold holes. Number 2 was a dirty rod. Slowed the grate to B-5. Ash average is 5.7 inches.

2040 Coaled up at 12.67 tons.

2220 Ash average is 12.8 inches. Grate speed is B-5. No clinkering is evident. Burning hotter between holes 2 and 3 as well as 5 and 6. Number 1 hole is showing fire.

2220 Saturation air flow is 650 cfm. Offtake temperature is 419 C.

2300 Saturation air flow is 600 cfm. Offtake temperature is 440 C. Cleaned the caustic pump.

2315 Saturation air flow is 500 cfm. Offtake temperature is 465 C.

2330 Coaled up at 1.04 tons. Dumped the cyclone.

November 9, 1982

0005 Fire test ash average is 18.7 inches. Freeboard average is 44 inches. Fire is burning through on all holes except 7.

0030 Coaled up at 1 ton and took a sample. Dumped ash.

0100 Freeboard average is 42.5 inches.

0130 Coaled up at 0.93 ton.

0200 Fire test ash average is 14.4 inches. Fire is still burning through on holes 1-6. Offtake temperature is dropping fast.

0230 Coaled up at 1.04 tons. Offtake temperature is 428 C.

0300 Freeboard average is 40 inches. Offtake temperature is 488 C. Saturation air flow is 450 cfm. Fire is still burning through on holes 1-6.

0330 Coaled up at .94 ton. Fire is still burning through. Offtake temperature is 483 C. Grate speed is CD-5.

0400 Fire test ash average is 21.8 inches. Freeboard average is 44 inches. Dumped ash. Offtake temperature is 465 C.

0410 Quench/ESP and Stretford system are going back on line.

0430 Coaled up at 0.92 ton. Offtake temperature is 427 C.

0445 Offtake temperature is 411 C.

0500 Freeboard average is 44 inches. Offtake temperature is 407 C.

0530 Coaled up at 0.96 ton. Offtake temperature is 378 C. Fire is stil burning through on holes 1-5.

0600 Fire test ash average is 15.1 inches. Freeboard average is 40.5 inches. Dumped ash. Offtake temperature is 355 C.

0630 Coaled up at 0.96 ton. Offtake temperature is 347 C.

0700 Freeboard average is 43.5 inches. Offtake temperature is 338 C. Still burning through on holes 2 and 3.

0730 Coaled up at 1.07 tons. Offtake temperature is 317 C. Saturation air flow is 450 cfm. Saturation temperature is 62 C. Fire loss pressure is 5.4 inches wc. Ash average is 10.4 inches.

0750 Started the agitator at 0. Offtake temperature is 310 C. Fire loss pressure is 5.5 inches wc. Ash average is 10.7 inches.

0800 The agitator is off. Freeboard average is 43.5 inches.

0820 Agitator is back on at 0. Grate speed is C-5. Dumped ash. Offtake temperature is 293 C.

0830 Coaled up at 1.09 tons. Stretford crew reports a negative pressure. Combustor primary air flow is 4000 cfm. The induced draft fan is set at 100.

0900 Stopped the agitator. Offtake temperature is 298 C. CO is 31 and CO2 is 6.1. Freeboard average is 44 inches.

0915 Number 3 hole shows burning near the wall. Offtake temperature is 307 C.

0930 Coaled up at 1.03 tons. Offtake temperature is 307 C. Ash average is 9.5 inches. Fire loss pressure is 5 inches wc.

0943 Offtake temperature is 300 C.

1000 Fire test ash average is 16 inches. Freeboard average is 43.5 inches. Grate speed is D-5.

1015 Offtake temperature is 294 C. Ash average is 10.1 inches. Saturation temperature is 63 C.

1030 Coaled up at 1.06 tons. Offtake temperature is 310 C.

1035 Agitator is set at 0.

1105 Freeboard average is 43.5 inches. Still burning through on number 3.

1115 Increased the grate speed to +E5 for 15 minutes.

1120 Agitator is off. Offtake temperature is 303 C.

1130 Dumped the cyclone. Coal up at 1.07 tons. Adjusted the grate to D-5.

1200 Fire test ash average is 15.4 inches. Offtake temperature is 290 C. Freeboard average is 44.5 inches.

1223 Grate speed is +E-5.

1230 Coaled up at 1.14 tons.

1238 Grate speed is D-5.

1240 Moved the agitator into position.

1300 Freeboard average is 44.5 inches. Offtake temperature is 275 C. Ash average is 10.2 inches. Fire loss pressure is 4.9 inches wc.

1330 Coaled up at 1.06 tons.

1400 Fire test ash average is 10.7 inches. Freeboard average is 44.5 inches. Offtake temperature is 268 C.

1430 Coaled up at 1.14 tons.

1500 Freeboard average is 44.5 inches. Offtake temperature is 274 C. Fire is showing near the wall on number 3 hole.

1515 Raised the agitator 2 inches and started it on 0.

1615 Stopped the agitator. Ash average is 16.1 inches.

1620 Increased the grate speed to E-5.

1630 Number 5 hole is burning on top. Offtake temperature is 315 C.

1700 Moved the grate drive pin to the slowest hole near the center.

1710 Grate drive is running wide open.

1735 Slowed the grate drive to D-5. Lowered the agitator 4 inches.

1800 There is burning on top of holes 2,3,4 and 5.

1815 Grate drive is E-5.

1900 Offtake temperature is 277 C.

2030 Offtake temperature is 248 C.

2100 Ash average is 7.1 inches. Slowed the grate to D-5.
Offtake temperature is 232 C. No burning through.

2215 Dumped ash. Ash average is 16.7 inches with some
clinkering. The grate is wide open on 5 teeth.

2230 Offtake temperature is 244 C. Saturation air flow is 450
cfm.

2235 Saturation air flow is 460 cfm. Offtake temperature is 239
C.

2240 Saturation air flow is 470 cfm and offtake temperature is
238 C.

2245 Saturation air flow is 480 cfm. Offtake temperature is 235
C.

2250 Saturation air flow is 490 cfm. Offtake temperature is 233
C.

2255 Saturation air flow is 500 cfm. Offtake temperature is 232
C. Slowed the grate.

2300 Number 3 hole is showing burning through. Offtake
temperature is 233 C.

2330 Coaled up at 1.2 tons.

November 10, 1982

0005 Fire test ash average is 14.8 inches. Freeboard average is
42 inches.

0030 Coaled up at 1.28 tons.

0100 Freeboard average is 40 inches.

0130 Coaled up at 1.36 tons.

0200 Fire test ash average is 8 inches. Grate speed is CD-5.

0230 Did not coal up. Letting it burn out the dry coal. Washed
coal is in the upper bin. Offtake temperature is starting
to climb (190 C). Increased the grate speed to D-5.

0300 Freeboard average is 39 inches. Offtake temperature is
still climbing. Fire is not burning through.

0330 Did not coal up. Offtake temperature is still climbing
(254 C).

0400 Fire test ash average is 4.4 inches. Freeboard average is 45 inches. Offtake temperature is 276 C. CO is coming up and the CO2 is dropping.

0430 Slowed the grate to CD-5. No coal up. Offtake temperature is 229 C.

0445 Coaled up at 2.07 tons. Coal legs are empty. Washed coal is entering the retort.

0500 Freeboard average is 43 inches. Offtake temperature is 225 C.

0530 Coaled up at 1.34 tons. Offtake temperature is 218 C.

0600 Fire test ash average is 4.4 inches. Slowed the grate to B-5. Freeboard average is 41 inches. Offtake temperature is 201 C.

0630 Coaled up at 2.1 tons.

0700 Freeboard average is 42.5 inches. Increased the saturation air flow to 525 cfm. Saturation temperature is 63 C.

0712 Increasing saturation air flow to 540 cfm.

0720 Saturation air flow is 550 cfm.

0730 Coaled up with 1.42 tons of wet coal.

0800 Fire test ash average is 10.9 inches. Freeboard average is 44.5 inches. Offtake temperature is 210 C. Saturation air flow is 550 cfm. Saturation temperature is 63 C.

0815 Increased the grate speed to C-5.

0830 Coaled up at 1.15 tons. Offtake temperature is 220 C.

0900 Freeboard average is 42 inches. Offtake temperature is 232 C. Fire loss pressure is 5.5 inches wc. Ash average is 11.5 inches.

0930 Coaled up at 1.25 tons. Offtake temperature is 243 C. Fire loss pressure is 5.5 inches wc. Ash average is 11.5 inches.

0945 Burning through is evident on hole number 3. Reduced the saturation air flow to 500 cfm. Offtake temperature is a little over 250 C.

0950 Repositioned the agitator and started it.

0955 Switched the caustic drums.

1000 Fire test ash average is 7.9 inches. Stopped the agitator.

Offtake temperature is 226 C. Reduced the grate speed to CD-5.

1025 Coaled up at 2.72 tons.

1037 Stopped loading coal at 5.57 tons.

1040 Resumed loading coal at 4.22 tons.

1050 Increased the grate speed to D-5.

1055 Started the agitator.

1105 Freeboard average is 45 inches. Ash average is 10.8 inches. Fire loss pressure is 5.3 inches wc. Offtake temperature is 234 C.

1127 Stopped the agitator in a different position. Offtake temperature is 239 C. Stopped loading coal at 12.51 tons.

1130 Coaled up at 0.97 ton.

1135 The agitator is back on. Moving it back to the previous position.

1136 Reducing the saturation air flow to 450 cfm. Offtake temperature is 244 C. Decreasing the grate speed to C-5.

1200 Fire test ash average is 7.7 inches. Freeboard average is 47.5 inches.

1230 Coaled up at 1.09 tons. Offtake temperature is 232 C. Saturation air flow is 450 cfm. Ash average is 10.5 inches. Fire loss pressure is 5.1 inches.

1300 Freeboard average is 44 inches. Offtake temperature is 233 C. Number 3 hole is showing orange, but all others are black.

1330 Coaled up at 1.14 tons.

1400 Fire test ash average is 11.9 inches. Freeboard average is 44 inches. Offtake temperature is 20 C. Number 3 shows orange near the wall and number 6 is stiff near the bottom.

1430 Increased the grate speed to CD-5. Coaled up at 1.17 tons.

1500 Freeboard average is 43.5 inches. Offtake temperature is 217 C. Ash average is 10.1 inches. Fire loss pressure is 4.6 inches.

1615 Slowed the grate drive 1/2 turn. The grate setting is C-5. Ash average is 8.4 inches. Offtake temperature is 215 C.

1620 Dumped ash.

1700 Freeboard average is 45 inches.

1800 Freeboard average is 44 inches. Ash average is 4.8 inches. Number 3 is a dirty rod and number 7 cold. Reduced the grate drive speed to BC-5. Offtake temperature is 212 C.

2000 Freeboard average is 46 inches. Ash average is 7.2 inches. Offtake temperature is 229 C.

2145 Conveyor belt broke and found a replacement.

2200 Freeboard average is 44.5 inches. Ash average is 8.1 inches. Offtake temperature is 234 C.

2330 Coaled up at 1.05 tons.

November 11, 1982

0005 Fire test ash average is 12 inches. Freeboard average is 41 inches. Number 3 and 4 bars were dirty this fire test. Offtake temperature is 229 C.

0030 Coaled up at 1.16 tons. Offtake temperature is 233 C.

0100 Freeboard average is 42 inches. Offtake temperature is 229 C.

0130 Coaled up at 1.18 tons. Offtake temperature is 224 C.

0200 Fire test ash average is 10.4 inches. All rods were red. The bed appears to be very even. Freeboard average is 44.5 inches. Reduced the grate drive speed to B-5. Offtake temperature is 222 C.

0230 Coaled up at 1.14 tons.

0300 Freeboard average is 42 inches.

0330 Coaled up at 1.13 tons.

0400 Fire test ash average is 10.8 inches. Freeboard average is 41.5 inches.

0420 Increased the temperature to 64 C.

0430 Coaled up at 1.13 tons.

0500 Freeboard average is 43 inches.

0530 Coaled up at 1.18 tons.

0600 Fire test ash average is 11 inches. Freeboard average is 40 inches. Offtake temperature is 228 C.

0630 Coaled up at 1.14 tons. Offtake temperature is 227 C.

0700 Freeboard average is 43.5 inches. Offtake temperature is 228 C. Saturation temperature is 64 C. Saturation air flow is 450 cfm.

0730 Coaled up at 1.18 tons.

0800 Fire test ash average is 8.4 inches. This was a 5 minute bar drop. Number 6 was dirty and number 5 a little low. Freeboard average is 45 inches. Offtake temperature is 208 C.

0817 Increased the saturation air flow to 460 cfm.

0830 Coaled up at 1.23 tons. Offtake temperature is 210 C. Saturation air flow is 460 cfm. Saturation temperature is 64 C. Fire los pressure is 5.3 inches wc. Ash average is 11.2 inches.

0838 Saturation air flow is 475 cfm. Offtake temperature is 207 C.

0900 Freeboard average is 46.5 inches. Offtake temperature is 207 C.

0915 Saturation air flow is 500 cfm. Offtake temperature is 207 C. Ash average is 11.5 inches. Fire loss pressure is 5.5 inches wc.

0930 Coaled up at 1.28 tons. Offtake temperature is 212 C. Ash average is 11.5 inches. Fire loss pressure is 5.5 inches wc.

0955 Exercised the vent valve.

1000 Fire test ash average is 9.1 inches. Freeboard average is 44.5 inches. Offtake temperature is 210 C.

1017 Saturation air flow is 515 cfm.

1030 Coaled up at 1.16 tons.

1040 Saturation air flow is 525 cfm. Offtake temperature is 218 C.

1100 Freeboard average is 41 inches.

1130 Coaled up at 1.16 tons.

1145 Saturation air flow is 540 cfm. Offtake temperature is 218 C. Fire loss pressure is 5.6 inches wc.

1200 Fire test ash average is 10.1 inches. Freeboard average is 44 inches. Offtake temperature is 218 C. Number 6 bar was

in for 5 minutes and still showed no clear zone.

1230 Coaled up at 1.29 tons. Offtake temperature is 221 C. The slide gate relay hung up.

1245 Changed caustic barrels.

1258 Coaled up at 4.38 tons.

1300 Freeboard average is 43.5 inches.

1336 Coaled up at 1.31 tons. Slide gate relay still hung up.

1400 Fire test ash average is 8.1 inches. Freeboard average is 43.5 inches. Number 5 was a dirty rod and clinkering was apparent. Offtake temperature is 215 C.

1430 Coaled up at 1.18 tons. Limit switch cleared. Offtake temperature is 219 C. Saturation temperature is 64 C. Saturation air flow is 540 cfm.

1500 Freeboard average is 44 inches. Offtake temperature is 218 C.

1510 Saturation air flow is 550 cfm.

1530 Coal up at 1.19 tons.

1600 Freeboard average is 44.5 inches. Ash average is 11 inches. Increased the grate drive speed to D+5. Offtake temperature is 207 C.

1630 Coaled up at 1.34 tons.

1700 Freeboard average is 45 inches. Offtake temperature is 201 C.

1730 Offtake temperature is 205 C. Ash average is 11.4 inches. Fire loss pressure is 5.8 inches wc. Gas offtake pressure is 5.9 inches wc.

1735 Dumped ash and got large clinker.

1745 Coaled up at 1.55 tons.

1800 Freeboard average is 42 inches. Offtake temperature is 195 C. Ash average is 11.6 inches. Fire loss pressure is 5.8 inches wc. Slowed the grate to D-5.

1815 Saturation air flow is 560 cfm. Offtake temperature is 195 C.

1820 Saturation air flow is 570 cfm and the offtake temperature is 196 C.

1825 Saturation air flow is 580 cfm and the offtake temperature is 198 C.

1830 Saturation air flow is 590 cfm and the offtake temperature is 200 C.

1835 Saturation air flow is 600 cfm and the offtake temperature is 199 C. Coaled up at 1.05 tons. Ash average is 12.7 inches. Fire loss pressure is 6.2 inches wc. Offtake pressure is 6.4 inches wc.

1900 Freeboard average is 46 inches. Offtake temperature is 195 C.

1930 Coaled up at 1.32 tons. Offtake temperature is 188 C. Saturation air flow is 600 cfm. Ash average is 12.8 inches. Fire loss pressure is 6.3 inches wc and offtake pressure is 6.5 inches wc.

1935 The pH is 4.5 and the pump has stopped.

1945 Dumped ash.

2000 Freeboard average is 44 inches. Ash average is 12.7 inches. Offtake temperature is 187 C. Fire loss pressure is 6.6 inches wc.

2030 Coaled up at 1.4 tons. Offtake temperature is 187 C. Ash average is 12.9 inches. Fire loss pressure is 6.5 inches wc and the offtake pressure is 6.6 inches wc.

2050 The coal bin is full at 11.10 tons.

2100 Freeboard average is 42.5 inches. Offtake temperature is 183 C.

2130 Offtake temperature is 190 C. Coaled up at 1.38 tons. Ash average is 13.3 inches. Fire loss pressure is 6.6 inches wc and the offtake pressure is 6.5 inches wc.

2200 Ash average is 9.2 inches wc. Offtake temperature is 189 C. Ash pit pressure is 13.4 inches wc. Fire loss pressure is 6.9 inches wc. Offtake pressure is 6.7 inches wc.

2230 Dumped ash.

2300 Freeboard average is 45 inches. Offtake temperature is 193 C. Ash average is 13.2 inches. Fire loss pressure is 6.8 inches wc and Offtake pressure is 6.4 inches.

2330 Coaled up at 1.36 tons.

November 12, 1982

0005 Fire test ash average is 10 inches.

0030 Coaled up at 1.54 tons.

0115 Shut down.

0145 On line. With a power blip, we lost the saturation blower and the combustor.

0200 Freeboard average is 41.5 inches. Saturation air flow is 450 cfm.

0230 Coaled up at 0.51 ton. Saturation air flow is 475 cfm.

0300 Increased the saturation air flow to 500 cfm. Freeboard average is 41 inches.

0330 Coaled up at 1.3 tons.

0400 Fire test ash average is 11.1 inches.

0430 Coaled up at 1.16 tons.

0530 Coaled up at 1.42 tons.

0600 Fire test ash average is 11.4 inches.

0630 Coaled up at 1.7 tons. Increased the saturation air flow to 525 cfm.

0645 Increased the saturation air flow to 550 cfm.

0700 Freeboard average is 43 inches.

0730 Coaled up at 1.37 tons. Offtake temperature is 167 C.

0800 Freeboard average is 42.5 inches. Offtake temperature is 161 C. Saturation air flow is 550 cfm. Saturation temperature is 64 C. Ash average is 12.3 inches. Fire loss pressure is 6.9 inches wc.

0817 Saturation air flow is 565 cfm.

0823 The Quench went down. Cyclone outlet pressure is 13.8 inches wc. The furnace induced draft fan is up to 110 cfm from 95 cfm.

0830 Coaled up at 1.31 tons. Offtake temperature is 164 C. Saturation air flow is 565 cfm.

0850 Saturation air flow is 575 cfm and the offtake temperature is 164 C.

0900 Cyclone outlet pressure is reading 13.8 inches wc. Freeboard average is 45.5 inches. Offtake temperature is 165 C.

0945 Offtake temperature is 163 C and the saturation air flow is 585 cfm.

0955 Saturation air flow is 600 cfm. Offtake temperature is 164 C.

1000 Fire test ash average is 10.7 inches. Freeboard average is 43.5 inches.

1015 Saturation temperature is 65 C with the saturation air flow at 625 cfm.

1030 Coaled up at 1.33 tons. Offtake temperature is 169 C.

1035 Started loading coal at 6.23 tons. The conveyor is frozen with ice chunks.

1100 Freeboard average is 43 inches. Offtake temperature is 173 C.

1130 Coaled up at 1.2 tons. Offtake temperature is 177 C.

1205 No steam and the boiler regulator line is frozen. Reduced the saturation air flow to 450 cfm.

1210 Reduced the saturation air flow to 400 cfm.

1225 Reduced the saturation air flow to 300 cfm.

1230 Coaled up at 1.44 tons.

1300 The steam is back on. Saturation temperature is 65 C. Saturation air flow is 300 cfm. Offtake temperature is 138 C. Fire test ash average is 12.7 inches.

1315 The offtake temperature is 145 C. Saturation air flow is 400 cfm.

1325 Increased the grate speed to C-5.

1330 Coaled up at 1.08 tons. Cleaned the screen and hopper.

1340 Saturation air flow is 425 cfm.

1350 Offtake temperature is 164 C. Saturation temperature is 65 C. Saturation air flow is 425 cfm.

1400 Freeboard average is 44.5 inches. Offtake temperature is 172 C.

1430 Coaled up at 1.09 tons. Fire test ash average is 8.4

inches. Offtake temperature is 176 C.

1445 Saturation air flow is 450 cfm.

1530 Dumped the cyclone.

1535 Saturation air flow is 500 cfm.

1600 Fire test ash average is 11.7 inches. Offtake temperature is 170 C. Fire loss pressure is 6.9 inches wc.

1630 Offtake temperature is 177 C. Coaled up at 0.91 ton.

1635 Saturation air flow is 510 cfm.

1645 Saturation air flow is 520 cfm and offtake temperature is 177 C. Dumped 620 pounds of ash.

1655 Saturation air flow is 530 cfm. Offtake temperature is 176 C.

1705 Saturation air flow is 540 cfm. Offtake temperature is 175 C.

1715 Saturation air flow is 550 cfm and the offtake temperature is 176 C.

1730 Offtake temperature is 183 C. Ash average is 13.6 inches. Fire loss pressure is 7.3 inches wc. Saturation air flow is 550 cfm.

1735 Coal bin discharge gate is jammed.

1800 Freeboard average is 43 inches. Offtake temperature is 194 C. Ash average is 12.5 inches. Increased the grate drive to D-5. Saturation air flow is 550 cfm. Ash pit pressure is 15.0 inches wc. Fire loss pressure is 8.5 inches wc. Offtake pressure is 6.1 inches wc.

1830 Coaled up at 1.22 tons. Offtake temperature is 204 C. Ash pit pressure is 14.9 inches. Fire loss pressure is 8.8 inches wc. Offtake pressure is 5.6 inches wc.

1900 Dumped 608 pounds of ash. Freeboard average is 42.5 inches. Offtake temperature is 200 C.

1930 Still having trouble with the north slide gate. Coaled up at 1.25 tons. Offtake temperature is 188 C. Ash pit pressure is 14.7 inches wc. Fire loss pressure is 9.2 inches wc.

2000 Ash average is 14.7 inches wc. Increased the grate drive speed to E-5. Ash pit pressure is 15.6 inches wc. Fire loss pressure is 9.6 inches wc. Offtake temperature is 172 C.

2030 Fire loss pressure is 9.9 inches wc. Offtake temperature is 170 C.

2045 Dumped 550 pounds of ash.

2100 Freeboard average is 44 inches. Offtake temperature is 164 C. Ash pit pressure is 15.7 inches. Fire loss pressure is 9.6 inches. Grate is set at E+5.

2105 Saturation air flow is 560 cfm. Offtake temperature is 162 C.

2115 Saturation air flow is 575 cfm. Offtake temperature is 159 C.

2125 Saturation air flow is 585 cfm. Offtake temperature is 154 C.

2135 Saturation air flow is 600 cfm. Offtake temperature is 153 C. Ash pit pressure is 16.9 inches wc. Fire loss pressure is 10.5 inches wc.

2145 Boiler is down.

2205 Boiler is back on line (frozen lines to the pressure switches).

2210 Saturation air flow is 550 cfm. Reduced grate speed to CD-5. Ash pit pressure is 6.5 inches. Offtake temperature is 141 C.

2230 Dumped ash.

2245 Installed a boiler pressure instrument line bleed off line.

2330 Coaled up at 1.2 tons. Dry coal enters the fire bed.

November 13, 1982

0005 Ash average is 7.7 inches. Freeboard average is 40.5 inches. Reduced the grate speed to C-5.

0030 Coaled up at 1.23 tons.

0130 Coaled up at 1.12 tons.

0200 Ash average is 8.4 inches. Saturation air flow is 575 cfm. Increased the grate drive speed to D-5.

0230 Coaled up at 1.07 tons. Dumped ash.

0300 Boiler is down. Flame rod was out of adjustment and ice had formed on the gas valve. It would not open.

0420 Boiler is back on line.

0520 Saturation air flow is 425 cfm and the offtake temperature is 239 C.

0530 Coaled up at 0.84 ton.

0540 Saturation air flow is 450 cfm. Offtake temperature is 232 C.

0555 Saturation air flow is 475 cfm. Offtake temperature is 221 C.

0600 Fire test ash average is 15.7 inches. Increased the grate speed to E-5.

0610 Increased the saturation air flow to 500 cfm. Offtake temperature is 193 C.

0640 Saturation air flow is 525 cfm. Offtake temperature is 186 C.

0655 Increased the saturation air flow to 550 cfm. Offtake temperature is 157 C.

0700 Freeboard average is 43.5 inches.

0720 Boiler went off and was restarted.

0730 Coaled up at 1.71 tons. Saturation temperature is 65 C. Saturation air flow is 550 cfm. Offtake temperature is 157 C.

0750 Saturation air flow is 575 cfm. Ash pit pressure is 14.7 inches wc. Fire loss pressure is 8.1 inches wc.

0758 Boiler is out. Saturation air flow is 600 cfm.

0800 Fire test ash average is 6.6 inches. Freeboard average is 43 inches. Some clinkering was evident. Saturation air flow is 600 cfm. T-705 is 152 C. Decreased grate speed to DE-5.

0820 Boiler went off and was restarted. Offtake temperature is 149 C.

0826 Boiler is down.

0830 Coaled up at 0.07 ton. Coal is stuck and the boiler is down once again.

0850 Coaled up at 1.79 tons.

0900 Freeboard average is 43.5 inches. Offtake temperature is 164 C. Saturation air flow is 600 cfm. Saturation

temperature is 65 C.

0910 Changed caustic drums.

0930 Coaled up at 0.93 ton. Coal is frozen and had to jog the gates. Offtake temperature is 174 C.

1000 Fire test ash average is 6.8 inches. Ash pit pressure is 16.1 inches wc. fire loss pressure is 8.2 inches wc. Offtake temperature is 187 C. Freeboard average is 44 inches.

1030 Coaled up at 1.32 tons.

1035 Decreased the grate speed to D-5. Offtake temperature is 195 C.

1054 Increased the grate speed to DE-5. Offtake temperature is 204 C.

1100 Freeboard average is 44.5 inches. Offtake temperature is 210 C.

1110 Coaled up at 3.49 tons.

1130 Coaled up at 7.55 tons.

1200 Fire test ash average is 9.6 inches. Freeboard average is 43.5 inches.

1230 Coaled up at 1.24 tons. Offtake temperature is 228 C.

1300 Freeboard average is 45.5 inches.

1320 Offtake temperature is 251 C. There is burning through near the wall in hole number 3. Saturation air flow is 550 cfm.

1330 Coaled up at 1.09 tons. The coal was frozen.

1358 Saturation air flow is 550 cfm. Offtake temperature is 233 C.

1400 Fire test ash average is 9.4 inches. Grate speed is D-5. Offtake temperature is 220 C. Bars are sticky.

1430 Coaled up at 1.33 tons. Offtake temperature is 211 C.

1440 Dumped ash. Cleaned the screen and hopper.

1500 Freeboard average is 44 inches. Offtake temperature is 210 C.

1530 Coaled up at 1.33 tons. Offtake temperature is 207 C.

1600 Ash average is 7.2 inches. Offtake temperature is 204 C. Freeboard average is 44.5 inches. Ash pit pressure is 16.9 inches wc. Fire loss pressure is 8.8 inches wc.

1605 Saturation air flow is 560 cfm.

1615 Saturation air flow is 575 cfm.

1630 Saturation air flow is 600 cfm.

1645 Dumped 570 pounds of ash.

1700 Freeboard average is 43 inches. Offtake temperature is 212 C. Saturation air flow is 600 cfm. Ash pit pressure is 17 inches wc. Fire loss pressure is 7.5 inches wc.

1745 Coal elevator stopped shut. It was jammed with frozen coal in the region of the bucket and the housing.

1800 Boiler is down due to a frozen pressure gauge line.

1815 Boiler is back on line. Saturation temperature is 70 C.

1930 Coal elevator is once again running.

2000 Saturation temperature is 65 C. Jacket water flow is 7 gpm. Fire test ash average is 7.7 inches. Offtake temperature is 229 C. Ash pit pressure is 15.1 inches wc. Fire loss pressure is 7.7 inches wc.

2025 Reduced the jacket water flow to 1 gpm.

2100 Offtake temperature is 240 C. Freeboard average is 4.5 inches. Ash pit pressure is 16.6 inches wc. Fire loss pressure is 8.4 inches wc.

2115 Water line froze and broke on the first floor.

2145 Saturation air flow is 450 cfm. Offtake temperature is 244 C.

2230 Fire test ash average is 17.7 inches. Burning through is evident between holes 2 & 3 and 5 & 6. Offtake temperature is 254 C. Saturation air flow is 40 cfm.

2245 Dumped 598 pounds of ash.

2300 Slowed the grate down to B-5.

November 14, 1982

0005 Fire test ash average is 14.1 inches.

0030 Coaled up at 0.76 ton.

0100 Freeboard average is 43.5 inches.

0130 Coaled up at 2.54 tons.

0200 Fire test ash average is 9.5 inches.

0230 Coaled up at 1.3 tons.

0300 Freeboard average is 43.5 inches.

0330 Coaled up at 1.21 tons.

0400 Fire test ash average is 6.5 inches.

0430 Coaled up at 1.67 tons.

0500 Freeboard average is 44.5 inches.

0730 Coaled up at 1.22 tons.

0800 Freeboard average is 44.5 inches. Bars number 6 and 7 were dirty. Low fire zone on number 1. Saturation air flow is 450 cfm. Offtake temperature is 232 C. Saturation temperature is 65 C.

0830 Coaled up at 0.64 ton.

0840 Saturation air flow is 400 cfm. Grate drive speed is C-5. Saturation temperature is 65 C.

0850 Grate drive is E-5.

0900 Freeboard average is 4.5 inches.

0915 Reduced the grate drive speed to CD-5. Offtake temperature is 229 C.

0930 Coaled up at 1.57 tons. Saturation temperature is 65 C. Grate speed is still CD-5. Saturation air flow is 400 cfm. Offtake temperature is 222 C.

1000 Fire test ash average is 6.6 inches. Freeboard average is 44 inches.

1010 Coaled up at 5.94 tons.

1035 Coaled up at 1.28 tons. Offtake temperature is 216 C.

1104 Freeboard average is 43.5 inches. Saturation temperature is 64 C.

1205 Fire test ash average is 8.6 inches. Saturation temperature is 63 C.

1300 Freeboard average is 42 inches.

1320 Saturation temperature is 62 C. Saturation air flow is 400 cfm. Offtake temperature is 222 C.

1330 Coaled up at 1.23 tons. Offtake temperature is 226 C. Saturation temperature is 62 C. Saturation air flow is 400 cfm.

1400 Fire test ash average is 5.7 inches. Freeboard average is 44 inches. Saturation temperature is 62 C. Offtake temperature is 222 C. Grate speed is C-5.

1430 Coaled up at 1.13 tons. Offtake temperature is 23 C. Fire loss pressure is 7.3 inches wc.

1520 Caustic barrels were tipped over on the first floor. Moved them to the second floor.

1600 Fire test ash average is 10.4 inches. Increased the grate drive to D+5. Offtake temperature is 212 C. Ash pit pressure is 14.1 inches wc. Fire loss pressure is 6.7 inches wc. Freeboard average is 40 inches.

1635 Burning through on number 3 hole is evident.

1645 Dumped ash. Increased the jacket water flow to 4 gpm.

1700 Reduced the grate drive speed to C+5.

1800 Scrubber discharge temperature is 77 C. The line froze to the pads on top. Checked the boiler bleed off line and found it to be frozen to the pressure switch line. Thawed these lines.

1815 Fire test ash average is 7 inches. Some clinkers evident.

1845 Burning through on holes 2,3 and 4. Offtake temperature is 244 C. Saturation air flow is 350 cfm.

1900 Dumped ash.

1945 Offtake temperature is 256 C. Burning through on holes 3 and 4.

2000 Fire test ash average is 9.2 inches. Clinkering is still a problem.

2105 Put the steam saturation on manual.

2200 Increased the jacket water flow to 10 gpm. Offtake temperature is 221 C. Ash pit pressure is 14.4 inches wc. Fire loss pressure is 6.5 inches wc.

2245 Burning through is still evident in holes number 3 and 4.

2330 Coaled up at 0.91 ton.

November 15, 1982

0005 Fire test ash average is 12.1 inches.

0030 Coaled up at 1.13 tons.

0050 Shut down due to loss of the saturation blower.

0245 Back on line. Saturation air flow is 300 cfm. Offtake temperature is 191 C. The bearings on the saturation blower were dry. Installed new grease fittings and pipe extension.

0300 Coaled up at 0.89 ton.

0330 Coaled up at 0.39 ton.

0400 Fire test ash average is 13.2 inches. Freeboard average is 42 inches.

0420 Saturation blower is working well.

0430 Coaled up at 1.11 tons.

0530 Coaled up at 1.06 tons.

0600 Fire test ash average is 15.2 inches. Saturation air flow is 350 cfm. Offtake temperature is 211 C.

0630 Coaled up at 1.33 tons.

0645 Saturation air flow is 400 cfm. Offtake temperature is 211 C.

0700 Freeboard average is 45 inches.

0730 Coaled up at 1.14 tons. Saturation temperature is 62 C. Saturation air flow is 400 cfm. Offtake temperature is 222 C.

0800 Fire test ash average is 9.3 inches. Freeboard average is 44 inches.

0830 Coaled up at 1.22 tons. Offtake temperature is 212 C.

0900 Opened the secondary air on the combustor for the Interpoll tests. Freeboard is 44.5 inches. Offtake temperature is 212 C.

0930 Coaled up at 1.23 tons. Offtake temperature is 185 C.

1000 Fire test ash average is 8.4 inches. Freeboard average is 43.5 inches. Ash pit pressure is 17.1 inches wc. Fire loss pressure is 8.8 inches wc. Offtake temperature is 187 C. Grate drive is D-5.

1030 Coaled up at 1.23 tons. Offtake temperature is 185 C.

1130 No air to operate the cyclone valve.

1147 Coaled up at 1.53 tons. Offtake temperature is 211.

1200 Cyclone is erupting with gas. Reduced the saturation air flow to 200 cfm. Cleaned the downcomer.

1240 Saturation air flow is 400 cfm. The cyclone valve air line was frozen.

1320 Coaled up at 1.76 tons.

1322 Coaled up at 3.01 tons. Ash average is 16.9 inches.

1325 Grate drive speed is E-5.

1345 Saturation temperature is set at 61 C.

1400 Freeboard average is 43 inches. Saturation temperature is 61 C. Offtake temperature is 26 C.

1430 Coaled up at 1.31 tons. Offtake temperature is 221 C. Ash pit pressure is 13.6 inches wc. Fire loss pressure is 7.1 inches wc.

1435 Fire test ash average is 9.1 inches.

1500 Freeboard average is 44.5 inches.

1600 Fire test ash average is 2.7 inches. Increased the grate drive to E+5.

1700 Freeboard average is 44 inches. Offtake temperature is 216 C. Ash pit pressure is 14.3 inches wc. Fire loss pressure is 6.5 inches wc.

1715 Dumped ash.

1730 Coaled up at 1.19 tons. Offtake temperature is 207 C. CO2 is coming down.

1800 Fire test ash average is 13.5 inches. Reduced the grate drive speed to E-5.

1830 Coaled up at 1.19 tons. Offtake temperature is 203 C. Ash pit pressure is 13.6 inches wc. Fire loss pressure is 6.4 inches wc.

1900 Freeboard average is 44 inches. Offtake temperature is 217 C. Ash pit pressure is 14.1 inches. Fire loss pressure is 6.5 inches wc.

1925 Dumped ash and found large clinkers.

1930 Coal bin weight reads 13.21 tons. Offtake temperature is 217 C. Ash pit pressure is 13.6 inches wc. Freeboard is 6.8 inches.

2000 Fire test ash average is 11.8 inches. Bars 1 and 7 are cold. Number 6 is dirty. Freeboard average is 42 inches. Ash pit pressure is 15.3 inches. Fire loss pressure is 6.9 inches wc. Offtake temperature is 211 C.

2030 Coaled up at 1.17 tons. Offtake temperature is 211 C.

2100 Freeboard average is 45 inches. Offtake temperature is 219 C. Ash pit pressure is 14.8 inches wc. Fire loss pressure is 6.8 inches.

2115 Quench started taking gas.

2145 Dumped ash and there continued to be many clinkers.

2200 Fire test ash average is 1.2 inches. All but the number 2 bar were cold. Offtake temperature is 232 C. Ash pit pressure is 13.2 inches wc. Fire loss pressure is 6.6 inches.

2230 Coaled up at 1.12 tons. Offtake temperature is 228 C.

2330 Coaled up at 1.12 tons.

November 16, 1982

0005 Fire test ash average is 9.2 inches. Slowed the grate drive to D-5. Freeboard average is 41.5 inches.

0030 Coaled up at 1.40 tons. Offtake temperature is 210 C.

0100 Freeboard average is 45 inches.

0130 Coaled up at 0.83 ton. Dumped ash.

0200 Fire test ash average is 12.1 inches. Grate drive speed is E-5. Offtake temperature is 226 C.

0230 Coaled up at 1.09 tons.

0300 Freeboard average is 43 inches.

0330 Coaled up at 1.24 tons.

0400 Fire test ash average is 12.5 inches. Freeboard average is 45.5 inches.

0430 Coaled up at 0.89 ton.

0500 Saturation air flow is 425 cfm. Offtake temperature is 220

C. Freeboard average is 43 inches.

0515 Saturation air flow is 450 cfm. Offtake temperature is 222 C.

0530 Coaled up at 1.34 tons.

0600 Fire test ash average is 10.7 inches wc. Freeboard average is 43 inches. Offtake temperature is 245 C. There is evidence of burning through in the region of holes number 2 and 3. Reduced the saturation air flow to 400 cfm.

0700 Freeboard average is 42.5 inches. Saturation temperature is 61 C. Saturation air flow is 400 cfm. Offtake temperature is 284 C. The bed is burning on top. Saturation air flow is 350 cfm.

0715 Saturation air flow is 325 cfm. Offtake temperature is 290 C.

0730 Offtake temperature is 300 C. Saturation air flow is 300 cfm.

0735 Offtake temperature is 305 C. Saturation air flow is 250 cfm.

0745 Offtake temperature is 310 C. Saturation air flow is 200 cfm.

0750 Offtake temperature is 312 C. Saturation temperature is 61 C. Saturation air flow is 200 cfm.

0805 Saturation temperature is 62 C. Fire test ash average is 6.1 inches. Freeboard average is 4.5 inches.

0825 Saturation temperature is 63 C. Saturation air flow is 200 cfm. Offtake temperature is 283 C. Grate drive speed is E+5. Ash pit pressure is 11.2 inches wc. Fire loss pressure is 6.4 inches wc.

0830 Coaled up at 1.01 tons. Offtake temperature is 274 C. Saturation temperature is 64. Saturation air flow is 250 cfm.

0845 Saturation air flow is 275 cfm. Saturation temperature is 64 C.

0900 Freeboard average is 44 inches. Offtake temperature is 255 C. Saturation air flow is 300 cfm.

0930 Saturation air flow is 300 cfm. Coaled up at 1.05 tons.

0940 Offtake temperature is 260 C.

0955 Offtake temperature is 273 C. Saturation air flow is 275

cfm.

- 1000 Fire test ash average is 9 inches. Freeboard average is 44.5 inches.
- 1020 Offtake temperature is 266 C. Saturation temperature is 64 C. Saturation air flow is 275 C.
- 1030 Coaled up at 1.05 tons. Offtake temperature is 262 C. Saturation air flow is 275 cfm. Saturation temperature is 64 C. Ash pit pressure is 11.7 inches wc. Fire loss pressure is 6.1 inches wc.
- 1100 Freeboard average is 45 inches. Burning through is evident in holes 2 and 3. Offtake temperature is 276 C. Saturation air flow is 250 cfm.
- 1112 Offtake temperature is 280 C. Saturation air flow is 225 cfm.
- 1130 Coaled up at 1.06 tons.
- 1140 Offtake temperature is 278 C. Saturation air flow is 200 cfm.
- 1145 Coaled up at 5.28 tons.
- 1205 Saturation temperature is 63 C. Freeboard average is 43.5 inches.
- 1230 Coaled up at 1.09 tons. Offtake temperature is 277 C.
- 1300 Freeboard average is 44.5 inches. Offtake temperature is 242 C. Grate drive speed is +E-7.
- 1330 Coaled up at 1.12 tons. Offtake temperature is 226 C.
- 1400 Fire test ash average is 13.6 inches. Offtake temperature is 237 C.
- 1430 Coaled up at 1.19 tons. Offtake temperature is 232 C.
- 1500 Freeboard average is 43 inches. Offtake temperature is 209 C. Ash pit pressure is 11.7 inches. Fire loss pressure is 6.8 inches.
- 1530 Coaled up at 1.19 tons. Offtake temperature is 232 C.
- 1600 Fire test ash average is 15.1 inches. Freeboard average is 4 inches.
- 1630 Coaled up at 1.21 tons. Offtake temperature is 188 C.
- 1645 Started up the Stretford.

1700 Freeboard average is 41 inches. Lots of clinkers.
Saturation air flow is 260 cfm.

1710 Saturation air flow is 275 cfm. Offtake temperature is 201 C.

1720 Saturation air flow is 285 cfm. Offtake temperature is 196 C. Lowered the induced draft fan to 120 cfm.

1730 Coaled up at 1.16 tons. Offtake temperature is 192 C. Saturation air flow is 300 cfm. Ash pit pressure is 11.5 inches wc. Fire loss pressure is 6.4 inches wc.

1800 Fire test ash average is 10 inches. Offtake temperature is 207 C. Saturation air flow is 300 cfm. Ash pit pressure is 12.4 inches wc. Fire loss pressure is 6 inches wc.

1830 Coaled up at 1.07 tons. Offtake temperature is 209 C. Ash pit pressure is 11.7 inches wc. Fire loss pressure is 6 inches wc.

1900 Freeboard average is 44 inches. Offtake temperature is 230 C. Ash pit pressure is 11.2 inches wc. Fire loss pressure is 5.9 inches wc. There is a glow on top of hole number 3.

1930 Coaled up at 1.08 tons. Offtake temperature is 232 C. Ash pit pressure is 11.4 inches wc. Fire loss pressure is 6.9 inches wc.

1940 Dumped ash.

2000 Fire test ash average is 12 inches. Offtake temperature is 228 C. Ash pit pressure is 11.7 inches. Fire loss pressure is 6.3 inches wc. Saturation air flow is 315 cfm.

2020 Saturation air flow is 325 cfm. Offtake temperature is 223 C.

2030 Coaled up at 1.01 tons. Offtake temperature is 224 C.

2100 Freeboard average is 41 inches. Offtake temperature is 234 C. Still glowing on top of number 3 hole.

2130 Coaled up at 1.03 tons. Offtake temperature is 243 C. Ash pit pressure is 11.6 inches wc. Fire loss pressure is 6 inches wc. CO2 is wandering.

2200 Dumped ash.

2210 Fire test ash average is 7.7 inches. E-7 is the grate speed.

2230 Saturation air flow is 350 cfm. Offtake temperature is 212 C.

2245 Saturation air flow is 360 cfm. Offtake temperature is 204 C.

2330 Coaled up at 1.11 tons.

November 17, 1982

0005 Fire test ash average is 8.2 inches. Freeboard average is 42 inches.

0030 Coaled up at 1.22 tons.

0100 Freeboard average is 42.5 inches.

0130 Coaled up at 1.23 tons.

0200 Fire test ash average is 8.5 inches.

0230 Coaled up at 1.36 tons.

0300 Freeboard average is 42.5 inches.

0330 Coaled up at 1.04 tons.

0400 Fire test ash average is 7.8 inches.

0430 Coaled up at 1.43 tons.

0500 Freeboard average is 43 inches.

0530 Coaled up at 1.14 tons.

0600 Fire test ash average is 11.8 inches.

0630 Coaled up at 1.17 tons.

0700 Freeboard average is 43.5 inches. Offtake temperature is 238 C. Saturation air flow is 375 cfm. Saturation temperature is 63 C.

0720 Offtake temperature is 245 C. Saturation air flow is 350 cfm.

0730 Coaled up at 1 ton. Offtake temperature is 250 C. Saturation air flow is 300 cfm.

0735 Offtake temperature is 253 C. Saturation air flow is 275 C.

0745 Offtake temperature is 259 C. Saturation air flow is 250 cfm. Burning is evident in hole number 6.

0750 Offtake temperature is 262 C. Saturation air flow is 200 cfm.

0800 Offtake temperature is 267 C. Fire test ash average is 8.4 inches. Freeboard average is 43 inches.

0830 Coaled up at 1.2 tons. Dumped ash.

0845 Offtake temperature is 235. Grate drive speed is E-7. Saturation air flow is 200 cfm. Saturation temperature is 63 C.

0900 Freeboard average is 43 inches.

0930 Coaled up at 1.02 tons. Offtake temperature is 229 C.

1000 Fire test ash average is 5.4 inches. Freeboard average is 44.5 inches. Broke loose a clinker in hole number 6.

1023 Offtake temperature is 23 C. Saturation air flow is 225 cfm.

1030 Coaled up at 1.14 tons. Offtake temperature is 222 C.

1100 Freeboard average is 43 inches. Offtake temperature is 237 C. No longer burning through.

1130 Screen change. Coaled up at 1.08 tons. Offtake temperature is 236 C.

1200 Freeboard average is 42 inches. Offtake temperature is 242 C.

1225 Saturation air flow is 230 cfm. Offtake temperature is 240 C.

1230 Coaled up at 1.13 tons.

1300 Freeboard average is 44.5 inches. Offtake temperature is 250 C. Burning through on hole number 5.

1330 Coaled up at 0.67 ton. Offtake temperature is 255 C.

1400 Fire test ash average is 8 inches. Offtake temperature is 250 C. Freeboard average is 44 inches. Burning through on number 5 and hard clinkers on number 4.

1430 Coaled up at 1.42 tons. Offtake temperature is 251 C.

1500 Freeboard average is 43.5 inches. Offtake temperature is 264 C. Saturation air flow is 220 cfm.

1540 Dumped ash. Offtake temperature is 289 C. Burning through in holes number 3 and 5.

1600 Fire test ash average is 11.1 inches. Offtake temperature is 267 C. Ash pit pressure is 12.3 inches. Fire loss pressure is 6.9 inches wc.

1630 Coaled up at 0.67 tons. The bin is empty while reading 0.31 tons. Offtake temperature is 250 C.

1640 Saturation temperature is 64 C.

1645 Dumped ash.

1700 Freeboard average is 43.5 inches. Offtake temperature is 228 C. Sampled coal.

1730 Coaled up. Offtake temperature is 243 C.

1800 Offtake temperature is 255 C.

1845 Saturation temperature is 65 C. Flushed ash cone.

1910 Offtake temperature is 301 C. Burning on holes 1 and 2.

1930 Coaled up at 0.20 tons. Offtake temperature is 305 C.

1945 Offtake temperature is 318 C. Saturation air flow is 200 cfm. Saturation temperature is 63 C. Burning through all around.

2030 Offtake temperature is 309 C.

2045 Checked the grate drive as the ash was not increasing on the scale. Flushed the cone and beat under the grate drive to finally move the dog.

