FOSSIL

Clean Coal III Project:
Blast Furnace Granular Coal Injection Project

Topical Report
November 1997

Trial 2 Report - Blast Furnace Granular Coal Injection - Results with Higher Ash Coal

Work Performed Under Cooperative Agreement No.: DE-FC21-91MC27362

For
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Office of Fossil Energy
Federal Energy Technology Center
Pittsburgh Site
Pittsburgh, Pennsylvania

By
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INTRODUCTION

This report describes the second coal trial test conducted with the Blast Furnace Granular Coal Injection System at Bethlehem Steel Corporation's Burns Harbor Plant. This demonstration project is divided into three phases:

Phase I - Design

Phase II - Construction

Phase III - Operation

The design phase was conducted in 1991-1993. Construction of the facility began in August 1993 and was completed in late 1994. The coal injection facility began operating in January 1995 and Phase III began in November 1995.

A base period was established for C furnace in October 1996 to be used as a comparison period for the analysis of the operation during subsequent coal trials.

BACKGROUND

The granulated coal injection facility at the Burns Harbor Plant began operation in January 1995. Coal injection began on D furnace in mid-December 1994, primarily to test the coal grinding and preparation circuits. Significant operations began January 19, 1995 when coal was injected through four tuyeres at a total rate of 20 pounds/NTHM. Coal injection was initiated on C furnace on February 9, 1995 using four tuyeres at an overall rate of 25 pounds/NTHM. The remaining 24 tuyeres used natural gas injection at the same time. These conditions were maintained throughout February and March. Complete coal injection began on D furnace in April 1995 and on C in June 1995. Since that time an operational learning curve and the development of efficient operating practices with the granulated coal facility were completed. Currently, the coal injection rate on C furnace is about 270 pounds/NTHM and 200 pounds/NTHM on D furnace.

During the start of coal injection, the high volatile Sydney coal, was used on both furnaces for eight months. Subsequently, six different low volatile coal types were used on both furnaces for seven months. The low volatile coals performed well and led to the use of Virginia Pocahontas as the standard coal during 1996 and 1997.

The objective of the overall test program is to determine the effect of coal grind and coal type on blast furnace performance. The current trial was conducted to quantify the effect that ash content of the coal has on the blast furnace operation and the process economics.

BLAST FURNACE OPERATIONS

The Burns Harbor C furnace has been designated as the granulated coal test facility due, in large part, to the physical improvements made to the furnace during the 1994 reline. The furnace was enlarged slightly and the refractory cooling system was upgraded to a high density plate cooling configuration in the furnace stack region. This high density cooling was specifically designed to withstand the rigors of high coal injection rates and to provide for increased production capability.

Immediately prior to the higher ash trial period the operation was characterized by high production levels and a steady state for the major operating variables. During 1997 the operation has been run to achieve maximum furnace production rates. This is unlike most of 1996 when the primary focus was to maximize coal injection levels and achieve low furnace coke rates.

The trial began on May 28, 1997 and concluded June 23, 1997. The trial period is compared to three previous operating periods: a pre-trial period from May 1 - May 27, 1997, the October 1996 base period and a previously conducted study of coke replacement characteristics of low volatile coal is compared to this trial.

The important furnace operating conditions that are indicative of overall furnace performance were documented during the trial and compared to the three periods indicated above. In addition, extensive environmental stream testing of the closed water and gas cleaning systems, furnace refractory temperatures and furnace thermal loads are presented.

FURNACE TRIAL OPERATING CONDITIONS

Trial Coal Selection:

During the entire year of 1996 the injection coal used on both furnaces was the low volatile, high carbon content Buchanan/Virginia Pocahontas. The coal is designated by two names based on two different mine sites and the point of shipment to the plant. However, both coals are from the same seam and are very similar chemically.

The typical analysis of Virginia Pocahontas in October 1996 and the Buchanan coal used on the furnaces immediately prior to the trial period is shown in Table 1. For a trial that would assess ash content only, it was important to use a coal that varies only in ash so that there would be no confounding issues such as sulfur content or large differences in volatile matter. To achieve this the supplier of the Buchanan coal suggested that ash content could be increased at the mine site cleaning station if one of the usual coal cleaning steps was eliminated. Trials were run at the mine and subsequent coal analysis confirmed that the ash content could be increased with this method. The average analysis of the four train trial coal is also shown on Table 1. The trial coal is 2.4% higher in ash than the coal used for the October 1996 base and is 3.0% higher in ash than the coal used during the furnace period immediately prior to the trial. As demonstrated on Table 1, the three operating periods use coal that is significantly different only in ash content.

Also shown in Table 1 is the average size distribution of the final injection product coal during the trial period. The average size distribution satisfies the definition of granular coal; 100% is -4 Mesh, 98% is -7 Mesh and less than 30% is -200 Mesh.

C Furnace Operations:

The primary concern of the furnace operators, both before and during a blast furnace trial, is to maintain a consistent operation so that a valid comparative analysis of the trial variable can be made. Table 2 shows the operating results for the higher ash trial period on C furnace and the two operating periods that are used to make the comparative analysis.

Each of these periods is operationally similar: the amount of injected coal used during each period is about the same; the general blast conditions during the periods are comparable; the wind rates only vary from 135,370 SCFM to 137,000 SCFM; and blast pressure, top pressure and moisture additions are comparable.

General Trial Observations:

There were several operating variables that were of concern and were closely observed by the operators during the trial . Several of these parameters could have adversely affected furnace performance with the use of the high ash coal. However, the trial period confirmed that high coal ash, at the injection rate used, did not hinder furnace performance. This finding is based on data in Table 2 which shows the following:

1. Furnace permeability was not changed and a greater percentage of ash in the raceway did not have a deleterious effect.

2. Furnace blast pressure and wind volume were maintained at the base conditions during the trial.

3. Furnace production rates were up as delay periods declined during the trial.

4. Hot metal silicon and sulfur content and variability were comparable during all three periods

The primary change in the operation, as expected, was the increase in the blast furnace slag volume. The 461 pounds/NTHM slag volume during the trial is significantly higher than the 448 pounds/NTHM slag volume during the May 1 - May 27, 1997 period and the 424 pounds/NTHM during the October 1996 period. The general conclusion is that higher ash content in the injected coal can be adjusted for by the furnace operators and does not adversely affect overall furnace operations.

Furnace Coke Rate Results:

The primary reason for this coal trial was to determine the coke rate penalty to the blast furnace that results from the use of higher ash injection coal. In order to assess the comparative furnace coke rate during a trial, all of the blast furnace variables that affect the furnace coke rate that are different from the base must be adjusted for by using coke correction factors. The only variables that are not corrected or adjusted are those affected by the operating variable that is being assessed. After all of the operational coke differences between the base period and the trial period are accounted for, the remaining coke is attributed to the variable being studied. Since the higher ash coal causes an increase in the furnace slag volume and does contribute to higher furnace coke usage, we have not adjusted the coke for changes in the slag volume.

Three comparisons, using the above logic, were made to validate and substantiate the results of this trial. The high ash trial results were compared to the period immediately prior to the trial; the previously documented base period results from October 1996; and a previously completed study on the coke replacement characteristics of low volatile coals. The latter study was conducted using Burns Harbor C and D monthly average operating data for 1996 with low volatile coal. The detailed study was reported and documented in the 1996 Annual Report to DOE on the Blast Furnace Granular Coal Injection Project."

The results of the first comparison are shown in Table 3. The higher ash trial data has been adjusted to the comparison base period from May 1 - May 27,1997. The largest amount of coke that is adjusted for this comparison is seven pound which is attributable to the difference in the amount of injected coal between the periods. The conclusion from this table is that a three per cent increase in the injected coal ash causes a nine pound per NTHM increase in the furnace coke rate. This is the amount of carbon from the coke that is required on the furnace to replace the lower amount of carbon in the higher ash injected coal.

The values from the second comparative period are shown in Table 4. As with the previous analysis, only small adjustments are required to establish the overall corrected coke rate. This comparison substantiates the first results. The 2.4 per cent increase in coal ash from the October 1996 base period to the trial period results in a coke penalty of eight pounds per NTHM.

In Figure 1, the coal injection and furnace coke rates for the trial are compared with those on both C and D furnace during 1996. There was a coke rate increase on C furnace during the trial period at the coal and coke rates shown. The coke rate adjustments which include the trial data in this figure are documented in Table 5.

The blast furnace sulfur balance for the trial period is shown in Table 6. There is good closure for the sulfur input and output.

ENVIRONMENTAL TEST RESULTS

Gaseous Streams:

During the trial period three gas samples were obtained from the C furnace and analyzed by Mostardi Platt Associates, Inc. The results of the gas sampling are presented in Appendix 1. The sulfur reported in the gas samples were also used to complete the sulfur balance shown in Table 6.

Gas samples taken from the previous base trial period, October 1996, are very comparable to these results. As reported previously, the sulfur in the blast furnace gas was 3.1 grains/100 scf. During this trial the value was 2.5 grains/100 scf.

Wastewater Monitoring:

During the trial, monitoring of the Division's treated process water effluent (Monitoring Station 011) and the Division's combined effluent was conducted in accordance with the NPDES permit. In addition, internal monitoring of the Blast Furnace Recirculating Water System was performed weekly. All monitoring results at Station 011 and Outfall 001 were within the applicable limitations and/or expected ranges. There were no adverse affects on the Division's wastewater system that could be attributed to the granulated coal system during the month. Appendix 2 shows the monitoring results for the month.