2100 Freeboard average is 44 inches. Offtake temperature is 356 C.

2130 Offtake temperature is 322 C. In 45 minutes, the ash weight went from 207 to 651 pounds!

2145 Fire bed is no longer burning through.

2200 Fire test ash average is 14 inches. Offtake temperature is 285 C. The bars went in easily. Numbers 1,5,6 and 7 were cold.

2220 Dumped 1047 pounds of ash. Lots of clinkers were noted.

2230 Offtake temperature is 275 C. Ash pit pressure is 13.3 inches wc. Fire loss pressure is 7.4 inches wc.

2300 Freeboard average is 45 inches. Offtake temperature is 250 C.

2345 Coaled up at 1.6 tons.

November 18, 1982

0030 The grate is not removing the ash. Attempts to loosen the

drive failed. We banked the fire and flared off the vent. After shutdown, we opened the ash pit to find the grate drive and check dog packed solid. The whole pit was plugged. We dumped 5 hoppers of ash.

0245 Started back up.

0300 Sent gas downstream. Saturation air flow is 220 cfm. Offtake temperature is 209 C.

0700 Freeboard average is 43.5 inches. Offtake temperature is 201 C. Saturation temperature is 63 C. Saturation air flow is 275 cfm.

0730 Coaled up at 1.13 tons. Offtake temperature is 203 C.

0800 Fire test ash average is 5.6 inches. Freeboard average is 44.5 inches. Clinkering in number 7.

0830 Coaled up at 1.21 tons. Offtake temperature is 196 C.

0835 Saturation air flow is 300 cfm.

0900 Freeboard average is 44.5 inches.

0930 Coaled up at 1.18 tons. Offtake temperature is 197 tons. Saturation air flow is 325 cfm.

1000 Fire test ash average is 7.7 inches. Freeboard average is 45 inches. Offtake temperature is 192 C.

1030 Coaled up at 1.18 tons. Offtake temperature is 192 C.

1040 Started loading coal at 5.89 tons.

1100 Freeboard average is 44.5 inches. Offtake temperature is 200 C. Saturation air flow is 325 cfm. Saturation temperature is 63 C.

1130 Coaled up at 1.14 tons. Offtake temperature is 212 C. Saturation air flow is 310 cfm.

1200 Fire test ash average is 10.4 inches. Freeboard average is 43 inches. Offtake temperature is 222 C. Clinkering in number 7 hole.

1235 Coaled up at 1.16 tons.

1300 Freeboard average is 45 inches.

1330 Coaled up at 1.16 tons. Offtake temperature is 222 C.

1400 Fire test ash average is 9.3 inches. Freeboard average is 44 inches. Offtake temperature is 214 C. Saturation air flow is 325 cfm.

1430 Coaled up at 1.17 tons. Offtake temperature is 214 C.

1444 Saturation air flow is 350 cfm.

1500 Freeboard average is 42 inches. Offtake temperature is 212 C.

1530 Coaled up at 1.2 tons. Offtake temperature is 211 C.

1600 Fire test ash average is 14.4 inches. Grate drive speed is E+7. Saturation air flow is 370 cfm. Induced draft fan is 180 cfm.

1630 Coaled up at 1.21 tons. Offtake temperature is 206 C.

1700 Freeboard average is 45 inches. Offtake temperature is 212 C. Saturation air flow is 375 cfm. Ash pit pressure is 16.1 inches. Fire loss pressure is 18.6 inches.

1730 Coaled up at 1.15 tons. Offtake temperature is 212 C. Saturation temperature is 63 C.

1800 Fire test ash average is 9.4 inches. Offtake temperature is 212 C. Freeboard average is 41 inches.

1830 Coaled up at 1.12 tons. Offtake temperature is 214 C. Saturation air flow is 400 cfm.

1850 Dumped ash.

1900 Freeboard average is 44.5 inches. Offtake temperature is 218 C.

1930 Coaled up at 1.11 tons. Offtake temperature is 218 C. Ash pit pressure is 14.1 inches wc. Fire loss pressure is 8.5 inches wc.

2000 Ash average is 8.7 inches. Freeboard average is 44.5 inches. The bars are going in with ease.

2030 Offtake temperature is 204 C. Coaled up at 1.28 tons.

2045 Dumped ash.

2100 Freeboard average is 44 inches. Offtake temperature is 204 C.

2130 Coaled up at 1.37 tons. Offtake temperature is 206 C.

2200 Ash average is 14.1 inches. Offtake temperature is 198 C. Increased the grate drive to E+7.

2220 Dumped ash.

2230 Coaled up at 1.2 tons. Offtake temperature is 192 C.

2245 Increased the jacket water to 10 gpm.

2330 Coaled up at 1.35 tons.

November 19, 1982

0005 Fire test ash average is 15.1 inches. Dumped ash.

0030 Coaled up at 1.19 tons.

0100 Freeboard average is 45 inches.

0130 Coaled up at 1.37 tons.

0200 Fire test ash average is 9.5 inches. Slowed the grate drive to D-7.

0230 Coaled up at 0.84 ton. Dumped ash.

0330 Coaled up at 1.39 tons.

0400 Fire test ash average is 9.2 inches. Grate speed is B-7.

0430 Found 2 bolts broken off the shaker and replaced them.

0530 Coaled up at 1.47 tons.

0600 Fire test ash average is 19.7 inches. Grate speed is E-7.

0700 Freeboard average is 43.5 inches.

0705 Offtake temperature is 198 C. Saturation air flow is 400 cfm.

0730 Coaled up at 1.41 tons.

0740 Grate speed is E-7. Saturation temperature is 63 C.
Saturation air flow is 400 cfm. Offtake temperature is 192 C.

0800 Fire test ash average is 4 inches. Freeboard average is 43.5 inches. Turned the grate off.

0830 Coaled up at 1.2 tons. Grate is on at C-7.

0835 Saturation air flow is 410 cfm.

0845 Saturation air flow is 425 cfm. Offtake temperature is 181 C.

0900 Freeboard average is 44.5 inches. Offtake temperature is 182 C. Grate speed is C-7.

0930 Coaled up at 1.19 tons. Offtake temperature is 183 C. Ash

pit pressure is 14 inches wc. Fire loss pressure is 8.4 inches wc.

- 0940 Water line broke on the 1st floor to the boiler and quench/ESP unit. Reduced jacket water flow to 2 gpm.
- 0950 Reduced the jacket water to 1 gpm.
- 1000 No fire test or freeboard as we are conserving steam. Still working on the water line. Offtake temperature is 190 C.
- 1020 Water line repair has been completed.
- 1030 Fire test ash average is 4.9 inches. Coaled up at 1.26 tons. Freeboard average is 44.5 inches. Offtake temperature is 199 C.
- 1040 Grate is off.
- 1050 The grate is back on at 5 teeth.
- 1100 Freeboard average is 43.5 inches. Offtake temperature is 207 C.
- 1110 Started the grate at C-5. Offtake temperature is 212 C.
- 1125 Saturation air flow is 450 cfm. Offtake temperature is 214 C.
- 1130 Coaled up at 1.1 tons. Dumped ash. Offtake temperature is 215 C.
- 1135 Coaled up at 5.66 tons.
- 1200 Fire test ash average is 5.8 inches. Freeboard average is 44.5 inches. Offtake temperature is 221 C.
- 1235 Coaled up at 1.17 tons.
- 1340 Dumped the cyclone.
- 1400 Fire test ash average is 9.6 inches. Cleaned the top TC hole for T-705.
- 1440 North coal pipe feels hot. Efforts are being made to fill the pipe from on top.
- 1530 Coaled up at 1.35 tons. Efforts continue to clear and fill the north coal leg.
- 1600 The lower coal valve on the north coal leg appears to be working. Will run the agitator one sweep to even out the coal.

1635 Flushed the cyclone. The north coal leg is still empty.
1815 Started the agitator on 1 sweep per hour.
1830 Coaled up at 0.'69 ton. The south coal leg is empty.
Offtake temperature is 236 C.
1900 Ash average is 11.4 inches. Burning through on number 4.
2015 Saturation air flow is 400 cfm.
2045 Ash average is 15.1 inches. Grate drive speed is D-5.
Offtake temperature is 284 C. North coal leg is still not
feeding.
2200 Ash average is 15.6 inches. Offtake temperature is 273 C.
North feed leg is plugged and will not open.
2230 Offtake temperature is 2071 C. Burning through on hole
number 4. Continuing to work on the north leg.
2300 Freeboard average is 42.5 inches.
2315 Offtake temperature is 266 C. Started the pneumatic
vibrators on the coal legs.
2330 Coaled up at 1.23 tons. Offtake temperature is 264 C.

November 20, 1982

0005 Fire test ash average is 6.1 inches. The agitator is off.
Freeboard average is 44 inches.
0015 The agitator is back on. Offtake temperature is 265 C.
Still burning through on number 4.
0030 Coaled up at 1.04 tons. Offtake temperature is 261 C.
Dumped ash.
0100 Freeboard average is 43 inches. Offtake temperature is 257
C. Number 4 is starting to darken.
0130 Coaled up at 1.3 tons. Offtake temperature is 257 C.
0200 Fire test ash average is 7.6 inches. Freeboard average is
45.5 inches. The offtake temperature is 263 C. Agitator
is off during the fire test. Clinkering on number 3.
0230 Coaled up at 1.19 tons. Offtake temperature is 260 C.
0257 Offtake temperature readings are erratic. Straightened out
the problem with the readout.
0300 Freeboard average is 44 inches. Ash pit pressure is 19.4

inches wc. Fire loss pressure is 9.1 inches wc.

0315 Raked coal toward number 4. Could feel a poke rod wrapped up inside. Offtake temperature is 254 C.

0330 Coaled up at 1.22 tons. Offtake temperature is 250 C.

0345 Offtake temperature is 245 C. Raked coal toward number 4.

0400 Fire test ash average is 6.3 inches. Freeboard average is 44.5 inches. Bars number 2,3 and 5 are dirty.

0430 Coaled up at 1.08 tons. Offtake temperature is 248 C.

0445 All have been instructed not to go to the top level. High CO at the slide gates on the top floor makes it a danger. Coal valve is leaking on the north side. Started loading coal at 9.48 tons. CO monitor shows excessive CO (500 ppm) at the 4th floor level.

0500 Freeboard average is 45 inches.

0530 Coaled up at 1.24 tons. Offtake temperature is 248 C.

0600 Fire test ash average is 8.3 inches. Freeboard average is 45 inches. Numbers 2 and 3 were dirty bars.

0630 Coaled up at 1.25 tons. Offtake temperature is 246 C.

0700 Freeboard average is 44 inches. Offtake temperature is 246 inches.

0730 Coaled up at 1.12 tons. Dumped the cyclone.

0800 Fire test ash average is 7.1 inches. Freeboard average is 45.5 inches. Slowed the grate to CD-7.

0830 Coaled up at 1.28 tons.

0840 Coaled up at 0.37 ton. on the north leg.

0845 Dumped ash.

0900 Freeboard average is 43 inches.

0930 Coaled up at 0.79 ton.

1000 Fire test ash average is 13.2 inches.

1030 Coaled up at 1.4 tons.

1100 Freeboard average is 44 inches.

1115 Slipstream is shut down.

1125 Reduced saturation air flow to 300 cfm.

1130 Coal up.

1215 Shut down due to high levels of CO on the top level of the gasifier. Bureau of Mines personnel were notified of the existing hazardous levels of CO as was Joe Carvetti of PEDCo.

APPENDIX B

Weather Data for Testing Days

These data were taken from NOAA weather station 72658
approximately 3 miles from the test site.

Note: Barometric pressure has been adiabatically normalized to
sea level from 840 feet elevation and ambient temperature.

Temperature in degrees Farenheit

Relative Humidity in %

Barometric Pressure in inches mercury

Precipitation in inches

BOM/FGT-002

ROSEBUD

WEATHER DATA

DATE: NOVEMBER 3, 1982

DATE NOVEMBER 4, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	37	85	29.93	.01
0200	35	85	29.92	.02
0300	35	82	29.92	T
0400	34	79	29.93	T
0500	33	82	29.94	T
0600	33	78	29.95	.03
0700	32	85	29.96	.01
0800	33	78	29.97	.01
0900	32	75	29.98	.02
1000	33	75	29.99	T
1100	33	66	30.00	T
1200	33	64	30.01	
1300	34	56	30.01	
1400	34	56	30.01	
1500	33	59	30.03	
1600	32	69	30.03	T
1700	32	66	30.04	
1800	31	69	30.05	
1900	31	63	30.05	
2000	30	63	30.05	
2100	29	63	30.05	
2200	28	63	30.05	
2300	28	66	30.04	
2400	28	66	30.02	

GENERAL CONDITIONS: Cloudy sun-
rise and sunset. 204 minutes
of sunshine (34%). Maximum
wind speed was 28 mph.

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	28	71	30.01	T
0200	27	71	30.00	T
0300	28	68	29.99	T
0400	28	72	29.98	.01
0500	28	78	29.98	.02
0600	29	69	29.99	T
0700	28	69	29.99	T
0800	28	69	30.00	T
0900	29	69	30.02	T
1000	29	75	30.03	T
1100	30	75	30.04	T
1200	31	75	30.04	T
1300	31	69	30.04	
1400	32	64	30.05	
1500	31	69	30.06	T
1600	31	69	30.07	T
1700	31	69	30.08	T
1800	31	69	30.09	T
1900	30	75	30.10	T
2000	30	75	30.10	T
2100	30	69	30.10	T
2200	29	72	30.11	T
2300	29	75	30.11	T
2400	29	75	30.11	T

GENERAL CONDITIONS: Cloudy sun-
rise and sunset. No sunshine.
Maximum wind speed was 22 mph.

DATE: NOVEMBER 5, 1982

DATE NOVEMBER 6, 1982

TIME TEMP RELATIVE BAROMET RAIN
HUMIDITY PRESS. SNOW

0100	28	75	30.10	T
0200	28	75	30.10	T
0300	28	78	30.11	T
0400	28	75	30.11	T
0500	28	75	30.12	T
0600	28	75	30.12	T
0700	28	75	30.13	T
0800	28	75	30.15	T
0900	29	68	30.16	T
1000	30	68	30.16	T
1100	31	63	30.15	
1200	31	63	30.15	
1300	30	66	30.14	
1400	30	66	30.13	
1500	30	63	30.13	
1600	29	68	30.14	
1700	29	66	30.15	T
1800	29	66	30.15	T
1900	28	66	30.16	T
2000	28	66	30.16	T
2100	28	63	30.16	T
2200	28	63	30.16	T
2300	27	66	30.16	T
2400	27	63	30.16	T

GENERAL CONDITIONS: Cloudy sunrise and sunset. No sunshine. Maximum wind speed was 17 mph.

TIME TEMP RELATIVE BAROMET RAIN
HUMIDITY PRESS. SNOW

0100	28	60	30.15	T
0200	26	65	30.13	
0300	25	74	30.13	
0400	22	77	30.11	
0500	24	78	30.11	
0600	25	77	30.09	
0700	26	74	30.08	
0800	27	72	30.06	
0900	31	63	30.03	
1000	34	59	30.04	
1100	38	54	30.02	
1200	41	50	29.99	
1300	43	49	29.98	
1400	44	49	29.95	
1500	46	47	29.93	
1600	45	51	29.91	
1700	43	55	29.92	
1800	41	57	29.92	
1900	39	64	29.91	
2000	38	64	29.90	
2100	37	67	29.90	
2200	38	70	29.90	
2300	38	70	29.89	
2400	40	67	29.89	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 397 minutes of sunshine (66%). Maximum wind speed was 15 mph.

DATE: NOVEMBER 7, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	35	75	29.87	
0200	38	75	29.85	
0300	38	73	29.84	
0400	38	76	29.82	
0500	33	82	29.81	
0600	33	85	29.80	
0700	34	82	29.80	
0800	37	82	29.80	
0900	41	76	29.82	
1000	45	63	29.83	
1100	46	63	29.85	
1200	48	58	29.86	
1300	50	54	29.86	
1400	52	50	29.88	
1500	53	48	29.90	
1600	52	52	29.92	
1700	49	56	29.95	
1800	48	48	29.97	
1900	44	60	30.01	
2000	41	67	30.04	
2100	39	64	30.09	
2200	36	67	30.12	
2300	33	75	30.13	
2400	32	78	30.16	

GENERAL CONDITIONS: Hazy sunrise and sunset. 489 minutes of sunshine (82%). Maximum wind speed was 16 mph.

DATE NOVEMBER 8, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	33	75	30.18	
0200	32	75	30.20	
0300	30	78	30.21	
0400	29	82	30.23	
0500	30	78	30.25	
0600	29	81	30.26	
0700	30	78	30.28	
0800	31	75	30.31	
0900	36	69	30.32	
1000	37	64	30.32	
1100	39	59	30.34	
1200	40	57	30.34	
1300	40	57	30.35	
1400	41	57	30.34	
1500	40	59	30.33	
1600	39	57	30.33	
1700	39	57	30.33	
1800	39	55	30.35	
1900	39	55	30.35	
2000	39	55	30.36	
2100	38	59	30.37	
2200	38	59	30.37	
2300	38	62	30.37	
2400	38	62	30.37	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 156 minutes of sunshine (26%). Maximum wind speed was 15 mph.

DATE: NOVEMBER 9, 1982

DATE NOVEMBER 10, 1982

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	38	62	30.37		
0200	37	70	30.37	T	
0300	37	70	30.38	T	
0400	36	78	30.38	T	
0500	35	78	30.39	T	
0600	35	85	30.40		.05
0700	35	89	30.40	T	
0800	35	85	30.40		.02
0900	36	89	30.40		.01
1000	37	85	30.38	T	
1100	38	82	30.38	T	
1200	39	82	30.36		
1300	39	82	30.33	T	
1400	38	85	30.32	T	
1500	38	82	30.31		.03
1600	36	82	30.32		.04
1700	34	89	30.31		.08
1800	35	89	30.29		.03
1900	36	82	30.30	T	
2000	36	85	30.29	T	
2100	36	82	30.28		.03
2200	35	85	30.25		.06
2300	35	85	30.24		.06
2400	35	85	30.19		.18

GENERAL CONDITIONS: Cloudy sunrise and sunset. 1 minute of sunshine (0%). Maximum wind speed was 21 mph. Ice pellets.

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	35	89	30.17		.17
0200	36	82	30.12		.19
0300	36	82	30.08		.10
0400	36	85	30.05		.15
0500	36	85	30.02		.06
0600	36	89	30.01		.01
0700	37	86	30.00	T	
0800	37	89	29.99	T	
0900	38	89	29.99		.01
1000	39	93	29.98	T	
1100	39	89	29.97	T	
1200	40	89	29.97	T	
1300	41	86	29.96		
1400	41	79	29.96		
1500	40	79	29.97		
1600	40	76	29.97		
1700	39	79	29.97		
1800	39	76	29.99		
1900	38	76	30.00		
2000	38	79	29.99		
2100	38	76	29.99		
2200	38	76	30.00		
2300	38	76	29.99		
2400	38	79	29.98		

GENERAL CONDITIONS: Cloudy sunrise and sunset. No sunshine. Maximum wind speed was 18 mph.

DATE: NOVEMBER 11, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	38	75	29.96	
0200	38	75	29.96	
0300	38	75	29.93	
0400	37	79	29.92	
0500	37	79	29.90	
0600	37	79	29.88	T
0700	36	82	29.90	T
0800	37	79	29.81	
0900	7	79	29.84	
1000	37	82	29.81	
1100	37	82	29.79	
1200	38	75	29.69	
1300	38	82	29.68	
1400	37	82	29.66	.06
1500	37	79	29.55	.08
1600	37	85	29.56	.06
1700	38	82	29.50	.19
1800	37	85	29.47	.13
1900	36	82	29.43	.15
2000	35	84	29.47	.15
2100	35	85	29.36	.03
2200	36	85	29.39	.01
2300	35	89	29.31	.02
2400	35	85	29.34	.01

GENERAL CONDITIONS: Cloudy sunrise and sunset. No sunshine. Maximum wind speed was 25 mph.

DATE NOVEMBER 12, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	34	85	29.35	.03
0200	34	89	29.36	.03
0300	34	85	29.41	.02
0400	34	89	29.44	.03
0500	32	82	29.51	.01
0600	28	85	29.58	T
0700	24	81	29.66	T
0800	23	74	29.72	
0900	22	74	29.79	T
1000	21	77	29.84	T
1100	20	74	29.90	T
1200	20	74	29.92	T
1300	19	74	29.97	T
1400	18	70	30.02	T
1500	18	67	30.07	T
1600	17	64	30.12	T
1700	16	64	30.16	
1800	15	67	30.19	
1900	13	67	30.25	
2000	13	67	30.28	
2100	11	73	30.30	
2200	10	73	30.32	
2300	10	73	30.33	
2400	10	70	30.34	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 123 minutes of sunshine (21%). Maximum wind speed was 36 mph with blowing snow.

DATE: NOVEMBER 13, 1982

DATE NOVEMBER 14, 1982

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	9	76	30.34		
0200	9	76	30.36		
0300	9	72	30.36		
0400	8	76	30.33		
0500	8	79	30.33		
0600	9	79	30.35		
0700	9	83	30.34		
0800	11	76	30.34		
0900	12	73	30.34		
1000	13	73	30.34		
1100	15	70	30.31		
1200	16	70	30.29		
1300	17	73	30.26		
1400	18	70	30.23		
1500	18	70	30.21		
1600	19	74	30.20		
1700	19	71	30.17		
1800	19	71	30.19		
1900	20	68	30.20		
2000	20	74	30.21		
2100	20	71	30.21	T	
2200	19	77	30.21	T	
2300	19	88	30.21	.02	
2400	19	84	30.21	.01	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 108 minutes of sunshine (19%). Maximum wind speed was 14 mph.

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	19	84	30.21	.03	
0200	19	84	30.20	.01	
0300	18	84	30.20	T	
0400	17	81	30.22		
0500	16	87	30.23		
0600	15	84	30.24		
0700	14	80	30.26		
0800	14	84	30.27		
0900	16	80	30.30		
1000	17	73	30.32		
1100	19	70	30.32		
1200	21	68	30.31		
1300	22	59	30.30		
1400	23	50	30.30		
1500	23	54	30.30		
1600	22	54	30.30		
1700	20	65	30.31		
1800	20	74	30.31	T	
1900	20	74	30.31	T	
2000	18	77	30.32	T	
2100	16	80	30.31		
2200	15	77	30.31		
2300	13	80	30.28		
2400	13	84	30.28		

GENERAL CONDITIONS: Cloudy sunrise and sunset. 437 minutes of sunshine (76%). Maximum wind speed was 15 mph.

DATE: NOVEMBER 15, 1982

DATE NOVEMBER 16, 1982

TIME TEMP RELATIVE BAROMET RAIN
HUMIDITY PRESS. SNOW

0100	14	84	30.25	
0200	15	80	30.23	
0300	16	80	30.21	
0400	16	80	30.20	
0500	17	80	30.19	
0600	20	74	30.17	
0700	20	74	30.17	
0800	21	74	30.14	
0900	24	71	30.12	
1000	30	58	30.10	
1100	32	58	30.08	
1200	35	59	30.05	
1300	36	56	30.01	
1400	38	59	29.98	
1500	38	57	29.95	
1600	36	64	29.93	
1700	36	59	29.93	
1800	35	64	29.93	
1900	34	64	29.94	
2000	33	66	29.93	
2100	33	61	29.93	
2200	31	66	29.93	
2300	31	66	29.92	
2400	29	69	29.92	

GENERAL CONDITIONS: Clear sun-
rise and sunset. 458 minutes
of sunshine (80%). Maximum
wind speed was 21 mph.

TIME TEMP RELATIVE BAROMET RAIN
HUMIDITY PRESS. SNOW

0100	27	71	29.92	
0200	28	71	29.91	
0300	25	74	29.92	
0400	23	77	29.91	
0500	24	81	29.92	
0600	22	84	29.93	
0700	22	84	29.94	
0800	22	88	29.95	
0900	26	88	29.95	
1000	30	78	29.98	
1100	32	69	29.99	
1200	33	66	29.98	
1300	36	64	29.99	
1400	37	64	29.98	
1500	38	59	29.99	
1600	36	64	29.99	
1700	35	64	30.00	
1800	31	75	30.01	
1900	28	75	30.03	
2000	26	81	30.03	
2100	26	85	30.03	
2200	24	92	30.03	
2300	24	88	30.03	
2400	23	88	30.03	

GENERAL CONDITIONS: Hazy sun-
rise and sunset. 445 minutes
of sunshine (78%). Maximum
wind speed was 13 mph.

DATE: NOVEMBER 17, 1982

DATE NOVEMBER 18, 1982

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	22	88	30.02	
0200	23	88	30.04	
0300	22	92	30.03	
0400	23	88	30.03	
0500	24	85	30.03	
0600	23	88	30.02	
0700	25	85	30.02	
0800	25	85	30.03	
0900	28	85	30.02	
1000	31	85	30.00	
1100	36	72	29.99	
1200	40	62	29.99	
1300	42	62	29.96	
1400	44	60	29.95	
1500	45	58	29.92	
1600	43	60	29.93	
1700	40	65	29.92	
1800	40	65	29.92	
1900	38	70	29.93	
2000	37	72	29.93	
2100	36	72	29.94	
2200	37	75	29.94	
2300	36	76	29.95	
2400	35	78	29.96	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 348 minutes of sunshine (61%). Maximum wind speed was 16 mph.

TIME TEMP RELATIVE HUMIDITY BAROMET PRESS. RAIN SNOW

0100	36	79	29.95	
0200	35	82	29.95	
0300	36	79	29.95	
0400	36	79	29.94	
0500	35	82	29.95	
0600	35	82	29.95	
0700	35	82	29.96	
0800	35	82	29.96	
0900	38	79	29.97	
1000	42	73	29.97	
1100	45	70	29.97	
1200	47	68	29.96	
1300	50	66	29.94	
1400	50	63	29.94	
1500	48	71	29.95	
1600	48	71	29.95	
1700	47	73	29.95	
1800	47	71	29.96	
1900	47	73	29.96	
2000	46	73	29.95	
2100	47	71	29.93	
2200	46	79	29.93	
2300	46	79	29.93	
2400	46	86	29.92	

GENERAL CONDITIONS: Foggy sunrise and cloudy sunset. 337 minutes of sunshine (59%). Maximum wind speed was 23 mph.

DATE: NOVEMBER 19, 1982

DATE NOVEMBER 20, 1982

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	46	86	29.90	
0200	46	86	29.88	T
0300	47	86	29.87	.03
0400	46	89	29.84	.07
0500	47	86	29.82	.06
0600	47	89	29.82	.09
0700	48	86	29.81	.05
0800	48	89	29.80	.02
0900	48	86	29.79	.04
1000	49	86	29.77	
1100	51	83	29.76	T
1200	51	90	29.73	T
1300	52	86	29.71	T
1400	52	86	29.69	T
1500	53	83	29.69	.01
1600	53	86	29.69	T
1700	53	90	29.68	.01
1800	53	86	29.68	T
1900	53	90	29.67	T
2000	53	90	29.66	T
2100	53	90	29.65	t
2200	55	86	29.63	t
2300	56	86	29.61	T
2400	57	87	29.58	T

GENERAL CONDITIONS: Cloudy sunrise and sunset. No sunshine. Maximum wind speed was 17 mph.

TIME	TEMP	RELATIVE HUMIDITY	BAROMET PRESS.	RAIN SNOW
0100	58	83	29.54	
0200	59	83	29.51	.04
0300	59	83	29.47	.11
0400	60	81	29.46	.01
0500	60	81	29.46	
0600	60	81	29.46	
0700	59	80	29.47	
0800	59	80	29.47	
0900	58	80	29.48	.01
1000	55	80	29.51	.01
1100	51	83	29.54	T
1200	43	79	29.59	T
1300	42	73	29.62	
1400	42	65	29.66	
1500	41	60	29.71	

GENERAL CONDITIONS: Cloudy sunrise and sunset. 6 minutes of sunshine (1%). Maximum wind speed was 30 mph.

NOVEMBER WAS THE WETTEST ON RECORD SINCE 1891 WHEN RECORD KEEPING BEGAN!!

APPENDIX C

Coal Analysis Data

- C-1 Coal Sizing Data, North leg, BOM/FGT-002
- C-2 Coal Sizing Data, South leg, BOM/FGT-002
- C-3 Coal Analyses, BOM/FGT-002

Table C-1

Feed Coal Size Distribution, BOM/FGT-002
(North Coal Bin Leg)

Sample Number	Date	Shift Start Time	Screen Mesh Size inch	Cumulative Mass Fraction, % less than stated mesh size, inch				
				1/4	1/2	3/4	1	1 1/2
0	11/ 3/82	00:00	3/4	2.0	3.4	17.5	55.0	90.7
1	11/ 3/82	08:00	3/4	2.1	4.6	32.1	70.1	97.9
2	11/ 3/82	16:00	3/4	1.5	3.2	26.0	62.4	95.6
3	11/ 4/82	00:00	3/4	1.9	4.6	32.0	69.5	94.5
4	11/ 4/82	08:00	3/4	1.8	4.8	34.5	71.7	96.8
5	11/ 4/82	16:00	3/4	0.8	2.4	21.6	56.5	89.7
6	11/ 5/82	00:00	3/4	1.4	4.5	23.8	58.3	89.3
7	11/ 5/82	08:00	3/4	1.0	4.1	26.9	62.0	96.9
9	11/ 6/82	00:00	3/4	2.9	9.3	26.9	56.4	87.9
10	11/ 6/82	08:00	3/4	3.0	9.5	35.4	70.0	97.4
11	11/ 6/82	16:00	3/4	1.5	4.0	19.9	54.3	92.0
12	11/ 7/82	00:00	3/4	0.9	3.1	21.2	56.4	90.3
13	11/ 7/82	08:00	3/4	1.3	4.5	21.7	58.5	93.4
14	11/ 7/82	16:00	3/4	3.5	7.8	32.4	66.9	94.7
15	11/ 8/82	00:00	3/4	3.8	10.9	36.3	72.1	96.0
16	11/ 8/82	08:00	3/4	5.7	11.9	34.7	70.3	94.9
18	11/ 9/82	00:00	3/4	2.4	5.4	30.3	67.4	90.2
19	11/ 9/82	08:00	3/4	1.6	5.9	36.7	75.5	98.2
20	11/ 9/82	16:00	3/4	2.9	7.0	42.7	81.0	97.0
21	11/10/82	00:00	3/4	11.1	23.5	59.1	88.3	100.0
22	11/10/82	08:00	3/4	1.2	4.1	26.4	64.0	95.7
23	11/10/82	16:00	3/4	1.8	5.7	34.5	73.2	94.3
24	11/11/82	00:00	3/4	1.1	4.4	43.5	83.0	100.0
25	11/11/82	08:00	3/4	1.8	5.3	28.9	69.6	95.8
26	11/11/82	16:00	3/4	1.5	5.4	37.8	79.6	99.3
27	11/12/82	00:00	3/4	1.0	4.4	44.1	83.9	99.1
28	11/12/82	08:00	3/4	1.2	4.9	38.3	77.8	97.0
29	11/12/82	16:00	3/4	1.0	3.5	35.8	74.6	96.4
30	11/13/82	00:00	3/4	0.7	3.1	34.8	77.0	98.7
31	11/13/82	08:00	3/4	1.7	6.1	43.4	80.1	100.0
32	11/13/82	16:00	3/4	1.1	3.5	27.5	71.8	96.1
34	11/14/82	08:00	3/4	1.2	5.4	34.7	79.2	98.1
35	11/14/82	16:00	3/4	0.7	3.2	32.5	70.6	98.4
36	11/15/82	00:00	3/4	1.2	3.2	22.5	59.7	89.8
37	11/15/82	08:00	3/4	1.3	4.7	36.5	74.5	98.4
38	11/15/82	16:00	3/4	0.7	2.5	24.8	74.0	95.4
39	11/16/82	00:00	3/4	1.0	2.7	25.4	66.8	97.8
40	11/16/82	08:00	3/4	1.3	4.1	24.7	61.1	91.6
41	11/16/82	16:00	3/4	1.0	2.9	26.7	63.7	94.3
42	11/17/82	00:00	3/4	0.8	2.0	15.0	48.7	94.3
43	11/17/82	08:00	3/4	2.2	5.9	36.9	71.6	93.2
44	11/17/82	16:00	1 1/4	1.0	4.3	13.5	38.2	85.7
45	11/18/82	00:00	1 1/4	0.9	3.2	16.7	51.5	94.1
46	11/18/82	08:00	1 1/4	1.2	3.9	19.6	49.5	88.7

Sample Number	Date	Shift Start Time	Screen Mesh Size inch	Cumulative Mass Fraction, % <u>less than stated mesh size, inch</u>				
				1/4	1/2	3/4	1	1 1/2
47	11/18/82	16:00	1 1/4	1.8	5.5	20.8	47.7	92.1
48	11/19/82	00:00	1 1/4	2.8	8.3	20.5	41.6	79.8
49	11/19/82	08:00	1 1/4	2.9	9.3	23.4	47.4	89.4
Averages			3/4	1.9	5.4	31.0	68.5	94.7
			1 1/4	1.9	6.0	20.2	47.5	88.8

Table C-2

Feed Coal Size Distribution for BOM/FGT-002
(South Coal Bin Leg)

Sample Number	Date	Shift Start Time	Screen Mesh Size inch	Cumulative Mass Fraction, % less than stated mesh size, inch				
				1/4	1/2	3/4	1	1 1/2
0	11/ 3/82	00:00	3/4	1.8	3.5	21.5	59.3	91.6
1	11/ 3/82	08:00	3/4	2.0	5.0	27.8	67.6	91.8
2	11/ 3/82	16:00	3/4	2.4	5.7	34.5	69.4	96.9
3	11/ 4/82	00:00	3/4	2.0	5.8	37.5	70.8	95.4
4	11/ 4/82	08:00	3/4	1.3	3.6	28.4	67.1	96.3
5	11/ 4/82	16:00	3/4	0.7	2.2	19.5	55.8	93.4
6	11/ 5/82	00:00	3/4	1.6	4.2	27.3	60.9	94.1
7	11/ 5/82	08:00	3/4	1.5	3.5	23.7	62.0	95.7
9	11/ 6/82	00:00	3/4	2.7	7.9	30.6	66.5	95.3
10	11/ 6/82	08:00	3/4	3.2	10.0	35.0	64.9	100.0
11	11/ 6/82	16:00	3/4	0.8	2.3	16.7	47.5	78.9
12	11/ 7/82	00:00	3/4	1.0	3.6	24.6	70.0	96.4
13	11/ 7/82	08:00	3/4	1.4	4.3	21.2	59.7	92.3
14	11/ 7/82	16:00	3/4	2.1	6.0	27.5	67.8	95.2
15	11/ 8/82	00:00	3/4	2.6	7.6	27.6	66.8	93.1
16	11/ 8/82	08:00	3/4	4.2	10.2	32.6	68.1	96.1
18	11/ 9/82	00:00	3/4	1.6	5.0	27.2	66.3	97.0
19	11/ 9/82	08:00	3/4	2.1	6.4	34.4	69.6	97.1
20	11/ 9/82	16:00	3/4	2.2	5.4	32.5	74.0	94.9
21	11/10/82	00:00	3/4	4.7	11.3	37.9	67.8	91.8
22	11/10/82	08:00	3/4	1.2	3.9	25.7	60.1	94.2
23	11/10/82	16:00	3/4	1.6	4.6	30.0	71.8	96.5
24	11/11/82	00:00	3/4	1.3	4.0	40.5	79.9	96.9
25	11/11/82	08:00	3/4	1.1	3.8	36.4	76.9	98.5
26	11/11/82	16:00	3/4	1.5	4.6	30.1	74.1	98.7
27	11/12/82	00:00	3/4	0.8	3.2	29.8	74.1	96.9
28	11/12/82	08:00	3/4	1.5	6.2	41.7	79.2	96.5
29	11/12/82	16:00	3/4	0.7	3.5	41.5	84.5	100.0
30	11/13/82	00:00	3/4	2.5	7.3	40.1	77.7	100.0
31	11/13/82	08:00	3/4	0.8	3.1	33.1	73.5	98.1
32	11/13/82	16:00	3/4	0.8	4.1	40.4	78.0	96.1
34	11/14/82	08:00	3/4	7.6	19.9	62.5	90.1	98.7
35	11/14/82	16:00	3/4	1.0	4.1	36.7	75.3	96.3
36	11/15/82	00:00	3/4	3.3	9.4	44.9	77.5	97.5
37	11/15/82	08:00	3/4	1.2	4.3	30.5	70.0	97.9
38	11/15/82	16:00	3/4	0.8	3.1	24.7	59.1	93.5
39	11/16/82	00:00	3/4	1.2	2.9	20.6	54.2	88.2
40	11/16/82	08:00	3/4	2.0	5.3	34.0	70.9	94.7
41	11/16/82	16:00	3/4	1.3	3.8	30.5	66.8	94.6
42	11/17/82	00:00	3/4	1.1	3.3	22.7	64.8	94.8
43	11/17/82	08:00	3/4	1.6	4.8	27.7	61.5	93.2
44	11/17/82	16:00	1 1/4	1.2	4.0	14.1	39.5	79.2
45	11/18/82	00:00	1 1/4	1.4	4.4	21.6	60.3	92.5
46	11/18/82	08:00	1 1/4	1.5	5.1	24.5	52.9	87.7

Sample Number	Date	Shift Start Time	Screen Mesh Size inch	Cumulative Mass Fraction, % <u>less than stated mesh size, inch</u>				
				1/4	1/2	3/4	1	1 1/2
47	11/18/82	16:00	1 1/4	2.2	6.2	18.0	48.7	88.5
48	11/19/82	00:00	1 1/4	1.7	4.5	17.3	42.9	88.5
49	11/19/82	08:00	1 1/4	1.5	4.3	15.9	39.8	80.1
Averages				3/4	1.9	5.4	31.2	68.3
				1 1/4	1.7	4.9	19.5	48.9

TABLE C-3
COAL ANALYSES*

Samples Compositd Test Date	000-002 11/3/82	003-005 11/4/82	006-008 11/5/82	009-011 11/6/82	012-014 11/7/82	015-017 11/8/82	018-020 11/9/82	021-023 11/10/82	024-026 11/11/82	027-029 11/12/82	030-032 11/13/82	033-035 11/14/82	036-038 11/15/82	039-041 11/16/82	042-044 11/17/82	045-047 11/18/82	048-051 11/19/82	Average	COV
Type of Analysis ¹																			
Proximate Analysis, wt %:																			
Moisture	3.38	3.40	3.24	3.06	3.23	3.07	4.70	5.13	4.58	4.60	4.42	4.55	5.21	4.54	4.58	4.95	4.50	4.16	18.1
Volatile matter	38.42	37.85	37.94	38.45	37.71	37.71	38.63	37.89	38.26	37.11	37.84	37.09	36.42	38.37	36.86	37.01	37.27	37.70	1.7
Ash	13.34	10.32	12.77	11.63	11.82	11.65	11.42	11.16	11.42	12.52	14.60	13.14	15.56	12.12	13.58	13.30	11.55	12.46	10.7
Carbon fixed ²	44.86	48.43	46.05	46.86	47.24	47.57	45.25	45.82	45.74	45.77	43.14	45.22	42.81	44.97	44.98	44.74	46.68	46.65	3.1
Ultimate Analysis, wt%																			
Hydrogen	4.65	5.14	4.79	4.96	4.97	5.10	4.93	5.19	5.31	5.27	4.77	5.12	4.84	4.92	4.90	4.74	5.03	4.98	3.8
Carbon	62.44	65.50	63.71	65.37	64.67	64.88	62.78	63.93	63.49	62.73	60.74	62.28	59.68	62.94	62.54	62.17	64.00	63.17	2.4
Nitrogen	0.90	0.96	0.93	1.02	0.97	0.96	0.94	0.93	1.01	0.96	0.92	0.93	0.89	0.95	0.92	0.93	0.94	0.94	3.6
Sulfur	0.64	0.62	1.48	0.79	0.93	0.70	0.57	1.16	1.16	0.60	0.87	0.84	0.82	0.84	0.62	0.60	0.53	0.81	31.6
Oxygen ²	14.65	14.06	13.08	13.17	13.41	13.64	14.66	12.50	13.03	13.32	13.68	13.14	13.00	13.69	12.86	13.31	13.45	13.45	4.3
Ash	13.34	10.32	12.77	11.63	11.82	11.65	11.42	11.16	11.42	12.52	14.60	13.14	15.56	12.12	13.58	13.30	11.55	12.46	10.7
Moisture	3.38	3.40	3.24	3.06	3.23	3.07	4.70	5.13	4.58	4.60	4.42	4.55	5.21	4.54	4.58	4.95	4.50	4.18	18.2
Heating Value, Btu/lb :																			
As received	10670	11234	10897	11288	11074	11108	10839	10997	11026	10752	10366	10521	10200	10794	10650	10647	10970	10826	2.7
Moisture free	11043	11629	11262	11644	11444	11460	11374	11592	11555	11270	10845	11022	10761	11307	11161	11201	11487	11297	2.4
Ash Fusion Temperature, °F:																			
Reducing atmosphere -																			
Initial Def., IT	2180	2180	2110	2155	2170	2255	2210	2130	2155	2180	2170	2170	2200	2160	2180	2175	2205	2176	1.5
Softening, ST	2185	2185	2120	2175	2180	2265	2220	2145	2165	2190	2175	2185	2225	2165	2190	2190	2225	2187	1.5
Softening, HT	2195	2195	2145	2185	2185	2285	2230	2160	2175	2195	2180	2195	2235	2170	2195	2195	2245	2198	1.5
Fluid, FT	2205	2215	2170	2205	2260	2355	2280	2195	2195	2225	2190	2220	2250	2185	2225	2225	2260	2227	2.0
Oxidizing atmosphere -																			
Initial Def., IT	2180	2195	2190	2185	2200	2290	2180	2215	2185	2200	2180	2200	2205	2165	2255	2200	2220	2203	1.4
Softening, ST	2185	2220	2195	2195	2210	2315	2195	2225	2190	2215	2190	2215	2220	2175	2265	2220	2235	2216	1.5
Softening, HT	2190	2235	2205	2205	2220	2330	2205	2230	2200	2225	2200	2225	2240	2185	2275	2230	2245	2226	1.6
Fluid, FT	2243	2245	2235	2235	2250	2400	2220	2240	2225	2240	2225	2250	2265	2190	2315	2280	2295	2257	2.0
Free Swelling Index	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-

¹All values for coal "as received" unless otherwise noted.
²By difference

* Drying occurred during handling and transportation. Use these numbers for dry basis analyses only.

APPENDIX D

Coal Consumption Log

Coal Weights are given in short tons.