FURNACE THERMAL CONDITIONS

The C furnace is equipped with a Thermal Monitor System consisting of two components: eight thermocouples embedded in the furnace refractory at each of four furnace elevations and an extensive system of thermocouples in the discharge water cooling system at five furnace elevations. The heat loss in the furnace is calculated for the various elevations from the water system thermocouples.

The inwall refractory temperatures for C furnace are shown from September 1996 through the trial period in Figure 2. The refractory temperatures at several elevations have not changed significantly during this time. Several elevations decreased slightly from higher values measured during February and March 1997.

The thermal load values, the calculated heat loss in BTU/HR/FT^2, were practically unchanged during the trial as compared to the three previous months of operation. Figure 3 shows the thermal load values from September 1996 through the high ash trial period.

During the trial period the operating personnel were running the C furnace for high productivity. Figure 4 shows the comparison between furnace coke rates during times when fuel rates were the primary concern, June 1996 - January 1997, and periods when high production is the goal. Although the injected coal rates are similar during both times, furnace coke rates are noticeably higher during the period when high productivity was desired. The primary conclusion from this chart is that, although higher ash coal requires more furnace coke, it does not have an adverse effect on production levels.

CONCLUSIONS

This coal trial demonstrated some important blast furnace operating considerations when using a high ash coal:

- There is a coke rate disadvantage of three pounds per NTHM for each one per cent increase of ash in the injection coal at an injection rate of 260 pounds per NTHM.
- Higher ash coal had no adverse effect on the furnace permeability.
- The productivity of the furnace was unaffected by the three percent increase in coal ash at the injection rate of 260 pounds per NTHM.
- Hot metal quality was unaffected by the increased ash content of the injection coal.

TABLE 1

INJECTION COAL ANALYSIS
BURNS HARBOR HIGH ASH COAL TRIAL

Coal	Va. Pocahontas October 1996	Buchanan 6 Train Average Prior to Trial	High Ash Buchanan 4 Train Trial Average
Volatile Matter, %	18.00	19.79	18.75
Sulfur, %	.78	.82	.75
Ash, %	**5.30**	**4.72**	**7.70**
Ultimate Analysis, %			
Carbon	87.10	87.04	84.32
Oxygen	1.23	1.94	2.24
Hydrogen	4.20	4.27	3.88
Nitrogen	1.21	1.21	1.12
Chlorine	.170	.140	.120
Total Moisture, %	5.30	6.77	6.46
GHV, BTU/lb (dry)	14974	15086	14425
Ash Analysis, %			
SiO2	41.50	32.39	41.69
Al2O3	23.58	22.76	23.33
CaO	7.36	10.10	8.27
MgO	1.69	2.05	1.75

C FURNACE PRODUCT COAL SIZING
May 28 - June 23, 1997

		MEAN %	S.D. %
+4 Mesh		0	-
-4 Mesh	+8 Mesh	.3	.2
-8 Mesh	+16 Mesh	1.8	.9
-16 Mesh	+30 Mesh	7.4	2.5
-30 Mesh	+50 Mesh	15.1	1.5
-50 Mesh	+100 Mesh	27.0	3.1
-100 Mesh	+200 Mesh	34.0	3.1
-200 Mesh	+325 Mesh	13.6	3.0
-325 Mesh		.8	.4
TOTAL		100.0	

TABLE 2

BURNS HARBOR C FURNACE
SUMMARY OF OPERATIONS

	HIGH ASH TEST May 28 - June 23, 1997	LOW ASH BASE May 1 - May 27, 1997	PREVIOUS BASE October 1996
Prod, NTHM/d Rep	7437	7207	6943
Delays, Min/d	23	55	71
Coke Rate, lbs/NTHM	674	673	661
Nat. Gas Rate, lbs/NTHM	5.0	0	0
Inj. Coal Rate, lbs/NTHM	262	269	264
Total Fuel Rate, lbs/NTHM	940	942	925
Burden %:			
Sinter	34.9	27.0	35.9
Pellets	64.9	72.8	63.8
Misc.	.2	.2	.3
BOF Slag lbs/NTHM	0	53	5
Blast Conditions:			
Dry Air,SCFM	135,370	135,683	137,000
Blast Pressure, psig	38.3	38.2	38.8
Permeability	1.23	1.25	1.19
Oxygen in Wind, %	28.6	28.5	27.3
Temp, F	2012	2046	2067
Moist. Grs/SCF	20.7	20.4	19.8
Flame Temp, F	3953	4002	3841
Top Temp, F	199	195	226
Top Press, psig	16.6	17.0	16.9
Coke:			
H2O, %	5.0	4.9	5.0
Hot Metal, %:			
Silicon	.49	.51	.50
Standard Dev.	.097	.116	.128
Sulfur	.035	.040	.040
Standard Dev.	.012	.015	.014
Phos.	.073	.069	.072
Mn.	.46	.42	.43
Temp., F	2733	2741	2734
Slag, %:			
SiO2	36.21	36.08	36.54
Al2O3	9.91	9.43	9.63
CaO	39.40	38.86	39.03
MgO	11.32	12.03	11.62
Mn	.45	.42	.46
Sul	1.40	1.45	1.39
B/A	1.10	1.12	1.10
B/S	1.40	1.41	1.39
Volume, lbs/NTHM	**461**	**448**	**424**

TABLE 3

BURNS HARBOR C FURNACE ADJUSTED COKE RATE COMPARISON

Coke Correction Variables:	BASE 5/1/97 - 5/27/97	HIGH ASH TRIAL 5/28/97 - 6/23/97
Natural Gas, lbs/NTHM	0	5.0
Coke Correction, lbs coke		+6.0
Injected Coal, lbs/NTHM	269	262
Coke Correction, lbs coke		-7.0
Burden:		
Pellets, %	72.8	64.9
Coke Correction, lbs coke		+6.3
Sinter,%	27.0	34.9
Coke Correction, lbs coke		+6.3
Wind Volume, SCFM	135,683	135,370
Coke Correction, lbs coke		+.3
Added Moisture, Grs./SCFM Wind	20.4	20.7
Coke Correction, lbs coke		-.9
Iron Silicon Content, %	.51	.49
Coke Correction, lbs coke		+2.0
Iron Sulfur Content, %	.040	.035
Coke Correction, lbs coke		-2.5
Iron Manganese Content, %	.42	.46
Coke Correction, lbs coke		-1.0
Coke Ash, %	7.70	7.50
Coke Correction, lbs coke		+4.0
Blast Temperature, F	2046	2012
Coke Correction, lbs coke		-5.1
TOTAL COKE CORRECTIONS: lbs. coke	BASE	+8.4
Reported Furnace Coke Rate,lbs/NTHM	673	674
Corrected Furnace Coke Rate,lbs/NTHM		682
Coke Rate Difference from the BASE		**+ 9 Pounds of Coke/NTHM**

TABLE 4

BURNS HARBOR C FURNACE ADJUSTED COKE RATE COMPARISON

Coke Correction Variables:	BASE October 1996	HIGH ASH TRIAL 5/28/97 - 6/23/97
Natural Gas, lbs/NTHM	0	5.0
Coke Correction, lbs coke		+6.0
Injected Coal, lbs/NTHM	264	262
Coke Correction, lbs coke		-2.0
Burden:		
Pellets, %	63.8	64.9
Coke Correction, lbs coke		-.9
Sinter,%	35.9	34.9
Coke Correction, lbs coke		-.8
Wind Volume, SCFM	137,000	135,370
Coke Correction, lbs coke		+1.7
Added Moisture, Grs./SCFM Wind	19.8	20.7
Coke Correction, lbs coke		-2.6
Iron Silicon Content, %	.50	.49
Coke Correction, lbs coke		+1.0
Iron Sulfur Content, %	.040	.035
Coke Correction, lbs coke		-2.5
Iron Manganese Content, %	.43	.46
Coke Correction, lbs coke		-.8
Coke Ash, %	7.70	7.50
Coke Correction, lbs coke		+4.0
Blast Temperature, F	2067	2012
Coke Correction, lbs coke		-8.3
TOTAL COKE CORRECTIONS: lbs. coke	BASE	-5.2
Reported Furnace Coke Rate,lbs/NTHM	661	674
Corrected Furnace Coke Rate,lbs/NTHM		669
Coke Rate Difference from the BASE		**+ 8 Pounds of Coke/NTHM**

TABLE 5

BURNS HARBOR C FURNACE ADJUSTED COKE RATE COMPARISON

Coke Correction Variables:	BASE FEBRUARY 1996	HIGH ASH TRIAL 5/28/97 - 6/23/97
Natural Gas, lbs/NTHM	1.0	4.0
Coke Correction, lbs coke		+4.8
Injected Coal, lbs/NTHM	253	262
Coke Correction, lbs coke		+9.0
Burden:		
Pellets, %	67.7	64.9
Coke Correction, lbs coke		+2.2
Sinter,%	32.1	34.9
Coke Correction, lbs coke		+2.2
Wind Volume, SCFM	145,300	135,370
Coke Correction, lbs coke		+10.4
Added Moisture, Grs./SCFM Wind	14.0	20.7
Coke Correction, lbs coke		-19.4
Iron Silicon Content, %	.43	.49
Coke Correction, lbs coke		-6.0
Iron Sulfur Content, %	.044	.035
Coke Correction, lbs coke		-4.5
Iron Manganese Content, %	.43	.46
Coke Correction, lbs coke		-.8
Coke Ash, %	7.60	7.50
Coke Correction, lbs coke		+2.0
Blast Temperature, F	2075	2012
Coke Correction, lbs coke		-9.4
TOTAL COKE CORRECTIONS: lbs. coke	BASE	-9.5
Reported Furnace Coke Rate, lbs/NTHM		674
Corrected Furnace Coke Rate, lbs/NTHM		664

TABLE 6

BURNS HARBOR C FURNACE SULFUR BALANCE
HIGH ASH COAL TRIAL

SULFUR INPUT:	5/28-6/23/97	**SULFUR OUTPUT:**	5/28-6/23/97
Material;		Material;	
Furnace Coke, Sulfur Analysis	.71%	Blast Furnace Slag, Sulfur Analysis	1.40%
Tons Coke Used	70,461	Total Tons Produced	46,284
Tons Sulfur In	500.3	Tons Sulfur Out	648.0
Injected Coal,Sulfur Analysis	.75%	Blast Furnace Iron,Sulfur Analysis	.035%
Tons Coal Used	26,272	Total Tons Produced	200,799
Tons Sulfur In	197.0	Tons Sulfur Out	70.3
Sinter, Sulfur Analysis	.02%	Flue Dust,Sulfur Analysis	.34%
Tons Sinter Used	111,485	Total Tons Produced	893
Tons Sulfur In	22.3	Tons Sulfur Out	3.0
Pellets,Sulfur Analysis	.01%	Filter Cake,Sulfur Analysis	.38%
Tons Pellets Used	206,998	Total Tons Produced	2533
Tons Sulfur In	20.7	Tons Sulfur Out	9.6
Scrap,Sulfur Analysis	.13%	Top Gas, Sulfur Content	2.5grs/100SCF
Tons Scrap Used	2,183	Total Gas Produced, MMCF	100,125
Tons Sulfur In	2.8	Tons Sulfur Out	17.9
TOTAL TONS of SULFUR IN:	**743.1**	TOTAL TONS of SULFUR OUT:	**748.8**
		SULFUR OUT/SULFUR IN	**1.007**

FIGURE 1

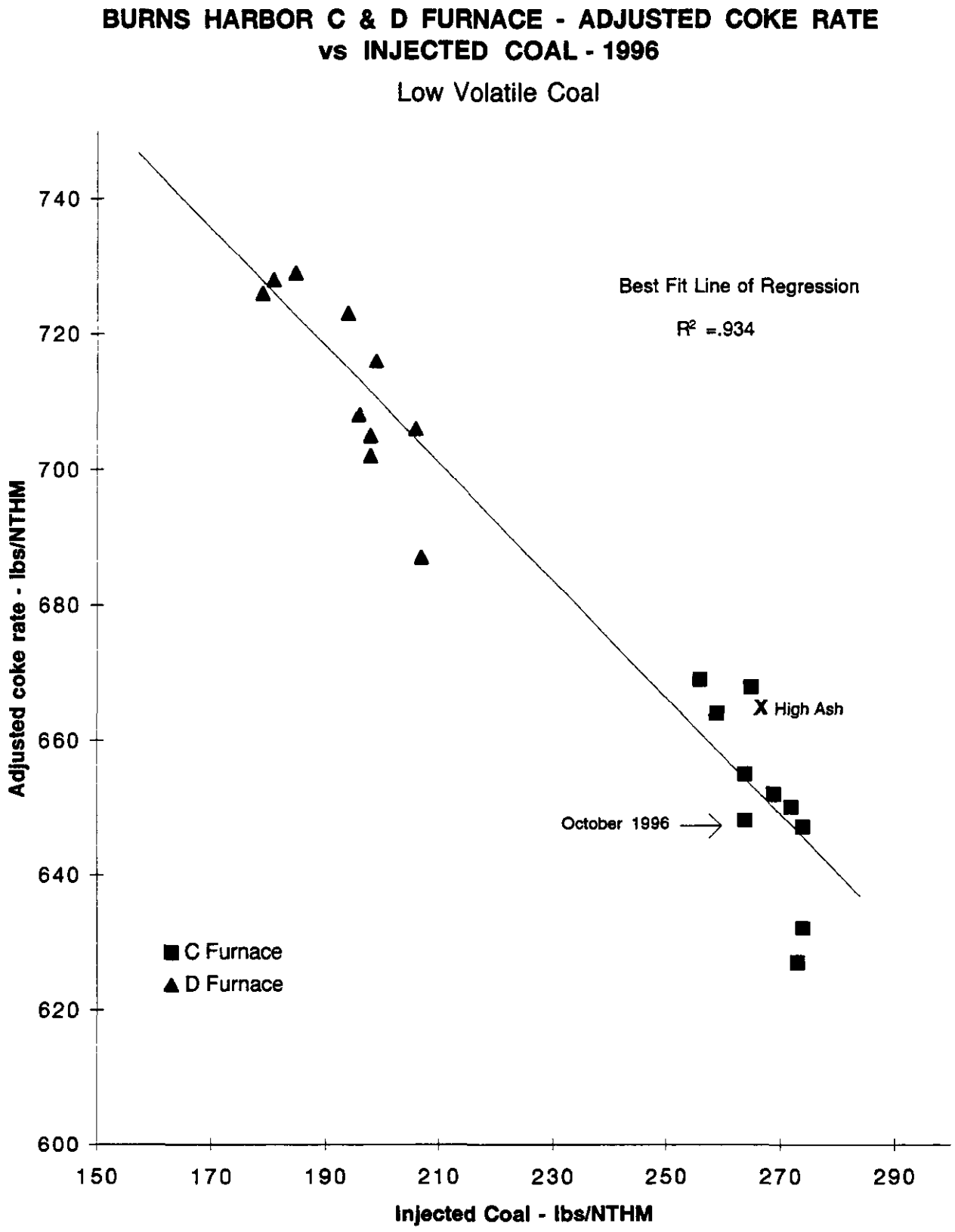

BURNS HARBOR C & D FURNACE - ADJUSTED COKE RATE
vs INJECTED COAL - 1996
Low Volatile Coal
Best Fit Line of Regression
R² =.934
X High Ash
October 1996
C Furnace
D Furnace
Adjusted coke rate - lbs/NTHM
Injected Coal - lbs/NTHM
740
720
700
680
660
640
620
600
150
170
190
210
230
250
270
290