COAL FEED LOG

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1102	2005	11.89	7.80	4.09
1102	2030	7.80	7.38	0.42
1102	2130	12.51	11.24	1.27
1102	2230	11.24	9.60	1.64
1102	2330	9.60	7.96	1.64
1103	0030	7.96	6.40	1.56
1103	0130	6.40	4.85	1.55
1103	0230	4.85	3.25	1.60
1103	0330	3.25	1.85	1.40
1103	0430	6.89	5.59	1.30
1103	0530	11.52	10.03	1.49
1103	0630	10.03	8.53	1.50
1103	0730	8.53	7.06	1.47
1103	0830	7.06	5.59	1.47
1103	0930	5.58	4.00	1.58
1103	1030	4.00	2.75	1.25
1103	1130	12.54	11.07	1.47
1103	1230	11.83	10.40	1.43
1103	1330	10.40	9.02	1.38
1103	1430	9.02	7.74	1.28
1103	1530	7.74	6.44	1.30
1103	1630	6.44	5.25	1.19
1103	1730	5.25	3.96	1.29
1103	1830	3.69	2.61	1.08
1103	1930	2.60	1.44	1.16
1103	2030	6.01	4.87	1.14
1103	2130	11.78	10.62	1.16
1103	2230	10.62	9.46	1.16
1103	2330	9.46	8.15	1.31
1104	0030	8.15	7.11	1.04
1104	0130	7.11	6.00	1.11
1104	0230	6.00	4.57	1.43
1104	0330	4.57	3.75	0.82
1104	0430	3.75	2.44	1.31
1104	0530	2.44	1.38	1.06
1104	0630	12.42	11.13	1.29
1104	0730	11.12	9.88	1.24
1104	0830	9.87	8.70	1.17
1104	0930	8.70	7.40	1.30
1104	1030	7.39	5.87	1.52
1104	1130	5.86	4.39	1.47
1104	1230	4.39	2.96	1.43
1104	1330	2.95	1.50	1.45
1104	1430	5.80	4.36	1.44
1104	1530	12.00	10.69	1.31
1104	1630	10.69	9.28	1.41
1104	1730	9.28	7.84	1.44

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1104	1830	7.84	6.61	1.23
1104	1930	6.61	5.33	1.28
1104	2030	5.33	4.13	1.20
1104	2130	9.91	8.77	1.14
1104	2230	10.22	9.14	1.08
1104	2330	9.12	7.97	1.15
1105	0030	7.97	6.84	1.13
1105	0130	6.84	5.78	1.06
1105	0230	5.78	4.59	1.19
1105	0330	4.59	3.46	1.13
1105	0430	3.46	2.19	1.27
1105	0530	12.07	10.71	1.36
1105	0630	10.71	9.84	0.87
1105	0730	9.84	8.48	1.36
1105	0830	8.48	7.32	1.16
1105	0930	7.31	6.21	1.10
1105	1030	6.20	5.23	0.97
1105	1130	5.23	4.12	1.11
1105	1230	4.11	3.10	1.01
1105	1330	3.09	1.76	1.33
1105	1430	1.77	0.89	0.88
1105	1530	11.51	10.59	0.92
1105	1630	10.59	9.49	1.10
1105	1730	9.49	8.38	1.11
1105	1830	8.38	7.18	1.20
1105	1930	7.18	5.97	1.21
1105	2030	5.97	4.75	1.22
1105	2130	12.45	11.35	1.10
1105	2230	11.35	9.81	1.54
1105	2330	9.81	8.85	0.96
1106	0030	8.85	7.66	1.19
1106	0130	7.66	6.54	1.12
1106	0230	6.54	5.45	1.09
1106	0330	5.45	4.31	1.14
1106	0430	4.31	3.09	1.22
1106	0530	3.09	2.04	1.05
1106	0630	2.04	0.89	1.15
1106	0730	12.95	11.86	1.09
1106	0830	11.84	10.56	1.28
1106	0930	10.57	9.48	1.09
1106	1030	9.48	8.41	1.07
1106	1130	8.41	7.19	1.22
1106	1230	7.18	6.00	1.18
1106	1330	6.00	4.84	1.16
1106	1438	9.43	8.15	1.28
1106	1530	11.48	10.68	0.80
1106	1630	10.68	9.62	1.06
1106	1730	9.62	8.53	1.09
1106	1830	8.53	7.38	1.15
1106	1930	7.38	6.26	1.12
1106	2030	6.26	5.21	1.05

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1106	2130	12.58	11.47	1.11
1106	2230	11.47	10.30	1.17
1106	2330	10.30	9.15	1.15
1107	0030	9.15	8.10	1.05
1107	0130	8.10	7.04	1.06
1107	0230	7.04	5.97	1.07
1107	0330	5.97	4.72	1.25
1107	0430	4.72	3.64	1.08
1107	0530	11.93	10.82	1.11
1107	0630	10.82	9.62	1.20
1107	0730	9.62	8.41	1.21
1107	0910	8.41	7.02	1.39
1107	1030	7.03	5.82	1.21
1107	1130	5.82	4.83	0.99
1107	1230	4.85	3.73	1.12
1107	1330	3.75	2.54	1.21
1107	1455	12.50	11.45	1.05
1107	1530	11.45	10.97	0.46
1107	1630	10.97	9.97	1.00
1107	1730	9.97	9.02	0.95
1107	1830	9.02	8.15	0.87
1107	1930	8.15	7.08	1.07
1107	2030	7.07	6.01	1.06
1107	2130	12.41	11.31	1.10
1107	2230	11.31	10.05	1.26
1107	2330	10.03	8.63	1.40
1108	0030	8.63	7.23	1.40
1108	0130	7.23	5.73	1.50
1108	0230	5.73	4.33	1.40
1108	0330	4.33	2.92	1.41
1108	0430	8.33	6.92	1.41
1108	0530	11.62	10.40	1.22
1108	0630	11.67	10.24	1.43
1108	0730	10.24	8.94	1.30
1108	0830	8.94	7.82	1.12
1108	0930	7.81	6.66	1.15
1108	1030	6.66	5.52	1.14
1108	1130	5.53	4.29	1.24
1108	1230	4.28	2.99	1.29
1108	1330	10.21	8.88	1.33
1108	1430	10.83	9.50	1.23
1108	1530	9.60	8.35	1.25
1108	1630	8.35	7.05	1.30
1108	1730	7.05	5.73	1.32
1108	1830	5.73	4.43	1.30
1108	1930	4.43	3.21	1.22
1108	2030	3.21	2.05	1.16
1108	2130	12.68	11.48	1.20
1108	2230	11.48	10.35	1.13
1108	2330	10.35	9.31	1.04
1109	0030	9.31	8.31	1.00

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1109	0130	8.31	7.38	0.93
1109	0230	7.38	6.34	1.04
1109	0330	6.34	5.42	0.92
1109	0430	5.42	4.50	0.92
1109	0530	4.50.	3.54	0.96
1109	0630	11.80	10.84	0.96
1109	0730	12.42	11.35	1.07
1109	0830	11.35	10.26	1.09
1109	0930	10.26	9.23	1.03
1109	1030	9.23	8.17	1.06
1109	1130	8.17	7.10	1.07
1109	1230	7.09	5.95	1.14
1109	1330	5.95	4.89	1.06
1109	1430	10.6	9.52	1.14
1109	1530	13.23	12.22	1.01
1109	1630	12.22	11.21	1.01
1109	1730	11.21	10.24	0.97
1109	1830	10.24	9.18	1.06
1109	1930	9.18	7.98	1.21
1109	2030	7.98	6.78	1.20
1109	2130	6.78	5.66	1.12
1109	2230	5.66	4.49	1.17
1109	2330	4.48	3.28	1.20
1110	0030	3.28	1.99	1.29
1110	0130	1.99	0.63	1.36
1110	0445	12.07	10.00	2.07
1110	0530	10.00	8.66	1.34
1110	0630	8.66	6.56	2.10
1110	0730	6.55	5.13	1.42
1110	0830	5.13	3.98	1.15
1110	0930	3.97	2.72	1.25
1110	1037	5.57	4.22	1.35
1110	1130	12.51	11.54	0.97
1110	1230	11.53	10.44	1.09
1110	1330	10.43	9.29	1.14
1110	1430	9.29	8.12	1.17
1110	1530	8.13	7.01	1.12
1110	1630	7.01	5.81	1.20
1110	1730	5.81	4.61	1.20
1110	1830	4.61	3.49	1.12
1110	1930	3.49	2.36	1.13
1110	2030	2.36	1.21	1.15
1110	2130	2.90	1.80	1.10
1110	2230	11.24	10.15	1.09
1110	2330	10.13	9.08	1.05
1111	0030	9.88	7.92	1.16
1111	0130	7.92	6.74	1.18
1111	0230	6.74	5.60	1.14
1111	0330	5.60	4.53	1.07
1111	0430	4.53	3.40	1.13
1111	0530	10.27	9.09	1.18

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1111	0630	12.91	11.77	1.14
1111	0730	11.76	10.58	1.18
1111	0830	10.58	9.35	1.23
1111	0930	9.36	8.08	1.28
1111	1030	8.06	6.90	1.16
1111	1130	6.90	5.67	1.23
1111	1230	5.67	4.38	1.29
1111	1336	9.12	7.81	1.31
1111	1430	7.83	6.65	1.18
1111	1530	6.64	5.45	1.19
1111	1630	5.45	4.11	1.34
1111	1745	12.49	10.94	1.55
1111	1830	10.94	9.89	1.05
1111	1930	9.89	8.57	1.32
1111	2030	8.57	7.17	1.40
1111	2130	11.10	9.72	1.38
1111	2230	9.72	8.38	1.34
1111	2330	8.38	7.02	1.36
1112	0030	7.02	5.48	1.54
1112	0200	5.48	3.80	1.68
1112	0230	3.80	3.29	0.51
1112	0330	3.29	1.99	1.30
1112	0430	1.99	0.83	1.16
1112	0530	10.83	9.41	1.42
1112	0630	12.72	11.62	1.10
1112	0730	11.59	10.22	1.37
1112	0830	10.22	8.91	1.31
1112	0930	8.92	7.55	1.37
1112	1030	7.55	6.22	1.33
1112	1130	7.17	5.97	1.20
1112	1230	13.38	11.94	1.44
1112	1330	11.93	10.85	1.08
1112	1430	10.88	9.79	1.09
1112	1545	9.79	8.30	1.49
1112	1630	8.30	7.39	0.91
1112	1730	7.39	6.12	1.27
1112	1830	6.12	4.90	1.22
1112	1930	8.80	7.56	1.24
1112	2030	12.89	11.73	1.16
1112	2130	11.73	10.25	1.48
1112	2230	10.25	8.99	1.25
1112	2330	8.98	7.78	1.20
1113	0030	7.78	6.55	1.23
1113	0130	6.55	5.43	1.12
1113	0230	5.43	4.36	1.07
1113	0330	4.36	3.23	1.13
1113	0430	3.23	2.22	1.01
1113	0530	11.10	10.26	0.84
1113	0630	10.26	9.05	1.21
1113	0730	9.04	7.33	1.71
1113	0830	7.33	7.26	0.07

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)

		FROZEN COAL		
1113	0850	7.26	5.47	1.79
1113	0930	5.74	4.81	0.93
1113	1030	4.82	3.50	1.32
1113	1130	7.55	6.26	1.29
1113	1230	13.28	12.04	1.24
1113	1330	12.06	10.97	1.09
1113	1430	10.96	9.62	1.34
1113	1530	9.64	8.32	1.32
1113	1630	8.32	6.99	1.33
1113	1730	6.99	5.72	1.27
1113	1845	6.35	4.81	1.54
1113	1930	4.81	4.13	0.68
1113	2030	9.44	8.16	1.28
1113	2130	8.45	7.36	1.09
1113	2230	12.70	11.55	1.15
1113	2330	11.55	10.95	0.60
1114	0030	10.95	10.19	0.76
1114	0130	10.19	8.04	2.15
1114	0230	8.04	6.74	1.30
1114	0330	6.74	5.53	1.21
1114	0430	5.53	3.86	1.67
1114	0530	3.86	3.28	0.58
1114	0630	7.45	6.45	1.00
1114	0730	9.38	8.16	1.22
1114	0830	8.15	7.51	0.64
1114	0930	7.51	5.94	1.57
1114	1030	7.14	5.86	1.28
1114	1130	8.68	7.67	1.01
1114	1230	7.67	6.49	1.18
1114	1330	12.41	11.18	1.23
1114	1430	12.44	11.31	1.13
1114	1530	11.31	10.16	1.15
1114	1630	10.16	8.86	1.30
1114	1730	8.86	7.71	1.15
1114	1830	9.17	8.11	1.06
1114	1930	11.45	10.57	0.88
1114	2030	10.57	9.54	1.03
1114	2130	12.92	11.97	0.95
1114	2230	12.25	11.26	0.99
1114	2330	11.26	10.35	0.91
1115	0030	10.35	9.22	1.13
1115	0200	9.22	8.91	0.31
1115	0300	8.91	8.02	0.89
1115	0330	8.02	7.63	0.39
1115	0430	7.63	6.52	1.11
1115	0530	8.87	7.81	1.06
1115	0630	12.40	11.07	1.33
1115	0730	11.07	9.93	1.14
1115	0830	9.92	8.70	1.22
1115	0930	8.71	7.57	1.14

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1115	1030	7.56	6.33	1.23
1115	1147	6.31	4.78	1.53
1115	1320	4.77	3.01	1.76
1115	1430	13.16	11.85	1.31
1115	1530	11.85	10.66	1.19
1115	1630	10.66	9.60	1.06
1115	1730	9.60	8.41	1.19
1115	1830	8.41	7.22	1.19
1115	1930	13.14	12.22	0.92
1115	2030	12.22	11.05	1.17
1115	2130	11.05	10.14	0.91
1115	2230	10.14	9.02	1.12
1115	2330	9.02	7.90	1.12
1116	0030	7.90	6.50	1.40
1116	0130	6.50	5.67	0.83
1116	0230	5.67	4.58	1.09
1116	0330	4.58	3.34	1.24
1116	0430	3.34	2.45	0.89
1116	0530	12.87	11.53	1.34
1116	0630	11.53	10.52	1.01
1116	0730	10.50	9.48	1.02
1116	0830	9.47	8.46	1.01
1116	0930	8.46	7.41	1.05
1116	1030	7.40	6.35	1.05
1116	1130	6.34	5.28	1.06
1116	1230	13.06	11.97	1.09
1116	1330	11.97	10.85	1.12
1116	1430	10.85	9.66	1.19
1116	1530	9.66	8.46	1.20
1116	1630	8.46	7.25	1.21
1116	1730	7.25	6.09	1.16
1116	1830	6.09	5.02	1.07
1116	1930	11.00	9.92	1.08
1116	2030	9.92	8.91	1.01
1116	2130	10.06	9.03	1.03
1116	2230	12.59	11.26	1.33
1116	2330	11.24	10.13	1.11
1117	0030	10.13	8.91	1.22
1117	0130	8.91	7.68	1.23
1117	0230	7.68	6.32	1.36
1117	0330	6.32	5.28	1.04
1117	0430	5.28	3.85	1.43
1117	0530	3.85	2.71	1.14
1117	0630	11.55	10.38	1.17
1117	0730	10.58	9.58	1.00
1117	0830	9.57	8.37	1.20
1117	0930	8.37	7.35	1.02
1117	1030	7.35	6.21	1.14
1117	1130	6.20	5.12	1.08
1117	1230	5.11	3.98	1.13
1117	1330	3.97	3.30	0.67

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1117	1430	3.29	1.87	1.42
1117	1530	1.87	0.98	0.99
1117	1630	0.98	0.31	0.67
1117	1730	CYCLED VALVES		
1117	1830	CYCLED VALVES		
1117	1910	5.01	1.74	3.27
1117	1930	2.90	2.70	0.20
1117	2030	9.95	9.04	0.91
1117	2130	10.32	9.22	1.10
1117	2230	11.56	10.44	1.12
1117	2330	10.44	8.84	1.60
1118	0030	8.84	8.09	0.75
1118	0330	8.09	6.28	1.81
1118	0430	6.28	5.03	1.25
1118	0530	12.83	11.75	1.08
1118	0630	11.75	10.60	1.15
1118	0730	10.61	9.48	1.13
1118	0830	9.48	8.27	1.21
1118	0930	8.26	7.08	1.18
1118	1030	7.07	5.89	1.18
1118	1130	13.20	12.06	1.14
1118	1235	12.06	10.90	1.16
1118	1330	10.89	9.83	1.06
1118	1430	9.83	8.66	1.17
1118	1530	8.66	7.46	1.20
1118	1630	7.46	6.25	1.21
1118	1730	7.45	6.30	1.15
1118	1830	8.61	7.49	1.12
1118	1930	8.04	6.93	1.11
1118	2030	13.17	11.89	1.28
1118	2130	11.89	10.52	1.37
1118	2230	10.52	9.32	1.20
1118	2330	9.32	7.97	1.35
1119	0030	7.97	6.78	1.19
1119	0130	6.78	5.41	1.37
1119	0230	5.41	4.57	0.84
1119	0330	4.57	3.18	1.39
1119	0430	3.18	2.41	0.77
1119	0530	2.41	0.98	1.43
1119	0630	11.59	10.87	0.78
1119	0730	11.84	10.43	1.41
1119	0830	10.43	9.23	1.20
1119	0930	9.23	8.04	1.19
1119	1030	8.03	6.77	1.26
1119	1130	6.76	5.66	1.10
1119	1230	10.70	9.53	1.17
1119	1330	11.36	10.31	1.05
1119	1430	10.28	9.18	1.10
1119	1530	9.17	7.82	1.35
1119	1630	7.82	6.59	1.23
1119	1730	6.59	5.51	1.08

DATE	TIME	START WT. (TONS)	STOP WT. (TONS)	NET WT. (TONS)
1119	1830	5.51	4.82	0.69
1119	1930	11.74	9.77	1.97
1119	2030	9.77	8.90	0.87
1119	2130	12.76	11.69	1.07
1119	2230	11.69	10.62	1.07
1119	2330	10.61	9.38	1.23
1120	0030	9.38	8.34	1.04
1120	0130	8.33	7.30	1.03
1120	0230	7.29	6.10	1.19
1120	0330	11.78	10.56	1.22
1120	0430	10.56	9.48	1.08
1120	0530	12.61	11.37	1.24
1120	0630	11.37	10.12	1.25
1120	0730	10.12	9.00	1.12
1120	0830	9.00	7.72	1.28
1120	0930	7.35	6.56	0.79
1120	1030	6.56	5.16	1.40
1120	1130	5.16	4.77	0.39

END OF BOM/FGT - 002

ROSEBUD

APPENDIX E

Ash and Dust Analysis Data

E-1 Ash Analysis, BOM/FGT-002

E-2 Elemental Analysis of Moisture-Free Ash

Table E-1

ASH ANALYSIS, BOM/FGT-002

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				
001	11/ 2/82	18:15	11.6	26.7	40.2	48.0	60.8	0.64	18	16.9	0.59
002	11/ 2/82	21:40	15.3	32.7	49.5	64.0	88.7	0.69	17	17.2	0.38
003	11/ 3/82	02:25	20.0	45.7	63.9	74.0	89.4	0.61	22	17.8	0.33
004	11/ 3/82	07:40	18.7	43.1	59.7	70.3	89.0	0.63	17	12.3	0.34
005	11/ 3/82	12:20	23.7	46.9	64.1	78.6	92.8	0.76	15	6.3	0.32
006	11/ 3/82	18:30	28.2	48.6	63.3	73.5	92.6	0.84	34	4.5	0.42
007	11/ 3/82	22:15	28.4	50.6	63.9	70.4	92.1	0.76	23	4.7	0.56
008	11/ 4/82	02:50	27.2	49.6	63.0	74.3	100.0	0.82	-	4.0	0.90
009	11/ 4/82	06:45	21.4	46.3	68.3	84.3	99.4	0.82	-	2.1	0.48
010	11/ 4/82	07:50	23.5	40.4	54.8	68.9	100.0	0.87	-	3.1	0.90
011	11/ 4/82	10:30	32.6	53.4	70.3	83.3	100.0	0.91	30	1.2	0.76
012	11/ 4/82	13:00	29.4	48.3	63.2	76.3	100.0	1.02	9	1.9	0.71
013	11/ 4/82	16:30	50.3	56.2	59.9	66.3	79.6	1.01	19	6.3	0.73
014	11/ 4/82	19:05	28.5	42.0	54.0	66.9	91.9	0.91	8	8.0	1.0
015	11/ 4/82	21:05	37.5	43.0	49.4	55.8	86.6	1.03	28	14.3	1.3
016	11/ 4/82	22:50	30.4	45.3	59.5	71.0	95.2	0.98	15	5.2	0.76
017	11/ 5/82	01:40	65.1	72.7	76.5	80.7	86.7	0.86	7	25.8	1.3
018	11/ 5/82	02:30	44.6	52.6	57.3	60.6	77.3	0.97	2	8.7	0.97
019	11/ 5/82	04:15	42.1	51.3	59.3	66.6	87.6	1.08	7	6.4	0.84
020	11/ 5/82	06:30	68.0	76.9	82.2	86.9	89.3	0.84	9	26.5	0.99
021	11/ 5/82	09:30	22.9	28.5	33.9	41.0	64.8	1.08	2	25.0	0.11
022	11/ 5/82	11:47	92.5	97.0	98.4	99.1	100.0	0.70	1	42.7	1.2
023	11/ 5/82	13:20	23.6	30.9	37.9	45.8	67.6	0.99	4	16.1	0.63
024	11/ 5/82	16:30	45.7	59.4	71.6	82.3	100.0	1.08	10	30.5	1.0
025	11/ 5/82	18:30	56.0	65.5	69.2	80.4	100.0	-	27	26.7	0.65
026	11/ 5/82	20:30	53.2	63.8	71.6	78.3	93.4	0.84	5	42.8	0.99
027	11/ 5/82	22:22	54.3	63.3	71.3	77.1	89.5	0.77	9	49.2	1.0
028	11/ 6/82	00:30	31.5	41.2	49.3	55.1	76.2	0.88	3	32.8	0.73
029	11/ 6/82	03:15	75.1	82.7	88.2	94.9	100.0	0.74	14	41.0	1.4
030	11/ 6/82	06:10	44.7	55.7	63.1	70.7	80.0	0.87	9	46.5	0.97
031	11/ 6/82	08:30	45.7	61.3	72.9	80.2	100.0	0.91	13	35.8	0.6
032	11/ 6/82	11:00	38.0	47.4	56.8	64.6	72.3	0.90	6	31.4	1.0
033	11/ 6/82	13:15	37.6	48.1	52.9	58.7	84.8	0.92	-	42.7	0.82
034	11/ 6/82	17:20	61.9	67.7	70.9	74.2	88.4	-	-	48.5	1.4
035	11/ 6/82	19:15	41.4	52.7	58.4	68.3	93.4	0.93	1	42.0	1.7
036	11/ 6/82	21:30	65.8	74.2	78.7	82.4	95.0	0.82	1	40.0	1.3
037	11/ 7/82	00:30	75.7	83.2	87.0	90.5	100.0	0.81	2	45.1	1.3
038	11/ 7/82	05:30	74.0	81.7	85.4	88.9	93.9	0.82	1	41.0	1.5
039	11/ 7/82	07:30	39.6	50.1	56.6	61.1	100.0	-	22	24.1	0.9
040	11/ 7/82	11:15	47.2	64.6	78.0	86.9	100.0	0.79		25.0	0.79
041	11/ 7/82	13:30	45.9	57.8	64.3	69.8	83.3	0.90	13	11.2	0.61
042	11/ 7/82	16:17	33.6	46.5	59.9	71.2	91.9	-	10	8.1	0.67
043	11/ 7/82	20:10	47.8	57.2	68.2	76.7	99.9	0.90	11	12.8	0.84
044	11/ 7/82	21:10	21.0	34.0	45.5	56.8	83.6	0.95	2	36.6	1.5
045	11/ 7/82	22:05	5.7	13.3	22.5	40.4	74.5	-	1	1.7	0.91

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				
046	11/ 7/82	23:00	23.0	37.5	49.9	60.6	92.7	0.93	1	7.8	0.56
047	11/ 8/82	00:00	27.4	43.4	56.6	71.7	84.8	0.94	1	4.4	0.48
048	11/ 8/82	01:00	40.3	53.7	65.0	75.5	97.4	0.95	1	17.4	0.68
049	11/ 8/82	02:00	35.2	48.6	58.1	68.5	87.6	1.01	5	18.9	0.88
050	11/ 8/82	03:20	49.1	64.6	74.5	79.9	91.0	0.89	5	6.4	0.82
051	11/ 8/82	05:33	21.8	38.7	51.2	65.8	89.0	0.88	1	6.0	0.77
052	11/ 8/82	06:30	23.9	39.0	48.1	57.0	80.6	1.09	2	5.0	0.91
053	11/ 8/82	07:30	40.5	63.1	77.6	85.7	100.0	0.94	4	7.0	1.4
054	11/ 8/82	11:25	32.4	46.3	54.3	61.1	87.6	1.00	11	3.3	1.3
055	11/ 8/82	14:30	52.7	68.1	77.6	82.8	94.7	0.99	13	5.6	0.93
056	11/ 8/82	17:50	31.9	45.9	54.5	63.9	80.1	1.05	13	1.9	0.80
057	11/ 8/82	20:05	44.7	70.0	80.6	88.0	100.0	1.00	16	2.7	1.5
058	11/ 8/82	22:25	30.1	52.4	66.6	82.6	100.0	-	16	2.3	0.82
059	11/ 9/82	01:00	31.0	53.1	67.0	77.4	100.0	0.85	14	2.9	1.5
060	11/ 9/82	04:00	22.0	39.5	55.5	65.2	100.0	0.87	12	0.98	1.4
061	11/ 9/82	06:00	20.8	49.0	69.6	83.1	100.0	0.80	6	1.2	0.93
062	11/ 9/82	08:20	38.5	62.9	75.4	86.4	100.0	0.95	10	1.1	0.90
063	11/ 9/82	11:05	46.9	73.0	82.6	89.1	100.0	0.99	9	1.0	0.89
064	11/ 9/82	13:30	20.6	42.8	57.2	73.6	100.0	0.95	8	1.8	0.99
065	11/ 9/82	15:35	36.8	55.9	65.4	73.0	93.7	1.03	8	3.3	1.2
066	11/ 9/82	18:20	46.1	66.8	-	81.7	100.0	0.98	19	2.4	1.3
067	11/ 9/82	20:15	24.6	43.5	59.6	70.6	96.3	1.03	5	1.9	1.0
068	11/ 9/82	21:13	22.3	38.3	51.9	64.5	90.0	0.90	8	3.4	1.3
069	11/10/82	00:10	47.5	64.4	73.9	79.4	100.0	0.92	10	4.0	1.7
070	11/10/82	02:40	49.5	67.4	77.2	88.9	100.0	0.85	11	4.0	1.7
071	11/10/82	05:30	31.8	52.9	68.2	79.8	100.0	0.87	4	3.1	2.4
072	11/10/82	09:15	39.6	59.0	69.9	76.0	90.1	0.88	12	1.1	0.94
073	11/10/82	12:30	45.2	66.0	77.8	86.0	100.0	0.99	14	1.8	1.1
074	11/10/82	15:30	19.1	31.3	41.5	51.8	88.1	-	5	0.36	0.86
075	11/10/82	-	36.6	53.3	63.2	71.2	94.8	1.01	19	1.3	1.6
076	11/11/82	01:05	37.9	56.6	67.1	77.4	100.0	0.82	10	0.69	1.2
077	11/11/82	03:00	45.4	64.0	72.7	76.0	93.6	0.97	11	1.0	1.0
078	11/11/82	06:30	24.3	42.4	52.7	60.3	91.9	0.89	6	0.59	2.4
079	11/11/82	08:45	30.2	46.9	59.2	76.4	95.2	0.92	7	0.76	1.5
080	11/11/82	12:20	73.4	87.3	92.9	94.3	100.0	0.94	15	2.3	4.3
081	11/11/82	14:30	41.0	60.0	71.9	81.7	97.1	0.89	10	0.90	1.0
082	11/11/82	17:00	-	-	-	-	-	-	-	-	-
083	11/11/82	21:30	54.1	66.7	73.6	79.0	90.4	0.98	12	1.8	1.7
084	11/11/82	21:45	77.8	90.9	93.4	96.9	100.0	-	16	1.8	1.5
085	11/11/82	22:00	18.6	28.6	35.7	41.7	68.1	-	6	0.45	0.99
086	11/12/82	01:00	52.4	68.6	75.5	78.7	100.0	0.88	11	2.6	2.1
087	11/12/82	04:00	74.2	91.8	95.2	98.1	100.0	1.0	15	2.5	2.6
088	11/12/82	06:30	78.5	89.1	98.7	99.6	100.0	0.90	13	1.5	1.5
089	11/12/82	08:20	66.1	79.2	85.9	90.8	100.0	-	33	1.8	2.1
090	11/12/82	11:30	36.3	61.3	74.3	81.1	100.0	0.88	11	1.1	1.9
091	11/12/82	14:00	39.5	60.2	68.9	77.8	100.0	0.97	22	0.49	1.1
092	11/12/82	17:00	28.4	48.4	60.1	69.2	91.1	-	9	0.55	0.80
093	11/12/82	18:00	34.1	56.0	67.0	79.2	100.0	-	12	1.1	1.1
094	11/12/82	20:00	38.1	58.4	71.6	82.9	97.7	0.94	9	0.86	0.86
095	11/12/82	22:30	73.6	85.3	90.0	93.1	100.0	0.90	28	0.98	1.1

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				
096	11/13/82	02:15	46.4	64.6	75.2	84.1	100.0	0.91	16	0.85	1.0
097	11/13/82	07:00	43.0	63.5	72.7	80.9	97.1	0.93	12	1.2	0.98
098	11/13/82	07:20	42.1	66.6	79.1	88.0	100.0	0.90	7	0.40	0.54
099	11/13/82	10:30	35.8	61.8	76.2	87.1	100.0	0.89	11	1.0	0.60
100	11/13/82	14:00	38.0	59.0	72.5	82.5	90.4	0.88	11	0.81	0.77
101	11/13/82	17:00	40.5	61.0	70.7	79.1	94.7	0.83	11	2.0	1.6
102	11/13/82	19:00	23.3	38.4	52.4	64.8	100.0	0.81	9	0.99	1.2
103	11/13/82	22:30	32.2	47.5	61.8	72.3	90.8	0.99	10	1.1	0.97
104	11/14/82	01:10	47.6	63.5	71.8	78.5	88.2	0.98	4.7	1.4	0.71
105	11/14/82	03:30	36.0	56.4	67.8	78.4	94.1	0.84	6.6	1.3	0.83
106	11/14/82	07:00	39.5	57.5	68.3	75.0	97.5	0.90	11.4	1.6	0.73
107	11/14/82	11:00	32.4	56.1	71.8	84.1	94.6	0.80	5.4	3.7	0.72
108	11/14/82	14:15	41.5	59.7	71.9	80.0	96.1	0.87	6.9	5.6	1.0
109	11/14/82	16:00	39.3	59.6	72.1	80.8	100.0	0.83	2.7	9.8	0.38
110	11/14/82	19:00	31.8	48.9	62.1	73.2	100.0	0.98	11.6	7.0	0.31
111	11/14/82	21:30	27.7	49.3	65.2	76.6	100.0	1.03	11.2	3.8	0.24
112	11/15/82	02:30	38.5	56.5	69.6	77.1	90.8	0.95	16.5	5.2	0.38
113	11/15/82	05:00	47.0	65.6	75.9	83.9	92.3	0.97	17.3	7.9	0.39
114	11/15/82	06:30	27.9	49.6	70.2	85.2	100.0	1.0	0.7	9.4	0.50
115	11/15/82	08:30	28.0	43.5	53.5	62.2	88.6	0.99	1.4	7.5	0.37
116	11/15/82	10:00	61.6	77.8	87.8	94.0	100.0	0.96	7.9	13.0	0.54
117	11/15/82	14:00	27.2	44.9	57.4	69.2	100.0	0.85	4.4	2.2	0.35
118	11/15/82	17:30	29.4	49.2	60.2	69.1	90.9	1.03	3.0	3.5	0.27
119	11/15/82	19:00	34.3	49.1	57.6	65.7	88.5	0.98	5.7	4.5	0.36
120	11/15/82	21:30	34.4	49.7	59.6	69.2	95.5	1.02	5.7	6.8	0.50
121	11/16/82	00:45	26.7	42.6	56.8	68.1	85.4	0.92	10.7	5.3	0.41
122	11/16/82	03:30	12.4	30.7	48.4	65.1	81.0	0.94	0.25	1.5	0.27
123	11/16/82	08:30	22.6	37.6	50.5	60.8	100.0	1.01	1.5	6.0	0.48
124	11/16/82	13:00	24.7	46.6	61.9	70.0	94.8	1.1	1.9	2.4	0.28
125	11/16/82	14:30	27.9	43.1	53.8	66.4	85.2	1.03	0.73	4.2	0.31
126	11/16/82	17:00	18.1	33.9	47.5	62.4	95.7	1.09	2.1	2.1	0.49
127	11/16/82	19:00	22.6	37.0	50.0	60.9	100.0	0.88	3.0	1.8	0.34
128	11/16/82	21:00	29.3	44.8	55.4	63.5	92.7	0.90	1.1	2.1	0.33
129	11/17/82	02:15	32.4	50.6	65.2	78.4	100.0	0.93	14.8	2.9	0.43
130	11/17/82	03:50	31.1	50.6	67.9	79.1	100.0	0.83	12.0	4.9	0.51
131	11/17/82	08:30	54.1	68.9	78.3	89.6	100.0	1.02	2.7	9.6	0.56
132	11/17/82	11:45	37.3	51.7	63.1	74.8	100.0	1.05	4.7	6.3	0.53
133	11/17/82	15:30	35.7	56.9	68.4	77.2	95.3	0.99	14.2	5.0	0.32
134	11/17/82	16:45	32.3	46.2	55.9	66.3	83.8	-	18.2	8.9	0.34
135	11/17/82	22:00	11.9	23.0	38.4	62.6	100.0	-	0.62	4.1	0.38
136	11/17/82	23:30	32.5	50.4	64.8	75.7	100.0	-	25.6	10.7	0.35
138	11/18/82	04:15	46.9	61.7	72.5	82.1	100.0	0.91	3.0	10.9	0.51
139	11/18/82	06:30	33.2	58.8	74.9	88.9	100.0	0.95	2.4	10.7	0.38
140	11/18/82	09:00	43.4	60.9	74.6	83.4	94.4	0.89	4.3	10.9	0.34
141	11/18/82	13:00	40.5	65.4	79.0	88.2	100.0	1.04	0.79	8.8	0.36
142	11/18/82	15:00	28.8	52.8	68.2	78.5	100.0	0.99	0.09	10.5	0.35
143	11/18/82	16:30	10.6	25.2	37.4	49.4	100.0	0.93	1.1	1.9	0.37
144	11/18/82	18:30	18.1	34.8	47.4	56.1	74.4	0.89	0.60	10.0	0.35
145	11/18/82	21:00	32.5	55.4	68.3	78.2	96.7	0.88	1.1	8.0	0.36
146	11/18/82	22:00	21.3	36.8	47.1	54.2	67.7	0.95	0.40	4.6	0.28

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				
147	11/18/82	23:30	16.1	24.7	33.8	41.8	74.0	-	0.65	5.5	0.27
148	11/19/82	02:00	22.3	41.4	55.7	70.8	100.0	-	0.29	9.0	0.38
149	11/19/82	04:00	33.8	47.5	52.1	59.9	75.1	0.88	0.19	9.0	0.26
150	11/19/82	07:00	27.9	46.3	58.0	64.7	94.5	-	0.13	8.0	0.34
151	11/19/82	08:20	32.5	51.1	61.9	71.5	92.0	-	5.6	9.3	0.42
152	11/19/82	11:30	28.5	43.0	55.2	66.5	95.1	1.09	5.9	11.1	0.65
153	11/19/82	14:30	47.8	64.6	73.6	77.7	95.5	1.03	7.6	7.8	0.58
154	11/19/82	18:00	33.5	52.1	65.2	76.0	100.0	-	5.2	2.4	0.38
155	11/19/82	22:00	9.5	19.8	34.5	47.6	95.1	-	2.6	5.8	0.49
156	11/20/82	00:35	28.2	44.9	58.7	68.7	100.0	0.92	4.3	7.1	0.45
157	11/20/82	03:15	33.6	49.4	62.7	76.1	100.0	0.99	8.1	3.5	0.29
158	11/20/82	06:15	17.5	37.0	51.8	65.3	92.8	0.86	2.6	9.1	0.56
159	11/20/82	08:45	25.0	43.2	57.4	74.9	100.0	0.92	4.6	7.0	0.54
160	11/20/82	10:30	37.5	56.7	68.7	75.5	100.0	1.01	4.1	3.9	0.68
161	11/20/82	13:00	-	-	-	-	-	0.92	10.0	6.5	0.47

AVERAGES

Samples	005 - 161	35.9	53.7	64.7	74.0	93.6	0.93	8.6	9.3	0.87
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TABLE E-2

CHEMICAL ANALYSIS OF MOISTURE-FREE ASH

DATE	COMPOSITED SAMPLE NUMBERS	MASS FRACTION, %, FOR ELEMENT											
		Fe	Fe ²⁺	Si	Al	C	Ca	Mg	K	P	Na	S	Ti
11/2	001-002	10.1	6.3	20.2	9.1	14.0	0.98	0.43	1.3	0.014	0.19	0.24	0.52
11/3	003-007	10.1	5.9	22.3	10.1	7.6	3.8	0.91	1.3	0.018	0.44	0.36	0.51
11/4	008-016	3.0	2.1	20.8	7.5	10.1	10.5	1.9	0.47	0.10	0.64	0.83	0.38
11/5	017-027	3.4	1.7	15.7	6.3	33.5	9.3	1.3	0.36	0.080	0.45	0.79	0.33
11/6	028-036	2.5	2.1	11.9	4.9	46.7	8.2	0.96	0.24	0.085	0.43	1.0	0.31
11/7	037-046	5.3	3.2	18.6	7.0	6.7	10.7	1.8	0.37	0.10	0.64	1.0	0.35
11/8	047-058	5.3	4.4	20.3	7.6	3.2	12.3	1.9	0.43	0.10	0.6	0.70	0.37
11/9	059-068	5.1	3.2	20.6	6.9	2.7	11.5	1.9	0.50	0.12	0.69	1.0	0.37
11/10	069-075	5.5	3.2	21.2	6.9	1.4	10.7	1.9	0.57	0.10	0.75	0.93	0.41
11/11	076-085	4.6	2.1	20.6	8.0	1.4	12.8	1.9	0.44	0.11	0.69	1.4	0.36
11/12	086-095	5.9	3.2	20.7	8.7	0.96	11.5	2.0	0.53	0.10	0.74	0.88	0.40
11/13	096-103	5.3	3.2	22.8	7.5	1.1	9.5	1.8	0.62	0.081	0.73	0.99	0.42
11/14	104-111	5.3	2.5	20.0	7.7	7.0	10.8	1.9	0.38	0.10	0.74	0.57	0.38
11/15	112-120	4.6	3.2	20.2	6.2	7.4	11.0	1.8	0.46	0.10	0.68	0.62	0.40
11/16	121-128	5.0	2.1	20.7	6.6	2.7	11.2	1.9	0.50	0.11	0.77	0.56	0.44
11/17	129-137	4.4	3.2	20.0	7.1	9.3	10.5	1.7	0.45	0.10	0.77	0.68	0.37
11/18	138-147	3.6	2.7	19.6	6.3	5.9	10.3	1.6	0.51	0.10	0.70	0.46	0.38
11/19	148-155	4.6	3.2	22.5	5.9	7.8	10.6	1.6	0.41	0.10	0.73	0.74	0.37
11/20	156-161	4.4	2.1	20.6	6.9	6.3	10.5	1.7	0.44	0.082	0.78	1.1	0.38
Average (**)		4.6	2.8	19.8	6.90	9.10	10.7	1.70	0.45	0.010	0.68	0.84	0.38

** Average based on sample numbers 008-161

APPENDIX F

Ash Removal Log

Ash weights are given in pounds.

Flush water is given in gallons.

ASH LOG
BOM/FGT 002 ROSEBUD

DATE	TIME	SAMPLE NUMBER	INITIAL DRY WT.	FINAL DRY WT.	NET DRY WT.	INITIAL WET WT.	FINAL WET WT.	NET WET WT.	NET DRY & NET WET	FLUSH GALS.
1103	0235	003	570	58	512	451	50	401	913	30
1103	0740	004	720	65	655	465	53	412	1067	30
1103	1220	005	580	62	518	480	51	429	947	30
1103	1830	006	538	63	475	438	51	387	862	30
1103	2215	007	525	77	448	520	50	470	918	30
1104	0205	008	961	65	896	622	45	577	1473	30
1104	0645	009	973	62	911	570	50	520	1431	30
1104	0750	010	825	61	764	550	50	500	1264	30
1104	1030	011	734	53	681	540	50	490	1171	30
1104	1300	012	681	48	633	527	54	473	1106	30
1104	1630	013	1224	54	1170	535	63	472	698	30
1104	1905	014	800	47	753	453	42	411	1164	30
1104	2105	015	787	54	733	465	46	419	1152	30
1104	2250	016	637	54	583	484	40	444	1027	30
1105	0140	017	900	48	852	524	51	473	1325	30
1105	0230	018	535	49	486	460	60	400	886	30
1105	0415	019	725	57	668	445	58	387	1055	30
1105	0630	020	790	50	740	449	57	392	1132	30
1105	0930	018	1100	46	1054	483	48	435	1489	30
1105	1147	022	833	500	333	912	46	866	1199	30
1105	1320	023	403	48	355	450	48	402	757	30
1105	1630	024	769	99	670	486	51	435	1105	30
1105	1830	025	612	54	558	946	69	877	1435	30
1105	2030	026	690	50	640	423	53	370	1010	30
1105	2222	027	546	61	485	436	34	402	887	30
1106	0030	028	638	65	573	456	56	400	973	30
1106	0315	029	670	53	617	430	39	391	1008	30
1106	0610	030	670	57	613	439	62	377	990	30
1106	0830	031	512	84	428	469	68	401	829	30
1106	1100	032	794	55	739	458	60	398	1137	30
1106	1315	033	784	60	724	411	35	376	1100	30
1106	1720	034	1056	63	993	310	41	329	1322	30
1106	1915	035	518	71	447	338	52	286	733	30
1106	2130	036	590	50	540	405	57	348	888	30
1107	0030	037	706	49	657	400	43	357	1014	30
1107		038	849	52	797	400	32	368	1165	30
1107	0730	039	600	64	536	430	63	367	903	30
1107	1115	040	518	99	419	395	65	330	749	30
1107	1330	041	504	67	437	430	66	364	801	30
1107	1617	042	630	71	559	384	64	320	879	30
1107	2010	043	559	65	494	393	69	324	818	30
1107	2110	044	704	61	643	423	70	353	1349	30
1107	2205	045	635	63	572	413	73	340	912	30
1107	2300	046	790	65	725	404	70	334	1059	30
1108	0000	047	745	6	679	409	76	333	1012	30
1108	0100	048	715	56	659	437	81	356	1015	30

DATE	TIME	SAMPLE NUMBER	INITIAL DRY WT.	FINAL DRY WT.	NET DRY WT.	INITIAL WET WT.	FINAL WET WT.	NET WET WT.	NET DRY & NET WET	FLUSH GALS.
1113	1400	100	570	110	460	505	48	457	917	30
1113	1700	101	524	95	429	521	158	363	792	30
1113	1900	102	759	145	614	524	152	372	986	30
1113	2230	103	598	91	507	520	50	470	977	30
1114	0110	104	848	98	750	554	158	396	1146	30
1114		105	830	91	739	486	72	414	1153	30
1114	0700	106	908	98	810	485	73	412	1222	30
1114	1100	107	1046	584	962	497	90	407	1369	30
1114	1415	108	814	81	733	510	72	438	1171	30
1114	1600	109	598	96	502	480	82	398	900	30
1114	1900	110	570			970	83	893		30
1114	2130	111	500	473	27	101	89	12	39	30
1115	0230	112	641	78	563	440	79	361	924	30
1115	0500	113	793	71	722	508	85	423	1145	30
1115	0630	114	735	57	678	509	112	397	1075	30
1115	0830	115	711	78	633	519	80	439	1072	30
1115	1000	116	719	121	598	514	87	427	1025	30
1115	1400	117	943	97	846	499	89	410	1256	30
1115	1730	118	571	89	482	468	81	387	869	30
1115	1900	119	577	63	514	407	136	271	785	30
1115	2130	120	540	70	470	417	144	273	743	30
1116	0045	121	776	79	697	415	66	349	1046	30
1116	0330	122	774	91	683	441	70	371	1054	30
1116	0830	123	774	104	670	396	77	319	989	30
1116	1300	124	858	78	780	465	87	378	1158	30
1116	1430	125	694	76	618	481	86	395	1013	30
1116	1700	126	640	92	548	446	60	386	934	30
1116	1900	127	608	86	522	404	77	327	849	30
1116	2100	128	586	73	513	439	53	386	899	30
1117	0215	129	873	74	799	438	78	360	1159	30
1117	0350	130	934	82	852	440	68	372	1224	30
1117	0830	131	878	85	793	503	75	428	1221	30
1117	1145	132	705	91	614	579	79	500	1114	30
1117	1530	133	560	92	468	416	83	333	801	30
1117	1645	134	690	92	598	910	64	846	1444	30
1117	2200	135	1074	110	964	500	77	423	1387	30
1117	2330	137	1025	73	952	437	65	372	1324	30
1118	0415	138	735	91	644	602	72	530	1174	30
1118	0630	139	820	65	755	454	65	389	1144	30
1118	0900	140	774	94	680	427	85	342	1022	30
1118	1300	141	1037	92	945	447	75	372	1317	30
1118	1500	142	586	79	507	439	85	354	861	30
1118	1630	143	64	75	589	432	115	317	906	30
1118	1830	144	900	76	824	433	58	375	1199	30
1118	2100	145	758	80	678	403	127	276	954	30
1118	2200	146	690	74	616	398	108	290	906	30
1118	2330	147	931	72	859	389	56	333	1192	30
1119	0200	148	874	66	808	406	96	310	1118	30
1119	0400	149	770	79	691	409	57	352	1043	30
1119	0700	150	743	87	656	391	95	296	952	30

DATE	TIME	SAMPLE NUMBER	INITIAL DRY WT.	FINAL DRY WT.	NET DRY WT.	INITIAL WET WT.	FINAL WET WT.	NET WET WT.	NET DRY & NET WET	FLUSH GALS.
1108	0200	049	823	57	766	412	86	326	1092	30
1108	0320	050	840	84	757	440	68	410	1211	30
1108	0533	051	872	71	801	478	68	410	1211	30
1108	0630	052	722	70	652	431	76	355	1007	30
1108	0730	053	485	80	405	427	69	358	763	30
1108	1125	054	622	85	537	477	75	402	939	30
1108	1430	055	729	85	644	430	73	357	1001	30
1108	1750	056	608	86	522	442	75	367	889	30
1108	2005	057	714	87	627	458	83	375	1002	30
1108	2225	058	430	87	343	429	76	353	696	30
1109	0000	059	460	81	379	449	69	380	759	30
1109	0400	060	524	79	445	500	73	427	872	30
1109	0600	061	580	81	499	451	72	379	878	30
1109	0820	062	667	87	580	486	71	415	995	30
1109	1105	063	622	88	534	450	73	377	911	30
1109	1330	064	665	89	576	485	75	410	986	30
1109	1535	065	542	90	452	449	77	372	824	30
1109	1820	066	565	83	482	432	70	362	844	30
1109	2015	067	680	87	593	455	74	381	974	30
1109	2113	068	545	92	453	449	70	379	832	30
1110	0010	069	876	83	793	445	70	375	1168	30
1110	0240	070	839	77	762	439	71	368	1130	30
1110	0530	071	716	170	546	600	70	630	1176	30
1110	0915	072	733	81	652	460	74	386	1038	30
1110	1230	073	722	85	637	448	75	373	1010	30
1110	1530	074	845	375	470	767	121	646	1116	30
1110		075	160	127	33	1009	140	869	902	30
1111	0105	076	864	72	792	483	76	407	1199	30
1111	0300	077	650	91	559	442	128	314	873	30
1111	0630	078	588	82	506	498	77	421	927	30
1111	0845	079	617	84	533	442	81	361	894	30
1111	1220	080	910	105	805	530	87	443	1248	30
1111	1430	081	625	95	530	440	79	361	891	30
1111	1700	083	913	92	821	533	87	446	1267	30
1111	2130	084	792	637	155	1053	84	969	1124	30
1111	2200	085	708	95	610	493	86	407	1017	30
1112	0100	086	755	101	654	480	85	395	1049	30
1112	0400	087	776	96	680	490	85	405	1085	30
1112	0630	088	696	177	519	609	89	520	1039	30
1112	0820	089	567	110	457	507	95	412	869	30
1112	1130	090	740	94	696	530	93	437	1133	30
1112	1400	091	580	82	498	474	65	409	907	30
1112	1700	092	574	84	490	464	63	401	891	30
1112	1800	093	621	147	474	362	81	281	755	30
1112	2000	094	544	85	459	511	66	445	904	30
1112	2230	095	785	72	713	494	63	431	1144	30
1113	0215	096	725	87	638	541	68	473	1111	30
1113	0700	097	737	79	658	498	71	427	1085	30
1113	0720	098	712	98	614	498	65	433	1047	30
1113	1030	099	619	82	537	520	73	447	984	30

DATE	TIME	SAMPLE NUMBER	INITIAL DRY WT.	FINAL DRY WT.	NET DRY WT.	INITIAL WET WT.	FINAL WET WT.	NET WET WT.	NET DRY & NET WET	FLUSH GALS.
119	0821	151	619	109	510	375	77	298	808	30
119	1130	152	606	92	514	415	97	318	832	30
119	1430	153	690	82	608	443	85	358	966	30
119	1800	154	705	76	629	439	58	381	1010	30
119	2200	155	884	72	812	465	61	404	1216	30
120	0035	156	722	76	636	453	61	392	1028	30
120	0315	157	766	84	682	430	74	356	1038	30
120	0615	158	812	119	693	464	84	380	1073	30
120	0845	159	706	79	627	466	67	399	1026	30
120	1030	160	623	86	537	459	78	381	918	30

END OF BOM/FGT 002 ROSEBUD

APPENDIX G

Operator Logged Data

Included are three tables of data:

G-1. Freeboard Data

G-2. Firetest Data

H - Relatively hot bar

C - Relatively cold bar

D - Multiple incandescent zones

G-3. Miscellaneous Operator Logged Data

Water flows in gpm.

Water totals in gallons.

Steam flows in lb/min.

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 et al, 1984).