FIGURE 2

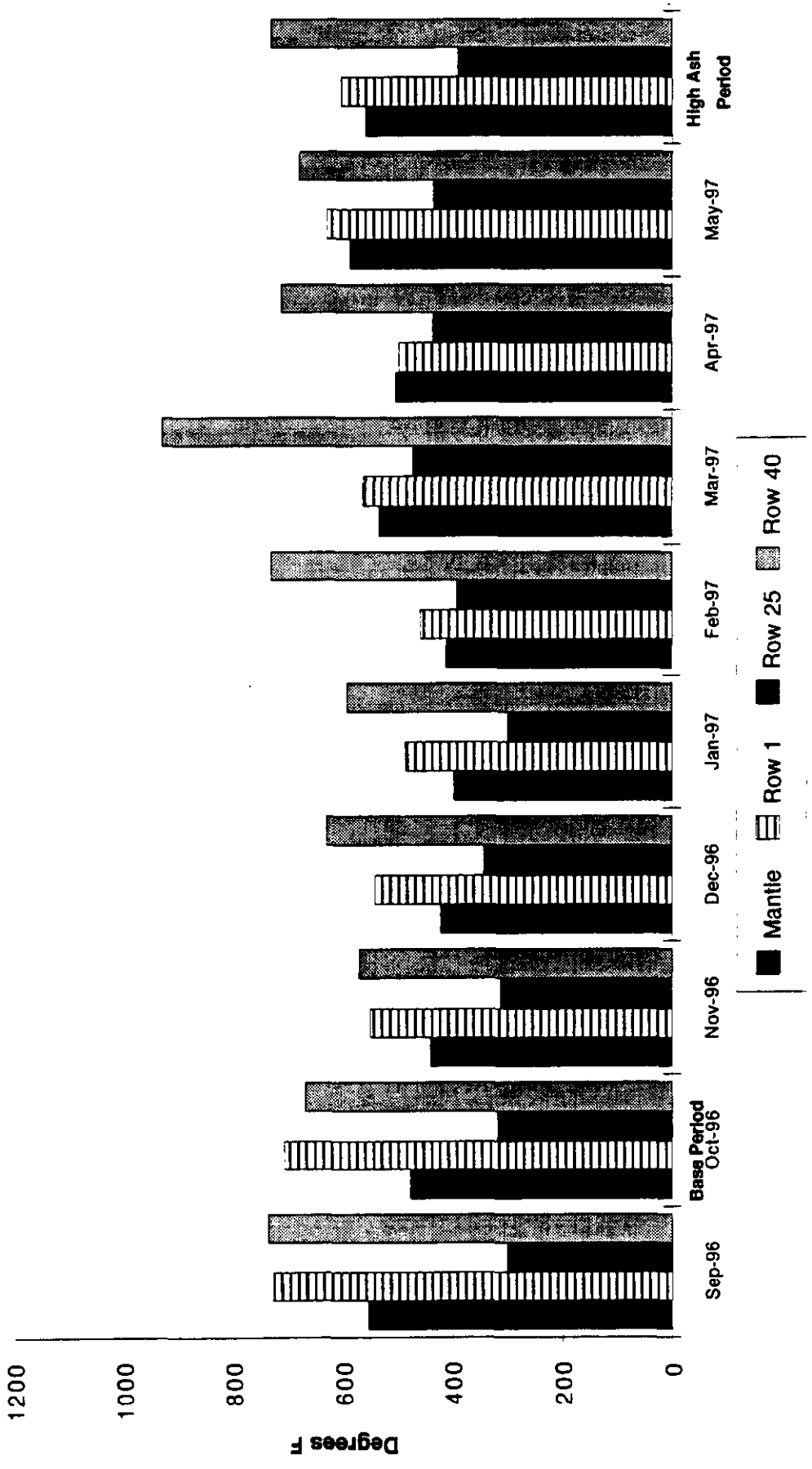

BURNS HARBOR C FURNACE - INWALL REFRACTORY TEMPERATURES
Degrees F
1200
1000
800
600
400
200
0
Sep-96
Oct-96
Nov-96
Dec-96
Jan-97
Feb-97
Mar-97
Apr-97
May-97
Base Period
High Ash Period
Mantle
Row 1
Row 25
Row 40

FIGURE 3

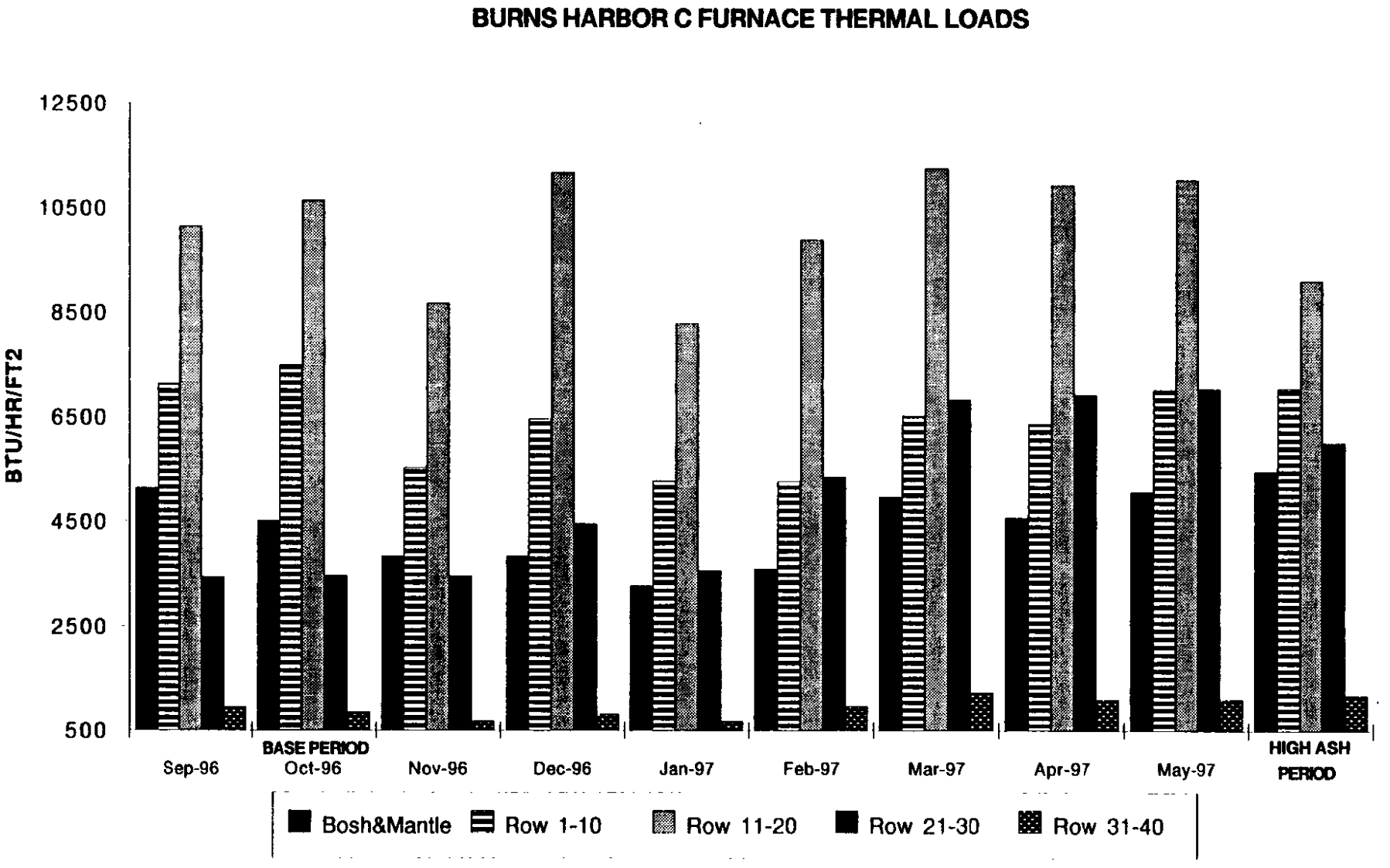
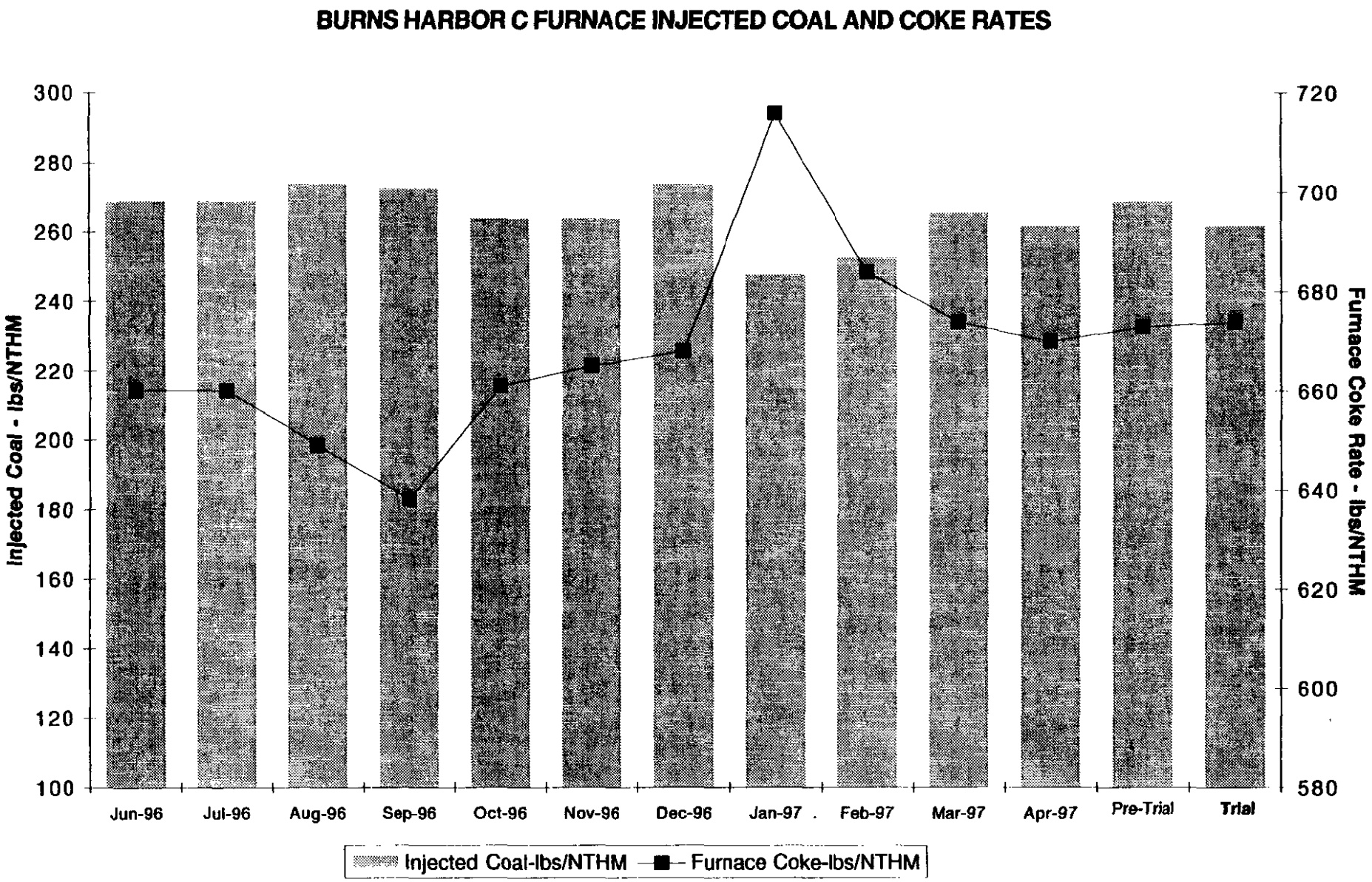

BURNS HARBOR C FURNACE THERMAL LOADS
BTU/HR/FT2
12500
10500
8500
6500
4500
2500
500
BASE PERIOD
HIGH ASH PERIOD
Sep-96
Oct-96
Nov-96
Dec-96
Jan-97
Feb-97
Mar-97
Apr-97
May-97
Bosh&Mantle
Row 1-10
Row 11-20
Row 21-30
Row 31-40

FIGURE 4


BURNS HARBOR C FURNACE INJECTED COAL AND COKE RATES
Injected Coal - lbs/NTHM
Furnace Coke Rate - lbs/NTHM
300
280
260
240
220
200
180
160
140
120
100
720
700
680
660
640
620
600
580
Jun-96
Jul-96
Aug-96
Sep-96
Oct-96
Nov-96
Dec-96
Jan-97
Feb-97
Mar-97
Apr-97
Pre-Trial
Trial
Injected Coal-lbs/NTHM
Furnace Coke-lbs/NTHM

Blast Furnace Granulated Coal Injection
Environmental Monitoring Report

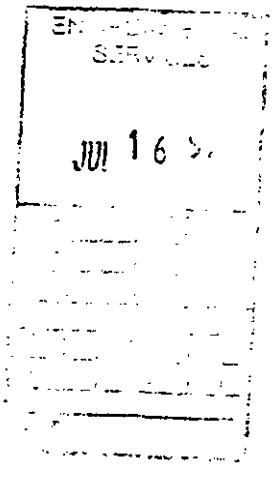
Appendix 1 - Gaseous Stream Testing Results

A Full-Service
Environmental Consulting
Company

945 Oaklawn Avenue
Elmhurst, Illinois 60126-1012
Phone 630-993-9000
Facsimile 630-993-9017

Mostardi Platt

GAS ANALYSIS STUDY
Performed For
BETHLEHEM STEEL CORPORATION
At The
Burns Harbor Works
Blast Furnace C
Burns Harbor, Indiana
June 12, 17 and 18, 1997



MOSTARDI PLATT PROJECT 72418 AND 72521
DATE SUBMITTED: JULY 11, 1997

Bethlehem Steel
C-Blast Furnace
Gas Test Results
Burns Harbor, Indiana

Date Sampled	Time Sampled	Hydrogen (mol %)	CO_2 (mol %)	O_2 (mol %)	Carbon Monoxide (mol %)	Total Sulfur Content	
						(ppmv)	(as gr/100 scf)
06/12/97	1045	5.10	24.3	0.60	26.4	31.0	1.9
06/12/97	1230	5.29	25.0	0.60	25.6	36.3	2.3
06/12/97	1330	4.91	24.9	0.59	26.6	36.8	2.3
06/17/97	0830	6.64	23.6	0.60	25.5	84.0	5.3
06/17/97	1050	6.68	23.6	0.64	25.5	36.6	2.3
06/17/97	1230	6.83	23.7	0.60	25.3	41.1	2.6
06/18/97	0820	4.89	24.7	0.61	25.7	30.0	1.9
06/18/97	1005	5.03	24.6	0.61	25.6	31.4	2.0
06/18/97	1210	4.92	24.6	0.61	26.0	30.0	1.9

Lab sheets are attached.

72418 - June 12, 1997
BETHLEHEM STEEL
BURNS HARBOR, IN
SB

Project	Sample	Sample Point	Analyte
72418	001	C-BLAST FURN.T1	Major Gas Components
72418	001	C-BLAST FURN.T1	Trace Sulfur Compounds
72418	002	C-BLAST FURN.T2	Major Gas Components
72418	002	C-BLAST FURN.T2	Trace Sulfur Compounds
72418	003	C-BLAST FURN.T3	Major Gas Components
72418	003	C-BLAST FURN.T3	Trace Sulfur Compounds

72521
BETHLEHEM STEEL
'C' BLAST FURNACE
EAP

Project	Sample	Sample Point	Analyte
72521	001	"C"BLAST FRN.T1	Major Gas Components
72521	001	"C"BLAST FRN.T1	Trace Sulfur Compounds
72521	002	"C"BLAST FRN.T2	Major Gas Components
72521	002	"C"BLAST FRN.T2	Trace Sulfur Compounds
72521	003	"C"BLAST FRN.T3	Major Gas Components
72521	003	"C"BLAST FRN.T3	Trace Sulfur Compounds
72521	004	"C"BLAST FRN.T4	Major Gas Components
72521	004	"C"BLAST FRN.T4	Trace Sulfur Compounds
72521	005	"C"BLAST FRN.T5	Major Gas Components
72521	005	"C"BLAST FRN.T5	Trace Sulfur Compounds
72521	006	"C"BLAST FRN.T6	Major Gas Components
72521	006	"C"BLAST FRN.T6	Trace Sulfur Compounds

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712431
Sample Description: 72418-001 Test 1 6/12/97
Date Analyzed: 20-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	5.10%	0.04%	0.34%
Carbon Dioxide	24.3%	0.03%	34.9%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.60%	0.03%	0.64%
Nitrogen	43.6%	0.03%	39.9%
Methane		0.03%	
Carbon Monoxide	26.4%	0.03%	24.2%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide		0.0001%	
Carbonyl Sulfide	0.0031%	0.0001%	0.0061%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99902	0.99902
Relative Density =	1.0571	1.0571
Gross HV (DRY) =	102.2	102.5
Gross HV (SAT.) =	100.4	100.7
Wobbe Index =	99.4	99.6
Net HV (Dry) =	98.7	99.0
Net HV (Sat.) =	97.0	97.2

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

6/23/97
IGT Log # : 9712431.XLS

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712431
Sample Description: 72418-001 Tank 1 6/12/97
Date Analyzed: 20-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide		Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	31	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	31.0
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	31.0
Di-t-Butyl Disulfide		As Grains/100 SCF	1.9
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

6/23/97
IGT Log # : 9712432_XLS

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712432
Sample Description: 72418-002 Test 2 6/12/97
Date Analyzed: 20-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	5.29%	0.04%	0.35%
Carbon Dioxide	25.8%	0.03%	35.8%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.60%	0.03%	0.64%
Nitrogen	43.5%	0.03%	39.8%
Methane		0.03%	
Carbon Monoxide	25.6%	0.03%	23.4%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide	0.0003%	0.0001%	0.0004%
Carbonyl Sulfide	0.0033%	0.0001%	0.0065%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91		
Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99900	0.99900
Relative Density =	1.0591	1.0591
Gross HV (DRY) =	100.2	100.5
Gross HV (SAT.) =	98.5	98.7
Wobbe Index =	97.4	97.6
Net HV (Dry) =	96.6	96.9
Net HV (Sat.) =	95.0	95.2

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

6/23/97
IGT Log # : 9712432.XLS

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712432
Sample Description: 72418-002 Tedlar 6/12/97
Date Analyzed: 20-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide	3.3	Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	33	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	36.3
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	36.3
Di-t-Butyl Disulfide		As Grains/100 SCF	2.3
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

6/23/97
IGT Log # : 9712433.XLS

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712433
Sample Description: 72418-003 Test 3 6/12/97
Date Analyzed: 20-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	4.91%	0.06%	0.32%
Carbon Dioxide	24.9%	0.03%	35.6%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.59%	0.03%	0.62%
Nitrogen	43.0%	0.03%	39.1%
Methane		0.03%	
Carbon Monoxide	26.6%	0.03%	24.3%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide	0.0064%	0.0001%	0.0064%
Carbonyl Sulfide	0.0033%	0.0001%	0.0064%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Pres. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99900	0.99900
Relative Density =	1.0621	1.0621
Gross HV (DRY) =	102.3	102.5
Gross HV (SAT.) =	100.5	100.8
Wobbe Index =	99.3	99.5
Net HV (Dry) =	99.0	99.2
Net HV (Sat.) =	97.2	97.5

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

6/23/97
IGT Log # : 9712433.XLS

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates
IGT Sample Number: 9712433
Sample Description: 72418-003 6/11/97 T+T 3
Date Analyzed: 20-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide	3.8	Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	33	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	36.8
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	36.8
Di-t-Butyl Disulfide		As Grains/100 SCF	2.3
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712551.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712551
Sample Description: 72521-001 Tst 1 6/17/97
Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	6.64%	0.04%	0.44%
Carbon Dioxide	23.6%	0.03%	34.6%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.60%	0.03%	0.65%
Nitrogen	43.6%	0.03%	40.6%
Methane	0.64%	0.03%	0.61%
Carbon Monoxide	25.5%	0.03%	23.7%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide	0.0044%	0.0001%	0.0050%
Carbonyl Sulfide	0.0040%	0.0001%	0.0080%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91		
Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99807	0.99906
Relative Density =	1.0394	1.0394
Gross HV (DRY) =	104.8	105.1
Gross HV (SAT.) =	103.0	103.3
Wobbe Index =	102.8	103.1
Net HV (Dry) =	100.3	100.5
Net HV (Sat.) =	98.5	98.7

Notes: *All blank values are below detection limit*
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712551.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712551
Sample Description: 72521-001 Tank 1 6/17/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide	44	Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	40	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	84.0
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	84.0
Di-t-Butyl Disulfide		As Grains/100 SCF	5.3
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712552.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Maxtarch-Platt Associates, Inc.
IGT Sample Number: 9712552
Sample Description: 72521-002 Test 6/17/97
Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	6.68%	0.04%	0.45%
Carbon Dioxide	23.6%	0.03%	34.5%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.66%	0.03%	0.69%
Nitrogen	43.7%	0.03%	48.7%
Methane		0.03%	
Carbon Monoxide	25.5%	0.03%	23.7%
Ethyne		0.002%	
Propene		0.002%	
Propane		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide	0.0001%	0.0001%	0.0002%
Carbonyl Sulfide	0.0035%	0.0001%	0.0071%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor (Z) =	0.99907	0.99907
Relative Density =	1.0389	1.0389
Gross HV (DRY) =	104.5	104.8
Gross HV (SAT.) =	102.7	103.0
Wobbe Index =	102.6	102.8
Net HV (Dry) =	100.0	100.2
Net HV (Sat.) =	98.2	98.5

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712552.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712552
Sample Description: 72521-002 Test 2 6/17/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide	1.3	Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	35	C2-Thiophenes	
Carbon Disulfide	0.2	C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	36.5
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	36.6
Di-t-Butyl Disulfide		As Grains/100 SCF	2.3
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712553.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates, Inc.