Table G-1

FREEBOARD HEIGHT

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1102	2100			40			38	39
1102	2200	40			40			40
1102	2300		41			41		41
1103	0000	39			37			38
1103	0100		36			34		35
1103	0200			40			43	41.5
1103	0300	41			40			40.5
1103	0400		42			41		41.5
1103	0500			40			41	40.5
1103	0600	39			36			37.5
1103	0700		38			39		38.5
1103	0800			42			40	41
1103	0900	38			35			36.5
1103	1000		38			38		38
1103	1100			36			37	36.5
1103	1200	37				37.5		37.25
1103	1300		33				33	33
1103	1400			35			33	34
1103	1500	34			34			34
1103	1700		36			36		36
RAISED THE AGITATOR TO 34" FROM 36"								
1103	1800			35			33	34
1103	1900	36			37			36.5
1103	2000		33			33		33
1103	2100			30			27	28.5
1103	2200	34			34			34
1103	2300		33			33		33
1104	0000	33			34			33.5
1104	0100		32			28		30
1104	0200			33			32	32.5
1104	0300	35			36			35.5
1104	0400		35			36		35.5
1104	0500			34			30	32
1104	0600	37			37			37
1104	0700		36			38		37
1104	0830			38			33	35.5
1104	0930	36			38			37
1104	1000		38			35		36.5
1104	1100			37			35	36
1104	1200		37			36		36.5
1104	1300			32			32	32
1104	1400	32			35			33.5
1104	1500		34			35		34.5
1104	1600			37			34	35.5
1104	1800	33			34			33.5
1104	1900		33			32		32.5
1104	2000			36			32	34
1104	2100	36			32			34

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1104	2200		34			33		33.5
1104	2300			36			33	34.5
1105	0000	35			35			35
1105	0100		27			32		29.5
1105	0200			38			34	36
1105	0300	34			35			34.5
1105	0400		37			38		37.5
1105	0500			36			38	37
1105	0600	28			34			31
1105	0700		36			33		34.5
1105	0800			36			32	34
1105	0900	33			31			32
1105	1000		38			38		38
1105	1100			38			37	37.5
1105	1200	36			39			37.5
1105	1345		35			35		35
1105	1400			33			33	33
1105	1500	37			36			36.5
1105	1600		37			34		35.5
1105	1700			35			35	35
1105	1800	35			35			35
1105	1900		36			36		36
1105	2000			36			34	35
1105	2100	36			36			36
1105	2200		37			36		36.5
1105	2300			35			35	35
1106	0000	34			35			34.5
1106	0100		35			36		35.5
1106	0200			36			36	36
1106	0300	35				36		35.5
1106	0400		34			36		35
1106	0500			34			32	33
1106	0600	33			33			33
1106	0700		33			33		33
1106	0800			34			35	34.5
1106	0900	36			37			36.5
1106	1000			38			37	37.5
1106	1100		40			39		39.5
1106	1200			37			39	38
1106	1300	38			37			37.5
1106	1400		40			39		39.5
1106	1500			39			38	38.5
1106	1600	39			40			39.5
1106	1700		39			38		38.5
1106	1800			40			39	39.5
1106	1900	37			37			37
1106	2000	37			38			37.5
1106	2100			37			37	37
1106	2200	37			38			37.5
1106	2300		38			38		38
1107	0000	38			36			37
1107	0100		33			32		32.5

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1107	0200			40			40	40
1107	0300	38			38			38
1107	0400		40			40		40
1107	0500			38			38	38
1107	0600	38			40			39
1107	0700		37			38		37.5
1107	0900	38			38			38
1107	1000		38			39		38.5
1107	1100			40			42	41
1107	1200	38			39			38.5
1107	1300		42			41		41.5
1107	1400	42	43	40	42	41	43	41.8
1107	1500	43	42	41	41	42	41	41.7
1107	1600	40			41			40.5
1107	1700		42			42		42
1107	1800			42			42	42
1107	1900	40			41			40.5
1107	2000		42			40		41
1107	2100			42			41	41.5
1107	2200	41			41			41
1107	2300		41			41		41
1108	0000		45			45		45
1108	0100			46			46	46
1108	0200	38			40			39
1108	0300		41			43		42
1108	0400			43			43	43
1108	0500		44			42		43
1108	0600	43			43			43
1108	0700		44			42		43
1108	0715	43		43	44		44	43.5
1108	0800	44		43	45		44	44
1108	0900	45		45	45		45	45
1108	1000	44		45	45		47	45.25
1108	1100	44		44	44		45	44.25
1108	1230	44		45	44		44	44.25
1108	1300	43		45	44		45	44.25
1108	1400		44			44		44
1108	1500			45			45	45
1108	1600	42			43			42.5
1108	1700		40			44		42
1108	1800			42			42	42
1108	1900	40			41			40.5
1108	2000		44			42		43
1108	2100			42			41	41.5
1108	2200	40			41			40.5
1108	2300		42			42		42
1109	0000		44			44		44
1109	0100	42			43			42.5
1109	0200			43			45	44
1109	0300		38			42		40
1109	0400	44			44			44
1109	0500			44			44	44

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1109	0600		40			41		40.5
1109	0700			44			43	43.5
1109	0800	44			43			43.5
1109	0900		44			44		44
1109	1000			44			43	43.5
1109	1100	44			43			43.5
1109	1200		44			45		44.5
1109	1300			44			45	44.5
1109	1400	45			44			44.5
1109	1500		44			45		44.5
1109	1600			42			45	43.5
1109	1700	42			44			43
1109	1800		44			45		44.5
1109	1900			44			44	44
1109	2000	42			44			43
1109	2100		43			44		43.5
1109	2200			44			44	44
1109	2300	42			46			44
1110	0000	42			42			42
1110	0100		42			38		40
1110	0200			47			46	46.5
1110	0300	40			38			39
1110	0400		45			45		45
1110	0500			42			44	43
1110	0600		41			41		41
1110	0700	42			43			42.5
1110	0800		44			45		44.5
1110	0900			42			42	42
1110	1000	45			46			45.5
1110	1100		45			45		45
1110	1200			46			49	47.5
1110	1300	44			44			44
1110	1400		43			45		44
1110	1500			43			44	43.5
1110	1600	42			44			43
1110	1700		45			45		45
1110	1800			44			44	44
1110	1900	44			45			44.5
1110	2000		46			45		46
1110	2100			44			45	44.5
1110	2200	45			44			44.5
1110	2300		45			45		45
1111	0000	41			41			41
1111	0100		43			41		42
1111	0200			45			44	44.5
1111	0300	40			44			42
1111	0400		41			42		41.5
1111	0500			44			42	43
1111	0630	40			40			40
1111	0700		44			43		43.5
1111	0800			44			46	45
1111	0900	46			47			46.5

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1111	1000		45			44		44.5
1111	1100			40			42	41
1111	1200	44				44		44
1111	1300		44			43		43.5
1111	1400			44			43	43.5
1111	1500	44			44			44
1111	1600		45			46		45.5
1111	1700			45			45	45
1111	1800	42			42			42
1111	1900		46			46		46
1111	2000			43			45	44
1111	2100	42			43			42.5
1111	2200		46			46		46
1111	2300			45			45	45
1112	0000	42			41			41.5
1112	0100		42			43		42.5
1112	0200			41			42	41.5
1112	0300	40			42			41
1112	0400		38			41		39.5
1112	0500			42			44	43
1112	0600	40			43			41.5
1112	0700		44			42		43
1112	0800			42			43	42.5
1112	0900	46			45			45.5
1112	1000		43			44		43.5
1112	1100			43			43	43
1112	1200			BOILER OFF				
1112	1300	43			43			43
1112	1400		44			45		44.5
1112	1500			43			42	42.5
1112	1600	42			43			42.5
1112	1700		44			44		44
1112	1800			43			43	43
1112	1900	41			45			43
1112	2000		44			46		45
1112	2100			44			44	44
1112	2200	42			43			42.5
1112	2300		43			45		44
1113	0000	41			40			40.5
1113	0100		42			42		42
1113	0200			42			40	41
1113	0300	42			42			42
1113	0400		43			44		43.5
1113	0500			39			44	41.5
1113	0600	40			44			42
1113	0700		43			44		43.5
1113	0800			43			43	43
1113	0900	43			44			43.5
1113	1000		44			44		44
1113	1100			45			44	44.5
1113	1200	43			44			43.5
1113	1300		45			46		45.5

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1113	1400			44			45	44.5
1113	1500	43			45			44
1113	1600		45			44		44.5
1113	1700			43			43	43
1113	1800	44			45			44.5
1113	2000		45			45		45
1113	2100			45			44	44.5
1113	2200	42			44			43
1113	2300		45			45		45
1114	0000	43			42			42.5
1114	0100		43			44		43.5
1114	0200			44			44	44
1114	0300	43			44			43.5
1114	0400		41			44		42.5
1114	0500			44			45	44.5
1114	0600	42			43			42.5
1114	0800		45			44		44.5
1114	0900			44			45	44.5
1114	1000	44			44			44
1114	1100		43			44		43.5
1114	1200			42			41	41.5
1114	1300	42			42			42
1114	1400		44			44		44
1114	1500			43			44	43.5
1114	1600	40			40			40
1114	1700		45			45		45
1114	1800			44			44	44
1114	1900	40			42			41
1114	2000		45			45		45
1114	2100			45			44	44.5
1114	2200	42			42			42
1114	2300		43			46		44.5
1115	0000	43			43			43
1115	0200			44			43	43.5
1115	0400		42			42		42
1115	0600			45			46	45.5
1115	0700	44			46			45
1115	0800		43			45		44
1115	0900			44			45	44.5
1115	1000	42			45			43.5
1115	1100		44			46		45
1115	1300			43			44	43.5
1115	1400	43			43			43
1115	1500		44			45		44.5
1115	1600			44			44	44
1115	1700	41			42			41.5
1115	1800		44			44		44
1115	1900			44			44	44
1115	2000	41			43			42
1115	2100		45			45		45
1115	2200			42			44	43
1115	2300	41			41			41

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1116	0000	42			41			41.5
1116	0100		44			46		45
1116	0200			42			46	44
1116	0300	42			44			43
1116	0400		46			45		45.5
1116	0500			43			43	43
1116	0600	42			44			43
1116	0700		42			43		42.5
1116	0800			44			45	44.5
1116	0900	43			45			44
1116	1000		45			44		44.5
1116	1100			45			45	45
1116	1200	43			44			43.5
1116	1300		44			45		44.5
1116	1400			43			44	43.5
1116	1500	43			43			43
1116	1600		45			43		44
1116	1700			41			41	41
1116	1800	40			42			41
1116	1900		45			44		44.5
1116	2000			43			42	42.5
1116	2100	40			42			41
1116	2200		42			45		43.5
1116	2300			44			44	44
1117	0000	42			42			42
1117	0100		42			43		42.5
1117	0200			41			45	43
1117	0300	43				42		42.5
1117	0400		42			43		42.5
1117	0500			42			44	43
1117	0600	43			42			42.5
1117	0700		43			44		43.5
1117	0800			43			43	43
1117	0900	43			43			43
1117	1000		44			45		44.5
1117	1100			43			43	43
1117	1200	42			42			42
1117	1300		44			45		44.5
1117	1400			44			44	44
1117	1500	43			44			43.5
1117	1600		41			44		42.5
1117	1700			44			43	43.5
1117	1800	40			42			41
1117	1900		42			42		42
1117	2000			44			45	44.5
1117	2100	44			44			44
1117	2200		45			46		45.5
1117	2300			44			46	45
1118	0400			45			44	44.5
1118	0500		44			44		44
1118	0600	43			41			42
1118	0700		43			42		42.5

DATE	TIME	#1	#2	#3	#4	#5	#6	AVERAGE
1118	0800			44			43	43.5
1118	0900	45			43			44
1118	1000		45			45		45
1118	1100			44			45	44.5
1118	1200	43			43			43
1118	1300		45			45		45
1118	1400			43			45	44
1118	1500	42			42			42
1118	1600		44			44		44
1118	1700			45			45	45
1118	1800	41			41			41
1118	1900		44			45		44.5
1118	1900		44			45		44.5
1118	2000			45			44	44.5
1118	2100	44			44			44
1118	2200		42			45		43.5
1118	2300			45			45	45
1119	0000	42			44			43
1119	0100		46			44		45
1119	0200			46			46	46
1119	0300	44			44			44
1119	0400		45			43		44
1119	0500			44			43	43.5
1119	0600	42			43			42.5
1119	0700		44			43		43.5
1119	0800			43			44	43.5
1119	0900	42			47			44.5
1119	1030		44			45		44.5
1119	1100			44			43	43.5
1119	1200	42			47			44.5
1119	1300		44			45		44.5
1119	1430			42			42	42
1119	1550	46			50			48
1119	1700		44		40	42		42
1119	1900			42			45	43.5
1119	2000	42			44			43
1119	2100		44			43		43.5
1119	2200			43			44	43.5
1119	2300	40			45			42.5
1120	0000		44		47	44		45
1120	0100			43			43	43
1120	0200	43			48			45.5
1120	0300		44			44		44
1120	0400			45			44	44.5
1120	0500	43			47			45
1120	0600		45			45		45
1120	0700			43			45	44
1120	0800	43			46			44.5
1120	0900		42			44		43
1120	1000			44			43	43.5
1120	1100	44			44			44

Table G-2
FIRE TEST DATA

Date	Time	#1	#2	#3	#4	#5	#6	#7	Average
1102	2200	30	22	19	15D	13	26	19	20.6
1103	0000	23	11	12	36C	30	40	7	22.7
1103	0200	14	18	19	21	20	9	13	16.3
1103	0400	18	23C	23	19	29	12	7	18.7
1103	0600	24	27	25	9	7	18	16	18.0
1103	0800	20	19	23	23	15	24	19	20.4
1103	1000	16	13	3	4	12	30	15	13.3
1103	1200	20	19	12	10	-	6	4	11.8
1103	1400	22	19	9	9	13	7	18	13.9
1103	1600	27	19	13	7	22	3	11	14.6
1103	1800	24	12	14C	14	24	13C	17	16.9
1103	2000	37	20C	21	21C	24	12C	19	22.0
1103	2200	20D	23	23C	29D	32	20C	25	24.6
1104	0000	23	27	36	30	26	19	21	26.0
1104	0200	13	16	19	16	20	13	29	18.0
1104	0400	15	9	18	31	24	15	15	18.1
1104	0600	16	12	14	24	8	20	27	17.3
1104	0800	-	15	-	28D	0	-	-	21.5
1104	0900	9	13	15	31	0	4	9D	11.6
1104	1030	10	7	3	14	3	17	8	8.9
1104	1200	24	16	4	2	16	0	22	14.0
1104	1400	27	8	40	8	0	1	33	19.5
1104	1500	11	9	19D	3	2C	9	62	16.4
1104	1800	18C	14C	29	11	4C	11C	12D	14.1
1104	2000	11	10	24C	25	25	10	5D	15.7
1104	2200	12C	12	0	10C	6	11C	56C	17.8
1105	0000	11	8	11	20	36	12	44	20.3
1105	0200	7	8	17	15	14	0	11	12.0
1105	0400	0	6	54	6	8	19	27	20.0
1105	0600	12	14	5	19	7	12	13	11.7
1105	0800	15	14	60	16	0	0	0	22.25
1105	1000	25	25	3D	9	13	0	17	15.33
1105	1200	0	28	0	0	3	0	-	15.5
1105	1400	0	27	13	24	13	31	-	21.6
1105	1600	21	17	23	21	8	25	47	23.1
CLINKERING									
1105	1800	11	29D	10C	27	4C	12	3	13.7
1105	2000	24	25	10C	18	1	18	7	14.7
1105	2200	4	12	45C	28C	1	8	13	15.9
CLINKERING									
1106	0000	8	6	12	23	0	7	10	11.0
1106	0200	12	13	7	6	18	0	8	10.7
1106	0400	23	0	6	5	0	5	22	12.2
1106	0600	21	40	0	17	34	23	16	25.2
1106	0800	15	4D	34D	13	6D	35	13	17.9
1106	1000	20D	12	27	20	16	15	28D	19.7
1106	1200	8	4D	6D	5	8	9	12	7.4
1106	1400	-	9	10	9	14	0	9	10.2

Date	Time	#1	#2	#3	#4	#5	#6	#7	Average
1106	1600	0	27C	12C	7	39	0	20	21.0
1106	1800	50	11D	10	7	2D	35D	9	17.7
1106	2000	13	28	11	4	1C	33C	8	14.0
1106	2200	2D	2C	14	11C	10D	61	11	15.9
1107	0000	31	10	8	6	17	0	5	12.8
1107	0200	15	12	17	3	0	7	37	15.2
1107	0400	6	13	12	0	8	15	43	16.2
1107	0600	12	4	17D	9	7	14	27	12.9
1107	0845	4	0	35C	0	0	0	14	17.7
SHUTDOWN									
1107	1000	19	38	6	24	39	10	HIGH	22.7
1107	1200	9	1	13D	13	39	13	HIGH	14.7
1107	1400	21	0	9	35	4	0	HIGH	17.25
1107	1600	30	14	4D	66	65	44	57	40.0
1107	1800	48	18	14D	67	60	65	45	45.3
1107	2000	50	33D	58	64	66	60	55	55.1
1107	2200	53	25	41	50	53	38D	46	43.7
1108	0000	35	45	42	45	59	42	37	43.5
1108	0200	29	32	24	30	42	44	44	35.0
1108	0400	28	22	26	38	40	45	20	31.3
1108	0600	24	16	34	29	34	9	10	22.3
1108	0745	4	20	8	9	23	20	10	13.4
1108	1000	10	2	12	25	2	17	14	11.7
1108	1200	5	1	2	12	17	15	3	7.9
1108	1400	17	12	1	18	1	1D	5	7.9
1108	1600	3D	3	4	4	5	3	5	3.9
1108	1800	7C	4C	5	20	5C	6C	7	7.7
1108	2000	4C	9D	12	15C	3C	4	2C	7.0
1108	2200	7C	19	3D	10	18	27	6	12.9
1109	0000	14	12	20	24	31	8	22	18.7
1109	0200	43	5	24	4	10	4	11	14.4
1109	0400	33	19	28	8	23	30	12	21.9
1109	0600	7	2C	6	27	22	15	7	15.1
1109	0800	7	4D	3D	2	1	1	6	3.4
1109	1000	14	11	44	25	17	43D	19	24.7
1109	1200	4	44	27	6D	45D	23	21	24.3
1109	1400	45	13	5	44D	18D	13	LOW	23.0
1109	1600	8C	16	21	14C	41	7C	6C	14.7
1109	1800	20	14	21	31	4	9	5	14.9
1109	2000	5	12C	6	7	11	2	7	7.1
1109	2200	13	15	12	19	50	5	3	16.7
1110	0000	17	9	12	0	53	3	10	17.3
1110	0200	10	8	11	0	0	16	11	11.2
1110	0400	3	6	4	9	6	3	0	5.2
1110	0600	4	4	5	6	9	3	0	5.2
1110	0800	5	44	12	4	45	16	13	19.9
1110	1000	45	6	3D	46	18	5	12	19.6
1110	1200	5	18	46	5	9	49	7	19.9
1110	1400	12	43	4	12	22	10	8	15.9
1110	1600	7	6	8	12	12	6	8C	8.4
1110	1800	4	5	8D	5	4	4	4C	4.9
1110	2000	8	8	7	4	8	6C	10	7.3

Date	Time	#1	#2	#3	#4	#5	#6	#7	Average
1110	2200	3	11	2	13	10	8	10	8.1
1111	0000	11	10	9	24	12	11	7	12.0
ROOF VENTILATOR OFF									
1111	0200	11	10	11	12	11	10	8	10.4
1111	0400	12	12	12	10	15	5	10	10.9
1111	0600	11	8	10	12	13	13	10	11.0
1111	0800	7	14	44	7	3	46D	12	19.0
1111	1000	11	43	9	6	44	12	10	19.3
1111	1200	44	10	7	44D	13	14	10	20.3
1111	1400	13	12	9	3	5D	6	9	8.1
1111	1600	10	14	7	14	12	8	12C	11.0
1111	1800	13	6	2	11	12	9	2	7.9
1111	2000	19	34	8	5	3	12	8	12.7
1111	2200	5	10	8	12	11	9C	10C	9.3
1112	0000	13	15	4	10	10	11	8	10.1
1112	0400	10	9	11	12	13	11	12	11.1
1112	0600	11	8	15	9	12	12	13	11.4
1112	0800	14	10	42	9	10	43	14	20.3
1112	1000	13	43	13	9	3	14	10	15.0
1112	1300	10	11	11	15	15	10	17	12.7
1112	1430	7	12	11	7	11	6	5	8.4
1112	1600	14	9	7	15	14	16	7	11.7
1112	1800	15	15	11	13	10	14	10C	12.6
1112	2000	20	10	9	14	12	34	4C	14.7
1112	2200	4	5C	9	11	8C	10C	0	7.8
1113	0000	6	5	3	12	12	11	5	7.7
1113	0200	8	7	14	14	5	5	6	8.4
BOILER DOWN									
1113	0600	8	13	24	11	26	16	12	15.7
1113	0800	9	7	43	11	2	43	1	16.6
1113	1000	10	44	5	5	44	7	3	16.9
1113	1200	3	11	6	5	14	8D	11	12.6
1113	1400	13	11	4	6	17	10	9	10.0
1113	1600	16	7	4	5	7	6	6	7.3
BOILER DOWN COAL ELEVATOR DOWN									
1113	2000	8	10C	3D	4	11	11	7	7.7
1113	2200	6	6	57	4	4	43	C	20.0
1114	0000	13	12	28	16	11	7	12	14.1
1114	0200	14	3	3	3	23	11	10	9.6
1114	0400	0	3	2	6	19	8	8	7.7
1114	0600	10	8	6	10	12	11	5	8.9
1114	0800	2	45	6D	16	44	11	3D	18.1
1114	1000	44	4	6	44	2	8	14	17.4
1114	1200	5	6	12	4	12	11	10	8.6
1114	1400	3	5	14	5	4	2	7	5.7
1114	1600	8C	4	8C	17C	14C	8C	6	9.3
1114	1800	3C	15	11	2	4C	12C	2	7.0
1114	2000	8C	12	3	8	2	24C	8C	9.3
1114	2200	3	5	26	14	7	2	4C	8.7
1115	0000	22	13	10	10	14	5	11	12.1
SHUT DOWN									
1115	0400	17	18	31	6	21	0	0	18.6

Date	Time	#1	#2	#3	#4	#5	#6	#7	Average
1115	0600	22	14	16	15	25	15	0	17.8
1115	0800	15	8	6D	12	16	8	0	10.8
1115	1000	42	12	17	45	17	8	LOW	23.5
1115	1200	9	13	43	18	13	44	20	22.9
1115	1430	7	11	16	12	13	5	C	10.7
1115	1600	26C	3C	26C	25	26	26	20C	21.7
1115	1800	21C	14C	6	20	22	0	12	15.8
1115	2000	20C	4	11	26	8	4D	10C	11.9
1115	2200	20C	8	10C	10C	10C	6C	15C	11.3
1116	0000	6	8	31	6	14	0	0	13.0
1116	0200	4	31	25	2	14	3	6	12.1
1116	0400	13	16	20	0	21	8	10	14.7
1116	0600	10D	20	10D	12	12	6	5	10.7
1116	0800	6	6D	4D	7	6	5	9	6.1
1116	1000	8	6	5	18	9	6	11	9.0
1116	1400	8				18		15	13.7
1116	1600	4D	4	27	27	15C	15C	14	15.1
1116	1800	15	11C	6	7C	12	11C	8C	10.0
1116	2000	5	15C	6	25	12C	6	15C	12.0
1116	2200	4	1D	6C	25	8	1	8	7.6
1117	0000	11	14	7	7	5	7	7	8.3
1117	0200	8	6	12	5	10	15	4	8.6
1117	0400	3	0	28	12	0	7	5	11.0
1117	0600	17	12	24	8	11	6	5	11.9
1117	0800	1	5	43	6	8	8	3	10.6
1117	1000	5	5	8	6	6	6	2	5.4
1117	1200	6				6		C	6.0
1117	1400		14		5		5		8.0
1117	1600	6	6D	22C	6C	8	16	14C	11.1
CLINKERING									
1117	1800	2	34	18	10C	6	7	12C	12.7
1117	2000	10	14	30	4	12	6	C	12.7
GRATE STOPPED DUE TO ASH BUILD UP									
1117	2200	14	14	15C	3	12C	20C	20C	14.0
1118	0000	13	16	12	10	11	14	13	12.7
SHUT DOWN									
1118	0400	5	10	6	3	4	4	6	5.4
1118	0600	5	16	4	12	10	9	4	8.6
1118	0800	3D	3DF	8	1D	6	14	4	5.6
1118	1000	7	14	8	5	6	6	C	7.7
1118	1200	43	14	20	43	4	14	5	20.4
1118	1400	16	18	13	8	1	4	5	9.3
1118	1600	10D	17C	26	6	24	18	C	16.8
1118	1800	20	3	12C	7	4	20	C	11.0
1118	2000	12	5	6	12D	20	6	C	10.2
1118	2200	15C	18	7	30D	11	18C	C	16.5
1119	0000	12	19	16	19	0	22	18	17.7
1119	0200	0	12	3	11	10	31	0	13.4
1119	0400	0	10	4	23	3	0	35	15.0
1119	0600	30	24	40	12	16	10	6	19.7
1119	0800	10	4	0	6D	4	0	4	5.6
1119	1030	6	9D	10D	3	0	0	6	6.8

Date	Time	#1	#2	#3	#4	#5	#6	#7	Average
1119	1200	42	5	2D	47	9	4	4	16.1
1119	1400	23	32	6	0H	0C	2C	4	13.4
1119	1600	19	0	3	32	9	10	10	13.0
1119	1900	20	1	20	6	8C	10C	15C	11.4
1119	2000	12	27	10	40	5	12	C	17.7
1119	2200	5	6	28	5	20	41	4	15.6
1120	0000	5	44	4D	47D	44	5	6	22.1
1120	0200	10	7	2C	3D	7	21	3	7.6
1120	0400	10	8D	7D	6	7D	6	0	7.3
1120	0600	4	45D	10D	11	45	0	5	20.0
1120	0800	43	1	14	4	9	7	0	13.0
1120	1000	5	14	44	12	13	43	12	20.4

END OF BOM/FGT-002

ROSEBUD

Table G-3

OPERATOR DATA LOG

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READNG	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1102	2030	4.5	12	562	<2.42	11.5	10.5	1.0	20%	1763	3349
1102	2130	4.5	12	570	4.0	11.0	10.5	4.0	25%	1772	3368
1102	2230	4.5	12	577	5.0	11.0	10.5	5.0	30%	1781	3385
1102	2330	4.5	13	585	5.0	11.0	11.0	7.0	35%	1793	3405
1103	0030	4.5	12	592	8.0	10.0	11.0	7.0	38%	1803	3424
1103	0130	4.5	12	600	6.0	11.0	10.0	7.0	42%	1814	3447
1103	0230	4.5	12	607	6.0	11.0	100	7.0	38%	1824	3470
1103	0330	4.5	12	614	6.0	10.0	10.00	7.0	40%	1834	3470
1103	0430	4.5	13	621	7.0	11.0	10.0	7.0	40%	1845	3517
1103	0530	4.5	13	628	7.0	11.0	10.0	7.0	42%	1856	3540
1103	0630	4.5	12	636	6.0	11.0	10.0	9.0	46%	1868	3565
1103	0730	4.5	12	642	5.8	11.0	10.0	9.0	50%	1877	3584
1103	0830	4.5	12	649	7.0	11.0	10.5	7.0	32%	1889	3608
1103	0930	4.5	12	658	7.0	11.5	11.0	7.5	32%	1905	3639
1103	1030	4.5	12	664	7.0	11.2	10.5	7.0	32%	1915	3659
1103	1130	4.5	12	672	7.0	11.0	10.5	7.5	33%	1931	3674
1103	1230	4.5	12	678	6.8	11.5	10.5	8.5	35%	1946	3686
1103	1330	4.5	12	685	7.0	11.5	10.5	9.0	40%	1962	3698
1103	1430	4.5	12	693	6.5	11.0	10.5	6.5	30%	1980	3712
1103	1530	4.5	11.5	700	6.0	11.0	11.0	7.0	32%	2001	3723
1103	1630	4.5	11.5	707	6.5	11.0	10.5	6.5	32%	2016	3732
1103	1730	4.5	11.5	714	6.5	11.5	11.0	6.0	28%	2034	3742
1103	1830	4.5	11.5	727	6.0	11.0	11.0	5.5	30%	2055	3753
1103	1930	4.5	11.5	729	6.0	11.0	10.5	4.0	25%	2071	3762
1103	2030	4.5	11.5	736	<2.46	11.0	10.5	1.0	20%	2089	3773
1103	2130	4.5	11.5	743	<2.42	2.0	1.0	0.5	40%	2108	3785
1103	2230	4.5	11.5	750	<2.42	11.5	11.0	0	16%	2127	3805
1103	2330	4.5	11.5	757	<2.42	11.0	10.0	1.0	20%	2147	3825
1104	0030	4.5	11.5	764	<2.42	11.0	11.0	0	16%	2165	3855
1104	0130	4.5	11.5	771	<2.42	11.0	11.0	1.0	20%	2179	3886
1104	0230	4.5	11.5	779	<2.42	11.0	10.0	1.0	20%	2196	3937
1104	0330	4.5	11.5	786	<2.42	11.0	10.0	1.0	20%	2207	4017
1104	0430	4.5	11.5	794	<2.42	11.0	11.0	0	10%	2218	4017
1104	0530	4.5	11.5	801	<2.42	11.0	11.0	2.0	18%	2229	4057
1104	0630	4.5	11.5	806	<2.42	11.0	10.0	1.0	20%	2241	4100
1104	0730	4.5	11.5	814	<2.42	14.0	14.0	0.0	12%	2254	4147
1104	0830	4.5	11.5	820	<2.42	14.0	15.0	0.0	0 %	2265	4187
1104	0930	4.5	11.5	826	<2.42	14.0	15.0	0.0	10%	2277	4221
1104	1030	4.5	12.0	832	<2.42	11.5	11.0	0.0	18%	2289	4253
1104	1130	4.5	12.0	840	<2.42	11.0	10.5	2.5	22%	2303	4293
1104	1230	4.5	12.0	848	3.0	11.0	10.5	2.0	22%	2320	4335
1104	1330	4.5	12.0	854	6.0	11.0	10.5	9.5	50%	2334	4369
1104	1430	4.5	12.0	861	6.5	11.5	10.5	10.0	100%	2348	4402
1104	1530	4.5	9.0	867	7.0	11.5	11.0	9.5	50%	2366	4433
1104	1630	4.5	8.5	873	7.0	11.0	10.5	10.0	100%	2381	4478

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READNG	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1104	1730	4.5	7.0	877	7.0	11.5	11.0	11.0	100%	2396	4512
1104	1830	4.5	7.0	881	7.5	11.0	11.0	6.0	30%	2411	4547
1104	1930	4.5	7.0	886	<2.42	0.0	0.0	0.0	100%	2426	4583
1104	2030	4.5	7.0	890	4.0	11.0	10.5	4.0	26%	2442	4617
1104	2130	4.5	7.0	894	4.5	11.0	10.5	3.5	24%	2459	4654
1104	2230	4.5	7.0	898	5.0	11.0	10.0	6.5	34%	2474	4687
1104	2330	4.5	12.5	903	5.0	10.0	10.0	7.0	40%	2494	4732
1105	0030	4.5	12.5	906	6.0	11.0	10.0	10.0	100%	2505	4756
1105	0130	4.5	7.0	911	6.0	10.0	11.0	8.0	50%	2521	4815
1105	0230	4.5	7.0	915	6.0	11.0	11.0	9.0	40%	2536	4875
1105	0330	4.5	7.0	918	6.0	11.0	11.0	8.0	56%	2550	4923
1105	0430	4.5	7.0	921	7.0	11.0	10.0	10.0	80%	2564	4971
1105	0530	4.5	5.0	924	8.0	11.0	11.0	10.0	100%	2579	5019
1105	0630	4.5	10.0	927	5.0	11.0	10.0	10.0	70%	2590	5067
1105	0730	4.5	1.5	929	7.0	11.0	10.0	10.5	100%	2602	5084
1105	0830	4.5	6.0	933	7.5	11.0	11.0	8.0	35%	2619	5131
1105	0930	4.5	5.0	936	7.2	11.0	10.5	8.0	35%	2636	5256
1105	1030	4.5	5.0	939	7.0	11.0	10.5	8.0	35%	2636	5256
1105	1130	4.5	5.0	942	7.0	11.0	10.5	6.5	30%	2645	5321
1105	1230	4.5	5.0	945	6.0	11.0	10.5	8.0	35%	2653	5356
1105	1330	4.5	5.0	948	7.0	11.0	10.5	9.0	45%	2667	5387
1105	1430	4.5	5.0	951	7.5	11.0	10.5	9.0	45%	2684	5416
1105	1530	4.5	5.0	954	7.5	11.5	11.0	10.0	52%	2695	5445
1105	1630	4.5	5.0	957	7.5	11.0	10.5	10.0	92%	2707	5475
1105	1730	4.5	4.0	959	7.5	11.0	10.0	10.0	100%	2719	5512
1105	1830	4.5	4.0	962	7.5	11.0	10.5	10.5	100%	2729	5550
1105	1930	4.5	4.0	964	7.5	11.5	10.5	10.5	100%	2741	5591
1105	2030	4.5	3.5	966	7.5	11.0	10.5	10.5	100%	2753	5628
1105	2130	4.5	3.0	967	7.5	11.0	10.5	10.5	100%	2763	5661
1105	2230	4.5	3.0	969	7.5	11.0	10.5	10.5	100%	2777	5702
1105	2330	4.5	3.0	970	6.0	10.0	10.0	10.0	100%	2789	5741
1106	0030	4.5	3.0	972	7.5	11.0	10.0	10.0	100%	2798	5769
1106	0130	4.5	3.0	973	7.5	11.0	10.0	10.0	100%	2810	5806
1106	0230	4.5	2.0	973	7.5	11.0	10.0	11.0	100%	2821	5835
1106	0330	4.5	2.0	975	7.5	11.0	10.0	11.0	100%	2834	5860
1106	0430	4.5	2.0	975	7.5	11.0	10.0	11.0	100%	2845	5897
1106	0530	4.5	2.0	976	7.5	11.0	10.0	10.0	100%	2858	5907
1106	0630	4.5	2.0	977	7.5	11.0	10.0	11.0	100%	2868	5948
1106	0730	4.5	1.0	978	7.5	11.0	10.5	11.0	100%	2879	5984
1106	0830	4.5	1.0	979	7.8	11.5	10.8	10.5	68%	2889	6016
1106	0930	4.5	0	980	7.8	11.2	10.5	10.0	60%	2899	6060
1106	1030	4.5	1.0	981	7.5	11.5	11.0	10.0	55%	2908	6109
1106	1130	4.5	2.5	982	7.5	11.5	11.0	10.5	100%	2917	6173
1106	1230	4.5	1.0	983	7.5	11.5	10.5	9.0	42%	2924	6221
1106	1330	4.5	1.0	984	7.2	11.0	11.0	7.8	38%	2933	6266
1106	1430	4.5	1.0	985	7.0	11.5	11.0	7.5	32%	2941	6305
1106	1530	4.5	1.0	986	7.0	10.5	10.5	7.0	30%	2951	6349
1106	1630	4.5	1.0	987	6.5	10.5	10.5	6.0	30%	2951	6349
1106	1730	4.5	1.0	988	6.0	11.0	10.5	6.0	30%	2959	6392

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READING	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1106	1830	4.5	1.0	989	6.0	11.5	11.0	6.0	28%	2976	6489
1106	1930	4.5	1.0	990	6.0	11.5	11.0	5.0	26%	2984	6533
1106	2030	4.5	1.0	991	6.0	11.0	10.5	5.5	28%	2993	6577
1106	2130	4.5	1.0	992	5.0	11.0	11.0	4.0	28%	3001	6622
1106	2230	4.5	1.0	993	4.5	11.0	12.0	3.5	24%	3011	6668
1106	2330	4.5	1.0	994	6.0	11.0	10.0	3.0	25%	3020	6701
1107	0030	4.5	1.0	995	6.0	11.0	10.0	3.0	25%	3029	6737
1107	0130	4.5	1.0	996	5.0	11.0	10.0	5.0	28%	3037	6773
1107	0230	4.5	1.0	997	6.0	11.0	10.0	5.0	28%	3046	6812
1107	0330	4.5	1.0	998	5.0	11.0	10.0	5.0	28%	3055	6849
1107	0430	4.5	1.0	999	5.0	11.0	10.0	5.0	28%	3064	6883
1107	0530	4.5	1.0	1000	5.0	11.0	10.0	5.0	28%	3073	6918
1107	0630	4.5	1.0	1001	5.0	11.0	10.0	4.0	20%	3085	6952
1107	0730	4.5	1.0	1002	4.8	11.5	11.5	3.8	22%	3094	6981
1107	0915	4.5	1.0	1004	4.0	11.5	11.0	3.5	25%	3106	7013
1107	0930	4.5	1.0	1005	4.0	11.5	11.0	4.0	25%	3108	7013
1107	1030	4.5	1.0	1006	4.2	11.5	10.5	3.5	25%	3113	7034
1107	1130	4.5	1.0	1007	4.2	11.0	10.5	4.0	28%	3118	7065
1107	1230	4.5	1.0	1008	4.8	11.0	10.2	4.0	26%	3122	7100
1107	1330	4.5	1.0	1009	4.8	11.5	10.5	5.0	28%	3125	7125
1107	1430	4.5	1.0	1010	4.8	11.0	10.5	4.0	28%	3125	7155
1107	1530	4.5	1.0	1011	4.8	11.5	11.0	3.0	24%	3125	7189
1107	1630	4.5	1.0	1012	5.0	11.5	10.5	2.5	24%	3127	7226
1107	1730	4.5	1.0	1013	4.5	11.5	10.5	2.5	24%	3128	7282
1107	1830	4.5	1.0	1014	4.5	11.0	10.5	1.5	24%		7335
1107	1930	4.5	1.0	1015	4.5	11.5	11.0	1.5	24%		7379
1107	2030	4.5	1.0	1016	4.5	11.5	11.0	2.0	24%		7443
1107	2130	4.5	1.0	1017	4.5	11.0	10.0	2.0	24%		7541
1107	2230	4.5	1.0	1018	4.5	11.5	11.0	1.5	24%		7643
1107	2330	4.5	1.0	1019	5.0	11.0	10.0	1.0	20%	3128	7749
1108	0030	4.5	1.0	1020	5.0	11.0	10.0	3.0	15%		7842
1108	0130	4.5	1.0	1021	5.0	11.0	10.0	1.0	18%		7944
1108	0230	4.5	1.0	1022	5.0	11.0	10.0	2.0	22%		8046
1108	0330	4.5	1.0	1023	5.0	11.0	10.0	1.0	20%		8050
1108	0430	4.5	1.0	1024	5.0	11.0	10.0	3.0	22%		8152
1108	0530	4.5	1.0	1025	5.0	11.0	10.0	3.0	20%		8254
1108	0700	4.5	1.0	1026	3.0	11.5	11.0	0.0	20%		8479
1108	0730	4.5	1.0	1027	3.0	11.2	11.0	0.0	20%		8524
1108	0830	4.5	1.0	1028	2.42	11.0	11.0	0.0	20%		8603
1108	0930	4.5	1.0	1029	2.42	11.0	10.5	1.0	20%		8666
1108	1030	4.5	1.0	1030	3.0	11.5	10.5	1.0	22%		8726
1108	1130	4.6	1.0	1031	3.0	11.2	10.5	1.5	22%		8770
1108	1230	4.7	1.0	1032	3.0	11.0	10.8	1.5	22%		8814
1108	1330	4.6	1.0	1033	3.0	11.5	10.5	1.5	22%		8853
1108	1430	4.7	1.0	1034	3.0	11.5	10.5	1.5	22%		8885
1108	1530	4.5	1.0	1035	3.0	11.5	10.5	1.5	22%		8429
1108	1630	4.5	1.0	1036	3.0	11.5	10.5	1.5	24%		8963
1108	1730	4.5	1.0	1037	3.5	11.5	10.5	1.5	24%		8994
1108	1830	4.5	1.0	1038	4.0	11.5	10.5	2.5	25%		9024

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READING	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1108	1930	4.5	1.0	1039	4.0	11.0	10.0	3.0	25%		9052
1108	2030	4.5	1.0	1040	4.0	11.0	10.0	4.0	26%		9079
1108	2130	4.5	1.0	1041	4.5	11.0	10.0	4.0	28%		9104
1108	2230	4.5	1.0	1042	4.5	11.0	10.0	4.0	28%		9126
1108	2330	5.0	1.0	1044	5.0	11.0	10.0	3.0	20%		9150
1109	0030	5.0	1.0	1045	5.0	11.0	10.0	2.0	20%		9173
1109	0130	5.0	1.0	1046	5.0	11.0	10.0	3.0	20%		9197
1109	0230	5.0	1.0	1047	5.0	11.0	10.0	3.0	20%		9221
1109	0330	5.0	1.0	1048	5.0	11.0	10.0	2.0	20%		9245
1109	0430	5.0	1.0	1049	5.0	11.0	10.0	2.0	20%		9285
1109	0530	5.0	1.0	1050	5.0	11.0	10.0	2.0	20%		9315
1109	0630	5.0	1.0	1051	5.0	11.0	10.0	2.0	22%		9356
1109	0730	4.5	1.0	1052	4.0	11.0	10.5	2.0	22%		9405
1109	0830	4.5	1.0	1053	4.0	11.2	10.8	2.0	22%	3131	9448
1109	0930	4.5	1.0	1054	4.0	11.5	11.0	1.8	22%	3132	9476
1109	1030	4.8	1.0	1056	5.5	11.0	10.0	7.0	35%	3133	9510
1109	1130	4.5	1.0	1057	5.5	11.2	11.0	4.2	25%	3135	9553
1109	1230	4.5	1.0	1059	5.5	11.5	11.0	4.5	25%	3135	9598
1109	1330	4.5	1.0	1060	5.5	11.5	11.0	4.5	25%	3135	9640
1109	1430	4.5	2.0	1062	5.5	11.0	10.5	4.5	29%	3136	9676
1109	1530	4.5	2.0	1064	5.5	11.5	10.5	5.0	28%	3137	9721
1109	1630	4.5	2.0	1066	5.5	11.0	10.5	4.5	28%	3139	9763
1109	1730	4.5	2.0	1067	5.5	11.0	10.0	5.0	28%		9819
1109	1830	4.5	2.0	1069	5.5	11.0	10.0	5.0	30%		9861
1109	1930	4.5	2.0	1071	5.5	11.0	10.0	6.0	32%		9920
1109	2030	4.5	2.0	1072	5.5	11.0	10.5	6.0	30%		9970
1109	2130	4.5	2.0	1074	5.5	10.5	10.5	5.0	28%		10007
1109	2230	4.5	2.0	1076	5.5	11.0	10.0	6.0	30%		10055
1109	2330	4.5	2.0	1078	5.0	10.0	10.0	5.0	20%		10105
1110	0030	4.5	2.0	1080	5.0	10.0	10.0	5.0	20%		10158
1110	0130	4.5	2.0	1082	5.0	10.0	10.0	5.0	22%		10211
1110	0230	4.5	2.0	1083	5.0	10.0	10.0	52.0	20%		10264
1110	0330	4.5	2.0	1084	5.0	10.0	10.0	4.0	24%		10315
1110	0430	4.5	2.0	1085	5.0	10.0	11.0	3.0	20%		10368
1110	0530	4.5	2.0	1087	5.0	10.0	11.0	4.0	24%		10391
1110	0630	4.5	2.0	1089	5.0	10.0	11.0	4.0	26%		10418
1110	0730	4.5	2.0	1091	5.5	11.0	10.0	5.0	30%	3139	10437
1110	0830	4.5	2.0	1093	5.5	11.0	10.0	6.0	30%		10460
1110	0930	4.5	2.0	1094	5.5	11.5	10.5	6.0	30%		10490
1110	1030	4.5	2.0	1096	5.5	11.0	10.0	6.0	30%		10527
1110	1130	4.5	2.0	1097	5.5	11.5	10.0	6.0	30%	3142	10564
1110	1230	4.5	2.0	1099	5.5	11.0	10.5	5.0	29%		10592
1110	1330	4.5	2.0	1101	5.5	11.0	10.5	5.0	28%		10621
1110	1430	4.5	2.0	1103	5.5	11.5	10.5	5.0	28%		10650
1110	1530	4.5	2.0	1104	5.5	11.0	10.0	5.52	30%		10684
1110	1630	4.5	2.0	1106	5.5	11.0	10.0	5.5	30%		10717
1110	1730	4.5	2.0	1108	5.5	11.5	10.5	5.0	28%		10749
1110	1830	4.5	2.0	1110	5.5	11.0	10.0	5.0	30%		10778
1110	1930	4.5	2.0	1111	5.5	10.5	10.5	5.0	28%		10803

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READNG	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1110	2030	4.5	2.0	1113	5.5	11.5	10.5	5.5	30%		10830
1110	2130	4.5	3.0	1115	5.5	11.3	10.52	5.0	28%		10858
1110	2230	4.5	2.0	1116	5.5	11.0	10.5	5.5	30%		10883
1110	2330	4.5	2.0	1118	5.0	11.0	10.0	5.0	30%		10909
1111	0030	4.5	2.0	1120	5.0	11.0	10.0	6.0	32%		10932
1111	0130	4.5	2.0	1122	5.0	11.0	10.0	5.0	30%		10952
1111	0230	4.5	2.0	1123	5.0	11.0	10.0	5.0	30%		10985
1111	0330	4.5	2.0	1125	5.0	11.0	10.0	6.0	32%		11012
1111	0430	4.5	2.0	1127	5.0	11.0	10.0	4.0	28%		11039
1111	0530	4.5	2.0	1129	5.0	11.0	10.0	7.0	34%		11073
1111	0630	4.5	2.0	1131	5.0	11.0	10.0	7.0	34%		11119
1111	0730	4.5	2.0	1132	6.8	11.5	11.0	6.5	32%	3142	11146
1111	0830	4.5	2.0	1133	7.0	11.0	10.2	7.0	32%		11182
1111	0930	4.5	2.0	1135	7.0	11.5	10.8	7.5	35%		11220
1111	1030	4.6	2.0	1137	7.0	11.2	10.8	8.0	40%		11256
1111	1130	4.6	2.0	1139	6.8	11.2	10.8	8.0	40%		11291
1111	1230	4.5	2.0	1140	7.0	11.5	10.5	8.0	40%		11327
1111	1330	4.4	2.0	1142	7.0	11.5	10.5	8.0	40%		11327
1111	1430	4.5	2.0	1143	7.0	11.0	10.0	7.2	38%		11395
1111	1530	4.5	2.0	1145	7.0	11.0	10.5	7.0	32%		11435
1111	1630	4.5	2.0	1146	7.0	10.5	10.5	7.0	32%		11474
1111	1730	4.5	2.0	1148	7.0	11.5	10.5	7.0	30%		11513
1111	1830	4.5	2.0	1149	7.0	11.0	10.5	7.0	34%		11556
1111	1930	4.5	2.0	1151	7.0	11.5	10.5	6.5	30%		11595
1111	2030	4.5	2.0	1152	7.0	11.5	11.0	7.0	32%		11635
1111	2130	4.5	2.0	1153	7.0	11.0	10.5	7.5	35%		11673
1111	2230	4.5	2.0	1155	7.0	11.5	11.0	6.5	32%		11712
1111	2330	4.5	2.0	1157	8.0	11.0	10.0	6.0	30%		11777
1112	0030	4.5	2.0	1159	8.0	11.0	10.0	6.0	30%		11816
1112	0130				SHUT DOWN						
1112	0230	4.5	2.0	1163	5.0	11.0	10.0	5.0	20%		11896
1112	0330	4.5	2.0	1164	5.0	11.0	10.0	3.0	20%		11935
1112	0430	4.5	2.0	1165	5.0	11.0	10.0	5.0	30%		
1112	0530	4.5	2.0	1165	5.0	11.0	10.0	6.0	30%		
1112	0630	4.5	2.0	1166	8.0	10.0	10.0	6.0	32%		
1112	0730	4.5	2.0	1168	6.0	11.0	10.5	5.5	30%		12066
1112	0830	4.5	2.0	1169	6.0	11.0	10.2	5.5	30%		12105
1112	0930	4.8	2.0	1170	6.0	11.0	10.5	5.5	30%		12146
1112	1030	4.8	2.0	1172	6.0	11.0	10.2	6.5	32%		12184
1112	1130	4.5	2.0	1173	6.0	10.5	10.0	6.5	35%		12221
1112	1230	4.5	2.0	1174	<2.42	0.0	0.0	0.0	100%		12259
1112	1330	4.5	8.0	1175	4.5	11.0	10.5	4.0	28%		12279
1112	1430	4.5	1.0	1176	5.0	11.0	10.0	4.0	28%		12309
1112	1530	4.5	1.0	1178	5.5	11.0	10.5	6.5	26%		12343
1112	1630	4.5	1.0	1178	5.5	11.0	10.5	6.0	24%		12367
1112	1730	4.5	1.0	1179	5.0	11.0	10.5	4.0	26%		12402
1112	1830	4.5	1.0	1180	4.0	11.0	10.5	3.5	24%		12435
1112	1930	4.5	1.0	1181	3.5	11.0	10.0	3.5	24%		12479
1112	2030	4.5	1.0	1182	3.5	11.5	11.0	3.5	22%		12524