IGT Sample Number: 9712553

Sample Description: 72521-003 TS+ 3 6/17/97

Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	6.83%	0.04%	0.46%
Carbon Dioxide	23.7%	0.03%	34.7%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.60%	0.03%	0.65%
Nitrogen	43.5%	0.03%	40.6%
Methane		0.03%	
Carbon Monoxide	25.3%	0.03%	23.6%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide	0.0004%	0.0001%	0.0005%
Carbonyl Sulfide	0.0037%	0.0001%	0.0074%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	104.8%		100.8%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99907	0.99906
Relative Density =	1.0382	1.0382
Gross HV (DRY) =	104.7	104.9
Gross HV (SAT.) =	102.9	103.1
Wobbe Index =	102.8	103.0
Net HV (Dry) =	100.0	100.3
Net HV (Sat.) =	98.3	98.5

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712553.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712553
Sample Description: 72521-003 TG+ 3 6/17/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide	4.1	Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	37	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		*Individual Unidentified*	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	41.1
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	41.1
Di-t-Butyl Disulfide		As Grains/100 SCF	2.6
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712554.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates, Inc.

IGT Sample Number: 9712554

Sample Description: 72521-004 T3 + 1 6/18/97

Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	4.89%	0.04%	0.32%
Carbon Dioxide	34.7%	0.03%	35.4%
Ethane		0.03%	
Ethene		0.03%	
Oxygen/Argon	0.61%	0.03%	0.65%
Nitrogen	44.1%	0.03%	46.2%
Methane		0.03%	
Carbon Monoxide	15.7%	0.03%	13.4%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide		0.0001%	
Carbonyl Sulfide	0.0030%	0.0001%	0.0060%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [z] =	0.99901	0.99901
Relative Density =	1.0612	1.0612
Gross HV (DRY) =	99.1	99.4
Gross HV (SAT.) =	97.4	97.6
Wobbe Index =	96.2	96.5
Net HV (Dry) =	95.8	96.0
Net HV (Sat.) =	94.1	94.3

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712554.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712554
Sample Description: 72521-004 Tk + 1 6/18/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide		Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	30	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	30.0
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	30.0
Di-t-Butyl Disulfide		As Grains/100 SCF	1.9
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712555.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712555
Sample Description: 72521-085 Tst 2 6/18/97
Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	5.83%	0.04%	0.33%
Carbon Dioxide	24.6%	0.03%	35.3%
Ethene		0.03%	
Ethane		0.03%	
Oxygen/Argon	0.61%	0.03%	0.64%
Nitrogen	44.1%	0.03%	40.3%
Methane		0.03%	
Carbon Monoxide	25.6%	0.03%	23.4%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide		0.0001%	
Carbonyl Sulfide	0.0017%	0.0001%	0.0054%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.8%		100.8%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F)=	60.0	60.0
Press. (psia)=	14.696	14.73
Compressibility Factor [Z] =	0.99901	0.99901
Relative Density =	1.0595	1.0595
Gross HV (DRY) =	99.5	99.7
Gross HV (SAT.) =	97.8	98.0
Wobbe Index =	96.7	96.9
Net HV (Dry) =	96.1	96.3
Net HV (Sat.) =	94.4	94.6

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712555.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712555
Sample Description: 72521-005 Tet 2 6/18/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide		Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	27	C2-Thiophenes	
Carbon Disulfide	2.2	C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	29.2
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	31.4
Di-t-Butyl Disulfide		As Grains/100 SCF	2.0
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712556.xls

Major Component Gas Analysis By Gas Chromatography

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712556
Sample Description: 72521-006 Trt 3 6/18/97
Date Analyzed: 23-Jun-97 Analyst: AGJ

Component	Mol %	Det. Limit	Weight %
Helium	ND	0.001%	ND
Hydrogen	4.92%	0.04%	0.32%
Carbon Dioxide	24.6%	0.03%	35.3%
Ethane		0.03%	
Ethene		0.03%	
Oxygen/Argon	0.61%	0.03%	0.64%
Nitrogen	43.9%	0.03%	40.8%
Methane		0.03%	
Carbon Monoxide	26.0%	0.03%	23.7%
Ethyne		0.002%	
Propane		0.002%	
Propene		0.002%	
Propadiene		0.002%	
Propyne		0.002%	
i-Butane		0.002%	
n-Butane		0.002%	
1-Butene		0.002%	
i-Butene		0.002%	
Trans-2-Butene		0.002%	
Cis-2-Butene		0.002%	
1,3-Butadiene		0.002%	
neo-Pentane		0.001%	
i-Pentane		0.002%	
n-Pentane		0.002%	
Pentenes		0.002%	
Hexane Plus		0.002%	
Hydrogen Sulfide		0.0001%	
Carbonyl Sulfide	0.0030%	0.0001%	0.0058%
Unidentified		0.001%	
Water	ND	0.001%	ND
Total	100.0%		100.0%

Calculated Real Gas Properties per ASTM D3588-91

Temp. (°F) =	60.0	60.0
Press. (psia) =	14.696	14.73
Compressibility Factor [z] =	0.99901	0.99901
Relative Density =	1.0605	1.0605
Gross HV (DRY) =	100.2	100.5
Gross HV (SAT.) =	98.5	98.7
Wobbe Index =	97.3	97.6
Net HV (Dry) =	96.9	97.1
Net HV (Sat.) =	95.2	95.4

Notes: All blank values are below detection limit
ND - Not Determined

IGT Institute of Gas Technology

Analytical Report

7/10/97
IGT Log # : 9712556.xls

TRACE SULFUR DETERMINATION BY GAS CHROMATOGRAPHY

Client Name: Mostardi-Platt Associates, Inc.
IGT Sample Number: 9712556
Sample Description: 72521-006 Tot 3 6/18/97
Date Analyzed: 23-Jun-97
Analyst: AGJ

Component Name	PPMV	Component Name	PPMV
Hydrogen Sulfide		Thiophene	
Sulfur Dioxide		C1-Thiophenes	
Carbonyl Sulfide	30	C2-Thiophenes	
Carbon Disulfide		C3-Thiophenes	
Methyl Mercaptan		Benzothiophene	
Ethyl Mercaptan		C1-Benzothiophenes	
i-Propyl Mercaptan		C2-Benzothiophenes	
n-Propyl Mercaptan			
t-Butyl Mercaptan		Thiophane	
Dimethyl Sulfide		Individual Unidentified	
Methyl Ethyl Sulfide		Sulfur Compounds	
Diethyl Sulfide		(all as monosulfides)	
Di-t-Butyl Sulfide			
Dimethyl Disulfide			
Methyl Ethyl Disulfide			
Methyl i-Propyl Disulfide			
Diethyl Disulfide			
Methyl n-Propyl Disulfide			
Methyl t-Butyl Disulfide			
Ethyl i-Propyl Disulfide			
Ethyl n-Propyl Disulfide			
Ethyl t-Butyl Disulfide			
Di-i-Propyl Disulfide		Total Unidentified:	0
i-Propyl n-Propyl Disulfide		Total Identified:	30.0
Di-n-Propyl Disulfide			
i-Propyl t-Butyl Disulfide		**Total Sulfur Content**	
n-Propyl t-Butyl Disulfide		As PPMV	30.0
Di-t-Butyl Disulfide		As Grains/100 SCF	1.9
Dimethyl Trisulfide			
Diethyl Trisulfide			
Di-t-Butyl Trisulfide			

Notes:
Component Detection Limit
1 ppmv for Hydrogen Sulfide
0.2 ppmv for all other compounds per sulfur
All blank values are below detection limit.

MOSTARDI-PLATT ASSOCIATES, INC.

Environmental Consultants

Read Instructions on Reverse Side Before Completing Form!