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READING	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1112	2130	4.5	1.0	1183	4.0	10.0	9.5	3.0	24%		12588
1112	2230	4.5	1.0	1184	6.0	11.5	11.0	5.0	28%		12637
1112	2330	4.5	2.0	1185	5.0	11.0	10.0	3.0	25%		
1113	0030	4.5	2.0	1186	5.0	11.0	10.0	3.0	25%		12711
1113	0130	4.5	2.0	1187	5.0	11.0	10.0	3.0	25%		12744
1113	0230	4.5	2.0	1188	5.0	11.0	10.0	4.0	26%		12774
1113	0330				SHUTDOWN						
1113	0430	4.5	2.0	1190	5.0	11.0	10.0	3.0	22%		12862
1113	0530	4.5	2.0	1191	5.0	11.0	10.0	3.0	20%		12880
1113	0630	4.5	2.0	1192	5.0	11.0	10.0	5.0	30%		12965
1113	0730	4.5	1.0	1193	5.0	11.2	10.5	5.5	30%		13034
1113	0830	4.5	1.0	1194	5.0	7.0	6.0	4.0	35%		13086
1113	0930	4.5	1.0	1195	6.0	11.2	10.5	5.5	30%		13128
1113	1030	4.5	1.0	1196	5.5	11.0	12.0	5.0	28%		13169
1113	1130	4.5	1.0	1197	5.0	11.0	10.5	4.2	25%		13210
1113	1230	4.5	1.0	1198	4.8	11.2	10.5	5.0	28%		13252
1113	1330	4.5	1.0	1199	5.2	10.8	10.0	6.0	30%		13304
1113	1430	4.5	1.0	1200	6.0	11.2	10.5	6.5	30%		13344
1113	1530	4.5	1.0	1201	6.0	11.0	10.0	6.5	30%		13381
1113	1630	4.5	1.0	1202	6.0	11.0	10.0	6.0	30%		13417
1113	1730	4.5	1.0	1203	5.5	10.0	9.5	5.0	30%		13454
1113	1830	4.5	1.0	1204	8.0	10.5	10.5	10.0	60%		13501
1113	1930	4.5	7.0	1206	7.0	11.0	10.5	8.5	34%		13521
1113	2030	4.5	1.0	1209	7.0	11.0	10.5	9.0	46%		13548
1113	2130	4.5	1.0	1210	7.0	11.0	10.5	7.5	34%		13573
1113	2230	4.5	2.0	1212	6.0	11.5	10.5	6.0	30%		13598
1113	2330	4.5	2.0	1214	7.0	11.0	10.0	6.0	30%		13632
1114	0030	4.5	2.0	1215	6.0	11.0	10.0	7.5	34%		13669
1114	0130	4.5	2.0	1216	5.0	11.0	10.5	6.0	30%		13753
1114	0230	4.5	2.0	1217	6.0	11.5	11.0	5.0	26%		13799
1114	0330	4.5	2.0	1218	6.0	11.0	10.0	5.0	30%		13823
1114	0430	4.5	2.0	1220	5.0	11.0	10.0	4.0	28%		13856
1114	0530	4.5	2.0	1222	5.0	11.0	10.0	5.0	30%		13890
1114	0630	4.5	2.0	1224	5.0	11.0	10.0	52.0	25%		13923
1114	0730	4.5	2.0	1225	5.0	11.5	10.5	4.5	28%	3142	13968
1114	0830	4.5	2.0	1226	5.5	11.0	10.0	5.0	30%		13991
1114	0930	4.5	2.0	1227	5.5	11.0	10.5	4.5	28%		14036
1114	1030	4.5	2.0	1229	5.0	11.0	10.5	5.0	28%		14068
1114	1130	4.5	2.0	1230	5.0	11.0	10.5	3.5	25%		14103
1114	1230	4.5	2.0	1232	3.0	11.5	10.5	1.5	20%		14146
1114	1330	4.5	2.0	1233	<2.42	11.5	11.0	0.8	20%		14168
1114	1430	4.5	2.0	1234	<2.42	11.0	10.5	1.0	20%		14198
1114	1530	4.5	2.0	1236	2.42	11.0	10.5	2.0	20%		14231
1114	1630	4.5	2.0	1237	2.42	11.0	10.5	2.0	20%		14265
1114	1730	4.5	4.0	1239	<2.42	11.5	10.5	0.0	26%		14307
1114	1830	4.5	4.0	1241	<2.42	11.0	11.5	0.0	12%		14340
1114	1930	4.5	4.0	1243	<2.42	13.5	12.5	0.0	10%		14373
1114	2030	4.5	10.0	1247	<2.420	11.5	11.0	0.0	18%		14403
1114	2130	4.5	10.0	1252	3.5	11.0	10.5	0.0	24%		14430

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READING	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1114	2230	4.5	10.0	1259	4.0	11.0	10.0	0.0	24%		14460
1114	2330			SHUTDOWN							
1115	0730	4.5	11.0	1308	4.5	11.5	11.5	0.0	28%	3142	14847
1115	0830	4.5	10.0	1312	<2.42	11.0	11.5	0.0	15%		14908
1115	0930	4.5	10.0	1318	2.5	11.0	11.0	0.0	22%		14977
1115	1030	4.5	10.0	1324	4.0	11.5	11.0	0.0	24%		15041
1115	1130				6.0	11.5					
1115	1330	4.5	10.0	1342	6.0	11.5	11.0	0.0	30%		15159
1115	1430	4.5	10.0	1348	3.0	11.0	11.0	0.0	20%		15212
1115	1530	4.5	10.0	1355	<2.42	11.5	11.0	0.0	18%		15262
1115	1630	4.5	10.0	1360	3.0	10.5	11.5	0.0	22%		15311
1115	1730	4.5	10.0	1366	3.0	10.5	11.0	0.0	24%		15371
1115	1830	4.5	10.0	1372	3.0	11.5	11.0	0.0	24%		15417
1115	1930	4.5	10.0	1379	3.0	11.0	11.0	0.0	22%		15466
1115	2030	4.5	10.0	1384	3.5	11.5	11.0	0.0	22%		15509
1115	2130	4.5	10.0	1391	4.5	11.5	11.5	0.0	20%		15556
1115	2230	4.5	10.0	1397	4.0	11.5	11.5	0.0	24%		15600
1115	2330	4.5	11.0	1404		11.0	11.0	0.0	20%		15650
1116	0030	4.5	11.0	1411		11.0	11.0	0.0	28%		15690
1116	0130	4.5	11.0	1416		11.0	11.0	0.0	20%		15730
1116	0230	4.5	11.0	1421		11.0	11.0	0.0	20%		15769
1116	0330	4.5	11.0	1428		11.0	11.0	0.0	20%		15827
1116	0430	4.5	11.0	1434		11.0	11.0	0.0	20%		15882
1116	0530	4.5	11.0	1440		11.0	11.0	0.0	20%		15936
1116	0630	4.5	11.0	1446		11.0	11.0	0.0	20%		16001
1116	0730	4.5	11.0	1453	6.0	11.0	11.0	0.0	32%		16086
1116	0830	4.5	5.0	1457	7.0	11.0	11.0	5.0	45%		16151
1116	0930	4.5	5.0	1460	5.5	11.2	11.0	0.0	30%		16225
1116	1030	4.5	5.0	1463	6.0	11.0	11.0	0.0	35%		16288
1116	1130	4.5	5.0	1467	6.0	11.0	11.0	0.0	35%		16288
1116	1230	4.5	5.0	1467	6.0	11.0	11.0	0.0	32%		16370
1116	1330	4.5	5.0	1472	4.5	11.0	10.8	0.0	25%		16539
1116	1430	4.5	5.0	1475	5.0	11.4	11.0	0.0	28%		16635
1116	1530	4.5	5.0	1478	4.0	11.0	11.0	3.5	26%		16730
1116	1630	4.5	5.0	1481	4.5	11.0	10.5	4.5	28%		16826
1116	1730	4.5	5.0	1484	4.0	11.0	11.0	5.0	26%		16921
1116	1830	4.5	5.0	1487	5.0	11.5	11.0	5.0	28%		17024
1116	1930	4.5	5.0	1490	5.0	11.0	11.0	5.5	30%		17117
1116	2030	4.5	5.0	1493	5.0	11.5	11.0	5.0	28%		17217
1116	2130	4.5	5.0	1496	5.0	11.5	11.0	5.0	30%		17313
1116	2230	4.5	5.0	1499	5.0	11.5	11.0	5.0	32%		17411
1116	2330	4.5	6.0	1502	5.0	11.0	11.0	6.0	30%		17496
1117	0030	4.5	6.0	1505	5.0	11.0	11.0	6.0	30%		17574
1117	0130	4.5	6.0	1508	5.0	11.0	10.0	5.0	25%		17644
1117	0230	4.5	6.0	1511	5.0	11.0	10.0	6.0	30%		17713
1117	0330	4.5	6.0	1514	5.0	11.0	10.0	3.0	22%		17783
1117	0430	4.5	6.0	1517	5.0	11.0	10.0	6.0	30%		17852
1117	0530	4.5	6.0	1520	5.0	11.0	10.0	4.0	20%		17920
1117	0630	4.5	6.0	1523	5.0	11.0	10.0	6.0	30%		18005

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READNG	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
1117	0730	4.5	5.0	1526	5.5	11.0	10.5	5.0	30%	3142	18081
1117	0830	4.5	5.0	1529	5.5	11.0	10.5	6.0	30%		18176
1117	0930	4.5	5.0	1532	5.5	11.0	11.0	5.0	30%		18270
1117	1030	4.5	5.0	1534	5.5	11.0	10.5	6.5	32%		18362
1117	1130	4.5	5.0	1537	5.5	11.0	10.5	6.0	30%		18456
1117	1230	4.5	5.0	1540	5.0	11.5	11.0	5.0	28%		18551
1117	1330	4.5	5.0	1543	4.5	11.0	11.0	4.52	28%		18633
1117	1430	4.5	5.0	1546	5.0	11.0	10.8	4.0	28%		18736
1117	1530	4.5	5.0	1549	5.5	11.5	11.0	6.0	30%		18834
1117	1630	4.5	5.0	1552	6.0	11.0	11.0	7.0	34%		18920
1117	1730	4.5	5.0	1555	6.5	11.0	11.0	6.5	32%		19007
1117	1830	4.5	5.0	1558	6.0	11.0	11.0	6.0	30%		19109
1117	1930	4.5	5.0	1561	6.0	11.5	11.0	5.5	30%		19202
1117	2030	4.5	5.0	1564	6.0	11.5	11.0	5.0	28%		19300
1117	2130	4.5	5.0	1567	6.0	11.5	11.0	6.0	30%		19403
1117	2230	4.5	5.0	1569	6.0	11.5	11.0	5.0	28%		19490
1117	2330	4.5	5.0	1572	6.0	11.0	11.0	5.0	28%		19588
1118	0030				SHUTDOWN						
1118	0330	4.5	5.0	1586	6.0	11.0	11.0	8.0	40%		
1118	0430	4.5	5.0	1587	6.0	11.0	11.0	5.0	28%		19957
1118	0530	4.5	5.0	1591	6.0	11.0	11.0	4.0	24%		19997
1118	0630	4.5	5.0	1593	6.0	11.0	11.0	3.0	18%		20041
1118	0730	4.5	5.0	1597	4.5	11.4	11.0	3.5	25%	3142	20098
1118	0830	4.5	5.0	1599	4.5	11.0	11.0	3.5	25%		20138
1118	0930	4.5	5.0	1602	3.5	11.5	11.0	2.5	22%		20187
1118	1030	4.5	5.0	1605	4.0	11.5	11.0	4.5	25%		20234
1118	1130	4.5	5.0	1608	4.0	11.5	11.0	2.5	22%		20282
1118	1230	4.5	5.0	1611	3.5	11.0	11.0	1.5	22%		20332
1118	1330	4.5	5.0	1614	4.0	11.0	113.0	2.5	25%		20373
1118	1430	4.5	5.0	1617	3.5	11.5	11.0	1.5	20%		20425
1118	1530	4.5	5.0	1620	6.0	10.5	11.0	3.0	22%		20471
1118	1630	4.5	5.0	1623	3.0	11.5	11.0	5.0	20%		20522
1118	1730	4.5	5.0	1626	<2.42	11.0	11.0	0.0	18%		20593
1118	1830	4.5	5.0	1629	<2.42	11.5	11.5	0.0	18%		20663
1118	1930	4.5	5.0	1632	2.42	11.0	11.0	2.0	20%		20730
1118	2030	4.5	5.0	1635	2.42	11.5	11.5	2.0	20%		20800
1118	2130	4.5	5.0	1638	<2.42	10.5	11.5	0.0	12%		20879
1118	2230	4.5	5.0	1641	<2.42	11.0	12.0	0.0	12%		20950
1118	2330	4.5	11.0	1646	5.0	11.0	11.0	4.0	20%		21301
1119	0030	4.5	11.0	1652	5.0	11.0	11.0	4.0	20%		2113
1119	0130	4.5	11.0	1659	5.0	11.0	11.0	4.0	20%		21196
1119	0230	4.5	11.0	1664	5.0	11.0	11.0	4.0	20%		21144
1119	0330	4.5	11.0	1669	5.0	11.0	11.0	4.0	20%		21197
1119	0430	4.5	11.0	1676	5.0	11.0	11.0	5.0	22%		21250
1119	0530	4.5	11.0	1682	5.0	11.0	11.0	5.0	22%		21304
1119	0630	4.5	11.0	1689	5.0	11.0	11.0	5.0	22%		21460
1119	0730	4.5	11.0	1695	6.0	11.5	11.0	4.5	206%	3142	21562
1119	0830	4.5	11.0	1700	5.5	11.0	11.0	4.5	28%		21618
1119	0930	4.5	11.0	1707	5.5	11.0	11.0	6.5	32%		21658

DATE	TIME	AGITATOR WATER FLOW	JACKET WATER FLOW	JACKET FLOW READNG	STEAM FLOW RATE	METER INLET PRES.	INLET VALVE PRES.	OUTLET VALVE PRES.	VALVE POS.	AGITATOR COUNTER READING	GRATE GEAR COUNTER READING
11196	1030	4.5	5.0	1709	3.5	11.0	11.0	1.0	20%		21697
1119	1130	4.5	5.0	1712	3.0	11.0	10.5	2.0	22%		21718
1119	1230	4.5	5.0	1715	3.0	11.5	11.5	2.5	22%		21746
1119	1330	4.0	5.0	1718	3.0	11.5	11.5	2.5	22%		21780
1119	1430	3.5	5.0	1721	3.0	11.0	10.8	2.5	22%		21814
1119	1530	4.0	5.0		3.0	11.5	10.8	3.5	23%		21856
1119	1630	4.0	5.0	1726	3.2	11.5	11.0	2.0	20%		21875
1119	1830	4.0	5.0	1732	3.0	11.5	11.0	4.0	25%	3147	21936
1119	1930	4.0	5.0	1735	4.0	11.5	11.0	4.0	25%	3150	21966
1119	2030	4.0	5.0	1737	4.5	11.5	11.5	2.0	20%	3154	21997
1119	2130	4.0	5.0	1740	3.0	11.0	11.0	2.5	22%	3157	22033
1119	2230	4.0	5.0	1743	3.0	11.0	10.5	3.0	22%	3160	22068
1119	2330	3.5	5.0	1746	3.5	11.0	11.0	2.0	22%	3164	22114
1120	0030	3.5	5.0	1749	3.5	11.0	11.0	2.0	22%	3166	22147
1120	0130	3.5	5.0	1751	3.0	11.5	11.0	1.5	22%	3169	22183
1120	0230	3.5	5.0	1754	3.5	11.5	11.0	2.0	22%	3172	22225
1120	0330	3.5	5.0	1757	3.5	11.5	11.0	2.5	22%	3176	22265
1120	0430	3.5	5.0	1760	3.8	11.5	10.5	4.0	25%	3187	22301
1120	0530	3.5	5.0	1763	4.0	11.5	11.0	4.0	28%	3181	22337
1120	0630	3.5	5.0	1766	4.0	11.5	11.0	4.0	25%	3184	22379
1120	0730	3.5	5.0	1769	4.0	11.0	11.0	4.0	25%	3187	22418
1120	0830	3.5	3.0	1772	4.0	11.0	11.0	3.0	25%	3190	22462
1120	0930	3.5	5.0	1775	4.0	11.0	11.0	3.0	25%	3193	22498

END OF BQM/FGT-002 ROSEBUD

APPENDIX H
Gas Chromatograph Data

GAS CHROMATOGRAPH DATA

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

11/ 2/1983

16:29	16.691	6.822	0.119	0.189	0.000	47.59	1.752	25.84			160.0	149.5	99.00	24.28	0.838
17:01	17.039	6.537	0.127	0.179	0.000	47.81	1.725	25.59			160.0	149.3	99.00	24.15	0.834
17:33	17.020	6.275	0.132	0.180	0.000	49.60	1.764	24.03			155.4	144.7	99.00	24.11	0.832
18:05	16.347	6.208	0.132	0.171	0.000	51.27	1.684	23.18			149.5	139.3	99.00	24.28	0.838
18:37	16.182	5.780	0.127	0.170	0.000	51.32	1.612	23.81			150.2	140.1	99.00	24.26	0.837
19:09	15.840	5.818	0.113	0.169	0.000	50.96	1.589	24.51			150.8	141.0	99.00	24.36	0.841
19:41	15.876	6.438	0.117	0.174	0.000	50.30	1.623	24.47			151.3	141.4	99.00	24.45	0.844
20:13	16.605	6.716	0.105	0.168	0.000	49.68	1.581	24.14			151.9	141.7	99.00	24.31	0.839
20:13	16.605	6.716	0.105	0.168	0.000	49.68	1.581	24.14			151.9	141.7	99.00	24.31	0.839
20:45	33.334	13.482	0.212	0.338	0.000	0.00	3.174	48.46			304.9	284.4	99.00	20.85	0.720
20:45	16.538	5.728	0.075	0.141	0.000	49.07	1.515	25.93			155.8	145.8	99.00	24.17	0.834
22:48	17.631	4.758	0.064	0.152	0.000	44.32	1.850	30.23			176.5	165.6	99.00	23.69	0.818
23:21	17.826	4.648	0.063	0.146	0.000	43.44	1.768	31.10			179.0	168.1	99.00	23.63	0.816
23:53	18.125	4.725	0.060	0.148	0.000	42.59	1.867	31.48			182.2	171.0	99.00	23.56	0.813

11/ 3/1983

0:25	17.576	4.548	0.055	0.138	0.000	42.73	1.683	32.27			180.8	170.1	99.00	23.69	0.818
0:57	18.010	4.631	0.058	0.148	0.000	44.35	1.839	29.96			176.6	165.5	99.00	23.58	0.814
1:29	17.319	4.463	0.057	0.142	0.000	45.49	1.721	29.80			172.6	161.9	99.00	23.74	0.820
2:01	17.444	4.014	0.056	0.140	0.000	45.80	1.729	29.82			173.0	162.3	99.00	23.64	0.816
2:33	17.471	4.287	0.058	0.143	0.000	44.01	1.716	31.32			177.9	167.2	99.00	23.67	0.817
3:05	17.983	4.464	0.060	0.141	0.000	42.40	1.758	32.20			182.8	171.8	99.00	23.57	0.813
3:37	18.036	4.593	0.061	0.146	0.000	41.93	1.789	32.45			184.2	173.1	99.00	23.57	0.814
4:09	18.097	4.753	0.060	0.138	0.000	41.99	1.733	32.23			183.0	172.0	99.00	23.58	0.814
4:41	18.242	4.891	0.060	0.143	0.000	41.45	1.791	32.42			184.7	173.6	99.00	23.56	0.813
5:13	18.254	4.650	0.062	0.142	0.000	41.29	1.772	32.84			185.9	174.8	99.00	23.52	0.812
5:47	18.615	4.619	0.063	0.148	0.000	40.66	1.894	33.00			189.0	177.5	99.00	23.41	0.808
6:19	18.306	4.534	0.061	0.144	0.000	42.03	1.761	32.16			183.8	172.7	99.00	23.49	0.811
6:51	17.888	4.200	0.030	0.139	0.000	44.02	1.746	30.98			178.0	167.0	99.00	23.55	0.813
7:23	17.440	4.138	0.058	0.133	0.000	45.36	1.672	30.20			173.6	163.0	99.00	23.66	0.817
7:55	17.157	4.021	0.062	0.132	0.000	46.19	1.656	29.78			171.2	160.7	99.00	23.72	0.819
8:27	16.439	4.056	0.068	0.134	0.000	47.64	1.687	28.98			166.8	156.6	99.00	23.91	0.825
8:59	16.501	3.956	0.082	0.126	0.000	44.92	1.568	31.84			175.0	165.0	99.00	23.89	0.825
9:32	16.692	4.354	0.090	0.124	0.000	43.65	1.564	32.52			177.9	167.7	99.00	23.91	0.825
10:04	16.467	4.391	0.085	0.121	0.000	43.84	1.520	32.58			176.8	166.8	99.00	23.98	0.828
11:23	16.691	4.397	0.110	0.129	0.000	42.86	1.585	33.23			180.8	170.6	99.00	23.91	0.825
11:55	16.610	4.355	0.105	0.124	0.000	43.03	1.520	33.25			179.8	169.7	99.00	23.93	0.826
12:27	16.200	4.723	0.115	0.125	0.000	43.67	1.552	32.61			176.9	167.0	99.00	24.09	0.832
13:00	16.406	6.005	0.113	0.118	0.000	44.41	1.515	30.43			170.0	160.0	99.00	24.25	0.837
13:32	16.226	4.971	0.101	0.113	0.000	44.63	1.417	31.54			171.7	161.9	99.00	24.14	0.833
14:05	15.637	5.800	0.100	0.105	0.000	47.54	1.400	28.42			159.5	150.0	99.00	24.43	0.843
15:37	15.742	5.990	0.112	0.112	0.000	46.28	1.478	29.28			163.7	154.1	99.00	24.42	0.843
17:19	13.688	7.436	0.131	0.104	0.000	50.78	1.399	25.46			144.1	135.6	99.00	25.20	0.870
17:51	14.187	7.255	0.120	0.100	0.000	50.02	1.352	25.97			146.6	137.9	99.00	25.05	0.865
18:24	14.258	7.431	0.125	0.099	0.000	50.13	1.353	25.60			145.8	137.0	99.00	25.06	0.865

GAS CHROMATOGRAPH DATA

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

11/ 3/1983

19:35	14.550	7.547	0.150	0.108	0.000	50.06	1.474	25.11			146.9	137.9	99.00	24.98	0.862
20:08	14.029	7.805	0.172	0.106	0.000	51.21	1.463	24.22			142.6	133.8	99.00	25.16	0.869
20:41	13.712	8.517	0.144	0.108	0.000	52.34	1.443	22.74			136.2	127.6	99.00	25.36	0.875
21:46	14.559	8.685	0.153	0.113	0.000	50.85	1.545	23.09			141.3	132.2	99.00	25.16	0.868
22:18	14.265	8.826	0.145	0.108	0.000	51.29	1.484	22.88			138.9	129.9	99.00	25.26	0.872
22:51	14.460	8.961	0.147	0.110	0.000	51.50	1.497	22.33			137.9	128.9	99.00	25.23	0.871
23:23	14.249	8.585	0.149	0.118	0.000	51.36	1.538	23.00			140.0	131.0	99.00	25.22	0.871
23:56	14.840	9.323	0.148	0.110	0.000	51.19	1.504	21.88			137.8	128.6	99.00	25.19	0.870

11/ 4/1983

0:28	14.734	9.845	0.102	0.123	0.000	51.71	1.563	20.93			134.5	125.3	99.00	25.29	0.873
1:01	14.556	9.611	0.137	0.107	0.000	51.77	1.519	21.30			134.9	125.9	99.00	25.31	0.874
1:34	14.655	9.917	0.112	0.109	0.000	51.79	1.484	20.93			133.4	124.3	99.00	25.34	0.875
2:07	14.710	9.848	0.106	0.117	0.000	52.18	1.544	20.49			132.8	123.6	99.00	25.30	0.873
3:10	15.701	9.432	0.142	0.120	0.000	50.07	1.648	21.88			142.1	132.3	99.00	24.97	0.862
3:43	15.439	9.374	0.139	0.116	0.000	50.95	1.607	21.38			139.1	129.5	99.00	25.03	0.864
4:16	15.437	9.751	0.123	0.126	0.000	51.07	1.680	20.81			138.0	128.3	99.00	25.08	0.866
4:49	13.513	10.483	0.123	0.107	0.000	54.03	1.494	19.24			124.5	116.0	99.00	25.72	0.888
5:22	14.376	8.940	0.145	0.115	0.000	51.17	1.600	22.65			139.8	130.7	99.00	25.24	0.871
5:55	15.127	8.709	0.152	0.124	0.000	49.85	1.683	23.36			145.6	136.0	99.00	25.00	0.863
6:28	14.332	9.562	0.128	0.121	0.000	51.64	1.624	21.59			136.3	127.2	99.00	25.35	0.875
7:00	14.835	9.367	0.126	0.118	0.000	51.30	1.591	21.66			137.8	128.5	99.00	25.19	0.869
7:33	15.426	9.067	0.118	0.125	0.000	50.16	1.645	22.46			142.8	133.1	99.00	24.98	0.862
8:06	14.502	9.909	0.099	0.134	0.000	52.00	1.688	20.66			134.3	125.1	99.00	25.35	0.875
8:38	14.768	10.182	0.084	0.120	0.000	51.34	1.650	20.86			134.9	125.6	99.00	25.33	0.874
9:11	16.127	9.498	0.075	0.122	0.000	48.90	1.650	22.63			144.9	135.0	99.00	24.87	0.858
9:44	15.412	9.532	0.105	0.114	0.000	49.92	1.563	22.36			141.2	131.6	99.00	25.07	0.865
11:07	16.105	9.018	0.107	0.109	0.000	48.56	1.545	23.56			147.0	137.2	99.00	24.81	0.856
11:40	16.173	9.219	0.100	0.111	0.000	49.21	1.601	22.59			144.6	134.7	99.00	24.81	0.857
12:11	16.340	9.032	0.082	0.109	0.000	49.53	1.502	22.40			143.3	133.4	99.00	24.75	0.854
12:44	16.644	9.339	0.097	0.116	0.000	48.21	1.577	23.02			147.3	137.2	99.00	24.71	0.853
13:17	17.255	9.252	0.082	0.102	0.000	47.36	1.454	23.49			149.1	138.8	99.00	24.56	0.848
13:50	16.960	9.295	0.103	0.108	0.000	47.77	1.499	23.27			148.3	138.1	99.00	24.63	0.850
14:21	16.334	9.555	0.148	0.098	0.000	48.87	1.508	22.49			144.4	134.5	99.00	24.84	0.857
14:53	16.893	9.606	0.140	0.107	0.000	48.16	1.574	22.52			147.0	136.7	99.00	24.69	0.852
14:53	16.893	9.606	0.140	0.107	0.000	48.16	1.574	22.52			147.0	136.7	99.00	24.69	0.852
14:54	16.893	9.606	0.140	0.107	0.000	48.16	1.574	22.52			147.0	136.7	99.00	24.69	0.852
15:26	16.229	10.758	0.138	0.111	0.000	49.63	1.528	20.60			138.3	128.4	99.00	25.06	0.865
16:37	17.761	9.755	0.187	0.125	0.000	47.86	1.775	21.54			149.8	138.8	99.00	24.47	0.845
17:10	17.334	9.585	0.153	0.114	0.000	48.02	1.619	22.18			148.2	137.6	99.00	24.57	0.848
17:41	15.534	11.496	0.110	0.116	0.000	52.11	1.689	17.94			128.8	119.1	99.00	25.34	0.875
18:13	16.383	10.816	0.097	0.106	0.000	50.96	1.547	19.09			133.4	123.4	99.00	25.02	0.864
18:45	17.057	10.776	0.074	0.118	0.000	48.93	1.555	20.49			140.0	129.7	99.00	24.84	0.857
19:19	17.926	10.162	0.096	0.131	0.000	47.19	1.738	21.76			149.3	138.4	99.00	24.49	0.845
19:51	17.918	9.888	0.122	0.155	0.000	47.26	1.855	21.80			151.5	140.3	99.00	24.44	0.844

GAS CHROMATOGRAPH DATA

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

11/ 4/1983															
20:24	18.653	9.359	0.109	0.113	0.000	46.20	1.665	22.90			154.5	143.3	99.00	24.18	0.835
21:29	16.675	9.598	0.102	0.112	0.000	49.04	1.571	21.90			143.8	133.6	99.00	24.75	0.854
22:01	16.806	10.166	0.069	0.116	0.000	49.20	1.575	21.07			141.1	130.9	99.00	24.81	0.856
22:53	17.826	11.171	0.059	0.111	0.000	47.88	1.581	20.37			142.0	131.3	99.00	24.70	0.853
23:25	18.040	11.699	0.094	0.119	0.000	47.95	1.697	19.40			141.5	130.5	99.00	24.72	0.853
23:59	19.047	10.877	0.122	0.124	0.000	46.34	1.785	20.71			150.3	138.7	99.00	24.31	0.839
11/ 5/1983															
0:31	18.699	10.931	0.138	0.125	0.000	47.12	1.862	20.13			148.4	136.9	99.00	24.40	0.842
1:05	17.943	11.571	0.127	0.135	0.000	48.38	1.897	18.95			142.5	131.4	99.00	24.70	0.852
1:38	18.705	11.388	0.104	0.131	0.000	46.98	1.873	19.82			147.1	135.6	99.00	24.47	0.845
2:11	19.687	10.234	0.069	0.111	0.000	45.63	1.742	21.53			153.5	141.7	99.00	24.05	0.830
2:43	19.594	10.367	0.064	0.115	0.000	45.63	1.716	21.52			152.9	141.2	99.00	24.10	0.832
3:16	20.468	8.957	0.105	0.124	0.000	43.11	1.795	24.44			166.8	154.5	99.00	23.63	0.816
3:49	19.172	10.037	0.103	0.119	0.000	45.57	1.758	22.24			155.0	143.4	99.00	24.15	0.834
4:22	18.473	8.721	0.094	0.121	0.000	45.71	1.695	24.19			158.3	147.1	99.00	24.13	0.833
4:55	18.489	9.288	0.132	0.122	0.000	46.13	1.726	23.11			155.8	144.5	99.00	24.21	0.836
5:59	19.712	10.144	0.083	0.131	0.000	44.61	1.841	22.48			158.3	146.3	99.00	24.01	0.829
6:32	20.235	10.151	0.132	0.141	0.000	44.17	2.027	22.15			161.7	149.3	99.00	23.86	0.824
7:05	19.579	9.310	0.151	0.114	0.000	44.94	1.806	23.10			160.2	148.3	99.00	23.92	0.826
7:38	18.988	9.886	0.145	0.126	0.000	46.45	1.873	21.53			154.1	142.4	99.00	24.16	0.834
8:11	18.256	10.921	0.104	0.125	0.000	47.24	1.815	20.54			147.3	136.1	99.00	24.52	0.846
8:44	18.394	10.275	0.172	0.146	0.000	47.58	2.070	20.36			151.2	139.6	99.00	24.35	0.841
9:17	15.108	10.360	0.160	0.136	0.000	50.92	1.913	20.40			138.7	128.9	99.00	25.24	0.871
9:50	16.727	10.032	0.122	0.111	0.000	49.63	1.721	20.66			141.8	131.4	99.00	24.79	0.856
10:23	17.430	10.690	0.119	0.132	0.000	48.12	1.797	20.71			145.3	134.5	99.00	24.70	0.853
10:56	19.241	10.132	0.077	0.124	0.000	45.64	1.823	21.96			154.7	143.0	99.00	24.14	0.833
11:29	19.247	9.010	0.090	0.132	0.000	44.76	1.906	23.86			161.9	150.1	99.00	23.95	0.827
12:02	17.653	9.156	0.119	0.124	0.000	47.13	1.783	23.03			153.2	142.3	99.00	24.40	0.842
12:35	18.378	10.212	0.104	0.131	0.000	46.74	1.780	21.65			151.0	139.8	99.00	24.38	0.842
13:08	18.636	10.079	0.097	0.107	0.000	47.02	1.724	21.34			149.7	138.4	99.00	24.30	0.839
13:41	20.020	9.408	0.080	0.129	0.000	43.93	1.875	23.56			163.0	150.8	99.00	23.81	0.822
14:14	19.255	9.866	0.075	0.114	0.000	45.08	1.720	22.89			156.4	144.9	99.00	24.10	0.832
14:47	18.509	9.378	0.117	0.103	0.000	45.89	1.692	23.31			155.6	144.4	99.00	24.22	0.836
15:20	19.756	9.290	0.089	0.127	0.000	43.94	1.916	23.88			163.7	151.6	99.00	23.86	0.824
15:53	17.577	9.471	0.094	0.127	0.000	48.76	1.848	21.12			147.2	136.3	99.00	24.46	0.844
16:26	19.971	9.396	0.124	0.152	0.000	44.19	2.174	22.99			165.1	152.6	99.00	23.79	0.821
18:01	20.225	9.376	0.084	0.138	0.000	43.23	1.922	24.02			165.8	153.5	99.00	23.75	0.820
18:34	20.539	8.460	0.079	0.130	0.000	42.42	1.879	25.49			170.9	158.5	99.00	23.53	0.812
11/ 9/1983															
12:03	17.988	5.725	0.093	0.130	0.000	44.75	1.677	28.63			170.9	160.0	99.00	23.78	0.821
12:38	18.211	5.823	0.086	0.128	0.000	44.21	1.642	28.90			172.0	161.0	99.00	23.74	0.819
13:11	18.345	5.784	0.075	0.129	0.000	43.81	1.657	29.20			173.4	162.3	99.00	23.69	0.818

GAS CHROMATOGRAPH DATA

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

11/ 9/1983

13:42	18.063	5.938	0.081	0.128	0.000	44.32	1.629	28.84			171.1	160.2	99.00	23.80	0.821
17:23	18.232	5.941	0.101	0.122	0.000	44.44	1.566	28.60			170.4	159.5	99.00	23.76	0.820
17:55	17.542	6.907	0.106	0.129	0.000	46.04	1.643	26.63			162.9	152.2	99.00	24.08	0.831
18:28	17.996	6.464	0.098	0.128	0.000	44.83	1.608	27.87			167.8	157.0	99.00	23.90	0.825
19:00	18.412	6.083	0.081	0.133	0.000	44.04	1.691	28.56			172.0	160.9	99.00	23.72	0.819
19:33	18.872	5.825	0.073	0.134	0.000	43.43	1.655	29.01			174.5	163.2	99.00	23.56	0.813
20:05	18.443	6.066	0.074	0.137	0.243	44.07	1.663	28.31			171.0	159.9	99.00	23.72	0.819
20:38	18.747	5.585	0.069	0.134	0.000	43.38	1.574	29.51			174.8	163.6	99.00	23.57	0.814
21:26	18.683	5.724	0.065	0.131	0.000	43.74	1.595	29.06			173.3	162.1	99.00	23.60	0.815
21:59	18.432	5.988	0.067	0.134	0.000	44.54	1.673	28.17			170.5	159.3	99.00	23.70	0.818
22:31	18.531	6.117	0.070	0.134	0.000	44.01	1.637	28.50			171.5	160.4	99.00	23.70	0.818
23:03	18.685	6.317	0.072	0.136	0.000	43.84	1.663	28.28			171.7	160.4	99.00	23.69	0.818
23:35	18.620	6.523	0.060	0.135	0.000	43.79	1.655	28.22			171.0	159.8	99.00	23.74	0.820

11/10/1983

0:07	18.993	5.982	0.059	0.132	0.000	43.68	1.680	28.48			173.2	161.8	99.00	23.55	0.813
0:40	19.333	5.584	0.062	0.140	0.000	42.67	1.706	29.50			178.0	166.4	99.00	23.40	0.808
1:12	19.355	5.687	0.060	0.139	0.000	42.69	1.723	29.34			177.7	166.1	99.00	23.41	0.808
1:45	19.466	5.785	0.060	0.145	0.000	42.64	1.766	29.14			177.9	166.2	99.00	23.39	0.807
2:17	19.402	6.081	0.060	0.148	0.000	42.72	1.772	28.82			176.8	165.1	99.00	23.45	0.810
2:48	19.210	5.495	0.059	0.144	0.000	42.31	1.847	29.93			180.5	168.8	99.00	23.40	0.808
3:20	18.901	6.258	0.051	0.123	0.000	43.67	1.608	28.38			171.6	160.3	99.00	23.63	0.816
3:53	18.279	6.673	0.050	0.115	0.000	44.68	1.470	27.73			165.9	155.1	99.00	23.88	0.824
4:24	18.948	6.340	0.058	0.137	0.000	43.98	1.710	27.83			171.3	159.9	99.00	23.62	0.815
4:57	19.307	5.900	0.062	0.142	0.000	42.98	1.718	28.89			176.1	164.5	99.00	23.46	0.810
5:29	19.196	5.939	0.054	0.129	0.000	43.16	1.603	28.92			174.3	162.9	99.00	23.50	0.811
6:01	19.182	6.490	0.059	0.140	0.000	43.39	1.716	28.03			172.8	161.3	99.00	23.58	0.814
6:34	19.054	6.758	0.059	0.143	0.000	43.64	1.747	27.60			171.4	159.9	99.00	23.66	0.817
7:05	19.222	6.041	0.060	0.149	0.025	42.67	1.895	28.94			177.9	166.1	99.00	23.48	0.810
7:05	19.222	6.041	0.060	0.149	0.025	42.67	1.895	28.94			177.9	166.1	99.00	23.48	0.810
7:38	19.378	5.817	0.059	0.143	0.000	42.70	1.731	29.17			177.4	165.7	99.00	23.42	0.808
8:11	19.190	5.806	0.057	0.137	0.000	43.01	1.654	29.14			175.7	164.3	99.00	23.48	0.810
8:43	19.337	5.575	0.061	0.137	0.000	42.66	1.642	29.58			177.6	166.0	99.00	23.40	0.808
9:47	18.705	6.404	0.072	0.136	0.000	44.03	1.600	28.06			170.4	159.2	99.00	23.71	0.818
10:20	18.671	6.554	0.064	0.131	0.000	44.13	1.664	27.79			169.8	158.6	99.00	23.73	0.819
10:52	18.947	6.389	0.068	0.132	0.000	43.70	1.659	28.11			171.8	160.4	99.00	23.63	0.816
11:25	18.639	6.440	0.068	0.134	0.000	44.07	1.682	27.96			170.6	159.3	99.00	23.72	0.819
11:57	18.746	6.394	0.063	0.137	0.000	43.69	1.603	28.37			171.4	160.2	99.00	23.69	0.818
12:30	19.171	5.838	0.061	0.135	0.000	43.01	1.612	29.17			175.4	163.9	99.00	23.49	0.811
13:02	19.046	5.735	0.060	0.137	0.106	43.21	1.618	29.09			174.8	163.4	99.00	23.51	0.812
13:34	19.026	5.868	0.063	0.137	0.000	43.19	1.604	29.11			174.7	163.4	99.00	23.54	0.812
14:07	18.947	5.902	0.065	0.138	0.185	43.49	1.634	28.64			173.3	161.9	99.00	23.57	0.813
14:39	19.065	6.079	0.064	0.140	0.000	43.45	1.646	28.56			173.5	162.1	99.00	23.56	0.813
15:10	19.539	5.666	0.066	0.137	0.000	42.55	1.767	29.28			178.6	166.8	99.00	23.35	0.806
15:42	19.176	6.201	0.062	0.137	0.000	43.23	1.793	28.40			174.8	163.2	99.00	23.53	0.812

GAS CHROMATOGRAPH DATA

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

11/10/1983

16:15	19.440	6.175	0.056	0.137	0.000	42.85	1.736	28.61			175.6	163.9	99.00	23.46	0.810
17:23	19.774	5.965	0.057	0.128	0.000	42.19	1.744	29.14			178.4	166.5	99.00	23.34	0.806
17:56	19.497	6.272	0.057	0.130	0.000	42.51	1.729	28.81			176.3	164.6	99.00	23.46	0.810
18:29	19.633	6.347	0.058	0.126	0.000	42.55	1.723	28.57			175.8	164.1	99.00	23.44	0.809
19:00	19.839	6.116	0.061	0.129	0.000	42.21	1.735	28.91			177.9	166.0	99.00	23.35	0.806
19:33	19.583	6.476	0.058	0.128	0.000	42.70	1.698	28.36			174.8	163.1	99.00	23.48	0.810
20:05	20.101	5.895	0.059	0.129	0.000	42.02	1.737	29.06			179.2	167.2	99.00	23.25	0.802
20:38	20.036	5.952	0.058	0.127	0.000	41.94	1.704	29.18			179.0	167.0	99.00	23.28	0.803
21:53	19.668	5.947	0.063	0.135	0.000	42.01	1.785	29.39			179.5	167.6	99.00	23.36	0.806
22:26	19.422	6.446	0.057	0.125	0.000	43.12	1.698	28.13			173.5	161.8	99.00	23.52	0.812
22:58	19.637	6.117	0.058	0.124	0.000	42.79	1.676	28.60			175.5	163.7	99.00	23.41	0.808
23:31	19.344	6.063	0.057	0.120	0.000	42.73	1.633	29.05			175.4	163.9	99.00	23.48	0.811

11/11/1983

0:03	19.273	5.928	0.060	0.126	0.000	43.76	1.686	28.17			173.1	161.5	99.00	23.47	0.810
0:35	19.616	6.195	0.058	0.128	0.000	42.68	1.704	28.62			175.8	164.1	99.00	23.42	0.809
1:08	19.892	5.809	0.058	0.133	0.000	41.76	1.788	29.56			180.7	168.7	99.00	23.28	0.804
1:40	19.764	5.772	0.060	0.132	0.000	42.20	1.791	29.29			179.4	167.5	99.00	23.31	0.805
2:13	19.069	6.024	0.061	0.127	0.000	43.07	1.690	28.96			175.0	163.5	99.00	23.54	0.813
2:46	19.505	6.022	0.061	0.127	0.000	42.60	1.686	29.00			176.5	164.8	99.00	23.43	0.809
3:18	19.395	5.913	0.071	0.123	0.000	42.72	1.695	29.08			176.6	165.0	99.00	23.44	0.809
3:51	19.091	6.081	0.078	0.122	0.000	43.24	1.647	28.75			174.2	162.7	99.00	23.55	0.813
4:23	19.453	6.552	0.074	0.125	0.000	42.97	1.673	28.15			173.7	162.0	99.00	23.53	0.812
4:56	19.657	6.213	0.072	0.130	0.000	42.29	1.725	28.91			177.4	165.6	99.00	23.41	0.808
5:28	20.084	6.283	0.070	0.131	0.000	42.07	1.751	28.61			178.0	166.0	99.00	23.31	0.805
6:01	19.821	6.623	0.071	0.133	0.000	42.51	1.774	28.07			175.7	163.8	99.00	23.43	0.809
6:33	19.430	6.603	0.069	0.128	0.000	42.86	1.709	28.20			174.1	162.4	99.00	23.54	0.812
7:06	19.759	6.440	0.068	0.132	0.000	42.50	1.785	28.31			176.3	164.4	99.00	23.42	0.808
7:38	19.970	6.295	0.064	0.133	0.000	42.27	1.801	28.47			177.6	165.6	99.00	23.34	0.806
8:11	19.956	6.186	0.060	0.131	0.000	42.14	1.762	28.77			178.1	166.1	99.00	23.33	0.805
8:41	20.042	6.219	0.058	0.138	0.000	41.97	1.744	28.83			178.4	166.4	99.00	23.31	0.805
9:14	19.956	6.105	0.060	0.134	0.000	42.00	1.720	29.02			178.5	166.6	99.00	23.32	0.805
10:58	19.966	6.380	0.060	0.139	0.000	42.18	1.728	28.55			177.2	165.2	99.00	23.36	0.806
11:30	19.998	6.155	0.057	0.130	0.000	42.12	1.656	28.89			177.4	165.5	99.00	23.32	0.805
12:03	19.869	5.833	0.059	0.131	0.426	42.10	1.673	28.90			177.3	165.5	99.00	23.32	0.805
12:36	19.702	6.095	0.062	0.134	0.000	42.26	1.637	29.11			177.1	165.4	99.00	23.39	0.808
13:08	19.995	6.114	0.006	0.133	0.000	42.10	1.687	28.97			177.2	165.4	99.00	23.31	0.805
13:41	19.786	6.103	0.055	0.129	0.000	42.25	1.619	29.06			176.9	165.1	99.00	23.37	0.807
14:13	19.928	6.062	0.057	0.128	0.000	42.22	1.645	28.96			177.3	165.5	99.00	23.33	0.805
14:43	19.988	6.024	0.057	0.131	0.000	42.13	1.646	29.02			177.8	165.9	99.00	23.31	0.805
15:15	20.044	6.086	0.057	0.134	0.000	41.90	1.699	29.08			178.7	166.8	99.00	23.30	0.804
15:47	20.082	6.202	0.057	0.136	0.000	41.93	1.696	28.90			178.3	166.3	99.00	23.30	0.804
16:19	20.095	6.123	0.054	0.135	0.000	41.85	1.689	29.05			178.7	166.7	99.00	23.29	0.804
17:56	19.621	6.020	0.048	0.128	0.000	42.25	1.801	29.13			178.3	166.5	99.00	23.38	0.807
18:28	19.577	6.033	0.049	0.123	0.000	42.36	1.735	29.12			177.4	165.6	99.00	23.40	0.808

GAS CHROMATOGRAPH DATA

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

11/11/1983

19:00	19.389	6.088	0.051	0.133	0.000	43.10	1.866	28.38			175.9	164.1	99.00	23.45 0.809
19:33	19.765	6.023	0.052	0.136	0.000	42.03	1.899	29.10			179.8	167.8	99.00	23.33 0.805
20:05	19.707	6.051	0.049	0.131	0.000	42.19	1.868	29.00			178.9	166.9	99.00	23.36 0.806
20:37	19.838	5.952	0.052	0.140	0.000	41.95	1.952	29.12			180.7	168.6	99.00	23.30 0.804
21:09	19.929	6.041	0.050	0.134	0.000	41.82	1.904	29.13			180.4	168.3	99.00	23.29 0.804
21:41	19.886	6.124	0.050	0.134	0.000	41.88	1.914	29.01			180.0	167.9	99.00	23.32 0.805
22:13	19.856	6.084	0.047	0.127	0.000	41.96	1.831	29.09			179.2	167.2	99.00	23.33 0.805
22:45	19.745	5.961	0.048	0.129	0.000	42.09	1.831	29.20			179.2	167.3	99.00	23.34 0.806
23:21	19.773	6.128	0.047	0.129	0.000	42.06	1.845	29.02			178.9	166.9	99.00	23.36 0.806
23:53	19.735	5.999	0.049	0.133	0.000	41.69	1.889	29.50			180.8	168.9	99.00	23.34 0.806