CHAIN-OF-CUSTODY RECORD

Project Number: 72418	Date Results Required:
Client: BETHLEHEM STEEL	TAT(Assessment Only)
Plant/Location: BURNS HARBOR, IN	LAB Use Only: PO Number:
Project Supervisor: STUART BURTON	LAB Use Only: LIMS Entry:

Sample Number	Date Sampled	Sample Point Identification	# of Conts	Grab/ Comp	Analysis Requested	Sub Lab
001	6-12	C-BLAST FURNACE	1	10:45	# TRACE SULFUR & MAJOR COMPONENTS	
002	6-12	"	1	12:30	"	
003	6-12	"	1	13:30	"	

Delivered by:	Date/Time	Processed by:	Date/Time	Received by Laboratory:
C.T.	6.13.97 17⁰⁰		6/16/97	Chris Arnold 6/16/97 12:00pm

Special Instructions:

MOSTARDI-PLATT ASSOCIATES, INC.
Environmental Consultants

Read Instructions on Reverse Side Before Completing Form!

CHAIN-OF-CUSTODY RECORD

Project Number: 72521	Date Results Required:
Client: Bethlehem Steel	TAT(Assessment Only)
Plant/Location: 'C' Blast Furnace	LAB USE Only — PO Number:
Project Supervisor: EP	LIMS Entry:

Sample Number	Date Sampled	Sample Point Identification	# of Conts	Grab/ Comp	Analysis Requested	Sub Lab
001	6/17/97	Blast Furnace Gas 85° Test 1	1	G	Trace Sulphur &	
002	6/17/97	" 105 Test 2	1		Motor Compounds	
003	6/17/97	" 120 Test 3	1			
004	6/18/97	" 90 Test 1	1			
005	6/18/97	" 100 2	1			
006	6/18/97	" 110 3	1	↓	↓	
		8:30				
		10:50				
		12:30				
		8:20				
		10:05				
		12:10				

Delivered by:	Date/Time	Processed by:	Date/Time	Received by Laboratory:
S B	6.20.97 9:00		6/20/97 9:15	

Special Instructions:

Institute of Gas Technology
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Jun 20 1997, 03:36 pm

Login Number: L97-1255
Account: MOSTARDI PLATT Mostardi Platt Associates, Inc
Project: MOST 97-1255

Laboratory Sample Number	Client Sample Number		Collect Date	Receive Date	Due PR Date
L97-1255-1	SAMPLE 72521-001		17-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:20-JUN-97			
Gas	S SLFRTG	Hold:18-JUN-97			
Gas	S SYNGAS				
L97-1255-2	SAMPLE 72521-002		17-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:20-JUN-97			
Gas	S SLFRTG	Hold:18-JUN-97			
Gas	S SYNGAS				
L97-1255-3	SAMPLE 72521-003		17-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:20-JUN-97			
Gas	S SLFRTG	Hold:18-JUN-97			
Gas	S SYNGAS				
L97-1255-4	SAMPLE 72521-004		18-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:21-JUN-97			
Gas	S SLFRTG	Hold:19-JUN-97			
Gas	S SYNGAS				
L97-1255-5	SAMPLE 72521-005		18-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:21-JUN-97			
Gas	S SLFRTG	Hold:19-JUN-97			
Gas	S SYNGAS				
L97-1255-6	SAMPLE 72521-006		18-JUN-97	20-JUN-97	11-JUL-97
source: steel industry					
Gas	S H2S FPD	Hold:21-JUN-97			
Gas	S SLFRTG	Hold:19-JUN-97			
Gas	S SYNGAS				
Miscell.	S ZZ S&H				

Signature: Alan Jana

Date: 7-10-97

IGT Insti

10-Jul-97

Purchase Order #:
Company :
Report Address :

IGT Institute of Gas Technology

24-Jun-97 **Analytical Report** Log # 971243.DOC

Purchase Order #:	**18731**
Company :	**Mostardi-Platt Associates, Inc.**
Report Address :	**945 Oaklawn Avenue** **Elmhurst IL 60126**
Requestor :	**Frank Jarke**
Work Description :	**Project #72418 gas samples**
Received Date :	**20-JUN-97**
Number of Samples :	**three**
Sample Description :	**See attached Chain of Custody Report**

Disclaimer:

Neither IGT nor any person acting on behalf of IGT assumes any liability with respect to the use of, or for damages resulting from the use of, any information presented in this report.

Submitted by :

Alan G. Janos 847-768-0603

Institute of Gas Technology 1700 South Mt. Prospect Road Des Plaines, IL 60018-1804

Sherman Chao, Ph.D., (847) 768-0587
Associate Director, Chemical Research Services

Institute of Gas Technology
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Jun 16 1997, 12:25 pm

Login Number: L97-1243
Account: MOSTARDI PLATT Mostardi Platt Associates, Inc
Project: MOST 97-1243

Laboratory Sample Number		Client Sample Number	Collect Date	Receive Date	Due PR Date
L97-1243-1		SAMPLE 72418-001	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
L97-1243-2		SAMPLE 72418-002	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
L97-1243-3		SAMPLE 72418-003	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
Miscell.	S	ZZ S&H			

Signature: _____

Date: _____

Institute of Gas Technology
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Jun 16 1997, 12:25 pm

Login Number: L97-1243
Account: MOSTARDI PLATT Mostardi Platt Associates, Inc
Project: MOST 97-1243

Laboratory Sample Number		Client Sample Number	Collect Date	Receive Date	[illegible]
L97-1243-1		SAMPLE 72418-001	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S H2S FPD		Hold:15-JUN-97		
Gas	P LANDGAS2				
Gas	C LANDGAS				
Gas	C SLFRTG		Hold:13-JUN-97		
L97-1243-2		SAMPLE 72418-002	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S H2S FPD		Hold:15-JUN-97		
Gas	P LANDGAS2				
Gas	C LANDGAS				
Gas	C SLFRTG		Hold:13-JUN-97		
L97-1243-3		SAMPLE 72418-003	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S H2S FPD		Hold:15-JUN-97		
Gas	P LANDGAS2				
Gas	C LANDGAS				
Gas	C SLFRTG		Hold:13-JUN-97		
Miscell.	S ZZ S&H				

Signature: ____________________

Date: ____________________

Institute of Gas Technology
LOGIN CHAIN OF CUSTODY REPORT (ln01)
Jun 16 1997, 12:25 pm

Login Number: L97-1243
Account: MOSTARDI PLATT Mostardi Platt Associates, Inc
Project: MOST 97-1243

Laboratory Sample Number		Client Sample Number	Collect Date	Receive Date	Due Date
L97-1243-1		SAMPLE 72418-001	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
L97-1243-2		SAMPLE 72418-002	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
L97-1243-3		SAMPLE 72418-003	12-JUN-97	16-JUN-97	07-JUL-97
Gas	S	H2S FPD	Hold:15-JUN-97		
Gas	P	LANDGAS2			
Gas	C	LANDGAS			
Gas	C	SLFRTG	Hold:13-JUN-97		
Miscell.	S	ZZ S&H			