11/12/1983

0:25	19.513	5.928	0.049	0.134	0.000	42.27	1.745	29.37			178.2	166.5	99.00	23.40 0.808
0:57	19.655	6.049	0.050	0.137	0.000	42.11	1.826	29.17			179.0	167.1	99.00	23.38 0.807
1:29	19.771	5.247	0.048	0.136	0.000	41.79	1.910	30.10			183.1	171.1	99.00	23.21 0.801
2:03	19.578	5.903	0.047	0.134	0.000	42.04	1.776	29.52			179.2	167.4	99.00	23.38 0.807
2:35	19.630	6.009	0.046	0.128	0.000	42.17	1.755	29.26			178.2	166.5	99.00	23.38 0.807
3:40	19.747	5.988	0.049	0.138	0.000	41.93	1.840	29.31			179.9	167.9	99.00	23.34 0.806
4:13	19.281	5.881	0.046	0.128	0.000	42.69	1.757	29.22			177.0	165.4	99.00	23.45 0.810
4:45	19.691	5.651	0.047	0.133	0.000	41.98	1.795	29.70			180.3	168.5	99.00	23.31 0.805
5:18	19.816	5.736	0.048	0.136	0.000	41.77	1.848	29.64			181.2	169.2	99.00	23.28 0.804
5:50	19.722	5.682	0.048	0.136	0.000	41.89	1.834	29.69			180.9	168.9	99.00	23.30 0.804
6:23	19.536	5.687	0.046	0.126	0.000	42.35	1.719	29.54			178.4	166.7	99.00	23.36 0.806
6:55	19.656	5.530	0.047	0.134	0.000	41.90	1.795	29.94			181.0	169.2	99.00	23.30 0.804
7:27	19.570	5.638	0.047	0.130	0.000	42.18	1.757	29.68			179.5	167.7	99.00	23.34 0.806
7:58	19.798	5.690	0.048	0.137	0.000	41.91	1.834	29.59			180.8	168.9	99.00	23.28 0.804
8:30	19.088	5.770	0.047	0.131	0.000	42.48	1.823	29.66			178.5	166.9	99.00	23.48 0.810
9:42	19.421	5.714	0.046	0.132	0.000	42.08	1.769	29.84			179.6	167.9	99.00	23.39 0.807
10:15	19.373	5.678	0.044	0.125	0.000	42.38	1.693	29.71			178.1	166.5	99.00	23.41 0.808
10:47	19.784	5.998	0.046	0.132	0.000	41.80	1.779	29.46			179.7	167.8	99.00	23.34 0.806
11:20	19.782	5.993	0.044	0.125	0.000	41.97	1.715	29.37			178.6	166.8	99.00	23.35 0.806
13:13	19.823	4.259	0.049	0.134	0.000	41.66	1.733	31.34			185.5	173.6	99.00	23.06 0.796
14:16	19.573	5.916	0.045	0.128	0.000	42.18	1.700	29.46			178.1	166.4	99.00	23.39 0.807
14:49	19.882	6.236	0.044	0.124	0.000	42.24	1.783	28.69			177.4	165.5	99.00	23.35 0.806
15:21	20.005	6.511	0.044	0.124	0.000	42.03	1.825	28.46			177.5	165.5	99.00	23.36 0.806
15:54	19.869	6.194	0.046	0.130	0.000	41.92	1.869	28.97			179.3	167.2	99.00	23.34 0.806
16:26	20.115	6.404	0.043	0.118	0.000	42.04	1.791	28.49			177.5	165.4	99.00	23.32 0.805
16:58	19.811	6.243	0.047	0.128	0.000	42.22	1.924	28.63			178.5	166.5	99.00	23.35 0.806
17:31	19.824	6.347	0.043	0.120	0.000	42.50	1.808	28.36			176.3	164.4	99.00	23.38 0.807
18:04	19.712	6.202	0.041	0.110	0.000	42.87	1.674	28.39			174.5	162.8	99.00	23.40 0.808
18:36	19.872	6.612	0.041	0.111	0.000	42.66	1.651	28.06			173.7	161.9	99.00	23.43 0.809
19:09	19.534	6.468	0.042	0.116	0.000	42.95	1.700	28.19			173.7	162.0	99.00	23.49 0.811
19:38	19.659	6.661	0.043	0.120	0.000	42.91	1.738	27.87			173.5	161.7	99.00	23.48 0.811
20:10	19.528	6.795	0.047	0.128	0.000	43.28	1.804	27.42			172.5	160.7	99.00	23.53 0.812
20:41	19.869	6.562	0.047	0.129	0.000	42.49	1.820	28.08			175.9	163.9	99.00	23.40 0.808

GAS CHROMATOGRAPH DATA

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

11/13/1983

0:00	21.451	6.790	0.047	0.121	0.000	40.43	1.885	28.28			182.2	169.4	99.00	23.02	0.795
0:00	21.451	6.790	0.047	0.121	0.000	40.43	1.885	28.28			182.2	169.4	99.00	23.02	0.795
0:00	21.451	6.790	0.047	0.121	0.000	40.43	1.885	28.28			182.2	169.4	99.00	23.02	0.795
0:00	21.451	6.790	0.047	0.121	0.000	40.43	1.885	28.28			182.2	169.4	99.00	23.02	0.795
2:16	19.844	6.133	0.045	0.114	0.000	42.88	1.721	28.26			175.1	163.3	99.00	23.35	0.806
2:48	19.766	6.036	0.043	0.111	0.000	42.51	1.658	28.87			176.1	164.4	99.00	23.36	0.807
3:19	19.757	6.126	0.044	0.111	0.000	42.65	1.657	28.65			175.4	163.7	99.00	23.38	0.807
3:51	19.360	5.956	0.046	0.119	0.000	43.16	1.781	28.58			175.3	163.6	99.00	23.44	0.809
4:22	21.451	6.790	0.047	0.121	0.000	40.43	1.885	28.28			182.2	169.4	99.00	23.02	0.795
4:54	19.794	6.561	0.047	0.120	0.000	42.86	1.811	27.80			174.5	162.6	99.00	23.42	0.809
5:26	20.051	6.417	0.050	0.123	0.000	42.52	1.805	28.04			176.1	164.1	99.00	23.33	0.805
5:57	19.951	7.069	0.054	0.138	0.000	42.74	1.928	27.12			174.4	162.3	99.00	23.45	0.809
6:29	20.142	7.080	0.052	0.136	0.000	42.50	1.899	27.19			175.0	162.7	99.00	23.41	0.808
7:01	20.409	6.871	0.053	0.136	0.000	42.16	1.918	27.45			176.9	164.5	99.00	23.30	0.804
7:32	20.602	6.859	0.059	0.154	0.000	41.68	2.095	27.55			180.0	167.3	99.00	23.23	0.802
8:04	20.362	6.307	0.049	0.135	0.000	41.95	1.896	28.30			179.1	166.8	99.00	23.23	0.802
8:36	19.927	6.222	0.055	0.147	0.000	42.32	2.011	28.32			179.2	167.0	99.00	23.31	0.805
9:07	20.256	6.781	0.051	0.129	0.000	42.17	1.829	27.78			176.4	164.2	99.00	23.34	0.806
10:17	19.970	6.827	0.051	0.128	0.000	42.79	1.832	27.40			174.2	162.2	99.00	23.42	0.808
10:49	20.377	6.900	0.049	0.124	0.000	42.11	1.793	27.64			175.8	163.6	99.00	23.33	0.805
11:21	20.678	6.482	0.047	0.123	0.000	41.62	1.800	28.25			178.8	166.4	99.00	23.18	0.800
11:54	20.331	6.422	0.047	0.122	0.000	42.06	1.802	28.21			177.5	165.4	99.00	23.26	0.803
12:26	20.112	6.669	0.048	0.123	0.000	42.46	1.802	27.79			175.5	163.4	99.00	23.36	0.806
12:58	20.088	6.581	0.054	0.119	0.000	42.51	1.742	27.91			175.2	163.2	99.00	23.36	0.806
14:01	19.657	7.260	0.063	0.128	0.000	43.67	1.768	26.46			169.7	157.9	99.00	23.58	0.814
14:33	20.054	6.953	0.060	0.138	0.000	42.72	1.850	27.22			174.4	162.3	99.00	23.41	0.808
15:04	19.929	6.415	0.058	0.128	0.017	42.46	1.801	28.19			176.5	164.5	99.00	23.37	0.807
16:05	20.251	7.111	0.055	0.124	0.000	42.29	1.665	27.50			173.8	161.8	99.00	23.41	0.808
16:36	20.442	6.775	0.053	0.127	0.000	41.80	1.731	28.07			176.9	164.7	99.00	23.30	0.804
17:08	20.116	6.908	0.056	0.125	0.000	42.25	1.679	27.86			174.7	162.7	99.00	23.41	0.808
17:39	20.001	6.694	0.057	0.127	0.000	42.04	1.729	28.35			176.4	164.5	99.00	23.40	0.808
18:10	16.095	4.163	0.060	0.128	0.000	46.30	1.642	30.61			170.2	160.3	99.00	24.02	0.829
18:41	22.058	8.650	0.061	0.130	0.000	40.57	1.840	25.69			175.8	162.7	99.00	23.17	0.800
19:13	20.893	8.950	0.050	0.116	0.000	42.20	1.603	25.19			167.6	155.3	99.00	23.54	0.813
19:44	19.936	7.607	0.052	0.122	0.000	42.81	1.641	26.83			170.3	158.5	99.00	23.57	0.814
20:15	19.530	7.174	0.058	0.124	0.000	43.14	1.699	27.27			171.1	159.4	99.00	23.60	0.815
20:47	19.584	7.010	0.068	0.128	0.000	42.47	1.785	27.95			174.6	162.7	99.00	23.55	0.813
21:18	20.233	7.355	0.070	0.135	0.000	42.12	1.837	27.24			175.1	162.9	99.00	23.43	0.809
21:49	20.204	7.566	0.072	0.125	0.000	42.51	1.767	26.76			172.6	160.4	99.00	23.48	0.811
22:54	19.257	7.299	0.082	0.124	0.000	43.40	1.742	27.09			170.4	158.8	99.00	23.69	0.818
23:25	19.516	7.204	0.078	0.131	0.014	43.22	1.717	27.12			171.2	159.4	99.00	23.61	0.815
23:57	19.155	7.346	0.080	0.120	0.000	43.72	1.715	26.86			169.0	157.5	99.00	23.73	0.819

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0:28	19.290	7.206	0.081	0.124	0.016	43.61	1.658	27.02			169.4	157.9	99.00	23.6	0.817
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GAS CHROMATOGRAPH DATA

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

11/14/1983

1:00	19.579	7.342	0.067	0.134	0.017	43.31	1.723	26.83			170.4	158.6	99.00	23.62	0.815
1:32	20.227	7.076	0.064	0.142	0.000	42.24	1.945	27.30			176.3	164.0	99.00	23.38	0.807
2:03	19.727	7.522	0.059	0.136	0.000	43.27	1.870	26.41			170.9	158.9	99.00	23.59	0.814
2:35	20.376	7.544	0.058	0.139	0.000	42.11	1.809	26.96			174.2	162.0	99.00	23.43	0.809
3:06	19.964	7.224	0.053	0.123	0.000	42.61	1.634	27.40			172.1	160.3	99.00	23.51	0.811
3:38	19.881	7.386	0.050	0.120	0.000	42.98	1.632	26.95			170.3	158.5	99.00	23.55	0.813
4:09	18.805	4.458	0.045	0.111	1.466	46.47	1.571	26.07			163.2	152.0	99.00	23.43	0.809
4:41	19.822	6.940	0.053	0.116	0.000	42.55	1.663	27.85			173.3	161.5	99.00	23.49	0.811
5:12	19.832	7.340	0.058	0.120	0.000	42.83	1.678	27.15			171.4	159.6	99.00	23.55	0.813
5:44	19.610	7.505	0.060	0.125	0.000	42.86	1.700	27.14			171.0	159.3	99.00	23.64	0.816
6:15	19.974	7.688	0.058	0.131	0.000	42.89	1.807	26.45			171.1	159.1	99.00	23.56	0.813
6:47	19.943	7.410	0.055	0.124	0.000	42.74	1.778	26.95			172.2	160.2	99.00	23.52	0.812
7:18	20.107	6.918	0.061	0.128	0.000	42.29	1.751	27.75			175.1	163.1	99.00	23.41	0.808
7:49	19.985	7.013	0.058	0.126	0.000	42.47	1.719	27.63			174.0	162.0	99.00	23.46	0.810
8:21	19.825	8.118	0.059	0.126	0.019	43.17	1.718	25.97			168.1	156.2	99.00	23.68	0.817
10:30	20.592	8.098	0.060	0.137	0.000	42.19	1.850	26.08			172.5	160.1	99.00	23.46	0.810
11:02	20.793	7.843	0.055	0.127	0.000	41.91	1.776	26.49			173.5	161.1	99.00	23.37	0.807
11:34	20.198	7.402	0.051	0.122	0.000	42.56	1.693	26.97			172.1	160.1	99.00	23.47	0.810
12:05	19.835	7.594	0.053	0.124	0.000	43.50	1.712	26.18			168.6	156.8	99.00	23.59	0.814
12:37	19.432	7.967	0.056	0.128	0.000	43.80	1.702	25.92			166.5	154.9	99.00	23.76	0.820
13:08	19.230	8.177	0.061	0.134	0.000	44.11	1.781	25.51			165.5	153.9	99.00	23.83	0.823
14:36	18.595	6.450	0.056	0.123	0.000	44.05	1.576	28.15			169.6	158.5	99.00	23.75	0.820
15:07	18.793	6.720	0.060	0.125	0.000	44.08	1.627	27.59			169.1	157.8	99.00	23.73	0.819
15:39	18.681	6.490	0.063	0.132	0.009	43.59	1.686	28.35			171.9	160.6	99.00	23.72	0.819
16:10	18.510	6.851	0.067	0.136	0.175	46.82	1.724	24.71			160.2	149.0	99.00	23.82	0.822
16:42	18.477	8.731	0.069	0.145	0.000	45.49	1.856	24.23			160.0	148.7	99.00	24.11	0.832
17:14	18.385	8.317	0.059	0.137	0.000	45.43	1.760	24.91			160.6	149.5	99.00	24.08	0.831
17:45	18.164	8.062	0.056	0.130	0.000	45.72	1.739	25.13			160.3	149.2	99.00	24.10	0.832
18:17	18.105	8.152	0.058	0.121	0.020	45.61	1.603	25.34			159.2	148.3	99.00	24.14	0.833
18:48	17.573	7.957	0.059	0.122	0.014	46.11	1.631	25.54			158.5	147.8	99.00	24.25	0.837
19:20	17.324	7.392	0.060	0.111	0.000	46.53	1.474	26.11			157.7	147.4	99.00	24.24	0.837
19:51	17.485	7.642	0.067	0.134	0.000	46.22	1.692	25.76			159.9	149.2	99.00	24.21	0.836
20:23	17.056	8.855	0.065	0.128	0.019	47.10	1.680	24.10			152.9	142.4	99.00	24.52	0.846
20:54	17.475	8.194	0.066	0.135	0.000	46.40	1.742	24.98			157.8	147.1	99.00	24.30	0.839
21:26	16.745	8.250	0.063	0.132	0.000	47.59	1.692	24.53			153.4	143.1	99.00	24.50	0.846
21:57	17.624	7.508	0.059	0.129	0.000	46.00	1.692	25.99			160.8	150.1	99.00	24.15	0.834
23:39	17.578	7.037	0.054	0.125	0.000	45.61	1.644	26.95			163.1	152.5	99.00	24.10	0.832

11/15/1983

0:00	0.000	15.440	0.000	0.127	0.000	74.20	0.692	8.54			36.6	35.8	99.00	30.12	1.040
0:11	16.768	8.058	0.055	0.120	0.000	48.02	1.567	24.42			151.5	141.3	99.00	24.48	0.845
0:43	17.145	7.847	0.054	0.121	0.012	46.78	1.577	25.47			156.2	145.8	99.00	24.35	0.840
2:49	17.176	7.341	0.060	0.111	0.000	46.58	1.451	26.29			157.6	147.3	99.00	24.27	0.838
2:49	17.176	7.342	0.060	0.111	0.000	46.58	1.451	26.28			157.6	147.3	99.00	24.27	0.838
3:20	15.735	9.988	0.051	0.115	0.000	49.72	1.479	21.91			139.1	129.5	99.00	25.07	0.865

GAS CHROMATOGRAPH DATA

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

11/15/1983

3:52	17.274	8.457	0.055	0.121	0.000	47.08	1.609	24.40			153.5	143.1	99.00	24.41	0.842
4:24	17.533	7.193	0.058	0.117	0.020	46.03	1.486	26.56			160.1	149.6	99.00	24.15	0.834
4:35	17.147	8.087	0.060	0.122	0.029	47.26	1.523	24.77			153.6	143.2	99.00	24.39	0.842
5:27	18.117	8.108	0.064	0.127	0.000	45.91	1.744	24.93			159.6	148.5	99.00	24.11	0.832
5:59	17.996	8.179	0.055	0.127	0.000	45.94	1.644	25.06			158.5	147.6	99.00	24.17	0.834
6:30	17.935	8.095	0.051	0.122	0.000	45.90	1.575	25.32			158.3	147.5	99.00	24.18	0.835
7:02	17.592	9.275	0.057	0.124	0.000	47.09	1.590	23.28			150.9	140.3	99.00	24.46	0.844
7:34	17.769	7.849	0.050	0.116	0.000	45.75	1.508	25.95			159.0	148.4	99.00	24.19	0.835
8:05	17.626	8.912	0.049	0.119	0.000	46.86	1.535	23.90			152.2	141.6	99.00	24.40	0.842
8:37	16.962	8.112	0.048	0.117	0.000	47.29	1.516	24.95			153.2	143.0	99.00	24.44	0.844
9:46	18.047	8.047	0.054	0.134	0.013	45.79	1.630	25.29			159.3	148.4	99.00	24.14	0.833
10:18	18.121	7.895	0.059	0.139	0.285	45.85	1.690	24.96			159.3	148.3	99.00	24.10	0.832
10:50	18.356	6.992	0.060	0.137	0.016	44.76	1.654	27.02			166.3	155.2	99.00	23.89	0.824
11:23	18.237	6.942	0.060	0.133	0.013	44.91	1.596	27.11			165.5	154.6	99.00	23.92	0.826
11:55	18.354	6.501	0.055	0.134	0.000	44.49	1.614	27.85			168.4	157.4	99.00	23.81	0.822
12:27	18.420	6.800	0.053	0.132	0.000	44.47	1.621	27.51			167.5	156.4	99.00	23.84	0.823
13:00	17.460	6.829	0.055	0.128	0.719	46.31	1.557	25.94			158.7	148.2	99.00	24.13	0.833
13:32	18.119	7.832	0.056	0.136	0.026	45.55	1.627	25.66			160.8	149.9	99.00	24.09	0.831
14:05	17.131	8.990	0.056	0.126	0.117	47.82	1.579	23.18			149.0	138.6	99.00	24.54	0.847
14:36	17.065	9.218	0.054	0.133	0.013	47.92	1.660	22.94			148.9	138.5	99.00	24.58	0.848
15:07	17.718	8.724	0.050	0.125	0.000	46.78	1.764	23.84			154.7	143.9	99.00	24.31	0.839
15:39	18.378	6.466	0.054	0.127	0.000	44.46	1.659	27.86			168.8	157.7	99.00	23.79	0.821
17:04	17.984	7.233	0.051	0.128	0.000	45.53	1.655	26.42			162.9	152.0	99.00	24.02	0.829
17:35	18.008	7.351	0.054	0.133	0.000	45.69	1.685	26.07			162.3	151.3	99.00	24.03	0.829
18:06	17.145	7.337	0.055	0.131	0.346	47.11	1.627	25.25			156.2	145.8	99.00	24.27	0.838
18:38	17.765	7.150	0.053	0.124	0.000	45.78	1.590	26.54			161.8	151.1	99.00	24.07	0.831
19:09	17.274	8.209	0.053	0.124	0.000	46.94	1.585	24.82			154.7	144.2	99.00	24.37	0.841
19:40	17.101	8.418	0.047	0.120	0.016	47.28	1.542	24.48			152.4	142.1	99.00	24.45	0.844
20:12	17.574	6.583	0.049	0.119	0.272	46.28	1.543	26.58			160.7	150.2	99.00	24.05	0.830
20:43	17.619	5.188	0.051	0.118	0.103	46.75	1.484	27.69			163.8	153.3	99.00	23.81	0.822
21:34	16.670	8.780	0.065	0.120	0.000	47.99	1.553	23.82			149.3	139.2	99.00	24.62	0.850
22:05	16.868	6.972	0.055	0.121	0.381	47.49	1.541	25.58			155.3	145.1	99.00	24.30	0.839
22:37	17.218	7.414	0.053	0.123	0.000	46.56	1.568	26.06			158.3	147.9	99.00	24.26	0.837
23:08	17.502	7.495	0.057	0.130	0.000	46.26	1.635	25.92			159.6	149.0	99.00	24.19	0.835
23:40	17.387	7.563	0.055	0.132	0.000	46.20	1.645	26.02			159.6	149.1	99.00	24.23	0.836

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0:00	18.642	6.403	0.060	0.124	0.000	44.64	1.627	27.50			168.3	157.1	99.00	23.72	0.819
0:11	17.409	7.603	0.057	0.133	0.000	46.81	1.674	25.31			157.8	147.2	99.00	24.23	0.836
0:43	17.121	7.910	0.053	0.131	0.000	46.91	1.668	25.21			156.4	145.9	99.00	24.35	0.841
1:15	17.800	7.507	0.054	0.130	0.000	45.87	1.676	25.97			161.1	150.3	99.00	24.11	0.832
1:46	17.682	6.273	0.054	0.120	0.000	45.15	1.595	28.12			166.6	156.0	99.00	23.95	0.827
2:18	17.311	6.754	0.059	0.120	0.000	46.08	1.544	27.13			161.8	151.4	99.00	24.13	0.833
2:49	17.136	7.574	0.064	0.125	0.012	46.85	1.505	25.74			156.5	146.2	99.00	24.31	0.839
3:21	16.701	8.843	0.062	0.124	0.018	48.15	1.526	23.58			148.4	138.3	99.00	24.63	0.850

GAS CHROMATOGRAPH DATA

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

11/16/1983

3:52	17.933	6.352	0.050	0.124	0.000	45.11	1.519	27.92			166.0	155.3	99.00	23.91	0.825
4:23	17.658	6.710	0.056	0.124	0.015	45.74	1.480	27.22			162.6	152.1	99.00	24.04	0.830
4:55	17.872	5.875	0.056	0.126	0.000	44.97	1.487	28.61			167.9	157.2	99.00	23.85	0.823
5:27	18.087	5.049	0.062	0.122	0.000	44.25	1.539	29.89			173.2	162.4	99.00	23.66	0.817
5:58	17.830	5.079	0.072	0.119	0.071	44.59	1.546	29.69			172.0	161.3	99.00	23.73	0.819
6:29	17.545	5.592	0.088	0.117	0.000	45.15	1.507	29.00			168.6	158.1	99.00	23.89	0.825
7:01	17.142	5.481	0.097	0.115	0.000	45.19	1.530	29.45			169.1	158.7	99.00	23.97	0.828
7:32	16.985	5.704	0.103	0.113	0.000	45.80	1.478	28.82			166.1	155.9	99.00	24.06	0.830
8:04	15.140	8.054	0.080	0.125	0.768	50.49	1.468	22.87			140.8	131.5	99.00	24.94	0.861
8:35	17.733	9.211	0.061	0.126	0.051	46.85	1.541	23.43			151.4	140.8	99.00	24.42	0.843
9:07	19.674	6.174	0.059	0.127	0.000	42.63	1.598	28.74			175.3	163.6	99.00	23.42	0.808
9:58	19.144	5.724	0.073	0.118	0.014	43.04	1.493	29.39			174.7	163.4	99.00	23.50	0.811
10:30	18.099	8.294	0.074	0.127	0.020	45.77	1.543	25.07			158.1	147.3	99.00	24.17	0.834
11:02	18.847	6.170	0.084	0.111	0.000	43.65	1.509	28.63			171.5	160.3	99.00	23.64	0.816
11:33	17.706	8.443	0.083	0.120	0.020	46.49	1.534	24.60			155.3	144.6	99.00	24.30	0.839
12:37	16.812	8.636	0.057	0.126	0.116	47.89	1.496	23.86			149.3	139.2	99.00	24.57	0.848
13:08	18.787	7.643	0.056	0.132	0.029	44.82	1.631	25.91			163.7	152.5	99.00	23.88	0.824
13:40	19.557	5.466	0.057	0.124	0.000	42.40	1.645	29.75			178.6	166.9	99.00	23.33	0.805
14:43	17.959	8.895	0.052	0.133	0.000	46.41	1.706	23.85			155.2	144.2	99.00	24.29	0.838
15:15	19.444	7.373	0.054	0.133	0.000	43.50	1.730	26.77			169.6	157.9	99.00	23.65	0.816
15:46	20.022	5.240	0.054	0.131	0.000	41.70	1.715	30.14			182.1	170.1	99.00	23.16	0.800
16:18	19.643	5.220	0.056	0.136	0.046	42.13	1.706	30.06			180.7	168.9	99.00	23.26	0.803
16:49	18.421	7.463	0.054	0.131	0.000	45.25	1.653	26.03			163.1	152.0	99.00	23.94	0.827
17:21	18.360	8.242	0.053	0.138	0.015	45.16	1.701	25.33			161.3	150.1	99.00	24.08	0.831
17:53	19.843	5.360	0.051	0.126	0.000	42.01	1.679	29.93			180.4	168.5	99.00	23.23	0.802
18:24	19.739	5.169	0.055	0.132	0.000	41.95	1.680	30.27			181.3	169.5	99.00	23.23	0.802
18:56	19.079	5.261	0.051	0.114	0.000	42.89	1.453	30.15			176.1	164.9	99.00	23.44	0.809
19:27	17.409	9.238	0.054	0.132	0.000	47.08	1.609	23.48			151.2	140.7	99.00	24.50	0.846
19:59	18.991	6.113	0.053	0.118	0.000	43.99	1.573	28.16			170.7	159.5	99.00	23.59	0.814
21:45	18.976	6.260	0.068	0.132	0.022	43.67	1.680	28.20			172.4	161.0	99.00	23.60	0.815
22:17	17.440	8.793	0.059	0.143	0.000	47.41	1.731	23.43			152.7	141.9	99.00	24.40	0.842
22:49	20.178	5.232	0.066	0.133	0.000	41.61	1.742	30.04			182.8	170.7	99.00	23.12	0.798
23:20	19.305	5.717	0.068	0.133	0.000	42.86	1.653	29.26			176.6	165.0	99.00	23.43	0.809
23:52	17.651	8.468	0.063	0.138	0.000	46.01	1.722	24.95			158.1	147.3	99.00	24.30	0.839

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0:24	17.932	8.501	0.052	0.127	0.000	46.01	1.643	24.73			157.2	146.3	99.00	24.24	0.837
0:56	19.386	5.165	0.053	0.115	0.000	42.40	1.544	30.34			178.7	167.2	99.00	23.34	0.806
1:27	18.310	6.827	0.050	0.116	0.000	44.70	1.472	27.52			165.4	154.6	99.00	23.89	0.825
1:59	19.355	5.095	0.053	0.119	0.027	42.41	1.514	30.43			178.6	167.2	99.00	23.34	0.806
2:31	18.619	5.572	0.061	0.126	0.000	43.59	1.507	29.53			173.5	162.5	99.00	23.61	0.815
3:03	17.924	7.666	0.058	0.137	0.012	45.62	1.601	25.98			161.0	150.2	99.00	24.11	0.832
3:34	17.776	8.208	0.054	0.134	0.033	46.15	1.570	25.08			157.2	146.5	99.00	24.24	0.837
4:06	18.569	7.479	0.053	0.134	0.183	44.84	1.605	26.14			163.5	152.4	99.00	23.92	0.826
4:38	18.836	6.159	0.049	0.123	0.000	43.55	1.516	28.76			171.6	160.5	99.00	23.64	0.816

GAS CHROMATOGRAPH DATA

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

11/17/1983

5:09	19.391	4.756	0.050	0.116	0.000	42.11	1.461	31.11			180.3	168.9	99.00	23.28	0.804
5:41	18.818	5.220	0.058	0.120	0.000	43.06	1.467	30.25			175.9	164.8	99.00	23.50	0.811
6:13	17.727	6.205	0.059	0.128	0.613	45.53	1.512	27.23			163.3	152.7	99.00	23.96	0.827
6:44	17.271	8.438	0.062	0.133	0.032	47.18	1.551	24.33			153.1	142.6	99.00	24.41	0.843
7:16	19.252	5.648	0.064	0.123	0.000	43.11	1.530	29.27			175.0	163.6	99.00	23.45	0.810
7:48	19.054	5.718	0.068	0.119	0.000	43.30	1.604	29.13			174.6	163.3	99.00	23.51	0.811
8:19	17.965	7.775	0.064	0.134	0.080	46.42	1.728	24.83			158.8	147.8	99.00	24.11	0.832
8:51	18.049	8.191	0.059	0.133	0.000	45.36	1.695	25.51			160.8	149.8	99.00	24.15	0.834
9:41	19.344	5.158	0.057	0.122	0.000	42.34	1.554	30.42			179.1	167.6	99.00	23.35	0.806
10:13	16.914	7.742	0.063	0.129	0.899	47.90	1.563	23.79			150.2	140.0	99.00	24.43	0.843
10:46	19.060	5.975	0.057	0.119	0.210	43.48	1.531	28.57			171.9	160.7	99.00	23.56	0.813
11:18	18.025	8.264	0.059	0.123	0.000	45.96	1.601	24.97			157.8	147.0	99.00	24.18	0.835
11:51	19.050	5.790	0.054	0.120	0.000	43.12	1.603	29.27			174.8	163.5	99.00	23.52	0.812
12:23	18.275	7.593	0.056	0.121	0.017	45.17	1.530	26.23			161.9	151.0	99.00	24.02	0.829
12:55	18.834	6.614	0.059	0.116	0.011	43.84	1.509	28.02			169.2	158.1	99.00	23.72	0.819
12:55	18.834	6.614	0.059	0.116	0.011	43.84	1.509	28.02			169.2	158.1	99.00	23.72	0.819

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0:00	22.660	9.981	0.318	0.293	0.469	31.09	3.926	30.27			220.5	204.5	99.00	22.99	0.794
0:00	18.392	7.799	0.055	0.134	0.000	45.27	1.690	25.66			162.3	151.1	99.00	24.00	0.828
0:00	18.392	7.799	0.055	0.134	0.000	45.27	1.690	25.66			162.3	151.1	99.00	24.00	0.828
15:08	18.958	7.262	0.054	0.136	0.000	44.28	1.721	26.59			167.4	156.0	99.00	23.76	0.820
15:39	18.622	6.919	0.056	0.138	0.000	44.33	1.684	27.25			168.1	156.9	99.00	23.80	0.822
16:11	18.016	7.851	0.054	0.137	0.435	46.09	1.707	24.71			158.2	147.3	99.00	24.12	0.833
16:42	18.566	8.359	0.056	0.137	0.000	45.36	1.709	24.81			160.4	149.1	99.00	24.04	0.830
18:14	19.110	6.797	0.057	0.130	0.169	43.94	1.730	27.07			169.5	157.9	99.00	23.66	0.817
18:46	18.479	8.137	0.059	0.132	0.000	45.33	1.728	25.14			161.3	150.1	99.00	24.03	0.829
19:17	18.937	7.265	0.057	0.132	0.000	44.19	1.737	26.68			167.8	156.3	99.00	23.77	0.820
19:49	18.748	7.873	0.058	0.143	0.000	44.58	1.777	25.83			165.0	153.6	99.00	23.91	0.825
20:21	18.841	7.740	0.057	0.136	0.127	44.67	1.754	25.68			164.5	153.1	99.00	23.87	0.824
20:52	18.557	8.484	0.056	0.139	0.000	45.25	1.824	24.69			161.1	149.8	99.00	24.05	0.830
21:24	18.795	7.819	0.052	0.131	0.000	44.52	1.693	25.99			164.6	153.2	99.00	23.90	0.825
21:56	18.002	8.965	0.055	0.136	0.609	46.67	1.800	22.76			152.8	141.8	99.00	24.30	0.839
22:28	18.341	8.360	0.054	0.138	0.000	45.45	1.872	24.78			161.2	149.9	99.00	24.08	0.831
23:00	19.513	7.240	0.060	0.143	0.000	43.49	1.904	26.65			171.5	159.6	99.00	23.59	0.814
23:32	18.329	9.103	0.060	0.146	0.000	45.78	1.855	23.73			157.8	146.5	99.00	24.21	0.836

11/19/1983

0:03	17.671	9.134	0.055	0.141	0.768	47.22	1.822	22.19			150.3	139.3	99.00	24.42	0.843
0:35	18.870	7.946	0.060	0.143	0.000	44.61	1.821	25.55			165.0	153.5	99.00	23.88	0.824
1:07	19.190	8.159	0.062	0.146	0.000	44.39	1.954	25.10			166.0	154.2	99.00	23.82	0.822
1:39	18.342	9.306	0.057	0.145	0.000	45.97	1.835	23.34			156.4	145.1	99.00	24.24	0.837
2:10	18.057	8.319	0.050	0.121	0.605	46.23	1.645	23.97			155.0	144.1	99.00	24.20	0.835
2:42	18.637	8.418	0.054	0.130	0.000	45.23	1.756	24.78			160.8	149.5	99.00	24.03	0.829

GAS CHROMATOGRAPH DATA

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

11/19/1983

3:14	18.648	9.163	0.057	0.134	0.000	45.54	1.842	23.62			158.1	146.7	99.00	24.13	0.833
3:45	18.688	8.900	0.052	0.129	0.000	45.39	1.753	24.09			158.7	147.4	99.00	24.09	0.832
4:17	18.977	7.646	0.054	0.136	0.000	44.28	1.709	26.20			166.1	154.7	99.00	23.82	0.822
4:49	19.655	5.504	0.056	0.133	0.000	42.29	1.798	29.56			180.0	168.1	99.00	23.29	0.804
5:20	19.376	5.460	0.055	0.131	0.000	42.44	1.833	29.70			179.8	168.1	99.00	23.35	0.806
5:52	18.770	7.025	0.061	0.131	0.000	44.08	1.765	27.17			169.1	157.7	99.00	23.77	0.820
6:23	17.770	9.519	0.056	0.136	0.154	47.07	1.892	22.40			151.9	140.9	99.00	24.42	0.843
6:55	19.060	8.685	0.053	0.132	0.000	45.04	1.919	24.11			161.7	150.0	99.00	23.94	0.826
7:27	18.134	9.994	0.074	0.156	0.000	46.52	2.088	22.03			154.5	143.1	99.00	24.37	0.841
7:58	18.899	8.098	0.053	0.130	0.000	44.82	1.773	25.23			163.2	151.8	99.00	23.91	0.825
8:30	19.868	5.826	0.053	0.137	0.000	42.08	1.943	29.09			180.6	168.5	99.00	23.27	0.803
9:02	19.088	6.568	0.053	0.133	0.000	43.45	1.831	27.87			173.0	161.4	99.00	23.61	0.815
9:44	19.200	6.822	0.052	0.129	0.000	43.45	1.774	27.57			171.7	160.1	99.00	23.62	0.815
10:16	19.248	7.481	0.053	0.128	0.000	43.70	1.820	26.57			169.1	157.5	99.00	23.71	0.818
10:48	19.394	5.878	0.048	0.119	0.000	42.84	1.666	29.06			175.8	164.2	99.00	23.44	0.809
11:19	19.040	5.919	0.053	0.129	0.000	43.28	1.671	28.91			174.5	163.0	99.00	23.53	0.812
11:51	18.309	7.596	0.053	0.122	0.000	45.03	1.675	26.21			163.4	152.3	99.00	23.99	0.828
12:23	18.733	7.525	0.062	0.132	0.000	44.44	1.801	26.31			166.6	155.2	99.00	23.85	0.823
12:55	18.667	7.357	0.064	0.124	0.000	44.61	1.662	26.51			165.6	154.4	99.00	23.86	0.824
13:27	18.430	7.580	0.067	0.131	0.000	45.05	1.697	26.04			163.8	152.7	99.00	23.95	0.827
14:28	19.820	8.387	0.061	0.132	0.000	43.79	1.667	25.14			165.1	153.2	99.00	23.73	0.819
15:00	19.857	7.734	0.062	0.131	0.000	43.31	1.595	26.31			168.2	156.5	99.00	23.62	0.815
15:31	20.472	6.993	0.062	0.131	0.000	42.33	1.698	27.31			174.4	162.3	99.00	23.33	0.805
16:03	19.713	7.732	0.061	0.131	0.000	43.53	1.611	26.22			167.6	155.9	99.00	23.66	0.817
16:35	20.274	7.966	0.062	0.128	0.000	43.02	1.674	25.88			168.9	156.9	99.00	23.54	0.813
17:07	19.232	8.384	0.080	0.128	0.010	44.47	1.590	25.11			162.5	151.0	99.00	23.89	0.825
17:39	19.387	7.999	0.075	0.129	0.000	44.12	1.627	25.66			165.1	153.5	99.00	23.78	0.821
18:11	19.564	8.278	0.072	0.131	0.000	44.02	1.632	25.31			164.6	152.9	99.00	23.78	0.821
18:42	20.498	7.194	0.075	0.155	0.000	42.14	1.888	27.05			176.3	163.8	99.00	23.33	0.805
19:14	19.813	7.240	0.067	0.136	0.192	43.59	1.673	26.29			168.9	157.1	99.00	23.55	0.813
19:46	19.192	7.758	0.069	0.124	0.000	44.32	1.519	26.01			164.3	153.0	99.00	23.81	0.822
20:18	18.749	8.572	0.081	0.127	0.000	45.38	1.529	24.56			158.6	147.4	99.00	24.05	0.830
20:49	19.214	8.081	0.076	0.132	0.006	44.37	1.638	25.49			164.2	152.7	99.00	23.84	0.823
21:42	19.311	7.982	0.059	0.123	0.000	44.18	1.555	25.79			164.2	152.7	99.00	23.81	0.822
22:14	19.261	7.671	0.079	0.123	0.000	44.08	1.562	26.23			165.8	154.4	99.00	23.77	0.820
22:46	18.874	8.507	0.077	0.119	0.000	44.99	1.519	24.92			159.8	148.6	99.00	24.01	0.829
23:18	19.451	7.515	0.068	0.122	0.001	43.77	1.543	26.53			167.0	155.5	99.00	23.70	0.818
23:50	19.741	6.945	0.081	0.128	0.000	43.05	1.586	27.47			171.7	160.0	99.00	23.53	0.812

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0:22	19.020	7.849	0.071	0.121	0.016	44.40	1.495	26.02			163.5	152.3	99.00	23.87	0.824
0:54	19.482	7.622	0.065	0.119	0.000	43.76	1.544	26.40			166.6	155.1	99.00	23.71	0.818
1:26	19.257	7.869	0.068	0.120	0.000	44.13	1.532	26.02			164.6	153.2	99.00	23.81	0.822
1:58	19.300	7.654	0.077	0.120	0.000	44.04	1.541	26.27			165.8	154.3	99.00	23.76	0.820
2:30	19.160	7.904	0.085	0.125	0.000	44.23	1.583	25.91			164.8	153.4	99.00	23.83	0.823

GAS CHROMATOGRAPH DATA

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

11/20/1983															
3:02	19.826	7.328	0.081	0.129	0.009	43.30	1.632	26.70			170.0	158.2	99.00	23.56	0.813
3:34	19.720	7.150	0.067	0.132	0.000	43.10	1.619	27.21			171.0	159.3	99.00	23.56	0.813
4:06	26.382	10.007	0.091	0.165	0.253	59.97	2.133	0.00			111.4	95.8	99.00	22.24	0.768
4:38	20.203	6.761	0.073	0.132	0.000	42.51	1.672	27.65			174.6	162.6	99.00	23.37	0.807
5:10	19.593	7.173	0.076	0.133	0.000	43.24	1.625	27.16			170.6	158.9	99.00	23.60	0.814
5:42	19.751	7.395	0.072	0.127	0.000	43.21	1.633	26.81			169.9	158.2	99.00	23.59	0.814
6:14	19.204	7.365	0.071	0.125	0.164	44.24	1.536	26.30			165.5	154.1	99.00	23.74	0.820
6:46	19.545	7.410	0.063	0.130	0.000	43.42	1.580	26.85			168.8	157.2	99.00	23.65	0.816
7:18	19.979	6.854	0.063	0.125	0.000	42.74	1.592	27.65			172.8	161.0	99.00	23.45	0.809
7:49	19.847	7.109	0.067	0.126	0.000	43.07	1.616	27.16			171.1	159.3	99.00	23.52	0.812
8:21	19.260	7.950	0.081	0.126	0.000	44.06	1.639	25.88			165.5	154.0	99.00	23.80	0.822
8:53	19.971	6.983	0.069	0.127	0.000	42.76	1.672	27.42			173.0	161.1	99.00	23.46	0.810
9:25	18.723	7.576	0.071	0.120	0.142	44.92	1.528	25.92			162.6	151.4	99.00	23.90	0.825
10:02	19.469	7.063	0.066	0.129	0.134	43.99	1.619	26.53			167.9	156.3	99.00	23.62	0.815
10:34	19.128	7.444	0.071	0.129	0.000	44.10	1.604	26.52			166.7	155.3	99.00	23.76	0.820
11:07	19.774	7.649	0.071	0.133	0.000	43.36	1.685	26.32			169.1	157.2	99.00	23.62	0.815
11:40	20.039	7.732	0.068	0.136	0.000	42.99	1.735	26.30			170.3	158.3	99.00	23.56	0.813
12:12	19.844	7.689	0.060	0.130	0.000	43.36	1.688	26.23			168.8	157.0	99.00	23.61	0.815
12:50	19.844	7.689	0.060	0.130	0.000	43.36	1.688	26.23			168.8	157.0	99.00	23.61	0.815

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 (Section 7.2).