Signature: _____

Date: _____

Blast Furnace Granulated Coal Injection
Environmental Monitoring Report

Appendix 2 - Wastewater Monitoring Summaries

Bethlehem Steel Corporation
Burns Harbor Division
Outfall 001 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
04/01/97	133.9	0.42	473.8		
04/02/97	141.0				
04/03/97	137.6	0.34	384.7		
04/04/97	144.6				
04/05/97	142.7				
04/06/97	124.2	0.33	340.0	<0.005	0.00
04/07/97	131.9				
04/08/97	145.6	0.39	475.1		
04/09/97	131.0				
04/10/97	140.0	0.41	483.7		
04/11/97	145.5				
04/12/97	145.1				
04/13/97	126.2	0.42	442.3	<0.005	0.00
04/14/97	138.7				
04/15/97	142.1	0.57	673.5		
04/16/97	136.1				
04/17/97	130.8	0.36	389.7		
04/18/97	113.4				
04/19/97	84.6				
04/20/97	91.9	0.39	301.4	<0.005	0.00
04/21/97	115.2				
04/22/97	138.5	0.52	602.2		
04/23/97	139.8				
04/24/97	140.2	0.21	243.4		
04/25/97	159.2				
04/26/97	130.2				
04/27/97	123.3	0.22	227.4	<0.005	0.00
04/28/97	131.8				
04/29/97	141.2	0.38	450.1		
04/30/97	144.3				
Average	133.0	0.38	422.1	<0.005	0.00
Maximum	159.2	0.57	673.5	<0.005	0.00
Minimum	84.6	0.21	227.4	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Outfall 001 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
05/01/97	143.2	0.29	340.6		
05/02/97	146.4				
05/03/97	146.0				
05/04/97	132.5	0.27	294.1	<0.005	0.00
05/05/97	143.5				
05/06/97	144.9	0.29	347.0		
05/07/97	148.2				
05/08/97	145.2	0.26	312.6		
05/09/97	170.7				
05/10/97	130.4				
05/11/97	139.4	0.26	297.8	<0.005	0.00
05/12/97	135.8				
05/13/97	144.8	0.27	325.0		
05/14/97	147.3				
05/15/97	141.2	0.18	207.4		
05/16/97	154.0				
05/17/97	150.0				
05/18/97	130.2	0.20	217.3	<0.005	0.00
05/19/97	122.1				
05/20/97	150.0	0.41	510.7		
05/21/97	152.7				
05/22/97	147.6	0.38	465.6		
05/23/97	169.4				
05/24/97	150.7				
05/25/97	136.6	0.38	433.2	<0.005	0.00
05/26/97	150.9				
05/27/97	149.0	0.38	477.5		
05/28/97	158.4				
05/29/97	154.1	0.23	300.9		
05/30/97	145.9				
05/31/97	132.8				
Average	145.6	0.29	348.4	<0.005	0.00
Maximum	170.7	0.41	510.7	<0.005	0.00
Minimum	122.1	0.18	207.4	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Outfall 001 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
06/01/97	151.2	0.37	464.3	<0.005	0.00
06/02/97	128.9				
06/03/97	153.5	0.28	362.5		
06/04/97	148.0				
06/05/97	162.8	0.27	366.8		
06/06/97	165.2				
06/07/97	161.4				
06/08/97	141.9	0.34	402.6	<0.005	0.00
06/09/97	153.5				
06/10/97	159.9	0.30	401.6		
06/11/97	156.9				
06/12/97	166.8	0.36	503.9		
06/13/97	174.0				
06/14/97	157.8				
06/15/97	150.2	0.33	412.4	<0.005	0.00
06/16/97	191.8				
06/17/97	154.1	0.40	517.0		
06/18/97	162.0				
06/19/97	158.4	0.24	319.9		
06/20/97	166.4				
06/21/97	164.2				
06/22/97	150.9	0.21	269.5	<0.005	0.00
06/23/97	155.6				
06/24/97	159.2	0.33	443.7	<0.005	0.00
06/25/97	158.4				
06/26/97	162.8	0.33	452.4		
06/27/97	159.9				
06/28/97	157.5				
06/29/97	141.5	0.31	361.3	<0.005	0.00
06/30/97	164.0				
Average	158.0	0.31	406.0	<0.005	0.00
Maximum	191.8	0.40	517.0	<0.005	0.00
Minimum	128.9	0.21	269.5	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Monitoring Station 011 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
04/01/97	66.3	0.54	296.6	<0.005	0.00
04/02/97	84.2				
04/03/97	73.1	0.40	245.8	<0.005	0.00
04/04/97	95.0				
04/05/97	65.8				
04/06/97	70.7	0.41	242.5	<0.005	0.00
04/07/97	83.7				
04/08/97	80.3	0.47	317.6	<0.005	0.00
04/09/97	77.9				
04/10/97	85.5	0.41	289.0	<0.005	0.00
04/11/97	79.6				
04/12/97	79.0				
04/13/97	59.9	0.54	271.9	<0.005	0.00
04/14/97	81.5				
04/15/97	81.8	0.79	535.9	<0.005	0.00
04/16/97	79.9				
04/17/97	60.9	0.64	324.2	<0.005	0.00
04/18/97	27.6				
04/19/97	17.8				
04/20/97	28.0	0.99	231.8	<0.005	0.00
04/21/97	31.1				
04/22/97	69.2	1.07	617.3	<0.005	0.00
04/23/97	78.5				
04/24/97	79.1	0.49	321.5	<0.005	0.00
04/25/97	91.4				
04/26/97	67.5				
04/27/97	37.3	0.47	146.9	<0.005	0.00
04/28/97	29.8				
04/29/97	65.1	0.61	330.3	<0.005	0.00
04/30/97	81.8				
Average	67.0	0.60	320.9	<0.005	0.00
Maximum	95.0	1.07	617.3	<0.005	0.00
Minimum	17.8	0.40	146.9	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Monitoring Station 011 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
05/01/97	77.7	0.42	273.0	<0.005	0.00
05/02/97	75.6				
05/03/97	79.9				
05/04/97	79.2	0.39	256.4	<0.005	0.00
05/05/97	66.8				
05/06/97	78.6	0.43	282.7	<0.005	0.00
05/07/97	84.4				
05/08/97	75.6	0.39	246.0	<0.005	0.00
05/09/97	104.9				
05/10/97	64.3				
05/11/97	73.9	0.31	193.0	<0.005	0.00
05/12/97	39.8				
05/13/97	77.6	0.24	158.0	<0.005	0.00
05/14/97	83.2				
05/15/97	73.5	0.20	123.3	<0.005	0.00
05/16/97	85.8				
05/17/97	83.8				
05/18/97	30.0	0.37	91.9	<0.005	0.00
05/19/97	32.7				
05/20/97	75.8	0.64	406.1	<0.005	0.00
05/21/97	84.6				
05/22/97	82.2	0.32	222.3	<0.005	0.00
05/23/97	88.7				
05/24/97	73.5				
05/25/97	72.7	0.42	254.2	<0.005	0.00
05/26/97	67.0				
05/27/97	65.8	0.42	231.2	<0.005	0.00
05/28/97	88.7				
05/29/97	83.8	0.24	166.4	<0.005	0.00
05/30/97	83.4				
05/31/97	75.9				
Average	74.5	0.37	223.4	<0.005	0.00
Maximum	104.9	0.64	406.1	<0.005	0.00
Minimum	30.0	0.20	91.9	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Monitoring Station 011 Monitoring Summary

Sample Date	Flow (MGD)	Ammonia (as N) (mg/l)	Ammonia (as N) (lb/day)	Cyanide (mg/l)	Cyanide (lb/day)
06/01/97	86.4	0.29	212.0	<0.005	0.00
06/02/97	59.3				
06/03/97	81.7	0.36	246.1	<0.005	0.00
06/04/97	78.7				
06/05/97	84.9	0.38	271.4	<0.005	0.00
06/06/97	82.1				
06/07/97	80.1				
06/08/97	31.3	0.40	105.5	<0.005	0.00
06/09/97	50.3				
06/10/97	83.7	0.49	342.3	<0.005	0.00
06/11/97	70.0				
06/12/97	84.4	0.41	288.1	<0.005	0.00
06/13/97	91.9				
06/14/97	78.2				
06/15/97	74.5	0.51	319.6	<0.005	0.00
06/16/97	84.7				
06/17/97	62.1	0.47	244.1	<0.005	0.00
06/18/97	79.9				
06/19/97	69.8	0.26	149.7	<0.005	0.00
06/20/97	84.9				
06/21/97	84.3				
06/22/97	62.0	0.41	209.5	<0.005	0.00
06/23/97	57.4				
06/24/97	77.4	0.34	220.9	<0.005	0.00
06/25/97	82.5				
06/26/97	82.7	0.31	213.3	<0.005	0.00
06/27/97	86.8				
06/28/97	75.1				
06/29/97	54.2	0.35	156.5	<0.005	0.00
06/30/97	86.2				
Avg	74.9	0.38	229.1	<0.005	0.00
Max	91.9	0.51	342.3	<0.005	0.00
Min	31.3	0.26	105.5	<0.005	0.00

Bethlehem Steel Corporation
Burns Harbor Division
Blast Furnace Closed Water Pump Station
Cold Well Monitoring Summary

Sample Date	Ammonia (as N) (mg/l)	Cyanide (mg/l)
04/01/97		
04/02/97	42.0	0.010
04/03/97		
04/04/97		
04/05/97		
04/06/97		
04/07/97		
04/08/97		
04/09/97	32.8	0.036
04/10/97		
04/11/97		
04/12/97		
04/13/97		
04/14/97		
04/15/97		
04/16/97	47.9	0.538
04/17/97		
04/18/97		
04/19/97		
04/20/97		
04/21/97		
04/22/97		
04/23/97	21.0	0.497
04/24/97		
04/25/97		
04/26/97		
04/27/97		
04/28/97		
04/29/97		
04/30/97	37.3	0.171
Average	36.2	0.250
Maximum	47.9	0.538
Minimum	21.0	0.010

Bethlehem Steel Corporation
Burns Harbor Division
Blast Furnace Closed Water Pump Station
Cold Well Monitoring Summary

Sample Date	Ammonia (as N) (mg/l)	Cyanide (mg/l)
05/01/97		
05/02/97		
05/03/97		
05/04/97		
05/05/97		
05/06/97		
05/07/97	29.2	0.104
05/08/97		
05/09/97		
05/10/97		
05/11/97		
05/12/97		
05/13/97		
05/14/97	29.8	0.040
05/15/97		
05/16/97		
05/17/97		
05/18/97		
05/19/97		
05/20/97		
05/21/97	24.7	0.042
05/22/97		
05/23/97		
05/24/97		
05/25/97		
05/26/97		
05/27/97		
05/28/97	20.6	0.058
05/29/97		
05/30/97		
05/31/97		
Average	26.1	0.061
Maximum	29.8	0.104
Minimum	20.6	0.040

Bethlehem Steel Corporation
Burns Harbor Division
Blast Furnace Closed Water Pump Station
Cold Well Monitoring Summary

Sample Date	Ammonia (as N) (mg/l)	Cyanide (mg/l)
06/01/97		
06/02/97		
06/03/97		
06/04/97	22.2	0.186
06/05/97		
06/06/97		
06/07/97		
06/08/97		
06/09/97		
06/10/97		
06/11/97	29.0	0.044
06/12/97		
06/13/97		
06/14/97		
06/15/97		
06/16/97		
06/17/97		
06/18/97	24.6	0.087
06/19/97		
06/20/97		
06/21/97		
06/22/97		
06/23/97		
06/24/97		
06/25/97	23.6	0.014
06/26/97		
06/27/97		
06/28/97		
06/29/97		
06/30/97		
Avg	24.9	0.083
Max	29.0	0.186
Min	22.2	0.014