AVERAGE FROM PERIOD: 11/ 2/82 22:45 TO 11/ 4/82 10:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	8.279	DEG C	1.736
T-702	19.604	DEG C	1.664
T-703	64.606	DEG C	23.366
T-710	16.728	DEG C	23.536
T-711	73.823	DEG C	13.498
T-712	14.008	DEG C	1.298
T-713	24.053	DEG C	4.275
T-705	287.700	DEG C	82.410
T-706	265.556	DEG C	69.785
T-707	258.119	DEG C	65.062
T-812	757.230	DEG C	114.974
T-813	--OFF--	DEG C	
T-814	717.184	DEG C	106.044
T-815	715.955	DEG C	103.434
T-816	934.575	DEG C	81.375
T-817	646.183	DEG C	115.987
T-818	641.208	DEG C	100.541
T-819	611.698	DEG C	97.483
T-820	532.563	DEG C	70.006
T-823	66.285	DEG C	2.744
T-822	66.584	DEG C	2.713
T-806	233.653	DEG C	56.191
T-811	776.475	DEG C	119.594
F-701	1127.973	SCFM	28.125
TT2-703	60.359	DEG C	2.233
P-703	14.114	IN WC	5.389
P-704	13.176	IN WC	5.288
P-705	0.938	IN WC	0.151
P-706	1.175	IN WC	0.195
F-707	1979.301	SCFM	218.794
WT-720	7.026	TONS	2.572
P-707	0.958	IN WC	0.237
P-810	-0.583	IN WC	0.010
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	56.672	DEG C	0.656
CO	27.910	%	5.140
CO2	7.231	%	2.397
O2	-0.240	%	0.533
SIGMA	155.820	BTU/SCF	16.590
T-715	146.046	DEG C	9.347
T-821	507.083	DEG C	59.665

AVERAGE BASE TEMPERATURE 19.645

AVERAGE FROM PERIOD: 11/ 5/82 5:40 TO 11/ 7/82 8:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	10.317	DEG C	3.807
T-702	22.167	DEG C	3.678
T-703	66.860	DEG C	4.869
T-710	12.455	DEG C	0.170
T-711	71.504	DEG C	8.323
T-712	12.597	DEG C	0.181
T-713	26.810	DEG C	7.534
T-705	262.245	DEG C	45.764
T-706	252.770	DEG C	25.691
T-707	244.966	DEG C	23.699
T-812	657.041	DEG C	109.033
T-813	--OFF--	DEG C	
T-814	608.245	DEG C	108.645
T-815	493.035	DEG C	243.701
T-816	1792.561	DEG C	4129.332
T-817	454.829	DEG C	101.264
T-818	530.012	DEG C	875.074
T-819	468.942	DEG C	133.882
T-820	466.017	DEG C	93.759
T-823	66.350	DEG C	3.735
T-822	65.775	DEG C	6.059
T-806	182.706	DEG C	36.325
T-811	668.440	DEG C	110.779
F-701	864.702	SCFM	151.156
TT2-703	66.007	DEG C	2.000
P-703	16.327	IN WC	4.847
P-704	12.228	IN WC	5.493
P-705	4.099	IN WC	0.783
P-706	4.041	IN WC	0.786
F-707	2006.270	SCFM	296.034
WT-720	7.467	TONS	2.527
P-707	3.793	IN WC	6.164
P-810	-0.534	IN WC	0.171
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	27.251	%	2.728
CO2	8.253	%	1.496
O2	-0.348	%	0.448
SIGMA	168.042	BTU/SCF	9.019
T-715	150.164	DEG C	7.636
T-821	457.680	DEG C	108.866

AVERAGE BASE TEMPERATURE 17.742

AVERAGE FROM PERIOD: 11/ 9/82 7:45 TO 11/ 9/82 21:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	8.743	DEG C	0.965
T-702	20.342	DEG C	0.942
T-703	64.617	DEG C	0.529
T-710	11.541	DEG C	0.227
T-711	66.127	DEG C	1.456
T-712	11.698	DEG C	0.238
T-713	14.836	DEG C	0.483
T-705	278.083	DEG C	25.634
T-706	267.738	DEG C	21.429
T-707	260.034	DEG C	20.998
T-812	647.221	DEG C	44.159
T-813	--OFF--	DEG C	
T-814	584.281	DEG C	53.286
T-815	596.633	DEG C	35.737
T-816	-1205.750	DEG C	923.439
T-817	391.609	DEG C	59.518
T-818	259.373	DEG C	47.393
T-819	475.778	DEG C	42.797
T-820	466.851	DEG C	19.693
T-823	69.712	DEG C	3.050
T-822	66.882	DEG C	0.573
T-806	178.789	DEG C	14.523
T-811	663.167	DEG C	39.028
F-701	858.603	SCFM	2.592
TT2-703	63.324	DEG C	0.452
P-703	10.678	IN WC	0.337
P-704	4.956	IN WC	0.165
P-705	5.722	IN WC	0.384
P-706	5.639	IN WC	0.409
F-707	2489.232	SCFM	593.349
WT-720	8.748	TONS	1.779
P-707	4.125	IN WC	0.400
P-810	-0.793	IN WC	0.082
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	31.087	%	0.861
CO2	6.258	%	0.539
O2	-0.304	%	0.104
SIGMA	169.698	BTU/SCF	5.823
T-715	152.287	DEG C	0.646
T-821	415.874	DEG C	34.951

AVERAGE BASE TEMPERATURE 20.421

AVERAGE FROM PERIOD: 11/10/82 2:00 TO 11/11/82 9:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	10.696	DEG C	1.479
T-702	21.921	DEG C	1.373
T-703	64.961	DEG C	0.328
T-710	10.175	DEG C	11.445
T-711	67.095	DEG C	5.705
T-712	11.779	DEG C	0.830
T-713	14.792	DEG C	0.835
T-705	222.133	DEG C	27.972
T-706	215.906	DEG C	12.329
T-707	210.651	DEG C	11.963
T-812	721.684	DEG C	35.763
T-813	--OFF--	DEG C	
T-814	672.222	DEG C	35.514
T-815	594.762	DEG C	31.648
T-816	-2075.920	DEG C	678.233
T-817	509.932	DEG C	32.971
T-818	366.733	DEG C	30.676
T-819	565.392	DEG C	30.410
T-820	509.930	DEG C	20.176
T-823	73.885	DEG C	30.912
T-822	68.041	DEG C	0.817
T-806	139.193	DEG C	9.240
T-811	724.774	DEG C	47.386
F-701	873.370	SCFM	21.838
TT2-703	63.746	DEG C	0.275
P-703	10.449	IN WC	0.691
P-704	4.720	IN WC	0.661
P-705	5.730	IN WC	0.275
P-706	5.588	IN WC	0.306
F-707	2478.589	SCFM	80.530
WT-720	6.757	TONS	2.882
P-707	4.497	IN WC	1.181
P-810	-0.757	IN WC	0.007
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	30.976	%	0.906
CO2	6.339	%	0.396
O2	-0.293	%	0.312
SIGMA	174.120	BTU/SCF	3.951
T-715	152.076	DEG C	2.277
T-821	469.114	DEG C	60.610

AVERAGE BASE TEMPERATURE 19.458

AVERAGE FROM PERIOD: 11/11/82 21:00 TO 11/15/82 0:50

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	7.475	DEG C	2.472
T-702	18.824	DEG C	2.378
T-703	66.079	DEG C	1.970
T-710	10.800	DEG C	3.147
T-711	70.332	DEG C	6.095
T-712	11.154	DEG C	0.561
T-713	14.074	DEG C	0.575
T-705	209.485	DEG C	29.176
T-706	199.970	DEG C	70.952
T-707	193.823	DEG C	24.455
T-812	815.595	DEG C	84.236
T-813	--OFF--	DEG C	
T-814	859.845	DEG C	1740.244
T-815	616.355	DEG C	79.386
T-816	-1186.768	DEG C	683.727
T-817	573.892	DEG C	73.758
T-818	481.961	DEG C	75.010
T-819	659.505	DEG C	69.938
T-820	556.139	DEG C	45.828
T-823	71.570	DEG C	3.584
T-822	68.215	DEG C	3.298
T-806	162.534	DEG C	25.973
T-811	814.313	DEG C	82.175
F-701	872.978	SCFM	71.099
TT2-703	64.716	DEG C	1.914
P-703	14.810	IN WC	1.828
P-704	7.366	IN WC	0.842
P-705	7.452	IN WC	1.283
P-706	8.821	IN WC	3.139
F-707	2453.604	SCFM	235.801
WT-720	8.191	TONS	2.059
P-707	5.341	IN WC	0.874
P-810	-0.843	IN WC	0.088
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	28.708	%	1.718
CO2	7.163	%	0.909
O2	-0.340	%	0.107
SIGMA	171.626	BTU/SCF	10.144
T-715	148.277	DEG C	7.223
T-821	530.551	DEG C	42.777

AVERAGE BASE TEMPERATURE 15.460

AVERAGE FROM PERIOD: 11/15/82 9:30 TO 11/16/82 9:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	11.431	DEG C	1.374
T-702	23.308	DEG C	1.340
T-703	62.592	DEG C	0.785
T-710	10.361	DEG C	0.231
T-711	77.639	DEG C	5.427
T-712	10.491	DEG C	0.215
T-713	13.569	DEG C	0.390
T-705	220.101	DEG C	24.692
T-706	184.872	DEG C	11.465
T-707	201.796	DEG C	20.912
T-812	709.950	DEG C	51.557
T-813	--OFF--	DEG C	
T-814	612.312	DEG C	59.839
T-815	534.525	DEG C	62.973
T-816	-1873.216	DEG C	760.096
T-817	439.584	DEG C	42.907
T-818	282.181	DEG C	46.567
T-819	585.204	DEG C	39.721
T-820	506.679	DEG C	25.384
T-823	68.519	DEG C	3.307
T-822	66.139	DEG C	1.255
T-806	163.533	DEG C	15.609
T-811	707.737	DEG C	48.918
F-701	804.314	SCFM	36.468
TT2-703	61.330	DEG C	0.801
P-703	14.037	IN WC	1.897
P-704	6.664	IN WC	1.281
P-705	7.373	IN WC	1.020
P-706	7.502	IN WC	1.710
F-707	2628.756	SCFM	138.586
WT-720	8.133	TONS	2.222
P-707	4.780	IN WC	1.011
P-810	-1.858	IN WC	0.341
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	27.653	%	1.955
CO2	7.832	%	1.180
O2	-0.305	%	0.129
SIGMA	161.923	BTU/SCF	10.901
T-715	147.430	DEG C	2.926
T-821	489.484	DEG C	25.249

AVERAGE BASE TEMPERATURE 20.335

AVERAGE FROM PERIOD: 11/16/82 9:00 TO 11/20/82 9:00

SIGNAL	AVERAGE	UNITS	STD.DEV.
T-701	15.893	DEG C	3.451
T-702	27.940	DEG C	3.383
T-703	64.612	DEG C	0.483
T-710	9.205	DEG C	0.757
T-711	77.794	DEG C	4.341
T-712	9.340	DEG C	0.746
T-713	13.310	DEG C	1.102
T-705	228.109	DEG C	31.600
T-706	187.957	DEG C	20.498
T-707	212.627	DEG C	28.562
T-812	634.166	DEG C	66.705
T-813	--OFF--	DEG C	
T-814	525.624	DEG C	70.824
T-815	527.033	DEG C	146.213
T-816	-1769.628	DEG C	750.568
T-817	390.526	DEG C	50.635
T-818	246.692	DEG C	40.487
T-819	523.785	DEG C	57.084
T-820	485.115	DEG C	34.647
T-823	67.522	DEG C	1.352
T-822	68.137	DEG C	1.277
T-806	152.555	DEG C	21.387
T-811	641.316	DEG C	67.492
F-701	743.113	SCFM	117.043
TT2-703	63.339	DEG C	0.462
P-703	13.919	IN WC	2.528
P-704	7.452	IN WC	1.228
P-705	6.466	IN WC	1.635
P-706	6.170	IN WC	1.568
F-707	2780.647	SCFM	202.136
WT-720	8.020	TONS	2.310
P-707	4.354	IN WC	1.239
P-810	-1.590	IN WC	0.214
F-802	--OFF--	CFM	
F-803	--OFF--	CFM	
TT1-703	--OFF--	DEG C	
CO	28.110	%	2.490
CO2	7.693	%	1.242
O2	-0.300	%	0.147
SIGMA	167.984	BTU/SCF	8.971
T-715	147.412	DEG C	1.991
T-821	475.935	DEG C	34.960

AVERAGE BASE TEMPERATURE 21.557

APPENDIX J

Stack Sampling Report

This is the report submitted by Interpoll, Inc., Circle Pines, Minnesota to the University of Minnesota Particle Technology Laboratory. The appendices to the stack sampling report have not been included here. The appendices include raw data and calculations.

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RESULTS OF THE NOVEMBER 15, 1982
MONTANA COAL (TREASURE COUNTY,
ROSEBUD MINE) TEST BURN EMISSION
TESTS ON THE WELLMAN-GALUSHA
GASIFIER AT THE TWIN CITIES
RESEARCH CENTER IN
MINNEAPOLIS, MINNESOTA

Submitted to:

UNIVERSITY OF MINNESOTA
Room 130 Mechanical Engineering Building
111 Church Street S.E.
Minneapolis, Minnesota 55455

Attention: Dr. Ben Liu

Approved by:

Report Number 2-1402
December 22, 1982

Larry M. Lannes for
Perry Lannes, Ph.D.
President

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APPENDICES:

- A - Results of Preliminary Measurements
- B - Location of Test Ports and Traverse Points
- C - Method 5 Field Data Sheets
- D - Method 6 Field Data Sheets
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- F - Laboratory Data Sheets
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- H - Procedures
- I - Calculation Equations
- J - Sampling Train Calibration Data

ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	diameter
FT/SEC	feet per second
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g	gram
HP	horsepower
HRS	hours
IN.	inches
IN. HG.	inches of mercury
IN. WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10 ⁶ BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/DSCM	milligrams per dry standard cubic meter
microns (µm)	micrometer
MIN.	minutes
ohm-cm	ohm-centimeter
PPH	pounds per hour
PPM	parts per million
PSI	pounds per square inch
SQ. FT.	square feet
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68⁰F (20⁰C) and 29.92 in. of mercury pressure.

On November 15, 1982, Interpoll Inc. personnel conducted a series of flow rate and emission tests on the pilot low BTU Gasifier at the Bureau of Mines Twin Cities Research Center, Minneapolis, Minnesota. On-site testing was performed by a two-man team under the direction of J. Stock. Coordination between testing activities and gasifier operation was provided by Dave Thimsen of Black, Sivalls and Bryson (BSB) and Dave Pui of the University of Minnesota. The unit tested is a six-foot, six-inch Wellman-Galusha, single stage, fixed-bed gasifier with an agitator. This gasifier has a nominal operating capacity of 30×10^6 BTU/HR (bituminous coal). A combustion test chamber is attached to the gasifier and it also has a nominal capacity of 30×10^6 BTU/HR. The combustion test chamber is a horizontal, cylindrical chamber, seven feet I.D. by 21 feet long, and exhausts through an impingement tray-type scrubber and an induced draft fan to a three-foot diameter stack. Most of the testing in this work was performed at the combustion test chamber outlet, however, flow determinations were performed at the forced draft fan outlet to allow assessment of the combustion air usage and in the stack to ascertain the total volumetric flow rate of the combustion products.

Particulate and sulfur dioxide determinations were performed in accordance with EPA Methods 1-6, CFR Title 40, Part 60, Appendix A (Revised July 1, 1982). A preliminary determination of the gas velocity profile was made before the first particulate run to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll sampling train which meets or exceeds specifications in the above-cited reference was used to collect particulate samples by means of a heated stainless steel-lined probe. A single diameter traverse was used in this work due to the high cost of installing a second test port at 90 degrees to the existing port.

The back half of the EPA Method 5 particulate sampling train was used to collect sulfur dioxide samples. This is the large impinger version specified in EPA Method 6 and provides for a complete stack traverse during sample collection. Collected sulfur dioxide samples were returned to the laboratory for sulfate analysis by the standard barium/Thorin 1 titration technique.

Nitric oxide concentrations in the flue gas were measured by means of a Monitor Labs chemiluminescent nitric oxide analyzer. Nitric oxide concentration were read at each traverse point in the particulate determination. The nitric oxide concentrations were determined on a dry basis using the exhaust gas stream from the EPA Method 5 sampling train.

An integrated flue gas sample was extracted simultaneously with each particulate and sulfur dioxide sample using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags. After sampling was complete, the bags were sealed and returned to the laboratory for Orsat analysis. The integrity of the sample bags was insured by reading the oxygen concentration of the bag in the field immediately after sampling and again in the laboratory immediately prior to Orsat analysis using a Teledyne Model 320P oxygen analyzer.

Testing at the combustion chamber outlet test site was conducted from one test port on the combustion chamber outlet duct (See Appendix B). A 12-point traverse was used to extract representative flyash samples. Each traverse point was sampled five minutes to give a total sampling time of 60 minutes per run. Test port and traverse port locations for the flow determinations are also given in Appendix B.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

The important results of the particulate determinations performed at the combustor outlet are summarized in Table 1. As will be noted, the particulate concentration ranged from .0042 to .0068 GR/ACF and the corresponding mass rate from 1.9 to 2.9 LB/HR. The particulate emission factor, the parameter used by most pollution control agencies to regulate emissions from boilers and combustors ranged from .094 to .142 LB/10⁶BTU (EPA methods specify that the emission factor be calculated from oxygen concentrations in the flue gas derived from Orsat analysis). The heat input to the combustion test chamber was estimated to be approximately 20 10⁶BTU/HR using the F-factor calculated from the low BTU gas composition together with the particulate emission factor and the particulate mass rates. These heat input rates were verified by the SO₂ emission factors and rates.

The results of the SO₂ determinations are given in Table 2. As will be noted, the SO₂ concentrations ranged from 179 to 194 ppm. The SO₂ emission rate was approximately 34 LB/HR and the SO₂ emission factor 1.67 LB/10⁶BTU. Using the heating value of the Montana Rosebud coal provided by the University of Minnesota, the sulfur concentration in the coal was calculated to be 0.73% by weight or more. Nitric oxide concentrations ranged from 80 to 100 ppm (dry). A visible emission determination performed by J. Stock, gave 0% opacity.

Volumetric flow rate determinations were performed at three different locations. The results of the flow rate determinations performed at the combustor outlet are given in Table 1 and ranged from 15,500 to 17,300 DSCFM. The flow rate at the forced draft fan outlet duct was estimated at 12,400 DSCFM. The flow rate at the stack test site was 17,900 DSCFM.

No difficulties were encountered in the field or in the laboratory evaluation of the flyash and sulfur dioxide samples. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the particulate, sulfur dioxide, and oxides of nitrogen concentration emission rates and emission factors reported herein are accurate and closely reflect the actual values which existed at the time the tests were performed.

Table 1. Summary of the Results of the November 15, 1982 Particulate Emission Test on the Gasifier Combuster Outlet at the Bureau of Mines Coal Gasifier in Minneapolis, Minnesota

ITEM	RUN 1	RUN 2	RUN 3
Time of test (HRS)	0937/1037	1102/1202	1237/1337
Estimated low BTU gas burning rate (DSCFM)	2060	1950	1970
Estimated heat input (MMBTU/HR)	20.8	19.7	19.9
Volumetric flow			
ACTUAL (ACFM)	51100	51100	51200
STANDARD (DSCFM)	17300	16800	16500
Gas temperature (DEG-F)	974	1002	1041
Moisture content (% v/v)	5.97	6.89	5.94
Gas composition (% v/v dry)			
carbon dioxide	4.24	4.25	4.83
oxygen	16.30	16.39	16.26
nitrogen	79.46	79.36	78.91
Oxygen analyzer (% v/v, dry)	16.07	15.91	15.59
Isokinetic variation (%)	96.5	99.8	99.0
Particulate concentration			
ACTUAL (GR/ACF)	.0068	.0042	.0059
STANDARD (GR/DSCF)	.0199	.0129	.0183
Particulate mass rate (LB/HR)	2.9	1.9	2.6
Particulate emission factor (LB/MMBTU)			
F-factor method (O2 analyzer)	.14	.08	.11
F-factor method (Orsat)	.14	.09	.13

Table 2. Summary of the Results of the November 15, 1982 Sulfur Dioxide Emission Test on the Combustor Outlet at the Bureau of Mines Coal Gasifier in Minneapolis, Minn.

ITEM	Run 1	Run 2	Run 3
Time of test (HRS)	937-1037	1102-1202	1237-1337
SO ₂ concentration			
(PPM/dry)	202	193	206
(PPM/wet)	190	179	194
SO ₂ mass rate (LB/HR)	35	32	34
SO ₂ emission factor (LB/MMBTU)			
F-factor method	1.68	1.63	1.69

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first, followed by the computer printout of particulate, visible emission data and results of NO concentrations. Preliminary measurements including traverse point description are given in Appendix A and B.

The results have been calculated on a DEC PDP-11 Computer using standard Fortran programs. EPA-published equations have been used as the basis of the calculation techniques in these programs. It should be noted in interpreting these results that the particulate emission rates have been calculated by both the "concentration x flow" and the "ratio of areas" methods and the average reported. The average is the best estimate of the true value, since the bias introduced by an isokinetic sampling is approximately equal but of opposite sign in the two calculation techniques and thus cancels in the average.

Test No. 2
 Combustor Outlet

3.1 Results of Orsat & Moisture Analysis -- Methods 3 & 4 (% v/v)

	Run 1	Run 2	Run 3
Date of run	11/15/82	11/15/82	11/15/82
Dry basis (orsat)			
carbon dioxide	4.24	4.25	4.83
oxygen	16.30	16.39	16.26
carbon monoxide	.00	.00	.00
nitrogen	79.46	79.36	78.91
Wet basis (orsat)			
carbon dioxide	3.99	3.96	4.54
oxygen	15.33	15.26	15.29
carbon monoxide	.00	.00	.00
nitrogen	74.72	73.89	74.22
Moisture content	5.97	6.89	5.94
Dry molecular weight	29.33	29.34	29.42
Wet molecular weight	28.65	28.55	28.74
Specific gravity (relative to air)	.9898	.9863	.9929
Teledyne oxygen analyzer (velocity & time weighted avg.)	16.07	15.91	15.59
FD	1.08	1.06	.96

Test No. 2
Combustor Outlet

3.2 Results of Particulate Loading Determinations -- Method 5(BE)

	Run 1	Run 2	Run 3
Date of run	11/15/82	11/15/82	11/15/82
Time run start/end (HRS)	0937/1037	1102/1202	1237/1337
Pitot tube coefficient	.845	.845	.845
Water in sample			
condensate (ml)	33.0	40.0	43.0
silica gel (grams)	13.0	14.0	2.0
Total particulate material collected (grams) *	.0441	.0287	.0398
Meter correction coefficient	.9997	.9997	.9997
Volume through gas meter			
at meter conditions...(CF)	33.40	33.79	32.85
standard conditions...(SCF)	34.15	34.35	33.53
Total sampling time (min)	60.0	60.0	60.0
Nozzle diameter (IN)	.374	.374	.374
Average stack gas temperature during determination (DEG-F)	974	1002	1041
Volumetric flow			
actual.....(CFM)	51084	51142	51189
standard.....(DSCFM)	17257	16778	16516
Isokinetic variation (%)	96.5	99.8	99.0
Particle concentration			
actual.....(GR/ACF)	.0068	.0042	.0059
dry standard.....(GR/DSCF)	.0199	.0129	.0183
Particle mass flow (LB/HR)	2.95	1.85	2.59
Emission factor (LB/MMBTU)			
by F factor (320-F)	.135	.085	.113
by F factor (orset)	.142	.094	.130

* Dry Catch Only

F factor^(B) = 10995.0 Run 2 = 10995.0 Run 3 = 10995.0

Test No. 2
Combustor Outlet

3.3 Results of Sulfur Dioxide Determinations -- Method 6

	Run 1	Run 2	Run 3
Date of run	11/15/82	11/15/82	11/15/82
Time run start/end (HRS)	937/1037	1102/1202	1237/1337
Average stack gas temperature during determination (DEG-F)	974	1002	1041
Barometric Pressure (IN.HG.)	29.27	29.27	29.27
Meter Temperature (DEG-F)	46.29	49.13	47.04
Meter correction coefficient	.9997	.9997	.9997
Volume thorough gas meter			
at meter conditions...(cf)	33.410	33.800	32.860
standard conditions...(scf)	34.148	34.355	33.534
Total sampling time (MIN)	60	60	60
Moisture content (% v/v)	5.97	6.89	5.94
Oxygen content (% v/v dry)	16.30	16.39	16.26
Milliequivalents of SO ₂ in gas sample	16.2476	15.5751	16.2476
Sulfur dioxide concentration			
(GR/DSCF)	.2351	.2240	.2394
(MG/DSCM)	538	513	548
(PPM-dry)	202	193	206
(PPM-wet)	190	179	194
Dry standard volumetric flow (DSCFM)	17257	16778	16516
Sulfur dioxide mass rate (LB/HR)	34.78	32.22	33.90
Sulfur dioxide emission factor (LB/MMBTU)			
F-factor method*	1.678	1.631	1.694

Test No. 2
Scrubber Stack

3.4 Results of Opacity Observations - EPA Method 9

Percent Opacity	Optical Density	Relative Frequency (%)
0	.0000	100.00
5	.0223	.00
10	.0458	.00
15	.0706	.00
20	.0969	.00
25	.1249	.00
30	.1549	.00
35	.1871	.00
40	.2219	.00
45	.2596	.00
50	.3010	.00
55	.3468	.00
60	.3979	.00
65	.4559	.00
70	.5229	.00
75	.6021	.00
80	.6990	.00
85	.8239	.00
90	1.0000	.00
95	1.3010	.00
99	2.0000	.00
.00	.00000	Time Average

Observer: J. Stock
Cert. Date: 06/09/82
Date of Observation: 11/15/82
Time of Observation: 1400-1406

Test No. 2
Combustor Outlet

3.5 Results of NO Measurement--Monitor Labs Chemiluminescent NO Analyzer

NO Concentration (PPM-DRY)		
Run 1	Run 2	Run 3
80	80	89
81	81	89
83	81	90
81	81	97
81	85	98
81	86	99
85	87	99
85	86	100
82	87	100
81	87	100
82	87	100
81	86	100
Average: 81.9	84.5	96.8

Appendix K

"Performance of a Quench/ESP Tar Scrubber on Producer Gas"

This report on the operation of the quench/ESP during BOM/FGT-002 was submitted to The Mining and Industrial Fuel Gas Group (MIFGa) January 1983 by ANR Technology Corporation. It is reproduced here with the exception of the some engineering design and construction drawings, a procurement history of the effort, and a detailed description of cooperator activities which is reflected in the Foreword to this volume.

System Design

The Fluid-Ionics tar scrubber is a two stage design incorporating both a spray quench with cyclonic separation and a wet parallel plate electrostatic precipitator (see P&ID enclosed in this section). The quench tank, 3 feet in diameter and 9 feet tall, receives dirty tar-laden gas through a tangential entry 8 inches in diameter. A full complement of 7 spray nozzles serve to cool and wash the gas. The first nozzle, producing a fine fog of fresh makeup water, is located within the tangential entry pipe. It and the third nozzle, also a fresh water fogging nozzle, produce the bulk of the gas cooling effect. Two other fresh water nozzles, numbered 5 and 7, produce fine conical washing sprays with a 90° dispersion angle. Between the fresh water nozzles are three coarse sprays of recycle liquor.

The quenched gas spirals downward with the water sprays, so that tar droplets are thrown to the vessel wall and washed down to a liquor holding volume at the base of the quench tank. The gas exits upwards through a central pipe located just above the surface of the quench liquor reservoir, and passes out through the vessel side wall to the precipitator.

The precipitator is a parallel plate unit having 6 emitting electrodes and 7 collecting plates (including the two outside walls). Dirty gas entering the precipitator first passes into a plenum chamber at the base of the unit. A crossed matrix of 1-inch pipes serves to uniformly distribute the flow of gas

upward into the precipitator collecting volume. Three spray nozzles are available above the distributor to further quench the gas or wash the distributor with fresh water.

Collector plates are supported above and below, while emitter electrodes are suspended from a large buss bar overhead. Vibration of the emitter electrodes is eliminated by pendant de-resonating weights. All plates and electrodes are designed for removal and cleaning through a large end door. In addition, a wash spray is available above the plates for occasional cleaning or wetting of the plates.

The emitter electrode buss bar is suspended on either side of the precipitator by insulators contained within enclosures ("ears") external to the collecting volume. The bars pass between the "ears" and the collecting volume through 10-inch ports in the vessel wall. Condensation on the insulators is prevented by coiled heating elements which surround them, eliminating short circuiting to the vessel walls. One "ear" contains two insulators - one internal and one external - inside which the high voltage is passed by a stainless steel rod from the external high voltage supply cable to the emitter electrode buss bar.

The scrubber quench system incorporates an extremely versatile water and recycle liquor system. Fresh water enters the system through a 65-gallon holding tank with bypass. A centrifugal pump feeds the fresh water through parallel strainers to the four fresh water quench nozzles. A holding tank bypass allows the fresh water system to operate on city water pressure in the event of pump failure, while the holding tank provides a

temporary supply should the city water system be interrupted. The fresh water system has sufficient capacity to handle the entire cooling load of the quench unit, allowing once-through operation. The liquor recycle system is equipped with a centrifugal pump capable of delivering about 1.5 times the fresh water flow rate to the three recycle nozzles. Recycle liquor can be drawn from any of three levels within the quench tank, allowing for selective recycle of oil, separated liquor or heavy tar. In the event of total failure of the fresh water system, the recycle system can maintain the scrubber outlet temperature near the adiabatic saturation temperature. The recycle spray nozzles are able to handle particles as large as 1/8 inch without plugging.

Quench system blowdown is accomplished by a Moyno pump, which pulls liquor from any of three levels in the quench tank, allowing selective disposal of light oil, wash water or heavy tar. Flow rate is controlled by recycle to the suction side of the pump. In the event of a failure in the Moyno pump, a minor modification allows the recycle loop to function as a blowdown system.

The unit is well equipped for gas and liquid sampling. Gas sample ports are installed at the quench inlet and outlet, as well as the precipitator outlet. Liquid sample ports are available for fresh water, quench liquor recycle, blowdown, precipitator drain, and three side levels in the quench tank. In addition, samples may be taken from the base of the quench tank.

Instrumentation of the unit is also fairly complete. Gas temperatures are provided for the quench inlet, outlet and precipitator outlet. Liquid temperatures are available for fresh water, and quench recycle. Gas pressure drops across the quench and precipitator are provided. Liquid pressures are given for each calibrated spray nozzle and the Moyno pump discharge. Visual flow indicators show flow in the fresh water spray systems, and to each recycle and blowdown spray nozzle. A water meter records the flow of makeup fresh water. The precipitator panel board also presents primary and secondary voltage and current, as well as sparking rate.

A series of shutdowns and alarms were also incorporated in the unit design. These include alarms for low water level, high gas temperature at the quench outlet, low water pressure monitored at the quench pump discharge and a no flow alarm at the Moyno pump. Shutdowns were included for undervoltage and oxygen levels. However, the oxygen monitor was not installed until the last few days of operation.

The mechanical manufacturer's drawings are included in this section for reference.

Operation

Following delivery of power to the scrubber on November 3, the motors and sensing devices were started up and set points calibrated. The precipitator was started in its static mode and it was discovered the unit was grounding out. Various diagnostic tests were conducted and the problem was isolated to either the high voltage cable connection on the insulator, or the ESP box itself containing foreign material or emitting electrode misalignment. The upper inspection door on the ESP hood was then removed and foreign material (gasket material) was found on the precipitator plates. The emitting electrodes were also misaligned. Several hours were spent aligning the electrodes and removing the foreign material. Upon completion, the high voltage test was attempted but was not successful.

The high voltage insulator housings were then dismantled and inspected. In the design of the high voltage supply connection, two insulators were used. The upper insulator received the high voltage cable and transmitted the voltage via a 1/4 inch stainless steel rod through the bottom insulator to the cage support structure and finally to the emitting electrodes. Each insulator was housed in an individual metal enclosure. The top enclosure protected the high voltage supply and provided worker and weather protection while the bottom enclosure contained the coal gas stream. Therefore, the stainless rod had to pass through two metal enclosures as well as the metal bases of two insulators.

In order to prevent grounding, a 1½ inch diameter phenolic tube insulated the 1/4 inch rod from these metallic surfaces.

Inspection of the phenolic bar revealed a failure of the material and a corresponding path to ground. The high voltage system was checked prior to shipment at the manufacturing plant; however, the insulator heaters (used to prevent condensation on the insulators) were not in operation at that time. The failure was attributed to the phenolic material operating at high temperatures, changing its insulation properties. After this failure, FIS's start-up engineer ordered replacement tubes made of teflon.

Since no spare parts were purchased with the unit, as recommended by FIS, it was decided that a substitute unit of polypropylene be field fabricated from the insulation on a piece of high voltage cable. The polypropylene was only used as a last resort to get the system on line until the teflon tubes arrived. The set point of the heating elements was lowered and the high voltage system was reassembled. The high voltage system checked out and the nitrogen purge began. The oxygen level was reduced to approximately 1% and coal gas was then introduced. The polypropylene bar then failed due to overheating and the high voltage again found a path to ground. The unit was then allowed to return to ambient oxygen levels. The polypropylene bar was in service for a total of 4-6 hours including the static test and purge cycle.

On November 4, a decision was made to bypass the upper insulator completely and bring in the high voltage directly to the lower insulator. This modification required removal of the cable

from its conduit and alterations to the lower insulator cover to allow entry of the cable. These modifications were completed, the unit was purged and pressure tested to 3.5 psig, and brought back on line at 1600 hours on November 5. The unit successfully operated for 26 hours until 1720 hours on November 6.

At this time, various diagnostic tests were conducted as directed by FIS via telephone. The high voltage system was checked out as well as an inspection of the T/R set. The problem was isolated to the automatic voltage control system circuit board. FIS arrived at the site with a replacement board within 12 hours of contact. The circuitry was checked out prior to switching out the board and no wiring problems were discovered so the board was replaced.

While the panel was being checked out and replaced, the high voltage system was being reassembled as originally designed. The teflon tubes and high voltage cable had arrived in Minneapolis the previous day (November 6).

With the system containing a new circuit board and the teflon tube reassembled as originally designed, the unit was started up and put back on the coal gas stream on November 7 at 2120 hrs. The unit only ran 2½ - 3 hours before the automatic voltage control board again failed. The control board manufacturer was again contacted by FIS and the problem was discussed. The problem was identified and the undervoltage circuit was bypassed on the board. The system was checked out and all other control/safety systems - the current limit, quench system and spark rate control - were found to be functional. The unit was then brought back on line at 1530 hrs., November 8.

The unit operated for 3-4 hours when another shutdown occurred at 1825 hrs. The problem was adjustment of the rise rate and setback controls on the logic board. These features determine the rate at which the output power will ramp up and the reduced level to which the recovery circuit will return the output following a spark. Once the circuits were adjusted, the unit was brought on line at 0430 hrs., November 9.

The unit then ran successfully for 75 hours until 0800 hrs. on November 12. The system was brought down due to low secondary voltage and an open bushing test was conducted. The results indicated grounding downstream of the T/R set and it was assumed the teflon tube failed. The high voltage enclosures were disassembled and the low insulator was discovered to be cracked. Here again no spare insulator was available, as recommended in the manufacturer's spare parts list. FIS was contacted and promptly responded by shipping two insulators from Phoenix that same afternoon. Upon arrival, the unit was reassembled and tested successfully in static conditions.

The unit was ready for start-up at approximately 0230 hrs. on November 13. However, problems occurred unrelated to the scrubber system which prevented its start-up until 2100 hrs. on November 15. These problems consisted of open sample valves on the Stretford system which prevented complete system purge, boiler shutdowns, lack of reliable O₂ level readings and finally insufficient supply of purge nitrogen. November 14 was spent cleaning the quench and ESP internals as well as changing the Stretford chemicals.

On November 15, the nitrogen arrived late in the afternoon and the unit was successfully restarted at 2115 hrs. on coal gas. The unit then ran 52 hours until 0100 hours on November 18, when the saturation fan on the gasifier shut down due to a power bump. The system was down for about 6 hours and purging was again necessary. Restart occurred at 0630 hrs. and the unit ran 51 hours until 1000 hrs. on November 20 when the entire facility was shut down due to a cracked valve in the gasifier feed system.

The table following this section (Table I) summarizes the operating time and availability of the quench/ESP system during the November 1982 test period. The dates of scheduled operation are shown in column 1 with the actual time period ran summarized in column 2. Columns 3 and 4 are the total number of operating hours on a daily and cumulative basis respectively. Column 5 and 6 display the available hours which are defined as -- the time period which the quench/ESP system was operable but other equipment, systems or materials prevented start-up. Column 7 is the percentage of operating hours as compared to the total number of test hours, while column 8 is the fraction of available hours over the total number of test hours.

A graphic illustration of the accumulated data is displayed on Graph I through IV. Summarized on these pages are the scrubber outlet temperature, secondary ESP voltage and the spray nozzle flow rates.

TABLE I
TAR SCRUBBER OPERATION

(1) Date	(2) Operating Times	(3) Operating	(4) Cumulative	Hours	(5) Available	(6) Cumulative	(7) Percent Operating	(8) Available
11/5	1660-2400h	8	8		8	8		
11/6	0000-1700h	18	26		18	26		
11/7	2120-2400	2.7	28.7		2.7	28.7		
11/8	1530-1825	3	31.7		3	31.7	56%	56%
11/9	0415-2400	20	51.7		20	51.7		
11/10	0000-2400	24	75.7		24	75.7		
11/11	0000-2400	24	99.7		24	99.7		
11/12	0000-0130	7	106.7		7	106.7		
	0230-0800	-						
11/13	-	-	106.7		21.5*	128.2	27%	84%
11/14	-	-	106.7		24*	152.2		
11/15	2300-2400	1	107.7		24*	176.2		
11/16	0000-0130	21.5	129.2		22.5	198.7		
	0300-1400							
	1700-2400							
11/17	0000-2400	24	153.2		24	222.7		
11/18	0000-0100	18.5	171.7		24	246.7	93%	99%
	0630-2400							
11/19	0000-2400	24	195.7		24	270.7		
11/20	0000-1100	11	206.7		11	281.7		
Overall							60%	82%

*Scrubber repair effected at 0230h on 11/13. Problems with downstream valves, boiler and N₂ supply prevented restart until 2300h on 11/15.

GRAPH I
TAR SCRUBBER GRAPHIC LOG

GRAPH II

TAR SCRUBBER GRAPHIC LOG

TAR SCRUBBER GRAPHIC LOG

GRAPH IV
TAR SCRUBBER GRAPHIC LOG

Data Analysis

Table I presents a summary of the chemical and physical analyses for 10 representative liquid samples from the tar scrubber. Included are heavy tar, oil, ESP drain, quench recycle liquor and liquid discharge for two representative times during the test program. Due to the tendency for tar samples to separate from water with time, tar analyses are given on the basis of the decanted sample rather than the total sample. Volumes of decanted water and tar are given where appropriate.

To further characterize the tar properties on a normalized basis, tar ultimate analyses and heating value are given on a dry, ash-free basis, where moisture content is given by the shape of the tar sample atmospheric distillation curve. Distillation data are given in Table I and in Figures 4 through 8. Figure 1 shows the boiling point curves for the samples taken on 11/10-11/82. Quench tank tar samples were quite similar, with fairly straight line boiling curves for the hydrocarbon fractions, and moisture contents below 20 percent. Samples decomposed at about 740°F. The recycle and blowdown samples were primarily water, with as much as 5 percent heavier fractions. The boiling point rises slowly after about 75 percent of the sample has been evaporated, indicating some dissolved materials. A true break in the boiling point curve does not appear until the 97 percent point, indicating that the tar content in this stream may be as low as 3 percent.

Figure 2 shows the boiling point diagrams for the tar samples, corrected for water content. Although there is an offset in the Float Tar curve at low boiling points due to apparent dissolved materials, the upper portions of the curves are virtually identical, indicating that the tar materials are similar.

Figures 3 and 4 are the samples from the period 11/18-19/82, both on an as-received and dry basis. These samples are quite similar to the previous set, except that the tar content of the recycle and blowdown streams is much more clearly defined, at 96 percent.

Table II presents a summary of the various average boiling points and molecular weight calculations, as developed according to the procedures given in the API Technical Data Book. Boiling points are quite consistent amongst the various samples, indicating again their physical similarity. The molecular weights all are around 200-300, comparable to about a C_{16} hydrocarbon. Slopes for the boiling point curves are comparable to that of a lube oil.

Figures 5 and 6 show the effect of vacuum distillation on the sink tar sample of 11/19/82, on an as-received and dry basis, respectively. From these data, two sets of vapor pressure curves were drawn, as shown in Figures 7 and 8. Here boiling point curves for the initial boiling point, the 10%, 50%, 70% and 90% points, and the Mean Average Boiling Point are shown as a function of pressure, and a vapor pressure equation is given based on the Mean Average Boiling Point.

The Reid Vapor Pressure values measured for the tar samples are fairly consistent falling in the range of a high boiling kerosene (JP-5). Specific gravities, on the other hand, average about 1.05, more typical of asphaltic materials.

Material Balances

Given the gasifier operating data from the BS&B log sheets, the gas flow rates and compositions from the Pedco log sheets, and the temperature flow conditions and sample compositions from the ANR tar scrubber data (attached), it was possible to calculate material balances around the tar scrubber at two times during the test run. The standard ANR gasifier data analysis program was used to convert the gasifier operating data and gas compositions into useful mass and heat balance information. The resulting analyses are given in Table III. Calculation of coal feed rate by the balance program agree with measured coal feed rate within 5 percent. Useful figures for the material balance calculations are the producer gas water content of 18-20.3 percent, well within the range 17 to 21 percent measured by BS&B; the gas yield of 38.8-41.5 dry SCF per pound of coal; and the ANR estimated tar yield of 4.3 weight percent of feed coal, based on previous test work.

Details of the material balance calculations are given in the attached work sheets. Because the scrubber blowdown rate was so low as to make nozzle pressure drop measurements meaningless, it was necessary to calculate the blowdown rate by difference, and to determine the tar yield accordingly.

Based on these figures, the experimental tar yields of 3.29% and 5.95% (average 4.42%) agrees well with ANR's previous estimate of 4.3%.

Quench/ESP Collection Efficiency

During the course of the test run, Pedco made 12 measurements of the tar and particulate loading of the gas stream after leaving the quench/ESP unit. Seven of these measurements were made immediately downstream of the scrubber system, while the remaining measurements were made after the gases had also passed through a venturi contactor. Similar measurements taken by ANR upstream of the precipitator and quench were not successful due to plugging of the gas sample test meter.

Table IV contains a summary of the 12 particulate sample measurements taken by Pedco Environmental. The first seven measurements were taken downstream of the ESP at the Stretford venturi inlet. Based on a tar yield of 4.3 lb./100 lb. of coal, the overall removal efficiency of the quench/ESP system averaged 99.802%. The lower portion of this table contains the particulate samples taken downstream of the venturi. As shown on this table the venturi removed an additional 0.046% or averaged 99.848% removal of the 4.3 lb. yield.

TABLE I

TAR SCRUBBER SAMPLE ANALYSES

Sample	Sink Tar	Float Tar	Recycle Liquor	Tar Discharge	ESP Drain	Sink Tar	Float Tar	Recycle Liquor	Tar Discharge	ESP Drain
Date	11/11/82	11/11/82	11/10/82	11/10/82	11/10/82	11/19/82	11/19/82	11/18/82	11/18/82	11/18/82
Time	1000h	0900h	1130h	1130h	1130h	1400h	1400h	0400h	2000h	2000h
Tot. Sample	1550 ml	0	0	0	375 ml	2500 ml	2400 ml	0	0	650 ml
Tar *	1500 ml	(100%)	(100%)	(100%)	150 ml	800 ml	1600 ml	(100%)	(100%)	250 ml
Tar Analysis *										
VM	78.52	84.20	-	-	(68.59)**	74.94	80.48	-	-	(77.62)**
FC	6.63	7.14	-	-	5.01	3.95	1.48	-	-	4.67
Ash	0.05	0.16	-	-	(trace)	0.11	0.04	-	-	0.01
H ₂ O	14.8	8.5	97	96	(26.4) **	21	18	96	96	(17.7) **
MAF ²										
C	80.69	81.45	-	-	(89.38)**	86.51	87.12	-	-	(79.68)**
H	9.07	9.18	-	-	(9.49)**	8.91	9.25	-	-	(9.03)**
O	8.45	8.47	-	-	-	3.68	2.40	-	-	(10.48)**
N	1.54	0.46	-	-	(0.90)**	0.58	0.95	-	-	(0.46)**
S	0.25	0.44	-	-	(0.30)**	0.32	0.28	-	-	(0.35)**
HHV	16,433	16,487	-	-	(16,450)**	16,460	16,339	-	-	(16,450)**
Distillation										
IBP	212	212	212	212	(N.A.)	216	219	212	212	(N.A.)
5	223	216	212	212		232	241	212	212	
10	219	226	212	212		241	255	212	212	
20	482	252	212	212		262	496	212	212	
30	558	558	212	212		543	552	212	212	
40	604	622	212	212		594	604	212	214	
50	626	662	212	212		640	655	212	214	
60	698	694	212	214		676	687	212	214	
70	734d	748d	214	216		705	705	212	214	
80			217	237		766	698	214	214	
85			228	248		774d	720d	216	214	
90			234	257				217	214	
95			244	277				221	219	
97			248	282				226	239d	
98			262d	284d				228		
99								230d		
Reid Vapor										
Pressure	1.16 psig	0.90	0.90	1.05	0.90	0.79	0.51	1.23	1.01	0.43
SPGR	1.118	0.952	0.998	0.998	1.009	1.044	1.073	0.999	1.000	1.009
pH	-	-	9.2	9.1	8.8	9.2	8.6	8.5	9.1	(N.A.)
Phenols, ppm	-	-	1392	208	-	-	-	2368	1776	-

* Tar analyses are based on the decanted wet samples.

** ESP Drain Moisture contents were estimated assuming a dry tar heating value of 16,450 Btu/lb.

Figure 1
TAR BOILING POINT DIAGRAM
(As Received)

Figure 2

TAR BOILING POINT DIAGRAM

(Dry Basis)

Figure 3
TAR BOILING POINT DIAGRAM
(As Received)

Figure 4

TAR BOILING POINT DIAGRAM

(Dry Basis)

Figure 5

TAR BOILING POINT DIAGRAM

(As Received)

Figure 6

TAR BOILING POINT DIAGRAM

(Dry Basis)

Figure 7

TAR VAPOR PRESSURE

Figure 8

TAR VAPOR PRESSURE

Figure 9

TAR VISCOSITY

TABLE III
MIFGA TEST DATA SHEET

Run <u>EGT-002</u> Coal <u>Colstrip</u> Corrected Airflows				
DATE	1110	1111	1118	1119
TIME	1240	1012	658	1336
COAL, LB/HR				
HOPPER	2,180.	2,320.	2,300.	2,100.
BALANCE	2,231.	2,581.	1,726.	2,001.
AIR	3,851.	4,149.	3,223.	3,772.
STEAM	786.	901.	660.	772.
EST. F	149.	151.	149.	149.
GAS ANALYSIS				
CO ₂ , % DRY	5.83	5.84	7.35	7.69
CO	26.33	27.88	24.35	24.57
H ₂	21.36	21.35	18.36	19.43
N ₂	44.37	42.97	47.67	47.16
CH ₄	1.95	1.81	2.00	1.03
C ₂ H ₄	0.17	0.15	0.26	0.12
C ₂ H ₆	0.00	0.00	0.00	0.00
H ₂ O	19.04	18.37	20.29	19.14
HV, BTU/SCF DRY	176.40	179.65	162.26	154.36
SCF/LB COAL	40.38	30.82	40.64	41.40
SCF/LB FC	110.32	106.06	111.04	113.34
DEW PT, F	138.78	137.39	141.25	133.99
1/KE0	4.98	5.03	4.59	3.89
TEXT, F	451.40	424.40	383.00	449.60
LB COAL/SQFT-HR	67.23	77.78	52.02	60.30
LB FC/SQFT-HR	24.61	28.47	19.04	22.07
SCF/SQFT-HR	2,714.44	3,019.25	2,114.09	2,501.28
KBTU/SQFT-HR	578.16	668.88	447.38	516.57
HEAT IN/LB COAL				
COAL	8,600.	8,600.	8,600.	8,600.
AIR	33.	31.	36.	36.
STEAM	384.	386.	416.	420.
HEAT OUT/LB				
GAS	7,122.	6,974.	6,594.	6,403.
TAR	703.	703.	703.	703.
SENS	570.	514.	475.	570.
LAT	358.	358.	415.	371.
DUST	221.	221.	221.	221.
EFFICIENCIES				
COLD GAS	82.8	81.1	76.7	74.5
GAS+TAR	91.0	89.3	84.9	82.6
BED DATA				
ASH DEPTH	7.7	9.1	8.5	5.0
BED DEPTH	80.0	83.0	85.0	83.0
FUEL DEPTH	72.3	73.9	76.5	77.2
BED dP	5.3	5.6	7.0	5.1
BED K	105.9	101.1	153.7	170.5
GRATE, T/M				
AGITATOR				

ANR INDUSTRIAL FUEL GAS

PAGE 1 OF 2

FOR MIFGA TAR SCRUBBER PROJECT
SUBJECT SCRUBBER MATERIAL BALANCE

DATE 1/13/83
BY F. JONES

BALANCE #1 - 11/11/82 @ 10/24

QUENCH

$$\begin{aligned} \text{FORGERS: } 2 \text{ nozzles} \times 0.1907 (144.5 \text{ psi})^{0.9703} &= 2.27 \text{ gpm} = 113.6 \text{ lb/h @ } 53^\circ\text{F} \\ \text{FRESH: } 0 & \\ \text{RECYCLE: } 3 \text{ nozzles} \times 1.2517 (21 \text{ psi})^{0.9055} &= 17.50 \text{ gpm} = 874.6 \text{ lb/h @ } 131^\circ\text{F} \\ \text{DISCHARGE: } 2.8226 (4.5 \text{ psi})^{0.9607} &= 4.598 \text{ gpm} = 229.0 \text{ lb/h @ } 131^\circ\text{F} \end{aligned}$$

From B.P. Curves: 97% H₂O, 3% Tar

GAS

From PEDCO data, outlet flow is 886 SCFM wet at 130°F Saturated

$$\text{then Drygas} = 0.8483 \times 886 = 751.6 \text{ dry scfm}$$

$$\text{Outlet} = 751.6 \text{ dry scfm} + 134.4 \text{ scfm H}_2\text{O}$$

From Gasifier Material Balances:

$$\% \text{H}_2\text{O in Inlet Stream} = 18.37\%$$

$$\text{Inlet} = 751.6 \text{ dry scfm} + 169.1 \text{ scfm H}_2\text{O @ } 364^\circ\text{F}$$

WATER BALANCE

$$113.6 + \left[\frac{169.1}{379.5} \times 18.016 \times 60 \right] = \text{Discharge (D)} + \left[\frac{134.4}{373.6} \times 18.016 \times 60 \right]$$

$$113.6 + 481.7 = D + 382.8$$

$$D = 1234.8 \text{ lb/hr H}_2\text{O}$$

TAR BALANCE

$$\begin{aligned} \text{Estimate} &= \text{Measured} \\ 751.6 \text{ scfm} \times \left(\frac{1}{38.22} \times 0.043 \text{ lb/lb} \right) \times 60 &= \frac{0.03}{0.97} \times 1234.8 \end{aligned}$$

$$49.95 \text{ lb/h} \approx 38.2 \text{ lb/h}$$

$$0.043 \approx 0.033 \text{ lb tar/lb coal}$$

ANR INDUSTRIAL FUEL GAS

PAGE 2 OF 2

FOR MIFGA TAR SCRUBBER PROJECT
SUBJECT SCRUBBER MATERIAL BALANCE

DATE 1/13/83
BY F. JONES

BALANCE #2 - 11/18/82 @ 0658h

QUENCH

$$\begin{aligned} \text{FRACTION: } 2.26 \times 10^{-3} \times 0.1907 \times (98 \text{ psi})^{0.57105} &= 2.20 \text{ gpm} = 1177.2 \text{ lb/h @ } 128^\circ\text{F} \\ \text{FRESH: } 0 & \\ \text{REFRESH: } 3.22 \times 10^{-3} \times 1.257 \times (27 \text{ psi})^{0.5055} &= 19.87 \text{ gpm} = 9930.5 \text{ lb/h @ } 128^\circ\text{F} \\ \text{DISCHARGE: } 2.8226 \times (45)^{0.4667} &= 45.98 \text{ gpm} = 22990 \text{ lb/h @ } 128^\circ\text{F} \end{aligned}$$

From BP Curves: 96% H₂O, 4% Tar

GAS

From PEDCO data, outlet flow is 808 SCFM wet @ 127°F Saturated

$$\text{Dry Gas} = 0.865 \times 808 = 698.9 \text{ dry SCFM}$$

$$\text{Outlet} = 698.9 \text{ dry scfm} + 109.1 \text{ scfm H}_2\text{O @ } 127^\circ\text{F}$$

From Gasifier Material Balance:

$$\% \text{ H}_2\text{O in Inlet Stream} = 20.29\%$$

$$\text{Inlet} = 698.9 \text{ dry scfm} + 177.9 \text{ scfm H}_2\text{O @ } 352^\circ\text{F}$$

WATER BALANCE

$$1177 + \left[\frac{177.9}{577.5} \times 118.016 \times 60 \right] = \text{DISCHARGE (D)} + \left[\frac{109.1}{577.5} \times 118.016 \times 60 \right]$$

$$1177 + 507 = D + 310.7$$

$$D = 1373.2 \text{ lb/hr H}_2\text{O}$$

TAR BALANCE

Estimate = Measured

$$698.9 \times \left(\frac{1}{44.01} \times 0.043 \right) \times 60 = \frac{0.04}{0.96} \times 1373.2$$

$$44.37 \approx 57.22$$

$$0.043 \approx 0.055 \text{ lb tar/lb coal}$$

AVERAGE

$$\frac{0.033 + 0.055}{2} = 0.044 \text{ lb tar/lb coal}$$

Recommendations

Prior to the next run of the scrubber/ESP unit, the following modifications/additions are recommended:

1. Platform addition: Install a platform below the left insulator for access to the high voltage system. This addition can be fabricated similar to the existing right platform.
2. Larger diameter or additional purge connections: With the present setup purging of the system takes 2-3 hours. Larger diameter or additional purge connections should be installed to minimize the purge cycle.
3. Externally heated level gauges: Problems were encountered with plugging of the level gauges. At the time the unit was fabricated, insufficient lead time prevented the installation of steam jacketed level gauges.
4. Modification of inlet piping: The present piping scheme has no provisions for removal of the inlet piping as the inlet 45° ELL is welded to a pipe support and insulated as a permanent fabrication. It is recommended that the insulation be made removable as well as the pipe support to allow for removal, inspection and cleanout of the upstream piping and valving.
5. Relocation of inlet temperature gauge: The existing inlet temperature gauge should be relocated several feet upstream of

the quench tank. In the present location, the quench water/ liquor sprays the thermowell resulting in false inlet temperature readings.

6. Secure spare parts: Since most gasification tests run at TCRC are only run for a 10-day duration, it is of prime importance to keep all systems on line and minimize delays. Several instances occurred preventing a timely restart while awaiting replacement parts during the November operation. Spare parts as outlined by FIS for the precipitator should be on hand to limit the amount of downtime. In addition a supply of breakables should also be on hand such as: level gauge glasses, temperature gauges, flow indicators and spray nozzles. Local suppliers should be contacted and their inventory of major items (motors, pumps, etc.) be known by the gasifier operating contractor.
7. Modify insulator enclosures: Each time the existing enclosure covers were removed, a considerable amount of water and other condensibles were found laying on the bottom of the insulator box. If the unit was run continuously, the accumulation may cause grounding or sparking within the enclosure. Therefore, it is recommended that a series of holes be drilled at the bottom of the enclosure into the ESP box below the 10" diameter crossarm hole to provide a continuous drain of condensibles down the ESP endwalls.

System Additions

Several options can be added to the quench/ESP cleanup system to simulate a commercial installation. One item would be a quench liquor cooler combined with a tar separation vessel(s). The cooler would eliminate the constant blowdown of quench liquor and provide data on the liquor stream compound concentrations. Fresh water, in most cases, would only have to be added to balance the evaporative losses. The tar separators would provide valuable information concerning tar/oil separation velocities and the impact on cooling the liquor to aid in separation.

Appendix

Included in this appendix are the log sheets from the November 1982 tar scrubber operation. The diagram included in this section is provided to identify the location of the various data points recorded as well as the sample points in the system.

QUENCH/ESP SYSTEM

SAMPLE LOCATIONS AND MONITORING POINTS

GENERAL NOTES

1. QUENCH TANK SUMP LEVEL MONITORED BY LIQUID LEVEL GAUGES AND RECORDED ON LOG SHEETS.
2. PRIMARY AND SECONDARY, VOLTAGE AND CURRENT, MONITORED AT CONTROL PANEL AND RECORDED ON LOG SHEETS.
3. LIQUID SAMPLES TAKEN FROM ESP DRAIN, RECYCLE LIQUOR, QUENCH TANK BOTTOM AND QUENCH TANK SURFACE.

PRESSURES			
DESIGNATION	FLUID	LOCATION	REMARKS
F1	FRESH WATER	QUENCH TANK	FOG NOZZEL
F2	FRESH WATER	QUENCH TANK	FOG NOZZEL
F3	FRESH WATER	QUENCH TANK	SPIRAL NOZZEL
F4	FRESH WATER	QUENCH TANK	SPIRAL NOZZEL
R5	RECYCLE LIQUOR	QUENCH TANK	SPIRAL NOZZEL
R6	RECYCLE LIQUOR	QUENCH TANK	SPIRAL NOZZEL
R7	RECYCLE LIQUOR	QUENCH TANK	SPIRAL NOZZEL
E10	FRESH WATER	ESP TOP	SPIRAL NOZZEL
E9	FRESH WATER	ESP DISTRIBUTOR	SPIRAL NOZZEL
E10	FRESH WATER	ESP DISTRIBUTOR	SPIRAL NOZZEL
E11	FRESH WATER	ESP DISTRIBUTOR	SPIRAL NOZZEL
D	QUENCH BLOWDOWN	DISPOSAL PUMP DISCHARGE	SPIRAL NOZZEL
Q	LOW BTU GAS	QUENCH TANK	PRESSURE NOZZEL
ESP	LOW BTU GAS	ESP	PRESSURE NOZZEL
TEMPERATURES			
DESIGNATION	FLUID	LOCATION	REMARKS
FRESH	FRESH WATER	NOZZLE INLET	PUMP DISCHARGE
RECYC	RECYCLE LIQUOR	NOZZLE INLET	PUMP DISCHARGE
GAS IN	LOW BTU GAS	QUENCH INLET	---
GAS OUT	LOW BTU GAS	QUENCH INLET	---
ESP OUT	LOW BTU GAS	ESP OUTLET	---
FLOW INDICATORS			
DESIGNATION	FLUID	LOCATION	REMARKS
QF	FRESH WATER	QUENCH NOZZLES	PUMP DISCHARGE
ET	FRESH WATER	ESP TOP	---
EP	FRESH WATER	ESP DISTRIBUTOR	---
R5	RECYCLE LIQUOR	NOZZLE NO. 5	---
R6	RECYCLE LIQUOR	NOZZLE NO. 6	---
R7	RECYCLE LIQUOR	NOZZLE NO. 7	---
D	QUENCH BLOWDOWN	DISPOSAL NOZZLE	PUMP DISCHARGE

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ANR TAR SCRUBBER

TEST DATA

Date 11-5

Time	Pressures											
	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000				30								
0100												
0200												
0300												
0400												
0500												
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600	34	0	0	30	24	30	24	0	0	0	0	80
1700	39	38	0	0	23	42	24	0	0	0	0	0
1800	33	33	0	0	24	42	24	0	0	0	0	18
1900	36	0	0	16	24	42	24	0	0	0	0	10
2000	36	0	0	16	24	42	23	0	0	0	0	5
2100	36	0	0	16	23	42	23	0	0	0	0	15
2200	36	0	0	16	23	42	23	0	0	0	0	5
2300	36	0	0	16	23	42	23	0	0	0	0	3

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Date 11-5

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures			
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000															
0100															
0200															
0300															
0400															
0500															
0600															
0700															
0800															
0900															
1000															
1100															
1200															
1300															
1400															
1500															
1600	.4	1.7	Y	N	N	Y	Y	Y	Y	932	50	130	?	129	127
1700	.6	?	Y	N	N	Y	Y	Y	Y	941	52	137	-	138	138
1800	.4	-	Y	N	N	Y	Y	Y	Y	956	52	122	-	138	126
1900	.6	-	Y	N	N	Y	Y	Y	Y	998	50	124	-	124	117
2000	.6	-	Y	N	N	Y	Y	Y	Y	1028	52	126	-	125	122
2100	.4	-	Y	N	N	Y	Y	Y	Y	1068	51	126	-	126	122
2200	.8	-	Y	N	N	Y	Y	Y	Y	1096	52	126	-	125	123
2300	.6	-	Y	N	N	Y	Y	Y	Y	11330	50	123	215	123	118

Page not operating

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Date 11-5

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	D/W	T/W		Primary Volts	Amps	KV	mA	
0000					320		35	32	
0100									
0200									
0300									
0400									
0500									
0600									
0700									
0800									
0900									
1000									
1100									
1200									
1300									
1400									
1500									Start up @ 14:30.
1600	12	1	1		300	-	35	32	
1700	15	-	-		315	-	36	33	
1800	15	>	-		280	-	34	26	
1900	16	-	-		288	-	34	28	changed over to 1/2" line and 4" (K-1 - top) on FWH 12:17
2000	16.5	-	-		284	-	34	24	took samples
2100	15.5	-	-		284	-	34	21	
2200	18.0	-	-		274	-	36	24	
2300	15	-	-		270		35	24	*FRESH H ₂ O pump

MADE loud grinding noise, sounded horn.
Horn was silenced & alternative fresh H₂O pump used.
inspected. Visual check of screen disclosed.

and reinitiated. The system regained normal operations.

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ANR TAR SCRUBBER
TEST DATA

Date 11-6-82

	Pressures											
Time	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000	44	C	C	17	24	42	24	C	C	C	C	10
0100	44	C	C	19	24	42	24	C	C	C	C	10
0200	44	C	C	20	24	42	24	C	C	C	C	10
0300	44	C	C	18	20	40	24	C	C	C	C	15
0400	42	C	C	22	24	42	24	C	C	C	C	15
0500	42	C	C	22	24	42	24	C	C	C	C	25
0600	42	C	C	20	24	42	24	C	C	C	C	5
0700	44	C	C	20	24	44	24	C	C	C	C	15
0800	42	C	C	20	24	44	24	C	C	C	C	10
0900	46	44	0	0	22	12	0	0	0	0	0	0
1000	46	46	0	0	22	42	24	0	0	0	0	0
1100	45	45	0	15	22	42	24	0	C	0	0	0
1200	44	42	0	5	22	42	24	0	0	0	0	0
1300												
1400	45	0	0	0	22	42	23	0	0	0	0	0
1500	45	0	0	0	22	42	23	0	0	0	0	10
1600	45	0	0	0	22	42	24	0	0	0	0	20
1700	42	0	28	0	23	42	24	0	0	0	0	20
1800												
1900												
2000												
2100												
2200												
2300												

ANR Technology Company
An American Natural Resources Company

Date 11-6-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drop		Flow Indicators							Water		Temperatures				
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out	
0000	0.8									11730	52	132	110	123	119	
0100	0.8	11								12070	52	132	170	120	119	
0200	0.6									13440	50	132	160	120	120	
0300	0.6	11								12820	52	130	160	120	118	
0400	0.6									13280	50	117	170	117	113	
0500	0.5	11								13720	50	117	200	117	114	
0600	0.4	4								14150	50	118	260	117	115	
0700	0.4	11								14540	52	150	240	120	120	
0800	1.3	11								14920	50	119	330	120	118	
0900	1.4	0.5								15340	52	100	?	130	126	
1000	1.4	1.3								15880	54	124	?	130	124	
1100	1.3	1.48								15820	52	120	?	120	116	
1200	1.3									16090	52	124	?	126	123	
1300																
1400	1.3	0.4								16800	55	122	?	129	123	
1500	1.3	1.20								17060	56	126	?	130	123	
1600	1.3									17580	52	130	?	120	129	
1700	1.3									18010	51	110	?	116	112	
1800																
1900																
2000																
2100																
2200																
2300																

Now
to go
0-1 scale

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ANR Technology Company
An American Natural Resources Company

Date 11-6-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Volts	Amps	KV	mA	
0000	14	-	-		240	-	31	18	FRESH WATER PIST. HEAVY
0100	14	-	-		250	-	32	20	C.F. HEAVY
0200	16	-	-		260	-	32	20	C.F. OPERATION DOWN
0300	16	-	-		250	-	32	18	
0400		-	-		250	-	31	21	
0500		-	-		250	-	31	18	
0600		-	-		260	-	32	20	
0700		-	-		250	-	32	22	
0800		-	-		240	-	31	18	
0900	10				270	-	33	20	System went down @
1000	16				260	-	33	26	0530 at this time
1100	10				270	-	33	24	don't know why, heavy
1200	17				280	-	38	26	system back online
1300									about 10-15 min. later
1400	14				250	-	33	21	Bed reading on rough 15-20
1500	16				275	-	33	22	Note - Running @ 3.3 Neg
1600	18				290	-	35	26	At 5:26 undervites
1700	16				260	-	33	23	light came on, eff. 10
1800									at resetting, it failed
1900									so shutdown was
2000									initiated, inlet manual
2100									valve and outlet valves
2200									closed, test
2300									pipe out of comb

Chamber up and out
Carl notified @ 5:40

ANR Technology Company
An American Natural Resources Company

ANR TAR SCRUBBER
TEST DATA

Date 11-7-82

Pressures												
Time	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000												
0100												
0200												
0300												
0400												
0500												
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												
2100	46	0	0	0	23	42	24	0	0	0	0	0
2200	0	0	0	0	26	46	0	0	0	0	0	0
2300	44	12	7	0	23	42	23	0	0	0	0	10

ANR Technology Company
An American Natural Resources Company

ANR TAR SCRUBBER
TEST DATA

Date 11-7-82

Pressure Drops			Flow Indicators							Water	Temperatures				
Time	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000															
0100															
0200															
0300															
0400															
0500															
0600															
0700															
0800															
0900															
1000															
1100															
1200															
1300															
1400															
1500															
1600															
1700															
1800															
1900															
2000															
2100	0	.10	N	N	N	Y	Y	Y	Y	1910	58	68	63	46	
2200	0	.09	N	N	N	Y	Y	N		1920	54	92	-	7	60
2300	.3	.04	Y	N	N	Y	Y	Y	Y	1930	54	100	122	131	

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ANR Technology Company
An American Natural Resources Company

Date 11-7-82

ANR TÅR SCRUBBER

TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Primary		Secondary		
					Volts	Amps	KV	mA	
0000									
0100									
0200									
0300									
0400									
0500									
0600									
0700									
0800									
0900									
1000									
1100									
1200									
1300									
1400									
1500									
1600									
1700									
1800									
1900									
2000									
2100	13.5	—	—	—	290	—	31	41	Started up at 21:20
2200	17.0	—	—	—	180	—	27	8	shut off trish V ₂ to speed up heating gas temp
2300	19.0				240		30	18	

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ANR Technology Company
An American Natural Resources Company

Date 11-8-82

AMR TAR SCRUBBER

TEST DATA

[illegible]

ANR Technology Company
An American Natural Resources Company

Date 11-8-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures			
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000															
0100															
0200															
0300															
0400															
0500															
0600															
0700															
0800															
0900															
1000															
1100															
1200															
1300															
1400															
1500															
1600	.42	106	X	X	X	✓	✓	✓	✓	19946	52	120	-	122	120
1700	.2	0	Y	N	N	Y	Y	Y	Y	20116	52	125	-	125	124
1800	.3	126	Y	N	N	Y	Y	Y	Y	20356	56	127	-	126	126
1900															
2000															
2100															
2200															
2300															

ANR Technology Company
An American Natural Resources Company

Date 11-8-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Volts	Amps	KV	mA	
0000									
0100									
0200									
0300									
0400									
0500									
0600									
0700									
0800									
0900									
1000									
1100									
1200									
1300									
1400									
1500									Start-up 15:30
1600	19	-	-	-	250	0	31	22	
1700	16	-	-	-	250	-	33	22	6 ³⁵ noticed undervoltage
1800	16	-	-	-	250	-	33	22	tried to reset but failed so
1900	18								had to shut down, inlet
2000									outlet valves closed
2100									
2200									
2300									

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ANR Technology Company
An American Natural Resources Company

Date 11-9-82

ANR TAR SCRUBBER
TEST DATA

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Time	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000												
0100												
0200												
0300												
0400												
0500	46	44	-	10	22	44	22					
0600	44	42	-	10	22	44	24					
0700	44	42	-	10	22	42	22					
0800	44	42	-	10	22	42	24					
0900	43	42	0	11	22	42	24	0	0	0	0	10
1000	44	43	0	11	22	42	23	0	0	0	0	9
1100	44	43	0	10	23	42	24	0	0	0	0	7
1200	46	45	0	0	21	40	23	0	0	0	0	7
1300	45	44	0	2	20	40	22	0	0	0	0	5
1400	44	42	0	13	20	40	20	0	0	0	0	5
1500	46	0	0	0	18	40	18	0	0	0	0	20
1600	40	38	0	36	13	40	15	0	0	0	0	5
1700	46	0	0	0	23	40	22	0	0	0	0	5
1800	46	0	0	0	22	40	23	0	0	0	0	5
1900	46	0	0	0	22	42	23	0	0	0	0	5
2000	46	0	0	0	20	42	22	0	0	0	0	5
2100	46	0	0	0	23	42	23	0	0	0	0	5
2200	46	0	0	0	23	42	24	0	0	0	0	5
2300	46	24	0	0	23	44	24	0	0	0	0	5

ANR Technology Company
An American Natural Resources Company

12-8011

ANR TAR SCRUBBER
TEST DATA

Date 11-9-82

	Pressure Drops		Flow Indicators							Water	Temperatures				
Time	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc.	Gas In	Gas Out	ESP
0000															
0100															
0200															
0300															
0400															
0500	.6				Y	Y	Y	Y	5	2,550	52	134	285	138	124
0600	.4				Y	Y	Y	Y	10	20,700	52	130	300	130	128
0700	.4				Y	Y	Y	Y	5	21,170	50	126	260	130	121
0800	.4				Y	Y	Y	Y	10	21,470	50	130	260	130	121
0900	700	100								21,970	50	120	290	122	12
1000	+0.34	100	?	N	N	Y	Y	Y	Y	22,255	50	126	280	128	12
1100	.3	?								22,480	50	124	250	126	12
1200	.5	~0		N	N	Y	Y	Y	Y	22,800	50	130	240	124	12
1300	.6	.3								23,100	50	122	200	122	12
1400	.4	.8								23,350	50	130	200	130	12
1500	.4	?								23,580	54	130	200	135	122
1600	.4									23,700	49	110	100	98	100
1700	.2									23,900	50	127		128	12
1800	.2									23,950	50	126		126	118
1900	.1									24,020	52	117		118	100
2000	.4	0								24,110	52	133		132	12
2100	.4									24,230	52	128		129	15
2200	.6									24,490	52	122		128	11
2300	.6									24,550	51	132		134	15

$\Delta P = -0.4$
 $\Delta t = +1.4$
 $\Delta P_{in} = +1.0$
 $\Delta P_{out} = +0.2$
 $P_{in} = 0.8$
 ΔP_{note}
 $+1.4$
 $+2.0$

F1
 F1
 1.4
 1.1

12-811

ANR Technology Company
An American Natural Resources Company

Date 11-9-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Primary		Secondary		
					Volts	Amps	KV	mA	
0000									
0100									
0200									
0300									
0400									0.415" FLOW 22" H ₂ O STATION COP. FLOW 0.19 GPM
0500	13				300	5	33	39	
0600	16				300	5	35	39	
0700	16				280	5	35	28	
0800	16				300	5	35	30	
0900	15				270	5	35	26	System running neg.
1000	16				310	45	34	2040	High X? High 300 250
1100	17				300	45	35	25	
1200	17				310	45	36	39	System now positive 1 in. 5000
1300	17				280	45	34	25	
1400	15				290	45	33	24	ESP pressure top F.O.s within giving way reading
1500	14				280	45	33	23	
1600	18				230	15	28	22	
1700	12				270	5	32	24	
1800	18				270	5	32	24	opened middle recycle valve sieved to clear up gauge problem Tar and water mixed better
1900	17				270	5	32	24	
2000	14				270	3	32	26	took samples: 1st d-2 m) recycle H ₂ O, (upper D. 2.5 m)
2100	18				280	3	31	24	
2200	20				290	3	34	28	
2300	17				270	3	35	25	

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ANR Technology Company
An American Natural Resources Company

Date 11-10-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressures											D
	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	
0000	46	38	0	0	22	42	22	0	0	0	0	5
0100	42	38	0	0	22	42	24	0	0	0	0	5
0200	42	32	0	0	22	42	24	0	0	0	0	5
0300	46	24	0	0	22	42	22	0	0	0	0	5
0400	46	24	0	0	21	41	22	0	0	0	0	5
0500	46	24	0	0	18	41	20	0	0	0	0	5
0600	46	24	0	0	22	42	22	0	0	0	0	5
0700	44	24	0	0	21	41	24	0	0	0	0	5
0800	46	44	0	0	22	42	22	0	0	0	0	5
0900	45	44	0	0	23	42	24	0	0	0	0	0
1000	39	38	0	35	23	42	22	0	0	0	0	0
1100	45	44	0	0	22	42	23	0	0	0	0	0
1200	44	44	0	0	23	23	24	0	0	0	0	25
1300	44	43	0	0	23	23	24	0	0	0	0	25
1400	45	44	0	0	23	23	24	0	0	0	0	25
1500	45	44	0	0	23	23	23	0	0	0	0	25
1600	45	44	0	0	23	23	23	0	0	0	0	25
1700	44	44	0	0	23	23	23	0	0	0	0	25
1800	44	44	0	0	23	23	23	0	0	0	0	25
1900	45	45	0	0	23	23	23	0	0	0	0	25
2000	46	46	0	0	23	23	23	0	0	0	0	25
2100	45	45	0	0	23	23	23	0	0	0	0	25
2200	45	45	0	0	23	23	23	0	0	0	0	10
2300	45	45	0	0	23	23	23	0	0	0	0	25

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ANR Technology Company
An American Natural Resources Company

Date 11-10-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures			
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000	.8		-							24650	50	130	-	132	124
0100	.6									24710	50	128	-	130	124
0200	.6									24860	50	128	-	130	124
0300	.6									24950	50	126	-	130	122
0400	.6									25050	50	128	-	132	124
0500	.6									25110	50	130	-	132	130
0600	.6									25280	50	131	-	134	130
0700	.6									25370	50	131	-	132	132
0800	.6									25480	50	128	-	132	125
0900	.5	.2								25570	52	130	200	134	132
1000	.3	neg								25810	50	110	200	110	120
1100		neg								26040	52	128	200	130	125
1200	.5	-								26150	54	134	220	137	133
1300	.5	.5								26290	54	130	200	130	128
1400	.6	neg								26470	54	130	200	130	125
1500	.2									26580	54	130	200	130	128
1600	.5	-								26730	53	130	220	130	128
1700	.5									26860	54	125	220	130	128
1800	.6									26970	54	131	220	136	130
1900	.5									27130	53	130	200	130	127
2000	.5									27270	53	134	220	134	130
2100	.4									27370	53	130	220	130	127
2200	.6									27630	51	122	220	124	115
2300	.5									27820	53	126	220	128	123

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P_{in} = 4P_{in} = 0

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ANR Technology Company
An American Natural Resources Company

Date 11-10-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Primary Volts	Primary Amps	Secondary KV	Secondary mA	
0000	17.5	-	-	-	340	5	35	24	STARTED SHIFT RUNNING SCRUBBER FINE
0100	14	-	-	-	320	5	35	38	
0200	12.5	-	-	-	320	5	35	24	
0300	15	-	-	-	270	5	35	24	
0400	14.5	-	-	-	320	5	37	32	
0500	14.5	-	-	-	320	5	38	35	
0600	16	-	-	-	320	5	38	38	
0700	14	-	-	-	320	5	40	35	
0800	14	-	-	-	330	5	40	38	
0900	18				330	<5	35	36	
1000	2				330	<5	38	39	Changed nozzle in combustor new nozzle working good
1100	14				270	<5	34	25	System running neg 09:30
1200	16	-	-	-	340	<5	39	38	
1300	16				280	<5	35	26	
1400	17				300	<5	36	25	
1500	13				300	<5	37	25	
1600	16				330	<5	39	38	
1700	19				320	<5	38	32	
1800	18				280	5	34	28	
1900	17				290	5	37	25	
2000	18				340	4	37	24	
2100	17				330	4	37	32	
2200	20				290	4	35	32	
2300	20				280	4	34	24	

12-8^{AM}

ANR Technology Company
An American Natural Resources Company

Date 11-11-82

ANR TAR SCRUBBER
TEST DATA

	Pressures											
Time	F1	F2	F3	F4	R5	R6	R7	ETB	E9	E10	E11	D
0000	46	42	0	0	24	23	24	0	0	0	0	5
0100	44	44	0	0	22	22	24	0	0	0	0	5
0200	40	38	0	0	24	23	24	0	0	0	0	5
0300	44	44	0	0	24	23	24	0	0	0	0	5
0400	44	44	0	0	24	22	24	0	0	0	0	5
0500	45	44	0	0	22	22	23	0	0	0	0	5
0600	44	44	0	0	22	22	24	0	0	0	0	5
0700	44	44	0	0	22	22	22	0	0	0	0	5
0800	45	44	0	0	22	21	22	0	0	0	0	5
0900	44	43	0	0	21	21	21	0	0	0	0	6
1000	45	44	0	0	21	21	21	0	0	0	0	45
1100	44	42	0	0	21	21	21	-	-	-	-	5
1200	44	43	-	-	20	21	21	-	-	-	-	5
1300	46	44	-	-	20	21	22	-	-	-	-	10
1400	44	43	-	-	20	21	22	-	-	-	-	5
1500	44	42	-	-	20	20	22	-	-	-	-	5
1600	46	43	-	-	20	20	21	-	-	-	-	
1700	44	44	-	-	20	20	21	-	-	-	-	5
1800	45	44	0	0	20	20	21	0	0	0	0	45
1900	45	44	0	0	20	19	20	0	0	0	0	45
2000	45	44	0	0	23	23	23	0	0	0	0	45
2100	44	44	0	0	24	24	23	0	0	0	0	5
2200	44	42	0	0	23	23	24	0	0	0	0	5
2300	45	43	0	0	23	23	24	0	0	0	0	5

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12-8^{AM}

ANR Technology Company
An American Natural Resources Company

Date 11-11-82

ANR TAR SCRUBBER
TEST DATA

Pressure Drops										Flow Indicators					Water		Temperatures				
Time	Q	ESP	DP	ET	EP	R5	R6	R7	D						Meter		Fresh	Recyc	Gas In	Gas Out	ESP Out
0000	.6														28620		52°	132°	0	138	132
0100	.6														28130		52	130	6	132	130
0200	.5														28130		50	120	6	119	118
0300	.5														28146		54	127	0	126	124
0400	1.2														28570		52	130	0	130	130
0500	.2														28574		52	128	0	129	128
0600	.62														28850		52	132	0	132	132
0700	.6														28970		52	130	0	130	128
0800	.6														29050		52	132	0	132	132
0900	.3														29362		52	122	-	126	120
1000	.6														29572		53	134	-	135	130
1100	0.7														29780		52	124	-	124	124
1200	1.0														29950		52	134	-	134	132
1300	1.0														30070		52	130	-	134	129
1400	0.2														30220		52	128	-	130	118
1500	1.4														30380		52	130	-	130	130
1600	0.4														30510		52	130	-	134	132
1700	0.8														30630		52	129	-	131	127
1800	0.3														30730		52	130	-	132	128
1900	0.3														30880		52	128	-	130	127
2000	0.4														30970		53	132	-	134	132
2100	0.6														31080		52	128	-	130	128
2200	0.3														31190		54	133	-	135	132
2300	1.														31330		54	129	-	130	129

P_{in} = 3
P_{out} = 4

ANR Technology Company
An American Natural Resources Company

Date 11-12-82

AMR TAR SCRUBBER
TEST DATA

[illegible]

K-51

12-8 AM

ANR Technology Company
An American Natural Resources Company

Date 11-12-82

ANR TAR SCRUBBER
TEST DATA

[illegible]

[illegible][illegible]

ANR Technology Company
An American Natural Resources Company

Date 11-15-82
11/14/82

ANR TAR SCRUBBER
TEST DATA

Pressures												
Time	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000												
0100												
0200												
0300												
0400												
0500												
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												
2100												
2200												
2300	52	48	-	52	38	26	20	0	0	0	0	75

K-53

ANR Technology Company
An American Natural Resources Company

Date 11-15-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures				
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out	
0000																
0100																
0200																
0300																
0400																
0500																
0600																
0700																
0800																
0900																
1000																
1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300	0.1	-									32650	62	26	-	128	123

ANR Technology Company
An American Natural Resources Company

Date 11-15-82

ANR TAR SCRUBBER
TEST DATA

TEST DATA

Liquid Levels

Electrical

Time

Surf.

O/W

T/W

O₂

Primary

Secondary

Volts

Amps

KV

mA

Remarks

0000

0100

0200

0300

0400

0500

0600

0700

0800

0900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

2000

2100

2200

2300

REPLACED FUSE ON CONTROL Ckt.

TRANSFERRED PUMP FUSE BLOWN. REPLACED

STARTED N₂ INTO SYSTEM FOR PRESSURE TEST

STILL NO PRESSURE @ 1700

FOUND LEAKAGE PAST AUTO CL

1945 - SYSTEM UP TO 3 LBS N₂ OP. @ 2000 HRS 11/15/82 2015

STARTED PURGE 2030

2115 O₂ IS 0.7% STARTED GAS PUMP

RECYCLE STEADIER CHECKED ALL RUNNING O.K.

WALL

2015

IN 51

2015

2015

K-54

12

270

25

28

35

285

45

31

34

285

5

31

34

300

4

31

34

305

4

31

34

34

K-54

ANR Technology Company
An American Natural Resources Company

Date 11-16-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressures											
	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000	52	48	0	50	28	26	26	0	0	0	0	5
0100	52	48	0	0	28	26	26	0	0	0	0	5
0200	52	50	0	0	28	26	26	0	0	0	0	5
0300	52	50	0	0	28	26	26	0	0	0	0	5
0400	52	50	0	0	27	26	26	0	0	0	0	0
0500	52	48	0	0	27	26	26	0	0	0	0	0
0600	52	49	0	0	27	26	26	0	0	0	0	0
0700	52	49	0	0	27	26	26	0	0	0	0	0
0800	52	49	0	0	27	26	26	0	0	0	0	0
0900	52	49	0	0	27	26	26	0	0	0	0	0
1000	52	49	0	0	27	26	26	0	0	0	0	0
1100	52	49	0	0	27	26	26	0	0	0	0	0
1200	52	48	0	0	26	27	26	0	0	0	0	0
1300	52	48	0	0	26	27	26	0	0	0	0	0
1400	52	48	0	0	26	26	27	0	0	0	0	0
1500	52	48	0	0	26	26	26	0	0	0	0	0
1600												
1700	52	50	0	0	26	28	26	0	0	0	0	0
1800	52	50	0	0	22	23	23	0	0	0	0	0
1900	52	48	0	0	26	27	26	0	0	0	0	0
2000	50	48	0	0	24	24	24	0	0	0	0	0
2100	50	47	0	0	25	25	24	0	0	0	0	0
2200	50	48	0	0	26	26	26	0	0	0	0	0
2300	50	48	0	0	28	28	27	0	0	0	0	0

STARTED UP

ANR Technology Company
An American Natural Resources Company

ANR TAR SCRUBBER
TEST DATA

Date 11-16-82

Time	Pressure Drop		Flow Indicators							Water		Temperatures			
	Q	ESP	OF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000	0									32,820	56	136		136	132
0100	0									32,980	76	138		138	134
0200															
0300	0									32,950	82	140		140	139
0400	0									32,970	64	136		138	137
0500	0									32,000	62	136		138	134
0600	0									33,010	84	138		138	138
0700	0									33,050	70	140		140	140
0800	0									33,060	60	140		144	142
0900	0									33,100	80	143		144	144
1000	0									33,200	72	130		138	-
1100	0									33,220	58	140		140	142
1200	0									33,240	82	144		142	142
1300	0									33,250	86	144		144	144
1400	0									33,320	85	139		143	
1500															
1600															
1700	0									33,600	50	108		118	121
1800	0									33,740	48	112		128	122
1900	0									33,880	56	134		136	138
2000	0									34,070	54	130		134	134
2100	0									34,260	54	128		128	128
2200	0									34,490	66	142		142	138
2300	0									34,710	56	130		138	131

ANR Technology Company
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ANR TAR SCRUBBER
TEST DATA

Date 11-16-82

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.)	O/W	T/W		Primary	Amps	Secondary	MA	
0000	12				280	6	98	32	
0100	19				320	5	39	32	AT 1830 AM TRANSFER
0200					320	5	39	32	PUMP MOTOR WENT OUT
0300	15				320	5	39	32	
0400	15				320	5	40	32	
0500	15				320	5	39	32	
0600	15				320	5	39	32	
0700	16				320	5	39	32	
0800	16				320	5	39	32	08:50 NOTE: DON'T HEAR TOO MUCH ZAPPING OF TAPS
0900	16				320	5	39	32	EVEN THOUGH ELECTRICITY READINGS SEEM OK.
1000	24				320	5	39	32	09:00 - PAUL COMMENTED THAT THERE IS TAR ON HIS INLET GAS SAMPLER.
1100	17				320	5	40	32	10:30 CHECKED WITH GASIFIER. BPT SCRUBBER UP SINCE
1200	17				320	5	40	32	AT LEAST 07:00. TAPS CAN BE BUENING UP IN GASIFIER.
1300	16				320	5	40	32	
1400	21				320	5	40	32	
1500									
1600									
1700	13				320	5	39	32	automatic water shot at 18:30
1800	17				320	5	39	32	super pump b/c gasification changed screens in recycle line
1900	12				320	5	39	32	valve shut again when
2000	17				320	5	39	32	changing screens, maybe shutting recycle pump
2100	17				320	5	39	32	save it to c/osp. moving pump running 22:10
2200	13				320	5	40	32	
2300	13				320	5	40	32	

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ANR Technology Company
An American Natural Resources Company

Date 11-17-82

AMR TAR SCRUBBER
TEST DATA

7

ANR Technology Company
An American Natural Resources Company

Date 11-17-82

ANR TAR SCRUBBER
TEST DATA

TEST DATA																
Time	Pressure Drop			Flow Indicators							Water		Temperatures			
	Q	ESP	DP	ET	EP	RS	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out	
0000	0									34980	50	130		138	134	
0100	0									35630	76	135		140	140	
0200	0									35040	89	140		140	143	
0300	0									35170	54	136		140	140	
0400	0									35220	54	134		138	138	
0500	0									35470	50	130		134	133	
0600	0									35580	50	132		134	133	
0700	0									35810	50	130		132	131	
0800	0									36140	50	140		140	140	
0900	0									36380	50	124		124	122	
1000	0									36700	50	120		120	118	
1100	0									37150	50	120		116	118	
1200	0									50	120		120	116		
1300	0									38040	50	118		116	116	
1400	0									38170	52	138		142	140	
1500	0									38300	64	138		142	140	
1600	0									38530	50	135	-	134	136	
1700	0									38830	48	130	-	128	127	
1800	0									39100	50	132		135	130	
1900	0									39360	48	130		130	123	
2000	0									39660	48	130		135	129	
2100	0									40020	50	134		135	131	
2200	0									40300	52	131		133	131	
2300	0									40600	52	129		131	127	

ANR Technology Company
An American Natural Resources Company

Date 11-17-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W		Primary		Secondary		
					Volts	Amps	KV	mA	
0000	15				320	5	38	34	
0100	13				320	5	40	34	
0200	14				320	5	40	34	
0300	13				320	5	40	34	
0400	13				320	5	40	34	
0500	14				320	5	40	34	
0600	14				320	5	40	34	
0700	14				320	5	38	34	
0800					320	5	38	34	
0900	15				314	5	37	33	
1000	16				290	5	34	34	
1100	16				280	5	34	34	
1200	14				280	5	34	30	READY ZAPPING NOW
1300	13				260	5	34	26	"
1400	13				320	5	34	34	"
1500	14				320	5	34	34	STILL ZAPPING
1600	14				320	5	34	34	"
1700	20				320	5	37	33	
1800	20				320	5	37	33	
1900	22				320	5	37	33	
2000	18				320	5	37	33	STEADY BURST OF RAPID OSCILLATION A NO PUMP
2100	20				320	5	37	33	SETTLED DOWN @ 1930 ACTIVE ZAP
2200	21				320	5	37	33	50 ACTIVE
2300	21				320	5	37	33	50 PORPOSED

ANR Technology Company
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Date 11-18-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressures											D
	F1	F2	F3	F4	R5	R6	R7	ET8	E9	ETD	E11	
0000	50	30	0	0	27	25	28	0	0	0	0	5
0100	50	40										
0200												
0300												
0400												
0500												
0600												
0700	50	46	0	0	27	26	28	0	0	0	0	5
0800	50	46	0	0	27	27	28	0	0	0	0	1
0900	50	44	-	10	27	27	28	0	-	-	-	
1000	48	44	-	10	26	28	28	-	-	-	-	10
1100	50	44	-	10	26	28	28	-	-	-	-	1
1200	50	46	-	10	26	28	28	-	-	-	-	5
1300	50	46	-	57	27	28	27	-	-	-	-	1
1400	51	46	-	52	27	25	28	-	-	-	-	1
1500	51	46	-	52	27	25	28	-	-	-	-	5
1600	50	46	-	26	27	28	28	-	-	-	-	5
1700	50	46	0	60	27	26	27					5
1800	50	45	0	60	27	26	27					5
1900	50	46	0	54	27	26	27					5
2000	50	45	0	56	27	26	26					5
2100	50	44	0	56	28	25	27					5
2200	48	42	0	56	27	26	26					5
2300	58	44	0	63	27	27	26					5

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ANR Technology Company
An American Natural Resources Company

Date 11-18-82

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures			
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out
0000	0									40910	50	124	0	132	125
0100															
0200															
0300															
0400															
0500															
0600															
0700	0									41310	50	128	0	130	125
0800										41610	50	128	-	129	128
0900										41770	49	124	-	129	124
1000	0									42200	46	116	-	118	114
1100										42390	50	122	-	122	124
1200	0									42510	50	130	-	130	128
1300	0.8									42840	50	122	-	126	124
1400										42980	50	124	-	125	123
1500										43100	48	130	-	133	130
1600	-									43240	47	124	-	126	122
1700										43520	47	120	-	127	121
1800										43770	48	125	-	128	124
1900										43990	48	128	-	131	127
2000										44190	48	124	-	130	124
2100										44450	46	118	-	121	118
2200										44680	49	133	-	138	132
2300										44860	47	132	-	132	130

SHUT DOWN

START-UP

K-58

ANR Technology Company
An American Natural Resources Company

Date 11-18-82

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/N	T/M		Primary Volts	Primary Amps	Secondary KV	Secondary mA	
0000					300	5	40	30	
0100					300	5	35	30	SHUT DOWN 1:00 AM LASH ORATE PLACED
0200									
0300									
0400									
0500									
0600									POURED SYRUCY
0700	15				300	5	36	34	STARTED UP 6:30 AM
0800	16				290	5	33	30	
0900	13				290	5	33	30	
1000	12				280	5	30	31	ZAPPING WALL
1100	14				290	5	32	30	SPARKYS ALL HAPPY!
1200	12				300	5	32	32	
1300	19				300	5	34	32	
1400	16				300	5	35	32	"
1500	15				300	5	36	32	"
1600	17				290	5	33	30	SPARKYS ARE JUMPIN
1700	21				290	5	33	32	
1800	21				290	5	34	32	POURED POPPIN
1900	17				280	5	38	32	
2000	17				300	5	36	34	WATER LEVEL & GAS TEMP DROPPED, ALSO H ₂ S LOW - 6
2100	15				290	5	30	24	VERY ACTIVE H ₂ S TO 60
2200	21				290	5	35	34	
2300					290	5	35	32	

ANR Technology Company
An American Natural Resources Company

Date 11-19-82

ANR TAR SCRUBBER
TEST DATA

Pressures												
Time	F1	F2	F3	F4	R5	R6	R7	ET8	E9	E10	E11	D
0000	50	44	0	0	28	26	29	0	0	0	0	5
0100	50	46	0	0	28	27	27	0	0	0	0	5
0200	50	46	0	0	28	27	28	0	0	0	0	5
0300	50	46	0	0	28	27	27	0	0	0	0	5
0400	50	46	0	0	28	27	27	0	0	0	0	5
0500	50	46	0	0	28	26	26	0	0	0	0	5
0600	50	46	0	0	28	27	26	0	0	0	0	5
0700	50	46	0	0	28	28	28	0	0	0	0	5
0800	51	44	0	0	28	28	28	-	-	-	-	5
0900	47	43	0	49	27	27	-	-	-	-	-	17
1000	0	0	0	0	28	28	0	-	-	-	-	-
1100	52	50	0	0	28	28	26	-	-	-	-	5
1200	50	48	0	54	28	28	27	-	-	-	-	5
1300	51	48	0	53	28	28	26	-	-	-	-	5
1400	49	48	0	53	27	27	26	-	-	-	-	5
1500	51	48	0	52	28	27	-	-	-	-	-	5
1600	50	46	0	56	28	28	-	-	-	-	-	5
1700	50	45	0	65	27	28	-	-	-	-	-	10
1800	49	46	0	68	27	28	-	-	-	-	-	5
1900	50	46	0	60	27	28	-	-	-	-	-	5
2000	48	44	0	58	27	27	-	-	-	-	-	5
2100	50	45	0	64	28	28	-	-	-	-	-	-
2200	50	47	0	31	28	28	-	-	-	-	-	5
2300	40	36	-	70	27	28	-	-	-	-	-	-

K-59

* 2" WATER LINE BROKE IN FIRST FLOW OF GAS FROM
BUILDING CUTTING OFF SUPPLY - BUT UNCLE

ANR Technology Company
An American Natural Resources Company

Date 11-19-82

ANR TAR SCRUBBER
TEST DATA

Pressure Drops			Flow Indicators							Water		Temperatures				
Time	Q	ESP	DP	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out	
0000	0									45140	46	128	0	130	132	
0100	0									45270	46	127	0	130	128	
0200	0									45400	46	128	0	130	128	
0300	0									45530	46	126	0	130	128	
0400	0									45750	46	130	0	132	128	
0500	0									45870	44	126	0	128	122	
0600	0									45880	46	130	0	132	128	
0700	0									46140	46	130	0	132	127	
0800	0									46310	48	126	0	130		
0900	1									46530	47	107	-	116	111	
1000	1									46740	48	130	-	137		
1100	1									46970	48	110	-	124	118	
1200	1									47120	48	122	-	134		
1300	1									47220	50	126	-	128	126	
1400	1									47400	50	132	-	134		
1500	1									47610	50	124	-	129	126	
1600	1									47830	50	130	-	136	132	
1700	1									48080	46	120	-	122	120	
1800										48110	46	120	-	122	117	
1900										48710	46	118	-	122	116	
2000										49010	47	104	-	112	110	
2100										49370	48	114	-	117	110	
2200										49580	48	134	-	134	128	
2300										49830	46	104	-	104	112	?

ANR Technology Company
An American Natural Resources Company

Date 11-19-82

AMR TAR SCRUBBER
TEST DATA

Liquid Levels				O ₂	Electrical				Remarks
Time	Surf.	O/W	T/W		Primary		Secondary		
					Volts	Amps	KV	MA	
0000	15				300 290	5 5	35 35	32 32	
0100	14				300 290	5 5	34 34	32 31	
0200	14				300 290	5 5	34 32	31 30	
0300	15				300 290	5 5	35 34	32 32	
0400	15				300 290	5 5	35 35	32 32	
0500	14				300 290	5 5	35 34	34 32	
0600	14				300 290	5 5	33 33	32 34	
0700	14				300 290	5 5	33 35	34 34	
0800	13				290 280	5 5	33 30	35 28	
0900	17				280 270	5 5	30 34	35 31	
1000	17				290 300	5 5	34 35	34 34	WATER LINE IN CAUTION GROUND NOT TAA SLOWDOWN ON REELLES
1100					280 280	5 5	34 32	34 28	NO FRESH WATER AVAILABLE UNTIL 10:20
1200	17				280 280	5 5	34 30	32 30	REALLY ZAPPING
1300	13				280 270	5 5	32 31	30 27	"
1400	17				280 260	5 5	30 30	28 27	"
1500	16				300 300	5 5	37 35	36 33	JUST KIND-A ZAPPING
1600	21				280 270	5 5	35 30	34 25	" " "
1700	16				280 250	5 5	30 30	28 28	DRAPASD TOMORROW OF GIN
1800	15				270 260	5 5	31 30	30 28	
1900	15				280 250	5 5	28 20	28 22-60	
2000	16				240 240	5 5	27 28	24 24-60	
2100	16				230 240	5 5	28 28	22-30 26	
2200	13				280 250	5 5	36 30	34 26	
2300	10				240 260	5 5	28 32	26 24	

1745 VISIBLE ARC ON HI VOLTAGE BOX, TOP OF ESP.
KV & mA NORMAL. > 1 SECOND DURATION

ANR Technology Company
An American Natural Resources Company

Date 11-20-82

AMR TAR SCRUBBER
TEST DATA

[illegible]

ANR Technology Company
An American Natural Resources Company

Date 11-20

ANR TAR SCRUBBER
TEST DATA

Time	Pressure Drops		Flow Indicators							Water		Temperatures				
	Q	ESP	QF	ET	EP	R5	R6	R7	D	Meter	Fresh	Recyc	Gas In	Gas Out	ESP Out	
0000	0									50060	44	118	0	124	118	
0100	0									50340	44	124	0	126	124	
0200	0									50440	44	126	0	128	125	
0300	0									50620	48	130	0	132	129	
0400	0									50840	48	128	0	132	127	
0500	0									50990	48	128	0	130	129	
0600	0									51180	48	128	0	130	127	
0700	0									51340	48	118	0	118	118	
0800	0									5140	48	126	0	128	124	
0900	0									51240	50	116	0	124	118	
1000	0									51930	40	124	0	130		
1100																
1200																
1300																
1400																
1500																
1600																
1700																
1800																
1900																
2000																
2100																
2200																
2300																

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Date 11-20

ANR TAR SCRUBBER
TEST DATA

Time	Liquid Levels			O ₂	Electrical				Remarks
	Surf.	O/W	T/W	Primary	Secondary	Volts	Amps	KV	mA
0000	14					270	5	32	30
						290	5	35	32
						270	5	32	32
0100	14					270	5	32	32
						280	5	32	32
0200	14					280	5	34	32
						280	5	32	30
0300	14					280	5	32	30
						290	5	35	32
0400	14					290	5	34	32
						290	5	34	32
0500	14					290	5	32	30
						280	5	32	30
0600	14					280	5	35	34
						280	5	32	30
0700	14					300	5	37	34
						280	5	34	30
0800	16					260	5	28	28
						270	5	32	26
0900	17					270	5	30	28
						290	5	33	30
1000	16								
1100									
1200									
1300									
1400									
1500									
1600									
1700									
1800									
1900									
2000									
2100									
2200									
2300									

50

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NOZZLE NOS 1 & 2
FRESH WATER FOG NOZZLES
NOTE NO 780

40

30

20

10

0

0

0.2

0.4

0.6

0.8

1.0

1.2

1.4

K-62

$$F_{gpm} = 0.097(P + 650)$$

or Approximately:

$$F_{gpm} = 0.1907(P)$$

0.6265

0.4703

Pressure 46 1326

K-E 10 X 10 TO 24 INCH 1 X 10 INCHES
KOPPEL & BERRY CO. MADE IN U.S.A.

BRANDON HIGHER PRESSURE
SPEEDING AIRFLOW TO
21 IN. DIAM. 1/2" THICK

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FRESH WATER
AND
RECYCLE LIQUOR
PUMPS

K-66

50

40

30

20

10

0

DISCHARGE
PUMP
(PSI)

0

10

20

30

40

50

60

Flow RATE - GPM